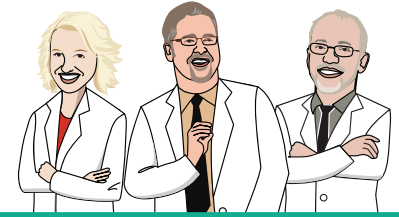




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WOUND MANAGEMENT – PART 1

Jessica Mason MD, Stuart Swadron MD, Mel Herbert MD

** Drug doses are a guide only, always check a second source and follow local practice guidelines*

Take Home Points:

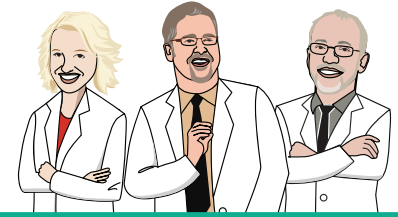
- Wound care skills are essential for every emergency provider; it is well worth the time to improve and add to our skills
- Wounds should be closed as soon as possible but closure after as long as 24 hours may be considered in areas of high cosmetic sensitivity and a low likelihood of infection such as the face
- Wounds should be anesthetized first, prior to irrigation
- The skin around the wound should be cleansed and the wound inspected for foreign bodies and injury to deeper structures (nerves, tendons and major blood vessels)
- Having a small selection of different suture types and sizes is more than adequate for most wounds
- Simple interrupted sutures are the most important technique to know and can be used to close most lacerations
- Multiple EMRAP:HD videos links demonstrate the various steps in good wound care
- Antibiotic and tetanus prophylaxis are indicated only in specific cases
- The timing of suture removal is important to maximize wound strength and minimize poor cosmetic outcome

Background

In this two-part episode of C3, we explore one of the most central tasks of acute and emergency care: the management of wounds. In the first part, we cover the basics: cleansing and preparing wounds, the decision of how (or even whether) to close a wound, analgesia and anesthesia, simple suturing techniques, and discharge instructions. In the second part, we will cover more complex wounds and the suturing techniques that can be used to manage them.

Basic Principles

- Goals of wound care
 - Identify complications:
 - Foreign bodies
 - Nerve injuries
 - Tendon injuries



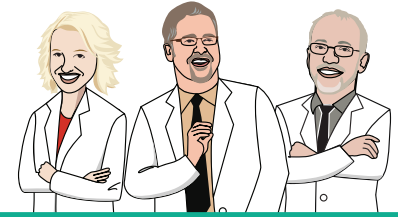
- Infection
 - Extension into joints or other vital structures
 - Cosmesis
- The “Golden Period” for laceration repair
 - There is a relationship between the duration of time that a wound is left open prior to repair and its likelihood of becoming infected but the concept of the “Golden Period” has been questioned
 - Some studies suggest an increase in infection rates at 8-12 hours
 - In practice, wounds are often left open for much longer than this, especially in cosmetically sensitive areas of the body with good blood supply (e.g. the face!)
 - When we close all wounds, especially those open for longer than we would have hoped, it is very important to clean the wound thoroughly and watch it carefully in follow-up for signs of infection
 - The face and scalp are very unlikely to get infected (roughly 2% chance)
 - The extremities and thigh areas have higher infection rates (10-20% and >20% chance respectively)
 - [EM:RAP 2017 May - Wound Repair Part 3 - Delayed Presentation](#)
 - [EMA 2017 March - Abstract 28 : The Impact Of Wound Age On The Infection Rate](#)

Anesthesia

- Appropriate personal protective equipment (PPE) should be used to protect the provider whenever there is potential for exposure to blood or body fluids; this includes the use of eye protection and the potential for exposure begins with the injection of anesthetic
- Local anesthesia
 - Topical options include LET and EMLA

EMLA	LET
Lidocaine, prilocaine with an emulsifier Cream	Lidocaine, epinephrine, tetracaine Gel or liquid
1 hour to take effect (time determines depth)	20-30 minutes to take effect
Meant for intact skin (before IVs or shots) but shown to be effective in lacerations	Goes into the laceration, doesn't work on intact skin

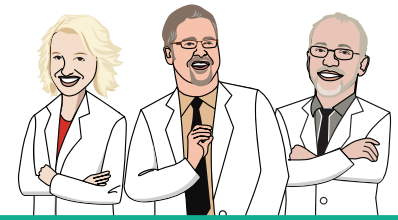
- TAC (tetracaine, adrenaline, cocaine) has largely been replaced by LET, which is as effective and carries less risk of toxicity (from the cocaine)
- Injectable options
 - Lidocaine vs bupivacaine, both available with and without epinephrine
 - Techniques to decrease pain of the injection include:
 - Warm it up



- Add bicarbonate as a pH buffer
- Distract the patient from the injection by simultaneously touching or gently pinching an area adjacent to the wound (this utilizes the gate theory of pain and is a technique commonly employed by dentists when they give intraoral injections)
- Inject through the wound itself into the subQ tissue, not through intact skin
- Use a small needle (e.g. 25 gauge or smaller)
- Apply topical anesthetic first, especially for kids
- Maximum doses
 - 4 mg/kg for lidocaine (max dose 300 mg)
 - 7 mg/kg for lido with epi
 - 2.5 mg/kg for bupivacaine (max dose 175 mg)
- Allergic patients
 - Lidocaine and bupivacaine are amides
 - In the case of allergy to either, you can switch to an ester such as procaine
 - The maximum dose of procaine is 7 mg/kg
 - Its duration of action is short (15-60 minutes)
 - [See EMRAP-HD video "Injecting Local Anesthetic"](#)
- Nerve blocks
 - A nerve block is better for large lacerations when multiple injections and potentially toxic volumes of anesthetic would be required to provide adequate local anesthesia
- Sedation
 - Consider with children especially, ensure adequate safety protocols are followed

Preparing The Wound

- Cleaning the wound
 - Anesthesia should be performed first to reduce pain of irrigation
 - Irrigation
 - The solution doesn't matter, it's the pressure that matters
 - No difference in outcomes has been found in studies using tap water vs saline vs bactericidal solutions
 - If you live somewhere that has clean water, you can irrigate in the sink
 - [See EMRAP-HD video "Wound Irrigation"](#)
 - [EMA 2018 March - That Was Then This Is Now - Tap Water For Wound](#)

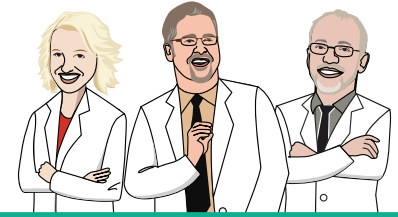


- Cleansing the skin
 - Chlorhexidine has largely replaced betadine
 - If betadine is used you have to let it dry completely
 - [EM:RAP 2017 March - Wound Repair Part 1 - Wound Prep`](#)
- Exploring the wound
 - Explore the inside of the wound through the full range of motion of the adjacent joints in a relatively bloodless field
 - You are looking for any foreign bodies and any tendon, vascular or nerve injuries (for complex wounds this may require a tourniquet)

Suture Materials

- There are too many types and variations of suture material to know them all
- Know and be comfortable with the materials that your facility uses
- Key characteristics of sutures include:
 - braided vs monofilament
 - absorbable vs nonabsorbable
 - tensile strength
 - time to absorption
- The following tables compare the most commonly used suture materials and the material typical used for each body location

Suture Type	Knot Security	Tensile Strength	Inflammation	Days of Suture Integrity	Time to Absorb
Absorbable					
Fast gut	Good	Fair	High	5-7	3-6 weeks
Surgical gut	Poor	Fair	High	5-7	10 weeks
Chromic gut	Fair	Fair	High	10-14	12 weeks
Polyglactin (Vicryl Rapide)	Good	Good	Low	5-7	6 weeks
Polyglactin (Vicryl, Polysorb)	Good	Good	Low	30	8-10 weeks
Monocryl	Good	Great	Low	7	12-16 weeks
PDS (Poly (ethylene terephthalate))	Fair	Great	Low	45-60	25-35 weeks
Nonabsorbable					
Nylon (Ethilon)	Good	Good	Low	N/A	N/A
Polypropylene (Prolene)	Low	Great	Low	N/A	N/A
Silk	Great	Low	High	N/A	N/A

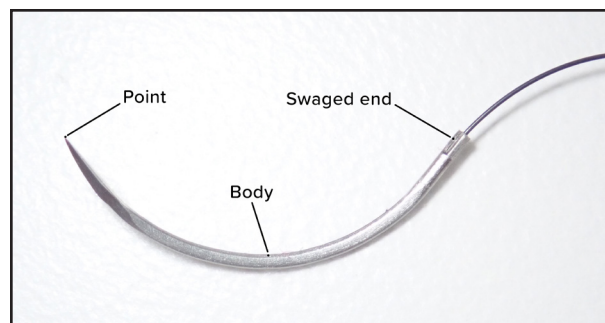


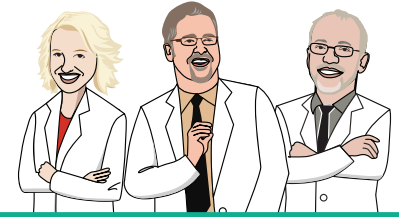
Laceration	Suture Recommendation
Uncomplicated	Ethilon 6-0 for face 4-0 or 5-0 for elsewhere
Uncomplicated in area of dark hairs	Prolene (blue)
Absorbable option	Vicryl rapide
Pediatric facial lacerations	Fast gut
Deep dermals	Vicryl
Intraoral	Chromic or Gut

- See EMRAP-HD video “Comparison of Suture Materials”
- Needle types
 - Shape
 - Cutting needle - sharp edge on the inside of the curve
 - Reverse cutting - most common in ED, sharp edge on the outside of the curve
 - Taper point - usually stocked in the ED, good when you don’t want to cause any further damage (e.g., when suturing a bleeding dialysis fistula)
 - Size
 - 3/8” most common, 1/2” or 1/4” also common
 - <https://www.slideshare.net/shourov999/surgical-needles-basics>

Technique

- Sterile gloves are not necessary in healthy patients with no risk factors
- Loading the needle on the needle driver
 - The parts of the needle are the point, the body, and the swage
 - The swage is where the thread meets the needle
 - Place in needle driver on the body of the needle near the swage but not on the swage
- Simple interrupted sutures
 - These are the most common and provide a great deal of flexibility in the way you close the wound
 - See EMRAP-HD video “Simple Interrupted Sutures”
 - EM:RAP 2017 April - Wound Repair Part 2 – Eversion and Simple Interrupted
 - Running sutures provide the advantage of speed, with only two knots (one at each end)

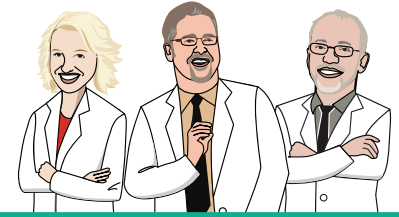




- Deeper wounds
 - Place a few deeper dermal sutures first to eliminate the dead space and reduce tension across the skin
 - Bury the knot by placing the sutures deep to superficial on the way in and then superficial to deep on the way out on the other side of the wound
 - *See EMRAP-HD video "Deep Dermal Sutures"*
 - Muscle lacerations are generally not repaired in the ED, however, you can close the fascia if it's not too deep
 - Some tendon injuries can be safely repaired in the ED (e.g. extensor tendons) but the trend is moving away from repair and certainty for partial lacerations with full motor power on examination, repair is not necessary)
 - Flexor tendons injuries are high risk and require prompt specialist surgical referral

Common Errors

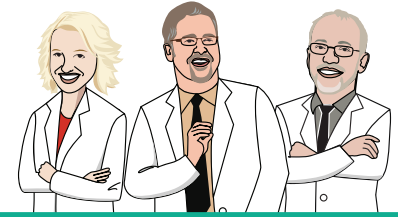
- Not making yourself comfortable and ensuring good lighting
- Not using a drape when suturing
 - The drape helps keep our equipment and our suture thread clean
- Grabbing the needle with your fingers
 - Train yourself to never pick up the needle with your fingers once it has touched the patient. Re-adjust the needle position using your needle driver and forceps, not your fingers
 - Over your career you will suture thousands of lacerations, so anything you can do to reduce a needle stick, even if it seems trivial, you should do it
- Not waiting long enough for the anesthetic to take effect
 - After anesthetizing, irrigate. It buys you more time for the anesthetic to take effect
- Slicing across the wound instead of entering the skin at 90 degrees
 - This causes tissue damage and prevents eversion
 - It helps to take your ring finger out of the rings of the needle driver. Then you can rotate your wrist more freely
- Lack of eye protection
 - Just wear it. Always. Reduce your chance of body fluid exposure
 - Don't get sprayed in the face when injecting the anesthetic
- Not keeping track of your sharps
 - It is YOUR responsibility to keep track of sharps and to dispose of them. This is not the task of an assistant or a nurse. They don't know where you put them and will get stabbed
 - Have a system for keeping track of all sharps and safely disposing of all sharps
- Recapping needles
 - Just don't do it. Reduce your chance of a stick.



- Using regular absorbable suture on the skin
 - Vicryl®, for example, takes way too long to absorb on the skin. You can use this for subcutaneous (buried) sutures
 - Rapidly absorbable suture (e.g., Vicryl Rapide®, or a gut suture) can be used on the skin
- Leaving suboptimal sutures in place
 - If it didn't turn out the way you wanted, remove the suture and do it over!
- Placing too few sutures
 - If the sutures are too far apart, the cosmetic outcome will be worse
- Gluing your glove to the laceration
 - Hold the sides of the wound so that you can get good approximation
 - After the glue is applied continue to hold for 1 minute to allow for polymerization

Antibiotics And Tetanus Prophylaxis

- Tetanus prophylaxis
 - When to update tetanus
 - If they had their primary series they only need a booster every 10 years CDC recommendation: <https://www.cdc.gov/vaccines/vpd/dtap-tdap-td/hcp/recommendations.html>
 - *EM:RAP 2015 July - Mysteries of the Tetanus Shot*
 - When to give immune globulin
 - A contaminated wound in someone who has not completed their primary vaccination series (3 shots)
 - A contaminated wound in anyone who is HIV+ or severely immunodeficient, regardless of vaccine status
 - Tetanus immune globulin 250 IU IM
- Antibiotics
 - Antibiotics are not indicated for clean wounds in healthy people
 - Antibiotics are indicated for:
 - Dirty wounds or bite wounds
 - Some patients with risk factors (immunosuppressed, diabetic) especially when they have wounds in high risk places (e.g. feet) and there is concern about their access to timely follow-up
 - A short course (3-5 days) of an antibiotic that covers skin flora (e.g., cefalexin, trimethoprim/sulfamethoxazole) is usually adequate for wound prophylaxis

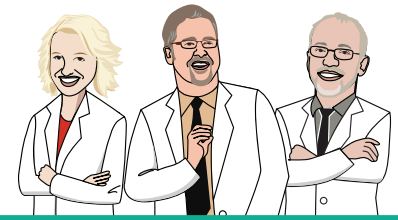


Disposition

- General instructions for patients
 - All cuts heal with scar
 - All lacerations have a risk of infection
 - Wounds take many months to heal fully and they will never return to their full tensile strength
 - After dressings are removed, wounds can get wet after repair
 - Wounds can be gently cleansed with soap and water in the shower but patients should avoid soaking the wound or swimming, generally until after sutures are removed
- General guidelines for timing of suture removal

Suture Location	Removal Time
Face	5 days
Scalp	7 days
Arms	7 days
Trunk	10 days
Legs	10 days
Hands / feet	10 days
Palms / soles / high tension (e.g., across joints)	14 days

- Wounds in cosmetically sensitive areas should be removed sooner rather than later for better cosmetic effect - to provide additional protection they may be replaced with steri-strips for a few additional days
- Return precautions and wound checks
 - Patients and guardians should understand the signs of wound infection (increasing pain, redness, heat, swelling, and fever) and return for care promptly if they appear
 - Wound checks may be scheduled, typically in 48 hours, especially in patients at high risk for infection and where there are concerns (e.g., issues with access to care, inability of patient to communicate symptoms well, etc.)

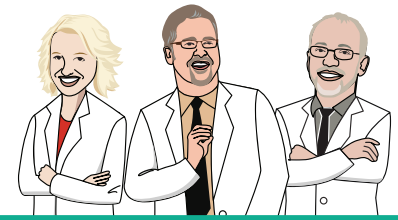


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