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Introduction

A wide spectrum of pediatric emergencies can be encountered in an office setting. Physicians and their staff who do not encounter emergencies on a regular basis will feel discomfort when faced with life-threatening situations. Anticipation of the types of emergencies that are likely to be seen and preparation of the staff and office environment for handling these situations will alleviate much of this discomfort and greatly facilitate the care of these children. The process of preparedness begins by ensuring that physicians and office staff are trained in the assessment of an emergency situation and in the methods of resuscitation. Offices must also be stocked with the correct, appropriately sized equipment and appropriate medications to allow maximum effectiveness of trained personnel. Once a patient is stabilized in the office setting, the office staff must be prepared to arrange for expeditious emergency transport to the most appropriate definitive care facility.

The American Academy of Pediatrics and others have recommended that an ambulatory site caring for pediatric patients, at a minimum, be prepared to stabilize and refer the emergency conditions cited in Table 25-1.1-3 Specific evaluation and management of some of these problems are discussed in other sections of this text. This chapter provides a review of issues related to general office preparedness for handling medical and traumatic emergencies and discusses certain office activities, such as telephone triage and education, which have an impact on the prevention, identification, and appropriate handling of potential emergencies. The procedures include step-by-step approaches to minor surgical emergencies that can be treated in the office setting.

In preparing a pediatric or family practice office to care for emergencies, it is important to recognize limitations. Awareness of institutional limitations and the availability of pediatric emergency care in the community can reduce the need for elaborate office preparation. In all cases, coordination of care with local and regional resources best serves the needs of children.

<table>
<thead>
<tr>
<th>TABLE 25-1</th>
<th>Pediatric Emergencies Encountered in Physicians’ Offices</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Anaphylaxis and allergic reactions</td>
<td></td>
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<tr>
<td>• Respiratory and cardiac arrest</td>
<td></td>
</tr>
<tr>
<td>• Respiratory distress (asthma, airway obstruction)</td>
<td></td>
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<tr>
<td>• Seizures and status epilepticus</td>
<td></td>
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<tr>
<td>• Sepsis and shock</td>
<td></td>
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<tr>
<td>• Trauma</td>
<td></td>
</tr>
</tbody>
</table>
Section 1: General Office Preparedness

1.1 Telephone Triage
Telephone triage proficiency is important for the staff in the physician’s office. The staff must be able to determine which patients are in need of immediate referral to an emergency department (ED), which patients need to be seen immediately but can be evaluated in the office, and which can be scheduled for routine appointments. Parents are often in need of advice and reassurance. Although books and electronic resources with pediatric telephone triage protocols are available to provide guidance, it is still essential that staff members receive the proper training. Even with proper training, there are many times when it is difficult or impossible to determine the true severity of an illness or injury by telephone. Office staff should recommend formal medical evaluation whenever there is doubt and participate in periodic training sessions to cover the common and important problems likely to be the basis of calls from parents.

1.2 Monitoring the Waiting Area
Early identification of significantly ill or injured patients followed by prompt intervention is key to optimal outcome. Registration staff should be educated about conditions that warrant immediate medical attention or isolation from other children. Instruct the staff to periodically check the waiting area for the possibility of deterioration of patients. Parents might become less vigilant once they have reached the health care facility and might miss signs of deterioration (Tables 25-2 and 25-3).

Preparedness
Self-assessment
Each office providing care to children should conduct periodic self-assessment to consider the unique factors related to emergency preparedness. This appraisal should include a review of emergencies experienced in the past, consideration of the types of patients seen in the practice, and available resources—both in the office and in the emergency care systems of the broader community. Staffing should be reviewed to ensure emergency readiness at all times that the office is open. Local emergency medical services (EMS) and ED resources should be reviewed. A standardized office assessment tool can help office practitioners examine the office readiness for emergencies and identify areas of need.

1.3 Staff Education
In most cases, early appropriate intervention can prevent deterioration to cardiorespiratory arrest. Prompt initiation of basic life-saving techniques can be the difference between life and death. The least experienced staff member, such as a secretary or receptionist, might be the first to respond to an office emergency; all office employees should be trained to recognize signs of serious illness.

Initial training and periodic practice drills require dedication of staff time to the process of developing and maintaining preparedness. Training in basic life support (BLS) and pediatric advanced life support (PALS) is recommended. The BLS training is a good baseline for all staff; PALS is recommended for all physicians and at least one nurse in the office. APLS: The Pediatric Emergency Medicine Course is a 1- to 2-day, comprehensive modular pediatric emergency medicine course for physicians, nurses, and other health care personnel who work in sites in which a substantial amount of emergency care is provided. The American Heart Association recommends an annual update for BLS and biannual update for PALS (Table 25-4). The American Academy of Pediatrics and the American College of Emergency Physicians recommend continuing study of the advanced pediatric life support materials, attendance at a “live” Advanced Pediatric Life Support course, and formal renewal education every 4 years. Once initial training is complete, no more than a few hours per month are required to maintain a reasonable state of preparedness.

Good resuscitation skills are not enough. Emergency stabilization and treatment require a team effort, a plan, adequate resources, and practice. Location of emergency equipment, supplies, and medications must be known at all times. Periodic practice drills are required.
**TABLE 25-2 Checklist for Pediatric Office Emergency Preparedness**

### Recognition:
Instruct secretaries and receptionists to recognize indications for immediate medical evaluation:

- Active vomiting or profuse diarrhea
- Actively bleeding wounds
- Altered mental state
- Any patient in pain
- Any patient who needs to lie down
- Difficulty breathing
- History of head injury
- History of ingestion and/or overdose
- Infants younger than 2 months with fever
- Pallor or cyanosis
- Petechiae and purpura (purple rash that resembles bruising)
- Seizures
- Testicular pain or swelling

### Response Plan:
- Is a staff member assigned to periodically check the waiting area?
- Who will call emergency medical services (EMS)? Is the number clearly posted?
- Is the staff informed about out-of-hospital health care professionals in the area and their capabilities?
- Is the staff prepared to quickly provide EMS with the necessary information, such as office address, patient age, condition, vital signs, transport destination, need for advanced life support vs basic life support?
- What will be done if the physician is not in the office?
- Who will call ahead to the receiving facility?

### Resuscitation Plan:
- Are roles preassigned for the resuscitation team?
  - Physician acts as team leader.
    - Another physician, if available, manages airway and obtains intravenous or intravenous (IV/IO) access.
  - Nurse practitioner or physician assistant obtains IV/IO access or manage airway as needed.
  - Nurse draws blood and gives medications and fluids.
  - Another nurse documents resuscitation.
  - Medical technician brings emergency cart and equipment to location, assists physician, and performs chest compressions.
  - Secretary or receptionist activates EMS system, accesses medical record, and notifies those in waiting room of delay.

### Equipment:
- Is resuscitation equipment:
  - Complete?
  - Well organized?
  - Easily located by office personnel?
  - Periodically restocked and rechecked? By whom?

### Provider Skills:
- Are all staff members adequately trained to fulfill their roles?
- Are all resuscitation protocols known or readily available?

### Maintaining Readiness:
Practice is critical to the success of any response plan.
- Perform mock codes.
- Perform group critique.

### Documentation:
Is a recorder designated for:
- Dates and times of all treatments and calls?
- Stabilization attempts, airway management, IV/IO access, medication and fluid doses and responses, and child’s weight (measured or estimated)?
- Conversations with family?
- Patient condition on leaving office?

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All office personnel are critical in managing office emergencies and need to be part of the planning and practice for such events. Assign every staff member a specific written role in case of an emergency. The office emergency response plan should be comprehensive, including answers to the questions posed in Table 25-2.

Not every drill must be a full mock code. Simply locating and preparing equipment and medications as though they were going to be used for an emergency and then discussing what would be done in the event of a real emergency can provide a useful experience for the staff with minimal input of resources and time. A physician and a nurse can work together to plan the sessions, and it is a good idea to involve as many of the staff as possible in conducting the sessions. Assign one or two individuals to observe and to share their observations constructively with the group. During debriefing, ensure that all participants have had an opportunity to share their observations. The involvement of community emergency physicians and EMS personnel can facilitate the implementation of practice sessions and build relationships that further help staff to function effectively under true emergency conditions. Educators with experience in medical simulation are available in many regions to provide training or assist with office preparedness.8

Conduct practice sessions regularly, preferably at least monthly, to maintain a reasonable degree of staff readiness, confidence, and comfort.

1.4 Equipment and Medications
The equipment and medications listed in Tables 25-5 and 25-6 can be assembled easily without a major investment of time or money and are sufficient for most pediatric or family practice offices.

### YOUR FIRST CLUE

#### Worrisome Waiting Room Signs and Symptoms
- Active seizures
- Altered mental status
- Difficulty breathing
- History of ingestion or overdose
- Pallor or cyanosis

to avoid deterioration of newly acquired knowledge and skills. This is especially important in environments in which emergency cases are rare. Such drills also assist the staff in maintaining the ability to locate and assemble emergency equipment quickly. Mock emergencies can also identify deficiencies in skills, supplies, equipment, or planning in a safe setting, allowing for corrections before an actual emergency takes place. In studies of office-based practice drills, physicians and staff in practices that underwent mock codes or drills were more confident in their emergency management skills and were more likely to develop written emergency protocols and regularly check emergency equipment.3–7

### Table 25-3 Patients Requiring Isolation

- Symptoms of possible lice or scabies
- History of exposure to chickenpox, tuberculosis, or measles
- History of immunosuppressive illness
- History of organ transplant surgery

### Table 25-4 Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Sponsoring Organization</th>
<th>Duration, day</th>
<th>Recommended Update</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLS</td>
<td>AHA</td>
<td>1</td>
<td>Annually</td>
</tr>
<tr>
<td>PALS</td>
<td>AHA/AAP</td>
<td>2</td>
<td>Every 2 years</td>
</tr>
<tr>
<td>APLS</td>
<td>AAP/ACEP</td>
<td>1–2</td>
<td>Every 4 years</td>
</tr>
</tbody>
</table>

Abbreviations: AAP, American Academy of Pediatrics; ACEP, American College of Emergency Physicians; AHA, American Heart Association; APLS, Advanced Pediatric Life Support; BLS, basic life support; PALS, pediatric advanced life support.
Tables 25-7 and 25-8 provide expanded equipment and medication lists more appropriate for large, busy, or remote sites or for facilities treating children with complex medical problems. The following considerations are important in deciding on the equipment needs of a specific office:

- Frequency and type of emergencies seen
- Proximity to a hospital ED
- Response time for EMS
- Level of training of EMS personnel

Another important issue to consider is the best way to manage a child’s airway in the office. In most cases, bag-mask ventilation should be the focus of airway management because intubation skills decline rapidly if not practiced.

Emergency equipment should be stored in a specific location that is well known to staff and easily accessible in an emergency situation. The development of an emergency cart or case is highly recommended. When properly assembled, the contents will enable the resuscitation of patients in a wide range of ages, from the premature newborn to the husky adolescent. Locking tool cabinets on wheels, such as those widely available in

### TABLE 25-6 Basic Emergency Office Medication List

- Albuterol (salbutamol), 0.5% nebulization solution, 20 mL
- Ceftriaxone, 5 g
- Dextrose, 25% or 50%, 200 mL
- Epinephrine (adrenaline), 1:1,000, 10 ampules or vials of 1 mg/mL (also effective when nebulized for croup in place of racemic epinephrine [adrenaline])
- Epinephrine (adrenaline), 1:10,000, 10 mL
- Lidocaine (lignocaine), 1%, 50-mL vial
- Lorazepam or diazepam
- Naloxone, 1 mg/mL, 2-mL vial
- Tetanus toxoid, (DTaP or Tdap)
- Corticosteroids (prednisolone or dexamethasone)
- Diphenhydramine syrup, 12.5 mg/5 mL

**Abbreviations:** DTaP, diphtheria and tetanus toxoids and acellular pertussis [vaccine]; Tdap, tetanus and diphtheria toxoids and acellular pertussis [vaccine].

### TABLE 25-7 Expanded Equipment and Supplies List

#### Airway Equipment:
- Masks for bagging (infant, pediatric, adult)
- Oxygen source with flow meter
- Self-inflating bag with reservoir (500 mL, 1,000 mL)
- Oxygen masks (simple and nonrebreather in premature child, infant, child, and adult sizes)
- Suction, wall or portable/Yankauer suction catheters (8, 10, 14F)
- Cardiac arrest board
- Emergency drug dosing card or Broselow Pediatric Emergency Tape

#### Fluid and Medication Administration:
- Butterfly needles (23 gauge)
- Intravenous catheters—short over-the-needle (18, 20, 22, 24 gauge), several of each size
- Intravenous boards, tape, alcohol swabs, tourniquet
- Normal saline and tubing
- Syringes
- Sphygmomanometer and blood pressure cuffs (infant, child, adult)
- Intravenous devices

#### Other:
- Cervical collar (several sizes)
- Lumbar puncture kit
- Portable monitor or defibrillator with pediatric paddles and skin electrode contacts (peel and stick) or automatic external defibrillator with pediatric electrodes
- Pulse oximeter
- Splints
- Urine dipsticks
- Blood glucose oxidase reagent strips
but they do not carry any medications in the ambulance. If an intravenous catheter is placed while the patient is in the office, medications are needed, or intubation is performed in the office, an advanced life support crew is required.

1.6 Patient and Parent Education
Education of parents and patients regarding preventive measures is a key role of the primary care physician. Effective injury prevention training programs include those that cover installation and use of adequate swimming pool barriers, the use of infant car seats, seatbelts, and bicycle helmets, as well as the use of poison centers. Early recognition of age-appropriate signs and symptoms of serious illness is another area of educational need for parents, and this topic leads logically to the discussion of how to proceed when an emergency occurs. Parents should be provided information on how to access EMS (911 or the local emergency number) and the poison control center number (1-800-222-1222).

Aftercare instruction is another important part of an office visit. Answer specific questions and give parents guidelines to follow. Instructions might include warning signs and symptoms of complications and when to call the office or go to an ED.

Section 2: Trauma

2.1 Major Trauma
The outcome after major trauma is related directly to the interval between the precipitating event and the initiation of therapy. Although most severely injured pediatric patients are appropriately routed to an ED or a trauma center, it is not rare for children with very significant injuries to be brought to the office of their primary care physician. Rapid assessment and treatment and contact of EMS for transfer to the ED for definitive care are important to achieve optimal outcome.

2.2 Minor Trauma
Minor Trauma
Minor emergencies account for large numbers of unscheduled urgent care visits, not only to the ED but also to the physician’s office. Emergency physicians and office-based pediatricians and

### Table 25-8: Expanded Office Emergency Medication List

- Activated charcoal, 125 g
- Atropine (0.1 mg/mL), 1-mL vials (at least five vials)
- Ipratropium for nebulization, 500 mcg
- Phenytoin, fosphenytoin, or phenobarbital
family practitioners therefore require a working knowledge of management of such conditions. The management of frequently encountered minor emergencies is summarized in the following sections.

2.3 Minor Head Trauma

Head trauma is one of the most common injuries during childhood, accounting for 7,400 deaths, more than 60,000 hospital admissions, and more than 600,000 ED visits annually. Although brain computed tomography (CT) remains the gold standard of emergent imaging in head trauma, there is increasing controversy regarding the risks of ionizing radiation in children. Although no study of children with minor head trauma has been able to identify reliable historical or physical examination criteria that will identify all children with radiographic abnormalities, a decision rule to identify children at low risk of clinically important brain injuries after head trauma has been developed. This multicenter study involved more than 42,000 children younger than 18 years with a Glasgow Coma Scale score of 14 to 15 and developed two validated prediction rules, one for children younger than 2 years and one for children 2 to 18 years old. Yet, the initial evaluation of these children has been a topic of much discussion over the years.

Diagnostic Studies

Computed tomographic imaging is recommended for children with altered mental status, focal neurologic deficits, or evidence of a palpable or basilar skull fracture. In addition, in a child younger than 2 years, an occipital, parietal, or temporal scalp hematoma, a history of loss of consciousness for longer than 5 seconds, severe mechanism of injury, and not acting normally per the parent warrant observation or CT on the basis of several other factors, such as age younger than 3 months, worsening symptoms, and multiple findings. Children younger than 2 years are more likely to sustain an intracranial injury or skull fracture than older children and are more likely to be abused. These children require a lower threshold for imaging than older children. Infants younger than 3 months are especially difficult to assess clinically and require a high index of suspicion for intracranial injury and a more aggressive evaluation. Consider the possibility of abuse in infants and young children with intraoral injuries, injuries to the ear, or injuries or histories inconsistent with the child’s developmental capabilities. Transport to the ED for appropriate imaging and further treatment might be necessary via EMS.

In a child 2 years and older, other factors, such as a history of loss of consciousness, a history of vomiting, severe mechanism of injury, or severe headache, prompt observation or CT scan based on factors such as worsening symptoms or multiple findings. In both age groups, physician experience and parental preference also weigh in the decision to observe or scan. The occurrence of an impact seizure is not, by itself, a reason to consider a head injury potentially more severe. Awake, alert, and otherwise asymptomatic children without a history of loss of consciousness do not require imaging. The need for skull radiographs after minor head trauma has been much debated and studied in recent years. Although CT imaging remains the diagnostic modality of choice, skull films can be a useful screen for skull fractures in awake and alert children younger than 2 years with a significant scalp hematoma who would not otherwise undergo a CT scan. The presence of a skull fracture increases the risk of finding an intracranial abnormality on CT scan by 20 times and therefore would prompt the physician to obtain a head CT.

Management

Although delayed deterioration is a rare event, this risk should be discussed even in those patients with minor head injury in whom imaging is not necessary. The child should be discharged to a competent adult for observation at frequent intervals during the first 24 hours after injury. The adult should be instructed to seek immediate medical attention at an ED in the event of any deterioration.

Children and adolescents who sustain a concussion should be counseled regarding the potential risks of returning to athletics or other strenuous activities too soon. Guidelines regarding return to play following concussion suggest a graduated return to activity.
2.4 Minor Torso Trauma

In children with blunt trauma to the chest or abdomen, the absence of signs or symptoms of serious injury and the presence of normal vital signs for age reassure the examining physician that internal injury is unlikely. However, abnormalities in vital signs must be taken seriously. In a study of patients admitted to pediatric trauma centers, abnormal vital signs for age were associated with high mortality rates. Accordingly, children who present with abnormal vital signs for age after seemingly trivial trauma warrant immediate evaluation in the hospital by physicians familiar with the initial management of major trauma in the pediatric population.

Clinical Features

Certain physical findings also warrant immediate evaluation. Children who present with significant chest pain, noisy or rapid breathing, respiratory distress or failure, or bloody sputum might have potentially serious intrathoracic injuries. Children who present with significant abdominal pain, swelling, tenderness, distention, abdominal wall contusions, or vomiting can have potentially serious intra-abdominal injuries. Vomiting is particularly significant when associated with blood or bile. Children who present with mild, localized, superficial chest or abdominal wall tenderness are not likely to have significant injuries, especially if such tenderness is limited to soft tissues located over bony prominences, such as the ribs or pelvis. All children with chest wall injury require careful evaluation for decreased or absent breath sounds and palpation for subcutaneous emphysema, either of which points toward the diagnosis of pneumothorax.

There are, however, certain mechanisms of blunt injury that require a more detailed evaluation. Children who sustain a sharp blow to the epigastrium, particularly from a handlebar during a fall from a bicycle, are at higher than usual risk for hepatic, splenic, duodenal, and pancreatic injury. Children who sustain a sharp blow to the flank, particularly during contact sports, also are at high risk of renal injury and require ED evaluation.

Hematuria is an important indicator of intra-abdominal injury. Perform a urine dipstick test for occult blood in children with a history of blunt abdominal trauma. Although significant renal injury is unlikely to have occurred unless there are more than 20 red blood cells per high-power field on microscopic examination, patients with any degree of hematuria should undergo a reevaluation within 2 days. If even a few red blood cells persist, a sonogram is indicated because renal abnormalities frequently are heralded by microscopic hematuria after trivial trauma. Evaluation in the ED and CT of the abdomen are indicated if gross or significant microscopic hematuria is found.

YOUR FIRST CLUE

Serious Signs and Symptoms of Torso Injury

- Abdominal pain
- Abdominal swelling
- Abdominal tenderness or distention
- Abdominal wall contusions
- Bloody sputum
- Hematuria
- Moderate to severe chest pain
- Noisy or rapid breathing
- Respiratory distress or failure
- Vomiting

2.5 Soft Tissue Injuries

Soft tissue injuries are treated by pain relief, rest, ice, compression, and elevation of the affected part to the extent possible (Figure 25.1). Ice packs can retard swelling during the first 1 to 2 days but might cause hypothermia and discomfort, especially in small children. After the initial period, warm showers, baths, and soaks or application of a carefully monitored moist heating pad several times daily can promote more rapid reabsorption of blood. Analgesia can be provided by administration of a nonsteroidal anti-inflammatory agent, such as ibuprofen.
on the scalp and face, to avoid confusion between suture material and hair at the time of suture removal.

- Use sutures that are large enough, placed far enough apart, and tied loosely enough so they are easy to remove and ensure there is not enough tension to cause unsightly cross-hatching.
- The use of staples on the scalp is another option for laceration closure. It does not require hair removal and has resulted in a more rapid procedure time and a more cosmetically acceptable wound closure.21

2.6 Lacerations

Closure of lacerations can present special technical problems in children, chiefly because the child usually is moving or thrashing about. The use of distraction techniques and involvement of the parent for psychological support of the child during suturing might facilitate the repair. Passive restraints, such as the papoose board, should be used as adjuncts to, rather than instead of, these other techniques. Topical anesthetic agents, such as the combination of lidocaine (lignocaine), epinephrine (adrenaline), and tetracaine (LET), infiltrative anesthetic agents buffered with sodium bicarbonate to reduce pain, and appropriate sedative agents can also be useful in reducing the anxiety and discomfort traditionally associated with suturing of lacerations in children.18 Suturing techniques are the same for children and adults, but it is wise to remember the following points when suturing children:

- The suture material chosen should be strong enough to withstand reinjury, especially when the laceration is on an extremity.
- Sutures of thin diameter and low reactivity should be used in highly visible areas such as the face.
- Consider using absorbable sutures, which appear to confer equivalent cosmetic outcomes but have the benefit of avoiding the cost and emotional and physical trauma of suture removal.19,20
- If nonabsorbable sutures are used, blue or green sutures can be helpful, particularly

2.7 Suturing

Basic wound management begins with wound assessment (Table 25-9), followed by application of local anesthesia (Table 25-10), wound preparation (Table 25-11), and selection of appropriate suture material (Table 25-12). Most wounds are closed with either a simple interrupted stitch or a horizontal mattress stitch.

**LET Application**

LET (lidocaine [lignocaine] 4% solution, epinephrine (adrenaline) 1:1,000 solution, and tetracaine 0.5% solution) is a topical anesthetic that can be used before cleaning, irrigating, or closing lacerations. The physician should make

<table>
<thead>
<tr>
<th>TABLE 25-9 Wound Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanism of injury</strong></td>
</tr>
<tr>
<td><strong>Time since injury</strong></td>
</tr>
<tr>
<td><strong>Foreign body, contamination</strong></td>
</tr>
<tr>
<td><strong>Functional examination</strong></td>
</tr>
</tbody>
</table>

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TABLE 25-10 Types of Anesthesia for Suturing

<table>
<thead>
<tr>
<th>Agent</th>
<th>Route of Administration</th>
<th>Dose</th>
<th>Onset, min</th>
<th>Duration, hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>LET</td>
<td>Topical, avoid mucous membranes</td>
<td>3 mL (or 1 mL/cm of wound length)</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>Lidocaine (lignocaine)</td>
<td>Injectable</td>
<td>4.5 mg/kg, maximum</td>
<td>2–4</td>
<td>1</td>
</tr>
<tr>
<td>Lidocaine (lignocaine) plus epinephrine (adrenaline)</td>
<td>Injectable</td>
<td>7 mg/kg, maximum</td>
<td>2–4</td>
<td>1–2</td>
</tr>
<tr>
<td>Bupivacaine</td>
<td>Injectable</td>
<td>1.5 mg/kg</td>
<td>2–10</td>
<td>3–6</td>
</tr>
<tr>
<td>Bupivacaine plus epinephrine (adrenaline)</td>
<td>Injectable</td>
<td>2.5 mg/kg</td>
<td>2–10</td>
<td>3–6</td>
</tr>
</tbody>
</table>

Abbreviation: LET, lidocaine (lignocaine), epinephrine (adrenaline), and tetracaine.

a Use of systemic sedation and analgesia might be necessary to achieve optimal patient compliance.

b Do not use epinephrine (adrenaline) in areas of terminal circulation, such as distal parts of digits, ears, nose, or penis. Pain on injection can be lessened with distraction, slow infiltration, warming, and alkalinization (1 in 10 parts sodium bicarbonate).

TABLE 25-11 Wound Preparation

- Remove excess dirt and debris by simple washing in sink (if possible).
- Skin can be scrubbed with povidone-iodine or other cleansing solution. Do not be timid when scrubbing the skin around a wound; the mechanical effect of scrubbing, independent of the agent used, is an important part of cleaning the skin. Do not instill povidone-iodine solution, iodophor, hydrogen peroxide, or hexachlorophene into an open wound.
- Cleanse anesthetized wound by irrigation with sterile normal saline solution using a 20- to 60-mL syringe and 18-gauge angiocatheter or splash shield. Another method is to stick an 18-gauge needle in the top of a 1-L bottle to make a hole, then squeeze the bottle. A fenestrated sterile drape will help maintain a sterile field when repairing the laceration.
- Use adequate direct pressure over the wound for at least 5 minutes without interruption to achieve hemostasis. Generally, 5 to 8 minutes with continuous pressure without release is sufficient. Do not send a child home with an open wound until proper hemostasis has been achieved.

Sure that the patient has no allergies or sensitivities to any components of the LET solution before applying it. Because LET contains epinephrine (adrenaline), a potent vasoconstrictor, it should not be used on fingers, toes, penis, nose, lips, ears, or other area of terminal circulation. The purpose of LET application is to make the child more comfortable for the wound repair process. If the child does not relax or appears to be significantly distressed, consider the need for a different technique for anesthesia.

**Technique**

1. Explain the procedure to the child and parent.
2. Using clean gloves, place 3 mL of a premixed solution on a cotton ball and apply it to the wound. For wider wounds, place a single LET-soaked 2 × 2 inch sterile gauze pad in the wound. Another option is to mix the LET with methylcellulose to form a gel and apply the mixture to the wound. If a premixed solution is not available, use separate sterile syringes and needles for each medication. Mix equal parts depending on wound size. For wounds less than
TABLE 25-12  Suture Material

<table>
<thead>
<tr>
<th>Suture Type</th>
<th>Examples</th>
<th>Anatomical Area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External Skin Sutures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nylon (nonabsorbable)</td>
<td>Ethilon</td>
<td>Body,* face*</td>
</tr>
<tr>
<td>Nylon coated with polypropylene glycol (nonabsorbable)</td>
<td>Prolene</td>
<td>Body, face</td>
</tr>
<tr>
<td>Rapidly degrading absorbable suture material</td>
<td>Vicryl rapide, fast-absorbing plain gut</td>
<td>Body, face,* lips</td>
</tr>
<tr>
<td>Surgical staples</td>
<td></td>
<td>Scalp*, noncosmetic areas</td>
</tr>
<tr>
<td>Wound closure strips</td>
<td>SteriStrips</td>
<td>Superficial epidermal closure</td>
</tr>
<tr>
<td>Silk (not recommended unless others not available)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Absorbable “Deep” Sutures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polyglactin</td>
<td>Vicryl</td>
<td>Most commonly used*</td>
</tr>
<tr>
<td>Catgut (plain or coated)</td>
<td></td>
<td>Not commonly used</td>
</tr>
</tbody>
</table>

*Primarily indicated closure type.

or equal to 2.5 cm or smaller, use 0.2 mL of each drug. For wounds 2.5 cm or larger, use 0.5 mL of each drug.

3. Place a bandage or other dressing (eg, Tegaderm) over the area. If the child will not keep the dressing on, ask the parent to apply single-finger, gentle pressure for 20 minutes. The parent should wear a glove because medication might be absorbed into skin.

4. The application should remain in place for 20 minutes. Skin blanching indicates effective absorption.

5. Do not use dry or partially soaked 2 x 2 inch pads to cover the wound because these can wick the medicine out of the wound, decreasing the effectiveness of the LET.

Irrigation of Wounds

Irrigation of a wound will remove particulate matter that can be a nidus of infection.

Technique

1. In a contaminated wound, scrub the surrounding skin with povidone-iodine or equivalent solution. Avoid getting the solution into an open wound; it might inhibit the healing process.

2. For successful irrigation, an adequate volume of solution and adequate pressure are necessary. A 20-mL or larger syringe with an opening equivalent to an 18- to 19-gauge opening is generally effective. Sterile normal saline is an appropriate irrigation solution in most cases.

3. Remove particulate matter.

4. Irrigate wound copiously.

5. If the depth of the wound cannot be clearly visualized, consider the presence of foreign bodies and conduct appropriate investigations to rule out this possibility.

Suturing Technique

1. The first principle of wound suturing is to match the skin heights absolutely, which requires eversion of the wound edges. Shadows are cast over a wound closure that is not perfectly flat. Do not allow the wound edge(s) to roll inward.

2. Ensure adequate exposure and illumination of the wound.
3. Assume a comfortable position; the best position generally is at one end of the long axis of the wound.

4. To aid eversion of the wound edges, place sutures so the depth is greater than the width.

5. Preserve and protect all viable tissue. Office suturing is not recommended in certain situations, including any massive injury, an open fracture or joint dislocation, a wound in which there is precarious viability or impaired function distal to the wound, or any injury complicated by a compartment syndrome.

6. Immediate wound closure is best accomplished when there is no tension across the suture line. Tension can be reduced by undermining the wound beneath the subcutaneous tissue. The more tension on the wound edge, the closer the stitches should be to the edge and the closer the stitches should be to each other.

7. Tie sutures just tight enough to approximate and slightly evert the wound edges, remembering that the tissues will swell with edema fluid.

8. Whenever possible, avoid the practice of halving an elliptical wound. This often causes bunching and uneven closure of the wound. Instead, work from one end of the wound to the other, sewing the skin the same distance along each side of the wound with each stitch.

**Simple Interrupted Stitch Technique**

1. Select appropriate suture material.

2. In a sterile manner, remove the suture material from the packet and arm the tip of the needle holder one-third of the way from the swage (needle-suture junction) (**Figure 25.2**). To prevent needlestick, do not use fingers to adjust the needle.

3. Enter the skin 5 mm or less from the laceration with the needle at 90° to the skin surface (**Figure 25.3**).

4. Following the curvature of the needle, complete the stitch by exiting the opposite side of the wound at the same depth and distance from the wound edge as the entrance bite (**Figure 25.4**).

5. Tie a surgical knot with the instrument tie (**Figure 25.5**). Use five knots for nylon, six for coated nylon, and three for polyglactin absorbable or silk. Cut the suture with a 3-mm tail.

6. Arrange all knots symmetrically on the same side of the wound (preferably the side least susceptible to ischemia or cosmetic problems) (**Figure 25.6**).

7. Apply a topical antibiotic and dressing.
Horizontal Mattress Stitch Technique
The horizontal mattress stitch is useful when a wound is under slight (not extreme) tension. Do not use in areas of cosmetic importance (e.g., face or hands).

1. Begin with the first stitch as above. Instead of tying this simple stitch, continue to the second half of the horizontal mattress suture by identifying the location you would have placed your next simple stitch (≤5 mm away). Do not cut the suture (Figure 25.7)!

2. Rearm the needle holder and enter the skin in the same manner from the second side to the first side. This is the simple stitch going back to the first side of the wound (Figure 25.8).

3. Tie the stitch on the first side of the wound parallel to the wound. It will look like a little box, with sides parallel to the laceration (Figure 25.9).

4. Instruct the patient to return for suture removal at the appropriate time based on the site of the laceration (Table 25-13).

TABLE 25-13 Suture Removal Guidelines

<table>
<thead>
<tr>
<th>Anatomical Area</th>
<th>Days Until Removal</th>
<th>External Suture Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face</td>
<td>3–5</td>
<td>6–0&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Scalp</td>
<td>7–10</td>
<td>Staples, 5–0&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Upper body</td>
<td>7–10</td>
<td>4–0</td>
</tr>
<tr>
<td>Hand</td>
<td>7–10</td>
<td>5–0</td>
</tr>
<tr>
<td>Lower body</td>
<td>10–14</td>
<td>4–0</td>
</tr>
<tr>
<td>Over joint (recommend splint)</td>
<td>14–21</td>
<td>4–0</td>
</tr>
</tbody>
</table>

<sup>a</sup>Use a colored suture material (usually green or blue) that will not be confused with the child’s facial or scalp hair.
2.8 Staples
Staples are generally used to close wounds on the scalp only. Large wounds on the extremities could be closed using staples, but staples are never used on cosmetic areas, including the face.

Technique
1. Carefully select patients for wound closure with staples. Disclose risks and complications of the procedure. Explain advantages and disadvantages of treatment alternatives. Discuss what to expect during the procedure and the importance of keeping the child still during the procedure. Discuss methods of immobilization.
2. Cleanse the skin and irrigate the wound thoroughly, just as for placing sutures.
3. Approximate and slightly evert the skin edges.
4. Hold the stapler at the angle to the skin specified by the manufacturer. Different staplers require the stapler to be held at different angles and placed with varying amounts of downward pressure on the skin.
5. To form the staple, squeeze the handle of the stapler.
6. To release the staple, release pressure on the handle.
7. Check the staple position and replace any poorly placed staples.

Staple Removal
1. Insert both lower jaw tips of the staple remover completely and symmetrically under the staple.
2. Lift slightly, holding the staple perpendicular to the skin.
3. Gently squeeze the handle while lifting the staple out of the skin.

2.9 Tissue Adhesive Application
Carefully select patients for wound closure with tissue adhesive. Small children often wet or pick at the wound, weakening or peeling off the tissue adhesive. Avoid tissue adhesive closure in areas of tension (chin, joints, weight-bearing surfaces, wounds that do not easily approximate), areas with hair (scalp, eyebrows), and areas that might be kept moist (fingers that might be sucked). The ideal laceration for repair with tissue adhesive is a short (<5 cm), linear or curvilinear, low-tension wound with clean edges. Wound edges must be easily approximated and dry, and care should be taken to avoid instilling the adhesive into the wound itself, where it can impair tissue healing. Adequate immobilization is required.

Disclose risks and complications of the procedure. Explain advantages and disadvantages of treatment alternatives. Discuss what to expect during the procedure, including the possibility of heat sensation with application. Discuss the importance of keeping the child from moving during the procedure and methods of immobilization.

Technique
1. Cleanse the skin and irrigate the wound thoroughly, just as for placing sutures or staples. Because local anesthesia might not be required, there can be temptation to be less aggressive when exploring, scrubbing, and irrigating these wounds.
2. Achieve complete hemostasis. Although sutures facilitate hemostasis within the ligature loop, tissue adhesive does not facilitate hemostasis. Optimally, the skin will be dry before application.
3. Wear tight-fitting vinyl gloves. Cyanoacrylate tissue adhesives adhere to vinyl gloves only weakly compared with their adherence to latex gloves.
4. Position the patient to avoid dripping of tissue adhesive onto sensitive areas (eg, keep eyes “uphill” from the laceration site). When possible, position the wound surface horizontally to reduce runoff. Tissue adhesive that seeps into the wound and polymerizes can cause the wound to be “glued open” or result in a foreign-body reaction and promote infection. Prophylactic application of petroleum jelly or ointment to sensitive areas can reduce adherence of tissue adhesive. Surrounding the laceration with damp gauze can also absorb tissue adhesive and prevent runoff. Moistened gauze is as effective as dry gauze in absorbing tissue adhesive but is much less likely to get glued to the skin.
5. Manually approximate and evert wound edges with a gloved hand, cotton-tipped applicator (Q-tip), metal forceps, or non-stick wound closure forceps. The wound must be held closed firmly until polymerization is complete, generally 1 minute after the last layer of tissue adhesive is applied. Unless specifically made for use with tissue adhesive, plastic forceps are much more likely than metal forceps to get glued to the skin.

6. Remove the applicator from sterile packaging and hold with its tip pointed upward. Crush the inner glass ampule by applying pressure at the midpoint of the outer plastic ampule. Use the tissue adhesive immediately after crushing the inner glass ampule. Polymerization of the tissue adhesive begins even before it is applied to the skin.

7. Apply adequate pressure to the ampule to moisten the fabric applicator tip, evidenced by a color change from white to purple color. Apply gentle pressure to the ampule while using gentle brushing strokes to apply a thin film of liquid over the approximated and everted wound edges. Overzealous pressure on the ampule will increase the likelihood of complications from tissue adhesive runoff. Apply three or four evenly distributed layers of tissue adhesive at least 0.5 cm on each side of the wound margins. Maintain approximation of the incision edges until a flexible film is formed, usually about 1 minute after applying the last layer.

8. Dab up excessive glue with a moistened cotton-tipped applicator or gauze.

9. There is no need to cover the tissue adhesive, but if desired, the wound can be covered with a dry dressing. Do not apply ointments, medications, or skin strips on top of tissue adhesive.

10. On discharge, provide instructions regarding proper wound care and potential complications, such as infection, allergic reaction, and dehiscence.

11. Instruct parents that the glue should slough off in 5 to 10 days.

12. Parents also should keep the area as clean and dry as possible. Do not expose the wound to prolonged wetness or scrubbing for 7 to 10 days. After this time, the patient should wet the wound so that tissue adhesive breakdown is accelerated and timely sloughing will occur. In some cases, tissue adhesive has been applied excessively; prolonged presence on the skin has been associated with superficial infection.

**Management of Wounds**

Given the uncanny ability of children to reinjure the involved areas, do not remove sutures from the extremities until it is clear that complete healing has occurred. This might require up to 2 to 3 weeks after injury over joints. With proper patient selection, certain minor wounds can be closed with absorbable sutures or tissue adhesive.

Systemic antibiotics are of little use and of potential harm in patients with blunt trauma, even if extensive. Systemic antibiotics also have no proven role in patients with clean lacerations, especially those of the face and scalp, provided they are closed promptly, within 12 to 24 hours of injury. Treat older wounds and tetanus-prone wounds with systemic antibiotics and aggressive local care, including debridement of devitalized tissue. Patients with such wounds also require tetanus prophylaxis, including tetanus immune globulin, if the immunization series has been deficient.

The importance of timely and appropriate wound care in the prevention of wound infection cannot be overemphasized. Wounds must be thoroughly explored, debrided, and irrigated before closure. Particulate debris in the wound must be picked out, and the wound must be vigorously scrubbed and irrigated. If these measures are inadequate, tissue excision might be necessary. Adequate volume and pressure of irrigation fluid are essential. Surgical consultation might be necessary if the wound is significantly contaminated. For wounds involving penetration of a body cavity, surgical consultation is mandatory.
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2.10 Human and Animal Bites

Bites inflicted by humans and animals can result in contaminated wounds due to the microorganisms that reside in oral cavities. *Staphylococcus* and both aerobic and anaerobic streptococci are found in all species, and *Pasteurella* species are prominent in the oral cavity of cats. All bite wounds should be thoroughly cleaned and meticulously debrided and then irrigated liberally. Most wounds can be left open, but if closure is necessary, only loosely approximate the wound edges. With the exception of deep puncture wounds, bite wounds on the head and face can be closed in the usual manner. Tetanus immunization status must be determined and appropriate measures taken if the immunization series is incomplete. Also consider the risk of rabies based on the animal species and circumstances of the attack.

Antibiotics are not necessary for meticulously cleaned, superficial human and dog bite wounds. However, puncture wounds and other deep, irregular, or extensive bite wounds, as well as all wounds involving the face, hands, wrists, feet, ankles, and genital area and all wounds in patients who are immunocompromised or those with asplenia, should be treated with antibiotics. All cat bites should be treated with antibiotics. Amoxicillin-clavulanic acid, in a dose of 40 mg/kg per day of amoxicillin, divided into two doses, is a good choice. An alternative regimen for patients with penicillin allergies includes clindamycin plus either an extended-spectrum cephalosporin or trimethoprim-sulfamethoxazole. Doxycycline has good activity against *Pasteurella multocida*, the most common pathogen in infections resulting from cat bites, but its use in young children can result in permanent dental staining.26

After cleansing or closure, the wound should be elevated, immobilized, and observed frequently for signs of cellulitis. At the first sign of infection, immediate hospitalization is required.

Section 3: Foreign Bodies

If clearly visible or palpable, most subcutaneous, subungual, and loose foreign bodies of the eye, ear, or nose can be removed in the ED or physician’s office depending on the child’s ability to cooperate (Figure 25.10). Procedural sedation can facilitate management of such problems but should be undertaken only when the treating physician is experienced in its use and proper monitoring is available. Foreign bodies of the gastrointestinal tract will usually pass spontaneously if allowed to do so. Endoscopic or surgical removal is required for ingested button batteries and small magnets. Promptly refer all patients with esophageal or tracheobronchial foreign bodies to an ED or qualified specialist. Because esophageal foreign bodies can be asymptomatic, it is appropriate to attempt imaging of any ingested foreign body that might be radiopaque. A hand-held metal detector can also be used to determine passage of metallic foreign bodies into the stomach, eliminating the need for routine radiographs.27

Figure 25.10 Children sometimes swallow tiny objects or put them in their noses or ears.
Section 3: Foreign Bodies

3.1 Subcutaneous Foreign-Body Removal

Subcutaneous foreign bodies often can be removed with simple methods appropriate to the type of foreign body retained. In general, it is best to attempt office removal of a foreign body only if its exact location can be determined by palpation or visualization. Radiographic localization is often deceptive in that, without fluoroscopy, the foreign body can be much more difficult to localize than anticipated. Surgical consultation, if available, is preferable for removal of foreign bodies that are not easily located.

**Technique**

1. Obtain anteroposterior and lateral radiographs of the affected part to localize a radiodense foreign body. Most glass is radiodense.
2. Prepare the site adjacent to the entrance wound with an antiseptic such as povidone-iodine.
3. For a long, sharp, metallic foreign body, such as a needle, pin, or nail:
   - Anesthetize the skin adjacent to the entrance wound and along the shaft of the foreign body with a short-acting local anesthetic such as lidocaine (lignocaine).
   - Slightly enlarge the entrance wound.
   - Press gently over the deep end of the foreign body to elevate the superficial end into the entrance wound.
   - Pass a straight mosquito hemostat into the entrance wound until it makes contact with the foreign body (Figure 25.11).
   - Open the jaws of the hemostat, grasp the foreign body, and remove the hemostat and foreign body as a unit.
4. For a horizontally embedded wooden splinter:
   - Anesthetize the skin along the entire length of the splinter with a short-acting local anesthetic, such as lidocaine (lignocaine).
   - Incise the skin over the splinter starting over the entrance wound and extend as far as necessary to expose the end of the splinter. Remove the splinter with a straight mosquito hemostat. It is important to visualize the entire foreign body before removal so that the likelihood of retained fragments is reduced (Figure 25.12).
8. Loosely close the skin if necessary.

5. Because a vertically embedded wooden splinter will not be visualized completely before removal, it is likely that a portion of the splinter will remain in the wound, increasing the risk of subsequent infection and need for surgical consultation later. In general, this type of foreign body is best removed in consultation with a surgeon.
**3.2 Nail Bed Splinter Removal**

1. Use of a digital block can facilitate splinter removal.
2. Pass a straight mosquito hemostat with jaws closed along the underside of the nail directly adjacent and parallel to the splinter, just past its tip, once on each side of the splinter.
3. Slightly open the jaws of the hemostat and pass each blade along the underside of the nail, straddling the splinter (Figure 25.13).
4. Close the jaws of the hemostat over the splinter and gently extract the hemostat and splinter as a unit.

![Figure 25.13](image-url) Nail bed splinter removal.

If the splinter appears likely to fragment during removal or if fragmentation occurs during attempted removal, the overlying portion of the nail should be removed so that complete splinter removal is ensured under direct visualization:

1. Test effectiveness of digital block.
2. Dissect under the nail with a hemostat, being careful to not injure the nail matrix.
3. Using sharp-pointed scissors, cut out the appropriate nail section to completely expose the splinter.
4. Lift the splinter out carefully and completely.
5. Irrigate the area using normal saline through an 18-gauge needle in a large syringe.
6. Dress the wound with nonadherent gauze, then sterile gauze and tape.
7. Arrange for wound recheck and dressing change the next day.

**3.3 Ocular Foreign-Body Removal**

Irrigation of the eye will remove particulate matter that can cause corneal abrasions or ulcerations. Superficial ocular foreign bodies that cannot be dislodged through repetitive blinking or washing the foreign body toward the medial canthus usually can be removed following the procedures described below.

**Eye Irrigation Technique**

1. Check visual acuity (in right eye, left eye, and both eyes) before irrigation. The only exception is alkaline exposures to the eye. Immediate removal of particulate matter and irrigation are appropriate in this case.
2. Using a topical anesthetic, such as proparacaine (0.5%), can enhance patient tolerance and lead to a better result.
3. Gauze pads are helpful to grasp the periorbital tissue and hold the eye open for irrigation.
4. Whenever possible, pull down the lower eyelid and evert the upper eyelid to irrigate most effectively.
5. In cooperative patients, a Morgan Lens can be helpful for prolonged irrigation (eg, alkaline exposures).

**Ocular Foreign-Body Removal Technique**

1. The use of a topical anesthetic, such as proparacaine, might facilitate foreign-body removal.
2. For loose foreign bodies, press the eyelashes against the superior orbital rim. Locate the foreign body and gently brush it downward with a moistened cotton-tipped applicator (Figure 25.14).

![Figure 25.14](image-url) Ocular foreign-body removal.
3.4 Cerumen and Aural Foreign-Body Removal

The only attempts to remove foreign bodies that should be made are those that are likely to end in success. Unsuccessful manipulation can cause bleeding, movement of the foreign body to a less accessible area, and mucosal edema, making the task of removal for an otolaryngology consultant even more difficult. Explain the procedure to the parent and child. It is best to accomplish removal without violating the child's trust.

Technique

Impacted cerumen and loose foreign bodies usually can be removed with the following technique:

1. Assess the need for sedation and administer medications as indicated.
2. Ensure adequate immobilization with a sheet or papoose board, along with assistants as needed. Adequate immobilization will reduce the risk of injury to the child and staff.
3. Place traction on the pinna, exposing the external auditory canal (Figure 25.16A).
4. Insert the operating head of an otoscope into the external auditory canal if necessary to expose the impacted cerumen or foreign body (Figure 25.16B).
5. For soft cerumen or foreign bodies such as food matter, pass a long, narrow, cylindric, thin-walled Frazier-type suction device into the external auditory canal until it makes contact with the entrapped matter. Occlude the side port of the suction device and then gently extract the suction device and entrapped matter as a unit.
6. Repeat as necessary.
7. For hard cerumen or hard foreign bodies, pass a cerumen spoon into the external auditory canal along its outer circumference, opposite the impacted cerumen or foreign body, until the tip of the instrument has passed beyond it. Rotate the cerumen spoon until its angulated tip engages the entrapped matter. Then gently extract the instrument, pulling the entrapped matter.
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3. Nasal Foreign-Body Removal

Again, do not attempt to remove a foreign body unless success is likely. Unsuccessful manipulation can cause bleeding, movement of the foreign body to a less accessible area, and mucosal edema, making the task of removal for an otolaryngology consultant even more difficult. Explain the procedure to the parent and child. It is best to accomplish removal without violating the child’s trust.

Technique

1. Assess the need for sedation and administer medications as indicated.
2. Ensure adequate immobilization with a sheet or papoose board, along with assistants as needed. Adequate immobilization will reduce the risk of injury to the child and staff.
3. Instill a topical vasoconstrictor, such as phenylephrine, cocaine, or epinephrine (adrenaline), to reduce nasal mucosal tissue.
4. With a good headlight or alternative light source for visualization, insert a nasal speculum and open it vertically to avoid injury to the nasal septum.
5. Depending on the shape and size of the foreign body, use one of the following techniques:
   - The “parent’s kiss” technique can be a successful first-line method. After reassuring the patient, a parent can hold the child’s mouth open with a hand on the chin, occlude the nostril opposite the foreign body, place the adult’s mouth against the open mouth of the child and deliver a short, sharp mouth-to-mouth breath. The goal is to create positive pressure behind the foreign body, forcing it outward through the nose.
   - Using alligator forceps, grasp the foreign body and extract it.
   - Place a wire loop or curette behind the foreign body and extract the foreign body and loop as a unit.
   - Attach a suction apparatus to the foreign body and extract it.
   - Apply an adhesive (eg, Super Glue) to a cotton-tipped applicator. Once the foreign body has adhered to the applicator, it can be extracted.
   - Pass a Foley or Fogarty catheter (size 8) beyond the object, then inflate the balloon and withdraw it along with the foreign body. Commercially available extractors use the same concept and are available with a smaller catheter and attached balloon specifically designed for extraction of pediatric ear and nose foreign bodies.
6. Once a foreign body is removed, check for additional objects in the nose and ears.
7. If removal is unsuccessful, immediate otolaryngology consultation should be sought. If immediate removal is not essential, the child can be given antibiotics and referred to an otolaryngologist for removal.

Section 4: Minor Burns

4.1 Minor Burns

Minor burns can be defined as superficial or partial thickness burns that do not require inpatient or burn center care. Most sunburn, scald, and contact burns that involve less than 10% of total body surface area are considered minor. Children with scald or contact partial thickness burns involving 10% or greater of total body surface area, any burns involving the eyes, ears, face, hands, feet, or genitalia, and those crossing a joint space require consultation with a burn specialist (Figure 25.18). Children with electrical burns and burns associated with inhalation injury or major trauma also are candidates for inpatient care. Burn size can be estimated using the rule of nines modified for use in pediatric patients (Figure 25.19) or the rule of palms, which states that the palmar surface of a child’s hand is equal to approximately 1% of body surface area (Figure 25.20).
Outpatient treatment of minor burns begins with gentle cleansing of burned skin with mild soap or detergent (eg, chlorhexidine scrub), then with sterile water or saline. Once the wound has been cleansed, bullae that have broken are débrided carefully with clean instruments. Intact bullae are not opened. Finally, a thin layer of silver sulfadiazine cream is applied to the wound and covered with nonadherent gauze; avoid using silver sulfadiazine on the face or in patients with sulfa allergy. Bacitracin ointment should be used on the face and bacitracin ophthalmic ointment used on burns near the eyes. This process is repeated daily. Follow-up medical evaluation should be arranged for at least twice weekly. Daily rechecks might be indicated initially for more complex wounds. Prophylactic antibiotics should be avoided because they can promote the emergence of resistant organisms. Tetanus immunization status should be confirmed and toxoid administered as indicated. Oral fluids are encouraged to replace transepidermal water losses that occur when skin is not intact.

Section 5: Miscellaneous Procedures

5.1 Subungual Hematoma Drainage

The decision to drain a subungual hematoma is based on the size of the hematoma, pain experienced by the child, and age of the hematoma. Injuries less than 1 or 2 days old are more likely to be made less painful with drainage. If there is spontaneous drainage of blood from around the edges of the nail, nail trephination is usually not necessary. The relative merits of alternative nonsurgical treatment with elevation and oral analgesics are considered in the decision to drain a subungual hematoma. Subungual hematomas can be decompressed easily.

Technique

1. Prepare the nail with an antiseptic such as povidone-iodine.
2. Consider using a digital block with an anesthetic such as lidocaine (lignocaine). Anesthesia is not necessary if the child is cooperative, and the procedure can be performed in a controlled manner so the nail bed itself is not penetrated.
3. Unfold a standard paper clip and hold one end in a flame for several seconds until the tip becomes red hot. A battery-operated, hand-held cautery unit or 18-gauge needle can be used instead of a hot paper clip.

4. Immediately apply the hot tip to the nail overlying the center of the hematoma, using gentle pressure until it burns a hole in the nail (Figure 25.21). Then remove the paper clip. This permits sufficient decompression of the hematoma to relieve the pain as the remainder of the subungual hematoma spontaneously resorbs. Because small holes in the nail can occlude with clotted blood, making more than one hole in the nail might be a good idea.

5.2 Paronychia
A paronychia is an infection involving the soft tissue folds of the fingernail or toenail. If there is only erythema and soft tissue swelling, it might be possible to treat with a combination of frequent warm water soaks and oral semisynthetic penicillin, cephalosporin, or other antistaphylococcal antibiotic (eg, clindamycin or trimethoprim-sulfamethoxazole) appropriate to local resistance patterns. If there is fluctuance, definitive treatment must include drainage of the pus. Paronychia can be drained in several ways. It is usually not necessary to remove the nail to drain the paronychia. Antibiotics are usually not necessary after successful evacuation of pus from a paronychia.

Technique
1. Consider digital block and/or systemic sedation.
2. Soften the epichondrium and nail by soaking it in warm water.
3. At the point of maximal swelling, lift the epichondrium from its attachment to the nail using scissors or hemostats or pierce the area of maximal swelling with an 18-gauge needle or a scalpel.
4. Hold the instrument parallel to the nail and gently sweep from side to side, breaking up any loculations of pus while minimizing damage to the nail bed (Figure 25.22).
5. Allow the pus to escape and irrigate the area with normal saline.
6. Place a small piece of gauze between the nail and epichondrium to allow continued drainage.
7. The gauze can be removed at follow-up 1 to 2 days later.

Figure 25.21  Apply the hot tip to the nail overlying the center of the hematoma.

Figure 25.22  Method for drainage of a simple paronychia.

If subungual pus is present or if the previous methods have been unsuccessful, consider partial nail removal.
1. Place digital block.
2. Lift the epichondrium off the nail using scissors or hemostats.
3. Dissect the portion of the nail to be removed from the nail bed using hemostats, being careful not to damage the nail matrix.
4. Using scissors, make a cut along the longitudinal axis of the fingernail to remove one-quarter of the nail.
5. Be sure the portion of the nail to be removed is completely freed from the nail bed all the way back to the nail matrix.
6. Grasp the nail firmly with hemostats and remove.
7. Allow pus to escape and irrigate the area.
8. Obtain hemostasis.
9. Place nonadherent gauze and a sterile dressing over the wound. If nonadherent gauze is not available, an antibiotic ointment can be used.
10. Have the patient follow up in 1 to 2 days.

5.3 Skin Abscess Incision and Drainage
A skin abscess is a localized infection that has coalesced to form pus. In the early stages of a skin infection, there might be only redness, tenderness, warmth, and swelling. In such cases it is advisable to treat with warm compresses, systemic antibiotics, and frequent reevaluation. However, if there is softening of the area (fluctuance) or if there is any draining of pus from the wound, drainage is necessary.

The drainage procedure used is largely dependent on the size and site of the abscess. Examples of special cases that require surgical consultation include deep tissue abscesses of the face, hand, perineum, or foot. Bedside ultrasonography, when available, can assist in determining the presence, size, and depth of a skin abscess. Most abscesses encountered in pediatrics do not involve deep tissue structures and can be handled as an outpatient procedure without surgical consultation.

Routine use of antibiotics after adequate incision and drainage of a simple subcutaneous abscess is controversial. If antibiotics are indicated (eg, sensitive location, significant surrounding cellulitis, or a child at increased immunologic risk), local patterns of antibiotic resistance (particularly community-acquired methicillin-resistant Staphylococcus aureus) should be considered in choosing an appropriate antibiotic.

**Technique**
1. Scrub the skin with an antibacterial solution such as povidone-iodine. Use an expanding spiral pattern to scrub three times, allowing the povidone-iodine to dry between applications.
2. Use topical anesthesia (lidocaine [lignocaine] cream) followed by injected local anesthetic (lidocaine [lignocaine] or bupivacaine) to provide local pain relief. Recall that local anesthetics are inactivated by the acidic environment within an abscess and will only anesthetize the overlying and surrounding skin and subcutaneous tissue. Consider systemic analgesia and sedation.
3. Using a scalpel, incise along the entire length of the abscess cavity ([Figure 25.23A](#)).
4. Insert and spread hemostats into the abscess cavity to break up any loculations.
5. Irrigate the abscess cavity ([Figure 25.23B](#)).
6. If a cavity remains, gauze packing is placed in the abscess to allow continued drainage. 1 cm of the packing should remain outside of the wound to act as a wick and to allow removal.
7. Cover the site with a sterile dressing.
8. Send pus to the laboratory for culture.
9. Arrange follow-up care for the next day.

5.4 Fish Hook Removal
Fish hooks usually can be removed with any of several methods. If the fish hook is not barbed, it can easily be removed by retrograde traction. Do not attempt fish hook removal without subspecialty consultation when removal can lead to tearing through the eyelid margin or other serious complications.

The preferred removal method will depend on patient cooperativeness and physician comfort with each technique. Although simplest to perform, the advance and cut technique requires the use of wire cutters and traumatizes previously undamaged tissue.
2. Depress the shaft of the fish hook using the thumb, then depress the curved portion of the hook with the index finger to disengage the barb from the subcutaneous tissue.

3. Pull sharply and strongly with the string to remove the fish hook.

The string traction method is particularly useful if local anesthesia is not preferred or impossible.

1. Wrap a loop of string around the curve of the fish hook.

**Technique**

The needle-over-barb technique can be easily mastered and is generally effective.

1. Prepare the skin adjacent to the entrance wound with an antiseptic, such as povidone-iodine.

2. Anesthetize the skin overlying the barb with a short-acting local anesthetic, such as lidocaine (lignocaine).

3. With the beveled tip facing the barb, pass a needle through the skin so the beveled tip engages the sharp end of the barb; extract the needle and hook as a unit (**Figure 25.24A, B**).

The string traction method is particularly useful if local anesthesia is not preferred or impossible.

1. Wrap a loop of string around the curve of the fish hook.
4. Cut the barb from the hook with wire cutters and then retract the hook, following the curve until completely removed (Figure 25.26).

Figure 25.25 Advance the fish hook, following the curve, until the barb passes outside the skin.

Figure 25.26 Cut the barb from the hook with wire cutters.

5.5 Ring Removal

Rings entrapped by soft tissue swelling of the digit distal to the ring that cannot be removed with lubricant and circular traction (after elevation of the digit and immersion in cold water) often can be removed using the following technique. The proximal interphalangeal joint is usually the major impediment to ring removal. Once the ring can be loosened beyond this point, it will typically be simpler to remove.

Technique

1. Use of a digital block can aid cooperation and facilitate ring removal.

2. Wrap a piece of string, heavy silk suture, or umbilical tape around the finger, starting proximal to the ring and pulling the end under the ring.

3. Continue wrapping tightly around the digit, moving from proximal to a point beyond the distal interphalangeal joint, laying each turn so that it touches the other and in such a way that the outer circumference of each turn is slightly less than the inner circumference of the entrapped ring (Figure 25.27).

4. Unwind the proximal end of the string and pull the ring gently but firmly toward the distal end of the digit.

5. The string will lift the ring off the finger as it unravels circumferentially (Figure 25.28). If the ring is not successfully removed by this method, a ring cutter or Dremel tool can be used. If a high-speed cutting tool is used, be sure to protect the skin of the finger from mechanical or thermal injury by irrigating the site with cool water while cutting the ring and by sliding a thin metal barrier between the ring and finger. After cutting through the ring, the cut ends can be spread to facilitate removal.

Figure 25.27 Wrap the string so that each turn touches the other.
Section 5: Miscellaneous Procedures

5.6 Contact Lens Removal

Requests for contact lens removal might be due to the inability to “find” the contact lens or actual inability to remove the lens after visualization.

**Technique**

1. Perform visual acuity testing. The child can use an ophthalmoscope to reproduce the corrective lens while viewing the eye chart.
2. Examine the eye, looking for a fine, curvilinear shape over the sclera, which represents one edge of the contact lens.
3. Use a topical anesthetic, such as proparacaine (0.5%), to facilitate thorough examination and removal.
4. If the lens is not easily visible, evert the eyelid.
5. If the lens still cannot be seen, evert the eyelid and sweep under the eyelid with a moist cotton swab.
6. Do not place fluorescein in the eye without notifying the family that the lens will be permanently discolored.

**Removal**

For a hard contact lens, push the edge of the lower eyelid under the edge of the contact lens while pushing the upper lid against the upper edge of the contact lens. Once the contact lens is lifted off the globe, it can easily be lifted out of the eye.

For a soft contact lens, slide the contact lens off the cornea onto the sclera, then pinch the contact lens between the thumb and index finger while lifting it off the globe. If the soft contact lens was initially dried out, it should be moistened by the instillation of local anesthetic. If the lens is still dry and difficult to bend, additional saline eye drops can be used.

Examine the eye for evidence of conjunctival trauma, retained foreign body, hemorrhage, and corneal ulceration or abrasion. If significant pain or corneal abrasion is present, consider the use of topical mydriatics, oral analgesics, and eye patching for comfort.

5.7 Eye Patching

In the past, eye patches in the pediatric emergency setting were used mostly for corneal abrasions. Because the literature suggests that there is no advantage to patching over the use of topical antibiotics and systemic analgesics for patients with small (<2 mm) corneal abrasions, eye patches are not frequently indicated for children in the emergency setting. Indications for pressure patching include larger corneal abrasions, chemical injuries, and UV light injuries. Simple patches can be used to protect a dilated eye from exposure to sunlight. Patches are contraindicated in the presence of an active corneal infection or penetrating injury.

**Placement of a Pressure Patch**

The goal of patching is to create adequate pressure under the patch to keep the eyelid closed, thus protecting the cornea from movements of the eyelid.

**Technique**

1. Place a topical anesthetic and mydriatic eye drop in the eye to be patched. Always have pilocarpine on hand when instilling a mydriatic agent, especially if there is a family history of narrow-angle glaucoma. If acute eye pain develops after instillation of a mydriatic agent, immediately instill pilocarpine.
2. Have the patient keep both eyes closed during the entire patching procedure.
3. Place a folded, vertically oriented eye patch in the orbital recess.
4. Overlay a horizontally oriented eye patch, holding both in position with one finger.

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*Figure 25.28*  The string will lift the ring off the finger as it unravels.

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5. Tape the patch securely in place while maintaining both patches in position using gentle, steady pressure.

6. Pull the tape firmly across the patched eye from cheek to forehead, while the patient or an assistant pulls the lips away from the affected side. This reduces the movement of the tape and patch with lip movements and makes the patch more comfortable for the patient.

7. Repeat the placement of tape two or three additional times until all areas of the patch are held firmly in place.

8. If age appropriate, have the patient open the unaffected eye and ask if the affected eye remains closed.

9. Have the patient follow up the next day to remove the patch and reexamine the eye.

5.8 Tooth Reimplantation and Stabilization

Avulsion of a primary tooth does not require reimplantation. Avulsion of a permanent tooth requires reimplantation as soon as possible; even a 30-minute delay can preclude successful reimplantation. Hold the tooth by the crown, avoiding trauma to the root surface and periodontal ligament. Quickly immerse the tooth in cold milk or place under the tongue of the child (as age appropriate) or parent. Placing the tooth in commercially available Hanks solution, a cell culture medium, might significantly extend the reimplantation window and should be done if possible.

Technique

1. After proper anesthesia, suction clot from the socket and irrigate the socket with normal saline.

2. Cleanse the tooth gently with irrigation. Avoid scrubbing, which can traumatize the root surface.

3. Place the tooth gently into the socket, then fully seat the tooth with firm pressure.

4. Stabilization can be accomplished with a variety of techniques; two simple, non-invasive methods are described:

   • Commercially available periodontal packs composed of a putty-like substance can be formed around the affected tooth and the teeth on both sides. A resin and catalyst are mixed together to form a paste, which is kneaded to obtain the proper consistency. This is a temporary stabilization technique to be used only with timely dental consultation.

   • Heavy silk suture can be tied in a figure-8 pattern around the replanted tooth and adjacent tooth. The teeth are anchored together as the suture is tightened and knotted in place.

5. Advise the patient to avoid further trauma and chewy or hard foods to reduce the risk of loosening the replanted tooth.

6. Have the patient follow-up with a dentist in 1 or 2 days.

5.9 Management of Penile Zipper Injury

Young, uncircumcised boys, usually between the ages of 3 and 6 years, can entrap the foreskin in the zipper mechanism when attempting to zip their pants. Splitting the median bar of the zipper mechanism with a bone cutter (or wire cutter) can be accomplished without local or general anesthesia as long as the patient remains cooperative (Figure 5.29). If the clothing can be sacrificed, it is advantageous to cut off the bar at the bottom of the zipper and also cut the zipper away from the clothing. Alternatively, the flat blade of a small screwdriver can be used to separate the inner and outer face plates of the zipper, releasing the foreskin.

Technique

1. Splitting the median bar of the zipper mechanism with a bone cutter (or wire cutter) can be accomplished without local or general anesthesia as long as the patient remains cooperative (Figure 5.29). If the clothing can be sacrificed, it is advantageous to cut off the bar at the bottom of the zipper and also cut the zipper away from the clothing. Alternatively, the flat blade of a small screwdriver can be used to separate the inner and outer face plates of the zipper, releasing the foreskin.

2. If proper cutting equipment is not available, it might be possible to pull the skin free from the zipper. Use a local anesthetic, such as lidocaine (lignocaine), then allow liberally applied mineral oil to soak into the foreskin for 10 minutes or more.

3. If the foreskin is caught between the teeth of the zipper only and not in the zipping mechanism, then simply cut the zipper below the entrapment and pull apart the teeth.
Section 5: Miscellaneous Procedures

5.10 Reduction of Inguinal Hernia

Inguinal hernias incarcerate in 10% to 12% of cases. The successful reduction of an incarcerated inguinal hernia allows elective rather than emergency herniorrhaphy. This reduces the complication rate of surgery, lessens the likelihood of bowel strangulation, and relieves the pain associated with incarceration.

**Technique**

1. Place the patient in a slight Trendelenburg position, externally rotating the hip and flexing the knee on the affected side.
2. Place the index and middle fingers of one hand over the hernial bulge in the inguinal canal. Grasp the apex of the hernia with the index and middle fingers of the other hand, providing slow, steady pressure.
3. If this procedure does not reduce the hernia quickly, parenteral sedation and analgesia should be considered, but only in the ED or if proper monitoring is available.
4. After sedation and analgesia, observe the patient in a slight Trendelenburg position for at least 20 minutes in a calm environment with a cool compress applied to the hernia sac.
5. If spontaneous reduction does not occur, reattempt manual reduction as described above. Slow, steady pressure is the key to success.
6. Timely elective surgical consultation for repair of an inguinal hernia is indicated after successful reduction. Inguinal hernia incarceration is likely to recur.
7. Avoid forceful repeated attempts to reduce an incarcerated inguinal hernia. Emergency surgery is indicated if manual attempts are unsuccessful.

5.11 Reduction of Paraphimosis

A paraphimosis occurs when a phimotic foreskin is retracted proximal to the glans penis and subsequent venous congestion edema prevents repositioning of the foreskin back to its normal position. Paraphimosis is a true urologic emergency that requires rapid reduction to reduce the risk of arterial compromise and necrosis. Immediate reduction also prevents further swelling and pain.

**Technique**

**Manual Reduction**

1. Consider systemic analgesia.
2. Apply topical anesthetic lubricant to the glans penis and inside of the foreskin. Do not apply to the penile shaft: this will make it more difficult to grasp the skin of the penile shaft.
3. If markedly swollen, consider the use of an ice slurry to reduce edema before attempting manual reduction. Fill an examination glove with crushed ice and water to create an ice slurry. Slide the penis into the thumb portion of the glove, holding it in place with gentle compression for 5 to 10 minutes.
4. Identify the location of the phimotic ring.
5. Stabilize the skin of the penile shaft proximal to the phimotic ring by compressing between the index and middle fingers of both hands.
6. Place the thumbs of both hands against the urethral opening using slow, steady, firm pressure to “push” the glans penis through the phimotic ring.

**Phimotic Ring Incision**

A urologist should be consulted if possible. This procedure should only be used when manual reduction is not possible.

1. Consider systemic analgesia.
2. Using a sterile procedure, cleanse the penis and infiltrate locally with 1% lidocaine (lignocaine) on and around the dorsal aspect of the phimotic ring.
3. Incise perpendicular to the phimotic ring, being careful to avoid injury to the penile shaft.
4. The constricting ring will spring open once it is completely incised.
5. Reduce foreskin back to its normal position.

**5.12 Reduction of Rectal Prolapse**

Partial rectal prolapse is the abnormal protrusion of rectal mucosa and submucosa through the anus. This condition occurs most commonly in the toddler age group and is not usually associated with an underlying condition. Straining with stool and excessive spreading of the gluteal folds (often caused by the use of an adult-sized toilet by a small child) are the most likely culprits. Complete rectal prolapse or protrusion of the entire rectal wall through the rectum is more common in older children and is associated with diseases such as cystic fibrosis, rectal polyps, and ascites. There is no contraindication to the procedure, and rectal prolapse should be reduced as soon as possible to avoid rare complications of bleeding, ulceration, and ischemia.

**Technique**

1. Adequately relax and/or sedate the child.
2. Place the child in the knee-chest position on the examination table or prone over the parent’s lap.
3. Stabilize the position of the buttocks using the nondominant hand.
4. Wrap a gloved index finger of the dominant hand with several layers of toilet tissue.
5. Insert the wrapped index finger into the lumen of the prolapsed rectal tissue, exerting constant, firm pressure while pushing it into the anal orifice.
6. The dry toilet tissue will attach to the rectal mucosa, allowing the index finger pressure to reduce the prolapsed segment. The prolapsed segment can be additionally guided using the fingers of the nondominant hand.
7. Once the prolapse has been reduced, remove the gloved index finger and leave the toilet tissue inside the rectum to be passed with the next bowel movement.
8. Refer for follow-up care to be sure that underlying condition is determined and the primary causes are addressed. Changes such as using a child-sized toilet seat or stool softeners might be necessary.

**THE BOTTOM LINE**

- Preparation of an office for handling pediatric emergencies need not be time-consuming or expensive.
- Proper matching of staff training, supplies, and equipment with the number and type of emergencies anticipated will lead to improved staff confidence and allow the office facility to meet reasonable emergency care needs.
- Attainment of skills to handle minor trauma and the occasional critically ill or injured child will enhance patient care and provide optimal outcome.
Check Your Knowledge

1. Which of the following statements regarding a paronychia is correct?
   A. Can be treated in the physician’s office or emergency department
   B. Deep space infection of the hands and feet
   C. Usually painless
   D. Usually requires removal of the nail on the affected digit

2. Which of the following statements regarding paraphimosis is correct?
   A. Associated with a phimotic ring of the foreskin
   B. Painless
   C. Can be reduced electively
   D. Should be reduced only by a urologist
   E. Usually seen as part of a febrile illness

3. All of the following are examples of appropriate management of an avulsed permanent tooth EXCEPT:
   A. avoiding further trauma after reimplantation.
   B. handling the tooth by the root surface.
   C. reimplanting the tooth as soon as possible.
   D. stabilizing the tooth using a periodontal pack or sutures, if possible.

4. Correct application of tissue adhesive includes which of the following?
   A. Complete hemostasis
   B. Debridement of foreign bodies or materials
   C. Immobilization
   D. Thorough wound cleansing and irrigation
   E. All of the above

References


Chapter Review


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