

# Basic Laceration Repair



**JUMIE LEE, MSN, CPNP-AC/PC**

**PEDIATRIC EMERGENCY MEDICINE LEARNING MODULE  
HARBOR UCLA MEDICAL CENTER  
JUNE 2020**

# Laceration: Basics

- 3 year old boy jumping on a couch and landed on a corner of a coffee table 1 hour ago. No hx of LOC or neuro changes. Presenting with stable vital signs and child is not in any distress.

**What next?**



<https://apps.ohsu.edu/health/md-4kids/new/image-477.html>

# Laceration: Basics



## Main Goals for Repair

1. Hemostasis
2. Functional closure
3. Decrease the risk of infection
4. Cosmesis

## Assessment

1. Mechanism of injury
2. Location (anatomical and environmental), length, depth, and width
3. Time of injury
4. Contaminants/foreign body
5. Explore damage to underlying deep structures (tendons, muscles, bones, vessels)
6. Assess for NAT (unusual or unexplained injury)
7. Comorbid disease/Tetanus status

# Laceration: Basics



## Decisions:

- 1. Timing of the wound closure:** Primary, delayed primary closure or healing by secondary intention
- 2. Repair choices:** Tape (steri-strips) vs. adhesive (dermabond) vs. staples vs. sutures (absorbable vs non-absorbable)
- 3. Specialty consult:** Associated neurovascular injury, fracture, joint contamination, concern for poor cosmesis

# Laceration: Basics



## Repair now?

### Not all wound require immediate repair

1. **Primary closure:** for low risk wound
2. **Delayed primary closure:** for contaminated wound -> clean, re-evaluate and repair in 4-6 days
3. **Heal by secondary intention:** for grossly contaminated wound

## High risk wounds

1. Grossly contaminated
2. Retained FB
3. Underlying open fracture
4. Wound > 12hrs old or > 24hrs old for face
5. Human or cat bites
6. Wounds requiring specialist evaluation
7. Puncture wound

# Anesthetics



## Anesthetics

1. Topical, local, and regional anesthesia
2. Max dose of common anesthetics:
  - A. Lidocaine\*: 4.5 mg/kg (max 300mg)
  - B. Lidocaine with epinephrine: 7 mg/kg (max 500mg)
  - C. Bupivacaine: 2.5 mg/kg (max 175mg)

\*Lido 1% = 10mg/ml; Lido 2% = 20mg/ml

## Topical Anesthetic

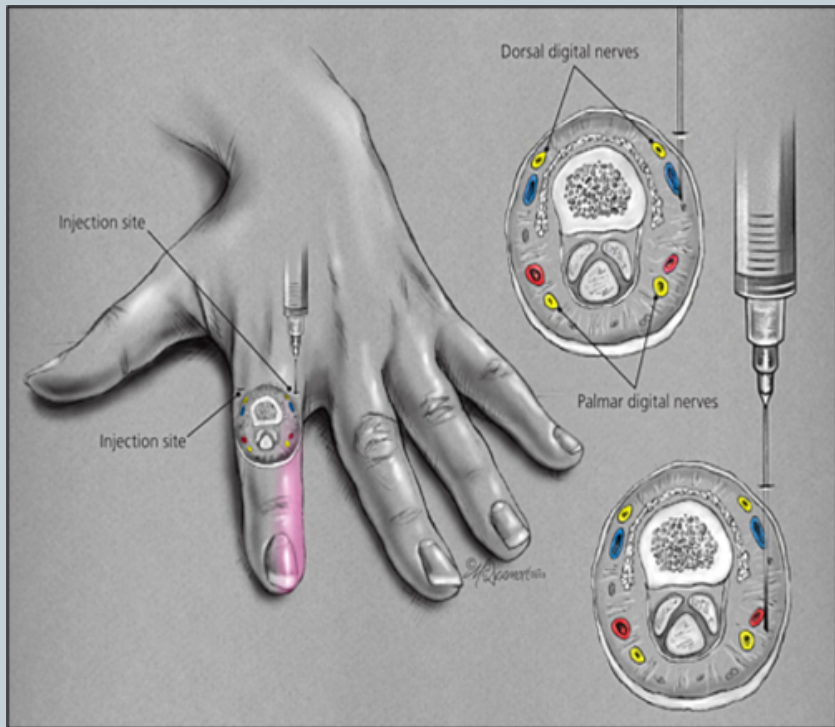
1. **Lidocaine 4%-Epinephrine 0.1%-Tetracaine 0.5% (LET) gel**: Topical 1-3ml (for open skin), onset 20-30 min, duration 45-60min. Can repeat x3 in order to obtain **blanching** (sufficiently numb) skin. Often, injectable anesthetic is not necessary after LET (but good to have on hand).



# Anesthetics



## Regional Block



<https://www.aafp.org/afp/2014/0615/p956.html>

## Local Infiltration



<https://www.doomandbloom.net/how-to-perform-a-nerve-block/>

# Tips on Reducing Injection Pain



1. Wait before repair (onset 5-10 min)
2. Warm up med vial
3. Mix with HCO<sub>3</sub> (10 anesthetic : 1 bicarb ratio) -> less acidic
4. Traction/distraction
5. Tiny needle (27-30g), tiny syringe (tuberculin)
6. Slow injection/small volumes (nerve ending to get accommodated)
7. Perpendicular injection: at 90 degrees to skin surface (less nerve ending in contact with needle)
8. Through wound edge



# Analgesia



<b>Meds</b>	<b>Route</b>	<b>Dose</b>	<b>Max</b>
Acetaminophen	Oral	15mg/kg/dose	650mg/dose
Ibuprofen	Oral	10mg/kg/dose	400mg/dose
Fentanyl	IN	1.5-2mcg/kg/dose	50mcg/dose 1ml/each nostril max
Fentanyl	IV	1mcq/kg/dose	50mcq/dose
Morphine	IV	0.05-0.1mg/kg/dose	5mg/dose
Ketorolac	IV	0.25-0.5mg/kg/dose	10mg/dose

# Anxiolysis/Sedation

## Anxiolysis

Meds	Route	Dose	Max
Midazolam	PO	0.25-0.5mg/kg	15mg
Midazolam	IV	0.1mg/kg	2mg
Midazolam	IN	0.2- 0.3mg/kg	10mg
Nitrous Oxide (N2O)	FM	50-70% N2O/O2  On demand vs. MD applying	n/a

## Sedation

Meds	Route	Dose	Max
Ketamine	IV	1-2mg/kg	100mg
	IM	4-5mg/kg	
Fentanyl	IV	1mcq/kg/dose	50mcq * Combo with Midazolam
Midazolam	IV	0.05-0.1mg/kg/dose	2mg *Combo with Fentanyl
Propofol	IV	0.5-1mg/kg initial loading dose, titrate 0.5mg/kg q3-5min	3mg/kg

# Laceration: Basics



## Irrigation and closure

1. Irrigation volume: 50–100ml/cm of laceration length or until no more visible debris. Tap water and non sterile gloves are ok.
2. Pressure: 5–8lb/PSI (approx. 19G catheter on 60ml syringe)
3. Clean wound localized to extremities < 12 hours post injury or to face and scalp up to 18–24 hours post injury

## Antibiotics

1. Grossly contaminated wound
2. Deep puncture wound/retained FB
3. Animal/ human bite
4. Immunocompromised
5. Late presentation with evidence of infection
6. Extensive mucosal injury

# Tetanus Update



## CDC Guideline

<https://www.cdc.gov/tetanus/clinicians.html>

- <7yo update with DTap
- >7yo update with Tdap
- **Dirty Wound:** Wounds contaminated with dirt, feces, soil, and saliva; puncture wounds; avulsions; from missiles, crushing, burns, and frostbite (per CDC)

# of tetanus doses received	Clean wound	Dirty wound
< 3 doses or unknown	yes	Yes *TIG (if immunocompromised, HIV)
> = 3 doses	No **Yes ( if last dose>10yr ago)	No **Yes (if last dose >5yr ago)

# Staples



## Indication

1. Good for scalp laceration
2. Wound for which cosmesis not priority, long and linear wounds
3. Contraindicated for use on the face, neck, hands, and feet
4. When involving separation of the galea → place deep sutures to close galea first

## Staples



<https://cobbped.com/for-parents/is-your-child-sick/illness-symptoms/?tCategoryId=1&tArticleId=651>

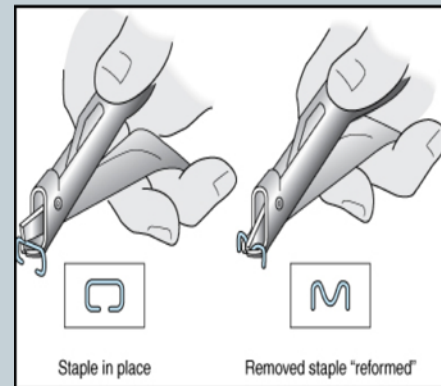
# Staples



## Stapler & Application



## Extractor & Removal



<https://www.medicaldevicedepot.com/Post-Mortem-Skin-Stapler-Non-Sterile-p/853590-cin.htm>  
<https://lacerationrepair.com/techniques/alternative-wound-closure/staples/>

<https://www.ciamedical.com/insights/everything-healthcare-professionals-need-to-know-about-surgical-staples/>  
[https://www.uptodate.com/contents/image?imageKey=EM%2F114821&topicKey=EM%2F6320&source=see\\_link](https://www.uptodate.com/contents/image?imageKey=EM%2F114821&topicKey=EM%2F6320&source=see_link)

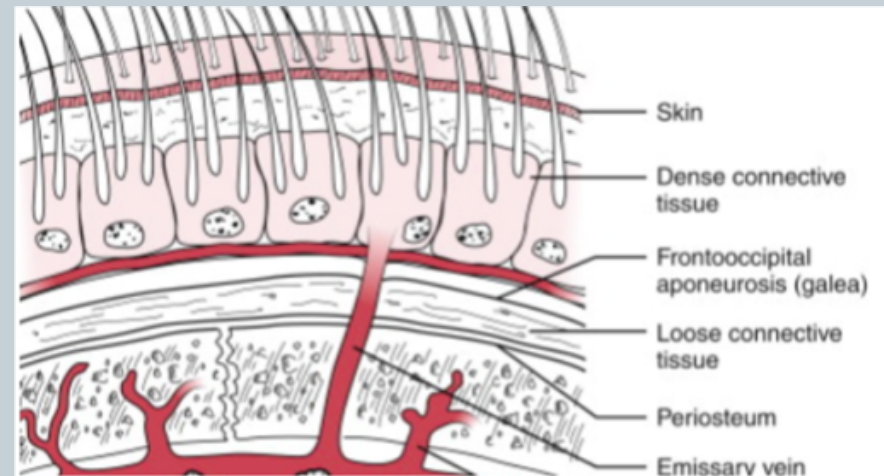
# Deep Scalp (Galeal-level) Laceration

## Management

1. Stop bleeding with direct pressure
  2. Apply LET
  3. Inject lido-epi
  4. Close gaping galea with Vicryl sutures
  5. Staple overlying skin
- \*Trim hair if needed but do not shave.  
May use petroleum jelly to mat down surrounding hair.

## SCALP

- Skin
- Connective tissue
- Aponeurosis (Galea)
- Loose connective tissue
- Periosteum



# Tissue Adhesive



[https://www.agnthos.se/index.php?id\\_product=1126&controller=product](https://www.agnthos.se/index.php?id_product=1126&controller=product)



<https://emedicine.medscape.com/article/874047-overview>



# Tissue Adhesive (Cyanoacrylate)

## Indication

- Clean, short (<5cm), low tension wounds that are easy to approximate

## Advantages

1. Speed of application
2. Painless
3. Less tissue inflammatory response vs. sutures
4. Typically no need for a follow up visit

**Main disadvantage:** lowest strength option (risk wound dehiscence)

## Application

1. Clean wound/ control bleeding
2. Crush the ampule
3. Gently use your fingers or instruments to approximate
4. Apply in a thin single layer, not to drip into wound
5. Allow to dry, then repeat the process x3-4 times

## Video Link:

- [https://www.youtube.com/watch?v=ewJN\\_IAjmTM](https://www.youtube.com/watch?v=ewJN_IAjmTM)

# Tissue Adhesive



## Clinical Pearls

1. Avoid ointment or petroleum jelly on wound (but can remove poorly glued with petroleum jelly and re-glue)
2. Can use steri-strips to approximate wound
3. Do not use on mucous membrane
4. Crush/stellate injuries = not recommended
5. Use Tegaderm technique around eyes

## Tegaderm trick



<https://www.aliem.com/trick-of-trade-preventing-tissue/>

# Suturing



## Indications

- Clean wounds with low risk of infection
- Wounds in areas where cosmesis is paramount (e.g., face, vermillion border)
- Gaping wound not amenable to tissue adhesive
- Wounds over tendons or nerves which need closure for protection

## Contraindications

- Heavily contaminated wounds
- Wound with high risk of infection
- Non cosmetic animal bites
- Wounds with high risk of tissue destruction (high pressure wounds)

# Suturing

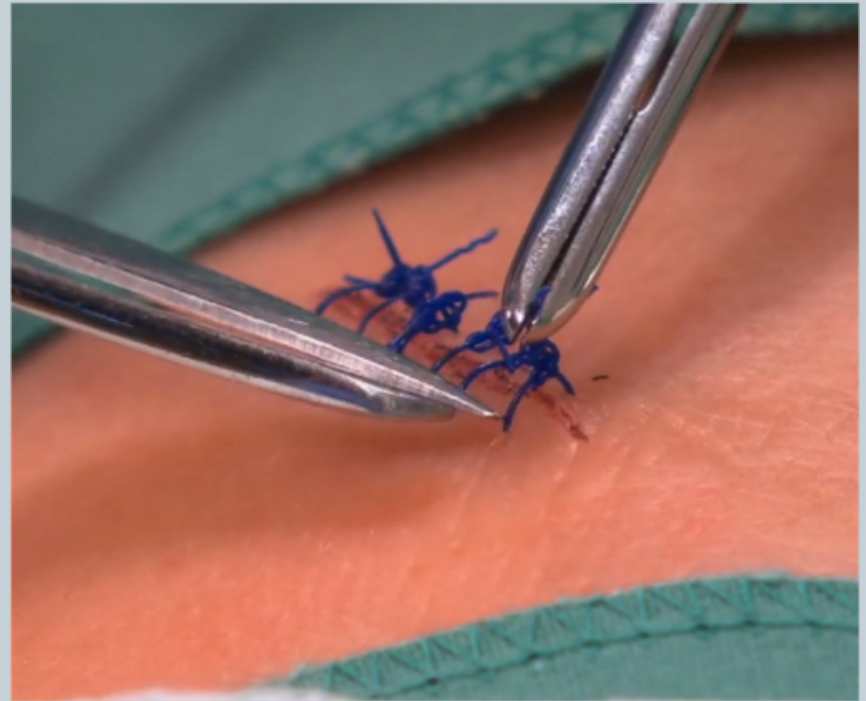


## Application

## Removal

**Video reference for basic suturing techniques:**

<https://lacerationrepair.com/>



<https://willowbrookmedicalsupplies.com/index.php/product/suture-stitches-removal-kit/>

# Suturing Techniques



Suturing method	Use
<b>Simple interrupted</b>	<ul style="list-style-type: none"><li>• Uncomplicated wounds</li><li>• Most commonly used</li><li>• Use absorbable or non-absorbable sutures</li></ul>
<b>Deep dermal sutures</b>	<ul style="list-style-type: none"><li>• Better approximate wound edges, reduce tension</li><li>• Deep wounds at risk for abscess or hematoma formation</li><li>• Use absorbable sutures</li></ul>
<b>Horizontal mattress</b>	<ul style="list-style-type: none"><li>• Gaping wounds/ high tension</li><li>• Potential for worse scarring</li></ul>
<b>Vertical mattress</b>	<ul style="list-style-type: none"><li>• High tension wounds</li><li>• Edges that tend to invert</li><li>• No need for separate deep sutures</li></ul>
<b>Subcuticular</b>	<ul style="list-style-type: none"><li>• Used to minimize scarring</li><li>• Often used by plastic surgeons</li></ul>
<b>Running</b>	<ul style="list-style-type: none"><li>• Rapid closure of long linear wounds</li><li>• Wounds that align easily, low risk of infection</li></ul>

# Suturing



## Sutures

### Type

- Non-absorbable (epidermis) vs. Absorbable (mucosal or buried layer)

### Size

- 4-0 for trunk
- 4 or 5-0 for extremity or scalp
- 5 or 6-0 for face
- 4 or 5-0 for mucosa (absorbable)

## Needles

### Type

- Taper (Round body) - bowel or blood vessel
- Cutting - skin

### Size

- Bigger the number → Smaller the size of suture (00 to 10-0)

# Suture Type and Size



Location	Suture Type	Size
Face	Nylon (Prolene or Ethilon) Fast-absorbing gut or Vicryl Rapide	5.0/6.0
Lip	Fast Absorbing gut or Chromic gut	5.0/6.0
Eyebrow/Ear	Fast Absorbing gut	5.0/6.0
Buccal Mucosa / Tongue	Chromic gut	3.0/4.0
Scalp	Staples, Vicryl for deep sutures, galea	4.0/5.0
Extremities/ trunk	Absorbable: Vicryl Rapide Fast absorbing gut  Non absorbable: Nylon (Prolene or Ethilon)	4.0/5.0

# Suturing



## Disposition

### Admit:

1. Hypovolemia
2. >10% BSA

### Referral:

1. Deep wound to hands or feet
2. Lac involving nerve, joints, crush injuries, bones, eye lid margin or lacrimal duct, concern for cosmetic outcome
3. Lac involving genitals

## Timing of removal

Location	Days
Face	3-5 d
Scalp/arms	7-10 d
Trunk/leg/hands /feet	7-10 d
High Tension Areas/joints	10-14 d



# References



1. DeBoard RH, Rondeau DF, Kang CS, Sabbaj A, McManus JG. Principles of basic wound evaluation and management in the emergency department. *Emerg Med Clin North Am.* 2007;25(1):23-39.
2. Havers FP, Moro PL, Hunter P, et al. Use of tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccines: Updated recommendations of the Advisory Committee on Immunization Practices - United States, 2019. *MMWR Morb Mortal Wkly Rep* 2020; 69:77.
3. Lammers RL, Smith ZE. Methods of Wound Closure. Robert and Hedges' *Clinical Procedures in Emergency Medicine* Ed 6. Saunders, 2013. 644-689.
4. Trott AT. *Wounds and Lacerations: Emergency Care and Closure.* Ed 3. Elsevier Mosby, 2005. 5-151.
5. <https://www.cdc.gov/vaccines/vpd/dtap-tdap-td/hcp/index.html>
6. <https://lacerationrepair.com/>
7. <https://www.aliem.com/pv-laceration-repair-and-sutures/>