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Introduction of Evidence Based Checklists for Procedural Skills Training in Pediatric Emergency Department: "P.S:CHECK" Application

THESIS

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BY

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KEY WORDS

Checklists – Evidence Based – Procedural Skills – Pediatric Emergency

JURY

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حَتَّىٰٓ إِذَا بَلَغَ أَشُدَّهُۥ وَبَلَغَ أَرۡبَعِينَ سَنَةٗ قَالَ
رَبِّ أَوۡزِعۡنِيٓ أَنۡ أَشۡكُرَ نِعۡمَتَكَ
ٱلَّتِيٓ أَنۡعَمۡتَ عَلَيَّ وَعَلَىٰ وَٰلِدَيَّ
وَأَنۡ أَعۡمَلَ صَٰلِحٗا تَرۡضَىٰهُ
وَأَصۡلِحۡ لِي فِي ذُرِّيَّتِيٓۖ
إِنِّي تُبۡتُ إِلَيۡكَ وَإِنِّي مِنَ ٱلۡمُسۡلِمِينَ
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Serment d'hippocrate

Au moment d'être admis à devenir membre de la profession médicale,
Je m'engage solennellement à consacrer ma vie au service de l'humanité.
Je traiterai mes maîtres avec le respect et la reconnaissance qui leur sont dus.
Je pratiquerai ma profession avec conscience et dignité. La santé de mes malades sera mon premier but.
Je ne trahirai pas les secrets qui me seront confiés.
Je maintiendrai par tous les moyens en mon pouvoir l'honneur et les nobles traditions de la profession médicale.
Les médecins seront mes frères.
Aucune considération de religion, de nationalité, de race, aucune considération politique et sociale, ne s'interposera entre mon devoir et mon patient.
Je maintiendrai strictement le respect de la vie humaine dés sa conception.
Même sous la menace, je n'userai pas mes connaissances médicales d'une façon contraire aux lois de l'humanité.
Je m'y engage librement et sur mon honneur.

Déclaration Genève, 1948

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DEDICATION

"At times, our own light goes out and is rekindled by a spark from another person. Each of us has cause to think with deep gratitude of those who have lighted the flame within us."

- Albert Schweitzer

I must fully admit my gratitude to all the people who supported me during my journey, who knew how to lift me up to reach my goal. It is with love, respect and gratitude that I dedicate this thesis to.....

To the good Lord,

Almighty who inspired me and guided me in the right path.

I owe what I have become to you.

Praise and thanks for your clemency and mercy.

To the memory of my father ABDERRAHMAN KHARTOUM

All the words in the world cannot express the immense love I have for you, nor the deep gratitude I have for all the efforts and sacrifices you have made for my education, my training and my well-being.
Thank you for always being there for me, a great support throughout my studies.
Without your honorable education, I would not be where I am today.
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Your advice has always guided my steps towards success.
Your endless patience, your understanding and your encouragement are for me the indispensable support that you have always given me.
Dear Dad, you are a man of heart, I am not the only one to affirm it. You have always shown humility, honesty and kindness.
I owe you what I am today and what I will be tomorrow and I will always do my best to remain your pride and never let you down.

May your souls rest in peace.
May God the Almighty shower you with holy mercy.

I love you very much dad...

To my dearest mother : FATIHA MANSOURI

To the sweetest and most wonderful mother of all.
To a person who has given me everything without counting the cost.
No tribute can convey the love, devotion and respect I have for you.
No dedication could be eloquent enough to express what you deserve for all the sacrifices you have given me since my birth.
Without you, I am nothing, but thanks to you I am becoming a doctor.
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I dedicate this thesis to you, which is only the fruit of your advice and encouragement.
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I hope you will find in this modest work a testimony of my gratitude, my deep affection and my profound respect.
On this day I hope to fulfill one of your dreams, dear mother and gentle creature, knowing that nothing I could do or say could equal what you have given me.
I hope with all my heart that on this day you are proud of me.
May God Almighty protect you from harm, give you long life, health and happiness so that I can give you back a little of what I owe you.
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To the memory of my paternal grandmother OUM HANI CHERBATLI

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love you

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To all students reading this guide:

You are the reason for this work. May this guide be a compass that shows you the way, and activates in you the love of curiosity and the desire to learn. We hope with all our hearts that you enjoy your guide to procedural skills .

Enjoy your reading.

To all those who are dear to me and whom I have unintentionally omitted to mention.
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To our master and thesis president: Professor BOUMZEBRA Drissi

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To our master and thesis reporter: Professor BOURROUS Mounir

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Please accept, dear master, in this work my sincere thanks and my deep respect.

TO OUR MASTER AND THESIS JUDGE: Professor RADA Noureddine

You are doing us a great honor by accepting to be associated with our thesis jury. This honor touches us infinitely and we would like to express our deepest gratitude. You represent for us the example of the professor with great human and professional qualities. Your competence and dedication are for us an example to follow in the practice of the medical profession. Please accept, dear Master, the expression of our sincere gratitude and our great respect.

We keep the best memories of your brilliant and precious teaching as well as the passage in your service which was very instructive.

ABBREVIATIONS

Liste of abbreviations

ACGME : Accreditation Council for Graduate Medical Education

ACLF : Acute on Chronic Liver Failure

ACLS : Advanced Cardiovascular Life Support

APSS : Actionable Patient Safety Solutions

AV : Atrio-Ventricular

BMI : Body Mass Index

BVM : Bag valve mask

CNS : Central nervous system

CPAP : Continuous Positive Airway Pressure

CPR : Cardiopulmonary Resuscitation

CSF : Cerebrospinal fluid

CVC : Central Vein Cannulation

CXR : Chest X-Ray

EBMP : Evidence-Based Practice

ECG : Electrocardiography

ED : Emergency Department

FIO2 : Fraction of Inspired Oxygen

HFMS : High-Fidelity Mannequin Simulator

HR : Heart Rate

IO : Intra-Osseous.

IM : Intra-Muscular

INR : International Normalised Ratio

IV : Intra-Venous

KM : Knowledge Managment

LMA : Laryngeal Mask Airway

LP : Lumbar Puncture

LVP : Large-Volume Parenteral

MRI : Magnetic Resonance Imaging

NAVEL : Nerve Artery Vein Empty space Lymphatics

NEMU : Measure nose-ear-mid-umbilicus

NOVEL : Opportunities for Verification of Enteral Tube Location

NG : Naso-Gastric

NGT : Naso-Gastric Tube

NP : Naso-Pharyngeal

NPA : Naso-Pharyngeal Airway

OP : Oro-Pharyngeal

OPA : Oro-Pharyngeal Airway

PAO2 : Oxygen saturation measured by pulse oximetry

PEEP : Positive end-expiratory pressure

PIVC : Peripheral intravenous cannula

PLPH : Post-lumbar puncture headache

PMN : Polymorphonuclear lymphocyte

POCUS : Point-of-care ultrasound

PPV : Pulse Pressure Variation

PVT **:** Paroxysmal Ventricular Tachycardia

ROSC : Return of Spontaneous Circulation

SBP : Spontaneous bacterial peritonitis

SIB : Self inflation bag-mask

SPA : Supra-Pubic Aspiration

SpO2 : Oxygen saturation measured by pulse oximetry

STLER : Standard 12-Lead Electrocardiograph Recording

UVC : Umbilical Vevous Catheter

VF : Ventricular Fibrillation

VT **:** Ventricular Tachycardia

WBCs : White Blood Cells

PLAN

INTRODUCTION

The teaching of procedural skills required for clinical practice remains an ongoing challenge in healthcare education. Health professionals must be competent to perform a wide range of clinical skills, and are also regularly required to teach these clinical skills to their peers, junior staff, and students. Teaching of procedural skills through the use of frameworks, observation and provision of feedback, with opportunities for repeated practice assists in the learners' acquisition and retention of skills.

Emergency departments offer a unique education setting where house staff can be exposed to and learn a variety of procedural skills. However, procedural skills are often overlooked as an assumed activity without a formal educational context. The clinical educator's understanding of the educational principals of teaching and learning procedural skills is minimal.

Life-saving procedures are rarely performed on children in the emergency department, making it difficult for trainees to acquire the skills necessary to provide proficient resuscitative care for children. Pediatric emergency medicine physicians may be required to perform emergent procedures, opportunities to receive training and assessment in these procedures are limited. Simulation and other educational modalities are being used to provide skill training and assessment, but cost and lack of resources, standardized protocols, and faculty interest are barriers to the implementation of training and assessment programs.

The traditional method for teaching clinical procedures in medical schools and residency programs—see one, do one, teach one—has come under fire in the past decade. In this paradigm, procedural skill training is accomplished through direct patient care, with trainees practicing procedures on patients as part of a medical apprenticeship model. This poor performance was thought to be in large part the result of a complete lack of teaching procedural skills.

Another problem is the knowledge-intensive nature of the clinical domain.It has become increasingly difficult for clinicians to effectively practice medicine by relying solely on memory and experience . so we must seriously consider the use of " Knowledge Management" in the field of education of medical sciences in order to help educators and students benefit from the knowledge present in the field of health sciences in a more meaningful and informed way.

Knowledge management (KM) is the collection of methods relating to creating, sharing, using and managing the knowledge and information of an organization. It refers to a multidisciplinary approach to achieve organisational objectives by making the best use of knowledge.

As a process, the goal of Knowledge Management in the field of medical sciences is to motivate the creation, sharing, storing and utilization of knowledge. Knowledge creation occurs by continually transforming tacit knowledge into explicit knowledge and vice versa. Another important aspect that needs to be considered with KM implementation in healthcare is what is known as evidence-based medical practices (EBMP) . EBMP is the integration of research evidence, clinical expertise and patient preferences and values in clinical decision making , which is known to influence decision making throughout healthcare delivery processes.

As a tool of Knowledge Management Checklists have been embraced in the medical field. Since the impressive success of the WHO surgical safety checklist in 2009, more than 4000 hospitals worldwide implemented modified versions of this checklist. In countries like the UK, Canada and the Netherlands, the Ministry of Health mandates the use of surgical safety checklists. Moreover, some policy makers apply "checklist use" as a measure for quality of care.

Although their format and content may vary, simple steps to identify, check, and verify what you have done or are about to do can determine whether you succeed or fail. They should be succinct, unambiguous, focused, and ultimately effective and efficient. When faced with a crisis, we can react quickly and decisively, knowing that the items we act out from the checklist are well thought out, tested, and will provide us with the results we want.

Throughout this guide, we try to bring to the students, interns, medical educators, and all doctors who face procedures in pediatric emergencies a material that focuses exclusively on procedures in pediatric emergency , and is not meant to be a comprehensive textbook of pediatric medicine. Rather, the aim is to provide a clinically useful, accessible guide with step-by-step instructions in an easy-to-use format to prevent errors in acute situation in pediatric emergency sitting , by helping medical students to manage emergency room stress , and assure a smooth transition from theory to practice , but the ultimate purpose for this work is ensuring health safety for patients.

METHODOLOGY

In this paper we introduce an evidence based, pedagogical checklists for teaching procedural skills in pediatric emergency department. We developed our proposed checklists based on a systematic process.

Initially, a PubMed search of English-language articles published with the terms 'procedural skills', 'checklist development' 'evidence-based practice', 'pediatric emergency department' and 'medical student training'. was conducted to identify published literature on the subject.

After that, we identified the most common procedural skills in pediatric emergency sitting that every student must know and organized them into five parts:

- **PART I: ACCESS**
  - ❖ Peripheral Intravenous Cannulation
  - ❖ Central Venous Line placement : Femoral Venous Catheterization
  - ❖ Central Venous Line placement : Umbilical Vein Cannulation
  - ❖ Intraosseous Line Insertion
- **PART II : SAMPLING**
  - ❖ Blood-Taking and Cultures
  - ❖ Arterial Puncture
  - ❖ Capillary Blood Sampling
  - ❖ Lumbar Puncture
  - ❖ Thoracentesis
  - ❖ Paracentesis
  - ❖ Suprapubic Bladder Catheterization
  - ❖ Arthrocentesis
- **PART III : THERAPEUTIC**
  - ❖ CPR
  - ❖ Chest Compression
  - ❖ Cardioversion-defibrilator
  - ❖ Bag-Mask Ventilation

- ❖ Placement of Oropharyngeal Airway
- ❖ Placement of Nasopharyngeal Airway
- ❖ Insertion of Laryngeal Mask Airway
- ❖ Placement of Endotracheal Tube
- ❖ Inhalation Medications
- ❖ Chest Drain
- ❖ Ascitic Drain
- ❖ Gastric lavage
- ❖ Hernia Reduction
- ❖ Rectal Prolapsus Reduction

– **PART IV : MONITORING**

- ❖ Urinary Catheterization
- ❖ Nasogastric Tube Insertion
- ❖ Electrocardiography

– **PART V : GENERAL APPLICATIONS**

- ❖ Intramuscular Injection
- ❖ Subcutaneous Injection
- ❖ Suturing
- ❖ Splinting

Also. current standards in the procedural skills practice were obtained by reviewing several recently published guidelines , so we can make 32 Checklists , each Checklist focuses on a specific procedure, accompanied by instructive illustrations and presented in a standard format featuring:

I. INDICATIONS:

Make sure that patient have one of the following indications.

II. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following contraindications.

III. EQUIPMENT:

Prepare all materials.

IV. PROCEDURE:

Including patient preparation and position, anatomic review, sterile preparation, procedure itself, monitoring and follow-up.

V. COMPLICATIONS:

Monitor the patient regularly in order to screen these Complications.

VI. PEARLS AND PITFALLS:

Some tips to perform the procedure in the best way.

Finally, the available literature was comprehensively reviewed to provide up to date information on the evidence-based practice of each procedural skills in pediatric emergency sitting to make the last part of the Checklist:

VII. EVIDENCE BASED PRACTICE:

Recommendations and evidences for safe procedure.

As mobile devices continue to become more prevalent and technologically advanced, innovators also continue to develop more mobile applications or apps. Apps can be highly complex, leveraging the power, popularity, and portability of mobile devices for an ever-increasing range of uses. Motivated by the integration of technology in the medical sector, we present in this section a simple mobile application to assist medical staff. We choose the use of mobile applications (by smartphones) to make this it as popular as possible.

The mobile application named P.S.CHECK was developed to organize the medical staff tasks. Both solution design and development of P.S.CHECK were done with the collaboration of professor Layla AZIZ from the FPSB, and a member of the LARAOSERY laboratory in the faculty of sciences, Chouaib Doukkali university- El Jadida. The App Graphical User Interface (GUI) was designed by fragments, layouts, and string on the designing section of Android Studio applied using the Extensible Markup Language (XML).

RESULTS

PART I : ACCESS

I. Peripheral Intravenous Cannulation

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Intravenous fluids.

☐ Intravenous drugs – continuous or intermittent.

☐ Blood or blood products.

☐ Intravenous radio-opaque contrast or sedation.

☐ Prophylactic use in unstable patients or those undergoing procedures.

☐ Continuous pressure monitoring.

☐ Need for frequent blood sampling.

☐ Major surgery involving fluid shifts/blood loss.

☐ Hypothermia (induced or environmental).

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

2.1. Absolute:

☐ Inflammation.

☐ Infection.

☐ Burn of overlying skin at proposed cannula site.

☐ Arteriovenous (AV) fistula in arm of proposed cannula site.

☐ Traumatic injury proximal to cutdown site.

2.2. Relative:

☐ Paralyzed extremity.

☐ Massively edematous extremity.

☐ An IV distal to injured organs (eg, do not use lower extremities when treating abdominal injuries).

☐ Avoid joint area.

☐ Coagulation disorders.

☐ Clinically evident fibrinolysis or disseminated intravascular coagulation.

3. EQUIPMENT:

Prepare all materials:

☐ Gloves.

☐ Tourniquet or rubber band.

☐ Tape and occlusive transparent dressing.

☐ Alcohol wipes.

☐ Povidone or chlorhexidine.

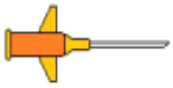
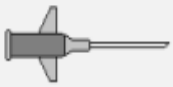
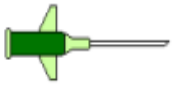
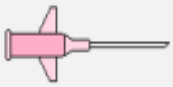
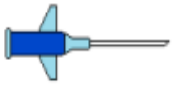
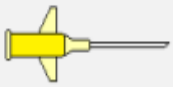
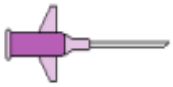
☐ Syringe filled with injectable saline.

☐ Gauze pads.

☐ Cannula: appropriate size to fit (Table I–Figure 1).

☐ Topical anesthetic cream.

Table I: Peripheral IV catheters

Color	Gauge Size	External Diameter (mm)*	Length (mm)*	Water Flow Rate (mL/min)*	Recommended Uses
 Orange	14G	2.1 mm	45mm	~240 mL/min	Trauma, Rapid blood transfusion, Surgery[1]
 Gray	16G	1.8 mm	45mm	~180 mL/min	Rapid fluid replacement, Trauma, Rapid blood transfusion[1]
 Green	18G	1.3 mm	32mm	~90 mL/min	Rapid fluid replacement, Trauma, Rapid blood transfusion[1]
 Pink	20G	1.1 mm	32mm	~60 mL/min	Most infusions, Rapid fluid replacement, Trauma, Routine blood transfusion[1]
 Blue	22G	0.9 mm	25mm	~36 mL/min	Most infusions Neonate, pediatric, older adults Routine blood transfusion[1]
 Yellow	24G	0.7mm	19mm	~20 mL/min	Most infusions Neonate, pediatric, older adults, Routine blood transfusion, Neonate or Pediatric blood transfusion[1]
 Purple	26G	0.6 mm	19mm	~13 mL/min	Pediatrics, Neonate[1]

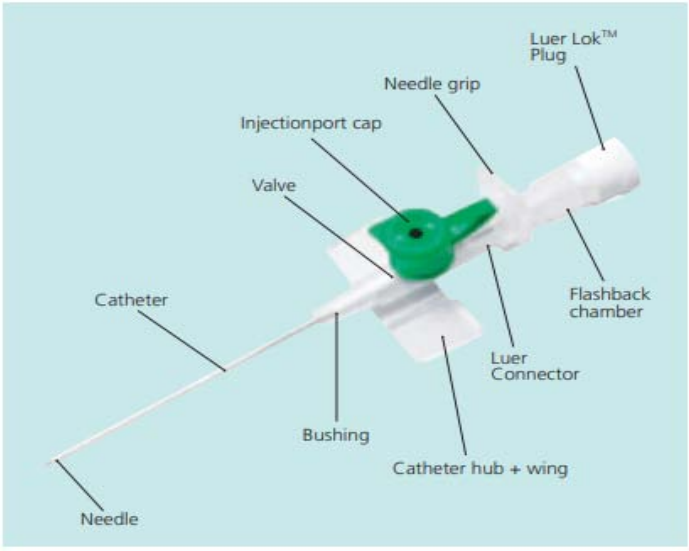


Figure 1 : parts of cannula

4. PROCEDURE:

4.1. Patient preparation :

☐ Introduce yourself to the parents and to the patient.

☐ Explain to the parents and the child, if appropriate, the procedure and its purpose.

☐ Choose 1 or more possible sites, and apply topical anesthetic cream.

☐ Answer all of the parents' and patient's questions.

4.2. Patient position :

☐ Position the patient with the chosen site closest to you.

☐ Have a helper gently restrain and distract the child.

☐ Have the patient at a comfortable working height.

☐ For external jugular line placement, have the patient's head lower than the trunk (Trendelenburg).

4.3. Anatomy review : (figure 2)

☐ Accessible peripheral veins that are usually available include the following:

- On the dorsum of the hands.
- On the radial side of the hand.
- In the antecubital fossa.
- The saphenous vein at the medial aspect of the ankle.
- The dorsum of the feet.
- External jugular vein.
- Scalp veins.

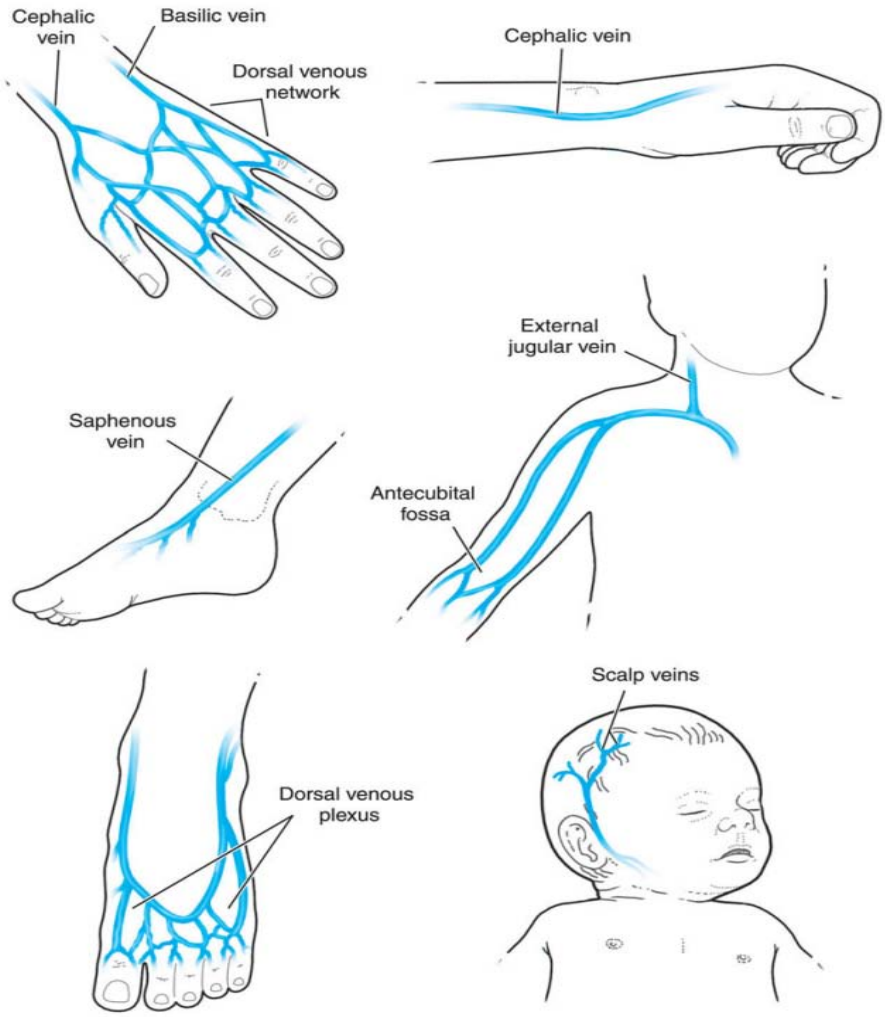


Figure 2 : Common sites for insertion

4.4. Sterile preparation:

☐ Sanitize or wash your hands thoroughly and don gloves.

☐ Use universal precautions or isolation precautions as appropriate.

4.5. Procedure :

a. Upper and Lower Extremities

☐ Apply tourniquet.

☐ Identify the blood vessel by palpation, visualization, transillumination, or ultrasound.

☐ Release the tourniquet, cleanse the site.

☐ Inspect the integrity of the catheter/stylet assembly.

☐ Flush the catheter and the connecting tube with saline (omit this step if you intend to draw blood through this catheter).

☐ Reapply the tourniquet.

☐ Use your nondominant hand to apply traction on the skin in order to stabilize the vein.

☐ Enter the skin at a 30- to 45-degree angle proximal to or alongside the vein .

☐ Reduce the angle as you advance the catheter and enter the vein .

☐ Watch for blood flashback in the hub of the catheter.

☐ Stabilize the catheter with the thumb and middle finger of your dominant hand.

☐ advance the catheter over the stylet using the tip of your index finger .

☐ Remove the stylet.

☐ Do not reinsert the stylet once it has been removed; it may damage the catheter.

☐ Release the tourniquet.

☐ Connect the extension tubing and saline-filled syringe to the catheter.

☐ Gently flush the catheter; observe for swelling, mottling, or color changes in the extremity.

☐ Secure the IV with occlusive transparent dressing and tape.

☐ Make a small loop in the IV tubing and tape it across.

☐ Attach the line to an IV infusion assembly and turn the pump on.

☐ Dispose of all sharp instruments in the proper secure container.

b. External Jugular Vein

☐ Bundle infant or child.

☐ Have the patient in the Trendelenburg position with the head toward you .

☐ Trendelenburg position, the body is laid supine, or flat on the back on a 15–30 degree incline with the feet elevated above the head.

☐ Turn the patient's head away from the jugular vein you intend to use.

☐ Elevate the patient's shoulders and neck (Figure 3)

☐ Apply traction with your nondominant hand to the skin over the jugular vein.

☐ Nick the skin with a large bore needle at a shallow angle below or alongside the vein in order to facilitate the catheter's entry.

☐ Insert the catheter through the puncture and advance subcutaneously a few millimeters before entering the vein .

☐ Synchronize your entry with the child's breathing.

☐ Enter the vein during exhalation in a spontaneously breathing patient to avoid air embolus.

☐ Enter the vein during a positive pressure breath if the patient is on positive pressure ventilation.

☐ Watch for blood flashback in the hub.

☐ Stabilize the catheter assembly and advance the catheter over the stylet.

☐ Withdraw the stylet and occlude the catheter with your gloved thumb to avoid air embolus.

☐ Connect the tubing and saline-filled syringe, draw back, and flush.

☐ Secure the line with occlusive transparent dressing and tape.

☐ Reposition the child and retest the line.

- The jugular vein has a number of valves that can obstruct the catheter when the neck position is altered.

☐ Traction may be needed or the catheter may need to be withdrawn slightly to ensure proper function.

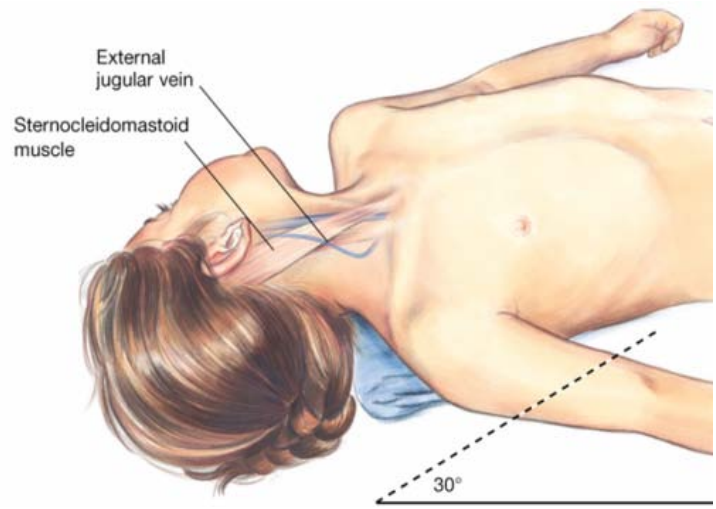


Figure 3 : positioning of patient for cannulation of external jugular vein.

c. Scalp vein (Figure 4)

☐ Inspect the scalp for appropriate veins.

☐ A rubber band may be used to help fill the scalp veins.

☐ The area of the scalp over the vein may need to be shaved.

☐ Palpate for pulse in order to avoid inadvertent arterial cannulation.

☐ Cleanse the skin.

☐ Apply traction with your nondominant hand.

☐ Insert the catheter proximal to the site of the vein,

☐ advance slightly subcutaneously, then enter the vein .

☐ Watch for blood flashback.

- If the vein is very small, there may be none.
- If there is no flashback, rely on the change in resistance as you enter the vein.

☐ Advance the catheter over the stylet.

☐ Flush the assembly gently; watch for blanching, swelling, or mottling.

☐ Secure the IV with transparent occlusive dressing and tape.

☐ Attach to an infusion assembly.

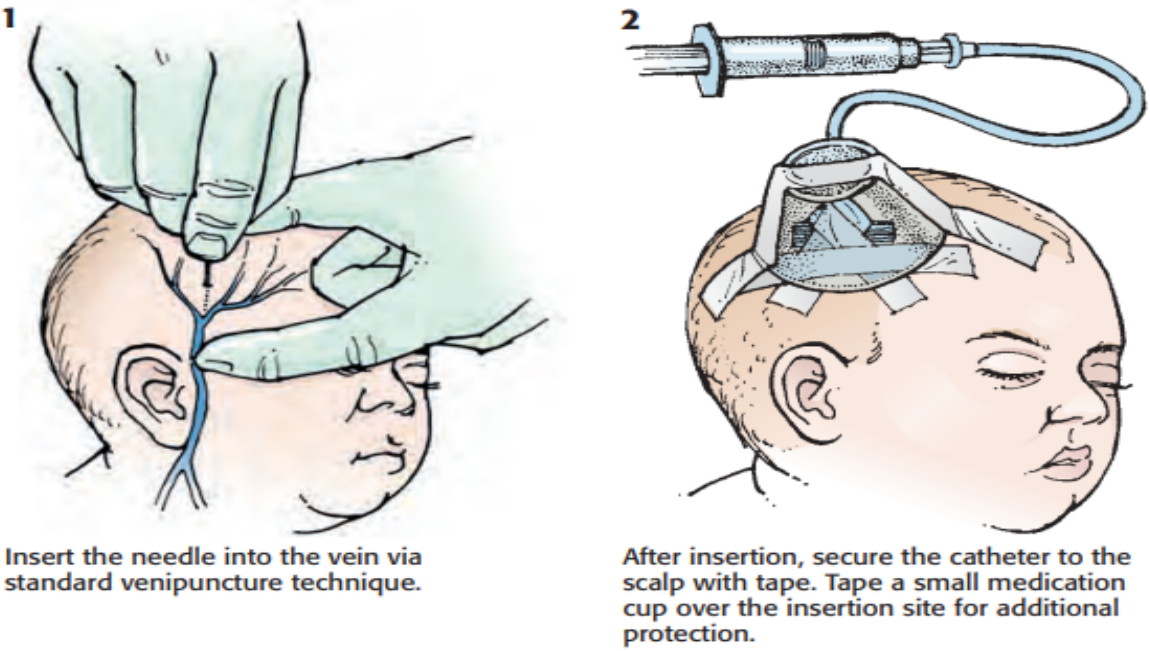


Figure 4 : Scalp vein intravenous catheterization

4.6. Monitoring:

a. Peripheral intravenous in Extremity

☐ Compare extremity's color and temperature; watch for congestion and swelling.

☐ Watch for signs of occlusion.

☐ Palpate pulses.

☐ Ensure skin integrity.

☐ Check tightness of dressing.

☐ Inspect IV tubing for blood or precipitation.

☐ Monitor IV pump for increased resistance that may indicate clotting.

☐ Watch for pump malfunction.

b. Jugular Vein

☐ Monitor for swelling.

☐ Assess for signs of occlusion.

c. Scalp vein

☐ Monitor for swelling and blanching.

☐ Watch for signs of occlusion.

☐ Assess skin integrity.

5. COMPLICATIONS:

Monitor the patient regularly in order to screen these complications:

☐ Hematoma formation

☐ Infection: Strict aseptic technique and hand hygiene are key to minimizing this risk to patients.

☐ Extravasation: It is often characterized by pain, stinging, swelling or other changes to the skin at the site of the intravenous infusion.

☐ Phlebitis: This is characterized by localised pain, redness, and swelling, symptoms may develop within hours and take up to weeks to resolve. The three types of phlebitis include: mechanical, chemical, and infective.

☐ Bleeding.

☐ Ischemia.

☐ Thrombosis/embolism.

☐ Arteriovenous fistula formation.

☐ Pseudoaneurysm formation.

☐ Skin ulceration.

☐ Air or particle embolism.

☐ Blood clot.

☐ Local ischemia.

6. PEARLS AND PITFALLS:

★ Plan the procedure.

★ Limit the procedure time.

★ Have a backup plan.

★ Examine all possible sites carefully before choosing one.

★ Veins in the antecubital fossa are often easiest (but more uncomfortable for the patient).

★ Make sure the area is as well lit as possible, even in the middle of the night.

- ★ Remember, a good vein is one you can feel but not always see!
- ★ Ask the patient to hang his or her hand down and to clench and release the hand.
- ★ Tapping the vein gently will vasodilate the vein and make it stand out.

7. EVIDENCE BASED PRACTICE:

- ✦ A peripheral intravenous cannula is inserted using an aseptic technique, which aims to minimize the infection risk to patients whilst protecting healthcare professionals .
- ✦ The use of an adhesive transparent dressing can lead to prevention and earlier detection of phlebitis and extravasation. Additionally, the new IV securement dressing brought about manpower cost savings enabling staff time directed to other patient care activities.
- ✦ the implementation of a multi-modal bundle of care, including education, visual aids and standardization of equipment, improved many aspects of PIVC insertion and management.
- ✦ Peripheral intravenous cannulation must be considered a skill that requires specialist knowledge of the device, size and site selection. In order to avoid multiple unsuccessful attempts at peripheral cannulation and cause unnecessary trauma to the patient, this should be avoided and alternative routes for IV therapy should be explored in order to conserve the veins for future use.

II. Central Venous Line Placement: Femoral Venous Catheterization

1. INDICATIONS:

Make sure that patient have one of the following indications:

- **Any situation that requires central venous access or venous access that cannot be obtained peripherally:**

☐ An emergency resuscitation requiring administration of large amounts of fluids.

☐ The need for central venous pressure monitoring.

☐ Placement of a pulmonary artery catheter.

☐ The need for frequent blood draws.

☐ Infusion of hyperalimentation, concentrated solutions (KCl, dextrose concentrations greater than 12.5%, chemotherapeutic agents, hyperosmolar saline).

☐ Infusion of vasoactive substances (ie, dopamine and norepinephrine) that can extravasate and cause soft-tissue necrosis.

☐ Dialysis catheter placement (hemodialysis)

☐ Long-term antibiotics

☐ Plasmapheresis

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

☐ obscure anatomical landmarks.

☐ thrombocytopenia,

☐ coagulopathy.

☐ anticoagulant or thrombolytic therapy.

☐ Skin lesions (such as cellulitis, burns, abrasions, or dermatitis).

☐ Conditions that predispose the patient to sclerosis or thrombosis (such as vasculitis).

☐ thrombus of the femoral vein.

3. EQUIPMENT:

Prepare all materials:

☐ The catheter.

☐ An appropriate size guidewire (at least 2 times the length of the catheter).

☐ An appropriate size introducer needle.

☐ A tissue dilator if the catheter is larger than 3F.

☐ Two or three 3- to 5-mL syringes.

☐ 1% lidocaine and a 26-gauge needle to inject the lidocaine.

☐ Skin preparation solution (either 2% chlorhexidine-based preparation for patients older than 2 months or 10% povidone-iodine).

☐ Sterile drapes.

☐ Scalpel blade.

☐ Suture (ie, 3.0 silk).

☐ Sterile gauze pads.

4. PROCEDURE:

4.1. Patient preparation :

☐ Introduce yourself to the parents and to the patient.

☐ Explain to the parents and the child, if appropriate, the procedure and its purpose.

☐ Young patients should ideally be sedated, or if that is not possible, well restrained, to minimize movement during the procedure

☐ Local anesthesia should be administered prior to central line placement

☐ Equipment should be placed in an easily accessible location to minimize the need to reach or move while inserting the catheter.

☐ Raise bed to a comfortable height for the operator.

☐ All catheter lumens should be pre-flushed and clamped before beginning the procedure.

4.2. Patient position:

☐ Place the patient in the supine position.

☐ Raise the hips slightly to flatten the inguinal area.

☐ Position the patient with his or her legs extended or with the hips and knees slightly flexed in the "frog" position.

4.3. Anatomy review : (Figure 5)

☐ The important anatomic landmarks in femoral artery catheter placement include the femoral artery and the femoral vein (Figure 5).

☐ The femoral artery and vein run in parallel with the artery lateral to the vein.

☐ The inguinal ligament runs from the anterior superior iliac spine to the pubic tubercle.

☐ Remember the mnemonic "NAVEL" (nerve, artery, vein, empty space, lymph), which describes the structures' anatomic location from lateral to medial.

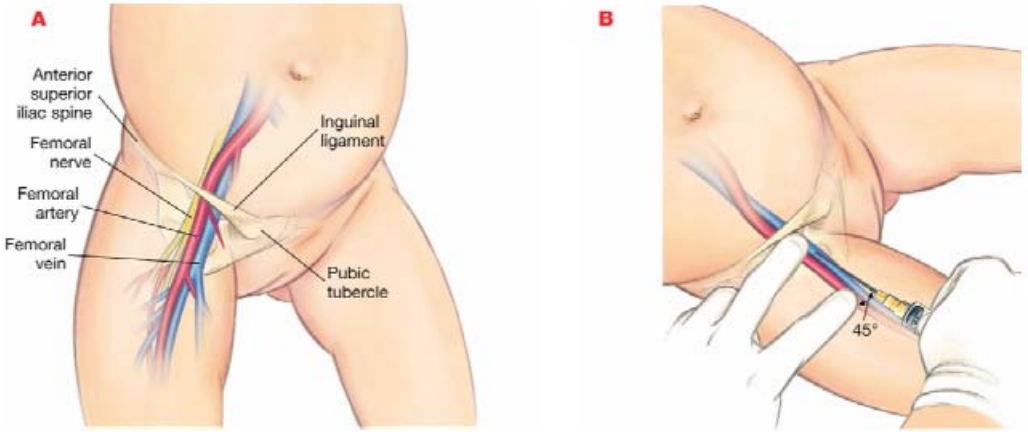


Figure 5 : Femoral vein : A.Anatomy B.Cannulation technique

4.4. Sterile preparation:

☐ Wash your hands and wear sterile attire using aseptic technique, including cap, mask, gown, and sterile gloves.

☐ Prepare the area using either 2% chlorhexidine-based preparation for patients older than 2 months of age or 10% povidone-iodine.

☐ Put sterile drapes.

4.5. Procedure :

☐ Using the nondominant hand, palpate the femoral artery in 2 to 3 places to get a sense for the path of the artery : The femoral vein lies just medial to the artery and typically follows in parallel.

☐ Use ultrasound if possible.

☐ Inject a local anesthetic (1% lidocaine) in the area of the venipuncture site and the tissues deep to the venipuncture site.

☐ Always withdraw the plunger slightly before injecting lidocaine to avoid injecting intravascularly.

☐ Flush all ports of the catheter with normal saline or heparinized saline prior to the procedure.

☐ The technique for placing the catheter is: the Seldinger technique (Figure 6).

☐ Attach the insertion needle to a syringe partially filled with saline.

☐ With the bevel of the insertion needle facing up (toward the ceiling) hold the needle and syringe at a 30- to 45-degree angle directing the needle toward the patient's umbilicus.

☐ Puncture the skin approximately 1–2 cm distal to the inguinal ligament in the location of the femoral vein (just medial to the palpated femoral artery).

☐ As the needle is slowly advanced, gently draw back on the syringe.

☐ When a free flow of blood appears remove the syringe.

☐ Insert the guidewire into the needle.

☐ The guidewire should pass easily through the needle into the vessel.

☐ Leave the distal end of the guidewire exposed.

☐ If resistance is met, redirect the needle or remove the guidewire and needle, apply pressure until the bleeding stops and begin the process over.

☐ Do not force the guidewire into place.

☐ Using the scalpel, make a small (approximately 2 mm) incision at the venipuncture site.

☐ Apply gentle pressure to the venipuncture site and remove the needle, leaving the guidewire in place.

☐ If the catheter is larger than 3F, thread the tissue dilator over the wire and advance it into the venipuncture site.

☐ It may be necessary to use a twisting action to advance the tissue dilator.

☐ Remove the tissue dilator.

☐ The guidewire should be exposed and visible continuously.

☐ Hold the guidewire with the nondominant hand and thread the catheter over the guidewire until the guidewire protrudes from the distal end of the catheter.

☐ It may be necessary to hold a little pressure at the insertion site if there is a significant amount of bleeding.

☐ Take the end of the guidewire with the nondominant hand and pass the catheter over the wire and into the vessel.

☐ Remove the guidewire.

☐ There should be good blood flow from all ports.

☐ Flush each port with attention to removing any air bubbles before flushing.

☐ Suture the catheter in place.

☐ Cap off the catheter or attach it to IV tubing.

4.6. Monitoring:

☐ If the catheter is correctly placed in the femoral vein, blood flow from the catheter should be steady, but not pulsatile.

☐ Verify correct placement by obtaining a venous gas and documenting an appropriate venous saturation.

☐ A more reliable method for verifying catheter placement is to transduce the catheter and confirm a venous waveform and pressure.

a. Follow-up:

☐ The catheter should be removed as soon as it is not needed.

☐ When catheter is no longer needed, remove the sutures and pull the catheter slowly and carefully.

☐ Apply pressure to the insertion site until the bleeding stops.

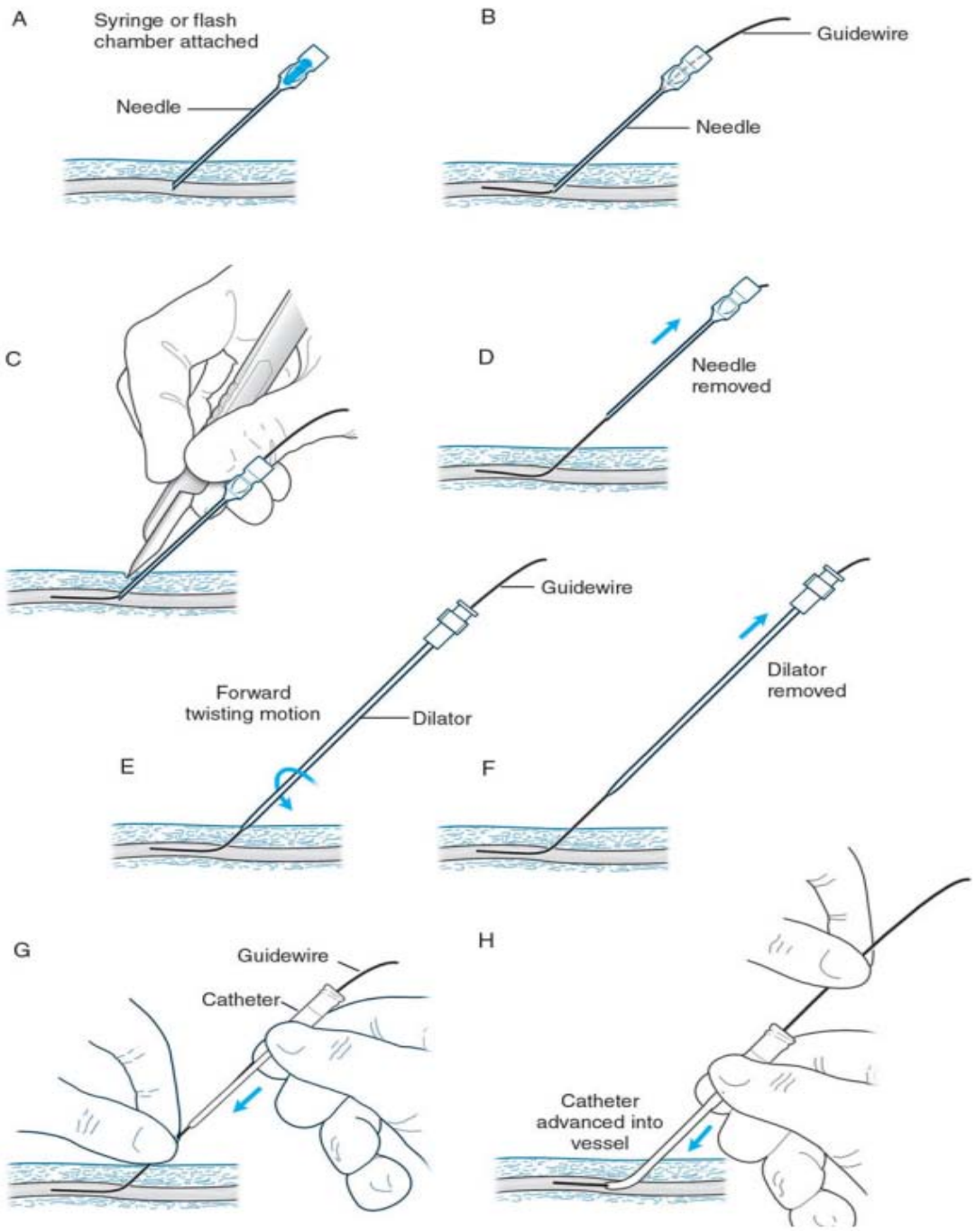


Figure 6: . Seldinger technique.

5. COMPLICATIONS:

Monitor the patient regularly in order to screen these complications:

5.1. During Catheter Placement

☐ Bleeding, the main complication, often results from inadvertent artery puncture.

☐ Local hematomas.

☐ Bowel or bladder perforation.

☐ Air embolus.

☐ Catheter embolus.

☐ Creation of an arteriovenous fistula.

5.2. With Catheter in Place

☐ Infection

☐ Swelling of the lower extremity, resulting from impaired venous return.

☐ Deep venous thrombosis or inferior vena cava thrombosis.

☐ Catheter knotting.

☐ Catheter malposition (ie, insertion into the lumbar venous plexus, a potentially lethal complication)

6. PEARLS AND PITFALLS:

★ The distal end of the guidewire must be visible at all times.

★ The most common complication of this procedure is infection; strict aseptic technique must be adhered to.

★ Always spend time positioning your patient; this maximizes the chances of success first pass.

★ Femoral central venous lines cannot accurately transduce central venous pressures.

★ Asking the patient to perform a Valsalva maneuver has been shown to increase the width of the femoral vein by 1/3.

★ The mnemonic NAVEL (Nerve Artery Vein Empty space Lymphatics) assists in remembering the order of femoral structures from lateral to medial.

★ Obesity is a more important risk factor for infection in femoral sites.

★ The swelling can often be managed by elevating the leg. Care should be taken to confirm palpable distal pulses in such cases.

7. EVIDENCE BASED PRACTICE:

✦ The most common mechanical complication of CVC placement is inadvertent cannulation of an artery. This potentially is a very serious complication. The combined use of ultrasound guidance and pressure measurement is recommended to minimize the incidence of this problem.

✦ Catheter-related bloodstream infection remains an important health problem for hospitalized children. Although placement of a central venous catheter is a life-saving intervention for critically ill children, these same central catheters are a potential source of infection.

✦ Infection control efforts may be most appropriately focused on processes rather than on products.

✦ Current recommendations for limiting infectious complications include the following:

- Strict adherence to sterile technique during catheter placement.
- Use of 2% chlorhexidine-based preparation in patients older than 2 months of age.
- Use of a catheter with the fewest number of lumens that is essential for treatment.

III. Central Venous Line Placement: Umbilical Venous Cannulation (Insertion and Removal)

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Temporary vascular access for infants up to roughly 10 days of life with shock or cardiopulmonary failure.

☐ Emergency vascular access in this age group, when peripheral intravenous (IV) access cannot be rapidly obtained.

☐ Preferred vascular access in infants less than 1000 g.

☐ Emergency vascular access for fluid and medications.

☐ Administration of high glucose concentration and total parenteral nutrition.

☐ Central venous pressure monitoring.

☐ Exchange transfusion.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

☐ Omphalitis.

☐ Omphalocele.

☐ Necrotizing enterocolitis.

☐ Peritonitis.

☐ Umbilical surgery.

3. EQUIPMENT:

Prepare all materials: (Figure 7)

☐ Sterile catheter

- Use 3.5F catheter for patients weighing < 1500 g.
- Use 5F catheter for patients weighing > 1500 g.

☐ Sterile umbilical catheter tray includes the following:

☐ Sterile drapes.

☐ alcohol swabs.

☐ Umbilical tie.

☐ Toothed iris forceps.

☐ 2 curved non-toothed hemostats.

☐ Suture scissors.

☐ Small needle holder.

☐ 3-0 silk suture on small curved needle.

☐ 3-way stopcock with Luer-Lok.

☐ 3-mL and 1-mL syringes with needles.

☐ 2 × 2 gauze

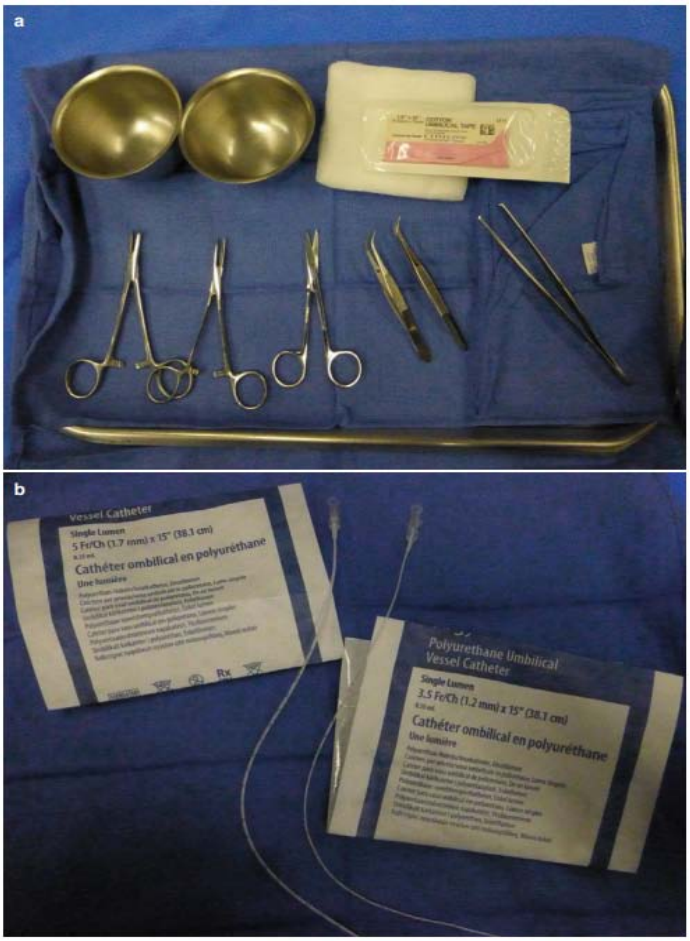


Figure 7: (a) Instrumentation suggested for umbilical venous catheter placement.
(b) Umbilical venous catheters (in an emergency, 5 F feeding tube is an acceptable alternative)

4. PROCEDURE:

4.1. Patient preparation :

☐ Place the infant on a radiant warmer.

☐ Place chest leads for continuous cardiorespiratory monitoring and a sensor for pulse oximetry monitoring throughout the procedure.

☐ Measure the distance from the tip of the shoulder and umbilicus and calculate the length of catheter insertion needed.

- 2/3 of shoulder–umbilical cord distance.

4.2. Patient position:

☐ Place the infant in the supine position, and secure the upper and lower extremities (Figure 8).

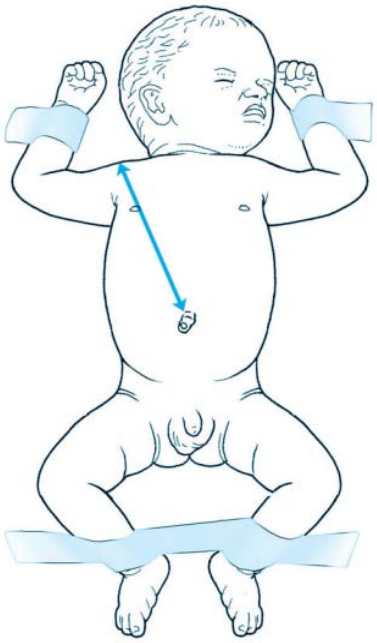


Figure 8: . Secure extremities and measure shoulder tip to umbilicus

4.3. Anatomy review :

☐ Identify the umbilical vessels

- The vein is thinner walled, larger in diameter, and somewhat floppy appearing, relative to the umbilical arteries, and typically located at the 12 o'clock position.
- The arteries are smaller, thick walled, and paired (a single umbilical artery often signifies the presence of a congenital malformation/syndrome) and located at the 4 and 8 o'clock positions full-term infant, the umbilical vein is approximately 2–3 cm long (Figure 9).

☐ In the full-term infant, the umbilical vein is approximately 2–3 cm long. It is directed cephalad and usually lies to the right of the umbilicus.

☐ The umbilical vein gives off several large intrahepatic branches directly to the liver before joining the left branch of the portal vein (Figure 10).

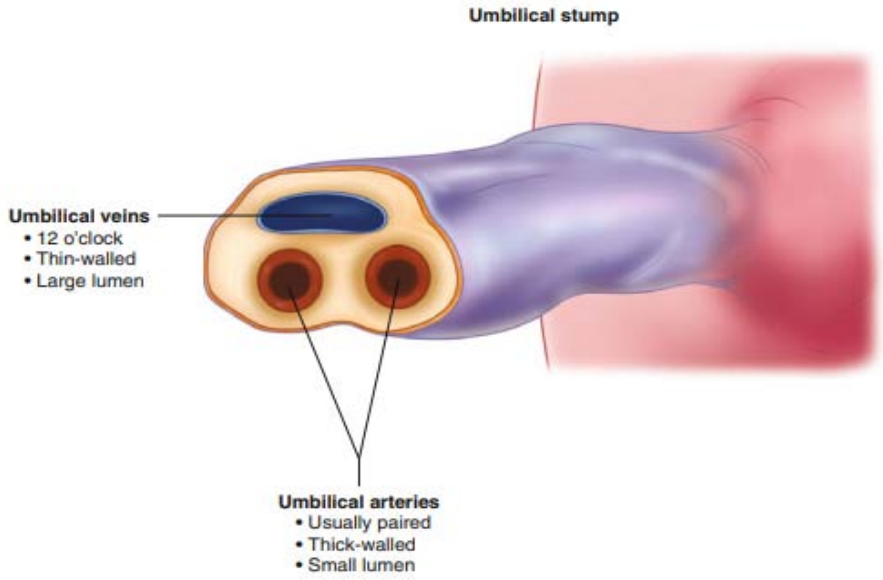


Figure 9: . Anatomy of the umbilical cord when cut transversely approximately 2 cm from abdominal wall

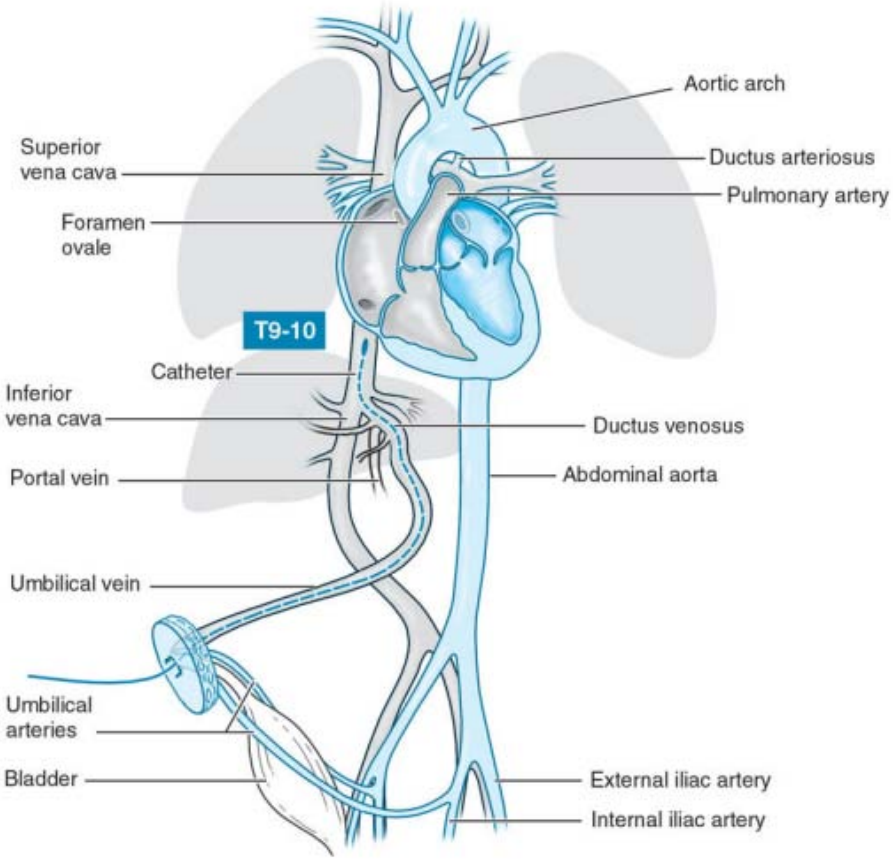


Figure 10: . . Course of umbilical venous catheter.

4.4. Sterile preparation:

☐ Sanitize or wash your hands thoroughly and don gloves.

☐ Use universal precautions or isolation precautions as appropriate.

4.5. Procedure :

☐ Carefully clean the cord and surrounding skin.

☐ Place an umbilical tie at the base of the umbilicus to control bleeding.

☐ Drape the infant with sterile drapes with head and feet visible.

☐ Cut the cord horizontally with a scalpel, approximately 1–2 cm above the skin.

☐ Identify vessels—usually 2 arteries and 1 vein. The vein is a large, thin-walled gaping vessel lying superiorly.

☐ Grasp the umbilical stump on either side with the curved hemostats.

☐ Remove visible clots in the lumen with a forceps.

☐ Gently insert the tip of the iris forceps into the lumen of the vein and dilate as needed.

☐ In general, minimal dilation is needed.

☐ Insert the heparinized saline-filled catheter attached to a stopcock and syringe into the vessel while applying gentle traction on the cord.

☐ Advance in a cephalad direction to the estimated catheter length (Figure 11)

☐ Aspirate gently. If there is smooth blood flow, secure in place and obtain chest and abdominal radiographs to verify position.

Figure 11. Introduction of catheter.

4.6. Monitoring:

☐ The ideal location of the tip of the umbilical catheter is T9–10, just above the right hemidiaphragm and below the heart.

☐ On a radiograph, the catheter will lie to the right of the vertebral column in the inferior vena cava.

4.7. Follow-up (Removal):

☐ Turn infusions off.

☐ Be certain the stopcock is closed to the infant.

☐ It is imperative that there be no air in the catheter before withdrawal (if air is present and infant takes inspiration, the negative pressure generated can pull significant amount of air into the central vasculature).

☐ Remove the securing tape from the infant.

☐ Withdraw the catheter gradually as a single maneuver.

5. COMPLICATIONS:

Monitor the patient regularly in order to screen these complications:

- ☐ Infection.
- ☐ Bleeding due to disconnection of tubing or perforation of vessels.
- ☐ Arterial injury by accidental perforation.
- ☐ Hepatic injury and necrosis if the catheter sits within a portal vein.
- ☐ Thrombosis.
- ☐ Air embolus.
- ☐ Dysrhythmia or pericardial tamponade or perforation if catheter is advanced too far.

6. PEARLS AND PITFALLS:

- ★ The umbilical vein is 2–3 cm long before it widens into the umbilical recess, just before intersecting with the left portal vein and the ductus venosus.
- ★ Be certain to include the length of the umbilical stump in any calculations for placement.
- ★ If the catheter meets resistance before achieving its estimated distance, it has most likely entered the portal system or an intrahepatic branch of the umbilical vein.
- ★ During resuscitation in the delivery room, radiographic confirmation of catheter placement is usually not possible; therefore, always dilute medications and infusions.
- ★ Always check the position of the catheter tip before exchange transfusion. The tip should not be in the portal system or intrahepatic venous branch.

7. EVIDENCE BASED PRACTICE:

- ✦ Because the risk of complications may increase with duration of use, UVCs are often removed after relatively short periods and replaced with percutaneous central venous catheters (PCVCs) for maintenance of long-term fluid and nutritional status.
- ✦ Infection and complication rates were similar between infants managed with an umbilical vein catheter in place for up to 28 days compared with infants managed with an umbilical vein catheter replaced by a percutaneous central venous catheter after 7 to 10 days. Umbilical vein catheter durations beyond the current Centers for Disease Control and Prevention–recommended limit of 14 days may be reasonable

IV. Intraosseous Line Insertion

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Emergency intravascular access when other methods have failed.

☐ Emergent temporary vascular access during cardiopulmonary resuscitation or during the treatment of uncompensated shock when unable to insert an intravenous line.

☐ ty to gain vascular access in pediatric patients presenting in shock due to hemorrhage (trauma), sepsis, profound dehydration, or cardiac failure.

☐ Sampling of blood and bone marrow.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

2.1. Absolute :

☐ Proximal ipsilateral fracture.

☐ Previous surgery at insertion site (e.g. sternotomy/knee replacement).

☐ Cellulitis or burn overlaying insertion sit.

2.2. Relative:

☐ Previous IO attempts in same bone.

☐ Osteogenesis imperfecta.

☐ Osteoporosis.

☐ Inability to identify landmarks (e.g. obesity).

☐ Cystic bones.

3. EQUIPMENT:

Prepare all materials:

☐ Intraosseous needle (Figure 12-13) or bone marrow aspiration needle.

☐ Povidone, chlorhexidine, alcohol wipes.

☐ Gauze.

☐ Tape.

☐ Extension tubing.

☐ T-connector.

☐ Syringe.

☐ Gloves.

Figure 12 : manual intraosseous needles

Figure 13 : EZ-IO™ power driver.

The EZ-IO intraosseous infusion system uses a hand-held power drill to drive a hollow drill-tipped needle into the intraosseous space .The EZ-IO™ needles come in both adult AD (25-mm; 15G) and Pediatric PD (15-mm 15G) sizes.

4. PROCEDURE:

4.1. Patient preparation :

☐ Introduce yourself to the parents and to the patient.

☐ Explain to the parents and the child, if appropriate, the procedure and its purpose.

☐ Choose the most appropriate site.

☐ Inject local anesthetic if the patient is conscious.

4.2. Patient position:

☐ Support the site of insertion over a firm surface.

☐ Hold the extremity above and below the insertion site.

☐ Position the patient with the selected site closest to where you are standing.

4.3. <u>Anatomy review :</u>

a. Recommended Sites of Intraosseous Insertion

a.1. INFANT (figure 14-B.E)

☐ Medial flat surface of the anterior tibia 1–2 cm below the tibial tuberosity.

☐ Direct the needle caudally to avoid the growth plate.

☐ Alternate site is the distal femur.

a.2. CHILD (figure 14.D)

☐ Medial flat surface of the anterior tibia 1–2 cm below the tibial tuberosity.

☐ Alternate site is the distal tibia.

a.3. ADOLESCENT (figure 14-B.C).

☐ Medial flat surface of the anterior tibia.

☐ Alternate sites include the following:

- Distal tibia proximal to the medial malleolus.
- Distal femur.
- Anterior superior iliac spine.
- Posterior superior iliac spine.
- Iliac crest.

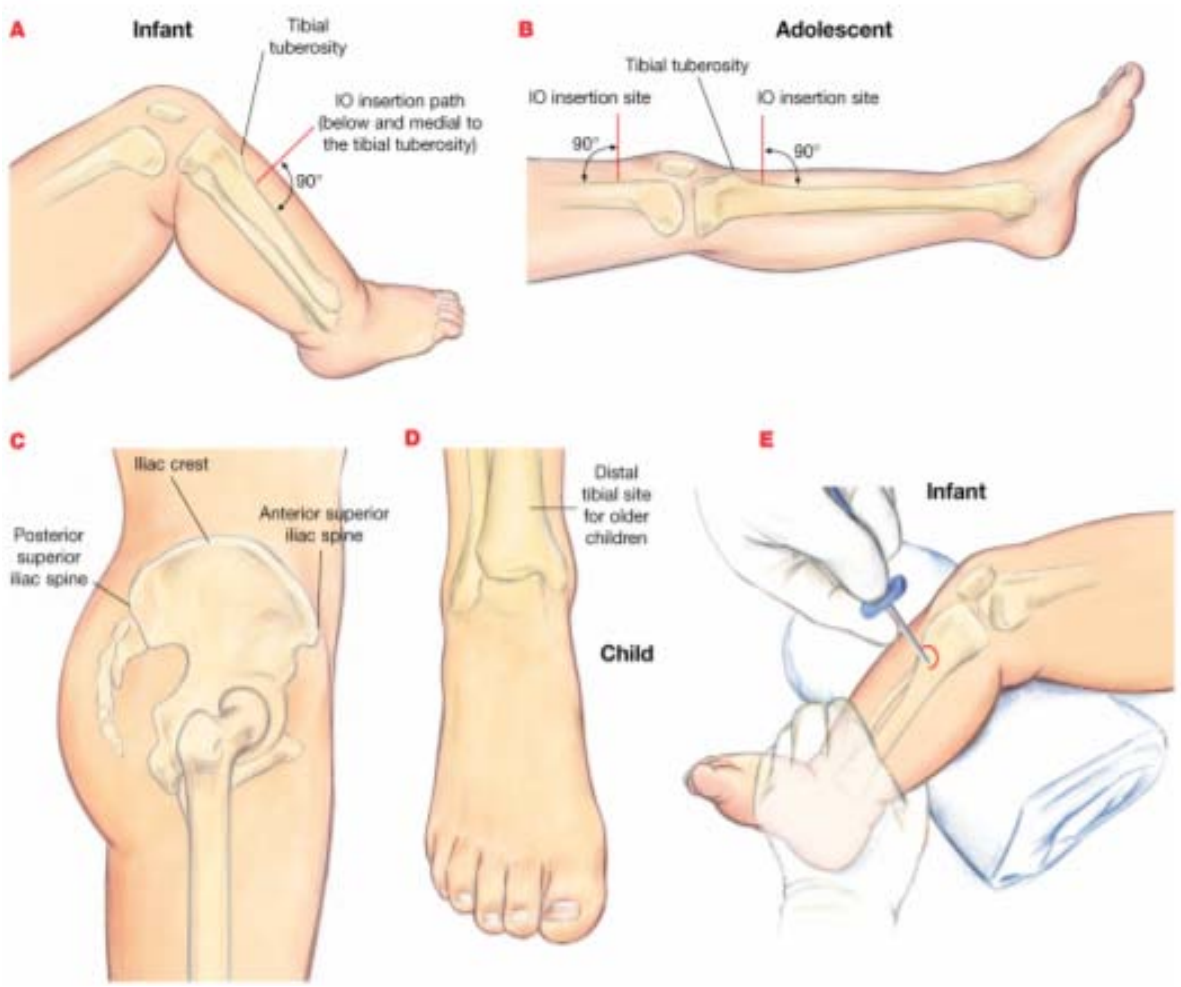


Figure 14 : A: general landmarks for IO insertion in the leg of an infant .B: locations for IO insertion in the proximal Tibia and distal Femur in older children .C: location for IO insertion in the iliac crest .D: location for IO insertion in the distal Tibia .E: technique for immobilizing the leg while twisting the IO needle into the leg of an infant.

4.4. Sterile preparation:

☐ Sanitize or wash your hands thoroughly and don gloves.

☐ Use universal precautions or isolation precautions as appropriate.

4.5. Procedure :

☐ Support the leg on a firm surface and have an assistant support the leg above and below the insertion site.

☐ Ensure no hand is under the site.

☐ Administer local anesthetic if the patient is conscious.

☐ Cup the handle in the palm of the hand and stabilise the needle with fingers.

☐ Identify the tibial tuberosity (Figure 15.1)

☐ One to 2 fingerbreadths below the tuberosity and medially, to the flat aspect of the proximal tibia (Figure 15.2)

☐ Angle the device slightly caudal to avoid growth plate (Figure 15.3).

☐ Insert the needle through the skin and into the bone by rotating the needle set clockwise-counterclockwise and applying downward pressure.

☐ Stop when you feel a pop/give. The needle tip should now lie in the intraosseous space.

☐ Unscrew the cap, remove the stylet (Figure 15.4)

☐ attempt to aspirate bone marrow.

☐ The unsupported needle should remain upright if properly placed

☐ If no marrow is aspirated but you think you are in the bone marrow, attempt to flush.

☐ If you encounter resistance, advance needle assembly and reattempt aspiration.

☐ Fluid should flow freely through the needle and the line should flush without resistance.

☐ Attach connector and flush system.

☐ Support/protect needle in position.

☐ Use tape and gauze to secure the line. (Figure 15.5)

4.6. Monitoring:

☐ Watch for signs of compartment syndrome (pain, pallor, loss of pulses, and paresthesia or paralysis).

☐ Look for swelling, redness, blanching, and leakage.

☐ Assess for vasoconstriction.

4.7. Follow-up:

☐ Avoid prolonged use. Replace with an intravenous line after the patient is stabilized.

☐ A properly placed unsupported needle will remain upright.

☐ Fluid should flow freely through the needle, and the line should flush without resistance.

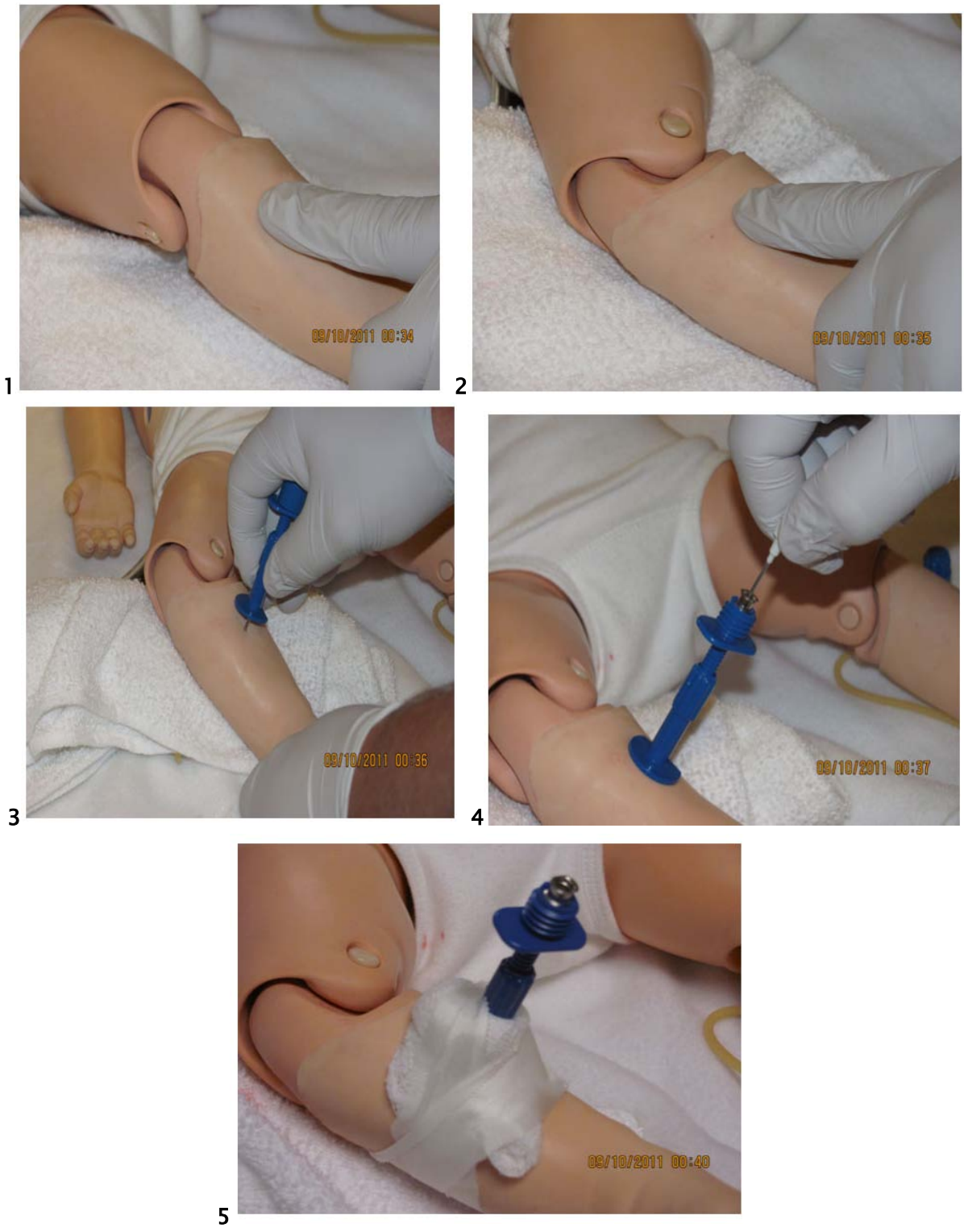


Figure 15 : Steps of IO Line insertion

5. COMPLICATIONS:

Monitor the patient regularly in order to screen these complications:

5.1. Technical difficulties

☐ Over-penetration.

☐ Incomplete penetration.

☐ Needle obstruction.

☐ Fluid extravasation.

5.2. Soft tissue and bony complications

☐ Infection.

☐ Bony inflammatory reaction.

☐ Skin sloughing.

☐ Compartment syndrome.

☐ Epiphyseal injury (Injury to growth plate).

☐ Fat embolism.

☐ Pain with infusion.

6. PEARLS AND PITFALLS:

★ Avoid administration of bone marrow-suppressing drugs.

★ Be certain to avoid placing a hand beneath the IO site during placement in order to prevent possible IO penetration into the provider's tissue.

★ Likewise, one may not be able to aspirate bone marrow or blood, even with an appropriately placed IO. DO NOT pull out the IO if marrow cannot be aspirated. Rather, gently but firmly infiltrate 10 mL normal saline.

★ Blood gases, body chemistries, and blood typing can be obtained from IO samples, but the sample CANNOT be used for hematocrit determination.

7. EVIDENCE BASED PRACTICE:

- ✦ Intraosseous infusion has numerous advantages over other techniques that provide vascular access during emergencies. It has broad applicability and few contraindications or restrictions.
- ✦ The success rate for the technique is very high, and the rate of complications is very low. The success rate increases as the staff becomes more experienced with the technique.
- ✦ the technique should be reserved for children in crisis (those with cardiopulmonary arrest, shock, burns, and life-threatening status epilepticus), in whom other methods of access to the vascular system have failed.
- ✦ A reasonable time limitation would be five minutes for children who have cardiopulmonary arrest, preferably five minutes after adequate ventilation is established, since many such children respond to adequate ventilation alone without need for drug therapy.
- ✦ IO cannulation requires significantly less time to enable administration of drugs or infusion solutions compared to CVC.

PART II : SAMPLING

I. Blood-Taking and Cultures

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ To obtain blood samples.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

☐ Infection at the site of access, e.g. cellulitis.

☐ Bleeding tendencies (relative contraindication), e.g. on warfarin

☐ Thrombophlebitis.

☐ Taking sample from 'drip arm' (stop infusion and wait for at least 2 minutes before sampling).

3. EQUIPMENT:

Prepare all materials:

☐ Straight needle or a multisampling needle and collecting tube. (Figure 16)

☐ Syringe

☐ Gloves.

☐ Tourniquet or rubber band.

☐ Alcohol wipes / cotton wool

☐ Povidone or chlorhexidine.

☐ capillary tube and/or blood bottle (Table II)

Table II: A summary of blood collection bottles

Bottle lid colour	Tube contents	Tests
Purple	EDTA (ethylenediamine-tetraacetic acid)	Full blood count, ESR, malaria screen, tacrolimus, cyclosporin, HbA1c, PCR analysis, cross-match and group and save
Gold	Clotting accelerator and separation gel	Biochemistry testing, tumour markers, endocrine testing
Light blue	Trisodium citrate	Coagulation testing
Red	Clotting accelerator	Serology, vancomycin, immunology, insulin, B12, folate
Grey	Sodium fluoride/ potassium oxalate	Glucose
Green	Lithium heparin	Ammonia
Royal blue	Sodium heparin	Trace elements

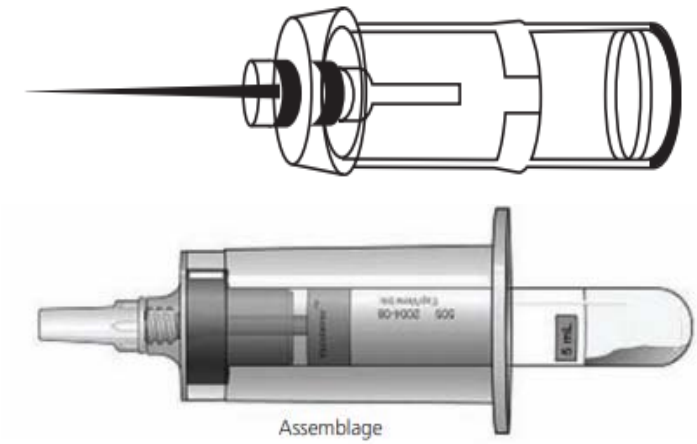


Figure16: A multisampling needle and collecting tube :the vacutainer

4. PROCEDURE:

4.1. Patient preparation:

☐ Introduce yourself to the parents and to the patient.

☐ Explain to the parents and the child, if appropriate, the procedure and its purpose.

☐ Identify the patient.

☐ Prepare and organize venipuncture equipment.

☐ Select the hand that has easily visible veins.

4.2. Patient position:

☐ Ensure the baby is in a safe and comfortable position.

4.3. Anatomy review:

☐ For babies and toddlers (younger than 2 years old) – use dorsal surface of hands and feet.

☐ For older children – use the antecubital fossa.

4.4. Sterile preparation:

☐ Sanitize or wash your hands.

☐ Cleanse the site with antiseptic solution.

☐ Wear protective gloves.

4.5. Procedure: (Figure 17)

☐ Reposition fingers around infant's wrist and flex infant's hand.

☐ The needle should be angled 15 degrees to the skin.

☐ The skin should be pierced 3-5 mm distal to the vein

☐ advanced slowly and carefully until vein is punctured.

☐ As soon as blood appears, pull the syringe plunger to fill with blood.

☐ Make sure not to exceed maximum daily blood volume.

☐ Insert slowly into a vein until blood drips from the end.

☐ Drip samples into bottles.

☐ With the syringe tip held facing down, center the blood collection tube over the holder portion of the Blood Transfer Device and push it in.

☐ After removing the last tube, discard the entire assembly into a sharps container.

☐ Gently invert additive tubes and label tubes with:

- Patient's name.
- Medical record number.
- Date; Time of draw.
- Blood collector's initials.

☐ Notify the infant's nurse of the total blood volume collected, or record in appropriate log.

The procedure for performing venipunctures on children older than 2 years is similar to that of adults. The differences include the necessary preparation of the child and parent, assistance in restraining the child, and the size of the venipuncture equipment.

(a)

(b)

(c)

Figure 17 : Step-by-step guide: venpuncture. (a) Apply a tourniquet to the upper arm. (b) Sterilise the skin using 2% chlorhexidine in 70% alcohol solution. (c) Attaching a collecting bottle to the Vacutainer™ system.

5. COMPLICATIONS:

Monitor the patient regularly in order to screen these complications:

☐ Infection at the puncture site. This can be minimized by cleaning the skin with an antiseptic

☐ Hematoma. This occurs more frequently if patients are on warfarin or steroid therapy. To avoid a hematoma, apply gentle pressure for 1–2 minutes after the procedure and release the tourniquet before removing the needle. Advise the patient to keep their arm straight.

☐ Pain. This may be from the tourniquet or from venipuncture. A local anesthetic cream may be applied to the skin to reduce the pain incurred.

6. PEARLS AND PITFALLS:

★ If using the needle and syringe technique, loosen the plunger several times before taking the blood – this should avoid the plunger sticking.

★ Encourage vasodilation by asking the patient to repetitively clench and release his or her first, and by gently tapping on the vein.

★ Tether the skin with your spare hand to help fix the vein.

★ Consider whether a cannula is also needed – if so, blood can be taken from the cannula after insertion, by using either a Vacutainer™ technique or a needle and syringe

★ Take great care when labelling cross-match and group and save samples – the smallest of errors can make the sample void. Always handwrite these samples and include all the patient's details.

7. EVIDENCE BASED PRACTICE:

- There is growing evidence that Blood Culture Contamination (BCC) is responsible for unnecessary and costly treatment or investigations. To reduce the risk of contamination at the time of BC sampling, a rigorous implementation of guidelines should be combined with strategies to avoid unnecessary blood venipuncture.
- Appropriate aseptic technique does not necessarily require sterile gloves. A new pair of disposable nonsterile gloves can be used in conjunction with a "no touch" technique for phlebotomy.
- Regarding the use of venous versus arterial sampling for blood cultures, some experts have suggested venipuncture as the preferred method of blood sampling for term neonates because it is associated with fewer complications and is less painful.

II. Capillary artery sampling : Heel prick

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Most routine blood tests requiring less than 1ml of blood.

☐ Metabolic and genetic screening tests.

☐ Blood glucose and Lactate analysis.

☐ Blood gases.

☐ Newborn Blood spot screening.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

☐ Severe bruising, oedema or poor perfusion.

☐ Test for : Clotting, Ammonia or blood cultures.

3. EQUIPMENT:

Prepare all materials:

☐ cotton wool,

☐ capillary tube and/or blood bottle,

☐ appropriate depth incision device

☐ clean tray

☐ sharps bin.

☐ antiseptic solution.

4. PROCEDURE:

4.1. PATIENT PREPARATION

☐ Identify the patient.

☐ Introduce yourself to the parents and to the patient.

☐ Explain to the parents and the child, if appropriate, the procedure and its purpose.

☐ Warm the foot before sampling

4.2. Patient position:

☐ Ensure the baby is in a safe and comfortable position, offer the baby oral sucrose if appropriate (Figure 18).

4.3. Anatomy review:

☐ Obtain the blood sample from the medial or lateral portions of the plantar surface of the heel (Figure 19).

Figure 18 : Holding the foot for heel prick sampling.

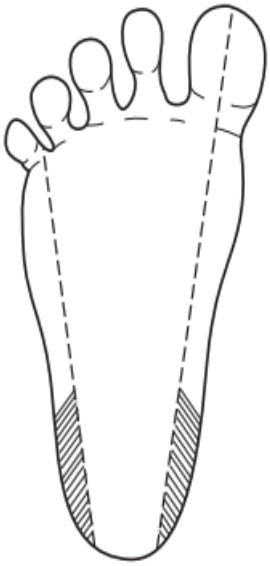


Figure 19: Shaded areas show where to perform heel prick.

4.4. Sterile preparation:

☐ Sanitize or wash your hands.

☐ Wear protective gloves.

4.5. Procedure:

☐ Warm the foot before sampling.

☐ Cleanse the site with antiseptic solution.

☐ Hold the foot between fingers and thumb.

☐ Puncture the skin with an appropriate lancet. There are different-sized devices depending on the size of baby.

☐ Milk the blood down the foot held in dorsiflexion.

☐ Release the foot momentarily each time to ensure blood flows back into the foot.

☐ Avoid squeezing the foot – this often results in hemolysis and having to repeat the test.

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

☐ bruising.

☐ Hemolysis of the sample.

☐ Infection from the puncture site.

☐ Sore heels.

6. PEARLS AND PITFALLS:

★ The heel stick method of capillary blood sampling is described, but capillary blood samples can also be obtained from a finger, toe, or earlobe.

★ When a heel stick is performed for an arterialized blood sample, use the same technique, but take care not to introduce ambient air into the sample. Place the tip of the tube as near the puncture site as possible to minimize exposure of the blood to environmental oxygen.

★ Excessive squeezing of the foot may artificially lower the partial pressure of oxygen (PO2).

★ Before taking a heel prick sample consider whether a venous sample would be more appropriate as:

- A venous sample is less painful for the infant.
- Poor peripheral perfusion does not permit successful capillary sampling.

★ If frequent sampling is required, try to sample from alternate heels/sites to prevent them becoming sore.

7. EVIDENCE BASED PRACTICE:

✦ Improper lancing of the heel can result in nerve damage, bone damage, osteomyelitis, cellulitis, infection and scarring. Bone damage results from heel-sticks that are sufficiently deep to pierce the calcaneus.

✦ Properly disinfect the site to reduce the potential for infection. Remove povidone iodine or chlorhexidine completely with sterile saline or sterile water and allow to dry. Alcohol should not be used for disinfection on premature infants.

✦ Numerous recent studies indicate that sucrose provides analgesia and that the effect is intensified with sucking.

✦ There is a large body of evidence demonstrating the analgesic efficacy of oral sucrose during minor painful procedures in young infants. Despite this evidence, sucrose is not utilized in many settings for management of acute procedural pain.

✦ Oral sucrose is a safe and effective mild analgesic which is effective in decreasing short-term pain and distress during minor procedures. Small amounts of sweet solutions (oral sucrose) are placed on the infant's tongue to reduce procedural pain.

III. Arterial Puncture

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Collection of arterial blood when unable to sample venous blood to help manage fluid and electrolyte imbalance

☐ Collection of arterial blood for blood gas analysis to manage cardiopulmonary disorders and maintain acid-base balance.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

2.1. Absolute :

☐ Inadequate circulation

☐ Raynaud's syndrome

2.2. Relative:

☐ Previous surgery in the area

☐ Anticoagulation/coagulopathy

☐ Skin infection at the site

☐ Atherosclerosis

☐ Inadequate collateral flow (Allen test)

☐ First- or second-degree burns of the extremity

3. EQUIPMENT:

Prepare all materials:

- ☐ Gloves.
- ☐ 23-gauge or smaller butterfly needle or regular needle.
- ☐ heparinized syringe for blood gas sampling.
- ☐ Syringes for blood sampling.
- ☐ Disinfectant (povidone-iodine, chlorhexidine, and alcohol) swabs.
- ☐ Sterile gauze pads.
- ☐ Topical anesthetic.

4. PROCEDURE:

4.1. Patient preparation:

- ☐ Introduce yourself to the patient and parents.
- ☐ Explain the procedure to the patient (if appropriate) and the parents.
- ☐ Choose site of puncture.
- ☐ **Apply topical anesthetic to the site.**

4.2. Patient position:

- ☐ Position the patient with the puncture site within easy reach.
- ☐ Have an assistant gently immobilize the extremity.
- ☐ If using the femoral artery, open the femoral joint by elevating it over a rolled up towel.

4.3. Anatomy review: (Table III)

☐ Radial Artery (Figure 20)

- ✓ The palmar arch is composed of the radial and ulnar arteries and connecting palmar arteries
- ✓ The radial artery is located at the wrist proximal to the head of the radius.
- ✓ In most patients, collateral circulation is dependent on an intact ulnar artery.

☐ Femoral Artery (Figure 21)

- ✓ The femoral artery is located below the inguinal ligament over the femoral gutter halfway between the pubic symphysis and the anterior superior iliac spine
- ✓ The femoral artery lies in the gutter lateral to the femoral vein.

Table III : sites for arterial puncture.

	Advantages	Disadvantages
Radial	Lies close to the surface Easily compressible Easy aseptic approach	End artery Pulse may be hard to feel in shut down patients or in patients with atrial fibrillation
Brachial	Can lie close to the surface Easy aseptic approach Easily compressible	End artery, quite mobile! Close proximity to the nerve
Femoral	Reliable position, good landmarks Can take other bloods at the same time Can be found in shut down patients with poor or no pulses	Dirtier' area of the body May dislodge plaque in PVD

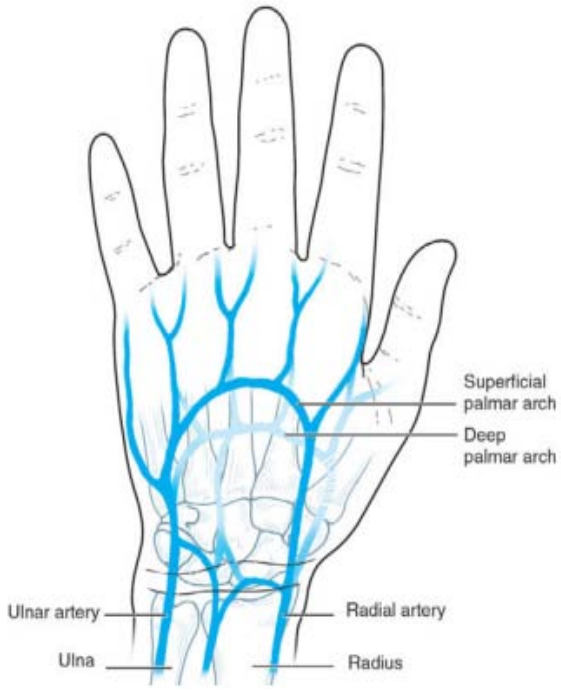


Figure 20 : Anatomy of radial artery.

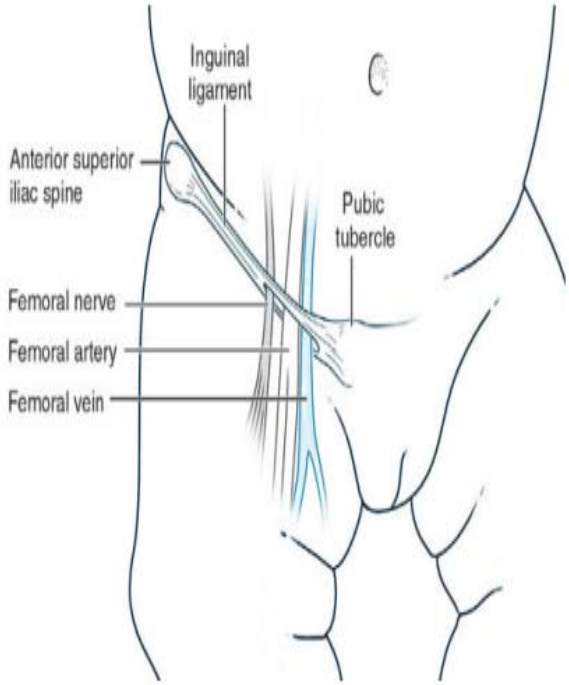


Figure 21 : Anatomy of femoral structures.

4.4. Sterile preparation:

☐ Sanitize or wash your hands thoroughly and don gloves.

☐ Use universal precautions or isolation precautions as appropriate.

4.5. Procedure :

a. Radial Artery (Figure 23)

☐ Palpate the radial pulse.

☐ Perform Allen test (Figure 22); proceed only if test demonstrates collateral circulation.

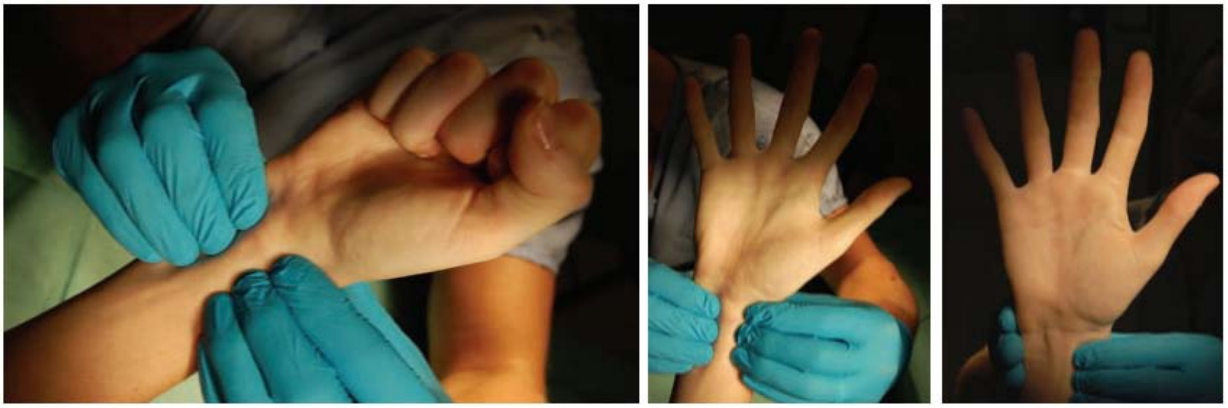


Figure 22 : Allen's test. (a) The patient's hand is elevated and pressure applied to both the radial and ulnar arteries. (b) The patient's hand will blanch white. (c) On release of pressure over the ulnar artery the hand should re-perfuse and lose its white coloration.

- ☐ With your nondominant hand, hold the patient's hand palm up in a neutral position.
- ☐ Hold all the patient's fingers in the palm of your nondominant hand.
- ☐ Palpate radial artery with your dominant hand.
- ☐ Disinfect site.
- ☐ Break the skin at a 30- to 45-degree angle proximal to the crease between the hand and the wrist .
- ☐ Flatten the angle and advance proximally until blood flashback is seen in the tubing.
- ☐ If the needle perforates the artery, gently withdraw it until flashback is seen in the tubing.
- ☐ Fill syringe and test tubes with arterial blood sample.

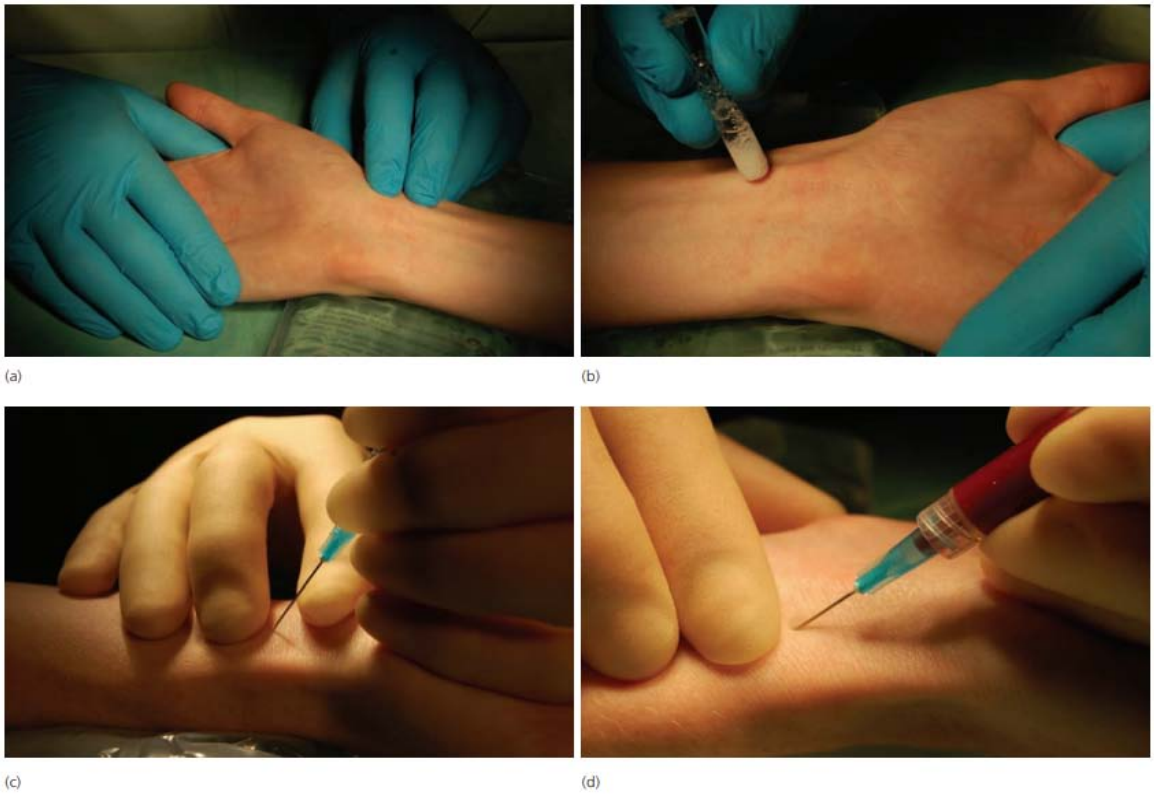


Figure 23: Step-by-step guide: sampling the arterial blood gas. (a) Palpating the radial pulse to identify the point of maximal pulsation. (b) Sterilising the area using 2% chlorhexidine in 70% isopropyl alcohol. (c) The skin is punctured at a 45° angle in a proximal direction with the syringe held like a pencil. (d) Flashback followed by syringe fi ling as the artery is punctured.

b. Femoral Artery

☐ Palpate the pulse with your nondominant hand.

☐ Don gloves.

☐ Disinfect puncture site.

☐ Palpate the artery with the second and third fingers of your nondominant hand, and apply traction with your thumb.

☐ Break the skin slightly distal to the palpated pulse at an 80-degree angle and advance until blood appears in the tubing.

☐ Fill syringes and test tubes with blood samples.

4.6. Monitoring:

- ☐ Monitor extremity for hematoma formation.
- ☐ Palpate distal pulses.
- ☐ If unable to palpate, use Doppler.
- ☐ Assess temperature of the extremity.
- ☐ Measure oxygen saturation levels of the extremity using pulse oxime

5. COMPLICATIONS :

Monitor the patient regularly in order to screen these complications:

- ☐ Pain and discomfort.
- ☐ Arterio-spasm.
- ☐ Hematoma.
- ☐ Infection.
- ☐ Bleeding
- ☐ Ischemia.
- ☐ Thrombus.
- ☐ Arteriovenous fistula formation.
- ☐ Pseudoaneurysm formation.

6. PEARLS AND PITFALLS:

- ★ Use smallest gauge needle to minimize arterial trauma.
- ★ Hold pressure over puncture to prevent hematoma formation and bleeding.
- ★ The radial artery and the femoral artery are the preferred sites for arterial puncture.

- ★ If the pulse is hard to palpate, use Doppler and mark the location.
- ★ In small infants, the radial artery may be located by transillumination.

7. EVIDENCE BASED PRACTICE:

- ✦ Well-planned, evidence-based training sessions using low-tech simulators could help educators to achieve good educational outcomes and promote patient safety.
- ✦ the use of a local anesthetic before arterial puncture is not universal, contrary to the standard of practice.
- ✦ sampling blood gas with the radial arterial procedure is less painful than the femoral arterial procedure.
- ✦ The research results showed that cold pack as a simple, non-invasive and inexpensive technique could be effective for pain management before arterial puncture.

IV. Lumbar Puncture

1. INDICATIONS:

Make sure that patient have one of the following indications:

1.1. Diagnostic:

☐ Evaluation of cerebrospinal fluid (CSF) for infection (viral, fungal, or bacterial) or malignancy.

☐ Metabolic studies.

☐ subarachnoid hemorrhage.

☐ Measurement of opening pressure.

☐ Diagnosis of central nervous system (CNS) metastases.

☐ Injection of radiopaque dye for spinal cord imaging.

1.2. Therapeutic:

☐ Intracranial pressure or pseudotumor: removal of CSF (e.g. idiopathic intracranial hypertension).

☐ Instillation of intrathecal chemotherapy.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

☐ Bleeding diathesis (platelet count <50,000).

☐ Overlying skin infection near the area of puncture site.

☐ Spinal cord trauma or spinal cord compression.

☐ Increased intracranial pressure.

☐ Cerebellar Tonsillar Herniation.

☐ Focal neurological signs.

☐ Unilateral mass lesion with edema or mass effect.

☐ Condition of the patient (e.g., unstable airway, potentially dangerous breathing problem, severe circulatory instability) that could cause an abrupt decompensation.

☐ Known spinal cord deformity.

3. EQUIPMENT:

Prepare all materials:

☐ Spinal needle(s) with stylet (**atraumatic needle**)

- Older children : 3.5-in.22-gauge needle
- Children: 2.5-in. 22-gauge needle (2-8years)
- Infants: 1.5-in. 22-gauge needle

☐ Three-way stopcock (optional: drainage catheter)

☐ Collection tubes: three sterile universal containers + glucose tube

☐ Local anesthetic (lidocaine 1 or 2 %)

☐ 5- to 10-mL syringe

☐ needle for local anesthesia

☐ Sterile drapes and gauze

☐ Mask, sterile gown, sterile gloves

☐ Antiseptic solution for skin preparation

4. PROCEDURE:

4.1. Patient preparation:

☐ Introduce yourself to the parents and the patient.

☐ Explain the procedure.

☐ **Local anesthesia**: 1 % Lidocaine(1-2ml) or anesthetic cream topically before preparing skin

☐ Sedation, if needed.

4.2. Positioning:

☐ **lateral recumbent position (Figure 24.a)**

☐ upright sitting position (open up the intervertebral spaces) **(Figure 24.b)**

☐ Shoulders and hips aligned.

(a)  (b) 

Figure 24. Positioning for lumbar puncture:

(a) lateral recumbent position
(b) upright sitting position

4.3. Anatomy review:

☐ Palpate the posterosuperior iliac crests with the midpoint of a visual line that connects the two crests (Tuffier's line) representing the L4 spinous process.

☐ Palpate the space between the L4–5 or the L5–S1 spinous processes and mark where the needle will be placed (midline approach; paramedian approach)

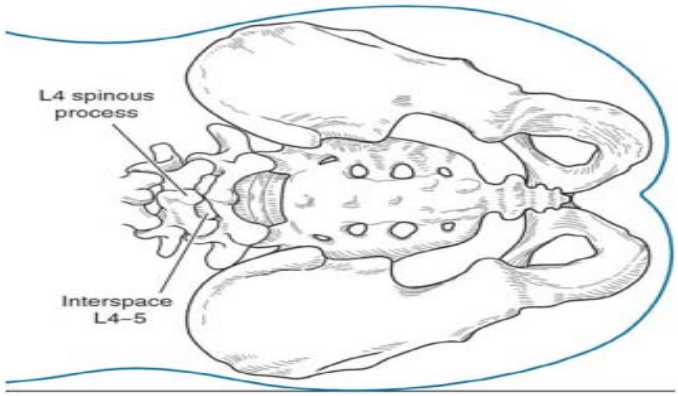


Figure 25. Use iliac crests as landmarks to palpate L4 spinous process.

4.4. Sterile preparation:

☐ Scrub up – wear mask, hat, sterile gown and gloves.

☐ Make sure the patient's back is completely exposed.

☐ Sterilize the skin of the patient's lower back (2% chlorhexidine or betadine)

☐ Sterile drape with fenestration over mid-lumbar spine.

4.5. Procedure:

☐ Needle should be inserted at 90° to the skin in the midline between the L4-5 or the L5-S1 spinous process, and the stylet should be firmly in place.

☐ Initially parallel to the bed, but once into the subcutaneous tissue, the needle should be angled toward the umbilicus (slightly cephalad, 15°) with the bevel facing upward.

☐ Advance the needle slowly.

☐ a "pop" will be felt when the needle penetrates the ligamentum flavum, entering into the subarachnoid space (Figure 26).

☐ Stop advancing the needle and withdraw the stylet.

☐ The CSF should flow freely.

☐ If no CSF flows, continue to advance the needle slowly.

☐ If bone is encountered during insertion, the needle should be withdrawn partially without exiting the skin and readjusted to a different angle more cephalad.

☐ Once lumbar puncture is successful. it is possible to measure the CSF pressure by attaching a manometer via a three-way tap the end of the needle.

(Normal value is 5–20 cmH2O with the patient in the lateral position; legs straightened)

☐ Collect 5–10 drops (approx. 1 mL) of CSF into three universal containers.

☐ Measure closing pressure, if needed.

☐ replace the stylet and remove the needle.

☐ clean the skin and place a bandage.

☐ Send samples for appropriate investigations.

4.6. Follow-up:

☐ Sterile dressing.

☐ Older adolescents should rest in bed for 1–3 hours.

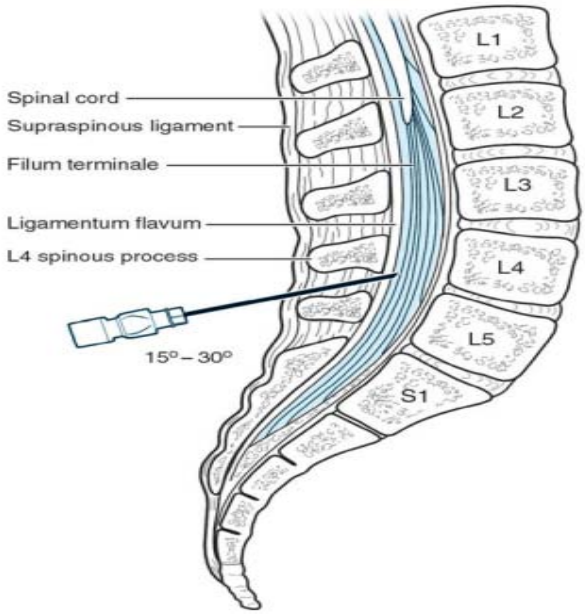


Figure26. Positioning the needle.

5. COMPLICATIONS

Monitor the patient's CNS observations and blood pressure regularly in order to screen these complications:

5.1. Minor

☐ Localized back pain

☐ Transient paresthesia during procedure

☐ Post-lumbar puncture headache: common and may last a few days.

↳ rest, oral analgesics and maintaining hydration.

5.2. Major

☐ subdural or epidural spinal hematoma: can cause spinal cord compression Severe back pain associated with neurological signs.

↳ urgent MRI and emergency neurosurgical drainage.

☐ LP-induced Infection: Meningitis, encephalitis or epidural abscess.

↳ Antimicrobials; MRI; drainage.

☐ **Cerebellar tonsillar herniation (coning): emergency scan; neurosurgery++++**

☐ Acquired epidermoid tumor.

☐ Damage to adjacent structures (disk herniation, retroperitoneal abscess, spinal cord hematoma).

6. PEARLS AND PITFALLS:

- ★ Positioning the patient is key to a successful procedure.
- ★ Always keep the stylet in place until after the skin barrier is penetrated because this will avoid introduction of epidermoid tissue.
- ★ Ultrasound guidance may be Helpful in obese patients, patients with previous surgical scarring, or anyone in whom palpation of the spinous processes is not easily done.
- ★ In obese patients, choosing an LP needle may be more difficult. One study calculated that an LP needle length (in centimeters) of 1 + [17 × (weight in kilograms/height in centimeters)] was most accurate.
- ★ Avoid prolonged severe flexion of the neck in an infant because it may produce airway obstruction. Flexing the hips is more important than flexing the neck.
- ★ Closely monitor all infants with serious cardiopulmonary disease during the procedure.
- ★ General recommendations:
  - **Tube 1: glucose, protein, protein electrophoresis.**
  - **Tube 2: Gram stain, bacterial and viral cultures.**
  - **Tube 3: cell count and differential.**

7. EVIDENCE BASED PRACTICE:

- ✦ Using smaller, 22 G atraumatic needles significantly reduces the incidence of headache after lumbar puncture. (Figure 27)
- ✦ Replacing the stylet before needle withdrawal also reduces the incidence of post-lumbar puncture headache (PLPH).
- ✦ study shows that lumbar puncture in the sitting position results in more post lumbar puncture headache in comparison with patients for whom the test is performed in the lateral decubitus position.

- ✦ Infiltration of 1% lidocaine or lidocaine-prilocaine cream (or both) are recommended measures for pain management in young children and has been associated with improved outcomes during the procedure.

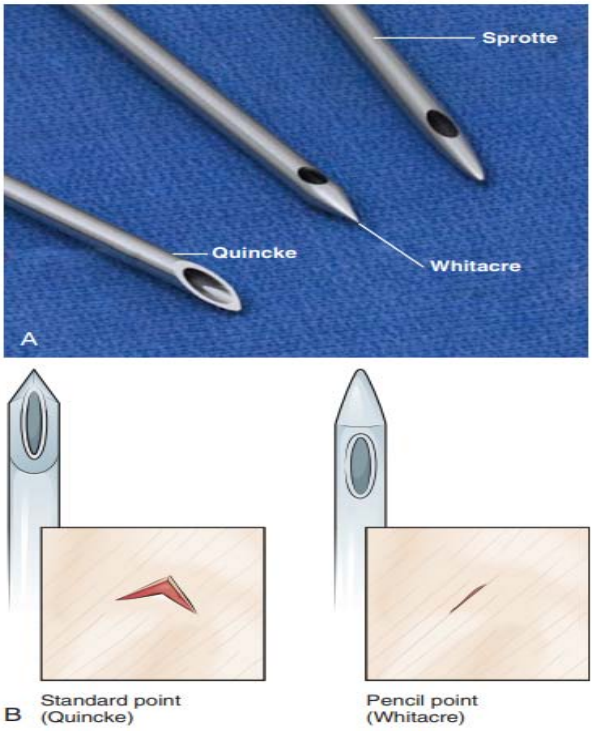


Figure 27 :A, Various spinal needles. B, Penetration of the dura by Whitacre (pencil-point) and Quincke (cutting) needles. The Whitacre needle separates the fibers of the dura without cutting them, whereas the Quincke needle cuts the fibers. The Quincke needle leaves a hole in the dura through which cerebrospinal fluid can leak until the hole heals several days or weeks later. Use of the Whitacre needle has been associated with a lower incidence of post-lumbar puncture headache.

V. Thoracentesis

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Diagnostic evaluation of pleural effusion of unknown etiology.

☐ Therapeutic removal of small pneumothorax.

☐ Therapeutic drainage of pleural effusion in patient with respiratory compromise when fluid is unlikely to reaccumulate.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

☐ Skin infection (eg, herpes zoster) at site of insertion.

☐ Bleeding diathesis, anticoagulant therapy.

☐ Mechanical ventilation.

☐ Small or loculated pleural effusion.

3. EQUIPMENT:

Prepare all materials:

☐ Sterile gloves, mask, and gown.

☐ Iodinated skin preparation with sterile sponges.

☐ Sterile towels.

☐ Local anesthetic (1% lidocaine without epinephrine).

☐ 5-mL syringe with 25-gauge needle.

☐ 18-gauge 2-inch needle.

☐ 18-20-gauge angiocatheter.

☐ Collection basin.

☐ 3-way stopcock.

☐ 20–60–mL syringe.

4. PROCEDURE:

4.1. Patient Preparation:

☐ Patient should have intravenous access.

☐ Oxygen should be available.

☐ Monitor oxygen saturation with pulse oximetry.

☐ Younger patients may need sedation for procedure.

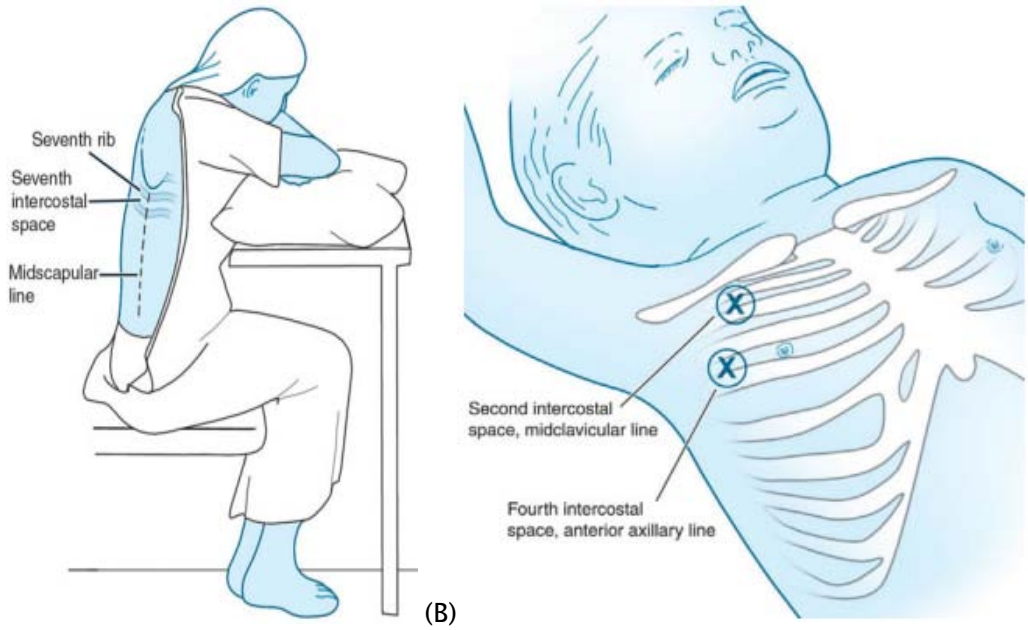
☐ Explain procedure in a developmentally appropriate manner before and during procedure.

4.2. Patient position:

☐ Pleural effusion. (Figure 28.A)

- Sitting upright with arms supported on table in front of patient .
- Lying in lateral decubitus position with effusion side down.

☐ Pneumothorax: Supine with head of bed up 30 degrees. (Figure 28.B)



(A) (B)

Figure 28: (A) Patient positioning for pleural effusion;(B) Patient positioning for pneumothorax.

4.3. Anatomy review:

☐ Chest radiograph.

- Manual percussion to find onset of dullness.

☐ Effusion is usually accessible via the sixth or seventh intercostal space just distal to the scapular tip in the mid-scapular line or posterior axillary line .

☐ If pneumothorax is present, it is usually accessible via the second intercostal space anterior:The first rib is normally not felt. The second rib is felt just below the clavicle. The second intercostal space is the area between the second and the third ribs.

- Ultrasonogram marked location.

☐ Mark location of effusion with the patient in the same position as necessary for procedure.

☐ If possible, do not move patient after marking the location because the fluid may shift.

☐ Neurovascular bundle is on the caudad edge of the rib.

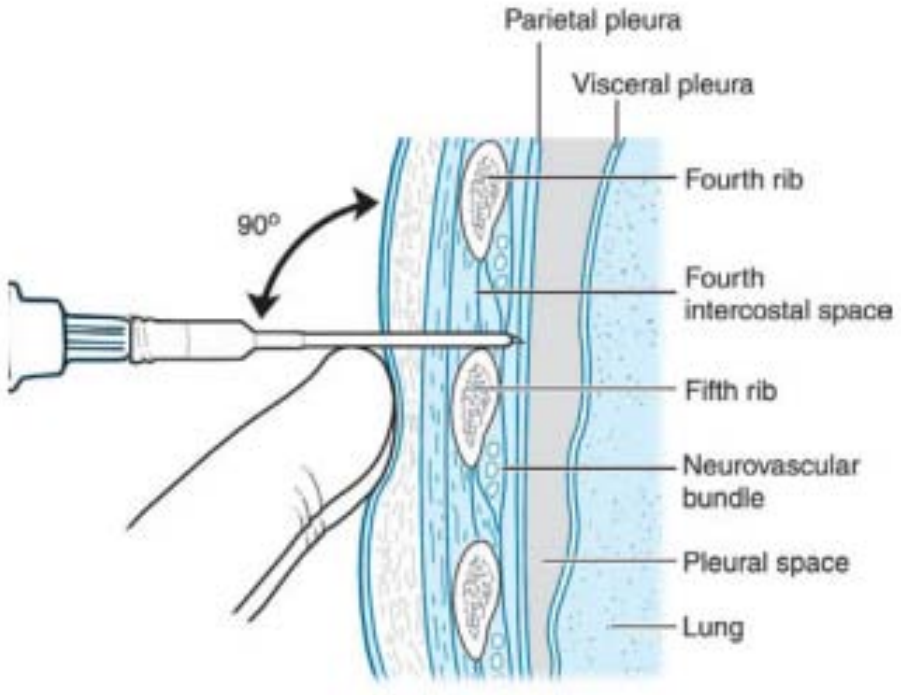


Figure 29. Anatomy of the neurovascular bundle

4.4. Sterile preparation:

☐ Scrub up – wear mask, hat, sterile gown and gloves.

☐ Cleanse area in sterile fashion.

☐ Drape surrounding area with sterile towels.

4.5. Procedure :

☐ Use a 25-gauge needle and 5-mL syringe to infiltrate the skin and make a wheal under the skin.

☐ Change needle to 18 gauge with 2-inch needle.

☐ Going over top of sixth rib, infiltrate through wheal, over top of rib to anesthetize the periosteum, and into pleural space.

☐ Be sure to aspirate first, and know when you are in the pleural space.

➢ Removal of Pleural Effusion for Diagnostic Evaluation

☐ Remove lidocaine syringe and needle to outside the pleural space, with needle still inserted but outside the pleural space; replace syringe with empty 20-60-mL syringe.

☐ Reinsert needle into pleural space while applying gentle negative pressure on syringe.

☐ When in pleural space, a "pop" may be felt and fluid or air will enter syringe.

☐ Remove effusion into syringe.

☐ Remove needle and apply bandage to area.

➢ Therapeutic Removal of Pleural Effusion

☐ Completely remove needle and syringe filled with lidocaine.

☐ Insert angiocatheter into same track and enter pleural space while applying gentle negative pressure.

- ☐ When in pleural space, a "pop" may be felt and fluid or air will enter syringe.
- ☐ Remove inner needle, leaving catheter in place.
- ☐ Ensure that the stopcock is closed to pleural space and chest wall or place a finger over the end of catheter to avoid introducing air into chest wall and creating a pneumothorax.
- ☐ Withdraw syringe full of fluid, close stopcock to chest wall and pleural space and drain into collection basin.
- ☐ Repeat withdrawal of fluid until desired amount has been removed.
- ☐ Remove angiocatheter and apply bandage to area.

4.6. Monitoring:

The following laboratory tests should be done on the fluid obtained during thoracentesis:

- ☐ Protein levels.
- ☐ Lactic acid dehydrogenase levels
- ☐ Glucose levels.
- ☐ Blood cell count and differential.
- ☐ pH levels.
- ☐ Gram stain.
- ☐ Aerobic and anaerobic culture.
- ☐ Other cultures as indicated (eg, viral, mycoplasma, fungal).
- ☐ determine whether the effusion is a transudate or an exudate (Table IV).

Table IV . Characteristics of fluid that help determine whether the effusion is transudative or exudative.

Characteristic	Transudate	Exudate
Appearance	Clear or straw colored	Clear, milky, turbid, bloody
Odor	Odorless	Possible malodor
Specific gravity	< 1.016	> 1.016
pH	Normal	Normal or acidic
Glucose levels	> 60 mL/dL	< 60 mL/dL
Protein levels	< 3 g/dL	> 3 g/dL
Pleural protein: serum protein ratio[a]	< 0.5	> 0.5
LDH[a]	< Two-thirds upper limit normal of serum	> Two-thirds upper limit normal of serum
Pleural LDH: serum LDH ratio[a]	> 0.6	< 0.6
Red blood cell count	< 100,000/mcL	> 100,000/mcL
White blood cell count	< 1000/mcL	> 1000/mcL

[a]Light's criteria.
LDH, lactic dehydrogenase.

4.7. Follow-up:

☐ Obtain chest radiograph to ensure no pneumothorax.

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

☐ Pneumothorax.

☐ Bleeding: from intercostal vessel creating subcutaneous hematoma or hemothorax.

☐ Hypoxia.

☐ Pulmonary edema.

☐ Puncture of liver or spleen.

☐ Infection.

☐ Laceration of lung.

6. PEARLS AND PITFALLS:

- ★ Younger children may require sedation for the procedure to be performed.
- ★ Most cases of pleural effusions in children are caused by infections.
- ★ Thoracentesis prior to initiation of antibiotic treatment allows for culture to guide antibiotic options.
- ★ Therapeutic removal of fluid in a patient with respiratory distress can also be useful in patients in whom the effusion is not likely to reaccumulate.
- ★ If you are suspecting that the pleural fluid might be very viscous (as with an empyema) use a large-bore needle or cannula.
- ★ Remember to prescribe some post-procedure analgesia.
- ★ Always monitor the patient throughout the procedure; the pulse oximeter is particularly important.

7. EVIDENCE BASED PRACTICE:

- ✦ Clear and convincing decrease in the overall complication rate associated with thoracentesis when ultrasound guidance is employed during the procedure. The most dramatic improvement was noted in the rate of pneumothorax, which is the most common recognized complication associated with the procedure.
- ✦ Specialty societies and expert consensus panels now urge integration of ultrasound into the thoracentesis procedure as a “best practice” guideline.
- ✦ Physicians in the many specialties that perform the thoracentesis procedure should be urged to learn ultrasound and to use this application whenever possible.

VI. Paracentesis \Diagnostic Peritoneal Lavage

1. INDICATIONS:

Make sure that patient have one of the following indications:

1.1. Diagnostic:

☐ Evaluation of new onset ascites

☐ Internal bleeding following blunt abdominal trauma

☐ Chylous ascites after surgery

☐ Rule out malignancy

☐ **Suspected spontaneous bacterial peritonitis**

(fever ;abdominal pain; leukocytosis)

1.2. Therapeutic:

☐ Tense ascites (to relieve the cardiorespiratory and gastrointestinal manifestations)

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

2.1. Absolute

☐ Unstable airway.

☐ Hemodynamically unstable patient.

☐ Intestinal perforation.

2.2. Relative

☐ Severe coagulopathy.

- Prothrombin time (PT) >21 s
- International normalized ratio (INR) >1.6
- Platelets <50,000/mm 3

☐ Skin infection over the needle insertion site.

☐ Acute abdomen that requires surgery.

☐ Distended bowel.

☐ Intra-abdominal adhesions.

☐ abdominal wall infection.

3. EQUIPMENT:

Prepare all materials:

☐ Alcohol swabs, povidone-iodine.

☐ 23-gauge and 21-gauge needles or angiocatheters with syringes.

☐ Local anesthetic (eg, 1% lidocaine).

☐ Large bore needle with plastic catheter.

☐ Sterile containers for fluid collection.

☐ Appropriate culture tubes for microorganisms

4. PROCEDURE:

4.1. Patient Preparation:

☐ Explain indication and risks to the patient and parents.

☐ Inform the patient of the intention of the procedure.

☐ Ensure the patient is comfortable, with an empty bladder.

4.2. Positioning:

☐ The patient should be in the supine position with the head of the bed slightly elevated to allow fluid to accumulate in the lower abdomen.

4.3. Anatomy Review:

☐ The preferred site is in the midline approximately one third of the distance from the umbilicus to the symphysis pubis (Figure 30).

☐ In infants, the fluid may bulge laterally, and the paracentesis may be obtained laterally to that point.

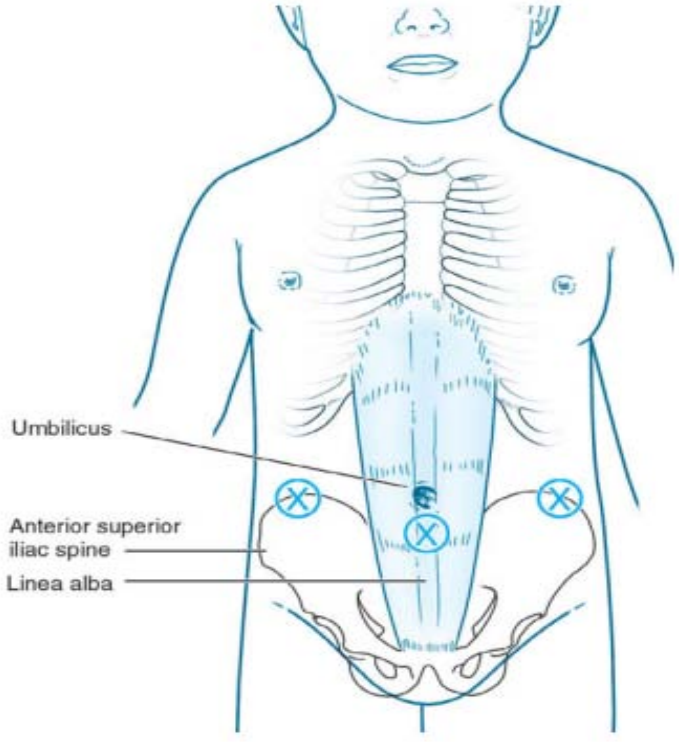


Figure 30. Anatomic landmarks and sites of entry.

4.4. Sterile preparation:

☐ Wash hands thoroughly, put on sterile gloves and a gown

☐ clean the area with antiseptic fluid (e.g. 2% chlorhexidine in 70% isopropyl alcohol)

4.5. Procedure :

a. Paracentesis

☐ Infiltrate the skin at the chosen site with local anesthetic (1% lidocaine).

☐ stretch the skin caudad and insert the needle while aspirating.

☐ Then, release the skin and continue to insert the needle through the peritoneal wall until fluid is retrieved :This will create a "Z-track" that will decrease leakage of peritoneal fluid through the skin (Figure 31).

☐ Aspirate gently as you advance the needle until fluid can be easily aspirated .

☐ Obtain a sample of fluid or withdraw as much fluid as necessary with a syringe (in case of therapeutic purpose).

☐ withdraw the needle .

☐ Apply pressure to the site and cover with an adhesive dressing.

☐ Distribute the aspirate into the containers, ensuring sterility throughout.

b. Diagnostic Peritoneal Lavage

☐ The puncture site should be cleaned with povidone-iodine.

☐ Inject local anesthetic, infiltrating the skin first and then penetrating into deeper layers.

☐ A small 3-mm incision can be made with a scalpel to help insert the needle.

☐ Insert the tap needle 1-2 inches into the abdomen.

☐ Insert a trochar and peritoneal catheter until the peritoneal cavity is reached (the resistance suddenly gives away).

☐ Remove the trochar and fix the catheter to the skin with a stitch.

☐ Aspirate

☐ If no bloody fluid is withdrawn, infuse 20 mL/kg of Ringer's lactate over 5-10 minutes.

☐ Turn the patient from side to side.

☐ Siphon the fluid off.

☐ Inspect for level of turbidity.

☐ Ascitic fluid should be sent for cytology, amylase, albumin, triglycerides, and culture.

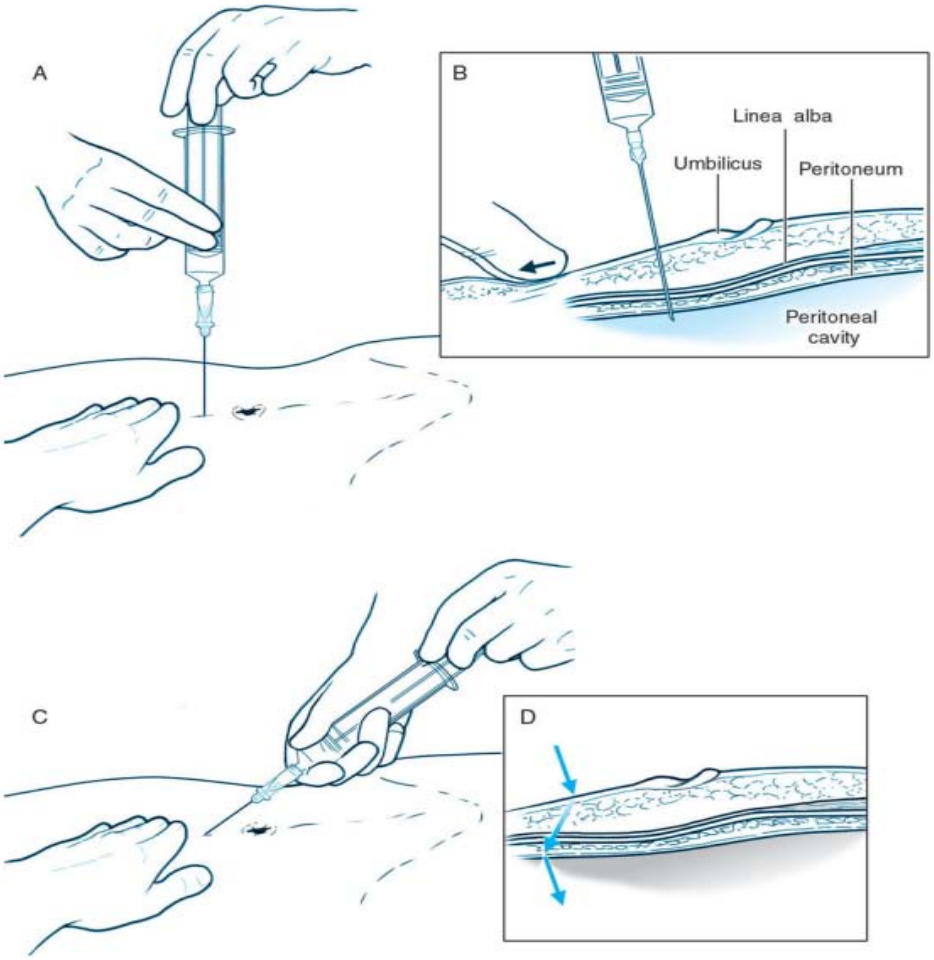


Figure 31. The Z-track. A: Needle is inserted perpendicular to skin while skin is pulled taut. B: Sagittal view. C: Alternatively, needle can be inserted at 45 degrees to skin and aimed caudally. D: Resultant Z-track (arrows)

4.6. Monitoring:

☐ Monitor vital signs (a rapid loss of significant volumes of ascitic fluid may lead to hypotension).

4.7. Follow-up:

☐ Call a senior when any of the following clinical signs is present:

- Fever.
- Nausea and vomiting.
- Blood in the stool.
- Abdominal pain.
- Abdominal distention.

5. COMPLICATIONS

5.1. Systemic

☐ Hyponatremia.

☐ Renal dysfunction.

☐ Hepatic encephalopathy.

☐ Hemodynamic compromise.

☐ Significant bleeding Death.

5.2. Local

☐ Persistent ascitic fluid leak at the wound site.

☐ Abdominal wall hematoma.

☐ Localized infection.

5.3. Intraperitoneal

☐ Perforation of vessels and viscera.

☐ Generalized peritonitis.

☐ Abdominal wall abscess.

6. PEARLS AND PITFALLS:

★ The preferred site of entry is in the midline of the abdomen, below the umbilicus.

★ The serum-ascites albumin gradient (SAAG) can be used to identify the cause of the ascites. It is calculated by subtracting the albumin concentration in the ascites from the albumin concentration in the serum. A high gradient (>1.1 g/dL) suggests portal hypertension, whereas a low gradient (<1.1 g/dL) suggests other causes.

★ Polymorphonuclear lymphocyte (PMN) count greater than 250/mm 3 is diagnostic of spontaneous bacterial peritonitis.

7. EVIDENCE BASED PRACTICE:

✦ There appears to be good concordance between recommendations of the European, American and British guidelines both for the diagnosis and for the management of ascites SBP (Spontaneous Bacterial Peritonitis) and HRS (Hepato-Renal Syndrom). The recommendations on the investigation of ascites differ slightly; however, all three generally promote the use of **ultrasound, diagnostic paracentesis, calculation of SAAG and ascitic fluid cultures** (especially when SBP is considered to be a possibility).

✦ All guidelines suggest that analysis of the ascitic fluid should include neutrophil counts for the diagnosis of SBP and estimation of total protein, as levels less than 15 g/l increase the risk for SBP.

- The advent of the serum albumin ascites gradient as a tool has advanced the diagnostic approach to patients with ascites and offers a more useful device in terms of determining the etiology when compared with measuring ascitic fluid protein levels in isolation.
- Distinguishing spontaneous from secondary bacterial peritonitis is critical, as the management is different. SBP is treated with antibiotics, as it is associated with a significant mortality rate (30% in hospital and 50% at 1 year) . Secondary bacterial peritonitis requires further imaging and possible surgical intervention in addition to antibiotics.
- **Paracentesis is a safe procedure, using evidence-based approaches to diagnosing ascites and abdominal paracentesis should reduce inappropriate testing and unnecessary administration of blood products.**

VII. Suprapubic Bladder Aspiration

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Diagnostic evaluation of urine in an infant.

☐ Collection of sterile urine for urinalysis and culture (avoiding urethral contamination).

☐ Collection of sterile urine in a child with gastroenteritis and frequent diarrheal stools.

☐ Female child with labial adhesions or male child with minimally retractable foreskin.

☐ Urinary retention.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

☐ Neutropenia.

☐ Thrombocytopenia and bleeding disorders.

☐ Cellulitis and infection at puncture site.

☐ Age greater than 2 years.

☐ Recent urologic or lower abdominal surgery.

☐ Empty or nonpalpable bladder.

☐ Urination within 1 h before the procedure.

☐ Anatomical abnormalities of the gut or genitourinary tract.

☐ Intestinal obstruction.

3. EQUIPMENT:

Prepare all materials:

☐ Topical anesthetic or buffered 1% lidocaine solution

☐ 22-gauge, 2-3-cm needle.

☐ 3-mL or 5-mL syringe.

☐ Sterile collection cup.

☐ 10% povidone-iodine (or equivalent).

☐ Sterile gloves, drapes, gauze.

4. PROCEDURE:

4.1. Patient preparation:

☐ Introduce yourself to the parents and the patient.

☐ Explain the procedure.

☐ Keep the patient covered until ready to begin.

☐ Good lighting is helpful.

4.2. Patient position:

☐ The child is placed supine in the frog-leg position (Figure 32).

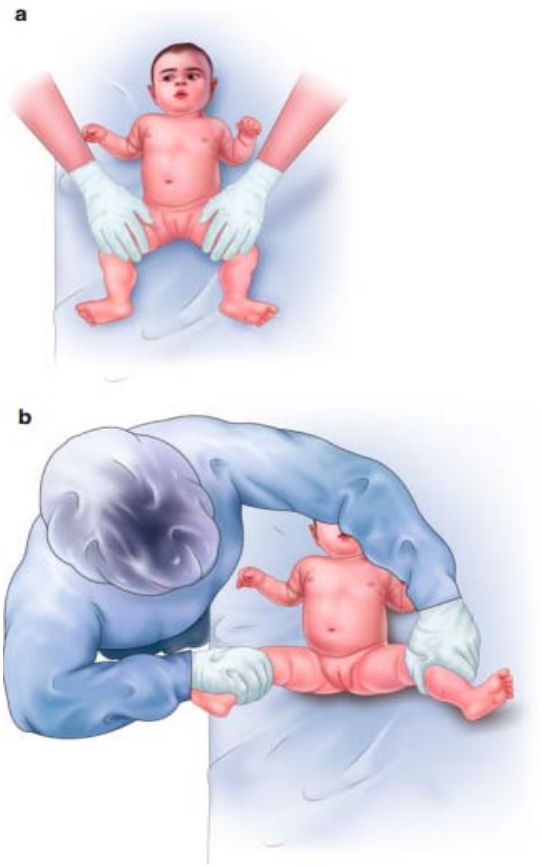


Figure 32. Frog-leg position

4.3. Anatomy review : (Figure 33)

☐ The needle is passed through the abdominal wall just rostral to the pelvic rim in the midline.

☐ The bladder in an infant is located in the abdomen. (The bladder in an older child and adult is located in the pelvis.)

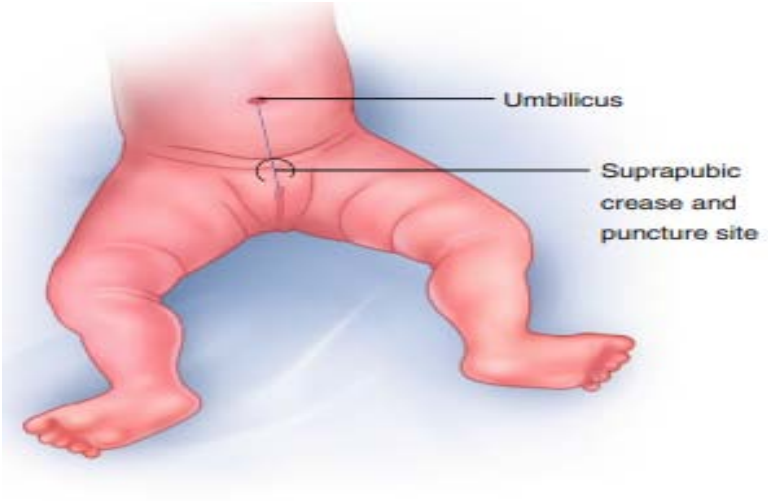


Figure 33. Landmarks of suprapubic puncture.

4.4. Sterile preparation:

☐ Sanitize or wash your hands thoroughly and don gloves.

☐ Use universal precautions or isolation precautions as appropriate.

4.5. Procedure :

☐ Strongly consider applying a topical anesthetic before starting the procedure.

☐ Leaving the topical anesthetic on for a sufficient time period provides a reasonable degree of topical anesthesia.

☐ Remove the topical anesthetic prior to skin preparation.

☐ The practice of additional injection of lidocaine varies; the injection represents a separate needle stick and is associated with pain from lidocaine infiltration.

☐ Apply 10% povidone-iodine solution to the skin surface of the abdomen 1-2 cm above the pubic symphysis.

☐ Use Sterile draps

☐ Attach the syringe to the needle.

☐ The provider should be positioned so that the dominant hand can insert the needle through the skin above the pubic symphysis.

☐ direct the needle caudad at about 20 degrees from perpendicular (Figure 34).

☐ A lesser angle may be used in very young infants whose bladder is more rostral.

☐ The skin is penetrated and the needle is advanced into the bladder.

☐ Slowly advance the needle while aspirating the syringe.

☐ When urine appears, stop and fill the syringe, then withdraw the needle.

☐ Clean the skin of residual povidone-iodine.

☐ Apply a gauze bandage to the needle puncture site.

☐ If no urine is obtained on the first attempt, change the angle of the needle slightly toward perpendicular and repeat (without coming out of the skin).

☐ This may be done once or twice (at most). Additional attempts are unlikely to yield urine.

☐ Consider waiting and repeating or obtaining urine by urethral catheterization.

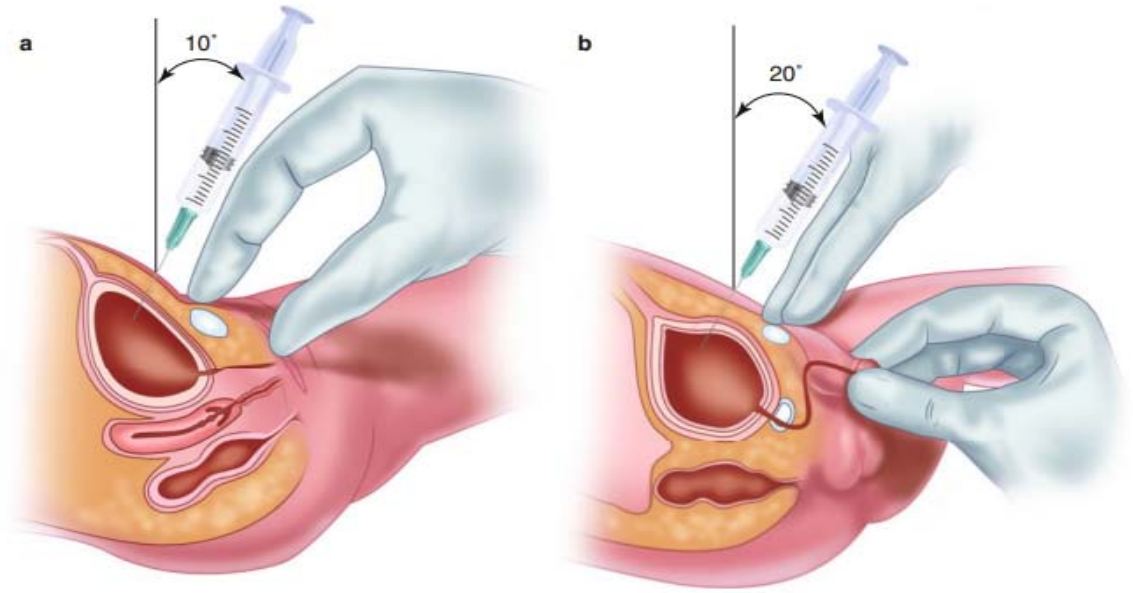


Figure 34. Insert the needle 10–20° perpendicular to the skin

4.6. Monitoring:

☐ Urine obtained via suprapubic catheter is usually evaluated for infection.

☐ Other urine tests that do not require sterile urine would likely be obtained via catheter.

4.7. Follow-up:

☐ Clear instructions on caring for the puncture site (ie, watching for redness, pain, and purulent discharge) as well as information about the symptoms of peritonitis should be given to the parent.

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

☐ Pain.

☐ Hematuria; with urethral catheterization this is usually temporary and more commonly microscopic.

☐ Peritoneal perforation with or without visceral injury.

☐ Infection: superficial of the skin and subcutaneous tissues, intra-abdominal or bladder.

☐ Inability to aspirate urine: you will need to contact the urology team.

6. PEARLS AND PITFALLS:

- ★ Advocates argue that SPA is the first-line test for infants with fever and suspected urinary tract infection so that the consequences of a false-positive urine culture (eg, unnecessary antibiotics, follow-up testing, overlooking another locus of infection) are avoided.
- ★ The argument against SPA includes the following:
  - o Procedure is invasive and painful.
  - o Success rates for obtaining urine are lower for SPA than for catheterization.
  - o SPA usually requires a physician, whereas catheterization is more often done by nurses.
- ★ If no fluid is obtained: – Hydrate the child and reattempt in 1 h.
- ★ Ultrasound can be used to identify bladder size or for ultrasound-guided aspiration.
- ★ If the catheterization is handed over to you out of hours, always take a brief history and examine the patient to ensure you are happy with the indications.
- ★ Always check for allergies, especially latex.
- ★ Take a drug history – if the patient is on anticoagulation hematuria secondary to catheterization is more likely and may last longer.

7. EVIDENCE BASED PRACTICE:

- ✦ The use of ultrasound guidance simplifies suprapubic aspiration of urine in babies. Low bacterial counts may be associated with abnormalities of the urinary tract. Laboratory

techniques capable of detecting such counts reliably should be used. Pyuria is absent in half of babies and very young children with bacteriuria. It rarely occurs without bacteriuria, and if it does an explanation should be sought.

- ✦ With the advent of point-of-care ultrasound (POCUS), the use of ultrasound by non-radiologists at the patient's bedside, great advancement has been noticed in various medical fields.
- ✦ In the current study, results showed that the POCUS-SPA significantly increased the success rate of urine sampling and most of the patients in all three groups had severe pain. Based on the shortage of access to radiologists in emergency setups, it seems that the POCUS-SPA by the pediatricians can be one of the most appropriate and applicable diagnostic methods in infants with urinary tract infection.

VIII. Arthrocentesis

1. INDICATIONS:

Make sure that patient have one of the following indications:

1.1. Diagnostic:

☐ Sampling of fluid for laboratory evaluation (septic joint, inflammatory arthritis).

1.2. Therapeutic :

☐ Instillation of medications for acute or chronic arthritis

☐ Removal of hemarthrosis for pain relief following trauma.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

2.1. Absolute :

☐ Skin or soft tissue infection (eg, cellulitis, septic bursitis) because there is an increased risk of causing a septic joint.

☐ Corticosteroid injection into a known or suspected septic joint.

2.2. Relative:

☐ Coagulopathy; thrombopeny.

- The procedure may result in hemarthrosis, but one needs to weigh the risk against the need to diagnose a septic joint.

☐ Bacteremia, because of the increased risk of causing septic joint.

☐ Joint prosthesis.

3. EQUIPMENT:

Prepare all materials:

☐ Syringes .0

☐ 21–25-gauge needles; they must be long enough to enter joint.

☐ Sterile collection container.

☐ Povidone-iodine and alcohol for sterile preparation of skin.

☐ Sterile gloves.

☐ 4 × 4 gauze.

☐ Lidocaine.

4. PROCEDURE:

4.1. ARTHROCENTESIS OF THE KNEE

a. Patient preparation:

☐ Introduce yourself to the patient and parents.

☐ Explain the procedure to the patient (if appropriate) and the parents.

☐ Choose site of puncture.

b. Patient position:

☐ Have the patient lie supine on the examination table.

☐ Place the table at a comfortable height for you and sit or stand at the affected side of the patient.

c. Anatomy review :

☐ The distal femur articulates with the proximal tibia to make up the knee joint.

☐ The patella sits in a groove anterior to the joint.

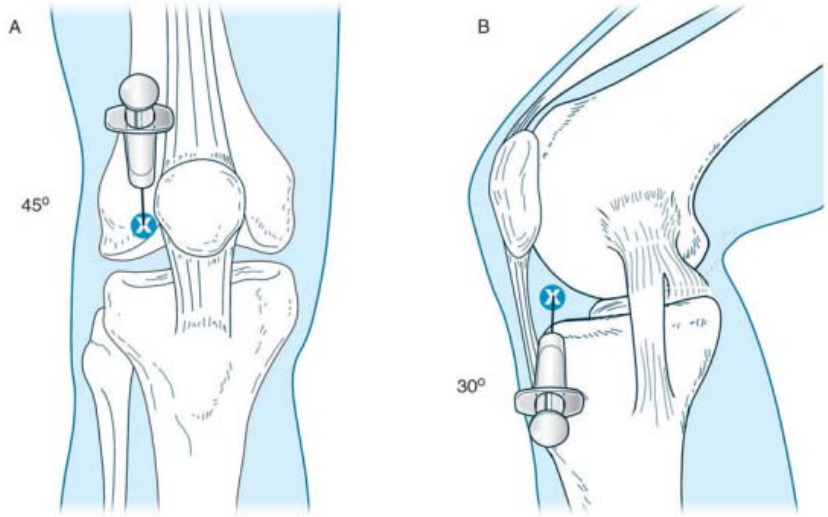


Figure 35. Anatomy of knee in extension (A) and flexion (B) with needle in aspiration sites.

d. Sterile preparation:

☐ Sanitize or wash your hands thoroughly and don gloves.

☐ Use universal precautions or isolation precautions as appropriate.

☐ Drape surrounding area with sterile towels.

e. Procedure :

e.1. Knee in Extension

☐ With the knee extended, have the patient relax the quadriceps.

☐ Palpate the superior and lateral edge of the patella.

☐ Mark with a pen or surgical marker the point 1 cm superior and 1 cm lateral to the upper border of the patella.

☐ Prepare the entire area with povidone-iodine.

☐ Anaesthetize the area around your aspiration site.

☐ Aim the needle at a 45-degree angle posteriorly and a 45-degree angle distally. It should fall under the patella but over the femoral condyle.

☐ Aspirate as the needle progresses into the joint space.

☐ If you feel the needle hit bone, pull back slightly and redirect it.

☐ As you enter the joint space you will feel a loss of resistance.At this point you will be able to aspirate joint contents.

☐ Remove as much fluid as possible.

☐ You may need to move the needle as fibrous septa can create pockets of fluid.

☐ Once the aspiration is complete, withdraw the needle and apply pressure to the area with sterile gauze.

☐ Place a sterile dressing over the site of aspiration.

☐ Fully document the procedure, including consent, local anaesthetic and volume used, and colour and volume of the aspirate.

e.2. Knee in Flexion

☐ Have the patient flex the knee to approximately 90 degrees.

☐ Palpate the inferior edge of the patella. Palpate 2 cm medially or laterally, and 2 cm inferiorly, feel the soft spot, and mark.

☐ Prepare the area with povidone-iodine.

☐ Aim the needle at a 30-degree angle superiorly and aspirate as the needle enters the joint .

☐ Remove as much fluid as possible.

☐ You may need to move the needle as fibrous septa can create pockets of fluid.

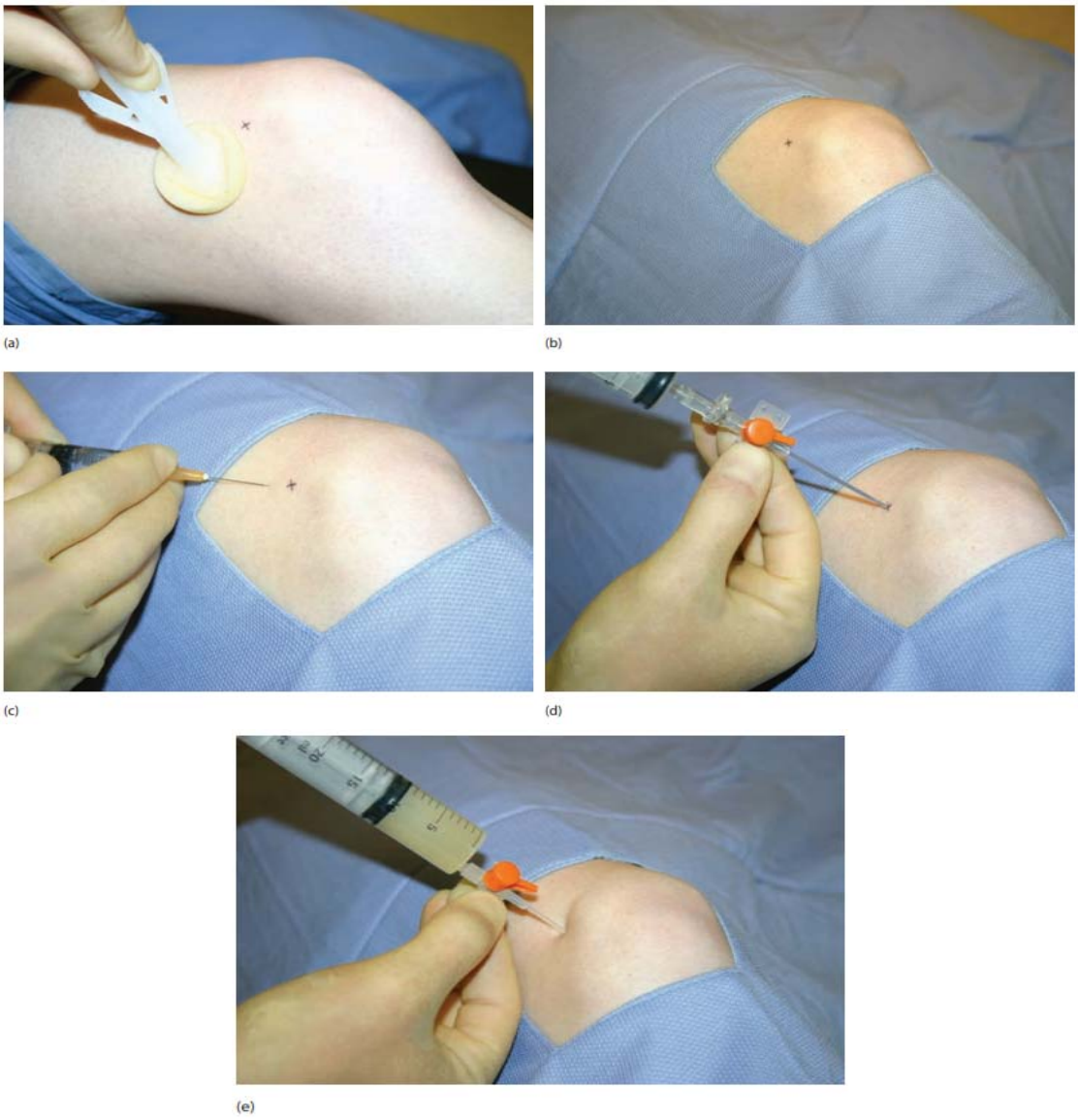


Figure 36. Step-by-step guide: joint (knee) aspiration. (a) Cleaning the marked knee. (b) Drape the area (a sterile fi eld is of paramount importance in this procedure). (c) Infiltration of local anaesthetic. (d) Insertion of cannula into the joint space. (e) Aspiration of turbid fluid from knee joint

f. Monitoring:

☐ Visually inspect joint fluid.

☐ Fluid should be sent to the laboratory for analysis of

- cell count with differential
- glucose, protein

- Gram stain and Culture
- crystal analysis

g. Follow-up:

☐ Instruct the patient to look for redness and swelling that could be indicative of infection

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

5.1. Early

☐ Bleeding.

☐ Iatrogenic trauma to surrounding structures including the joint itself.

☐ Failed aspiration.

☐ Pain.

☐ Allergic reaction. Patients with allergy to local anesthetic should not receive that class of medications.

5.2. Late

☐ Infection/septic arthritis.

☐ Re-accumulation of joint fluid.

6. PEARLS AND PITFALLS:

★ If infection is a concern, a larger bore needle (18 gauge or 19 gauge) may be needed to aspirate because sometimes purulent fluid will not be drawn into a smaller needle.

★ Do not overtighten the needle on to the syringe, and check to make sure the needle easily twists off the syringe before starting the procedure. This allows you to empty a full syringe and reattach it without ever pulling the needle out of the joint.

- ★ Make sure you have all your equipment ready before you start and that the area is well lit.
- ★ Position yourself carefully – bending over awkwardly for half an hour isn't going to help your back.
- ★ When assessing synovial fluid, differentiate among normal, inflammatory, and septic fluid. (Table V)
- ★ Only septic synovial fluid will have a positive Gram stain and culture.

Table V . Characteristics of synovial fluid.

Type	White Blood Count	Appearance of Fluid	Culture	Glucose
Normal	Correlates with red blood count	Clear	Negative	Similar to blood glucose
Inflammatory arthritis	> 2000/µL	Turbid	Negative	May be slightly decreased
Septic arthritis	> 50,000/ µL with > 75% polymorpho-nuclear leukocytes	Purulent	Positive	Decreased to 50% of blood glucose

7. EVIDENCE BASED PRACTICE:

- ✦ Owing to the importance of this analysis, it is clearly recommended that ultrasonography should be used to facilitate arthrocentesis in difficult cases.
- ✦ The most recent recommendations on arthrocentesis confirm the need for the procedure in the presence of synovial effusion of unknown origin, especially if septic or crystal arthritis is suspected.
- ✦ Ultrasound (US)–guided joint aspiration is a supplemental technique that improves several aspects of the arthrocentesis procedure.
- ✦ With appropriate local anesthesia, arthrocentesis should be a relatively painless procedure; without anesthesia, it may be quite painful and distressing to the patient.

PART III : THERAPEUTIC

I. CPR: Cardiopulmonary Resuscitation

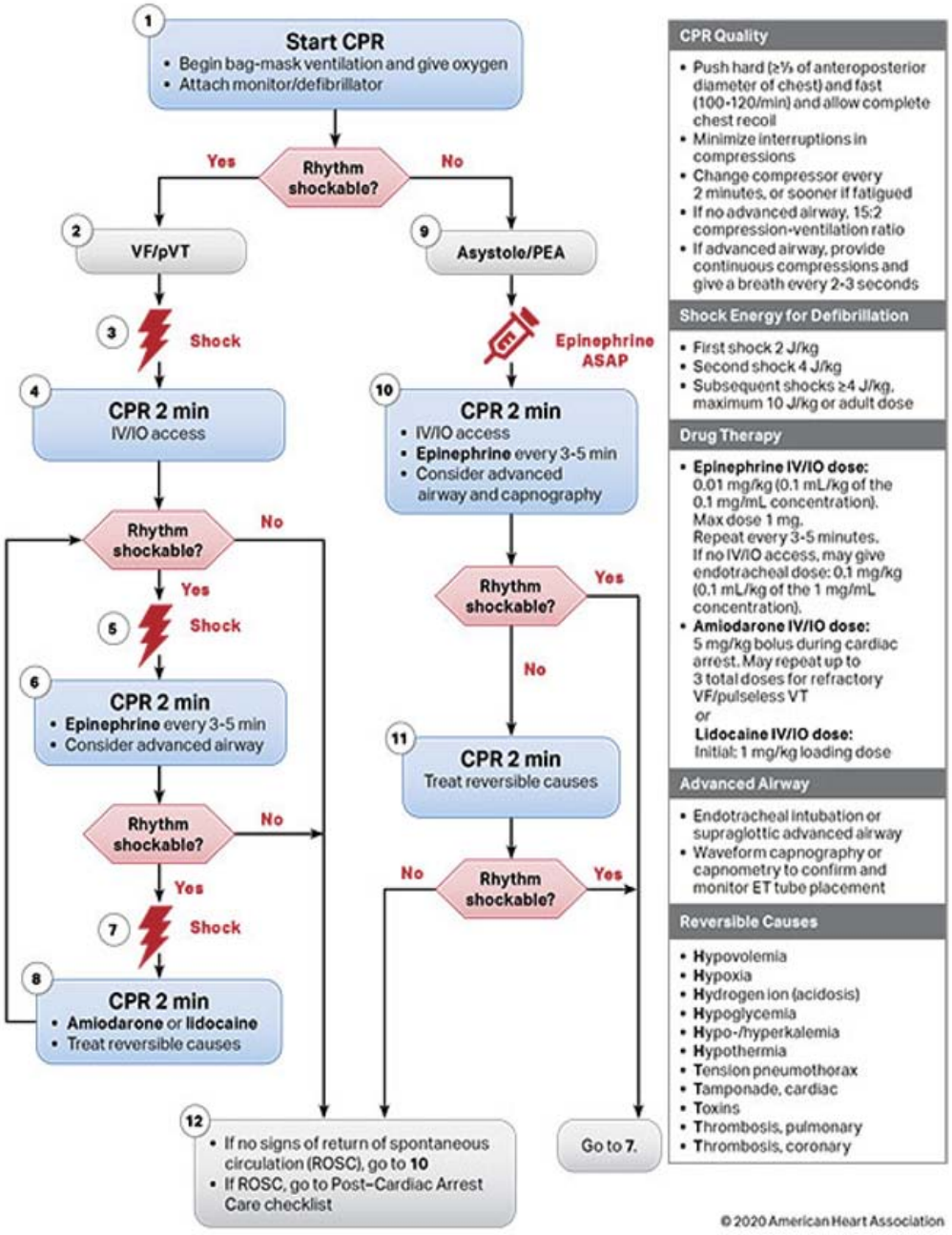


Figure 37: Pediatric Cardiac Arrest Algorithm

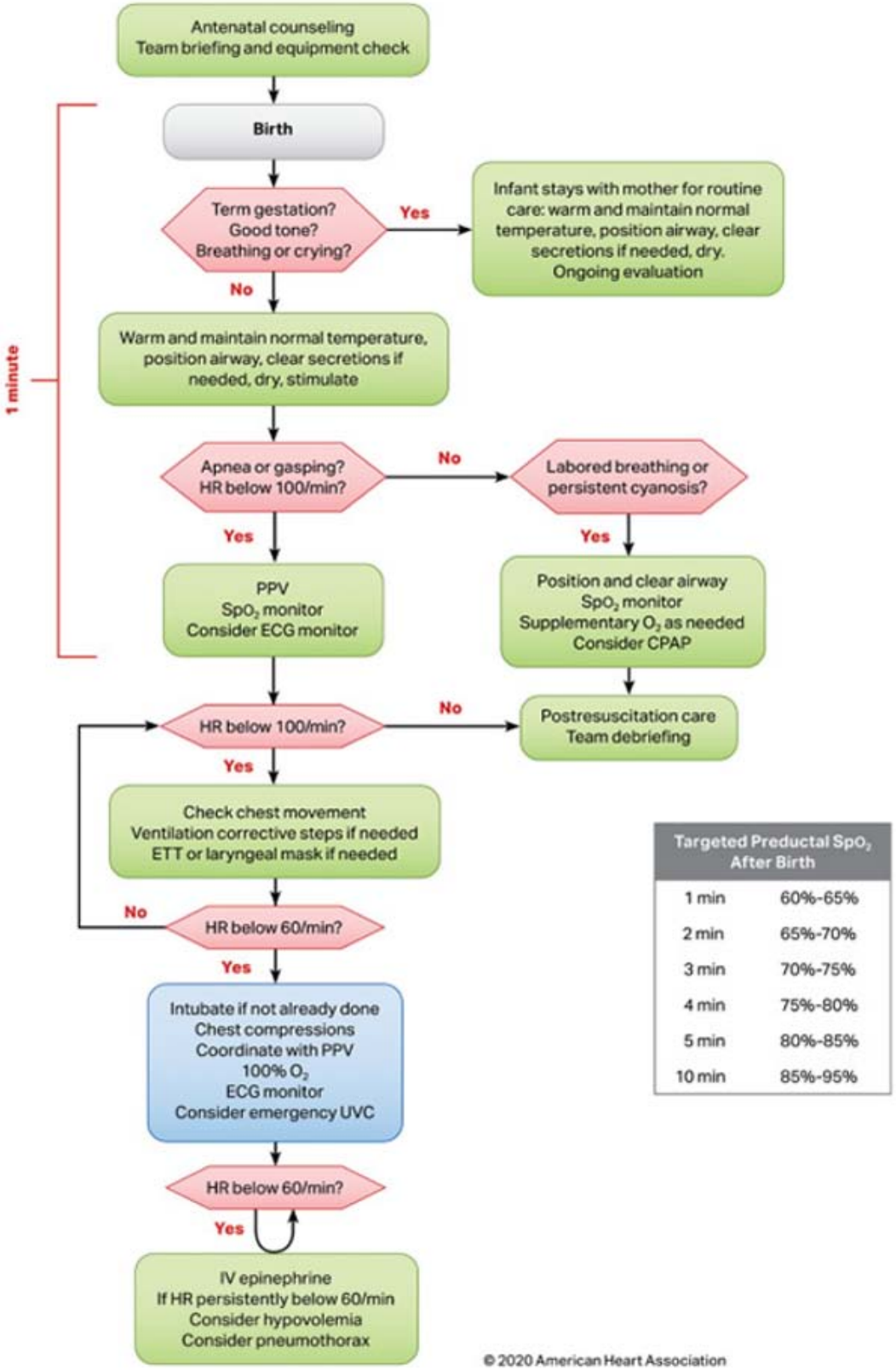


Figure 38: Neonatal Resuscitation Algorithm

II. Chest Compression

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Chest compressions are started once signs of circulatory arrest are identified.

- For the layperson, these include absence of breathing, coughing, and movement.
- In addition, for the healthcare worker, lack of an identifiable pulse is a sign of circulatory arrest.

☐ Chest compressions are started in infants and children if their heart rate is less than 60 beats per minute with signs of poor perfusion; the main mechanism for increasing cardiac output is by increasing heart rate.

☐ The combination of bradycardia and poor perfusion is a sign of imminent cardiac arrest.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

2.1. Absolute :

☐ None. However, compressions should be started with caution if the patient has a known period of prolonged asystole.

3. EQUIPMENT:

Prepare all materials:

☐ No equipment is necessary when patient is on a firm, flat surface.

☐ A resuscitation board is used when hospitalized patients are in a soft bed. It is placed underneath the patient for effective compressions.

☐ The board extends from the shoulders to the waist and across the width of the bed.

4. PROCEDURE:

4.1. Patient preparation :

☐ The patient is placed supine on a firm flat surface.

☐ If the patient is in bed, then a resuscitation board is placed underneath him or her.

☐ Any bulky clothing that will interfere with compressions or assessment is removed or opened up.

☐ The head and neck are placed in a neutral position.

4.2. Patient position:

☐ Have the patient lie supine on the examination table.

☐ Place the table at a comfortable height for you and sit or stand at the affected side of the patient.

4.3. Anatomy Review:

☐ The heart lies centrally in the chest between the lower part of the sternum and the thoracic spine.

☐ Effective compressions squeeze the heart between the sternum and spine to eject blood; for this reason, hand placement is over the lower portion of the sternum.

☐ The central pulse is located by palpating the brachial, femoral, or carotid arteries .

- The preferred location for checking the pulse depends on the patient's age as well as the number and skill of the rescuers.
- In infants, the brachial pulse is preferred but the femoral pulse can be used alternatively.

- In older children and adults, the carotid pulse is preferred but a second or third rescuer may be better able to use the femoral pulse to monitor compressions.
- The brachial artery is palpated just above the elbow, medial to the biceps (see Figure39.A).
- The femoral artery is palpated just below the inguinal ligament half-way between the anterior superior iliac spine and the pubic tubercle (see Figure39.B).
- carotid artery is palpated just medial to the sternocleidomastoid muscle (between the muscle and the trachea) (see Figure39.C).

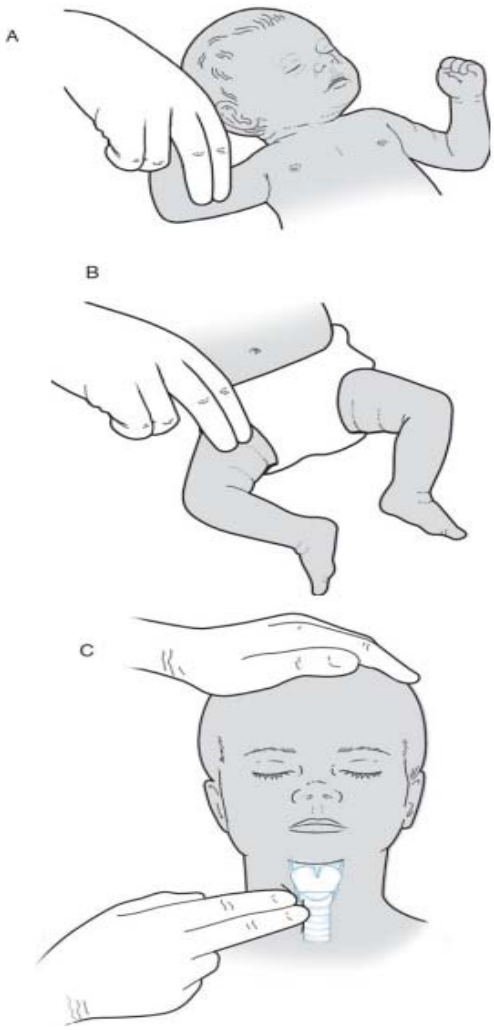


Figure 39. Locating the central pulse

4.4. Procedure :

a. Infants Younger than 1 Year :

a.1. TWO THUMB-ENCIRCLING HANDS TECHNIQUE

☐ Place thumbs side by side over the lower half of the sternum, approximately 1 finger breadth below the intermammary line (Figure 40.A).

☐ The hands then encircle the infant's chest with the fingertips used to give support to the back.

☐ Avoid compression of the xiphoid process.

☐ Apply compressions in a smooth manner with equal time for relaxation.

☐ Using the thumbs, depress the sternum approximately one-third to one-half the depth of the infant's chest.

☐ Allow the sternum to return to its original position during relaxation without removing the fingers.

☐ Deliver compressions at a rate of 100 times per minute.

☐ The compression to ventilation ratio is 5:1 for infants and 3:1 for newborns whether there are 1 or 2 rescuers.

a.2. TWO-FINGER COMPRESSION TECHNIQUE

☐ lace 2 fingers of 1 hand over the lower half of the sternum, approximately 1 finger breadth below the intermammary line (Figure 40.B).

☐ The infant is supported on a firm surface or on the other forearm of the rescuer.

☐ Avoid compression of the xiphoid process.

☐ Apply compressions in a smooth manner with equal time for relaxation.

☐ Depress the sternum approximately one-third to one-half the depth of the chest.

☐ Allow the sternum to return to its original position during relaxation without removing the fingers.

☐ Deliver compressions at a rate of 100 times per minute.

☐ The compression to ventilation ratio is 5:1 for infants and 3:1 for newborns whether there are 1 or 2 rescuers.

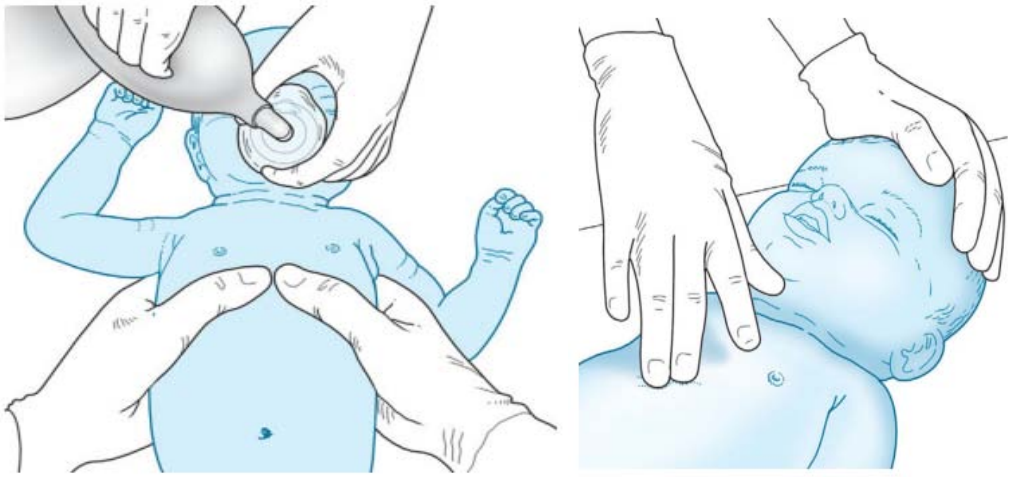


Figure 40. A.Two thumb-encircling hands technique; B.Two-finger compression technique.

b. Children Approximately 1 to 8 Years

☐ Place the heel of 1 hand over the lower half of the sternum between the intermammary line and the bottom of the sternum (Figure 40).

☐ Take care to avoid the xiphoid process.

☐ Deliver compressions in a smooth manner allowing equal time for relaxation.

☐ Depress the sternum one-third to one-half the depth of the chest..

☐ Allow the sternum to return to its original position during relaxation without removing the hand.

☐ Deliver compressions at a rate of 100 times per minute.

☐ Chest compressions and ventilations are always performed at a ratio of 5:1 whether 1 or 2 rescuers are present.

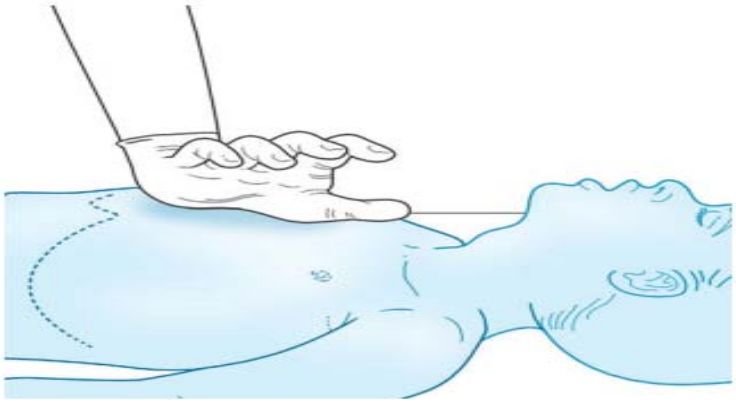


Figure 41. One-hand technique for children aged 1-8 years.

c. Patients Over 8 Years of Age

☐ Place the heel of 1 hand on the lower half of the sternum at the level of the intermammary line.

☐ Place the heel of the other hand on top of the first, being careful not to put pressure on the xiphoid process.

☐ Interlock the fingers of both hands and lift the fingers off the chest to avoid pressure on the ribs (Figure 41).

☐ Position yourself vertically above the patient with arms straight.

☐ Depress the sternum 1.5 to 2 inches. (Note: This is a defined value, not a proportion of the depth of the chest.)

☐ Deliver compressions in a smooth manner allowing equal time for relaxation.

☐ Allow the sternum to return to its original position during relaxation without removing the hands.

☐ Deliver compressions at a rate of 100 times per minute.

- In the unintubated patient, pause compressions after every 15 to give 2 ventilations whether there are 1 or 2 people present.
- If the patient is intubated, then the compression to ventilation ratio is 5:1.

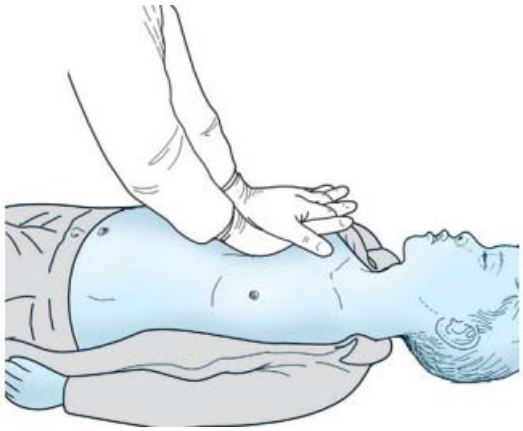


Figure 42. Two-hand technique for patients older than 8 years.

4.5. Monitoring:

- Once chest compressions are begun, they are continued for approximately 1 minute or 20 cycles and then paused to reassess the patient.
- After the initial reassessment, compressions are paused every few minutes for reassessment.
- If multiple rescuers are present, then the adequacy of chest compressions can be monitored by palpating the pulse.
- When the compressions are being performed effectively, a pulse is felt with every compression.

4.6. Follow-up :

No specific follow-up is recommended.

- However, patients who have undergone resuscitation are evaluated for transient or permanent end-organ damage.

- When traumatic injury from chest compressions is suspected, serial examinations and imaging studies are performed

5. COMPLICATIONS

- **Complications are rare in the pediatric population.**
- The most common injuries are
  - chest contusions .
  - abrasions.
- Significant complications occur in 3% of cases and include the following:
  - Rib fracture.
  - Retinal hemorrhages.
  - Retroperitoneal hematoma.
  - Pneumothorax.
  - Pulmonary hemorrhage.
  - Epicardial hematoma.
  - Gastric perforation.

6. PEARLS AND PITFALLS:

- ★ Rib fractures and retinal hemorrhages deserve additional attention as they have been linked to intentional trauma.
- ★ Multiple studies have shown that rib fractures from resuscitation are rare in children, probably because the rib cage is more compliant in children than in adults.
- ★ When rib fractures do occur, they are likely to be in ventral parts of the chest wall.

- ★ Thus, finding any rib fracture, especially posterior fractures, should prompt an evaluation for intentional trauma.
- ★ On the other hand, retinal hemorrhages, which have been considered pathognomonic for intentional trauma, have been attributed to resuscitation.

7. EVIDENCE BASED PRACTICE:

- ✦ The standardization of simulation to train and maintain skills used in ACLS (advanced cardiovascular life support) may improve care given to patients during times of decreased and less senior staffing.
- ✦ The high-fidelity mannequin simulator (HFMS) can be used to ensure that all physicians training in the care for the acutely ill, such as emergency medicine, have received appropriate exposure and assessment in all relevant cardiac emergencies prior to their graduation to get better outcome of cardiac arrest resuscitation.

III. Cardioversion and Defibrillation

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Rapid termination of tachycardia that is either unresponsive to medications or pacing interventions or is hemodynamically compromising, necessitating more urgent intervention (Table VI).

- ➢ **Cardioversion**: Can be performed using medications, electrical pacing, or electrical direct current shock synchronized to QRS complex to correct an abnormal rapid cardiac rhythm.

☐ Tachycardia, either supraventricular or ventricular, with regular ventricular response with mild to moderate hypotension (Table VI).

- **Defibrillation** : Uses electrical energy delivered trans-thoracically, non-synchronously, and in a random fashion during the cardiac cycle to correct a very rapid rhythm.

☐ The most effective treatment for ventricular fibrillation and pulseless ventricular tachycardia .

☐ Its effectiveness diminishes rapidly over time; therefore, early defibrillation is recommended in patients who have suffered cardiac arrest.

☐ Atrial fibrillation.

☐ Supraventricular tachycardia with rapid conduction via an accessory connection.

☐ Ventricular fibrillation.

☐ Torsades de pointes.

Table VI . Treating tachycardia.

Tachycardia	Specific rhythm	Treatment
Narrow QRS complex	Sinus tachycardia	Treat underlying cause
Narrow QRS complex	Supraventricular tachycardia	Medications Vagal maneuvers Pacing Cardioversion
Wide QRS complex	Ventricular tachycardia	Medications
	SVT with aberrant conduction	Cardioversion
	SVT with antegrade conduction over an accessory connection	
Pulseless rhythm	Very rapid atrial or ventricular tachycardia	Defibrillation
	Atrial or ventricular fibrillation	
	Torsades de pointes	

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

2.1. Absolute :

☐ A patient directive regarding resuscitation..

2.2. Relative:

☐ Cardioversion of a rhythm known to be automatic in origin is not indicated.

☐ Digoxin toxicity-induced arrhythmia :With digoxin toxicity, there is a high incidence of post-cardioversion ventricular tachycardia and fibrillation.

☐ Elective cardioversion of a hemodynamically stable patient with a known atrial thrombus; however, the likelihood of impending cardiovascular compromise can outweigh the risk of thromboembolism.

☐ Repeated cardioversion of a rhythm where the predisposing cause is not eliminated.

3. EQUIPMENT:

Prepare all materials:

☐ External defibrillator, either manual or semi-automated (Figure 43).

☐ Skin electrode patches, wires to connect to defibrillator.

☐ Heart rhythm monitor.

☐ Equipment to protect the airway as well as resuscitation medications to support blood pressure.

☐ Do not delay cardioversion or defibrillation in a hemodynamically unstable patient while waiting for additional monitoring equipment or personnel.

Figure 43. Cardioverter/defibrillator.

4. PROCEDURE:

4.1. Patient preparation:

☐ Consent for the procedure and sedation is obtained.

☐ With hands-off electrode pads, if anterior-posterior position is preferred, pads should be placed before the patient is sedated.

☐ If the patient has a pacemaker/implantable cardioverter defibrillator (ICD) in place, the electrode pads or paddles should not be placed directly over the device.

4.2. Patient position:

☐ Supine, with adequate airway protection and support.

4.3. Anatomy review :

There are 2 conventional electrode configurations: anterior-lateral and anterior-posterior.

☐ Anterior-lateral: Pads are positioned at right upper sternal border and cardiac apex.

☐ Anterior-posterior: Pads are positioned over upper midsternal border and between scapulae.

4.4. Procedure :

☐ Pediatric paddles are strongly recommended for children below 10 kg.

☐ If pediatric pads are not available, adult paddles and pads can be used as long as they are not in contact with each other (to avoid an electric short).

☐ Select an energy level that is sufficient to achieve prompt cardioversion or defibrillation and minimize myocardial damage from high-energy shocks.

a. Cardioversion.

☐ Lower energy shocks are used for regular rhythms, including atrial flutter and ventricular tachycardia.

☐ Synchronized initial energy of 0.5-1 J/kg is selected, increasing for subsequent shocks.

☐ Repeat cardioversion may be necessary in patients with chronic arrhythmias, or persistence of the underlying causative factors.

b. Defibrillation.

☐ Adequate sedation is essential and is generally given by an anesthesiologist or an intensivist.

☐ Emergent airway management equipment should be available.

☐ The patient should be preoxygenated before elective cardioversion.

☐ Electrode size is an important determining factor of the transthoracic current flow and success of cardioversion.

☐ Pad size should be adjusted for patient body surface area.

☐ Pediatric pads are necessary in infants and small children to avoid delivery of excessive energy.

☐ A larger paddle surface is associated with decreased resistance and increase in current delivery.

☐ Self-adhesive pads can be used in the standard anterior-lateral or anterior-posterior paddle positions in place of paddles (Figures 44 and 45).

☐ Higher energy delivery is necessary for atrial or ventricular fibrillation, delivered in asynchronous mode.

☐ In children, initial shock is delivered at 2 J/kg, increasing to 4 J/kg for subsequent shocks.

☐ In adults, initial shock is delivered at 200 J, second shock at 200-300 J, third and subsequent shocks 360 J.

☐ Charge the defibrillator to the desired energy.

☐ Ensure all medical personnel, including the one responsible for holding oxygen for the patient, are cleared from contact with the patient and bed before discharge.

☐ The phrase "I'm clear, you're clear, oxygen clear" is used.

☐ Oxygen should either be removed or pointed away from the electrode paddles.

☐ Deliver energy with shock command or by depressing the shock buttons simultaneously.

☐ Interpret response to energy delivery, assess efficacy, and deliver repeat energy as indicated.

☐ Monitor rhythm carefully during and following energy delivery.

☐ Cardiopulmonary resuscitation may be necessary following energy delivery.

☐ Appropriate resuscitation drugs should be readily available for rapid administration.

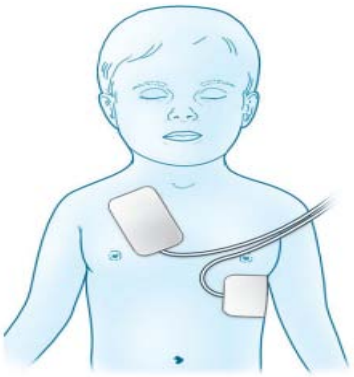


Figure 44. Anterior-lateral pad and paddle positioning.

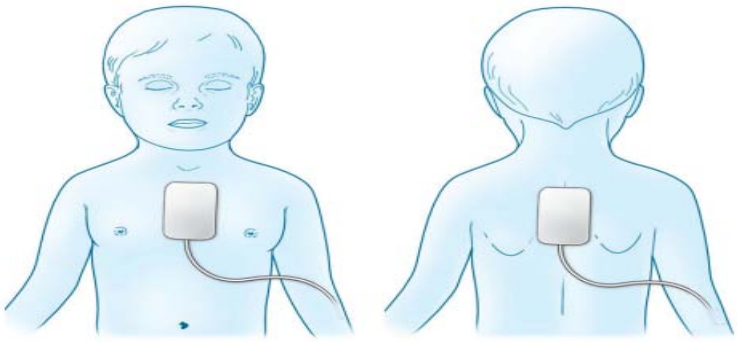


Figure 45. Anterior-posterior pad and paddle positioning.

4.5. Monitoring:

☐ Continuous monitoring of heart rhythm during and following energy delivery is required.

☐ Ideally, a 12-lead ECG should be obtained before and after cardioversion; clearly, this is not advised for emergent interventions with profound hypotension.

☐ The response to energy delivery is immediately interpreted, and the decision about whether repeat energy delivery is needed is made while adequate anesthesia is still present.

☐ Suspect an automatic rhythm when repeated energy delivery that is done correctly does not affect the rhythm.

☐ Mechanism of tachycardia should be reassessed.

☐ Pharmacologic rate control may be advised.

4.6. Follow-up:

☐ Post-sedation monitoring is required.

☐ Outpatient monitoring with Holter monitors or event recorders may help document the frequency and duration of arrhythmia recurrences or predisposing premature beats or bradycardia.

☐ Anticoagulation is frequently advised for at least 4 weeks following cardioversion.

☐ Long-term anticoagulation may be necessary in patients who are not aware of the onset of arrhythmia and are at risk for recurrent tachycardia.

5. COMPLICATIONS :

Monitor the patient regularly in order to screen these complications:

☐ Chest wall lesions.

☐ Neurologic complications.

☐ Arrhythmia complications.

☐ Transmitted electrical shock of nonprotected bystanders may occur.

☐ Skin burns may result from high-dose energy.

☐ Excessive energy delivery may also result in myocardial damage and irreversible cardiomyopathy.

☐ Stroke may result from thromboembolism of atrial or ventricular thrombus with energy delivery.

☐ Anticoagulation and assessment of risk of thrombus with transesophageal echocardiogram may minimize but not eliminate risk of stroke, which occurs in 1-3% of cardioversions.

6. PEARLS AND PITFALLS:

★ Most failures of cardioversion relate to any of the following:

- Improper lead positioning.
- Energy selection
- Synchronization.
- Use of cardioversion for an automatic rhythm not responsive to cardioversion (sinus tachycardia, automatic atrial tachycardia).

★ Lead positioning should direct the current of energy across the chamber to be cardioverted.

★ Cardioversion of ventricular tachycardia should direct energy across the ventricle: Position 1 electrode near the cardiac apex.

★ Atrial tachycardia requires the current of energy to be directed across the atria; an anterior-posterior pad configuration may be preferable.

★ Patients with repaired congenital heart disease resulting in dilated atria and atrial tachycardia are candidates for anterior-posterior pad configuration.

★ In dextrocardia, the pads need to positioned across the right chest.

★ Energy selection.

- Regular rhythms (atrial flutter, supraventricular tachycardia, ventricular tachycardia) require low-dose energy, up to 1 J/kg.
- Irregular tachycardias (atrial fibrillation, ventricular fibrillation) require high-dose energy, at least 2 J/kg.

7. EVIDENCE BASED PRACTICE:

✦ The implantable cardioverter defibrillator (ICD) is a costly new treatment for patients at high risk of sudden cardiac death. Randomized trials of the ICD showed it to be effective in some groups of patients but not in others.

IV. Bag-Mask Ventilation

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Hypoxia

☐ Hypoventilation/apnea

☐ Rescue maneuver if failed intubation

☐ Ventilation face mask may be used with an oropharyngeal or nasopharyngeal airway during spontaneous, assisted, or controlled ventilation.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

2.1. Absolute :

☐ Inability to ventilate secondary to complete upper airway obstruction

☐ Active, adequate spontaneous ventilation.

2.2. Relative:

☐ Full stomach (aspiration risk): cricoid pressure must be maintained to avoid vomiting and aspiration.

☐ After induction and paralysis during rapid sequence intubation (aspiration risk)

3. EQUIPMENT:

Prepare all materials:

☐ Bag valve mask (BVM) with reservoir

- Ventilation bags (manual resuscitator) come in 2 types: self-inflating bag and flow-inflating ("anesthesia") bag.
- Ventilation bags used for resuscitation should be self-inflating.
- Ventilation bags come in different sizes: infant, child, and adult.
- Face masks come in many sizes.
- A ventilation mask consists of a rubber or plastic body, a standard connecting port, and a rim or face seal.
- Supplemental oxygen can be attached to ventilation bags to provide oxygen to the patient

☐ Oxygen connector tubing

☐ +/- Nasal pharyngeal airway/oral pharyngeal airway

☐ Lubricant jelly.

4. PROCEDURE:

4.1. PATIENT PREPARATION

☐ Sedation may be required before beginning.

4.2. Patient position:

☐ A neutral "sniffing" position without hyperextension of the neck is usually appropriate for infants and toddlers.

☐ Avoid extreme hyperextension in infants because it may produce airway obstruction.

☐ In patients with head or neck injuries, the neck must be maintained in a neutral position.

4.3. Anatomy review :

☐ The upper airway consists of the oropharynx, the nasopharynx, and supraglottic structures.

☐ The cricoid cartilage is the first tracheal ring, located by palpating the prominent horizontal band inferior to the thyroid cartilage and cricothyroid membrane.

☐ Cricoid pressure occludes the proximal esophagus by displacing the cricoid cartilage posteriorly. The esophagus is compressed between the rigid cricoid ring and the cervical spine.

4.4. Procedure :

☐ Open the airway via chin lift/jaw thrust maneuver (Figure 46).

A

B

Figure 46: A.Head tilt and chin lift in children: sniffing position.
B.Jaw thrust in children and infants.

- E-C Clamp Technique(Figure 47)

☐ Tilt the head back and place a towel beneath the head.

☐ If head or neck injury is suspected, open the airway with the jaw thrust technique without tilting the head.

☐ If a second person is present, have that person immobilize the spine.

☐ Apply the mask to the face.

☐ Lift the jaw using the third, fourth, and fifth fingers from the left hand under the angle of the mandible; this forms the "E".

☐ When lifting the jaw, the tongue is also lifted away from the posterior pharynx.

☐ Do not put pressure on the soft tissues under the jaw because this may compress the airway.

☐ Place the thumb and forefinger of the left hand in a "C" shape over the mask and exert downward pressure .

☐ Create a tight seal between the mask and the patient's face using the left hand and lifting the jaw.

☐ Compress the ventilation bag with the right hand.

☐ Be sure the chest rises visibly with each breath.

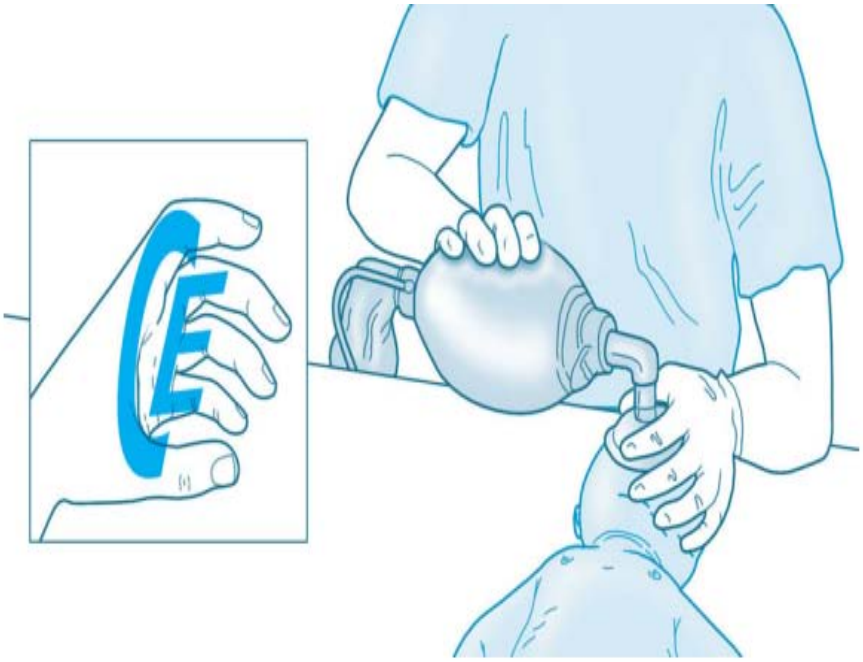


Figure 47. E-C clamp technique.

- If 2 people are present, then 1 person can hold the mask to the face while the other person ventilates with the bag. (Figure 48).
- One person uses both hands to open the airway and maintain a tight mask-to-face seal .
- The second person compresses the ventilation bag.
- If 2 or 3 people are present, someone can apply pressure to the cricoid cartilage (termed "Sellick maneuver") to limit gastric distention in unconscious patients . (Figure 49)
- The Sellick maneuver may also prevent regurgitation and aspiration of gastric contents.
- Avoid excessive cricoid pressure because it may produce tracheal compression and obstruction or distortion of the upper airway anatomy.
- To relieve gastric distention, a nasogastric tube can be placed (if not contraindicated).

Figure 48. Two-handed mask technique.

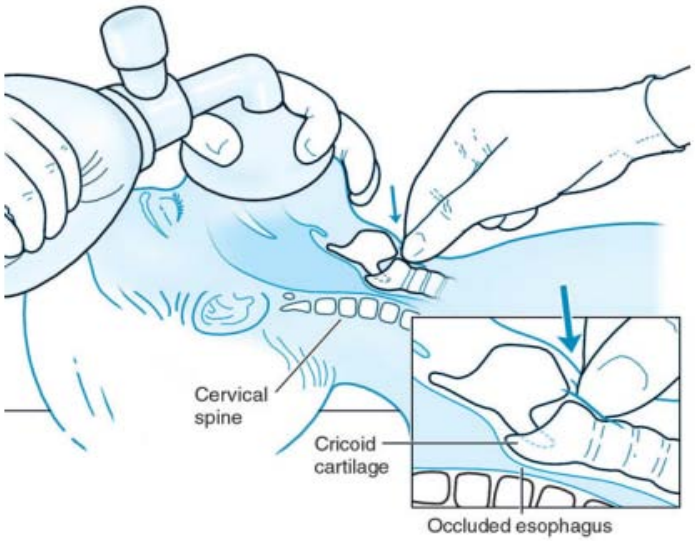


Figure 49. Sellick maneuver.

4.5. Monitoring:

☐ Seal the mask to the face.

☐ Deliver a tidal volume that makes the chest rise.

☐ Use pulse oximetry to measure oxygen saturation levels continuously.

☐ Measure heart rate continuously.

☐ Check blood pressure using a noninvasive device.

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

☐ Stomach inflation may lead to vomiting and aspiration.

☐ Increased positive thoracic pressure may cause decreased preload, worsening cardiac output, and/or hypotension.

☐ Hypoventilation (inadequate O2 tidal volume, airway patency, or mask seal).

□ Air trapping, barotrauma, air leak, and reduced cardiac output can be caused by excessive tidal volume and rate in patients with small airway obstruction (eg, asthma and bronchiolitis).

6. PEARLS AND PITFALLS:

★ Bag-mask ventilation gives the clinician time to prepare for more definitive airway management. While performing bag-mask ventilation, it is important for someone with more advanced airway skills to be preparing for intubation, or for someone to be arranging for the patient's transport to a facility where definitive airway management can be performed.

★ The mask should extend from the bridge of the nose to the cleft of the chin, enveloping the nose and mouth but avoiding compression of the eyes.

★ Cricoid pressure (Sellick maneuver) is not recommended during cardiac arrest resuscitation.

★ It is important to coordinate bag-mask ventilation with the patient's spontaneous breaths in a patient who is spontaneously breathing. Desynchrony can predispose patients to barotrauma and air leak.

★ No muscle relaxant should be given unless a person trained in advanced airway skills is present.

★ Ensure good seal:

- Select appropriate mask size.
- Choose two-handed technique over one-handed, if possible.
- Lift the mandible toward the mask (as opposed to pushing the mask onto the face).
- Rock the mask on face until no leak is present.

7. EVIDENCE BASED PRACTICE:

- The clinician should only use the force and tidal volume necessary to cause the chest to rise visibly. to minimize the risk of barotrauma.
- The SIB (self inflation bag-mask) should be the first choice for bag-mask ventilation in the Emergency Department (ED), with attention to maximize oxygen delivery.

V. Placement of Oropharyngeal Airway

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Maintaining an airway opened by a head-tilt/chin-lift or jaw thrust.

☐ As an alternative method of opening an obstructed airway when airway maneuvers have failed.

☐ As a 'bite-block' to protect an endotracheal tube.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

☐ Patients must be unconscious to tolerate an OP airway :Inserting an airway in a semi-conscious patient may stimulate the gag reflex causing them to vomit, leading to further airway compromise and potential aspiration.

3. EQUIPMENT:

Prepare all materials:

- ☐ Oropharyngeal airways come in various sizes ranging from 4 cm to 10 cm.
- ☐ Oropharyngeal airways consist of a flange, a short bite-block segment, and a curved body usually made of plastic and shaped to provide an air channel and suction conduit through the mouth. (Figure 50)
- ☐ A correctly sized airway will extend from the corner of the patient's mouth to the angle of the mandible .
- ☐ Improper sizing can cause bleeding of the airway and obstruction of the glottis.

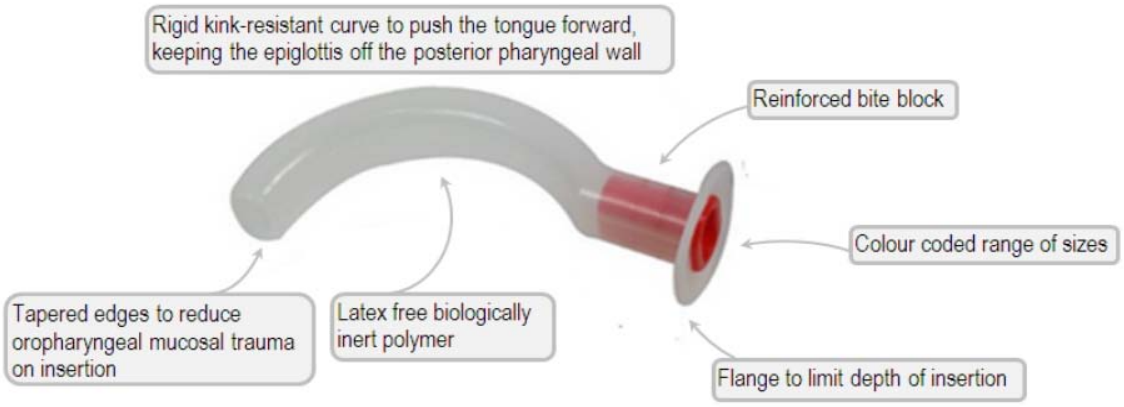


Figure 50. Anatomy of the oropharyngeal Guedel-style airway

4. PROCEDURE:

4.1. PATIENT PREPARATION

- ☐ Measure the distance from the central incisors to the angle of the mandible to approximate the correct size oral airway.

4.2. Patient position:

☐ Head and airway must be positioned properly to maintain a patent airway even after insertion of an oropharyngeal airway.

4.3. Anatomy review:

☐ The upper airway consists of the oropharynx, the nasopharynx, and supraglottic structures.

4.4. Procedure :

☐ Choose an appropriately sized airway .

☐ Open the patient's mouth (if an assistant is available get them to do a jaw thrust).

☐ Insert the airway upside down, with the curvature towards the tongue and the tip towards the hard palate (Figure 51).

☐ When the airway reaches the back of the tongue, rotate the device 180° so the tip faces downwards .

☐ Ensure the patient's tongue/lips are not caught between the airway and the teeth

☐ Reassess the patient's airway for patency.

4.5. Monitoring:

☐ Monitor for airway obstruction; the following clinical signs may manifest:

- Agitation.
- Desaturation.
- Impaired air exchange when auscultated.
- Diminished chest rise.

☐ Use pulse oximetry to measure oxygen saturation levels.

☐ Measure heart rate.

☐ Check blood pressure using a noninvasive device

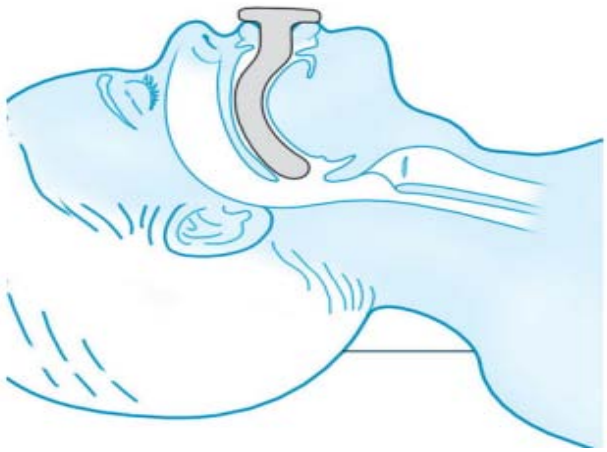


Figure 51. Sagittal view of oral airway in place

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

☐ If the oropharyngeal airway is too large, it may obstruct the larynx, make a tight mask fit difficult, and traumatize laryngeal structures.

☐ If the oropharyngeal airway is too small or is inserted improperly, it pushes the tongue posteriorly, obstructing the airway.

☐ If the oral airway is placed in the awake patient, it may induce vomiting, aspiration, and laryngospasm.

☐ If the airway is too long, it may induce vomiting and aspiration.

6. PEARLS AND PITFALLS:

★ Oropharyngeal airways do not prevent aspiration.

★ The oropharyngeal airway may not be sufficient to relieve upper airway obstruction, and the patient may subsequently require intubation.

7. EVIDENCE BASED PRACTICE:

- ✦ higher proportion of children were successfully ventilated using the facemask and oropharyngeal airway than is generally found in adult studies.
- ✦ This may be because facemask ventilation is inherently easier in children than in adults.

VI. Placement of Nasopharyngeal Airway

1. INDICATIONS:

Make sure that patient have one of the following indications:

- ☐ Maintaining an airway opened by a head-tilt/chin-lift or jaw thrust.
- ☐ As an alternative method of opening an obstructed airway when airway maneuvers have failed.
- ☐ Better tolerated than OP airways in semi-conscious patients.
- ☐ Excellent for use in patients unable to open their mouths (e.g. trismus or seizures).
- ☐ As a means of facilitating bronchial suction.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

- ☐ Known or potential base of skull fracture.
- ☐ Cerebrospinal fluid leak.
- ☐ Commonly causes nose bleeds so should be avoided in those patients known to have bleeding tendencies (e.g. on warfarin; Coagulopathy).
- ☐ Nasal airway occlusions.

☐ Nasal fractures.

☐ Adenoidal hypertrophy.

3. EQUIPMENT:

Prepare all materials:

☐ A nasopharyngeal airway is a soft rubber or plastic tube. (Figure 52)

- Nasopharyngeal airways come in various sizes ranging from 12F to 36F.
- A shortened tracheal tube may be used as a nasopharyngeal airway.

☐ Lubrication jelly

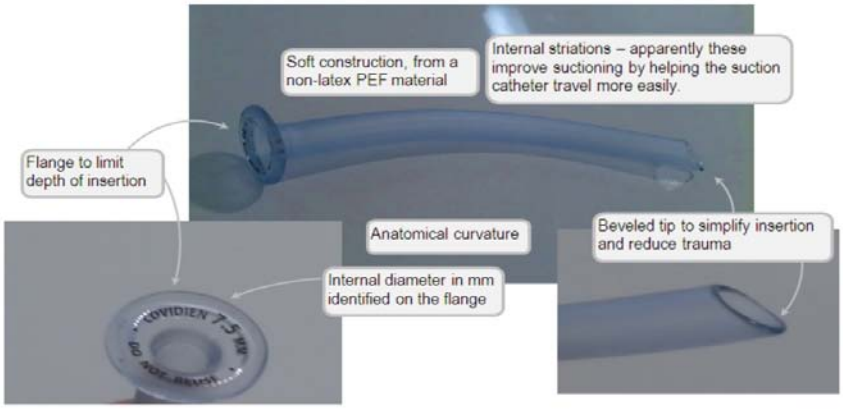


Figure 52.Anatomy of the nasopharyngeal airway

4. PROCEDURE:

4.1. Patient preparation:

☐ Measure the distance from the nares to the tragus of the ear to approximate the appropriate size and length of tube.

4.2. Patient position:

☐ Head and airway must be positioned properly to maintain a patent airway even after insertion of a nasopharyngeal airway.

4.3. Anatomy review :

☐ Upper airway consists of the oropharynx, the nasopharynx, and supraglottic structures.

4.4. Procedure :

☐ Choose an appropriately sized NP airway.

☐ If necessary, place a safety pin through the flange of the NP (this ensures it does not fully enter the nasal cavity).

☐ Apply a water-based lubricant .

☐ Insert the NP airway into the right nostril first .

☐ The bevel should be on the medial side of the NP airway.

☐ The NP airway should be inserted at 90° to the patient's forehead, and should pass with minimal resistance towards the patient's occiput (Figure 53).

☐ Rolling the NP from side to side in your fingers as you exert downwards pressure may make insertion easier

☐ If resistance is met try the other nostril.

☐ Reassess the patient's airway for patency.

4.5.

☐ Because the nasopharyngeal airway has a small internal diameter, it can be obstructed with mucus, blood, vomit, or the soft tissues of the pharynx.

☐ When necessary, suction the airway frequently to ensure patency.

☐ Use pulse oximetry to measure oxygen saturation levels.

☐ Measure heart rate.

☐ Check blood pressure using a noninvasive device.

Figure 53. Sagittal view of nasopharyngeal airway in place

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

☐ If the nasopharyngeal airway is too long, it may cause bradycardia through vagal stimulation or it may injure the epiglottis or vocal cords.

☐ Physical irritation of the larynx or lower pharynx may stimulate coughing, vomiting, or laryngospasm (if the tube is too long).

☐ Nasopharyngeal airways can cause a pressor response with increased blood pressure.

☐ Failure of insertion.

Monitoring:

☐ Epistaxis (due to mucosal tears or avulsion of turbinates).

☐ Submucosal tunneling and pressure sores.

☐ Perforation of cartilage into the sinuses.

☐ Stimulation of nasal secretions with obstruction of the tube.

☐ Prolonged placement of a tight fitting tube may lead to nasal necrosis

6. PEARLS AND PITFALLS:

- ★ NP airways tend to be better tolerated than OP airways in patients with fluctuating consciousness
- ★ Nasopharyngeal airways do not prevent aspiration.
- ★ The nasopharyngeal airway may not be sufficient to relieve upper airway obstruction, and the patient may subsequently require intubation.

7. EVIDENCE BASED PRACTICE:

- ✦ An NPA (nasopharyngeal airway) should be part of everyone healthcare provider's arsenal for basic airway management. Nasotracheal intubation, although rarely utilized, should not be placed by the wayside and should be a skill maintained by any healthcare provider who normally intubates patients to maintain their airway.
- ✦ During the initial airway management, nasopharyngeal airways devices can be utilized to help with oxygenation and ventilation of a patient that is difficult to oxygenate or ventilate via BVM (bag-valve mask) .
- ✦ The NPA (nasopharyngeal airway) is a simple piece of equipment that is easy to use and cheap. It is effective and has advantages over the OPA (oropharyngeal airway) but appears to be used less frequently.

VII. Insertion of Laryngeal Mask Airway

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ A first-line airway management device in those with limited airway management experience.

☐ Airway management in an unconscious patient who requires assisted ventilation in the absence of the ability to provide a definitive airway.

☐ As an alternative to oropharyngeal and nasopharyngeal airways (more suitable for prolonged ventilation).

☐ Emergency airway management at a cardiorespiratory arrest.

☐ Suitable airway device for certain operations/anesthetics.

☐ Part of a 'failed intubation' drill (alternative to Endotracheal tube).

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

2.1. Absolute

☐ Inadequate mouth opening.

☐ When a definitive airway (cuffed tube in the trachea) is required.

2.2. Relative

☐ Neck trauma/injury/radiation.

☐ High risk of aspiration

☐ High-risk anesthetics.

☐ Patient with fluctuating consciousness level (intact gag reflex is a contraindication due to risk of inducing vomiting).

☐ Unconscious patients unable to open mouth (e.g. trismus).

☐ Patients requiring high airway pressure to ventilate

3. EQUIPMENT:

- The LMA exists in a multitude of forms. The basic LMA consists of the following (Figure 54)
  - **15-mm connector**:This is a standard connector which will attach 15-mm connector to a bag-valve- mask, ventilator, filter etc.
  - **tube**: An anatomically designed semi-flexible tube. A black line Tube often runs along the back of the airway enabling easy orientation (should face towards the practitioner at the 'head' end).
  - **Inflation port**: The volume of air to be injected through this one-way valve can be found in Table . It is important to note that LMAs are removed fully inflated (unlike an ET tube where the cuff is fully deflated before removal).
  - **Cuff** : An inflatable cuff, anatomically designed to form a low-pressure seal with minimal mucosal pressure.

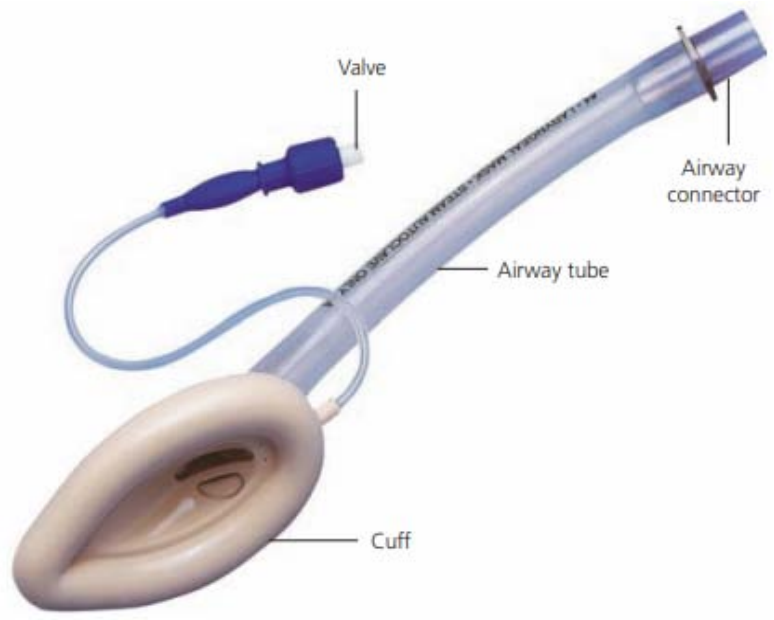


Figure 54. A 'standard' LMA

4. PROCEDURE:

4.1. PATIENT PREPARATION

☐ Measure the distance from the nares to the tragus of the ear to approximate the appropriate size and length of tube.

4.2. Patient position:

☐ Head and airway must be positioned properly to maintain a patent airway even after insertion of a LMA airway.

4.3. Anatomy review:

☐ Upper airway consists of the oropharynx, the nasopharynx, and supraglottic structures.

4.4. Procedure :

☐ Reassess the patient's airway for patency.

☐ Preoxygenate the patient using the bag-valve-mask technique .

☐ partly deflate the cuff of the LMA and apply a watersoluble lubricant to the posterior surface of the cuff (Figure 55.a).

☐ Hold the LMA like a pencil in your dominant hand, with the index finger placed at the junction of the cuff and the tube (Figure 55.b).

☐ Place your non-dominant hand on the back of the patient's head.

☐ Extend the head (unless cervical spine instability is suspected or known) and flex the neck .

☐ Press the tip of the cuff up against the hard palate and flatten the cuff against it (it helps to rotate the cuff slightly laterally at this point) (Figure 55.c).

- ☐ Use your index finger to guide the cuff down towards your non-dominant hand (Figure 55.d).
- ☐ Advance the LMA into the hypopharynx until a definite resistance is felt .
- ☐ Inflate the cuff with just enough air to obtain a seal. As the cuff inflates it tends to 'pop up' slightly into the correct position (Figure 50.e).
- ☐ Connect the LMA to your means of ventilation.
- ☐ Secure the LMA with tape or ribbon.

4.5. Monitoring:

Confirm adequate ventilation using the 'look, listen, feel' approach described in the previous chapter.

- ☐ look for chest movement;
- ☐ listen at the patient's mouth for breath sounds;
- ☐ feel for air on your cheek;

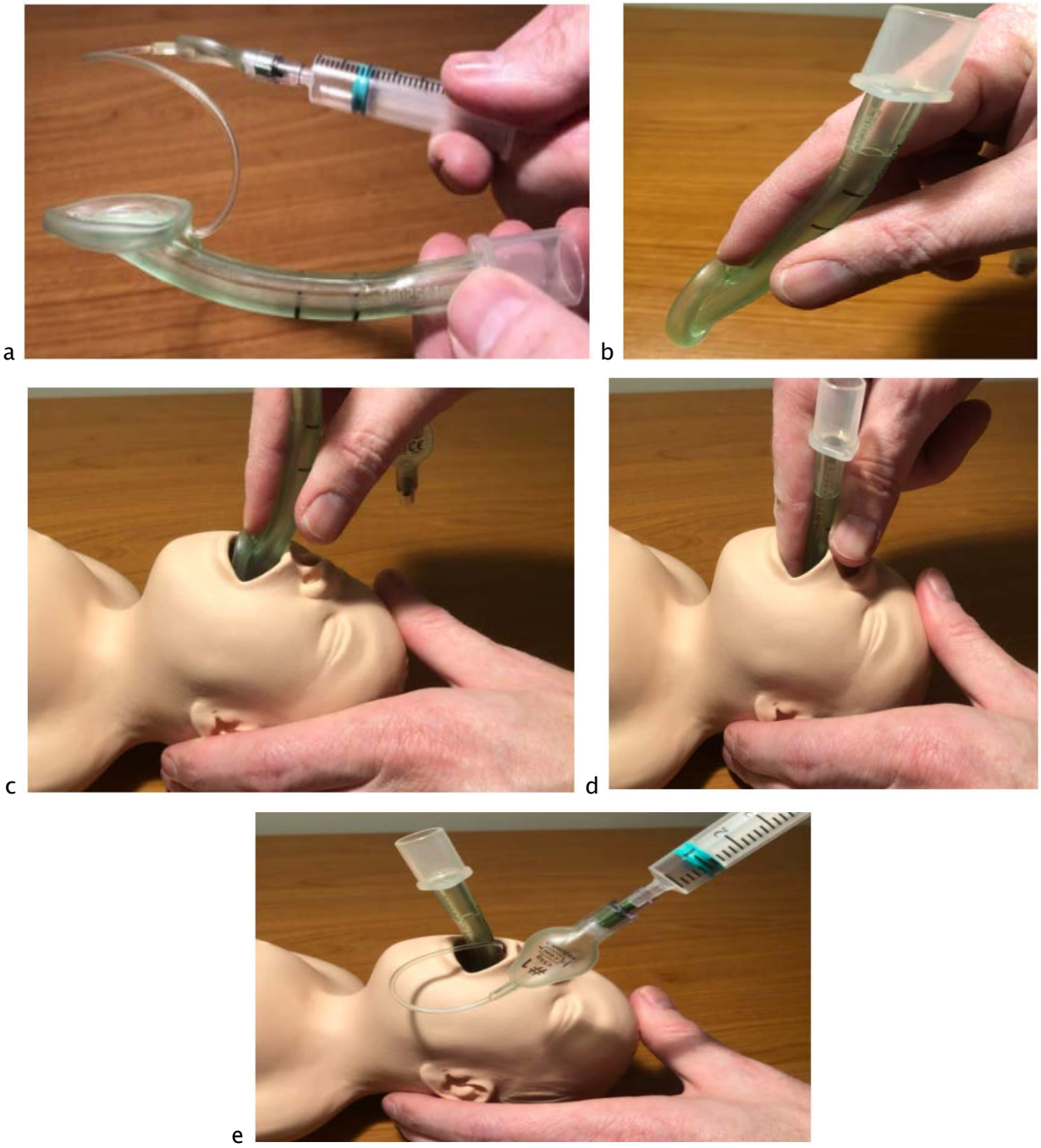


Figure 55. Insertion of LMA

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

☐ Aspiration with resulting pneumonitis

☐ Ineffective seal resulting in insufficient ventilation

☐ Coughing, bucking, or breath holding – Ensure that the patient is adequately sedated.

6. PEARLS AND PITFALLS:

- ★ Cricoid pressure can push the tip of the LMA out of the esophagus and prevent optimal placement.
- ★ A supervised session with an experienced anesthetist is an ideal environment to learn and practice this procedure.
- ★ Deflate the cuff fully before use (they are sometimes provided partially inflated).
- ★ If the patient does not tolerate the LMA remove it with the cuff fully inflated .

7. EVIDENCE BASED PRACTICE:

- ✦ Use of muscle relaxants in short-lasting laparoscopic procedures in children is not absolutely necessary and LMA with sub-paralytic dose of muscle relaxant or with no muscle relaxant is a safe alternative.
- ✦ the ease of insertion of the LMA in children was improved by partial inflation of the cuff. Possibly the softness of the inflated cuff allows for easier adaptation to the differing pharyngeal characteristics of the pediatric airway. In addition, 2% lidocaine topical solution appears beneficial in decreasing the incidence of coughing during emergence for patients whose anesthetic technique does not include an opioid.

VIII. Placement of Endotracheal Tube

1. INDICATIONS:

Make sure that patient have one of the following indications:

1.1. Respiratory

☐ Apnea.

☐ Acute respiratory failure ($PaO_2 < 50$ mm Hg in patient with fraction of inspired oxygen [FIO_2] > 0.5 and $PaCO_2 > 55$ mm Hg).

☐ Need to control oxygen delivery (institution of positive end-expiratory pressure [PEEP], accurate delivery of $FIO_2 > 0.5$).

☐ Need to control ventilation (eg, to decrease work of breathing, to control $PaCO_2$, to provide muscle relaxation).

1.2. Neurologic

☐ Inadequate chest wall function (in patient with Guillain-Barré syndrome, poliomyelitis).

☐ Absence of protective airway reflexes (cough, gag).

☐ Glasgow Coma Score ≤ 8.

1.3. Airway

☐ Upper airway obstruction.

☐ Infectious processes (epiglottis, croup).

☐ Trauma to the airway.

☐ Burns (concern for airway edema).

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

2.1. Relative:

- Presumed difficult airway
  - Anatomical limitations
    - ☐ Small oral opening (less than three of the patient's fingers)
    - ☐ Small mandible (hyomental distance less than three fingers)
    - ☐ Hyoid-thyroid distance (less than two fingers)
  - Clinical limitations
    - ☐ Patient with unstable cervical spine
    - ☐ Patient with multiple facial or neck trauma Patient with history of tracheal stenosis, irradiation, or history of tracheal mass or surgery

3. EQUIPMENT:

Prepare all materials:

- ☐ Suction.
  - Should have a tonsil-tipped suction device or a large bore suction catheter as well as a suction catheter of appropriate size that fits into the endotracheal tube.
- ☐ Oxygen.
- ☐ Resuscitation bags.
- ☐ Masks (appropriate sizes for ventilation).
- ☐ Laryngoscope (blade, handle, bulb, battery).

☐ Endotracheal tubes (appropriate sizes, cuffed, uncuffed) (Table VII – Figure 56).

☐ Forceps.

☐ Oropharyngeal airway.

☐ Tongue blade.

☐ Bite block.

☐ Tape (to secure tube).

☐ Stylet (appropriate sizes).

☐ CO2 detector device.

☐ Syringe to inflate the endotracheal tube balloon on cuffed tubes Lidocaine (optional).

Table VII. Suggested endotracheal tube size.

Age	Internal Diameter (mm)
Premature infant	2.5–3.0
Newborn	3.0
Newborn–6 months	3.5
6 months–12 months	3.5–4.0
12 months–2 years	4.0–4.5
3–4 years	4.5–5.0
5–6 years	5.0–5.5
7–8 years	5.5–6.0
9–10 years	6.0–6.5
11–12 years	6.5–7.0
13–14 years	7.0–7.5

[a]Useful formula: $\frac{16 + \text{age}}{4}$

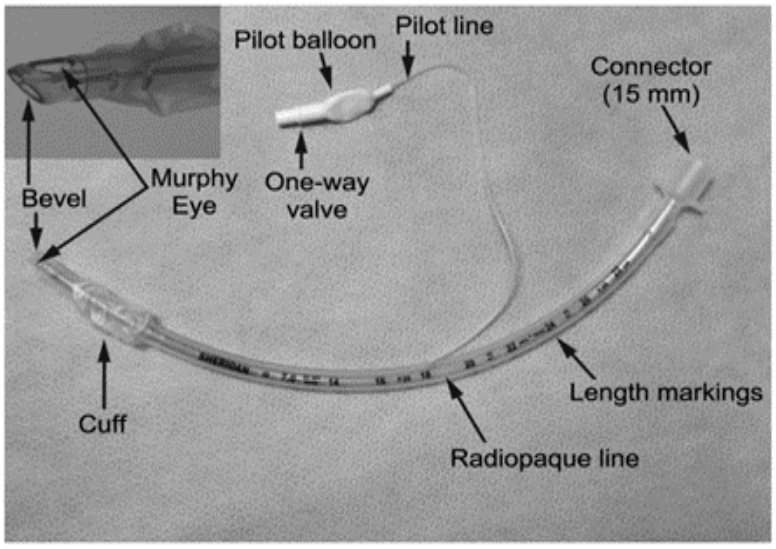


Figure 56. Anatomy of the standard endotracheal tube.

4. PROCEDURE:

4.1. PATIENT PREPARATION:

☐ Check the intubation equipment before beginning.

☐ Attach the blade to the handle and be sure that the bulb illuminates.

☐ Attach suction to a suction machine and be sure that suction is turned on.

☐ If using a stylet, insert stylet into endotracheal tube.

☐ The tip of the stylet should be 1–2 cm proximal to the distal end of the endotracheal tube, ensuring that the stylet does not go through the Murphy eye.

☐ Prepare to monitor the patient's heart rate, oxygen saturation levels, and blood pressure.

4.2. Patient position:

☐ Have the patient lie supine on the examination table.

☐ Place the table at a comfortable height for you and sit or stand at the affected side of the patient.

4.3. Anatomy review:

Following are the distinguishing features of the infant and child airway compared with adults:

- ☐ The larynx is more cephalad.
- ☐ The epiglottis is omega shaped.
- ☐ In children younger than 8 years, the cricoid is the narrowest part of the airway.
- ☐ The infant larynx is one-third the size of the adult larynx.
- ☐ The vocal cords are short and concave.
- ☐ Cricoid pressure occludes the proximal esophagus by displacing the cricoid cartilage posteriorly. The esophagus is compressed between the rigid cricoid ring and the cervical spine.
- ☐ Aligning the mouth, pharynx, and glottis to create a visual field is difficult.
- ☐ The endotracheal tube size relates to the cricoid ring.
- ☐ In children, the lower airways are smaller, have less supporting cartilage, and may easily obstruct.
- ☐ A small reduction in diameter results in a large reduction in the cross-sectional area and therefore increased airway resistance.

a. Procedure :

- ☐ Preoxygenate with 100% oxygen.
- ☐ Administer 0.01-0.02 mg/kg IV of atropine (minimum dose, 0.1 mg). Atropine may not be indicated in cases of significant tachycardia.
- ☐ Administer IV sedation (eg, fentanyl, morphine, midazolam, etomidate, thiopental, ketamine).

☐ Perform bag-mask ventilation with 100% oxygen.

☐ Give an IV muscle relaxant.

☐ Open the mouth and insert the laryngoscope .

☐ Avoid positioning the blade against the teeth, gums, or lips.

☐ Visualize the glottic opening.

☐ Suction any secretions that may obscure visualization.

☐ Insert endotracheal tube; observe the tube to pass through the glottic opening.

☐ Remove the stylet while holding the tube securely in place, and ventilate the patient.

☐ Secure the tube to the face.

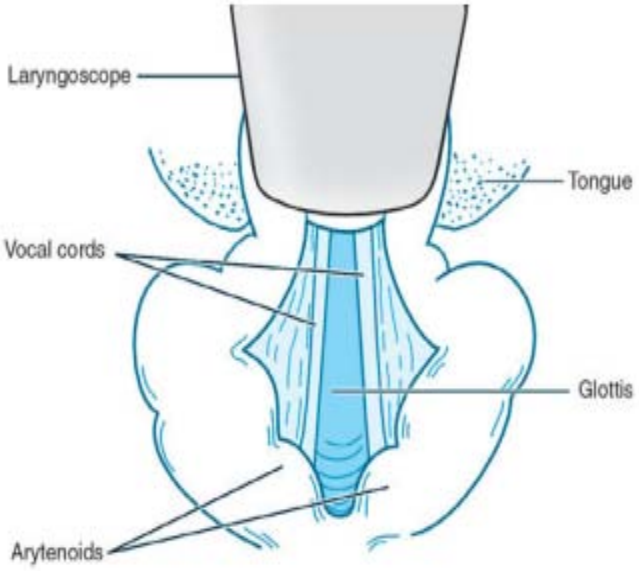


Figure 57. Head-on view of airway as seen with laryngoscope

b. Monitoring:

☐ Auscultation for symmetric breath sounds.

☐ Good chest excursion.

☐ Effective oxygenation.

☐ Disposable colorimetric capnometer (color should change from purple to yellow if patient has a perfusing rhythm) or capnograph.

☐ Obtain chest radiograph.

☐ Absence of breath sounds over the upper abdomen.

☐ If unilateral breath sounds are heard on the right, pull back the tube slowly while ventilating and listen for breath sounds on the left (probable intubation of right main bronchus).

☐ Use pulse oximetry to measure oxygen saturation levels continuously.

☐ Measure heart rate continuously.

☐ Check blood pressure frequently using a noninvasive device.

c. Follow-up:

☐ The importance of follow-up is to make sure that the endotracheal tube remains in the correct position and is not obstructed.

☐ Monitor end tidal CO2 using capnography.

☐ Monitor oxygen saturation levels.

☐ Check heart rate

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

5.1. Common (1–4 %)

☐ Esophageal intubation: can be fatal if unrecognized.

☐ Mainstem bronchus intubation.

☐ Tachycardia – Aspiration.

☐ Hypotension.

5.2. Uncommon (<1 %)

☐ Dental/oral trauma.

☐ Oropharyngeal edema or bleeding.

☐ Laryngospasm.

☐ Dysrhythmia.

☐ Pneumothorax.

☐ Cardiac arrest.

6. PEARLS AND PITFALLS:

★ Positioning is of key importance.

★ all patients with a stable cervical spine should be placed in the "sniffing" position to maximize view.

★ Consider the "ramping" position in obese patients with stable cervical spines.

★ elevation of the head and shoulders allows redundant tissue to fall and gives an improved glottic view.

★ Always have suction readily available to remove blood, vomitus, or edema.

★ If structures are not readily visible, withdraw the blade gradually because it is common to insert the blade too deep.

★ Uncuffed tubes are generally recommended in children younger than 8 years, except in cases of severe lung disease.

★ Laryngoscopes.

- Handle with battery and blade with light source. Adult and pediatric handles fit all blades, and differ only in handle diameter.

- A straight blade provides greater displacement of the tongue into the floor of the mouth and visualization of a cephalad and anterior larynx
- A curved blade may be used in the older child; the broader base and flange allow easier displacement of the tongue

★ For difficult intubations, other techniques, such as fiberoptic intubation, may be used.

7. EVIDENCE BASED PRACTICE:

✦ The advantages of using cuffed ETTs in the peri-anesthesia setting have been established, and the literature supports the appropriate use of cuffed ETTs in children

✦ Understanding the anatomical differences of the pediatric airway, knowing how to choose and size the ETT, appreciating the importance of measuring and controlling ETT CP, and being prepared to care for children with post-extubation laryngeal edema is imperative.

✦ Intensive care physicians more often adhered to currently considered preferable practices for endotracheal intubation than ED physicians in this single center retrospective study. Although larger scale studies are needed to unveil the effects of different practice patterns on short and long term outcomes, the present study identifies opportunity to bridge practice gaps that could lead to improved outcomes.

IX. Inhalation Medications

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Administration of medication to the lungs.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

2.1. Absolute :

☐ Allergic reaction to medication

2.2. Relative:

☐ Anatomic abnormalities that cause increasing symptoms with treatment.

3. EQUIPMENT:

Prepare all materials:

☐ Nebulizer and compressor.

☐ Metered-dose inhaler with spacer.

☐ Dry powder inhaler (Figure 58).

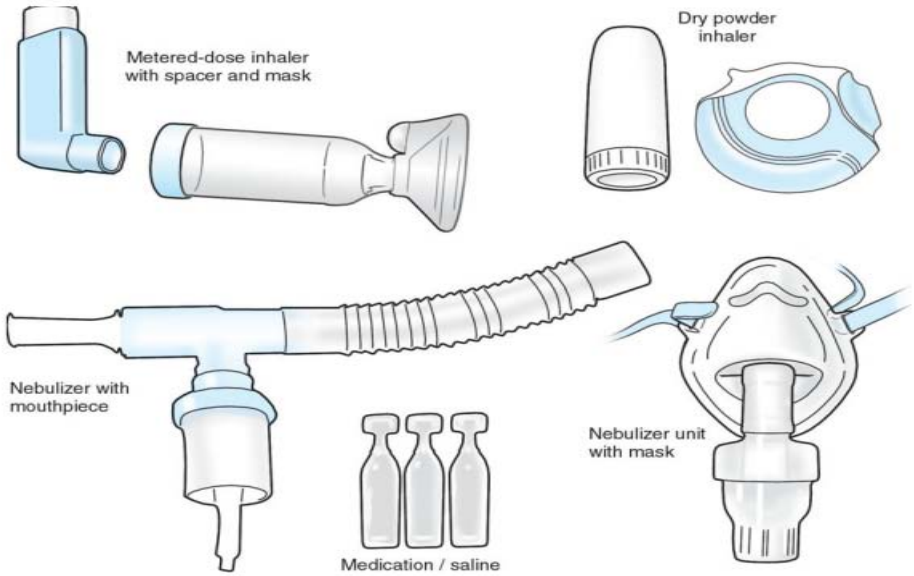


Figure 58. Equipment.

4. PROCEDURE:

4.1. Patient preparation:

☐ Most children who require inhalation medication for wheezing will be stable.

☐ Children with severe bronchospasm or hypoxia should be placed on a cardiac monitor and pulse oximeter. They should be allowed to sit in a position of comfort, preferably upright.

4.2. Patient position:

☐ Sitting upright is preferred.

☐ Young children should be held by their caregivers

4.3. Anatomy review:

☐ Effective administration involves transport of medication to the lower airways.

☐ The medication must be aerosolized and inhaled to facilitate delivery.

☐ Ineffective aerosolization as well as improper technique may result in disposition of medication onto the skin of the face, or on the soft palate or posterior pharynx.

4.4. Procedure :

a. Nebulizer

☐ Provide power to the compressor of the nebulizer machine (electric or battery).

☐ Attach oxygen tubing to the compressor and attach the nebulizer cup to the free end of the oxygen tubing.

☐ Open the top of the nebulizer cup by twisting and lifting the cap, pour medication into the cup, and reattach the top.

☐ Have patient put mouthpiece in mouth with seal made by lips, or if using mask, place it on patient's face (Figure 59).

☐ Turn the machine on.

☐ Instruct the patient to take slow deep breaths until the mist stops.

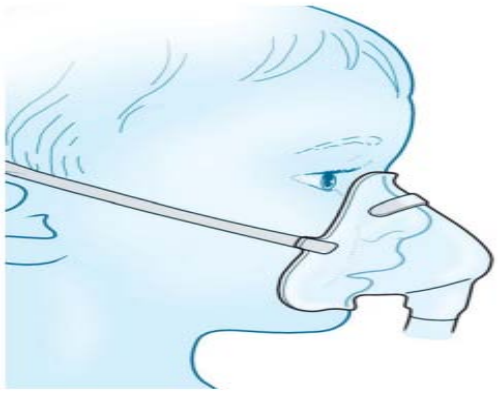


Figure 59. Proper fit of a nebulizer mask.

b. Metered-Dose Inhaler and Spacer Device

☐ Shake the inhaler.

☐ Remove the cap and attach it to the spacer device.

☐ Have the patient exhale completely.

☐ Place the mouthpiece of the spacer into the mouth and make a seal with the lips.

☐ If using a mask, apply it to the patient's face.

☐ Spray 1 puff from the inhaler into the spacer and have the patient breathe deeply and slowly.

- 4–5 breaths for young children.
- A single large breath held for 10 seconds for older children.

☐ Wait 1 minute and repeat with the second puff.

c. Dry Powder Inhaler

☐ Open inhaler (lever to slide open or cap to remove).

☐ Hold it in a horizontal position.

☐ Patient should inhale and exhale fully, put mouth on inhaler, inhale slowly and fully, and hold breath to count of 10.

☐ Close inhaler.

4.5. Monitoring:

☐ No specific monitoring is needed for the routine use of inhalation medications.

☐ For children in acute respiratory distress, symptoms (respiratory rate, wheezing, retractions) should be assessed before and after the administration of medication.

4.6. Follow-up:

☐ The management plan is dictated by the illness necessitating the use of inhalation medications.

☐ For children with acute wheezing, follow-up should be 1- 7 days after the intervention.

☐ For those with stable disease, follow-up every 3-6 months is adequate.

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

☐ the failure to deliver the medication.

☐ Bronchoconstriction secondary to preservative (most solutions are now preservative free).

☐ Tachycardia.

☐ Arrhythmia (supraventricular tachycardia).

☐ Agitation.

☐ Oral candidiasis.

6. PEARLS AND PITFALLS:

- ★ Ineffective aerosolization as well as improper technique may result in disposition of medication onto the skin of the face or on the soft palate or posterior pharynx.
- ★ In some younger children, the use of a spacer with a mask may allow more effective delivery than a spacer with a mouthpiece.
- ★ If used correctly, each method .of delivery of inhalation medications is equally effective.
- ★ When using a nebulizer, when mist starts sputtering, tapping on cup allows for aerosolization of remainder of medicine.
- ★ Effective administration involves transport of medication to the lower airways.
- ★ The medication must be aerosolized and inhaled to facilitate delivery.

7. EVIDENCE BASED PRACTICE:

- ✦ Training in correct inhalation technique is essential for patients and healthcare professionals.
- ✦ Inhalation technique should be checked and reinforced at regular intervals (e.g. every time a patient is prescribed a new inhaler).
- ✦ Teaching correct inhalation techniques should be tailored to the patient's needs and preferences: written material alone is insufficient to teach correct inhalation technique (one-to-one, group and video tuition are superior tools); group instruction in correct inhalation technique appears to be more effective than personal one-to-one instruction and equally effective like video instruction; younger patients may benefit more from multi-media teaching methods; elderly patients respond well to one-to-one tuition.

X. Chest Drain

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Prolonged drainage of air or fluid (e.g. empyema, hemothorax) from the pleural space.

☐ Definitive treatment of a tension pneumothorax (after needle decompression).

☐ Hemopneumothorax in acute trauma.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

2.1. Absolute:

☐ Emergent thoracotomy.

2.2. Relative:

☐ Coagulopathy.

☐ Pulmonary bullae.

☐ Pulmonary, pleural, or thoracic adhesions.

☐ Loculated pleural effusion or empyema.

☐ Skin infection over the chest tube insertion site.

☐ Bleeding diathesis.

☐ Mechanical ventilation.

☐ Presence of adhesions: may require pleurodesis.

3. EQUIPMENT:

Prepare all materials:

- ☐ Sterile gloves, mask, and gown.
- ☐ Iodinated skin preparation with sterile sponges.
- ☐ Sterile towels.
- ☐ Local anesthetic (1% lidocaine without epinephrine).
- ☐ 5-mL syringe with 25-gauge needle.
- ☐ 18-gauge 2-inch needle.
- ☐ #10 scalpel with handle.
- ☐ Chest tube and Kelly clamp for large bore insertion.
- ☐ Pleur-evac or other drainage system, including all connectors necessary to connect to chest tube and to suction.
- ☐ Suction.
- ☐ Needle holder.
- ☐ Suture scissors.
- ☐ 2-0 silk suture.
- ☐ 4 × 4 gauze.
- ☐ Transparent occlusive dressing.

4. PROCEDURE:

4.1. PATIENT PREPARATION

- ☐ Patient should have intravenous access.

☐ Oxygen should be available.

☐ Monitor oxygen saturation with pulse oximetry.

☐ Younger patients may need sedation or anesthesia for procedure, especially with large bore chest tube insertion.

☐ Explain procedure in a developmentally appropriate manner before and during procedure.

4.2. Patient position:

☐ Ideally the patient should be positioned on the bed at 45° with their arm held behind their head to expose the axillary area.

☐ Alternatively, the patient could be sitting forwards and leaning over a table.

4.3. Anatomy review:

☐ Neurovascular bundle is under the rib.

☐ Chest drains should be inserted within the 'triangle of safety' which has the following borders:

- anteriorly – anterior axillary line, lateral border of pectoralis major.
- posteriorly – anterior border of latissimus dorsi.
- inferiorly – at the level of the nipple.

4.4. Sterile preparation:

☐ Sanitize or wash your hands thoroughly and don gloves.

☐ Use universal precautions or isolation precautions as appropriate.

☐ Cleanse the site with antiseptic solution.

☐ Drape surrounding area with sterile drapes.

4.5. Procedure :

a. Insertion of Chest Tube by Seldinger Technique (Figure 60)

☐ Use 25-gauge needle and 5-mL syringe to infiltrate skin and make wheal under skin.

☐ Change needle to 18 gauge with 2-inch needle.

☐ Infiltrate through wheal, over top of rib, to anesthetize the periosteum, and into pleural space.

☐ Be sure to aspirate first, and know when you are in the pleural space.

☐ The pleura needs to be anesthetized, but, to avoid a puncture of the lung, do not advance the needle further.

☐ Insertion of Chest Tube by Seldinger Technique.

☐ Remove syringe from needle.

☐ Pass guidewire through needle into pleural space.

☐ Remove needle (while always maintaining a hold on the guidewire).

☐ Make small incision at site of insertion (large enough to pass chest tube).

☐ Starting with smallest dilator, insert dilator over guidewire using a twisting motion (while always maintaining a hold on the guidewire).

☐ Repeat with larger dilators over guidewire until track is large enough to easily pass chest tube (while always maintaining a hold on the guidewire).

☐ Insert chest tube over guidewire until all port holes are within the pleural space.

☐ Remove guidewire.

☐ Suture chest tube to chest wall.

☐ Connect tube to drainage device with suction at 15–20 cm H_2O.

☐ Apply sterile 4 × 4 dressing and transparent occlusive dressing.

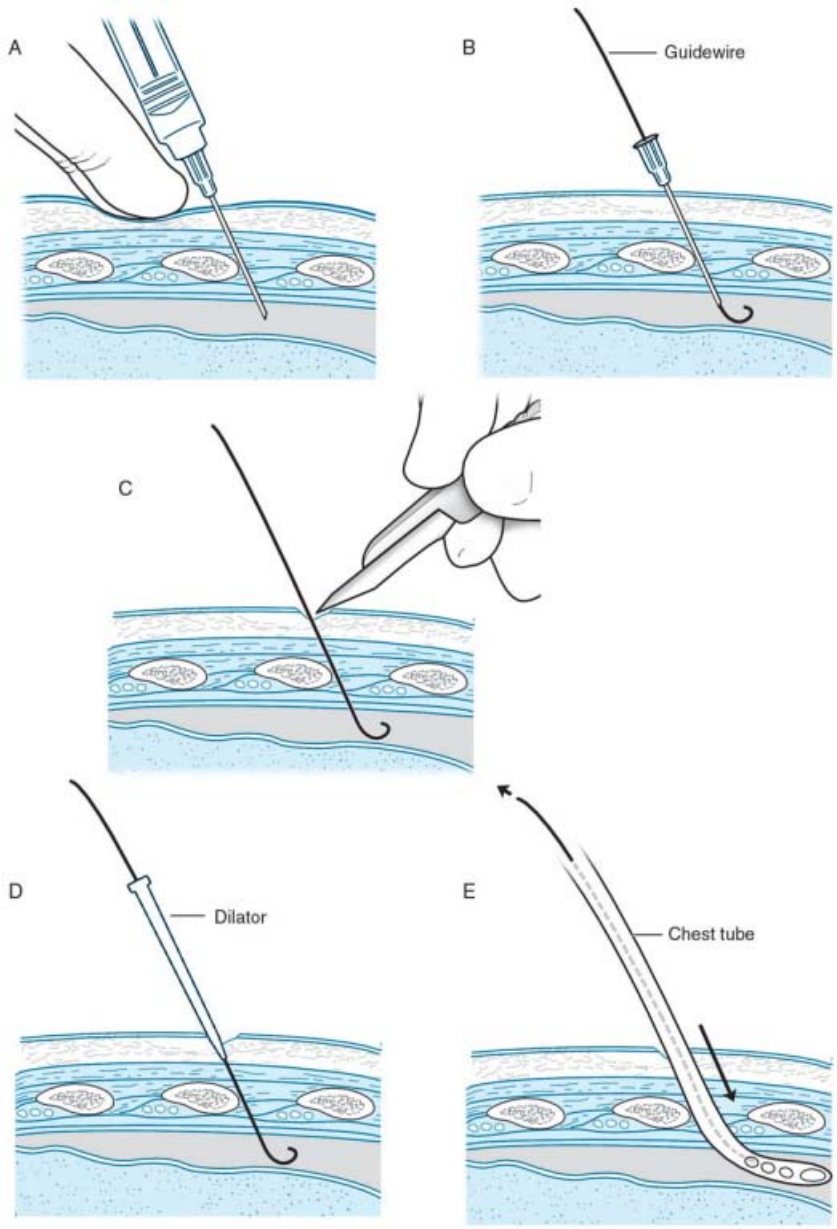


Figure 60. Inserting chest tube using Seldinger technique (patient's head is to the right in this figure).

b. Insertion of Chest Tube by Blunt Dissection Technique (Figure 61)

☐ Remove needle used for local anesthesia

☐ Using scalpel make ~1–2–cm incision through the skin and subcutaneous tissue (large enough to pass chest tube)

☐ Insert Kelly clamp and tunnel up 2 intercostal spaces in the subcutaneous space .

☐ Push through the intercostal muscle superior to the rib with the Kelly clamp and enter the pleural space; air or fluid may rush out.

☐ Spread the clamp to widen the area to allow for the chest tube.

☐ Remove clamp.

☐ Insert gloved finger into tract and ensure correct location and lyse any adhesions.

☐ Using the Kelly clamp attached to the chest tube as a guide, insert the chest tube into the pleural space.

☐ If to drain air, guide anterior and superior (turning the clamp so that the curve is upward will assist with this guidance).

☐ If to drain fluid, guide posterior and inferior (turning the clamp so that the curve is down will assist with this guidance).

☐ Advance chest tube until all ports are within the pleural space.

☐ Suture chest tube to chest wall.

☐ Connect tube to drainage device with suction at 15–20 cm H2O.

☐ Apply sterile 4 × 4 dressing and transparent occlusive dressing.

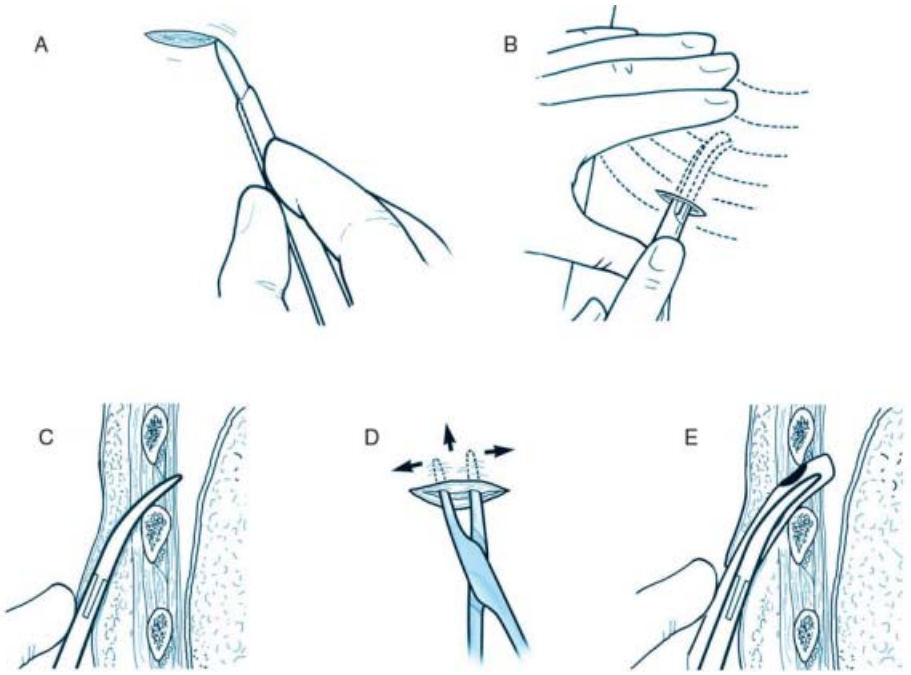


Figure 61. Inserting chest tube using blunt dissection technique.

4.6. Monitoring:

Frequent monitoring of vital signs following procedure is important in identifying hemodynamic changes and correcting them appropriately.

☐ Keep the bottle upright and below the level of the insertion site.

☐ A bubbling chest drain should never be clamped.

☐ When a drain is inserted for a pleural effusion, the drain should be clamped for 1 hour after draining 1 litre of fluid to reduce the risk of re-expansion pulmonary oedema.

4.7. Follow-up:

☐ Patients with a pneumothorax who are discharged without active intervention should be advised to return in 2 weeks' time for a follow-up CXR.

☐ Patients should be advised to avoid air travel until 6 weeks following resolution of the pneumothorax.

☐ Scuba diving should be permanently avoided by patients who have had a pneumothorax unless they undergo bilateral surgical pleurectomy.

☐ All patients should be given advice to return immediately should they experience worsening breathlessness.

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

☐ Pain (prescribe simple and/or opioid analgesia).

☐ Infection.

☐ Poor position of drain: may need withdrawing slightly.

☐ Blockage of drain: may require flush with 10 mL sterile saline.

☐ Organ damage: do not insert the sharp trocar into the pleural cavity.

☐ Bleeding: stop warfarin before insertion and correct any coagulopathy.

☐ Surgical emphysema may occur with pneumothorax.

☐ Re-expansion pulmonary oedema. Following drainage of a large effusion or pneumothorax, negative intrathoracic pressure caused by rapid re-expansion of the lung may cause non-cardiogenic pulmonary oedema.

☐ Empyema .

☐ Retained pneumothorax.

6. PEARLS AND PITFALLS:

★ Positioning the patient in a comfortable position is vital – they are going to be there for some time.

- ★ If you are sedating the patient you should have two medical practitioners, one doing the procedure and one responsible for sedation and monitoring.
- ★ Stitching in the chest drain securely is vital – they are notorious for falling out. This is not only annoying, but can also be very dangerous (pneumothorax).
- ★ Remember to order (and look at) the post-procedure chest X-ray and document the result.
- ★ Water seal acts as a one-way valve; if the system bubbles, there is an air leak.
- ★ In the Pleur-evac® systems, there is an orange floater which, when static, means the desired suction pressure (usually 20 cmH2O) has been reached.
- ★ The negative pressure in the chest cavity equals the amount of water in water seal plus amount of suction.
- ★ A chest tube can be removed when there is no air loss or blood for 24 h.
- ★ When removing the tube, have the patient exhale and remove as quickly as possible.
- ★ Leave petrolatum gauze in place for 48 h before changing it (allows wound to heal better).

7. EVIDENCE BASED PRACTICE:

- ✦ X-ray after chest tube/pigtail removal rarely changes patient management. We recommend considering imaging if there are clinical symptoms.
- ✦ Using a systematic guide to observe and monitor patients with chest tubes enhances the effectiveness and safety of nursing care in the hospital.
- ✦ Appropriate chest tube size selection to accommodate the clinical situation is key, especially in the setting of large pleural air leaks lest a tension pneumothorax ensue.
- ✦ Large-bore chest tubes are generally required for patients with pneumothorax, regardless of etiology, if the patient is mechanically ventilated, or for patients requiring drainage of viscous pleural liquids such as blood. Smaller bore tubes may be adequate in patients with limited production of pleural air or of free-flowing pleural liquid
- ✦ Chest tubes may be removed successfully at either end expiration or end inspiration, and potentially as soon as ≤200 mL/fluid output per day is achieved.

XI. Ascitic Drain

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ large ascites: leads to abdominal pain and mechanical effects such as respiratory compromise, early satiety, scrotal and leg swelling and frequently a poor quality of life.

☐ refractory ascites: Ascites from cirrhosis which is often controlled with diuretic therapy, but a significant proportion of patients are either resistant to or intolerant of diuretic therapy.

☐ Ascites from malignant causes tends not to respond to diuretic therapy.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

☐ Abdominal wall cellulitis

☐ Severe thrombocytopenia

☐ Coagulopathy

3. EQUIPMENT:

Prepare all materials: (Figure 62)

☐ Rocket catheter/drain or the Bonanno™ suprapubic catheter.

- Both of these catheters consist of a straight metal trocar, which serves as a core for a plastic tube with a curved end that is kept straight while the trocar is inside. The Bonanno™ catheter has a small flat plate on one end that can be taped or sutured to the skin.

☐ 23G and 21G needles.

☐ Dressing set containing sterile drapes and sterile gloves.

☐ Chlorhexidine solution for cleansing.

☐ Transparent adhesive dressing.

☐ Catheter drainage bag.

Figure 62. The equipment required for insertion of ascitic drain.

4. PROCEDURE:

4.1. Patient preparation:

☐ Introduce yourself to the parents and the patient.

☐ Explain the procedure.

☐ Choose the most appropriate site.

4.2. Patient position:

☐ Have the patient lie supine on the examination table.

4.3. Anatomy review:

☐ The preferred site is in the midline approximately one third of the distance from the umbilicus to the symphysis pubis (Figure 63).

☐ In infants, the fluid may bulge laterally, and the paracentesis may be obtained laterally to that point.

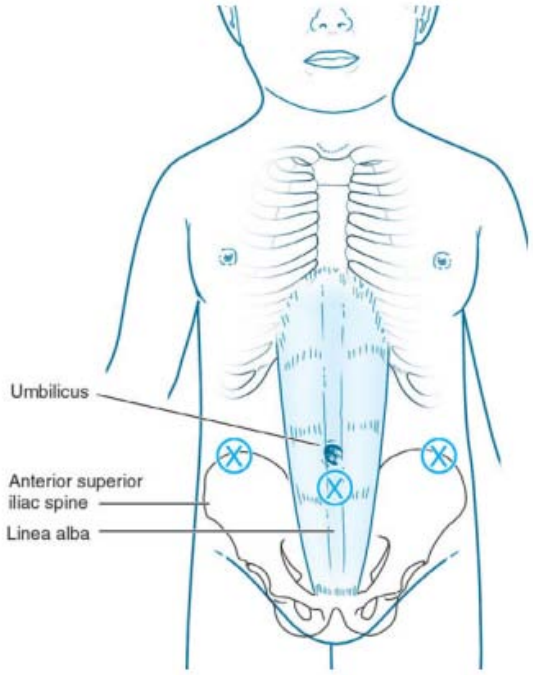


Figure 63. Anatomic landmarks and sites of entry.

4.4. Sterile preparation:

☐ Sanitize or wash your hands thoroughly and don gloves.

☐ Use universal precautions or isolation precautions as appropriate.

4.5. Procedure : (Figure 64)

☐ Infiltrate the skin at the chosen site with local anaesthetic (e.g. 1% lidocaine).

☐ Maintain the needle perpendicular to the abdominal wall at all times.

☐ Note the depth at which the peritoneum is entered (when ascites can be aspirated back into the syringe).

☐ Use a scalpel blade to make a small nick in the skin to allow for easy catheter access .

☐ Insert the catheter perpendicular to the selected entry point .

☐ Insert slowly in increments of 5 mm to minimise the risk of inadvertent vascular entry.

☐ Continuously apply suction to the syringe as the needle is advanced.

☐ Sudden loss of resistance is felt when you enter the peritoneal cavity and ascitic fluid can be aspirated into the syringe.

☐ At this point, advance the catheter a further 5 mm into the peritoneal cavity. Avoid advancing the catheter any deeper.

☐ Use one hand to firmly hold the trocar and syringe in place to prevent the trocar from entering further into the peritoneal cavity.

☐ Use the other hand to advance the plastic catheter over the trocar all the way into the peritoneal cavity .

☐ Resistance should not be felt while the catheter is advanced. Resistance could mean that the catheter has been misplaced.

☐ If resistance is felt withdraw the catheter completely and reattempt the procedure.

☐ Remove the trocar once the plastic catheter is completely inserted.

☐ attach the three-way stopcock and a catheter bag.

☐ Secure the drain with sutures or an appropriate purpose-made dressing.

4.6. Monitoring:

☐ Frequent monitoring of vital signs following paracentesis is important in identifying hemodynamic changes and correcting them appropriately.

4.7. Follow-up:

☐ look for clinical signs:

- Fever.
- Nausea and vomiting.
- Blood in the stool.
- Abdominal pain.

- Abdominal distention.

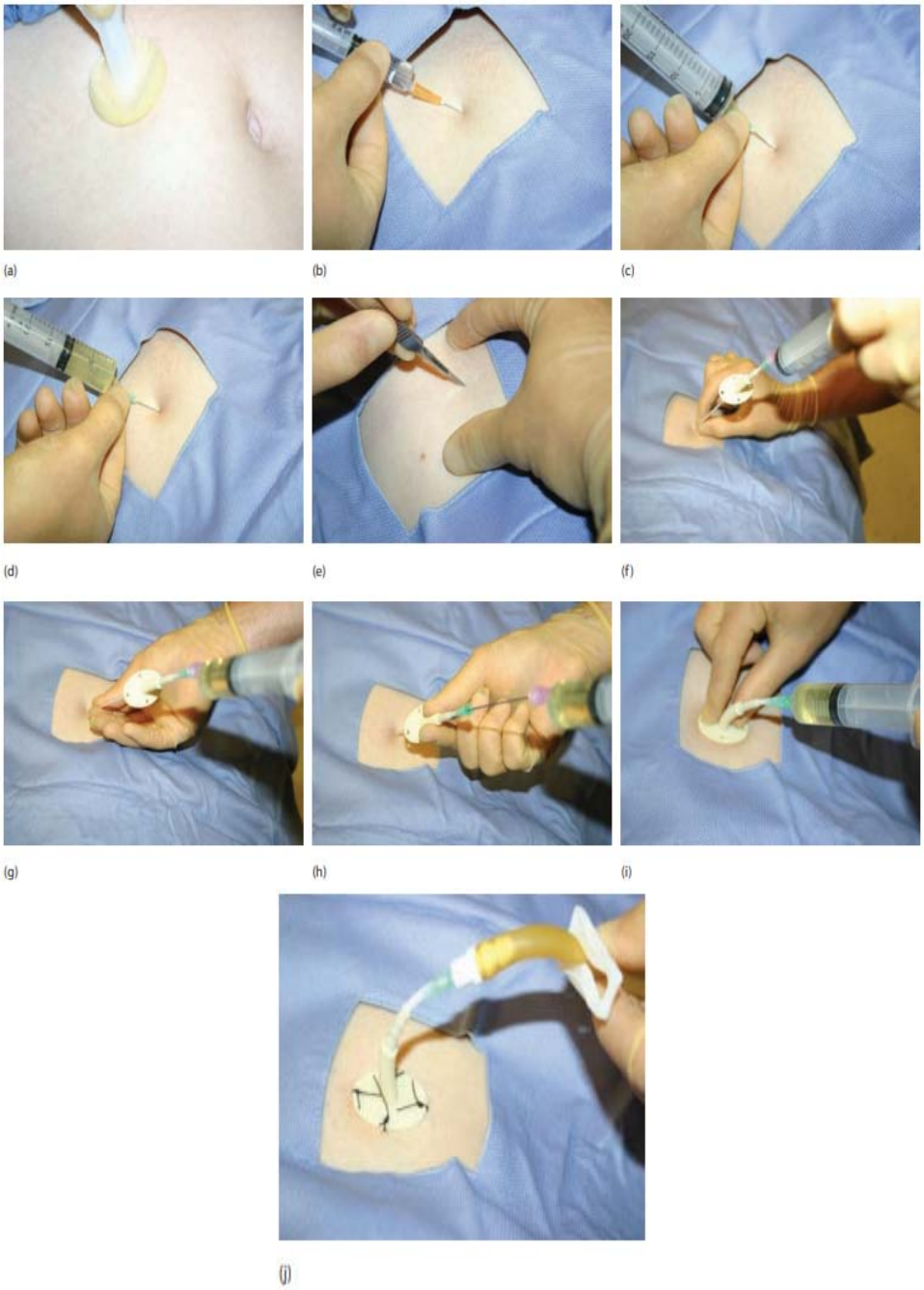


Figure 64. Step-by-step guide: insertion of ascitic drain.

(a) Cleaning the area (2% chlorhexidine in 70% alcohol). (b) Infiltration of local anesthetic. (c) Aspirating whilst advancing the green needle. (d) Successful aspiration of peritoneal fluid (the needle is not advanced any further). (e) Making a small incision. (f) Aspirating whilst advancing the catheter. (g) Flashback of peritoneal fluid. (h) Sliding the catheter over the needle. (i) Checking the position of the catheter once fully advanced (can still aspirate peritoneal fluid). (j) Catheter sutured in position.

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

5.1. Immediate complications

☐ Abdominal wall hematoma.

☐ Hemoperitoneum : This rare complication can result from trauma to a major blood vessel or intraabdominal varices at the time of insertion of the peritoneal catheter.

☐ Hollow viscus perforation. Simple precautions like careful selection of the entry site with attention to avoiding scars and obvious abdominal wall veins should minimise the risk of hollow viscus perforation or bleeding. **Alternately an ultrasound scan can be performed before the procedure to select the entry site.**

☐ Liver or splenic laceration.

☐ Catheter laceration and loss in abdominal cavity.

5.2. Late complications

☐ Post-paracentesis hypovolemia and hypotension.

The risk of renal failure is especially increased in patients with spontaneous bacterial peritonitis or pre-existing renal impairment.

☐ Hyponatraemia.

☐ Hepatorenal syndrome.

6. PEARLS AND PITFALLS:

★ Always check the clotting: a recent INR and platelet count should be assessed before starting the procedure.

- ★ Ensure the drain is well secured.
- ★ Ensure there is a clear plan documented in the notes regarding drainage volumes and replacement fluids.
- ★ Use the 'Z' technique, to avoid leakage of ascites post procedure.
- ★ This involves stretching the skin a couple of centimetres in any direction over the deep abdominal wall. The catheter is then inserted into the peritoneum. Upon releasing the skin a Z tract is created in that the entry points in the skin and the peritoneum are not directly against each other. Although there is little evidence to back up this theory, it is believed to minimise the risk of persistent leak from the puncture site

7. EVIDENCE BASED PRACTICE:

- ✦ Ultrasound guidance should be considered when available during LVP to reduce the risk of adverse events (perforation; bleeding)
- ✦ Albumin (as 20% or 25% solution) should be infused after paracentesis of >5 L is completed at a dose of 8 g albumin/L of ascites removed.
- ✦ Albumin (as 20% or 25% solution) can be considered after paracentesis of <5 L at a dose of 8 g albumin/L of ascites removed in patients with ACLF or high risk of post-paracentesis acute kidney injury.
- ✦ Renal impairment develops in up to 30% of patients with SBP and is one of the strongest predictors of mortality, alongside progressive liver dysfunction.
- ✦ In patients with SBP and an increased serum creatinine or a rising serum creatinine, infusion of 1.5 g albumin/kg within 6 hours of diagnosis, followed by 1 g/kg on day 3, is recommended.

XII. Gastric Lavage

1. INDICATIONS:

Make sure that patient have one of the following indications:

1.1. Therapeutically:

☐ Recent ingestion (<30–60 min).

☐ Life-threatening exposure and evacuation is expected to contribute to an improved outcome.

☐ Ingested agent is not absorbed with activated charcoal (e.g., pesticides, hydrocarbons, iron, alcohols, lithium, and solvents).

☐ Activated charcoal is unavailable.

☐ Ingestion exceeds adsorptive capacity of initial activated charcoal dosing (e.g., >100 mg/kg of pills).

☐ Ingestion of an agent likely to form a durable mass or bezoars after overdose.

1.2. Diagnostically:

☐ To confirm upper gastrointestinal bleeding.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

☐ Compromised airway protective reflexes (unless patient is intubated).

☐ Ingestion of corrosive substances (acids or alkalis).

☐ Hydrocarbons (unless containing highly toxic substances such as pesticides).

☐ Known esophageal strictures.

3. EQUIPMENT:

Prepare all materials: (Figure 65)

☐ Lubricant gel.

☐ Large bore orogastric tube.

☐ Terumo 60-mL catheter tip syringe.

☐ Normal saline at 38 °C.

☐ Drainage basin.

☐ Stethoscope.

Figure 65.equipment

4. PROCEDURE:

4.1. Patient preparation:

☐ Explain indication and risks to the patient and parents.

☐ Inform the patient of the intention of the procedure.

4.2. Patient position:

☐ Left lateral head-down position with a 20-degree table tilt (Trendelenburg).

4.3. Anatomy review::

☐ Tube position from the nose to the stomach.

☐ Measure the length of insertion from the mouth to the ear to the epigastrium (Figure 66); mark it on the tube with an indelible pen.

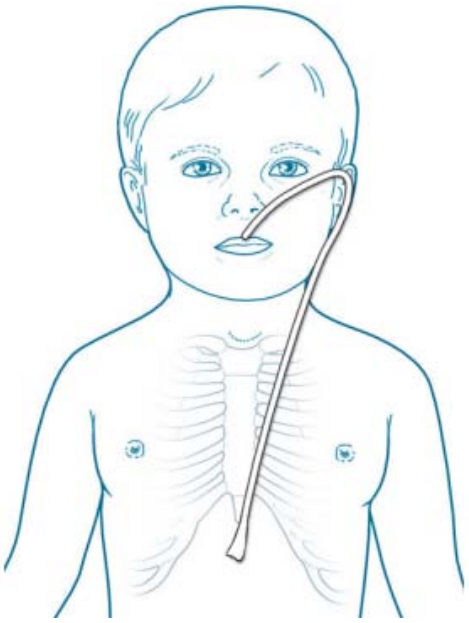


Figure 66. Measuring the length of tube for insertion.

4.4. Sterile preparation:

☐ Sanitize or wash your hands thoroughly and don gloves.

☐ Use universal precautions or isolation precautions as appropriate.

4.5. Procedure :

☐ Lubricate tube with gel.

☐ Insert the tube through the mouth midline after lubrication.

☐ Ask the patient to cooperate by swallowing while the tube is being inserted.

☐ Advance the tube to the length mark.

☐ To check position, aspirate tube with 50-mL catheter tip syringe gastric aspirate confirms positioning in stomach.

☐ Insert small amount of air (20-30 mL) via orogastric tube while listening to the epigastric area with stethoscope (Figure 67).

☐ If unsure about tube position, obtain a chest film to confirm tube position.

☐ Secure tube to the face with tape.

☐ After insertion of the orogastric tube, begin to irrigate stomach with saline.

☐ Use 10-15-mL/kg aliquots of warm (38 °C) isotonic saline.

☐ Lavage should continue until the effluent is clear.

☐ For diagnostic lavage, notice presence of fresh red blood, blood clots, or coffee ground material to confirm upper gastrointestinal bleeding.

- At this time, diagnostic lavage should be stopped.
- Confirm presence of blood with Gastroccult cards.

Figure 67. Checking the position of the tube

4.6. Monitoring :

☐ Monitor intake and output volume.

☐ Evaluate tube position.

☐ Patient symptoms.

4.7. Follow-up:

☐ Call a senior when any of the following clinical signs are present:

- Fever.
- Nausea and vomiting.
- Melanotic stool or bright red hematemesis.
- Abdominal pain.
- Abdominal distention.
- Chest pain.

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

☐ Vomiting.

☐ Esophageal tears or perforation after orogastric tube insertion.

☐ Inadvertent tracheal intubation and/or airway trauma.

☐ Aspiration pneumonitis : Instillation of lavage fluid into lungs.

☐ Cardiac dysrhythmias.

☐ Hypoxia.

☐ Laryngospasm Fluid and electrolyte disturbances.

☐ Hypothermia.

6. PEARLS AND PITFALLS:

- ★ Measure length of tube insertion by positioning the tube from the nares or mouth to the ear, and to the umbilicus. There is also a standard table, which uses height of child.
- ★ If the tube is obstructed, flush first with water; longstanding obstruction may be removed by flushing the tube with caffeinated soda
- ★ You must use a large-bore orogastric tube for maximal efficacy.
- ★ The left lateral decubitus position is recommended because the pylorus points upward in this orientation. This position theoretically helps prevent the xenobiotic from passing through the pylorus during the procedure.

7. EVIDENCE BASED PRACTICE:

- ✦ treatment of acute self-poisoning involves resuscitation and supportive care, followed by gastric emptying, administration of activated charcoal, and use of specific antidotes. Recently, however, the practice of gastric emptying has fallen out of favor in the West because physicians have recognized its complications and the lack of evidence for clinical benefit from its practice. Authoritative position statements have stated that forced emesis should not be used and that gastric lavage should be used in restricted settings.
- ✦ gastric lavage should not be performed routinely, if at all, for the treatment of poisoned patients. In the rare situation where, gastric lavage might seem appropriate, clinicians should consider treatment with activated charcoal or observation and supportive care in place of gastric lavage. New evidence since 2004 suggests the need to emphasize that gastric lavage should be performed only where the expertise exists.

XIII. Inguinal Hernia Reduction

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ A hernia is a benign process unless the contents within the hernia sac become incarcerated.

☐ Incarceration is the inability of the hernia's contents to be reduced.

☐ The risk of incarceration is highest during infancy with a 28–31% incarceration rate before 3 months of age and 15–24% by 6 months of age.

☐ Although the risk of incarceration gradually decreases with age, the severity of its consequences mandates immediate manual reduction when possible, followed by prompt operative repair.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

2.1. Absolute

☐ Reduction should not be attempted if there has been bowel compromise or when the patient appears toxic.

☐ Concern for toxicity should arise when the patient has any of the following:

- Severe tachycardia.
- Increased leukocyte count.
- Bloody stool.
- Severe pain with palpation.

- Erythema of the hernia sac.

2.2. Relative

☐ Some surgeons do not advocate manual reduction if the patient has any signs or symptoms of intestinal obstruction.

3. EQUIPMENT:

Prepare all materials:

☐ Gloves.

4. PROCEDURE:

4.1. PATIENT PREPARATION

☐ Introduce yourself to the parents and the patient.

☐ Explain the procedure.

4.2. Patient position:

☐ The child should be examined supine and undressed to observe any asymmetry or obvious masses in the scrotum or groin area.

☐ Both testicles should be palpated and identified separately from the mass.

☐ Next, the index finger should be placed over the inguinal canal in the attempt to palpate the cord structures.

☐ While perpendicular to the inguinal structures, the finger should be rubbed from side to side.

- If the cord structures appear thickened compared with the normal side, this is considered a positive silk glove sign.
- Ideally, this should feel similar to rubbing 2 pieces of silk together or running your fingers over a plastic baggy that contains a drop of water.
- If there is a good history of a hernia but the physical examination does not demonstrate a bulge, attempts to reproduce the hernia may be accomplished by increasing the intra-abdominal pressure.
- This can be achieved in infants by holding the patient with legs and arms extended, which will cause some struggle and an increase in intra-abdominal pressure.
- For older children, a Valsalva maneuver, such as blowing up a balloon or pretending to blow out candles, may be performed.
- It is important to note the extent of the hernia sac and the ease by which it reduces when the child is relaxed.

4.3. Anatomy review: (Figure 68)

- The anatomy for the inguinal region is basically that of the adult.
- However, the inguinal canal is not completely developed, making it extremely short, and the external ring is placed almost directly over the internal ring.

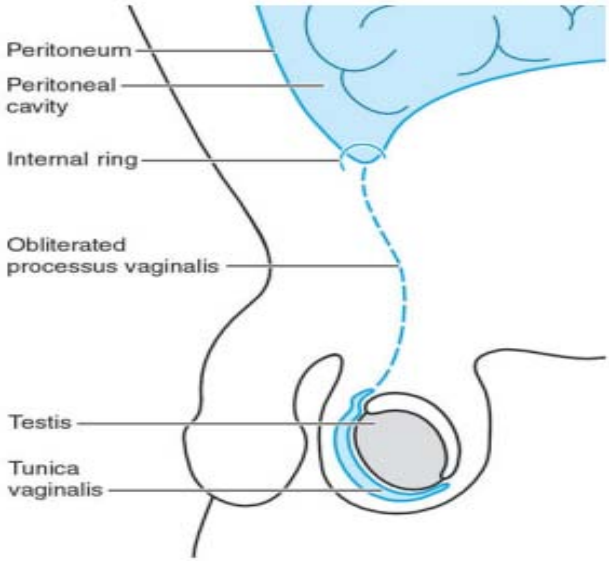


Figure 68. Anatomy for the inguinal region

4.4. Procedure :

- The patient should be placed supine and allowed to relax.
- If the hernia does not reduce with gentle pressure, consider using mild or conscious sedation.
- After allowing enough time for the sedation to take effect, attempts are made to align the hernia sac in the inguinal canal.
- When attempting manual reduction, it is important to remember that the inguinal canal is not completely developed, making it extremely short, and the external ring is placed almost directly over the internal ring.
- After alignment, firm, constant, posterior, and upward pressure is applied to the hernia sac with the contralateral hand while guiding the hernia's contents through the internal ring with the ipsilateral hand (Figure 69)
- This may take several minutes of constant pressure and several attempts at reduction.
- Placing the patient in the Trendelenburg position, as well as applying an ice pack to the groin area for several minutes prior to manipulation, may help ease the reduction.

4.5. Follow-up:

☐ A pediatric surgeon should be contacted to arrange for prompt follow-up in all patients with an incarcerated hernia.

☐ However, if a patient has signs of intestinal obstruction, toxicity, bowel strangulation, or an incarcerated hernia that cannot be reduced, a pediatric surgeon should be notified immediately and the patient prepared for operative repair.

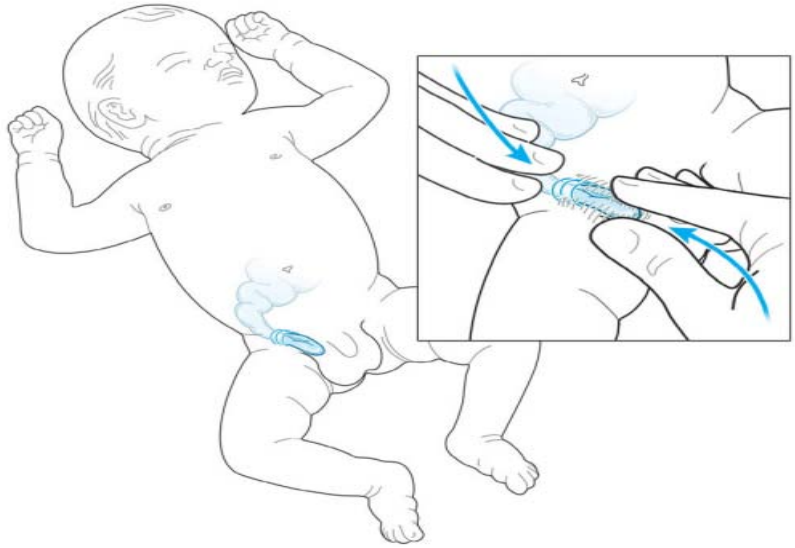


Figure 69. Reduction of inguinal hernia.

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

☐ **Bowel perforation** (with too much force)

☐ There is also the possibility that a piece of strangulated bowel may be reduced together with the hernia sac.

- If this should occur, the patient's symptoms will not resolve.
- Peritonitis may develop, requiring an emergent operation.

6. PEARLS AND PITFALLS:

- ★ Over 80% of incarcerated hernias can be initially reduced with manual reduction.
- ★ However, because most inguinal hernias do not spontaneously resolve and have a risk of recurrent incarceration or possible strangulation, definitive operative repair is necessary.
- ★ Most surgeons will attempt operative repair 48 hours after the manual reduction, allowing tissue swelling to resolve prior to the procedure.

7. EVIDENCE BASED PRACTICE:

- ✦ When reducing an incarcerated hernia, the clinician must be aware of the possibility of reduction en masse, in addition to damage to the hernia contents and necrosis. Especially, when performing an anterior hernia repair, check for a second hernia.

XIV. Rectal Prolapsus Reduction

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ full-thickness prolapse.

☐ Mucosal prolapse.

☐ A rectal examination needs to be performed to differentiate prolapse from an intussusception or rectal polyp.

Rectal prolapse occurs with stretching of the pelvic peritoneum, weakening and dilation of the rectal suspension mechanism, and a low resting anal sphincter pressure that may be secondary to protracted straining due to diarrhea and constipation.

It may also be attributed to poor posterior rectal fixation, redundant rectosigmoid colon, neurologic diseases, cystic fibrosis, infections, malnutrition, previous surgery, undiagnosed Hirschsprung disease, or imperforate anus.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

2.1. Absolute

☐ Presence of nonviable bowel or rupture of rectal mucosa.

☐ Child appears toxic (ie, with fever, tachycardia, or leukocytosis).

2.2. Relative

☐ Uncooperative patient.

☐ Questionable viability of bowel.

☐ Mucosal ulceration.

☐ Recent rectal pull-through procedure.

3. EQUIPMENT:

Prepare all materials:

☐ Gloves.

☐ Lubrication.

☐ Table sugar or salt.

☐ 6F rectal tube.

4. PROCEDURE:

4.1. Patient preparation:

☐ Introduce yourself to the patient and parents.

☐ Explain the procedure to the patient (if appropriate) and the parents.

☐ Consider use of ketamine or midazolam.

4.2. Patient position:

☐ Have the patient lie supine in the Trendelenburg position on a padded surface.

☐ Elevate the lower extremities and flex the patient's hips.

4.3. Anatomy review :

☐ On examination, a mucosal prolapse is described as a swollen rosette of mucosa with radial folds at the anal junction(Figure 70)

☐ A full-thickness prolapse (procidentia), involving all layers of the rectum, has circular folds of prolapsed mucosa(Figure 71)

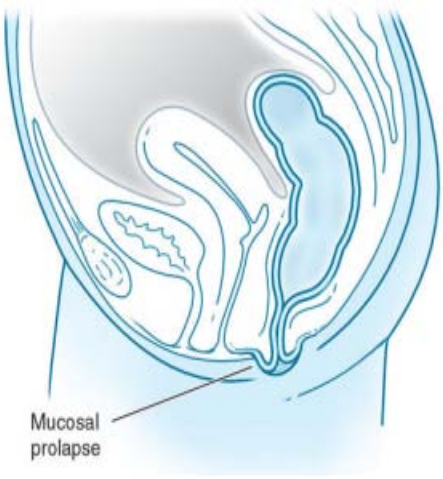


Figure 70. Mucosal prolapse.

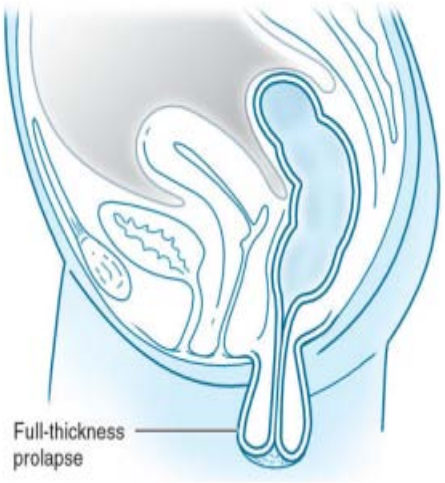


Figure 71. Full-thickness prolapse.

4.4. Procedure :

- ☐ The prolapsed rectum may be reduced with gentle and steady digital pressure.
- ☐ The herniated bowel should be grasped with a lubricated glove between fingertips with cephalad pressure applied to the tip of the prolapsed rectum until reduction is complete.
- ☐ Firm and steady pressure for several minutes may be necessary in edematous bowel to reduce swelling and allow reduction.
- ☐ A digital examination at the end of the procedure is necessary to verify that the reduction is complete.
- ☐ Taping of the buttocks has been used in the past but is not always effective.
- ☐ If manual reduction is unsuccessful, sedation and perianal field block with local anesthesia may aid in the success of reduction.
- ☐ With significant bowel edema, the application of topical sucrose or table salt applied to the prolapsed rectum may decrease edema and allow reduction of herniated bowel.
- ☐ It has also been described that use of a soft, lubricated, 6F rectal tube inserted through a segment of prolapsed bowel may help guide reduction (Figure 72)
- ☐ Reduction is accomplished by pushing the prolapsed segment over the tube.
- ☐ If all attempts fail, the prolapse needs to be surgically reduced.
- ☐ The parents should be instructed on how to reduce the prolapsed rectum should it occur at home and instructed to call or return to the emergency department if they are unable to reduce the prolapse.
- ☐ Surgical consultation should be obtained for the reduction under the following circumstances:
  - Presence of mucosal ulceration.
  - Failure of reduction.
  - Severe pain and discomfort.

- Patient with history of pull-through procedure for imperforate anus and Hirschsprung disease.

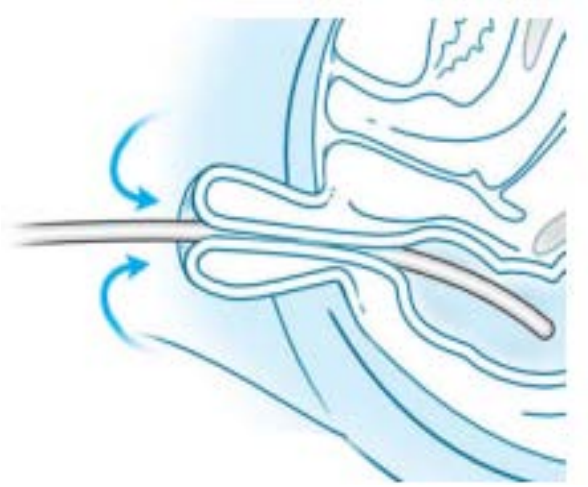


Figure 72 . Reduction of prolapse with rectal tube.

4.5. Monitoring:

☐ Monitor patient vital signs if using sedation.

4.6. FOLLOW-UP :

☐ Instruct parents to notify you if prolapse recurs and is unable to be reduced.

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

☐ Recurrence.

☐ Mucosal ulceration.

☐ Necrosis of bowel wall.

☐ Bleeding.

☐ Infection from inadvertent injury to the rectum during reduction.

6. PEARLS AND PITFALLS:

- ★ Treatment of rectal prolapse involves treating the underlying cause of straining during defecation. Therapy includes dietary modifications and identifying the cause (eg, intractable diarrhea or constipation).
- ★ If recurrent prolapse persists after several months of appropriate and adequate medical therapy, surgical intervention in the form of a cerclage, sclerotherapy, cauterization therapy, or trans-anal or perineal rectopexy may be necessary.
- ★ Rectal prolapse should be promptly reduced to prevent a sustained prolapse that allows edema to form and potential subsequent venous congestion and thrombosis to develop, which may lead to ulceration of the rectal mucosa with bowel ischemia and infarction.
- ★ Diagnostic studies are often not necessary, but a proctoscopy, colonoscopy, or barium enema may be indicated when the patient has a history of rectal bleeding.
- ★ Children need to be tested for parasites and cystic fibrosis as well as other causes of anal straining (including neuromuscular problems, proctitis, and inflammatory bowel disease).

7. EVIDENCE BASED PRACTICE:

- ✦ A careful history and physical examination should be performed before considering any operative intervention. If a patient's history suggests the diagnosis but no prolapse is detected on physical examination, the patient can be asked to reproduce the prolapse by straining while on a toilet with or without the use of an enema or a rectal balloon.
- ✦ Full inspection of the perineum and complete anorectal examination are equally important. Usually, these will reveal a patulous anus with diminished sphincter tone. In 10% to 15% of cases, proctoscopy will show an anterior solitary rectal ulcer.

PART IV : MONITORING

I. Straight Urethral Catheterization

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Obtaining a sterile urine specimen.

☐ Preventing or relieving urinary retention.

☐ Close monitoring of urine output for fluid balance with an indwelling urinary catheter.

☐ Urgent cystourethrography.

☐ Child with contusion or burns to the perineum and at risk for meatal swelling and obstruction to urine outflow.

☐ Temporary measure to relieve lower urinary tract obstruction.

☐ Neurogenic bladder.

☐ Anesthesia-induced and/or surgery-induced urinary retention has occurred.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

2.1. Absolute :

Potential urethral injury from trauma:

☐ Pelvic fractures

☐ Known trauma to the urethra

☐ Blood at the meatus

2.2. Relative:

☐ Recent genitourinary surgery (consult with a urologist before placing a catheter).

☐ Unable to identify urethra (e.g., labial adhesion).

☐ History of urethral strictures.

☐ Neutropenia.

3. EQUIPMENT:

Prepare all materials:

☐ Catheter.

- Feeding tube (4–5F).
- Urinary catheters (6F and up).

☐ Sterile collection cup.

☐ 10% povidone-iodine (or equivalent).

☐ Castile soap.

☐ Sterile gloves, drapes, and gauze.

☐ Lidocaine (2%) anesthetic jelly or water-based lubricant.

☐ Catheter sizing estimates:

- Infant: 5F feeding tube or 6F catheter
- Toddler: 6–8F catheter
- Older child: 8F catheter
- Adolescent: 8–10F catheters

4. PROCEDURE:

4.1. Patient preparation:

☐ Introduce yourself to the parents and the patient.

☐ Explain the procedure

☐ Keep the patient covered until ready to begin.

☐ Good lighting is helpful.

☐ Remove any powder, ointments, or medicated creams the child might have on the perineum.

4.2. Patient position:

☐ The child is placed supine with an absorbent pad under the buttocks.

- The female patient is placed in the frog-leg position.
- The male patient is placed with legs extended.

4.3. Anatomy review:

☐ In girls, the urethra is a short tube that opens just rostral to the vaginal introitus .

(It is often obscured in younger girls by vaginal tissue leading to confusion and erroneous passage of the catheter into the vagina.) (Figure 73-74)

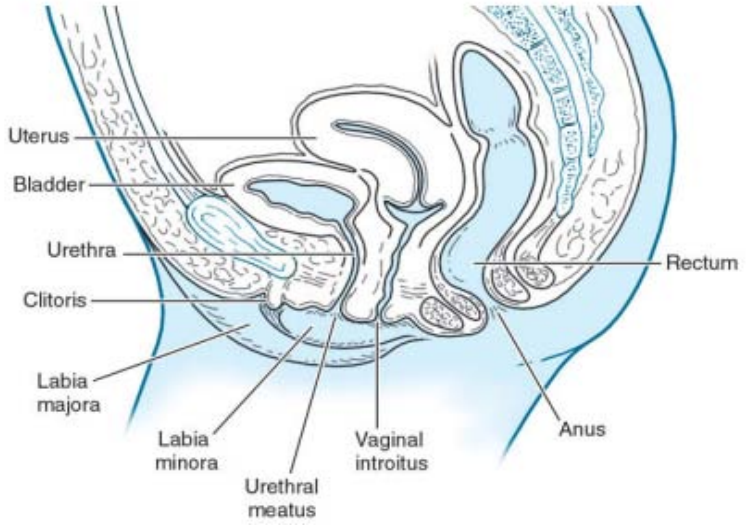


Figure 73. Female genitourinary system

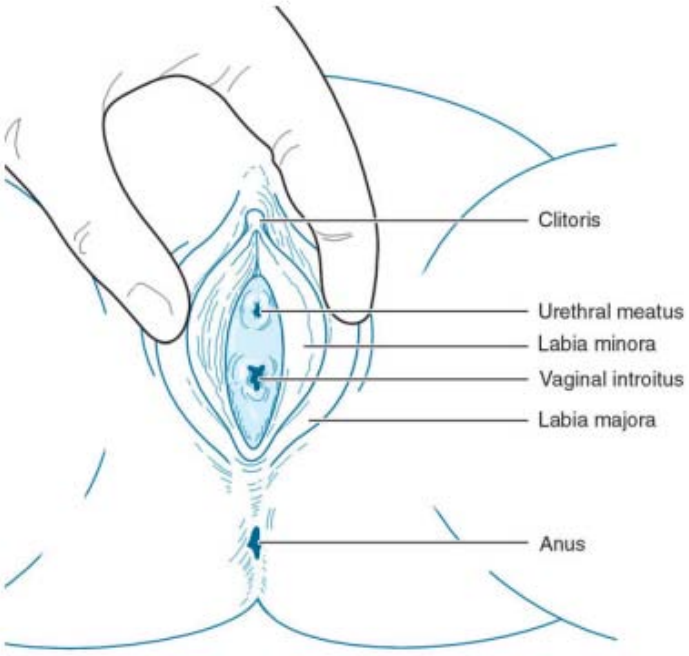


Figure 74 . Female perineum.

In boys, the urethra begins at the meatus and passes down through the penile shaft and into the urinary bladder after passing through the prostate gland (Figure 75) .

(The prostate and the urethral valves cause some resistance to catheter passage)

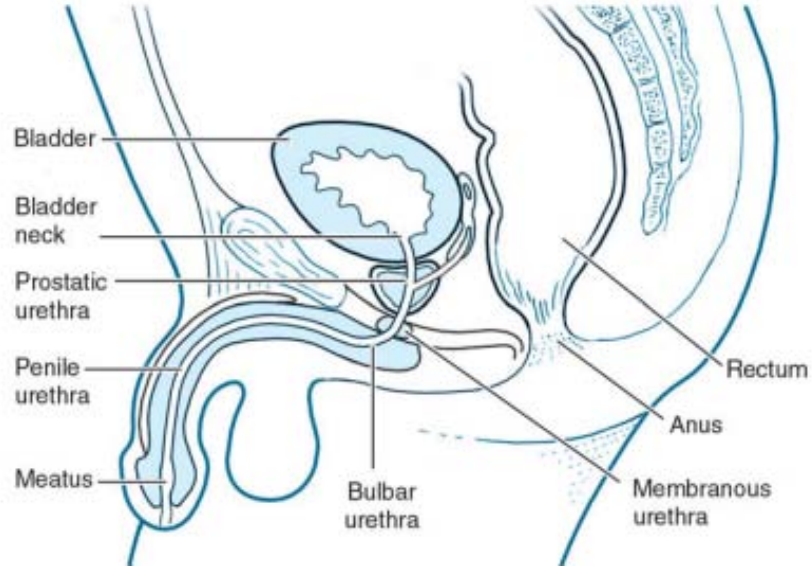


Figure 75. Male genitourinary system.

4.4. Sterile preparation:

☐ Sanitize or wash your hands thoroughly and don gloves.

☐ Use universal precautions or isolation precautions as appropriate.

☐ Cleanse the site with antiseptic solution.

☐ Drape surrounding area with sterile towels.

4.5. Procedure :

a. Male:

a.1. CIRCUMCISED BOY

☐ The glans and the distal phallus are cleaned with a 10% povidone-iodine solution.

☐ The penis is held gently retracted away from the body in the nondominant hand, with the penis held at about a 90- degree angle to the body.

☐ The catheter is lubricated with a water-based jelly with or without lidocaine and passed directly through the meatus downward (not angled rostrally).

☐ Some resistance may be felt at the prostate level, which can be overcome by using steady pressure.

☐ Do not push and pull the catheter to get it to pass.

☐ Once urine is visible in the catheter or collection cup, stop advancing the catheter.

☐ Remove the catheter gently after the sample is obtained.

a.2. UNCIRCUMCISED BOYS (Figure 76)

The procedure is the same as in circumcised boys, except that

☐ the foreskin is retracted just to the point that the meatus is visible. This area is then prepared as well.

☐ The catheter is inserted in the same fashion as above.

☐ The foreskin is then returned to the normal position.

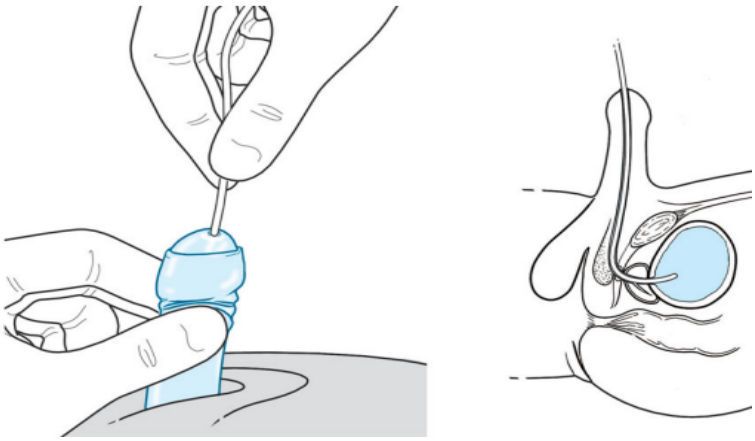


Figure 76. Foreskin reduction and catheter insertion

b. Female

☐ The periurethral area and labia minora and majora are prepared with a 10% povidone-iodine solution.

☐ The catheter is lubricated with a water-based jelly with or without lidocaine and is passed into the urethra and directed straight downward toward the bed or very slightly rostrally.

- In smaller children, vaginal tissue can obscure the urethral opening; this tissue can be moved with a cotton swab.
- The first portion of the urine may be discarded; this is analogous to a mid-stream urine collection. This is only possible if the collection system is not a kit with the collection vial attached to the catheter.
- Applying pressure of the suprapubic area (Credé maneuver) may force out additional urine.
- Remember to remove residual povidone-iodine from the skin.

4.6. Monitoring:

- Urine obtained via catheter may be evaluated in a number of ways:
  - **Urine dipstick tests (bedside)**: Be aware that reading the strips beyond the recommended times on the container may lead to false-positive results.
  - **Urinalysis (formal laboratory testing)**:
    - Culture is commonly used to detect bacteria.
    - Urine can also be tested for virus (eg, cytomegalovirus) and fungi.
    - Polymerase chain reaction is done to test for Chlamydia trachomatis and Neisseria gonorrhoeae.
    - Other (eg, urine electrolytes, organic acids)

4.7. Follow-up:

- Dysuria and hematuria complications are transient.
- Infants and toddlers who have dysuria and refuse to void can be placed in a warm bath, which promotes voiding.
- Ongoing symptoms would be unusual and should prompt a new visit and evaluation, with consideration of other causes of the symptoms (eg, inadequate treatment of an infection).

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

☐ Pain.

☐ Hematuria.

☐ Urethral or bladder injury.

☐ Infection if sterile field not maintained.

☐ Paraphimosis owing to failure to restore a retracted foreskin to its normal position.

☐ Dysuria with or without urinary retention.

☐ Paraphimosis, resulting from failure to reduce the foreskin after the procedure.

☐ Catheter knot (in infants, caused by advancing small catheters too far, allowing catheter to knot; may require cystoscopy or surgical removal).

6. PEARLS AND PITFALLS:

★ Because spontaneous voiding may occur during skin preparation or as the procedure is initiated, have a sterile container available to collect the urine.

★ When labial adhesions are present, holding the child in a frog-leg position and rocking the hips back and forth may line up the opening in the adhered labia with the urethral opening.

★ Cotton gauze pads are useful to hold the penis or to apply traction to the labia once the skin has been prepared and is slippery.

★ Remember that many of the newer, non-latex gloves fit poorly, making holding a slippery skin surface nearly impossible; wear tightly fitting non-latex gloves when possible.

- ★ The urethral meatus in an infant female is usually tucked just above the redundant hymen (as opposed to the more anteriorly located meatus in the adult woman) and often looks like a dimple or small blind pouch.
- ★ Using viscous lidocaine in lieu of, or blended with, lubricant anesthetizes the meatus and urethra as the catheter passes.
- ★ In the uncircumcised male, be certain to return the foreskin over the glans to avoid paraphimoses.
- ★ If catheterizing a child in search of infection, send a urine culture regardless of the urinalysis results because the younger infants can have false-negative urinalysis and still have positive cultures.

7. EVIDENCE BASED PRACTICE:

- ✦ Longer duration of urinary catheter drainage, positive contact precautions status and a history of catheterization appear to be associated with a higher risk of catheter associated urinary tract infection in hospitalized pediatric patients. Physicians should attempt to decrease the duration of catheterization, especially in patients who meet these criteria, to minimize the risk of catheter associated urinary tract infection.
- ✦ Catheterization is an aseptic procedure. Ensure that health care workers are trained and competent to carry out urethral catheterization.
- ✦ Clean the urethral meatus with sterile normal saline prior to the insertion of the catheter.
- ✦ Use an appropriate lubricant from a sterile single use container to minimize urethral trauma and infection.

II. Nasogastric Tube Insertion

1. INDICATIONS:

Make sure that patient have one of the following indications:

- ☐ Monitor and evaluate upper gastrointestinal bleeding.
- ☐ Prevents aspiration and gastric dilation in intubated patients.
- ☐ Decompression of the upper gastrointestinal tract (e.g., obstruction or perforation).
- ☐ Gastric lavage.
- ☐ Enteral feeding.
- ☐ Prolonged ileus.
- ☐ Administration of medication or oral contrast in a patient unable to swallow.
- ☐ Detection of transdiaphragmatic stomach herniation.
- ☐ Decompression of stomach.
- ☐ Reduce incidence and risk of vomiting.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

2.1. Absolute:

- ☐ Facial trauma with possible cribriform plate fracture.

2.2. Relative:

- ☐ Severe coagulopathy (consider orogastric tube placement).

☐ Esophageal strictures and alkali ingestions (possible esophageal perforation).

☐ Recent intestinal tract surgery (< 1 month ago).

3. EQUIPMENT:

Prepare all materials:

☐ Lubricant gel.

☐ Nasogastric (NG) tube.

- Larger diameter, polyethylene NG tube for suction and decompression.
- Smaller diameter, silicone NG tube for enteral feeding.

☐ Water or normal saline at room temperature.

☐ Drainage bag or feeding pump.

☐ 60-mL catheter tip syringe.

☐ Stethoscope.

4. PROCEDURE:

4.1. Patient preparation:

☐ Explain indication and risks to the patient and parents.

☐ Inform the patient of the intention of the procedure.

4.2. Patient position:

☐ Patient should be sitting.

☐ Measure the length of insertion from the nares to the ear and to the epigastrium (Figure 77).

☐ mark it on the tube with an indelible pen.

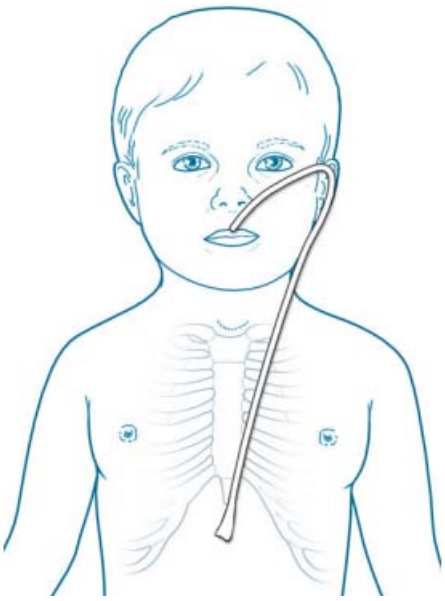


Figure 77. Measuring the length of tube for insertion.

4.3. Anatomy review:

☐ Tube position from the nose to the stomach

4.4. Sterile preparation:

☐ Sanitize or wash your hands thoroughly and don gloves.

☐ Use universal precautions or isolation precautions as appropriate.

4.5. Procedure :

☐ Lubricate tube with gel.

☐ Insert the tube through the nose (Figure 78)

☐ Ask the patient to cooperate by swallowing while the tube is being inserted.

☐ Advance the tube to the length mark.

☐ To check position, aspirate tube with 50-mL syringe ;gastric aspirate (pH = 1-3) confirms positioning in stomach.

☐ Insert small amount of air (20–30 mL) via NG tube while listening to epigastric area of stomach with stethoscope (Figure 79) .

☐ If unsure about tube placement, verify tube position by obtaining a chest film before starting enteral feeding or drug treatment.

☐ Secure tube to the face with tape.

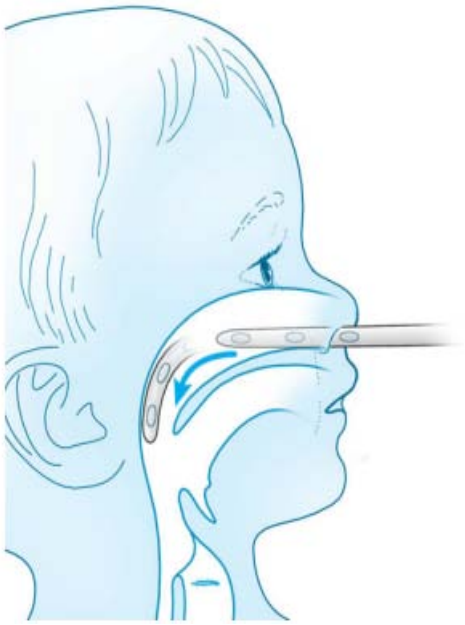


Figure 78. Inserting the nasogastric tube.

Figure 79. Checking the position of the tube.

4.6. Monitoring:

☐ Monitor intake and output volume.

☐ Evaluate tube position.

☐ Patient symptoms.

4.7. Follow-up:

☐ Call a senior when any of the following clinical signs are present:

- Fever.

- Nausea and vomiting.
- Melanotic stool or bright red hematemesis.
- Persistent abdominal pain.
- Abdominal distention.
- Chest pain.

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

☐ Inability to pass the tube.

☐ Bleeding.

☐ Curling of the NG tube in the patient's mouth.

☐ Pulmonary placement.

☐ Nasal necrosis.

☐ Aspiration.

☐ Infection.

☐ Sinusitis (caused by long-term NG tube feeding).

☐ Perforation.

☐ Mucosal tears.

6. PEARLS AND PITFALLS:

★ Measure length of tube insertion by positioning the tube from the nares or mouth to the ear, then to the umbilicus.

★ There is also a standard table, which uses height of child.

★ If the tube is obstructed, flush first with water; longstanding obstruction may be removed by flushing the tube with caffeinated soda.

★ NG tube placement was ranked #1 as the most painful procedure in the emergency department so it is imperative to maintain patient's comfort by using anesthetics and even maybe intravenous anxiolytics.

★ Estimate the proper length of the tube before passage to avoid placing the tip of the tube in the esophagus or excessively coiling it in the stomach.

7. EVIDENCE BASED PRACTICE:

✦ Nasogastric tubes (NGTs) pose several risks, including mistaken placement in the lung, esophagus, or small bowel. And even experienced clinicians may have difficulty recognizing pulmonary intubation when placing a temporary NGT.

✦ Complications from misplaced NGTs can range from pneumothorax, requiring chest tube placement, to profound chemical pneumonitis and respiratory distress syndrome.

✦ To confirm nasogastric tube (NGT) placement, both the New Opportunities for Verification of Enteral Tube Location (NOVEL) project and the Actionable Patient Safety Solutions (APSS) recommend a multimodal verification system that includes:

- **pH.** The existing British National Patient Safety Agency safety guideline recommends testing the pH of NGT aspirates. Use of the NGT is considered safe if pH is ≤ 5.5. If you can't obtain gastric aspirate or confirm placement after testing gastric aspirate, request an order for a radiograph that follows the path of the tube from the lungs to the stomach.
- **NEMU**. Measure nose–ear–mid–umbilicus (NEMU) every time you place an NGT—from the tip of the patient's nose to the earlobe and from the earlobe to the point midway between the xiphoid process and umbilicus.

- **Critical-thinking skills**. If patients deteriorate during NGT placement or soon after, remove the tube.
- **X-ray verification**. This remains the gold standard but raises concern with repeated radiation exposure, particularly in neonates. When x-rays are done, they must be read by someone with validated competency in NGT placement verification. Accurate verification requires confirming that the x-ray is the most recent one for the patient, then checking the path of the tube at key anatomic points, rather than solely assessing the tip.

III. Electrocardiography

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Screening for congenital or acquired heart disease.

☐ Follow-up of established cardiac disorders:

- Progression of chamber enlargement.
- Hypertrophy.
- Conduction disorders.
- Ischemic changes.

☐ Evaluation of apparent life-threatening event, syncope, chest pain, or new-onset seizure.

☐ Arrhythmia detection and evaluation.

☐ Evaluation of conduction disorder.

☐ Monitoring cardiac effects of medication.

☐ Evaluation for appropriate pacemaker or defibrillator function.

☐ Evaluation of cardiac effects of electrolyte or metabolic abnormalities.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

☐ Disorders that limit access to skin of chest wall, such as thoracic wound.

☐ Extensive bandages over chest.

☐ Third-degree skin burns.

3. EQUIPMENT:

Prepare all materials:

☐ ECG machine, leads.

☐ Electrode stickers; pediatric patches are best.

☐ Alcohol pads to clean skin.

4. PROCEDURE:

4.1. PATIENT PREPARATION

☐ Clean the area with alcohol swab.

☐ Skin must be clean and dry.

☐ Leads cannot be placed over bandages: either reposition bandage or omit lead.

4.2. Patient position:

☐ Supine position is essential.

4.3. Anatomy review: (Figure 80)

Lead placement is important and must be consistent; Inappropriate placement of limb or precordial leads results in interpretation errors, including hypertrophy or infarct patterns.

☐ RA: Right forearm, distal to insertion of deltoid muscle.

☐ LA: Left forearm, distal to insertion of deltoid muscle.

☐ RL: Right leg.

☐ LL: Left leg.

☐ V1: Fourth intercostal space, right sternal edge.

☐ V2: Fourth intercostal space, left sternal edge.

☐ V3: Halfway between V2 and V4.

☐ V4: Fifth intercostal space, midclavicular line

☐ V5: Same level as V4 on anterior axillary line.

☐ V6: Same level as V4 on midaxillary line.

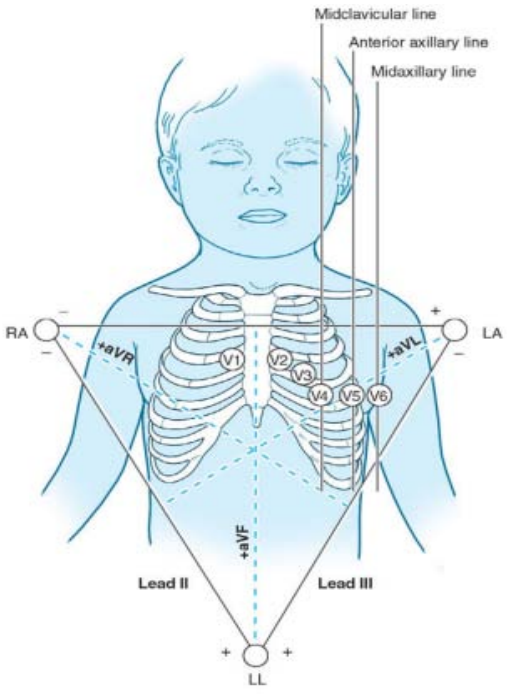


Figure 80. Lead positioning.

4.4. Procedure :

☐ Place electrode stickers appropriately.

☐ Attach the leads, with careful attention to limb lead placement.

☐ Enter the patient data into the ECG machine. ECGs without name, age, and date cannot be officially interpreted.

☐ Select gain and paper speed (standard speed 25 mm per second and standard gain 10 mm per mV).

☐ Use standard settings initially.

☐ Modify gain as needed.

☐ Select the type of tracing desired.

- 12-lead ECG.
- 12-lead rhythm strip.
- 3-lead rhythm strip.

☐ Ensure the patient is still and the tracing is stable on the monitor of the ECG machine.

☐ Once there is no artifact, record.

☐ Inspect the tracing before disconnecting the leads.

☐ If no additional tracings are needed, disconnect the leads and remove the electrode stickers.

4.5. Interpretation:

☐ To avoid missing important information, interpret ECGs consistently and systematically.

☐ Knowledge of the patient's age is essential because standards are age-dependent.

☐ ECGs in children should be interpreted by clinicians specifically trained in pediatrics because of the significant age-related differences from adult ECGs.

☐ Evaluate rate, rhythm, axis, intervals, hypertrophy, ST segments

4.6. Follow-up:

☐ Depends on the reason the test was obtained, the patients' clinical status, and the ECG findings.

☐ Patients with abnormal ECGs should be referred to a pediatric cardiologist; the timing of referral depends on both the ECG finding and the clinical context.

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

☐ Rare.

☐ Incorrect set-up or equipment malfunction may result in an ECG that is misinterpreted, resulting in additional (unnecessary) testing.

6. PEARLS AND PITFALLS:

★ Improper lead positioning is a major source of abnormal tracings.
  - o Results in repeat ECGs or unnecessary further testing.
  - o As many as 15–20% of pediatric ECGs performed in emergency departments or intensive care units show improper lead placement.

★ The most common recording error is limb lead reversal.

★ Automated ECG interpretations that read "left atrial rhythm" usually reflect limb lead reversal.

★ Negative P, QRS, and T waves in leads I and aVL are another indicator of lead reversal.

★ Make sure the initial recording is at the appropriate speed: 25 mm per second, and appropriate gain: 10 mm per mV.

★ Eliminating as much patient movement as possible is essential; blowing bubbles over young children often allows time for recording without movement

7. EVIDENCE BASED PRACTICE:

✦ The findings showed that EP (Electrode Placement) accuracy varies from 16–90%, and standards and guidelines on EP are not being adhered to. Poor EP can mean under- or overdiagnosis, which can increase morbidity and mortality, or mean that patients receive unnecessary treatment or hospitalization.

✦ Mandatory, appropriate training and assessment, including before an operator is allowed to acquire a STLER (standard 12-lead electrocardiograph recording) and refresher training for ECG operators, are recommended.

PART V : GENERAL APPLICATIONS

I. Intramuscular Injection

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Administration of medications or immunizations.

☐ Immunizations commonly administered intramuscularly

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

☐ bleeding disorder or thrombocytopenia.

☐ Erythema

☐ swelling at the injection site.

3. EQUIPMENT:

Prepare all materials:

☐ Alcohol wipe.

☐ Gauze pad.

☐ Syringe with medication or immunization.

☐ Appropriate size needle.

☐ Bandage.

4. PROCEDURE:

4.1. Patient preparation:

☐ Introduce yourself to the parents and the patient.

☐ Explain the procedure.

☐ Choose the most appropriate site.

4.2. Patient position:

☐ Position the child and assess the injection site.

☐ It may be necessary to enlist the help of a second person to hold the child.

4.3. Anatomy review: (Figure 81)

☐ **In infants and toddlers**, it is recommended that intramuscular injections be given in the middle one-third of the lateral aspect of the vastus lateralis muscle (anterolateral upper thigh).

☐ **In older children**, intramuscular injections are given in the deltoid muscle.

☐ **children over age 2**: The ventrogluteal site can be used ; This site is used less commonly because of the risk of nerve damage.

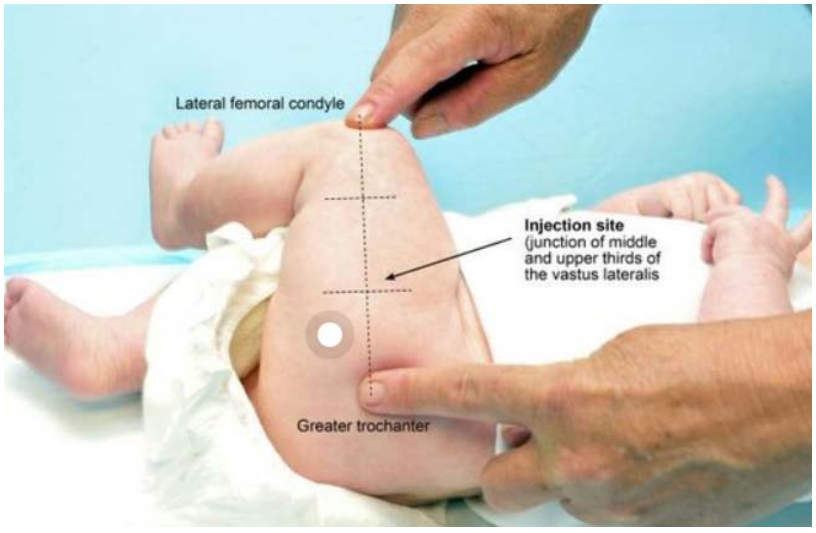


Figure 81. Intramuscular injection site.

4.4. Sterile preparation:

☐ Sanitize or wash your hands thoroughly and don gloves.

☐ Use universal precautions or isolation precautions as appropriate.

☐ Cleanse the site with antiseptic solution.

4.5. Procedure :

☐ Pinch muscle and quickly insert 1-inch 23- or 25-gauge needle at a 90-degree angle (Figure 82)

☐ Larger adolescents and adults may require the use of a 1.5-inch needle.

☐ Aspirate to check for possible blood vessel entry.

- Aspirate for at least 5 seconds.
- This ensures that the needle is not in a small blood vessel.
- If blood is obtained, withdraw the needle, discard the medication and syringe, and start again.

☐ If blood is not obtained, slowly inject the medication.

☐ Do not recap the needle.

☐ Dispose of the needle in the proper container.

☐ Apply pressure to the injection site with a gauze pad.

☐ Apply bandage and comfort the child.

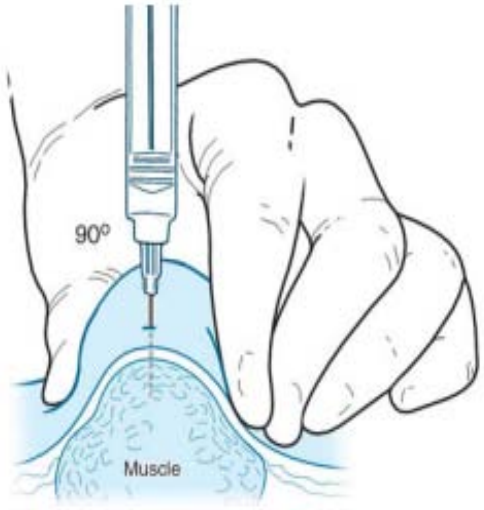


Figure 82. Intramuscular injection.

4.6. Monitoring:

☐ Watch the patient for any reaction to the medication.

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

☐ Bleeding.

☐ Pain.

☐ Swelling.

☐ infection at the injection site.

6. PEARLS AND PITFALLS:

★ Know the drug, its formulation, indication, route, volume and side effects.

★ Two-needle technique – change needles after preparation and before administration (so they are clean, sharp and dry).

- ★ Select needle size based on patient gender, weight and body mass index, condition, site, drug and volume.
- ★ Assess the skin and the patient's condition.
- ★ Use the Z-track method: smooth/stretch the skin.
- ★ Rotate sites for frequent injections and document to this effect.
- ★ Inject at 90°, dart-like, to the hub of the needle and inject at 1mL per second.
- ★ Wait at least ten seconds before withdrawing the needle.
- ★ Do not massage or rub the site afterwards unless otherwise indicated.
- ★ Reassess for therapeutic effect and any side effects.
- ★ Document accurately and appropriately.

7. EVIDENCE BASED PRACTICE:

- ✦ The intramuscular injection technique requires skill, knowledge and a good understanding of the implications for administering the injection.
- ✦ Best practices must include appropriate sites for injection, standardized injection techniques, and individualized needle length based on patient weights and gender.
- ✦ Furthermore, manufacturer recommendations and procedures in educational texts must be based on sound evidence as these guide practice.
- ✦ In summary, while evidence supporting the process of administration is extensive, techniques and procedures vary throughout the literature and in practice, potentially hindering IM injections efficacy.
- ✦ To assure medication efficacy, current evidence-based practice from the literature supports critical assessments of patient weight, BMI, gender and injection site, needle length, volume of medication before administering IM injections.

II. Sub-cutaneous Injection:

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Administration of medications or immunizations.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

☐ Erythema

☐ swelling at the injection site.

3. EQUIPMENT:

Prepare all materials:

☐ Alcohol wipe.

☐ Gauze pad.

☐ Syringe with medication or immunization.

☐ Appropriate size needle.

☐ Bandage.

4. PROCEDURE:

4.1. PATIENT PREPARATION

☐ Introduce yourself to the parents and the patient.

☐ Explain the procedure.

☐ Choose the most appropriate site.

4.2. Patient position:

☐ Position the child and assess the injection site.

☐ It may be necessary to enlist the help of a second person to hold the child.

4.3. Anatomy review: (Figure 83)

☐ In infants and toddlers, it is recommended that subcutaneous injections be given in the outer aspect of the upper thigh.

☐ For older children, the upper outer arm is the preferred spot.

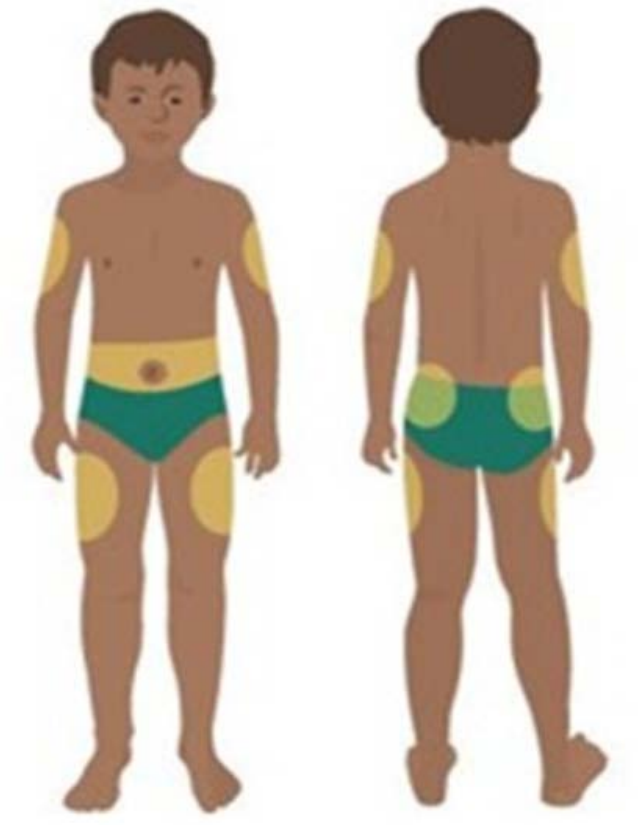


Figure 83. sub-cutaneous injection sites.

4.4. Sterile preparation:

☐ Sanitize or wash your hands thoroughly and don gloves.

☐ Use universal precautions or isolation precautions as appropriate.

☐ Cleanse the site with antiseptic solution.

4.5. Procedure :

☐ Gently pinch the skin at the injection site.

☐ Insert a 25- or 27-gauge 5 /8-inch needle into the subcutaneous layer.

☐ The needle should be directed at a 45-degree angle (Figure 84).

☐ Aspirate to check for entry into a blood vessel.

☐ If blood is obtained, withdraw the needle, discard the medication and syringe, and start again.

☐ If blood is not obtained, slowly inject the medication.

☐ Do not recap the needle.

☐ Dispose of the needle in the proper container.

☐ Apply pressure to the injection site with a gauze pad.

☐ Apply bandage and comfort the child.

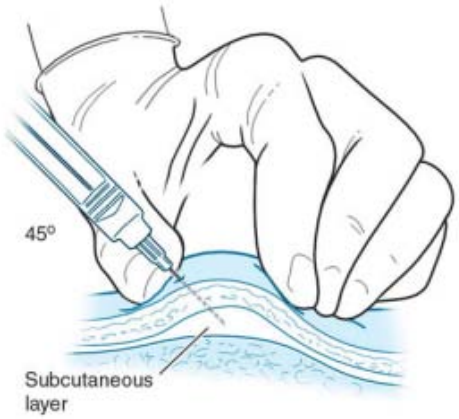


Figure 84. Subcutaneous injection.

4.6. Monitoring:

☐ Watch the patient for any reaction to the medication.

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

☐ Pain,

☐ swelling,

☐ Bleeding

☐ infection at the injection site.

☐ Lipo-hypertrophy or lipoatrophy may develop after repeated injections.

6. PEARLS AND PITFALLS:

- ★ Check the drug, formulation, indication, route, volume and side effects.
- ★ Assess the skin and the patient's condition.
- ★ Consider rotation of injection sites and assess those that are repeatedly used for injection.
- ★ Consider equipment and familiarity with insulin pens and pre-filled heparin syringes, and follow the manufacturer's guidelines.
- ★ Wait at least ten seconds before withdrawing the needle: the 'site and time' rule.
- ★ Do not massage or rub the site afterwards unless otherwise indicated.
- ★ Reassess for therapeutic effect and/or any side effects.

7. EVIDENCE BASED PRACTICE:

- ✦ The subcutaneous injection technique requires skill, knowledge and a good understanding of the indications for the injection.

III. Suturing

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Wounds created by sharp metal/knife/glass.

☐ Wounds overlying cosmetically unimportant areas (e.g. scalp laceration).

☐ Healthy wound edges (good blood supply).

☐ Base of the wound is visible.

☐ No neurovascular deficit.

☐ No or minimal tissue loss.

2. CONTRAINDICATIONS:

Make sure that patient don't have any one of the following:

☐ Associated tendinous or bony injury.

☐ Presence of foreign material.

☐ Infected/dirty wound.

☐ Inability to adequately clean/explore wound with facilities/local anesthetic alone.

☐ Irregular edges which are difficult to approximate accurately.

☐ Crush injuries.

☐ Wounds on the trunk and torso that are greater than 12 hours old.

☐ Wounds on the face that are greater than 24 hours old.

3. EQUIPMENT:

Prepare all materials:

- ☐ Sterile gauze.
- ☐ Sterile towels, drapes, and gloves.
- ☐ Detergent cleanser or povidone-iodine solution.
- ☐ Saline.
- ☐ Sterile basin.
- ☐ Suture material (Table VIII).
- ☐ 30-60-mL syringe for irrigation .
- ☐ Syringe with fine needle (25-30 gauge) for local analgesia infusion.
- ☐ Suture scissors.
- ☐ Needle holders.
- ☐ Forceps with teeth.
- ☐ Local anesthetic.

Table VIII. Surface wound closure guidelines.

Site	Suture Material	Suture Removal
Face	6-0 absorbing or nonab-sorbing	5 days
Scalp	5-0 nonabsorbing	7–10 days
Digits	5-0 nonabsorbing	7–10 days
Palms/ soles	2-0, 3-0, 4-0 nonabsorbing	7–10 days
Torso	4-0, 5-0 nonabsorbing	7–10 days
Joint	3-0, 4-0, 5-0 nonabsorbing	10–14 days

4. PROCEDURE:

4.1. Patient Preparation :

☐ Introduce yourself to the parents and the patient.

☐ Explain the procedure.

4.2. Patient position:

☐ The patient should be lying flat or sitting.

4.3. Anatomy review:

☐ See the diagram of a skin laceration(Figure 85).

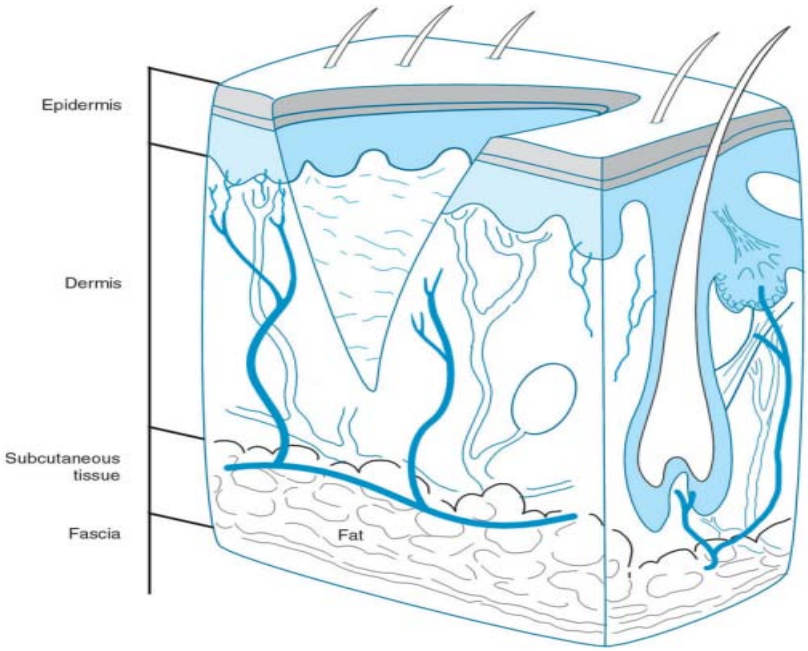


Figure 85. Diagram of skin laceration.

4.4. Sterile preparation :

☐ Sanitize or wash your hands thoroughly and don gloves.

☐ Use universal precautions or isolation precautions as appropriate.

4.5. Procedure:

☐ Position the patient comfortably, with the wound on a secure surface if possible.

☐ Ensure the field is adequately lit, adopt universal precautions.

☐ Document laceration length and depth.

☐ Lidocaine is the most commonly used anesthetic for simple wound repair.

☐ When administering the anesthetic, proceed in a slow, steady manner because rapid delivery can result in a burning sensation.

☐ The maximum dose of plain lidocaine is 5 mg/kg. When combined with epinephrine, it is 7 mg/kg.

☐ Clean the skin with detergent or povidone-iodine solution.

☐ Inspect visually for tendon, neurovascular, or deep tissue injury, or the presence of a foreign body.

☐ A finger may be placed inside the wound to explore the depth of injury.

☐ Copious irrigation under pressure reduces infection risk.

☐ 500-1000 mL (or more) may be needed for large or contaminated wounds.

☐ Irrigation should be continued until no contaminants are seen.

☐ Removal of contaminated, nonviable, or devitalized tissue is done using either a scissors or scalpel.

☐ Align appropriate tissue layers to prevent unnecessary scarring.

a. Skin Sutures : (Figure 86)

☐ Select suture appropriate to anatomic location.

☐ The needle is loaded onto the holder approximately two-thirds of the way from the tip.

☐ The throw begins in the dermis, passes through an adequate amount of subcutaneous tissue following the natural curvature of the needle, and exits the other side of the wound.

☐ The exit and entrance points should be equidistant from the wound edge.

☐ Approximate edges and gently evert the tissue to reduce tension.

☐ The most commonly used knot is the surgeon's knot.

☐ This is accomplished by a double first throw followed by 3 to 4 half-knots using a standard instrument technique.

☐ The end-result is a final square knot with sufficient strength to secure the suture .

☐ The suture is then tied and the ends cut at sufficient length to ensure simple removal.

☐ Suture knots are all aligned away from the wound on 1 side to reduce inflammatory reaction and surface tension at the laceration site .

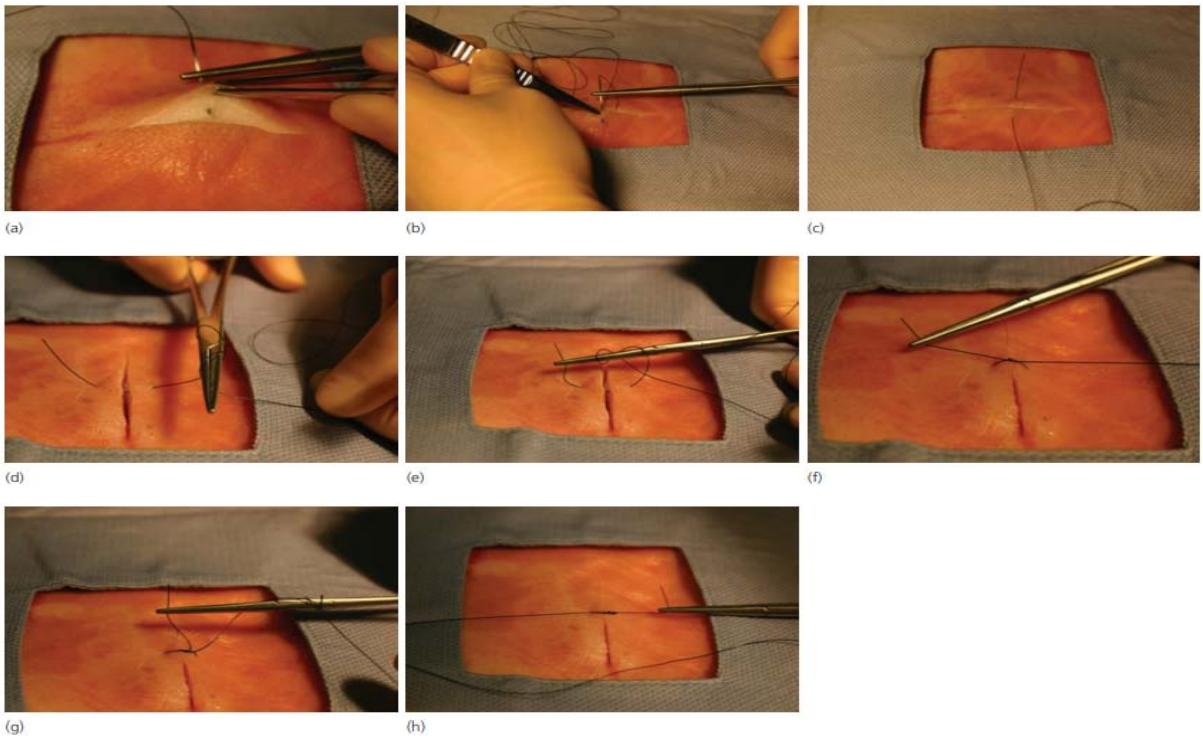


Figure 86. Step-by-step guide: suturing.

(a) Initial insertion of needle (with eversion of distal wound edge). (b) Insertion of needle through proximal wound edge. (c) Position of suture – length of 3–5 cm on distal edge. (d) Two clockwise turns of suture over needle holder. (e) Grasping the short end of suture with needle holder. (f) Forming the fi rst knot. (g) Securing knot with anticlockwise turn of suture over needle holder. (h) Securing the knot.

b. Deep Sutures: (Figure 87)

☐ Select suture.

☐ The initial throw begins in the subcutaneous tissue and is brought out in the natural curved path of the needle to the dermal–epidermal junction.

☐ The needle is then reloaded and inserted superficially into the opposite side and withdrawn in the superficial fascia.

☐ When the suture is tied, this allows the knot to be buried deep in the wound.

☐ The ends are cut short to prevent extrusion.

☐ Deep sutures perform a number of functions, including the following:

- Reduce surface tension.
- Reduce dead space, which acts as a potential for abscess and hematoma formation.
- Restore muscular function in cases of injured muscle.
- Improve aesthetics by reducing pitting of overlying tissue.
- Provide additional strength of repair as suture assists in binding tissue.

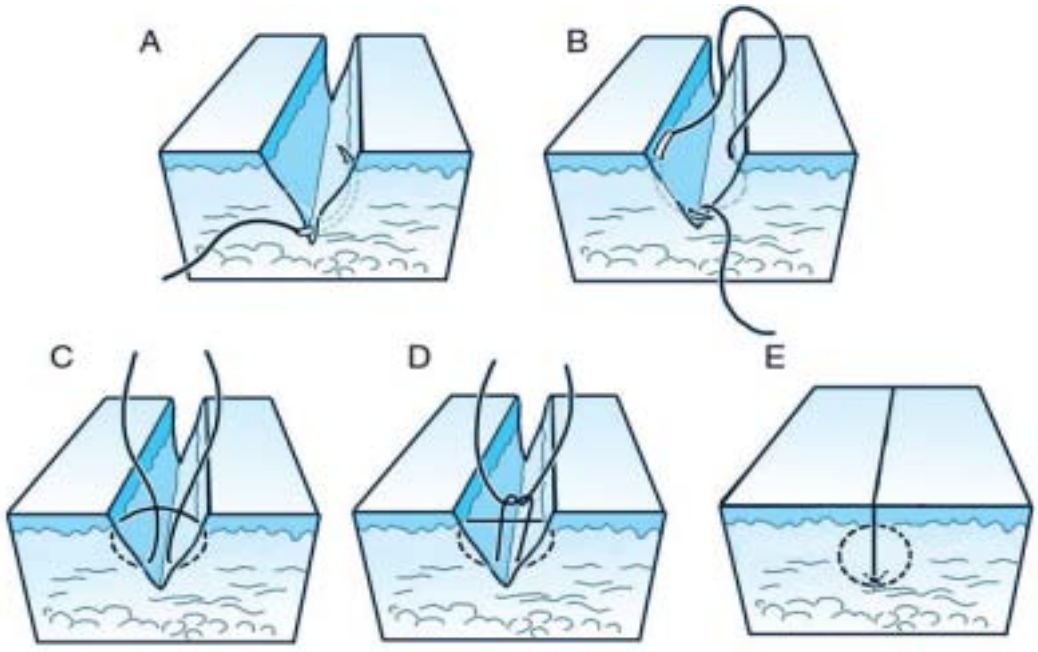


Figure 87. Layered closure.

c. Mattress Sutures:

- These techniques are useful in areas under tension and assist in everting wound edges.
- Their increased strength comes with a risk of ischemia and necrosis of the skin.
- For both horizontal and vertical mattress sutures, the suture passes through the wound twice and finishes on the same side it started from.

c.1. VERTICAL MATTRESS SUTURES (Figure 88)

- This method allows you to close dead space and provide both a deep and skin suture all with 1 tie.
- The stitch begins slightly further back from the wound edge than the simple interrupted skin suture.
- Using a large bite, the needle passes through to the other side.
- It is reloaded and reinserted through the skin closer to the wound edge and passed through to the beginning side.
- The suture is then tied in the customary fashion.

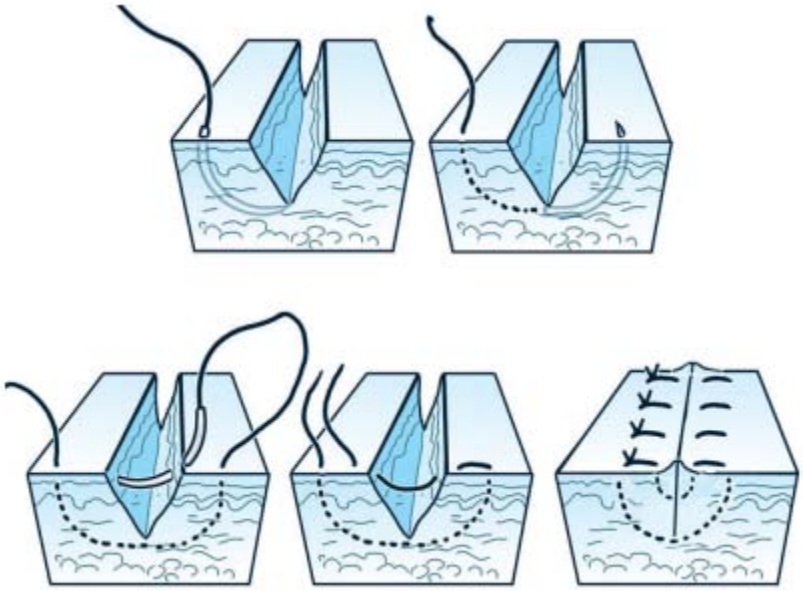


Figure 88. Vertical mattress sutures.

c.2. HORIZONTAL MATTRESS SUTURES (Figure 89)

- The suture is passed from 1 side of the wound to the other.
- It is then reinserted lateral to the exit site and passed back through to the initial side parallel to the first throw of the suture
- It is then tied, which creates a box or square stitch pattern.

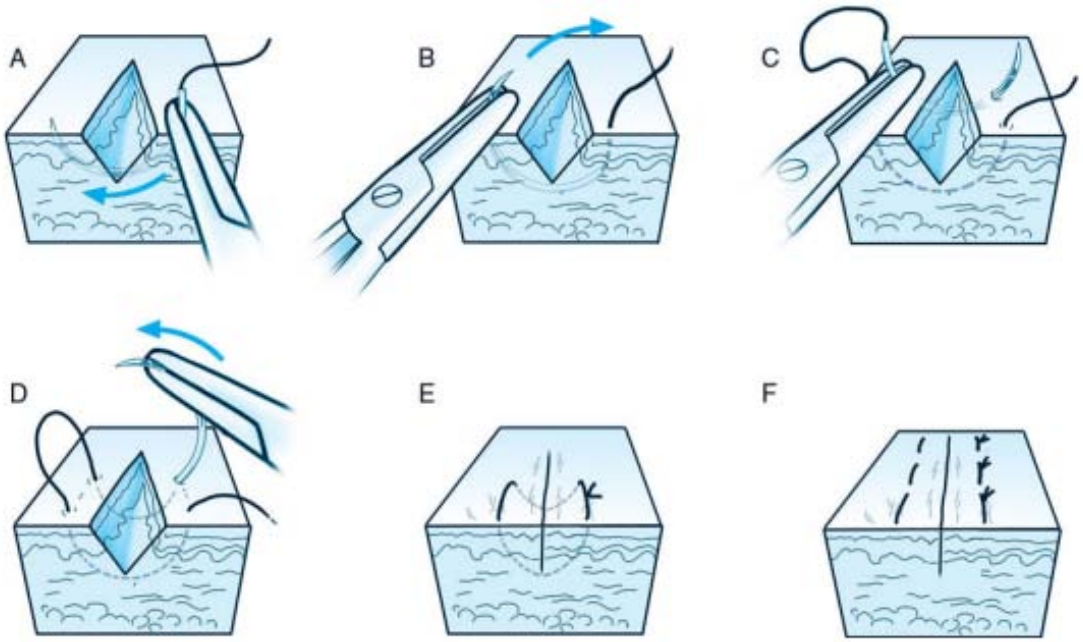


Figure 89. Horizontal mattress sutures

4.6. OTHER OPTIONS TO SUTURING :

a. Steristrips (Figure 90)

- Wounds with well approximated edges which will oppose with minimal tension
- Unsuitable on hairy areas.
- Need to be kept dry for 7 days.

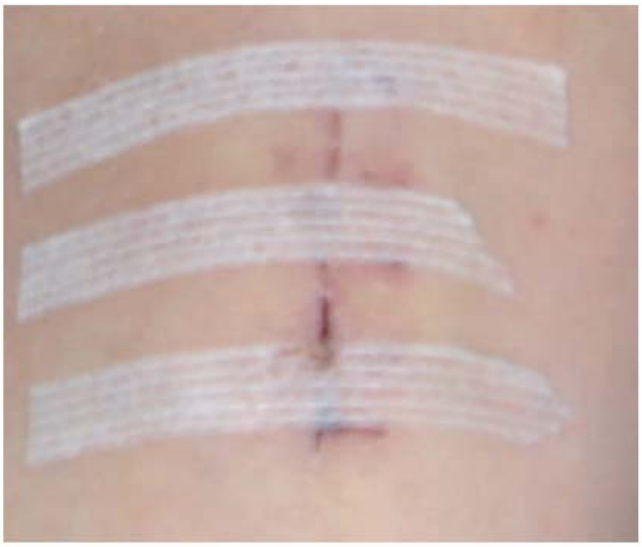


Figure 90. Steristrips.

b. Skin tissue adhesive/glue

- Applied only to the upper epidermis.
- Often used in conjunction with steristrips.
- Useful in children (eliminating the need to inject local anaesthetic).
- Needs to be kept dry for 7 days.

c. Metal clips

- These are infrequently used outside of the operating theatre.

5. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

- Early

☐ Wound malalignment.

☐ Suture displacement.

☐ Bleeding/hematoma formation.

☐ Inversion/overlapping of wound edges.

☐ 'Dog-earing' – this is where there is a unilateral excess of wound edge left over, caused by poorly placed sutures. If this occurs take your sutures out and start again.

- Late

☐ Infection/abscess formation.

☐ Bleeding (secondary hemorrhage).

☐ Wound breakdown.

☐ Skin necrosis.

☐ Suture displacement.

☐ Non-healing wound.

☐ Scarring.

☐ Loss of function.

6. PEARLS AND PITFALLS:

★ Suturing requires a calm and unhurried approach.

★ The practitioner should be comfortable, since preparation and closure of even small lacerations in children may require more time than initially expected.

★ Determine the circumstances and mechanism of injury (eg, blunt or sharp) and risk of contaminants or retained foreign body.

★ Obtain past medical history (including allergies, status of tetanus immunization, medication use, and chronic diseases), since specific medications, such as corticosteroids, and conditions, such as diabetes, delay wound healing.

★ Remember to consider other options such as Steristrip and gluing before you start – if in doubt ask advice from a senior.

- ★ Make sure you have all your equipment ready before you start and that the area is well lit.
- ★ Position yourself carefully – bending over awkwardly for half an hour isn`t going to help your back.
- ★ Use plenty of local anesthetic, antiseptic solution and irrigation.
- ★ Take care to choose the appropriate size of suture.
- ★ Nylon sutures can slip easily so use five knots for extra security.
- ★ Remember to check the patient`s tetanus status.

7. EVIDENCE BASED PRACTICE:

- ✦ Medical students who participated in an early and prolonged suturing module during the dissection laboratory of their first-year anatomy course demonstrated improved confidence by the end of the module which lasted through their third year clerkships.
- ✦ Furthermore, these students reported an increased number of suturing events during their third-year clerkships.
- ✦ Self-learning in a low-stress environment where cadavers and supervising faculty are available to medical students at their discretion results in a positive and sustained impact on medical student attitude and behavior.

IV. Splinting

1. INDICATIONS:

Make sure that patient have one of the following indications:

☐ Any fracture or dislocation of an extremity requiring stabilization.

2. EQUIPMENT:

Prepare all materials:

☐ Cast padding (cotton bandage or stockinette, or both).

☐ Splint material (plaster or fiberglass).

☐ Water bucket.

☐ Lukewarm water.

☐ Elastic wrap.

3. PROCEDURE:

3.1. Patient preparation:

☐ Introduce yourself to the parents and the patient.

☐ Explain the procedure.

3.2. Patient position:

☐ The patient should be comfortable with the affected extremity easily accessible.

☐ The extremity should be positioned as appropriate. (For most joints this is a neutral position).

3.3. Procedure : (Figure 91)

☐ Wrap the extremity circumferentially with cast padding (this is cotton and is generally not strong enough to cause a compartment syndrome).

☐ Usually 10 strips of plaster are used to make the splint.

☐ Measure the length of the plaster needed while it is dry, and then cut appropriately.

☐ The width depends on the extremity. Choose a width that allows for coverage of approximately half of the circumference of the affected extremity

☐ Dunk the plaster in the water and squeeze out the excess.

☐ The plaster can also be milked to remove more water so that it is moist but not dripping.

☐ Place the plaster splint over the padded extremity.

☐ An additional layer of cast padding is placed to hold the plaster, and to prevent the elastic wrap from sticking to the plaster.

☐ An elastic wrap is used over the top to hold the splint in place .

☐ Mold the splint into the position desired and allow it to harden

3.4. Follow-up:

☐ Patient should be seen 3–7 days after the splint is placed.

☐ The primary injury dictates definitive care.

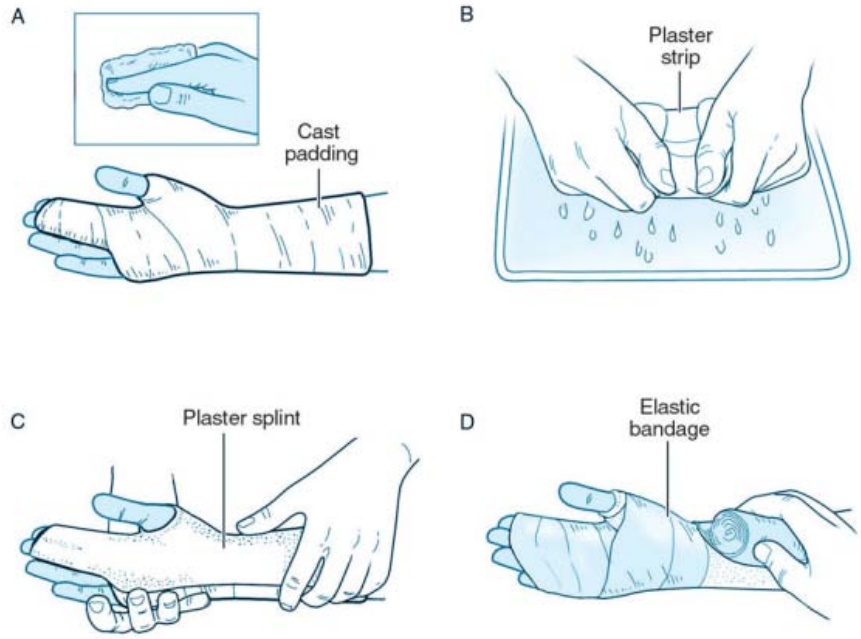


Figure 91. Layers of splint.

4. COMPLICATIONS

Monitor the patient regularly in order to screen these complications:

- ☐ Pressure sores;
- ☐ Skin necrosis from pressure applied by the splint..
- ☐ Reduction of joint function or contractures.

5. PEARLS AND PITFALLS:

- ★ Be careful not to cause a burn to a patient by using water that is too hot. In addition, the plaster gives off heat while it sets.
- ★ Use cast padding liberally. Be sure that all bony prominences are well padded to prevent pressure injury.
- ★ Do not apply the elastic wrap too tightly because it can have a tourniquet effect.
- ★ Splinting is performed to provide stabilization and reduce further injury to an injured extremity.
- ★ Because a splint is not circumferential (unlike a cast), it can accommodate swelling with less chance of compartment syndrome developing.
- ★ Splinting is preferred in acute injuries when there is soft-tissue edema.

6. EVIDENCE BASED PRACTICE:

- ✦ Removable splints when compared with circumferential casts in randomized trials have been shown to be a safe and cost-effective method of managing many common minor distal radius and fibular fractures.
- ✦ Clinicians often face a lot of problems in evidence-based practice when there are so many variations in the conditions and the splinting design, protocol and implementation strategies. There is a need to take a more serious step further to implement evidence-based practice in splinting the patients with hand injuries.

DISCUSSION

In this paper we tried to form a short and memoizable tool to guide students through their training for the most common procedural skills in pediatric ED, and make it accessible to educators and students by developing "PS: CHECK" Application.

We hope that the checklists described here will provide an evidence-based guide to medical educators involved in teaching procedural skills. Implementation of our proposed checklists will no doubt be challenging, even the best-designed checklist requires training in its use, especially because checklists have not traditionally been part of medical work settings. During training, it is necessary to counteract common myths (eg, checklist use signifies lack of expertise) and address user concerns. Training should include the checklist's purpose, who will use it, how, and when. Training should also cover potential barriers to use and how to address these roadblocks when they occur. Ideally, training would involve using the checklist as intended (eg, by a team) in simulation before it is used in actual practice.

Simulation-based medical education is an instructional technique that enables trainees to safely gain competency in procedural skills without harm to patients. Its use has been associated with better patient care and improved patient safety. The utility of simulation for psychomotor skills acquisition has been recently reviewed, and the use of simulation is advocated by the Accreditation Council for Graduate Medical Education (ACGME).Thus, a modern pedagogy for procedural skill education should incorporate instructional design strategies that effectively use simulation as a procedural skills training platform.

Also, checklists should continue to be evaluated after implementation. Ideally, a system for gathering suggested revisions should be in place so that ideas for improvement can be captured. Additionally, changes to workflow, standards of practice, and new technologies may require modification of checklist content, design, and use to maintain relevance and effectiveness. Some checklists may outlive their usefulness and should be retired, rather than revised.

In 2009, Peter Pronovost, a champion of medical checklists, said "My vision is that the science of how to do checklists is in its infancy." But we have not moved much beyond toddlerhood. We still lack a good understanding of why clinical checklists are or are not effective in different settings. As many have pointed out, checklists do not work in isolation; they are part of a complicated, dynamic, sociotechnical system, and many cultural and systemic changes are also necessary for checklists to achieve their potential.

CONCLUSION

Procedural skills have been identified across countries and medical specialties as an area of weakness in training programs. Medical students have specifically been shown to have difficulty with acute-care procedural skills, and often perform these tasks incorrectly. Several of these skills, however, have been identified as essential for practice in a general pediatric setting.

Although pediatric emergency medicine physicians may be required to perform emergent procedures, opportunities to receive training and assessment in these procedures are limited. Simulation and other educational modalities (checklists, guidelines) are being used to provide skill training and assessment, but cost and lack of resources, standardized protocols, and faculty interest are barriers to the implementation of training and assessment programs.

The development of both training tools and assessment guidelines and standards may help promote continued education in order to promote competency and improved patient care for critical procedures required in the pediatric ED.

Generally, a skill:

- ❖ is learned, and not innate
- ❖ is able to be broken into explicit steps (checklist)
- ❖ requires practice in order to improve (simulation)
- ❖ has a specific goal or outcome, that is measurable (evaluation)

Checklists are powerful tools to standardize work processes and create independent checks for key processes. Although they can have wide application in medicine, they are relatively underused. Checklists could create a more efficient and effective knowledge market by summarizing evidence into explicit behaviors, incorporating empiric and tacit evidence, and being continually updated by the health care community.

Further research is needed to advance the science for developing, implementing, and evaluating checklists in other aspects like diagnosis, treatment (checklist before antibiotic prescription to avoid resistance) and also prevention. So, we hope the science advances to help us build, refine, and use checklists wisely.

Checklists are an integral part of a safer medical system advocated by the Institute of Medicine in which "reliance on memory and vigilance" are to be avoided. Unlike all humans, the checklist never forgets. We are confident that our approach, with appropriate modifications, may provide a valuable guide to the implementation of those types of systems change advocated by the Institute of Medicine as essential to improvement of patient safety.

ABSTRACT

Abstract

Medical education in the 21st century is in a constant state of flux. Educational institutions are now investigating methods of improving the educational experiences of their graduates. One of the most important and challenging part in medical training is the procedural skills.

Checklists to guide critical procedures are becoming an increasingly important part of medical practice. These tools have proved effective in improving outcome in a variety of medical settings.

In this thesis , we tried to develop practical checklists to the main pediatric emergency procedural skills.

The intent of this work is to provide a comprehensive review of technical medical procedures applicable to pediatric patients. Throughout this guide, we try to bring to the students, interns, Pediatric residents and all doctors who face procedures in pediatric emergencies practical, useful and handy information.

The material focuses exclusively on procedures in pediatric emergency and is not meant to be a comprehensive textbook of pediatric medicine. Rather, the aim is to provide a clinically useful, accessible guide with step-by-step instructions in an easy-to-use format.

Résumé

L'enseignement médical au XXIe siècle est en constante évolution. Les établissements d'enseignement étudient actuellement des méthodes permettant d'améliorer les expériences pédagogiques de leurs diplômés. Les compétences procédurales constituent l'une des parties les plus importantes et les plus difficiles de la formation médicale.

Les « Checklists » (listes de contrôle) pour guider les procédures critiques deviennent une partie de plus en plus importante de la pratique médicale. Ces outils se sont avérés efficaces pour améliorer les résultats dans une variété de contextes médicaux.

Dans cette thèse, nous avons essayé de développer des « Checklists » pratiques pour les principales procédures d'urgence pédiatrique.

L'objectif de ce travail est de fournir une revue complète des procédures médicales techniques applicables aux patients pédiatriques. Tout au long de ce guide, nous essayons d'apporter aux étudiants, internes, résidents en pédiatrie et à tous les médecins confrontés aux urgences pédiatriques des informations pratiques, utiles et maniables.

Le matériel se concentre exclusivement sur les procédures des urgences pédiatriques et n'a pas pour but d'être un manuel complet de médecine pédiatrique. L'objectif est plutôt de fournir un guide accessible, cliniquement utile, avec des instructions étape par étape dans un format facile à utiliser.

ملخص

التعليم الطبي في القرن الحادي والعشرين في حالة تغير مستمر. تدرس المؤسسات التعليمية الآن طرق تحسين الخبرات التعليمية لخريجيها. تعتبر المهارات الإجرائية من أهم وأصعب جزء في التدريب الطبي.

أصبحت قوائم المراجعة لتوجيه الإجراءات الحرجة جزءًا مهمًا بشكل متزايد من الممارسة الطبية. أثبتت هذه الأدوات فعاليتها في تحسين النتائج في مجموعة متنوعة من الإعدادات الطبية.

في هذه الأطروحة؛ حاولنا تطوير قوائم مراجعة عملية للمهارات الإجرائية لحالات الطوارئ الأساسية للأطفال.

الهدف من هذا العمل هو تقديم مراجعة شاملة للإجراءات الطبية التقنية المطبقة على مرضى الأطفال. من خلال هذا الدليل ، نحاول أن نقدم للطلاب والمتدربين والمقيمين في طب الأطفال وجميع الأطباء الذين يواجهون حالات الطوارئ الخاصة بالأطفال معلومات عملية ومفيدة ومفيدة.

تركز المادة حصريًا على الإجراءات في حالات الطوارئ عند الأطفال ولا يُقصد منها أن تكون كتابًا دراسيًا شاملاً لطب الأطفال. بدلاً من ذلك ، الهدف هو توفير دليل مفيد سريريًا ويمكن الوصول إليه مع إرشادات خطوة بخطوة بتنسيق سهل الاستخدام.

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قسم الطبيب

أقْسِم بِالله العَظِيم

أن أراقبَ الله في مِهْنَتِي.

وأن أصُونَ حياة الإنسان في كآفّةِ أطوَارهَا في كل الظروف والأحَوال باذلة وسْعِي في انقاذها مِن الهَلاكِ والمرَضِ والألَم والقَلَق.

وأن أحفَظَ لِلنَاسِ كرَامَتهُم، وأسْتر عَوْرَتهُم، وأكتمَ سِرَّهُمْ.

وأن أكونَ عَلى الدوَام من وسائِل رحمة الله، باذلة رِعَايَتي الطبية للقريب والبعيد، للصالح والطالح، والصديق والعدو.

وأن أثابر على طلب العلم، وأسَخِّرَه لِنَفْعِ الإِنْسَان لا لأذَاه.

وأن أُوَقّرَ مَن عَلَّمَني، وأُعَلّمَ مَن يَصْغرَني، وأكون أخـًا لِكُلِّ زَميلٍ في المِهنَةِ الطِّبِّيَة مُتعَاونِينَ عَلى البرِّ والتقوى.

وأن تكون حياتي مِصْدَاق إيمَاني في سِرّي وَعَلانيَتي، نَقِيَّة مِمّا يُشينهَا تجَاهَ الله وَرَسُولِهِ وَالمؤمِنين.

والله على ما أقول شهيدا

كليـــــــة الـطب
و الصيدلة - مراكش
FACULTÉ DE MÉDECINE
ET DE PHARMACIE - MARRAKECH
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جامعة القاضي عياض
UNIVERSITÉ CADI AYYAD

سنة 2022 أطروحة رقم 092

تقديم قوائم المراجعة المبنية على الأدلة للتدريب على المهارات الإجرائية في قسم طوارئ الأطفال: تطبيق "P.S: CHECK"

الأطروحة

قدمت ونوقشت علانية يوم **2022/03/09**

من طرف

الآنسة أسماء خرطوم

المزدادة في 1995/04/05 مراكش

لنيل شهادة الدكتوراه في الطب

الكلمات الأساسية:

قوائم المراجعة - المبنية على الأدلة - المهارات الإجرائية - طوارئ الأطفال

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