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Laceration Care: State of the Art

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Philadelphia, PA

Wounds Account For…

- …more than 10,000,000 annual ER visits
- …27.4% of closed malpractice cases against emergency physicians annually

Treatment Goals

- Avoid infection
- Achieve acceptable scar

How Many Wounds Get Infected?

- Infection usually occurs with 10^5 organisms per gram of tissue
- Most wound have $<10^3$ organisms per gram

How Many Wounds Get Infected?

Galvin, 1976	4.8%
Gosnold, 1977	4.9%
Rutherford, 1980	7.0%
Buchanan, 1981	10.0%

What Is the ‘Golden Period’ for Repair?

- Roberts, 1977: no relationship between timing of suturing and subsequent infection
- Nylan, 1980: no relationship between timing of suturing and subsequent infection (up to 18 hours)

What Is the ‘Golden Period’ for Repair?

- Berk, 1988: 204 patients
- Mean time to repair: 24.2 + / - 18.8 hours
  - <19 hours →92% satisfactory healing
  - >19 hours →77% satisfactory healing
  - Exception: head and face
    → 95.5% satisfactory healing
    regardless of time

Do People Still Get Tetanus?

- >250,000 cases annually worldwide
- >50% mortality
- 100 cases annually in USA
- ~10% in patients with minor wound or chronic skin lesion
- ~20% of time, no wound implicated
- 2/3 in patients over age 50

But Isn't Everybody Already Immune?

- Ruben, 1978: nursing home patients
  - 49% without protective antibodies
- Crossley, 1979: urban Minnesota
  - Over age 60, 59% of women and 71% of women without protective antibodies

But Isn't Everybody Already Immune?

- Scher, 1985: rural elderly
  - 29% without protective antibodies
- Pai, 1988: urban family practice
  - Only 5 % without protective antibodies
  - All were women age 34 to 60 years

But Isn't Everybody Already Immune?

- Stair, 1989: ER patients
  - 9.7% without protective antibodies
- Alagappan, 1996: emergency patients
  - 129 patients ages 65-97
  - Prior immunizations unobtainable in 2/3
  - 50% only with adequate titers

But Isn't Everybody Already Immune?

- Mullooly, 1984: HMO patients
  - Routine immunization compliance fell off with age
  - ~28% in patients over age 70

So How We Doin’?

- Brand, 1983: 6 ERs
  - 6% undertreatment
  - 17% overtreatment
- Giangrasso, 1985: 3 ERs
  - 1.5% undertreatment
  - 11.9% overtreatment

How Well Does the Booster Work?

- Simonsen, 1984: 418 patients age 25 – 30 years not revaccinated since primary series
  - ~1 in 8 unprotected
  - 4 weeks after tetanus toxoid, all had protective antibody levels

How Well Does the Booster Work?

- Simonsen, 1987: 24 patients, last immunization 17 to 20 years prior
  - 1 unprotected, 15 minimally protected
  - 4 days after booster shot, all had protective antibody levels
  - Incubation period for tetanus: 14 – 21 days

Why Do We Use dT Instead of Toxoid?

- Pre-dT: 100,000 annual cases of diphtheria, mortality >10%
- 1977: <100 cases / year
- Now creeping up: >300 / year
- 1966: USPHS recommended dT

Why Do We Use dT Instead of Toxoid?

- Harnisch, 1989
  - Three diphtheria outbreaks: 1972 – 1982
  - Most among indigent alcoholics in Seattle's Skid Road
  - >1100 cases, >80% skin only
  - Significant morbidity / mortality if Native American or over age 60

But It Hurts My Arm!

- Jacobs, 1982: 740 chart review
  - 33% local edema & tenderness
  - 15% fever
  - 33% had ‘anaphylactoid’ reactions

But It Hurts My Arm!

- Middaugh: 1979
  - 87,000 doses by jet injector
  - 697 / 2000 postcards returned
    - sore arm: 42.7%
    - local swelling: 34.8%
    - local itching: 24.2%
    - abscess/infection: 0.7%

I’m Allergic to Tetanus

- Isolated case reports of anaphylactic reaction
  - Zaloga, 1982: 20 year-old male received 0.5cc toxoid, immediately developed wheezing, stridor, lost consciousness, BP 70/40 → attempt to intubate → laryngeal edema → recovered with epinephrine

How Do I Find a Foreign Body?

- Pond, 1977: 6 varieties of glass buried in roast beef
- Tandberg, 1982: 66 types of glass embedded in chicken legs (some fragments as small as 0.5 mm)
- de Lacey, 1985: 15 types of glass buried 2cm deep in pork

How Do I Find a Foreign Body?

ALL GLASS SEEN ON X-RAY, REGARDLESS OF DEPTH OR COMPOSITION

How Do I Find a Foreign Body?

- Gooding, 1987: ~15% of wooden foreign bodies seen on x-ray
- de Flaviis, 1988: splinters, sea urchin spines, sand in veal → ultrasound found them all
- Bodine, 1988: CT & MRI found wooden foreign bodies

How Do I Find a Foreign Body?

- Ginsberg, 1990: 2 mm fragments between strips of steak, then plain x-ray, xerography, CT and US
  - Glass: visible in all
  - Wood: visible only by ultrasound
  - Plastic: visible only by ultrasound

Does It Help to Ask the Patient?

- Montano, 1992: 438 patients
  - Patient who said, “it feels like there’s some glass there” right in 15 / 41
  - Retained glass highest in puncture wounds, stepping on glass, or MVCs

Can't I Just Look for It?

- Avner, 1992: 226 patients with lacerations due to glass
  - 10 → obvious glass contamination
  - 160 → bottom of wound seen and no glass identified → x-ray showed glass in 11 (6.9%)
  - 56 → bottom of wound NOT seen → x-ray showed glass in 12 (21.4%)

Well If I Miss a Foreign Body, So What?

- Anderson, 1982: 200 patients with retained foreign body
  - Average time to removal → 7 months
  - 16 patients had infection (8%)
  - 4 had neuropraxias (2%)
  - 75 seen by prior physician (37.5%)

What If a Tendon Is Partially Cut?

- Wray, 1980: 34 with partial flexor tendon lacerations
  - 1/3 were 75% to 95% disrupted
  - Mobilization one week after injury
  - NO TENDONS RUPTURED

How Do I Sedate a Screaming Kid?

No longer in the scope of this talk, as any standard Pediatric Emergency Textbook will give you plenty of good insight and information

What Local Anesthetic Should I Use?

Esters

- Cocaine
- Procaine (Novocain®)
- Benzocaine (Cetacaine®)
- Tetracaine (Pontocaine®)
- Chloroprocaine (Nesacaine®)

What Local Anesthetic Should I Use?

Amides = 2 i's

- Lidocaine (Xylocaine®)
- Mepivacaine (Polocaine®, Carbocaine®)
- Bupivacaine (Marcaine®)
- Prilocaine
- Levobupivacaine (Chirocaine®)

I'm Allergic to 'caines.

- Fischer, 1997: 208 patients with 'allergies' to local anesthetics
  - Intradermal testing or progressive challenge with 3 or 4 agents
  - 4 immediate response, 4 delayed responses
  - Remaining 200 – no response

I’m Allergic to ‘caines.

- Ernst, 1994, 98 adults
  - 48 got 1% lidocaine
  - 50 got 0.5% diphenhydramine
  - Equianalgesia in all areas except face

How Do I Make the Injection ‘Painless’?

- Christoph, 1988
  - 1% lidocaine pH = 5
  - Add 1cc of standard bicarbonate (8.4% = 1 mEq/ml) to each 10cc of anesthetic
  - Pain of injection significantly reduced without compromising anesthesia

How Do I Make the Injection ‘Painless’?

- Confirmation done by:
  - Larson, 1991
  - Bartfield, 1992
  - Mader, 1994
  - Brogan, 1995
  - Martin, 1996
  - Colaric, 1998
  - Fatovich, 1999

How Do I Make the Injection ‘Painless’?

- Edlich, 1988
  - 30-gauge hurts less than 27-gauge
  - 27-gauge hurts less than 25-gauge
  - 25-gauge hurts…but you’ve got the idea

How Do I Make the Injection ‘Painless’?

- Edlich, 1988
- Krause, 1997
- Scarfone, 1998
  - Slow injection (given over 10 seconds or more) hurts less than rapid injection (less than 2 seconds)

How Do I Make the Injection ‘Painless’?

- Arndt, 1984: injecting into deep tissues hurts less than injecting into superficial tissues, BUT full anesthesia takes up to 6 minutes

How Do I Make the Injection ‘Painless’?

- Kelly, 1994
- Bartfield, 1998

Injecting into wound edges hurts less than the skin around the wound and does NOT increase the infection rate

How Do I Make the Injection ‘Painless’?

- Robson, 1990: digital block hurts less than direct injection into digit, and gives better anesthesia
- Ellis, 1993: jet injection for digital blocks hurts less than syringe and needle injection

How Long Does the Local Anesthetic Last?

- 30-60 min
- 45-90 min
- 120-240 min
- 30-90 min

How Long Does the Local Anesthetic Last?

Lidocaine (Xylocaine®)	30 – 60 min
Mepivacaine (Carbocaine®)	45 – 90 min
Bupivacaine (Marcaine®)	120 – 240 min
Prilocaine	30 – 90 min

What About Topical Agents?

TAC

- Tetracaine: 25 cc of 2% solution
- Adrenaline: 50 cc of 1:1000
- Cocaine: 11.8 gm
  - Must be mixed by pharmacist
  - Not approved by FDA
  - Expensive – up to $35 / dose

Does TAC work?

Hegenbarth, 1990: TAC vs. lidocaine, face and scalp wounds

- TAC adequate in 171 of 212 children (80.7%)
- 1% lidocaine adequate in 136 of 157 children (86.6%)

Is TAC safe?

- Daya, 1988: 5 yo female with buccal mucosa laceration
  - 2 cc TAC on wound >20 minutes
  - “Unremitting” seizures

Is TAC safe?

- Dailey, 1988: 7½ mo male with lip laceration, observed licking lips
  - Discharged ‘wide eyed’ and ‘tense’
  - Found dead in crib at home 3 hours later

What About XAP / LET?

- Xylocaine: 15cc of 2% viscous
- Adrenaline: 7.5cc of 1:1000 topical
- Pontocaine: 7.5cc of 2% topical
  - Also called LET or LAT or LAP
  - XAP more fun to say or write

Does XAP work?

- Ernst, 1995 (Pediatrics and AJEM within a month of each other)
- Blackburn, 1995
- Ernst, 1997

All show effective anesthesia if left in place for 15 to 20 minutes

Don't Vasoconstrictors Affect Healing?

- Barker, 1982

"In our experimental study, exposure of wounds to …(TAC)… damaged host defenses and increased susceptibility toward infection."

- Martin, 1990

"TAC does not increase bacterial proliferation more than lidocaine infiltration in contaminated experimental wounds"

How Much Is Sterile Technique Necessary?

- Bodiwala, 1982: randomized 337 patients to ‘gloves’ or ‘careful hand-washing, no gloves’

Infection	Gloves	No gloves
None	167 (82.7%)	170 (82.5%)
‘Mild’	27 (13.4%)	27 (13.1%)
‘Severe’	8 (4.0%)	9 (4.4%)

How Much Is Sterile Technique Necessary?

- Caliendo, 1976: alternated face mask / no mask for 99 wound repairs
  - Mask – 1 / 47 infected
  - No mask – 0 / 42 infected
- Ruthman, 1984
- Whorl, 1987

Shouldn't I Shave or Clip the Hair?

- Seropian, 1971: 406 surgical wounds
  - Shaved pre-op, 3.1% infection
  - Depilated, 0.6% infection
- Howell, 1988: 68 scalp lacerations repaired without hair removal → no infection at 5-day follow-up

How About Disinfecting the Skin?

- An ‘ideal agent’ does not exist – either tissue toxic or poorly bacteriostatic
- Simple scrub with soap and water AROUND wound should be sufficient

What If the Wound Is Contaminated?

Haury, 1978: debridement is the **most important** step, as it…

…removes tissues contaminated with bacteria

…removes devitalized tissues which impair wound's ability to resist infection

What If the Wound Is Contaminated?

Dimick, 1988: Delayed Primary Closure

- Wound left open 4 or 5 days until edema subsides, no sign of infection, and all debris and exudates removed

What If the Wound Is Contaminated?

Dimick, 1988: Delayed Primary Closure

- >90% success rate in closure without infection
- Final scar → same as primary closure

How Do I Clean the Wound Before Sewing?

NEVER PUT ANYTHING IN AN OPEN WOUND THAT YOU WOULDN'T PUT IN YOUR OWN EYE

How Do I Clean the Wound Before Sewing?

- Mulliken, 1980: 1% povidone-iodine did not decrease wound tensile strength
- Roberts, 1985: povidone-iodine powder did not decrease rate of wound infections (except in the hand)

How Do I Clean the Wound Before Sewing?

Lineaweaver, 1985 – looked at…

…povidone-iodine 0.01, 0.001, 0.0001%

…sodium hypochlorite 0.05, 0.005, 0.0005%

…hydrogen peroxide 3.0, 0.3, 0.03, 0.003%

…acetic acid 0.25, 0.025, 0.0025%

How Do I Clean the Wound Before Sewing?

Lineaweaver, 1985

- The ONLY antiseptic not harmful to fibroblasts yet still bacteriostatic was…

How Do I Clean the Wound Before Sewing?

- Rodeheaver, 1982: povidone-iodine surgical scrub (NOT solution) caused significant increase in infection if used in fresh wounds

How Do I Clean the Wound Before Sewing?

- Lammers, 1990
  - Soaking fresh wounds in 1% povidone-iodine did not decrease bacterial count
  - Soaking in normal saline INCREASED bacterial count

How Do I Clean the Wound Before Sewing?

- Gross, 1972: 200 rats with face wounds experimentally contaminated
  - Bulb syringe vs. jet lavage
  - All bacteriologic loads less with lavage

How Do I Clean the Wound Before Sewing?

- Wheeler, 1976: experimental contaminated wounds
  - Irrigated with 35cc syringe and 19g needle (~7psi)
  - Fluid went into tissues, bacteria did not follow

How Do I Clean the Wound Before Sewing?

- Singer, 1994

"Both 35ml…and…65ml syringes with a 19-gauge needle are effective in performing high-pressure irrigation in the range of 25 psi to 35 psi. The use of IV bags and plastic bottles should be discouraged."

How Do I Clean the Wound Before Sewing?

- Angeras, 1992: 617 patients with wounds less than 6 hours old
  - 295 irrigated with tap water → 5.4% infection rate
  - 322 irrigated with NSS → 20.3% infection rate

How Do I Clean the Wound Before Sewing?

- Kaczmarek, 1982: cultured open bottles of saline irrigating solution
  - 36/169 1000cc bottles contaminated
  - 16/105 500cc bottles contaminated
- Brown, 1985: “…one in five of the opened bottles used for irrigation were contaminated…”

How Do I Clean the Wound Before Sewing?

Hollander, 1998:

- Clean face wounds
- Half irrigated, half left alone
- No difference in infection rate

How Do I Clean the Wound Before Sewing?

What about splatter??

- Pigman, 1993: Zerowet® Splashield and Irrijet® Irrigation Systems effective in preventing splatter of irrigation fluid

Do All ERs Follow This Protocol?

- Howell, 1992: 151 surveys, >60% Board Certified
  - 38% soaked wounds, didn't irrigate
  - 21% used full-strength povidone-iodine or hydrogen peroxide
  - 67% scrubbed entire wound surface before suturing

What Suture Material Should I Use?

- Laufman, 1977: gut vs. synthetic
  - Gut suture…

…caused more tissue reaction

…had a higher wound infection rate

…had less tensile strength

…had knots which held less well

…degraded more quickly in infection

What Suture Material Should I Use?

- Rodeheaver, 1981: Dexon® vs. Vicryl®
  - Dexon® thinner, weaker
  - Dexon® with less breaking strength at 10 days
  - Both absorbed at 90 - 120 days
  - Vicryl® was the preferred material

Absorbable Sutures

Type	Knot security	Tensile strength	Wound security	Tissue reaction
Gut	*	**	5-7 days	***
Chromic	**	**	10-14 days	***
Dexon®	****	****	25 days	*
Vicryl®	***	****	30 days	*

Non-Absorbable Sutures

Type	Knot security	Tensile strength	Wound security	Tissue reaction	Ease of working
Silk	****	*	*	****	****
Mersilene	****	**	***	***	****
Nurolon	***	**	**	***	
Nylon	**	***	***	**	**
Prolene®	*	****	****	*	*
Ethibond®	***	****	****	**(*)	***

I've Heard 'Running' Stitches Are No Good.

- McLean, 1980
  - 51 patients with continuous, running ('baseball') stitch
  - 54 patients with interrupted stitch
  - Two infections in each group

How Do I Close the "Dead Space?"

- Elek, 1956: "When bacterial contamination of simple wounds is moderate, suture foreign bodies are the sine qua non for development of wound infection."

How Do I Close the "Dead Space?"

- Condie, 1961
- de Holl, 1971
  - Leaving the dead space resulted in lower infection rates than obliterating it with sutures

What Can I Use Other Than Sutures?

- Brickman, 1989: 87 ER patients, 2/3 with scalp lacerations
  - 65% closed in 30 seconds using staples
  - No infections

What Can I Use Other Than Sutures?

- MacGregor, 1989: 100 ER patients, 2/3 with scalp lacerations (no anesthetic!)
  - Staples took 18.8 seconds each
  - Sutures took 124 seconds each
  - Patients preferred staples

What Can I Use Other Than Sutures?

- Koehn, 1981
  - Steri-Strips® stay on for ~8 days
  - Skin prep: no difference
  - Benzoin®: no difference
- Rodeheaver, 1983: Shur-Strips® better than Steri-Strips®

What Can I Use Other Than Sutures?

- Sutton, 1985: Strips vs. sutures for pretibial flap lacerations
  - 53 days for sutured flaps to heal
  - 38 days for taped flaps to heal

What Can I Use Other Than Sutures?

Dermabond® approved in US

- Bruns, 1996
- Simon, 1997
- Quinn, 1997
- Singer, 1998
- Quinn, 1998
- Osmond, 1999

What Can I Use Other Than Sutures?

- Davies, 1988: Scalp lacerations in children with long hair
  - 3 to 4 mm of hair twisted into ‘rope’
  - Tie across wound with 3 or 4 throws
  - Knots grow away from wound
  - Snip away in 3-4 weeks

Do Topical Antibiotic Creams Do Anything?

Topical Agent	Days of Healing
Polysporin®	8.8
Neosporin®	9.2
Johnson & Johnson	9.8
No treatment	14.2
Iodine	16.0

Do Topical Antibiotic Creams Do Anything?

- Dire, 1995: prospective randomized, double-blind, placebo-controlled

Topical Agent	Infection Rate
Bacitracin®	5.5% (6/109)
Neosporin®	4.5% (5/110)
Silvadene®	12.1% (12/99)
Placebo	4.9% (5/101)

How Long Should the Dressing Stay On?

- Chrintz, 1989: 1202 clean wounds
  - Dressing off at 24 hours → 4.7% infection
  - Dressing off at suture removal → 4.9%
- Lotti, 1997: many theoretical advantages to leaving occlusive dressing until suture removal

Can I Get the Stitches Wet, Doctor?

- Goldberg, 1981: 100 patients with sutured scalp lacerations allowed to wash hair → no infection or wound disruption
- Noe, 1988: 100 patients with surgical excision of skin lesions allowed to bathe next day → no infection or wound disruption

Who With a Cut Should Get Antibiotics?

- Burke, 1961

"Systemic antibiotics have no effect on primary staphylococcal infections if the bacteria creating the infection have been in the tissue longer than three hours before the antibiotics are given."

Who With a Cut Should Get Antibiotics?

- Edlich, 1971, 1973

Gentle scrubbing of wound prolonged effective period of antibiotics, probably by breaking up fibrin in which bacteria had taken hold

Who With a Cut Should Get Antibiotics?

Edlich, 1986: Recommends antibiotics if ‘chance of infection >10%’

- Delay in cleansing of >6 hours
- Stellate cut with abraded skin edges
- Soiled by saliva, feces, vaginal secretions
- “Dirty” or “contaminated”
- Feet

Who With a Cut Should Get Antibiotics?

- Edlich, 1986
  - Use a broad-spectrum antibiotic
  - Give the first dose intravenously
  - Treatment for more than 3 days unwarranted

Who With a Cut Should Get Antibiotics?

…artificial heart valves?

- Kaplan, 1977: no recommendation for patients with valves and simple cuts

BUT

- Clooey, 1985: reported 4 cases of endocarditis from skin infections

Who With a Cut Should Get Antibiotics?

…artificial joints?

- Ahlberg, 1978
  - 27 cases of hematogenous infection to joint arthroplasties requiring removal of hardware
  - At least 5 due to infection from skin

Who With a Cut Should Get Antibiotics?

…lymphedema?

- van Scoy, 1983
  - Patients with lymphedema and history of recurrent cellulitis require prophylactic penicillin when skin integrity disrupted

Who With a Cut Should Get Antibiotics?

…hand laceration?

- Roberts, 1977
- Worlock, 1980
- Grossman, 1981
- Haughey, 1981

Oral antibiotic administration has no effect on clinical course of simple hand wounds

Who With a Cut Should Get Antibiotics?

…other body site?

- Hutton, 1978
- Thirlby, 1983
- Samson, 1977
- Day, 1975

Oral antibiotic administration has no effect on the clinical course of most simple wounds

Aren't Human Bites Pretty Nasty?

- Lindsey, 1987: Institutionalized, retarded patients
  - Bites: 17.7% infected (77/434)
  - Cuts: 13.4% infected (108/803)
    - No one needed hospital admission
    - No one needed intravenous antibiotic
    - No serious infections or complications

Child Bites Child

- Schweich, 1985
  - 33 children bitten by other children
  - 4 were infected on presentation
  - 16 got antibiotic – one got infected
  - 13 got no antibiotic – none got infected

Child Bites Child

- Baker, 1987: 322 bites in children
  - 75% were superficial abrasions
    - 0% infection rate
  - 13% were puncture wounds
    - 38% infection
  - 11% were frank lacerations
    - 37% got infected

He Bit Your WHAT??

Tomasetti, 1979: 25 bites of face

Spinelli, 1986: 5 eyelids chewed off

Brandt, 1969: 5 ears chewed off

Laskin, 1958: 5 lips chewed off

- Sometimes in anger, sometimes in passion – all sewn back and did well

Aren't Bites of the Hand Really Bad?

- Bite U, 1984

"Patients seen soon after injury without evidence of joint penetration should be managed by irrigation and open management of the wound, immobilization in a hand dressing, tetanus prophylaxis, oral administration of a cephalosporin, and reexamination within 24 hours."

Dog Bites Man (and Woman)

- Dire, 1994: 769 dog bite victims
  - Prospective survey to define risk factors
    - Wound depth
    - Need for debridement
    - Female sex (??)

Dog Bites Man (and Woman)

- Cummings, 1994: meta-analysis
  - Relative risk for infection: 0.56
  - Number needed to treat: 14

Dog Bites Man (and Woman)

- Callaham, 1994: looked at Cummings' meta-analysis, dropped 60% infection rate study
  - NNT now 26
  - If you treat 100 dog-bite victims at $20 per prescription you will prevent 3.8 infections at a cost of $526 each

Cat Bites Man (and Woman)

- Elenbass, 1984: eleven patients with cat bite
  - Placebo – 5/6 infected
  - Oxacillin – 0/4 infected
  - Sanford's Guide to Antibiotic states '80% of cat bites get infected' based on this one study!!

I Still Wanna Treat. What Should I Use?

Callaham, 1988

- If already infected or high risk
  - Dog: dicloxacillin or cephalexin QID
  - Cat: dicloxacillin or penicillin QID
  - Man: dicloxacillin PLUS penicillin

If for prophylaxis, maximum treatment 5 days

I Stepped on a Rusty Nail!! – Foot Puncture

- Chisholm, 1989: treatment based on…
  - Type and condition of penetrating object
  - Footwear at time of injury
  - Estimated depth of puncture
  - Possibility of retained foreign body
  - Elapsed time since injury
  - Indoor vs. outdoor injury
  - Infection risks: diabetes, vasculopath

I Stepped on a Rusty Nail!! – Foot Puncture

- Chisholm, 1989
  - Presentation <24 hours – careful exam for retained material, trim epidermal flap – NO indication for prophylactic antibiotic
  - Presentation >24 hours usually with established infection – treat with oral antistaphylococcal antibiotic

How About Those Nasty Intra-Oral Cuts?

- Altieri, 1987
  - Suturing increased infection rate from 4% to 21%
  - 14 patients received sutures
    - No antibiotic given: 2 infections
    - Penicillin given: 1 infection

How About Those Nasty Intra-Oral Cuts?

- Steele, 1989: 62 patients with full-thickness through-and-through oral mucosa-to-skin wounds
  - Prospective, double-blinded, placebo-controlled
  - *Trend* toward penicillin-treated group having fewer infections