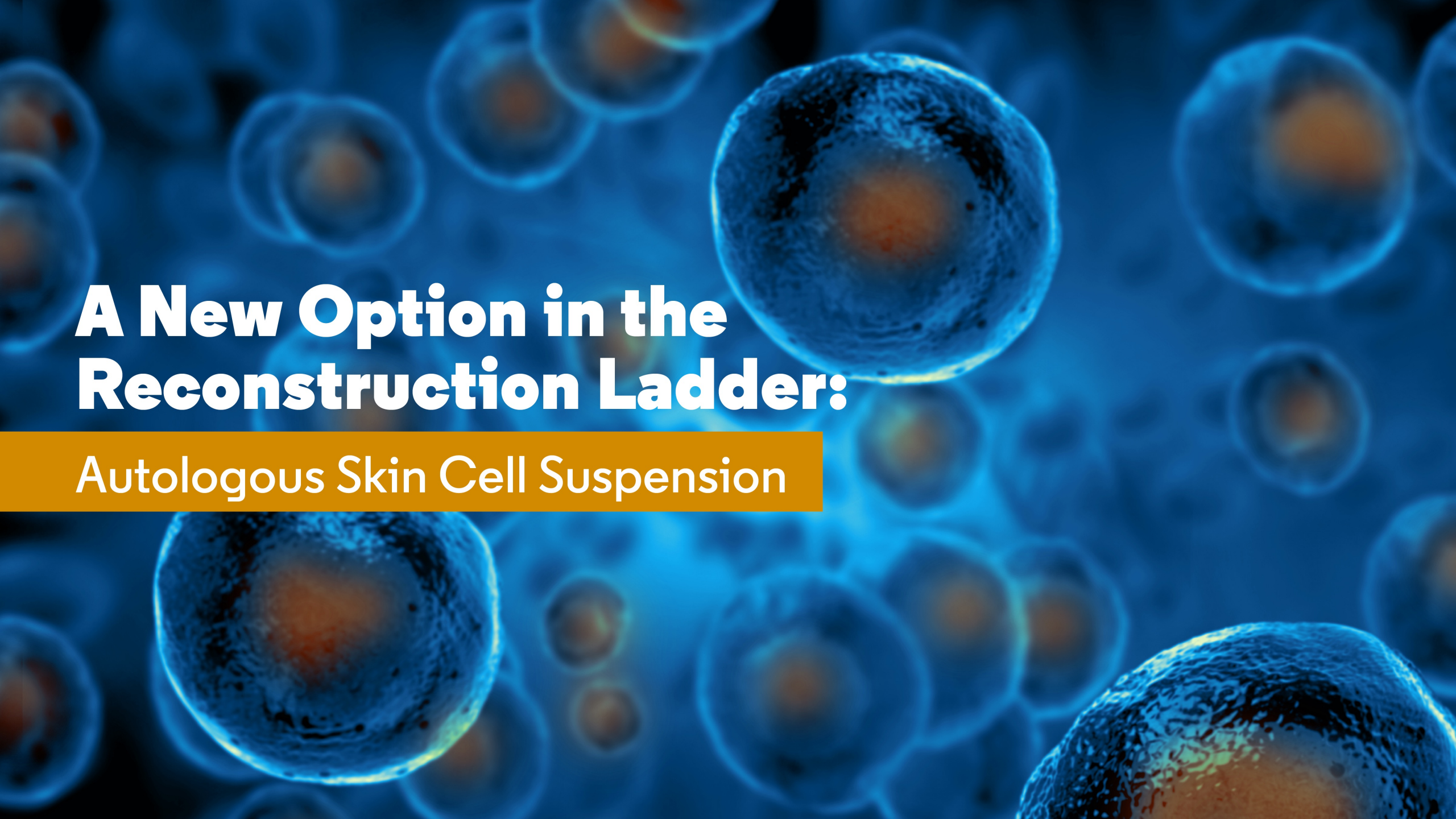
A New Option in the Reconstruction Ladder:
Autologous Skin Cell Suspension

# Faculty

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# Faculty Disclosures

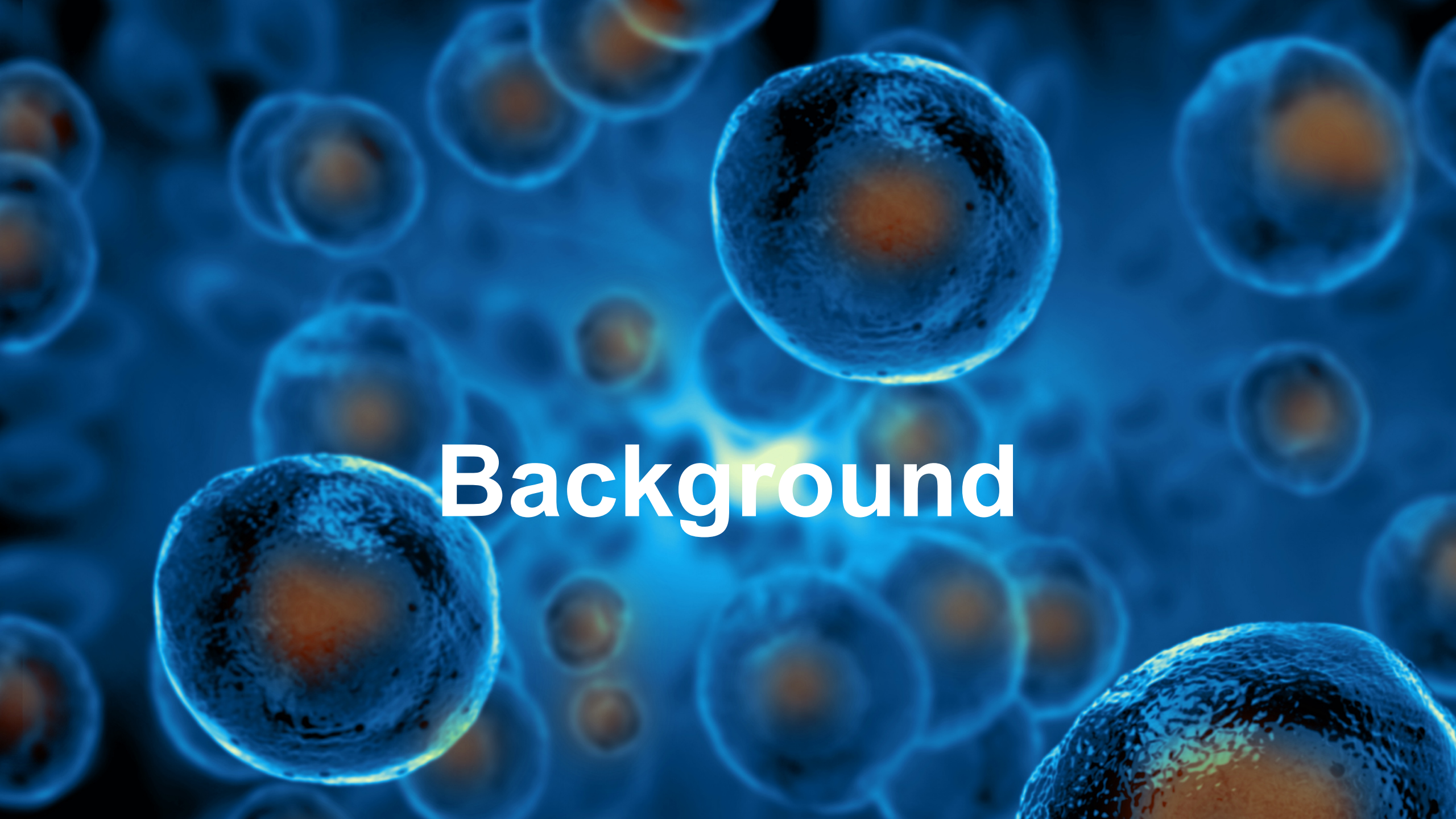
- **Dr. Carter:** Consultant (all proceeds donated to charity)—Avita Medical, PolyNovo, Vericel; stockholder—Spectral MD
- **Dr. Crombie:** Advisory Board—Avita Medical; consultant—Integra Lifesciences
- **Dr. Hultman:** Consultant—Avita Medical
- **Dr. Mashruwala:** Advisor/research—Avita Medical

# Program Information

- This program is provided by HMP Education, an HMP Global company
- Supported by an independent educational grant from Avita Medical

# Learning Objectives

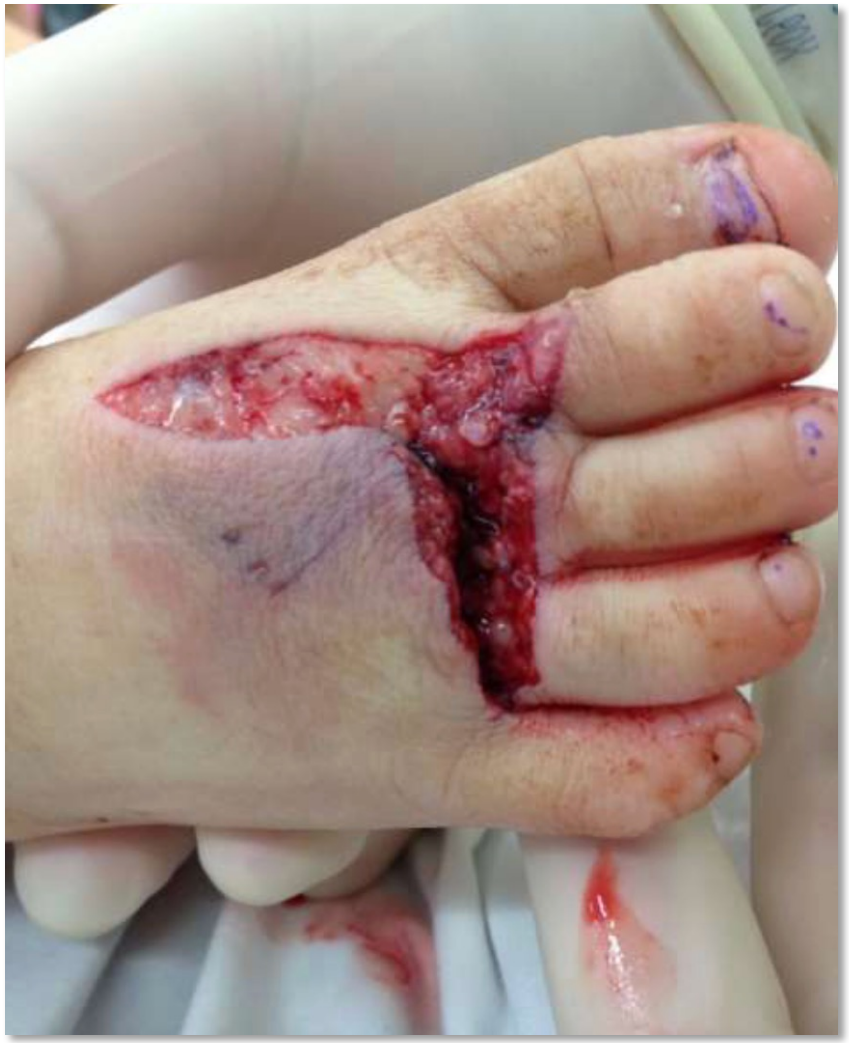
- Examine drawbacks and challenges with current standard of care for full-thickness, soft-tissue reconstruction
- Investigate results from a prospective multicenter randomized controlled clinical study on the safety and effectiveness of autologous skin cell suspension for reduction of donor area in soft-tissue reconstruction
- Describe the mechanism of action of spray-on skin cells and how autologous skin cell suspension is used to achieve wound closure
- Explore clinical case study outcomes using autologous skin cell suspension in soft tissue reconstruction



# Background

# Burden of Wounds

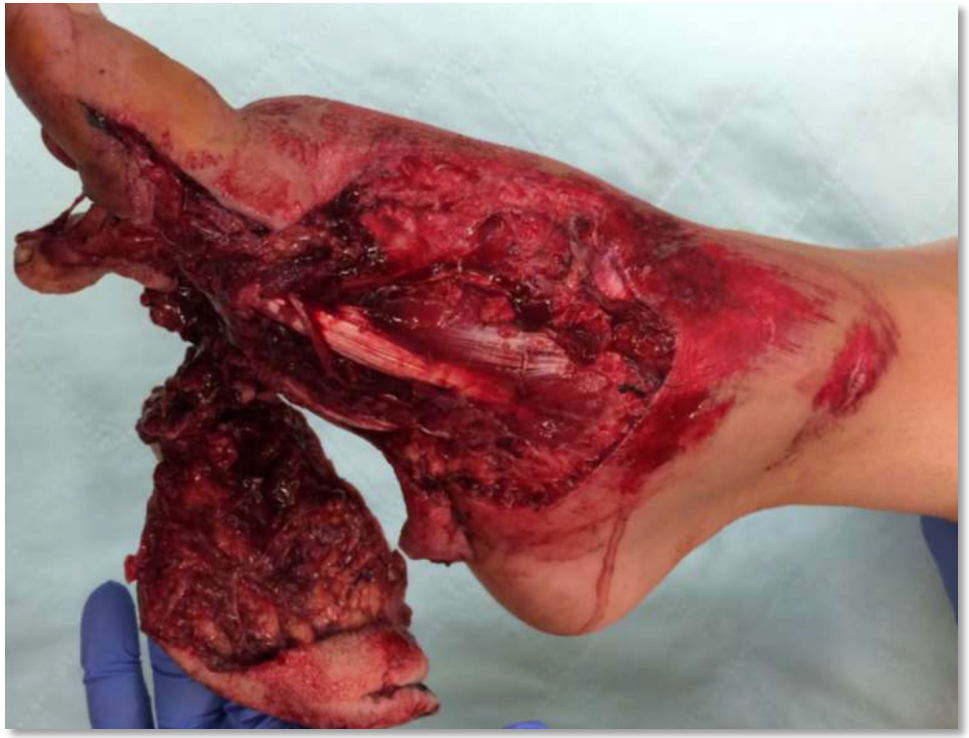
- **Emergency room**
  - 12.2 million patients each year
- **Emergency room wounds**
  - Average laceration 1-3 cm
  - 13% significantly contaminated
- **Why the consults?**
  - 5-20% of EM malpractice claims
  - Common complications
    - Wound infection
    - Failure diagnose underlying injury
    - Failure diagnose foreign body



EM =

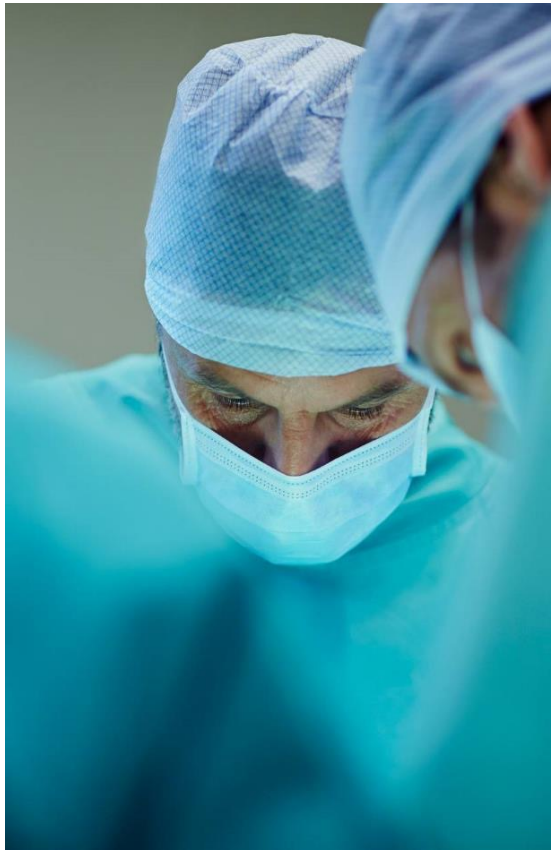
# Burden of Wounds

- **Common surgical wounds**
  - Necrotizing soft tissue infections (NSTI)
  - Degloving injuries
  - Crush injuries
  - Open fractures
  - Lacerations
  - Punctures
  - Bites
  - Burns



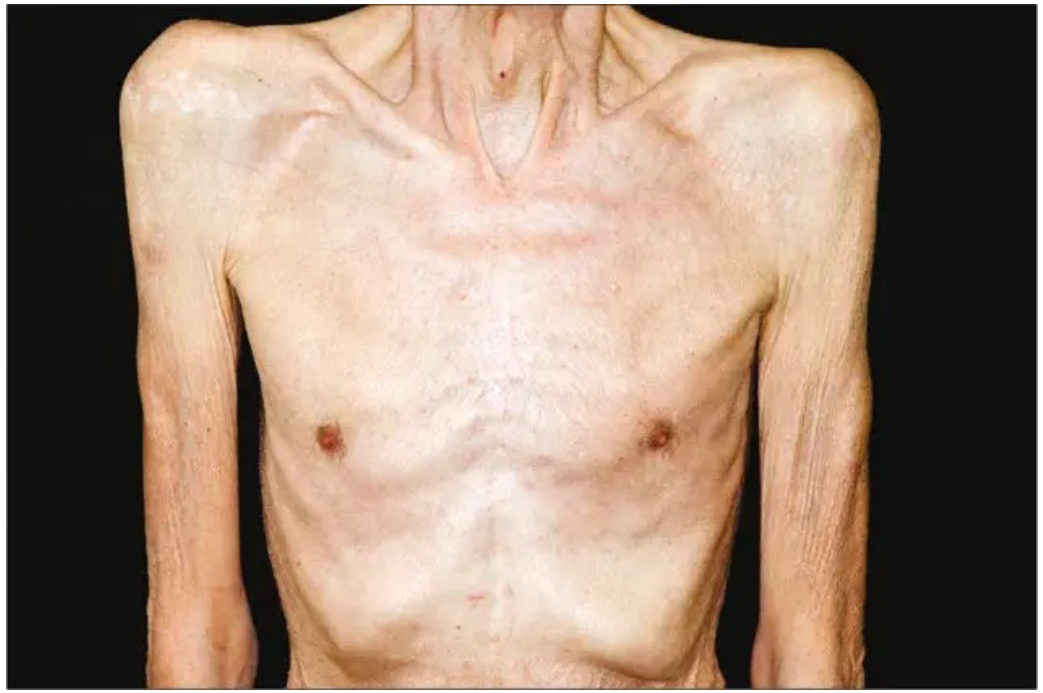
# Burden of Wounds

- **Common approach**
  - Assess for ***concomitant injuries and comorbidities***
    - Tendon injury
    - Underlying fracture
    - Hgb A1C
  - **Imaging:** ***F***racture, ***F***oreign body, or ***F***ree air
  - **Tetanus and treatment:** Antibiotics and vaccine
  - **Definitive care**
    - Debridement/fixation
    - Dressings
    - Disposition



# Burden of Wounds

- **Nutritional assessment**
  - 59% vitamin D deficiency
  - 70% thiamine deficiency
  - Vitamin C and E deficiency
  - 30% protein malnutrition
  - Copper, selenium, and zinc deficiency in ≥ 20% TBSA



**TBSA = total body surface area.**

**Zavala S, et al. *Burns.* 2020;46(1):172-177. Manzanares W, et al. *Curr Opin Clin Nutr Metab Care.* 2011;14(6):610-617. Traber MG, et al. *Free Radic Biol Med.* 2007;42(9):1421-1429. Corkins MR, et al. *JPEN J Parenter Enteral Nutr.* 2014;38(2):186-195. Gutowska I, et al. *Nutrients.* 2022;14(2):4248. Jeschke MG, et al. *Nat Rev Dis Primers.* 2020;6(1):11.**

# Burden of Wounds

- **Preoperative planning**
  - Discuss donor site location
  - Clip donor site hair
  - Bathe patient
  - Nasal decolonization
  - Warm patient pre-op
  - Warm IVF in OR 42°C
  - Warm OR table 42°C
  - Warm non-surgical regions


IVF = intravenous fluid; OR = operating room.

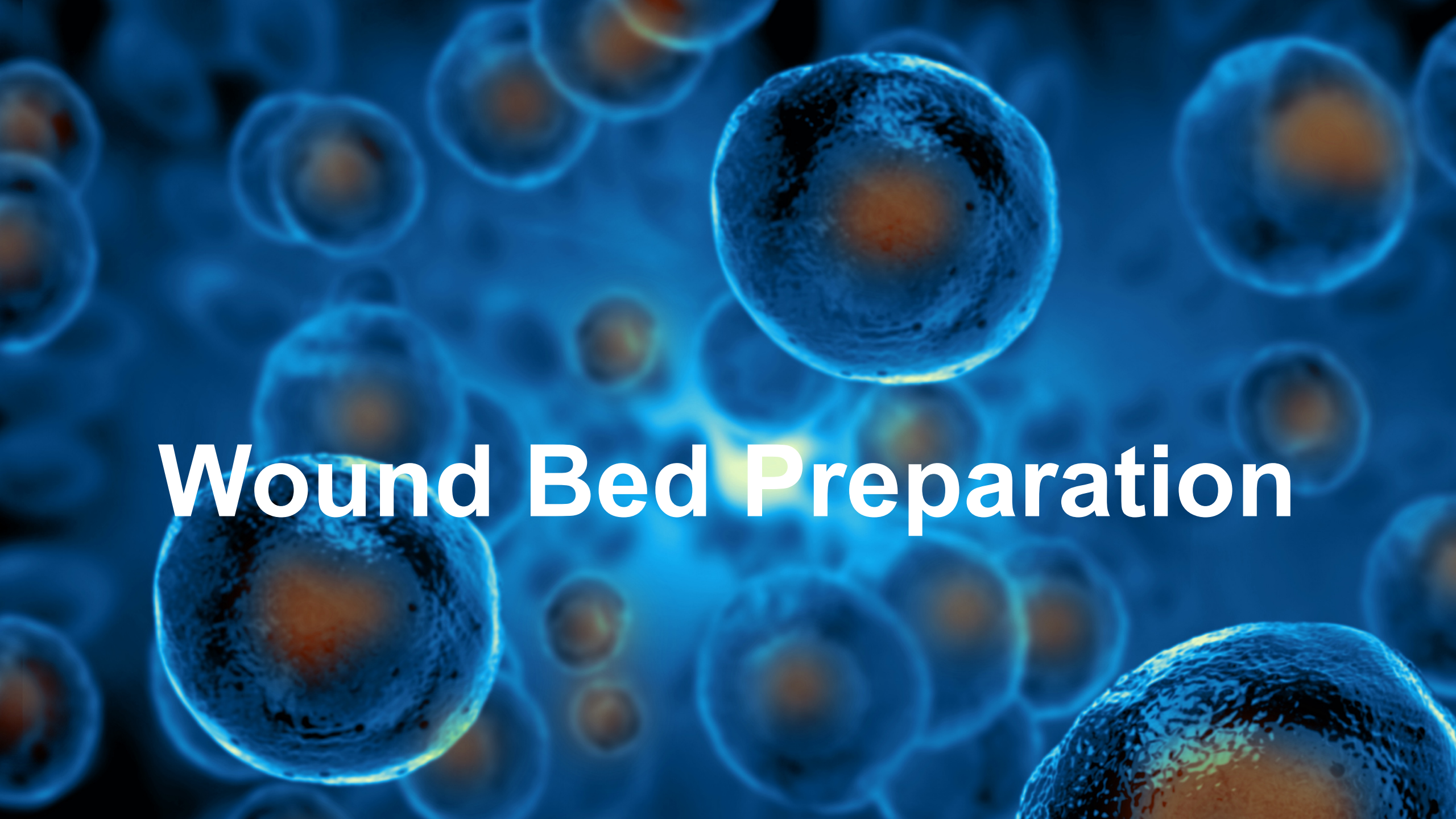
Github [www.github.com]. Accessed March 22, 2018. http://oerpub.github.io/epubjs-demo-book/content/m46489.xhtml. Nath S. *Biophys Chem.* 2016;219:69-74. Runciman WB, et al. *Anaesth Intensive Care.* 1993;21(5):506-519.

# Burden of Wounds

- **Intraoperative planning**
  - **Heat loss through evaporative cooling**
    - 533 cal/ml
    - Open wounds ~4,000ml/$m^2$ open wound
    - Temperature control = ambient + minimizing exposure
    - Trauma → hypothermia due to loss of ATP synthesis
  - **Communication**
    - 70-80% of medical mishaps are due to interpersonal interaction
    - Hourly updates: EBL/transfusion, temp, labs, meds, and dispo

**ATP = adenosine triphosphate; EBL = estimated blood loss.**

**Github [www.github.com]. Accessed March 22, 2018. http://oerpub.github.io/epubjs-demo-book/content/m46489.xhtml. Nath S. *Biophys Chem.* 2016;219:69-74. Runciman WB, et al. *Anaesth Intensive Care.* 1993;21(5):506-519.**



# Wound Bed Preparation

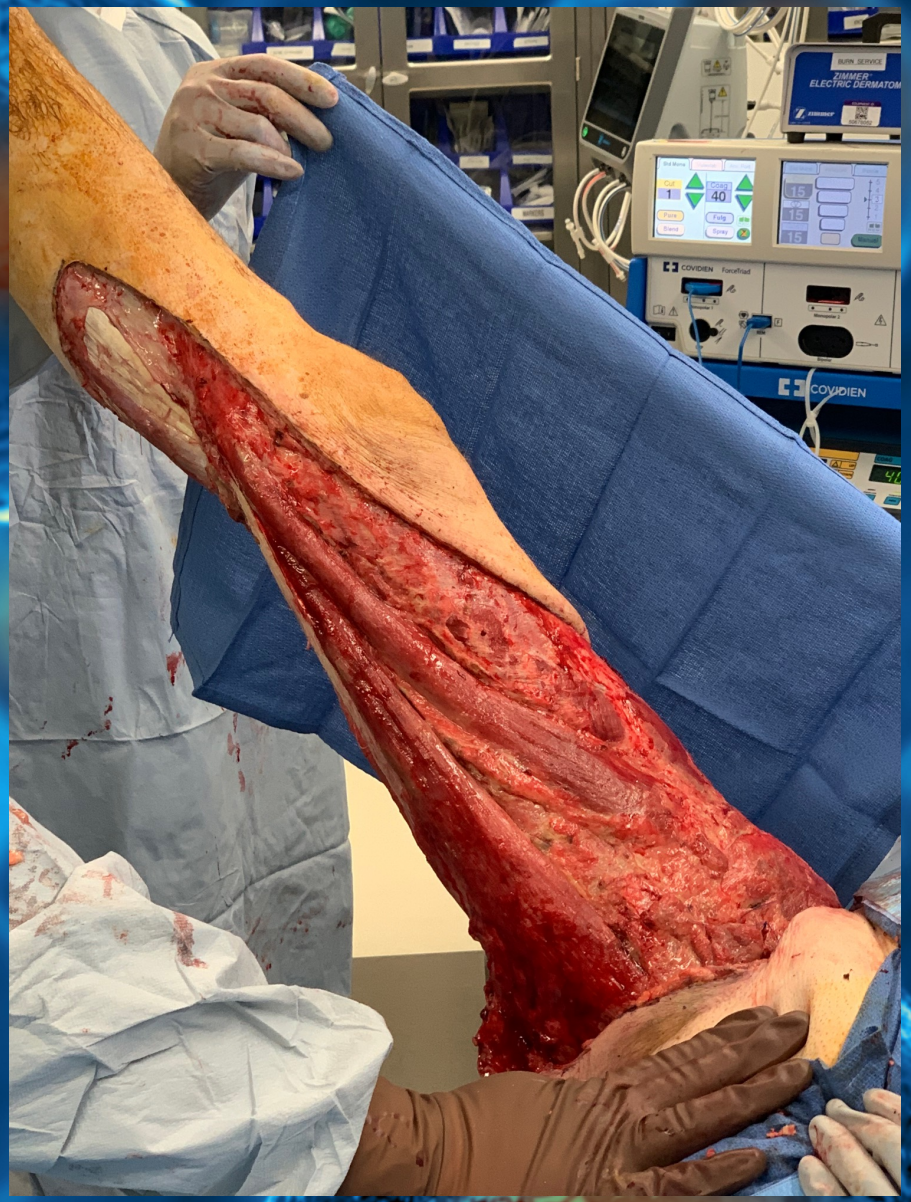
# Wound Bed Preparation

- **Debridement (CPT 97597 or 11042-11047)**
  - **Service location:** bedside, OR, ER, or physician office
  - **Technique:** scrubbing, brushing, trimming, or cutting
  - **Instruments:** scissors, scalpel, curette, or hydrosurgical
  - **Tissue removed:** slough, devitalized or non-viable tissue
  - **Descriptive terms**
    - Location: upper/lower limb, proximal/distal, medial/lateral, etc.
    - Size of the wound: $cm^2$ (measure post-excision, width x height)
    - Depth of the debridement: skin, fascia, subcutaneous tissue, soft tissue, muscle, bone (code by deepest debridement)

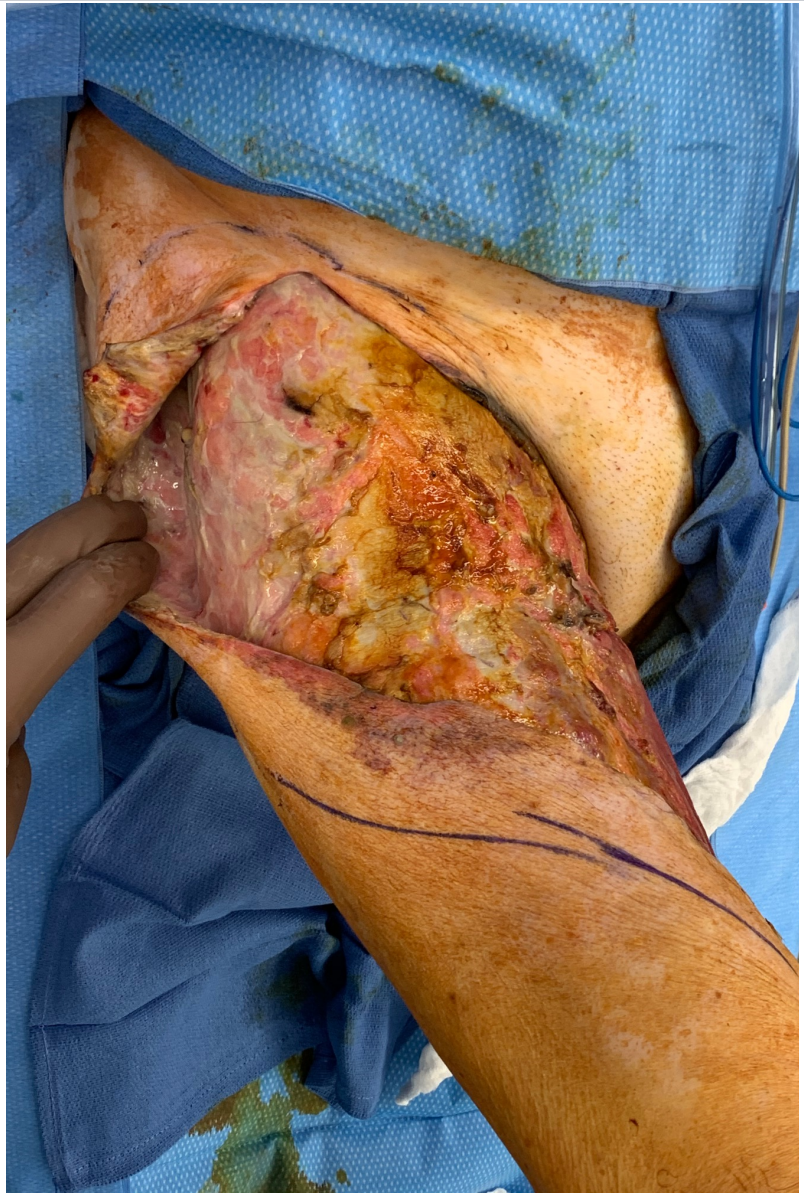
**ER = emergency room.**

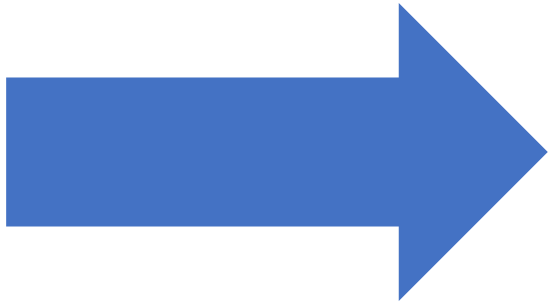
# Before Debridement

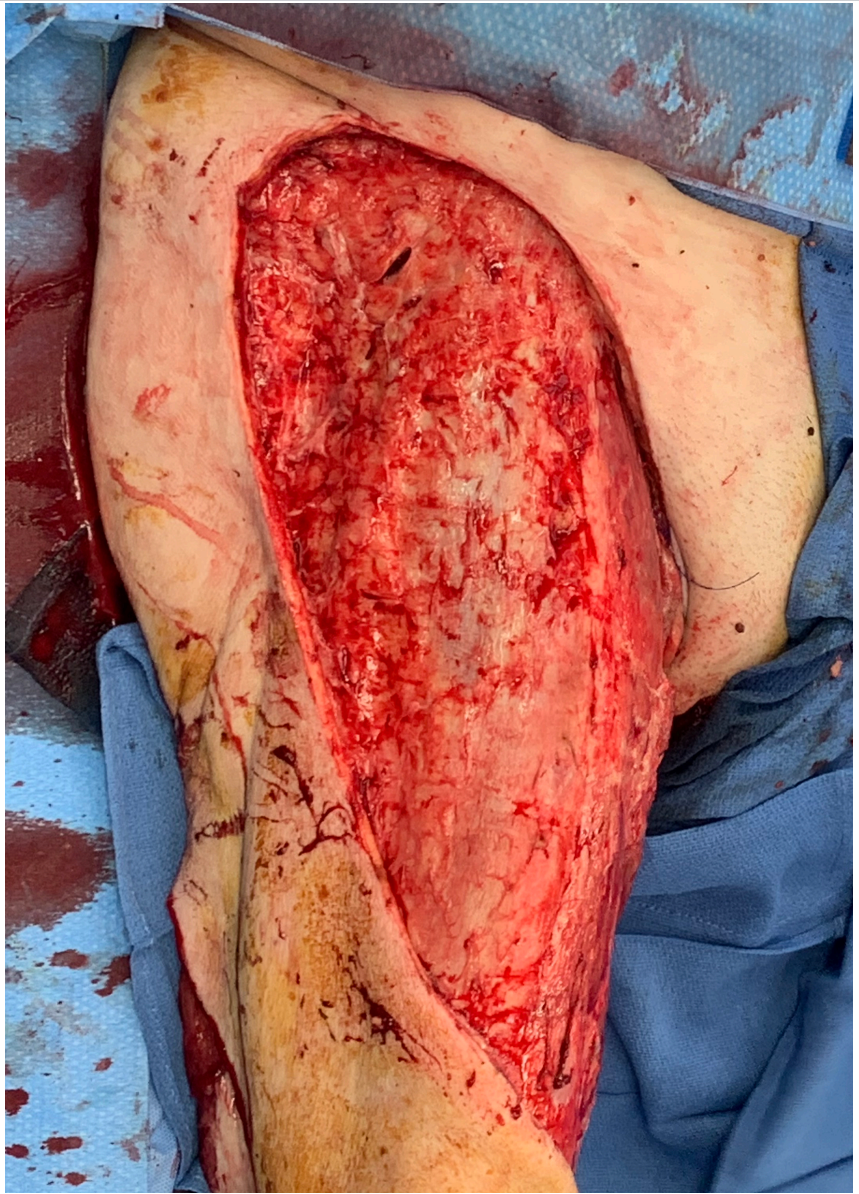

# After Debridement



# What Instruments Would You Use?

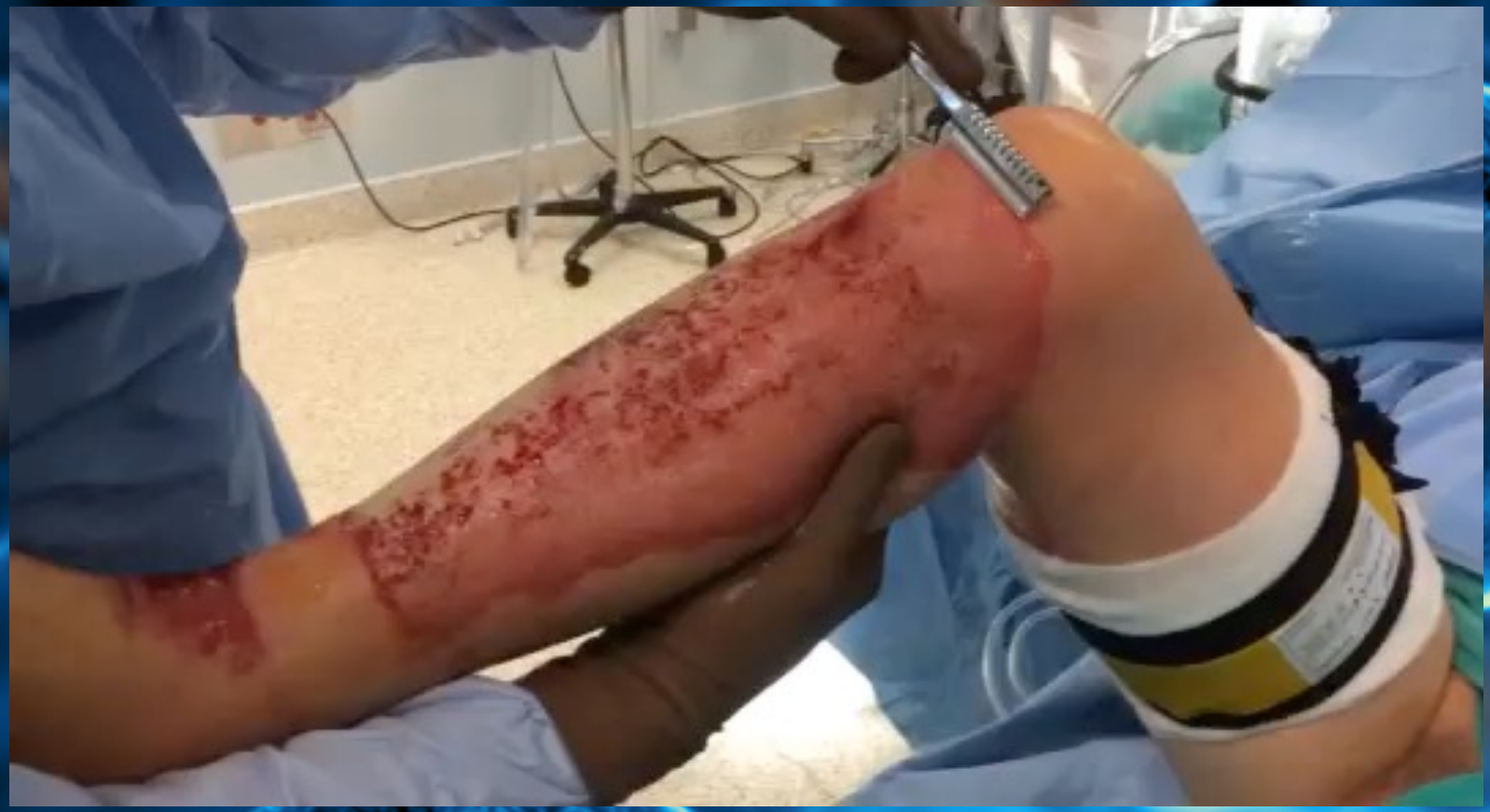


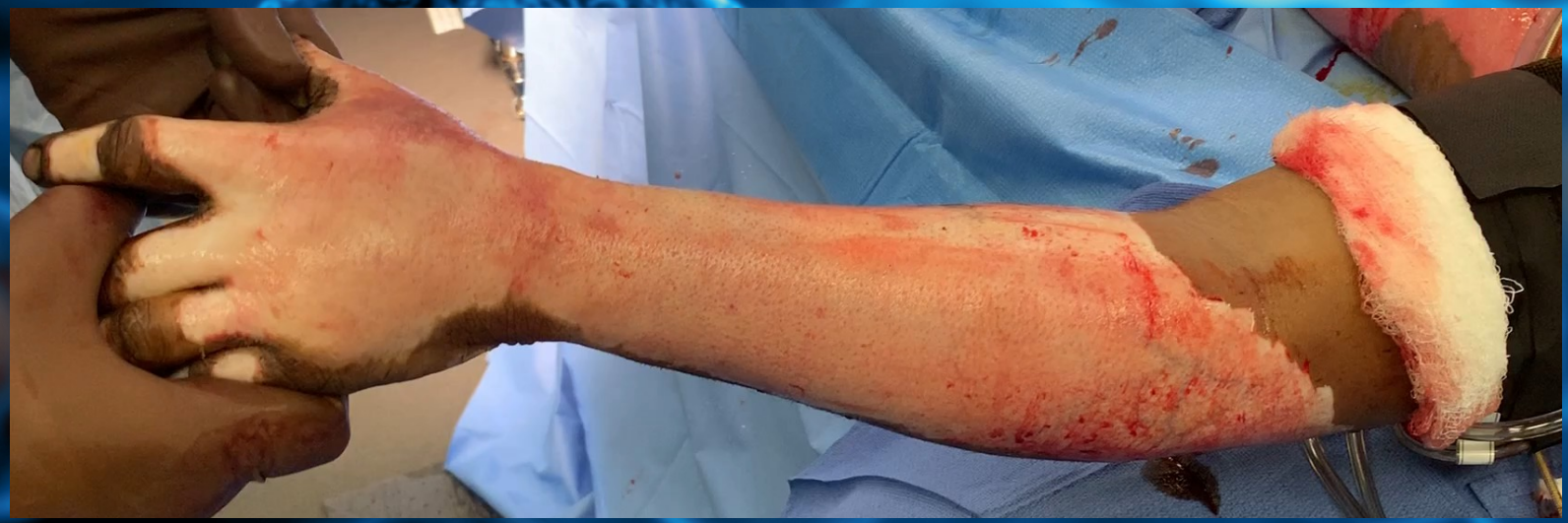


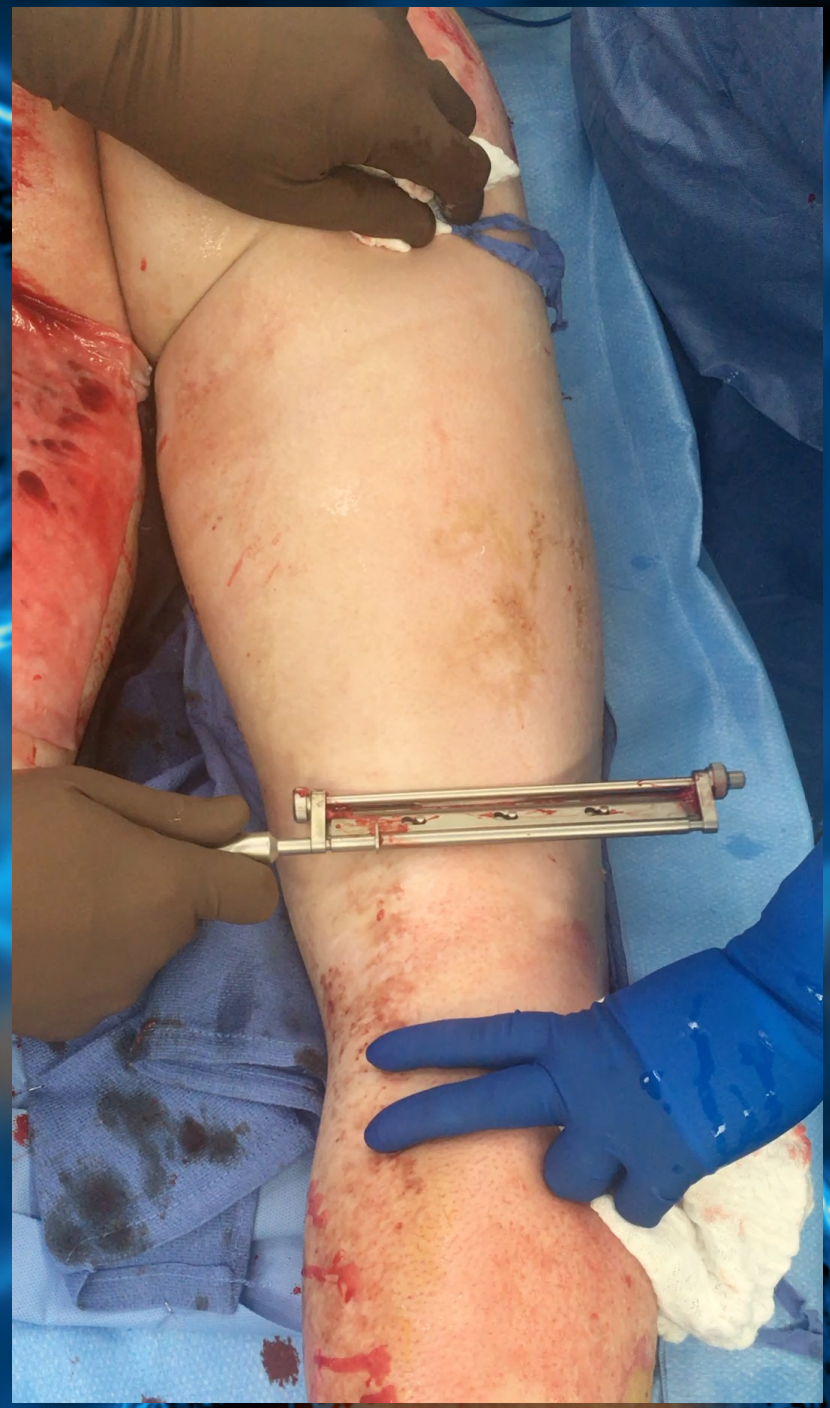


# Wound Bed Preparation

- **Tangential excision (CPT 15002-15005)**
  - **Service location:** OR
  - **Technique:** serial excision to viable tissue
  - **Instruments:** Goulian, Weck, Watson, scalpel, or hydrosurgical
  - **Tissue removed:** skin or subcutaneous tissue
  - **Descriptive terms**
    - Wound: punctate bleeding, non-viable tissue, 3$^{rd}$ degree burn
    - Location: upper/lower limb, proximal/distal, medial/lateral, etc.
    - Size of the wound: cm$^2$ (measure post-excision, width x height)
    - Depth of the debridement: reticular dermis, subcutaneous fat, etc.



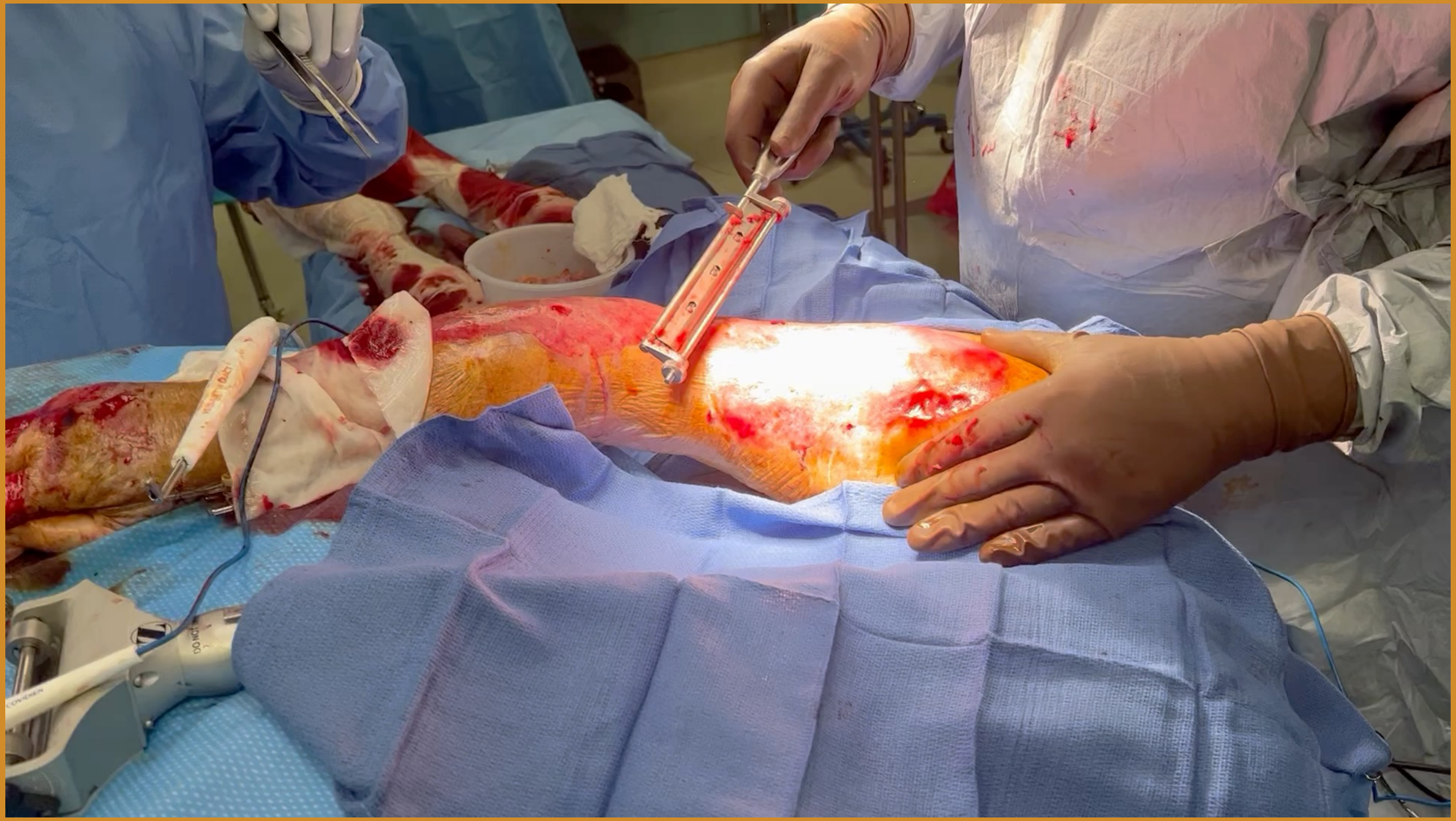




# Wound Bed Preparation

- **Tangential (CPT 15002-15005)**
  - **Service purpose:** to remove devitalized tissue while minimizing damage to viable tissues
  - **Viable tissue** demonstrated by punctate bleeding
  - **Early excision** within 7 days of injury
  - **Tourniquets** do not impact graft take

**Carter JE, et al., in Albanna MZ, et al. *Skin Tissue Engineering and Regenerative Medicine*. Academic Press; 2016. Sheridan R. *Crit Care Med*. 2007;35(2):665. O'Mara MS, et al. *Burns.* 2002;28(7):684-687. Sterling JP, et al. *Burns.* 2011;37(4):559-565. Rosenberg JL, et al. *J Trauma*. 1986;26(1):47-50.**



# Wound Bed Preparation

- **Hydrosurgical**
  - **Service location:** bedside, OR, ER, or physician office
  - **Technique:** commercially available devices
  - **Instruments:** hydrosurgery system and ultrasonic surgical aspirator
  - **Tissue removed:** slough, devitalized or non-viable tissue
  - **Descriptive terms**
    - Appearance: fresh bleeding tissue, viable tissue, etc.
    - Size of the wound: $cm^2$
    - Depth of the debridement: skin, fascia, subcutaneous tissue, soft tissue, muscle, bone

# Wound Bed Preparation

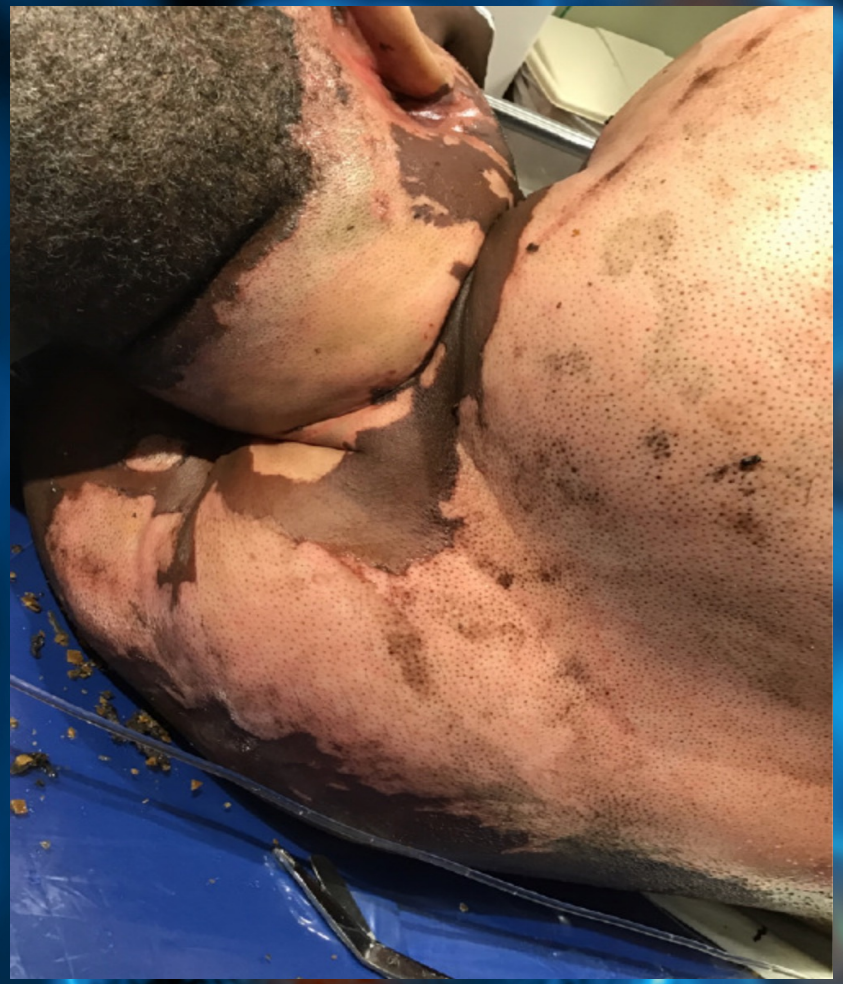
- **Hydrosurgical**
  - Hydrosurgical system
    - Tangential jet of saline
    - Difficult or sensitive anatomical areas
    - Small studies suggest better scarring
  - Ultrasonic surgical aspirator
    - Low-frequency ultrasound
    - Non-thermal debridement
    - Disrupts biofilms

**Rennekampff HO, et al. *Burns*. 2006;32(1):64-69. Hyland EJ, et al. *Burns*. 2015;41(4):700-707. Cao YL, et al. *Burns*. 2023;49(5):1087-1095. Korzendorfer H, et al. *Adv Wound Heal (New Rochelle).* 2014;3(12):733-741. Hiebert JM, et al. *Eplasty*. 2016;16:e32. Kataoka Y, et al. *Int Wound J.* 2021;18(2):176-186.**

# Wound Bed Preparation

- **Enzymatic**
  - **Service location:** bedside, OR, ER, or physician office
  - **Technique:** FDA-approved bromelain-based topical
  - **Instruments:** concentrate of proteolytic enzymes enriched in bromelain
  - **Indication:** deep-partial and full-thickness burn injury
  - **Tissue removed:** slough, devitalized or non-viable tissue
  - **Descriptive terms**
    - Appearance: color of residual dermis, presence of dermis or fat
    - Depth of the debridement: skin, fascia, subcutaneous tissue, soft tissue, muscle, bone

**FDA = US Food and Drug Administration.**



Before Enzyme

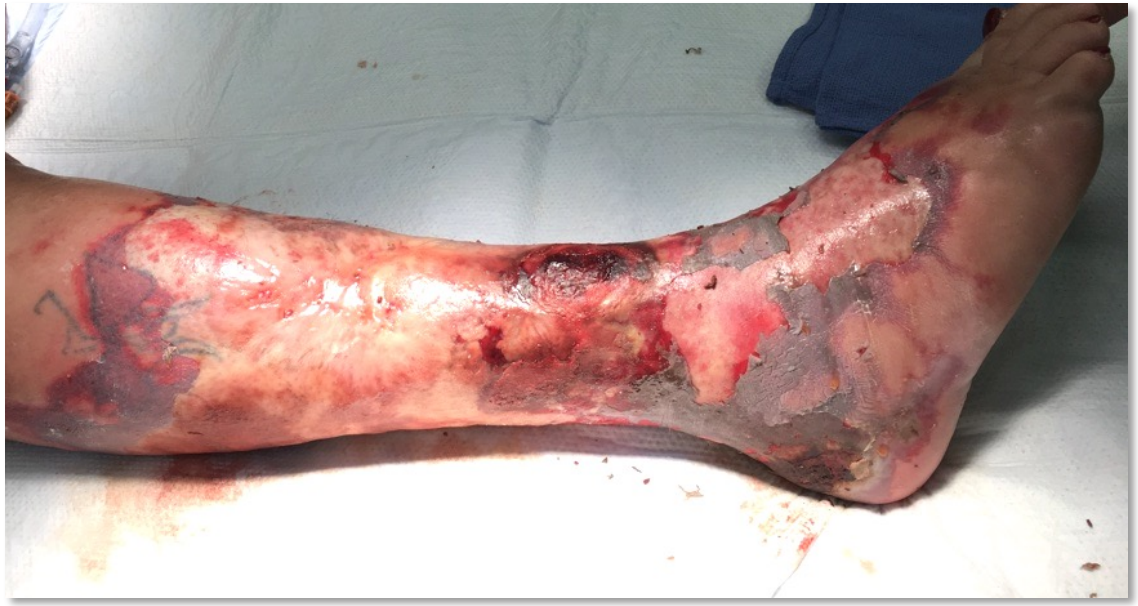
After Enzyme

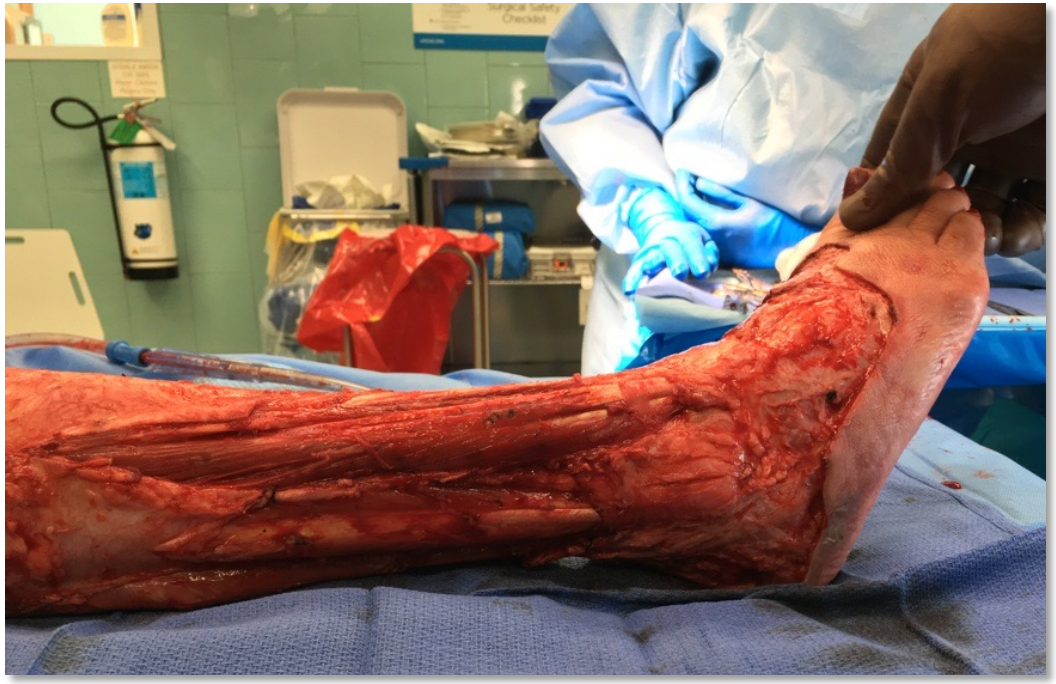
Images courtesy of Kahn S.

# Wound Bed Preparation

- **Fascial**
  - **Service location:** bedside, OR, ER, or physician office
  - **Technique:** FDA-approved bromelain-based topical
  - **Instruments:** concentrate of proteolytic enzymes enriched in bromelain
  - **Indication:** deep-partial and full-thickness burn injury
  - **Tissue removed:** slough, devitalized or non-viable tissue
  - **Descriptive terms**
    - Appearance: color of residual dermis, presence of dermis or fat
    - Depth of the debridement: skin, fascia, subcutaneous tissue, soft tissue, muscle, bone

# Necrotizing Soft Tissue Infection





# Wound Bed Preparation Coding

| CPT | Procedure | RVU | Global |
|---|---|---|---|
| | Wound Preparation and Excision | | |
| 15002 | Wound preparation trunk/arms/legs 0-100cm2 | 3.65 | 0 |
| 15003 | Wound preparation trunk/arms/legs additional 100 cm2 | 0.80 | 0 |
| 15004 | Wound preparation face/neck/hands/feet/genitals 0-100cm2 | 4.58 | 0 |
| 15005 | Wound preparation face/neck/hands/feet/genitals additional 100cm2 | 1.60 | 0 |
| | | | |
| | Deep Excision Codes | | |
| 11042 | Debridement of subcutaneous tissue <20cm2 | 1.01 | 0 |
| 11043 | Debridement of muscle/fascia <20cm2 | 2.70 | 0 |
| 11044 | Debridement bone <20cm2 | 4.10 | 0 |
| 11045 | Debridement subcutaneous tissue each additional 20cm2 | 0.50 | 0 |
| 11046 | Debridement of muscle/fascia each additional 20cm2 | 1.03 | 0 |
| 11047 | Debridement of bone each additional 20cm2 | 1.80 | 0 |


Wound Closure

# Closing the Wound

**Reconstructive Ladder**

Vascularized composite allograft
Vascularized free flap
Distant pedicle flap (groin/cross leg)
Local pedicle flap
Rotation muscle flap
Local skin flap
Skin substitute/epidermal autograft
Split-thickness/full-thickness autograft
Delayed primary closure
Primary closure
Secondary intention

# Closing the Wound

**Reconstruction Checklist**

- ❑ Removed devitalized tissue
- ❑ Infection source control/treatment
- ❑ Assessed for adequate perfusion
- ❑ Assessed for vitamin deficiencies
- ❑ Optimized nutritional support
- ❑ Optimized glucose management
- ❑ Evaluated fixation and mobilization plan
- ❑ Evaluated pain and scar mitigation options

# Closing the Wound

## Nutritional Assessment

- 59% vitamin D deficiency
- 70% thiamine deficiency
- Vitamin C and E deficiency
- Copper, selenium, and zinc deficiency in ≥ 20% TBSA
- 30% protein malnutrition

**Zavala S, et al. *Burns.* 2020;46(1):172-177. Manzanares W, et al. *Curr Opin Clin Nutr Metab Care*. 2011;14(6):610-617. Traber MG, et al. *Free Radic Biol Med.* 2007;42(9):1421-1429. Corkins MR, et al. *JPEN J Parenter Enteral Nutr*. 2014;38(2):186-195. Gutowska I, et al. *Nutrients.* 2022;14(2):4248. Jeschke MG, et al. *Nat Rev Dis Primers*. 2020;6(1):11.**

# Closing the Wound

- Pain and anxiety produce physiologic stress that ***delays wound healing***
  - Elevated glucocorticoids and adrenaline levels produce an immunosuppressive effect
  - Prohibits phagocytic activity and chemotaxis
  - Multiple studies have demonstrated ***impaired healing with stress***

**Marucha PT, et al. *Psychosom Med.* 1998;60(3):362-365. Kiecolt-Glaser JK, et al. *Arch Gen Psychiatry.* 2005;62(12):1377-1384. Glaser R, et al. *Arch Gen Psychiatry*. 1999,56(5):450-456. Broadbent E, et al. *Psychosom Med.* 2003;65(5):865-869. Sternberg EM, et al. *Nat Rev Immunol.* 2006;6(4):318-328. Chrousos GP, et al. *Ann N Y Acad Sci.* 1998;851:311-335. DeRijk R, et al. *J Clin Endocrinol Metab.* 1997;82(7):2182-2191. Glaser R, et al. *Nat Rev Immunol.* 2005;5(3):243-251.**

# Closing the Wound

- **What are the tissue deficits?**
  - Rotational flap, free flap, skin substitute?
  - Full-thickness, partial-thickness, epidermal autograft (spray)?
- **Donor site considerations**
  - Time to donor-site epithelialization: ***4.7 to 35.0 days***
  - Pain scores (0-10 scale) on post-operative day 3: ***1.24 to 6.38***
  - One study reported 28% of patients had donor-site ***scar hypertrophy at 8 years***
  - Infection rates were generally low but range from ***0 to 56%***
  - Persistent pigmentation problems > 5 years in **88% of donor sites**

**Asuku M, et al. *Burns.* 2021;47(7):1525-1546. Karlsson M, et al. *Adv Skin Wound Care.* 2020;33(12):1-5.**

# Skin Substitutes

- **Purpose:** wound coverage and/or promoting wound bed development to support definitive closure
- **Size:** < 1 $cm^2$ to > 1,800 $cm^2$
- **Cost:** $2 to > $200/$cm^2$
- **Types:** over 300 types of skin substitutes
  - ***Synthetic***
    - Bioengineered allogeneic cellularized construct (BACC)
    - Polyurethane bilaminate
    - Polydioxanone scaffolds
  - ***Biologic***
    - Xenograft—bovine, porcine, piscine
    - Allograft—human tissue donation
    - Placental extracellular matrix

**Table 1.** Currently used or emerging biologic and synthetic dermal substitutes for burn wounds

| Manufacturer | Country of origin | Product name | FDA approval | Year of approval | Approved indications |
|---|---|---|---|---|---|
| PolyNovo Ltd | Melbourne, Australia | NovoSorb® Biodegradable Temporizing Matrix | 510K | 2015 | Partial and full-thickness wounds, pressure ulcers, venous ulcers, diabetic ulcers, chronic and vascular ulcers, surgical wounds, trauma wounds (abrasions, lacerations, second-degree burns, and skin tears), and draining wounds |
| Medline Industries, LP | Northfield, IL | Hyalomatrix® | 510K | 2007 | Partial and full-thickness wounds, pressure ulcers, venous ulcers, diabetic ulcers, chronic and vascular ulcers, surgical wounds, trauma wounds (abrasions, lacerations, second-degree burns, and skin tears), and draining wounds |
| Polymedics Innovations | Denkendorf, Germany | Suprathel® | 510K | 2009 | Partial and full-thickness wounds, pressure, venous, diabetic, chronic, and vascular ulcers, surgical wounds, trauma wounds (abrasions, lacerations, second-degree burns, and skin tears), grafted wounds, donor sites, and draining wounds |
| Stedical Scientific | Shanghai, China | Permeaderm™ | 510K | 2016 | Partial and full-thickness wounds, pressure, venous, diabetic, chronic, and vascular ulcers, surgical wounds, trauma wounds (abrasions, lacerations, second-degree burns, and skin tears), grafted wounds, donor sites, and draining wounds |
| Integra Lifesciences | Princeton, NJ | Integra® Dermal Regenerative Template | PMA | 1996 | Life-threatening full-thickness or deep partial thermal injuries where sufficient autograft is not available at the time of excision or not desirable due to the physiological condition of the patient and for use in reconstruction of full-thickness defects of the integument where there is, in the opinion of the treating surgeon, a potential benefit to the patient by improving the reconstructive outcome or decreasing their mortality/morbidity |
| Integra Lifesciences | Princeton, NJ | Integra® Primatrx™ | 510K | 2016 | Wounds that include partial and full-thickness wounds, pressure, diabetic, and venous ulcers, second-degree burns, surgical wounds, trauma wounds (abrasions, lacerations and skin tears), tunneled/undermined wounds, and draining wounds |
| Kerecis LLC, USA | Isafjordur, Iceland | Kerecis® Omega3 GraftGuide™ | 510K | 2019 | Partial and full-thickness wounds, pressure, venous, diabetic, chronic, and vascular ulcers, surgical wounds, trauma wounds (abrasions, lacerations, second-degree burns, and skin tears), grafted wounds, donor sites, and draining wounds |
| Mallinckrodt Plc | Hobart, NY | StrataGraft® | BLA | 2021 | Treatment of adults with thermal burns containing intact dermal elements for which surgical intervention is clinically indicated (deep partial-thickness burns) |
| Triad Life Sciences | Memphis, TN | InnovaBurn™ | 510K | 2020 | Partial and full-thickness wounds, pressure, venous, diabetic, chronic, and vascular ulcers, surgical wounds, trauma wounds (abrasions, lacerations, second-degree burns, and skin tears), grafted wounds, donor sites, and draining wounds |
| MiMedx Group, Inc | Marietta, GA | AmnioBurn® | HCT/P | N/A | N/A |
| MedSkin Solutions Dr. Suwelack AG | Billerbeck, Germany | MatriDerm® | 510K | 2021 | Partial and full-thickness wounds, chronic, pressure, venous, and diabetic ulcers, surgical wounds, draining wound, traumatic wounds (abrasions, lacerations, and skin tears), and partial-thickness burns |

Hill DM, et al. *J Burn Care Res*. 2023;44(Suppl_1):S26-S32.

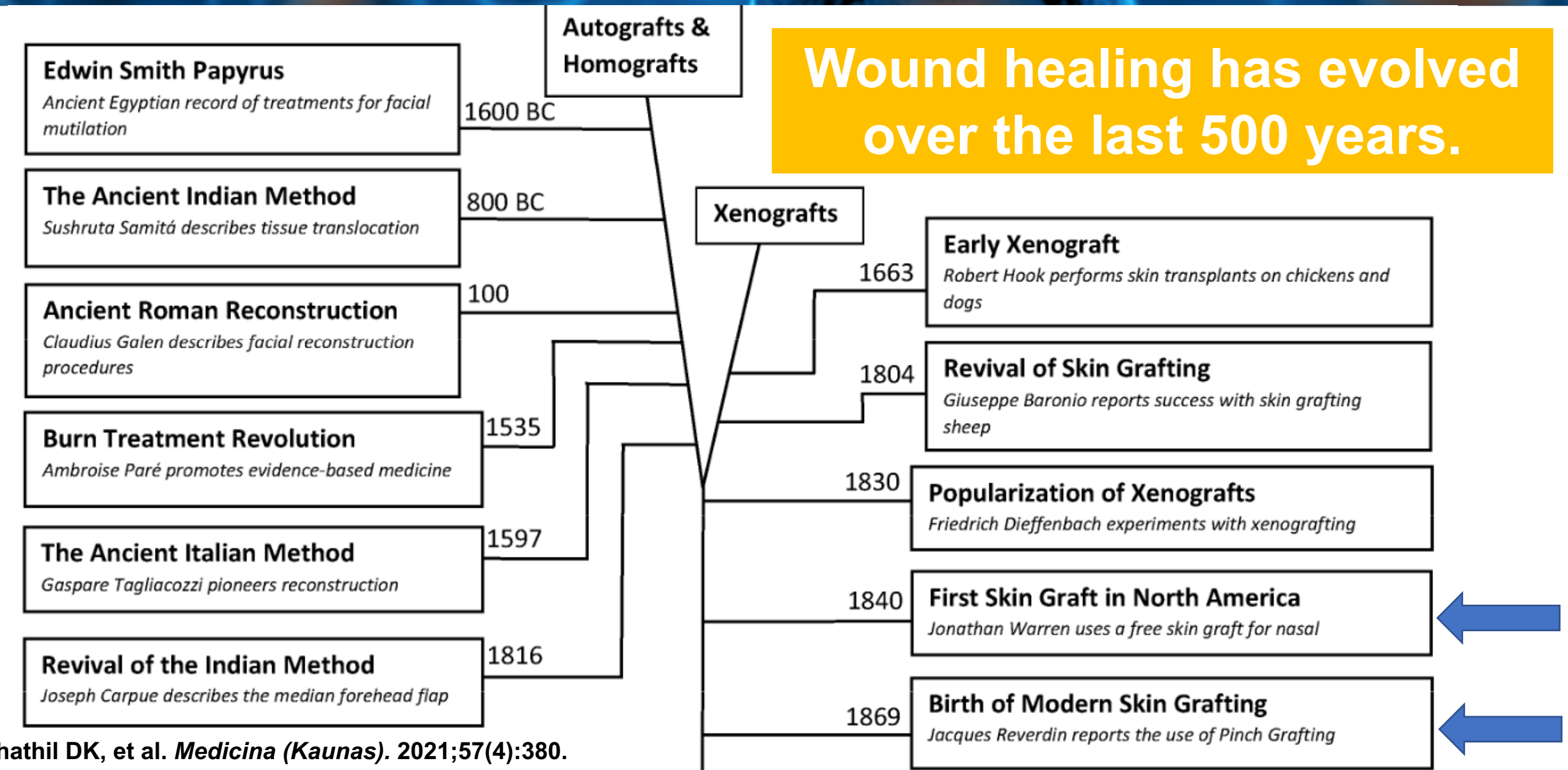
**Table 2.** Dermal substitute characteristics

| Product name | Classification | Components | Largest size ($cm^2$) | Smallest size ($cm^2$) | Promoted qualities | Product limitations |
|---|---|---|---|---|---|---|
| NovoSorb® Biodegradable Temporizing Matrix | Synthetic | Perforated polyurethane sealing membrane bonded to polyurethane foam | 800 $cm^2$ (20 × 40 cm) | 100 $cm^2$ (10 × 10 cm) | Resistant to infection, biodegrades, low contracture rates | Avoid excessive water saturation, time to engraftment |
| Hyalomatrix® | Synthetic | Nonwoven pad of esterfied hyaluronic acid available with or without semipermeable silicone membrane | 360 $cm^2$ (18 × 20 cm) | 6.25 $cm^2$ (2.5 × 2.5 cm) | Biodegrades, application to deep structures, low-cost | Less rigid, degrades rapidly |
| Suprathel® | Synthetic | Collection of synthetic polymers consisting mainly of dl-lactide (>70%), trimethylenecarbonate, and ε-caprolactone | 414 $cm^2$ (18 × 23 cm) | 25 $cm^2$ (5 × 5 cm) | Less wound care, absorbable, low-cost | Avoid exposed tendon, bone, cartilage, muscle, heavily exuding wounds, old burn wounds |
| Permeaderm™ | Synthetic | Monofilament nylon knitted fabric bonded to thin slitted silicon membrane coated with a hypoallergenic porcine gelatin and aloe vera | 2,903 $cm^2$ (38.1 × 76.2 cm) | 323 $cm^2$ (12.7 × 25.4 cm) | Glove available, variable porosity, good adherence, low-cost | Proper wound bed preparation |
| Integra® Dermal Regenerative Template | Biologic | Silicon sheet with with a porous matrix of cross-linked bovine tendon collagen and glycosaminoglycan (chondroitin-6-sulfate) | 500 $cm^2$ (20 × 25 cm) | 25 $cm^2$ (5 × 5 cm) | Works well with reconstruction | Cost, prolonged vascularization, high reported infection rates |
| Integra® Primatrx™ | Biologic | Acellular collagen matrix from fetal bovine dermis available meshed, fenestrated, & solid | 500 $cm^2$ (20 × 25 cm) | 36 $cm^2$ (6 × 6 cm) | Lower infection rate | Cost, time to vascularization, must maintain moist wound bed |
| Kerecis® Omega3 GraftGuide™ | Biologic | Piscine acellular 2:1 meshed collagen matrix processed from Icelandic cod | 600 $cm^2$ (20 × 30 cm) | 70 $cm^2$ (7 × 10 cm) | Accelerated healing | Cost, odoriferous |
| StrataGraft® | Biologic | Allogeneic cultured keratinocytes and dermal fibroblasts in a murine collagen-dsat | 100 $cm^2$ (8 × 12 cm) | N/A | No donor sites needed | Cost, healing time, not for full- thickness |
| InnovaBurn™ | Biologic | Decellularized extracellular matrix derived from porcine placental tissue that consists of collagen, elastin, laminin, fibronectin, hyaluronic acid, and sulfated glycosaminoglycans | 300 $cm^2$ (15 × 20 cm) | 35 $cm^2$ (5 × 7 cm) | Cost, decellularized | Newest to market, needs clinical data |
| AmnioBurn® | Biologic | Dehydrated layered matrix consisting of human amnion and chorion membranes | 180 $cm^2$ (9 × 20 cm) | 36 $cm^2$ (6 × 6 cm) | Decreased pruritis and hypertrophic scarring | May require reapplication |
| MatriDerm® | Biologic | Non-chemically cross-linked bovine collagen matrix with elastin | 624 $cm^2$ (21.0 × 29.7 cm) | 19 $cm^2$ (3.7 × 5.2 cm) | Scar quality, rapid vascularization, earlier skin graft coverage | Proper wound bed preparation, contraction higher in delayed definitive coverage |

Hill DM, et al. *J Burn Care Res*. 2023;44(Suppl_1):S26-S32.

# Wound Closure Techniques

**Wound healing has evolved over the last 500 years.**




Ozhathil DK, et al. *Medicina (Kaunas).* 2021;57(4):380.

# Wound Closure Techniques

**All wounds will attempt to close by regeneration and/or contracture.**

**Skin Grafting to Burns** — 1870
*Pollock and Reverdin reports successful use of skin grafts in burn treatment*

**Ollier-Thiersch Graft** — 1886
*Carl Thiersch presents to the German Surgical Association*

**Introduction of the Humby Knife** — 1934
*Thomas Humby invents the Humby knife*

**Brown Electric Dermatome** — 1948
*Harry Brown invents the electric dermatome*

**Introduction of the Watson Knife** — 1960
*John Watson invents the Watson knife*

**Integra® Skin Substitute** — 1996
*FDA approves the use of Integra® as a skin substitute*

**ReCell™ System** — 2018
*FDA approves use of ReCell™ in the United States*

**Viability of Refrigerated Skin** — 1903
*Johann Wentscher describes skin graft refrigeration*

**Padgett-Hood Dermatome** — 1939
*Padgett and Hood introduces the first dermatome*

**Meek-Wall Dermatome** — 1958
*Meek and Wall introduce their method for skin expansion*

**Popularization of Early Excision** — 1970
*Zora Janžekovič promotes early tangential excision and skin grafting of burn wounds*

**ReCell™ System** — 2005
*Fiona Wood introduces aerosolization of non-cultured epithelial cells*

**Ozhathil DK, et al. *Medicina (Kaunas).* 2021;57(4):380.**

# Wound Closure Techniques

- **Full-thickness autografts**
  - Excellent function and cosmetics limited by donor size
  - Tissue expanders provide an option for adjacent donor expansion
- **Split-thickness autografts**
  - Epidermal and dermal components transplanted from donor site to recipient wound site with or without meshing to increase coverage
  - Donor site morbidity and limited size with large wounds
- **Epidermal autografts**
  - $\leq$ 8/1,000$^{ths}$ of an inch thickness autograft or autologous skin cell suspension
  - Reduced donor site morbidity but requires dermal/neodermal components

**Ozhathil DK, et al. Medicina (Kaunas). 2021;57(4):380. Chacon MA, et al. *J Burn Care Res.* 2020;41(4):849-852. Israel JS, et al. *J Burn Care Res.* 2017;38(1):e125-132.**

# Wound Closure Techniques

***Keratinocytes***

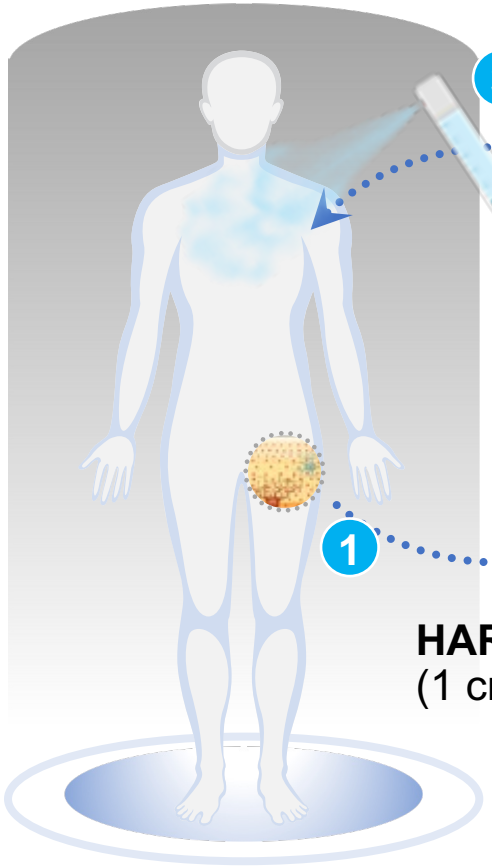
*Including basal, suprabasal, and activated keratinocytes, critical for regeneration of the epidermis*

***Melanocytes***

*Produce melanin to allow restoration of natural pigmentation*

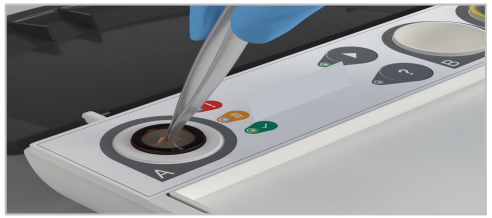
***Fibroblasts***

*Deposits new extracellular matrix proteins*



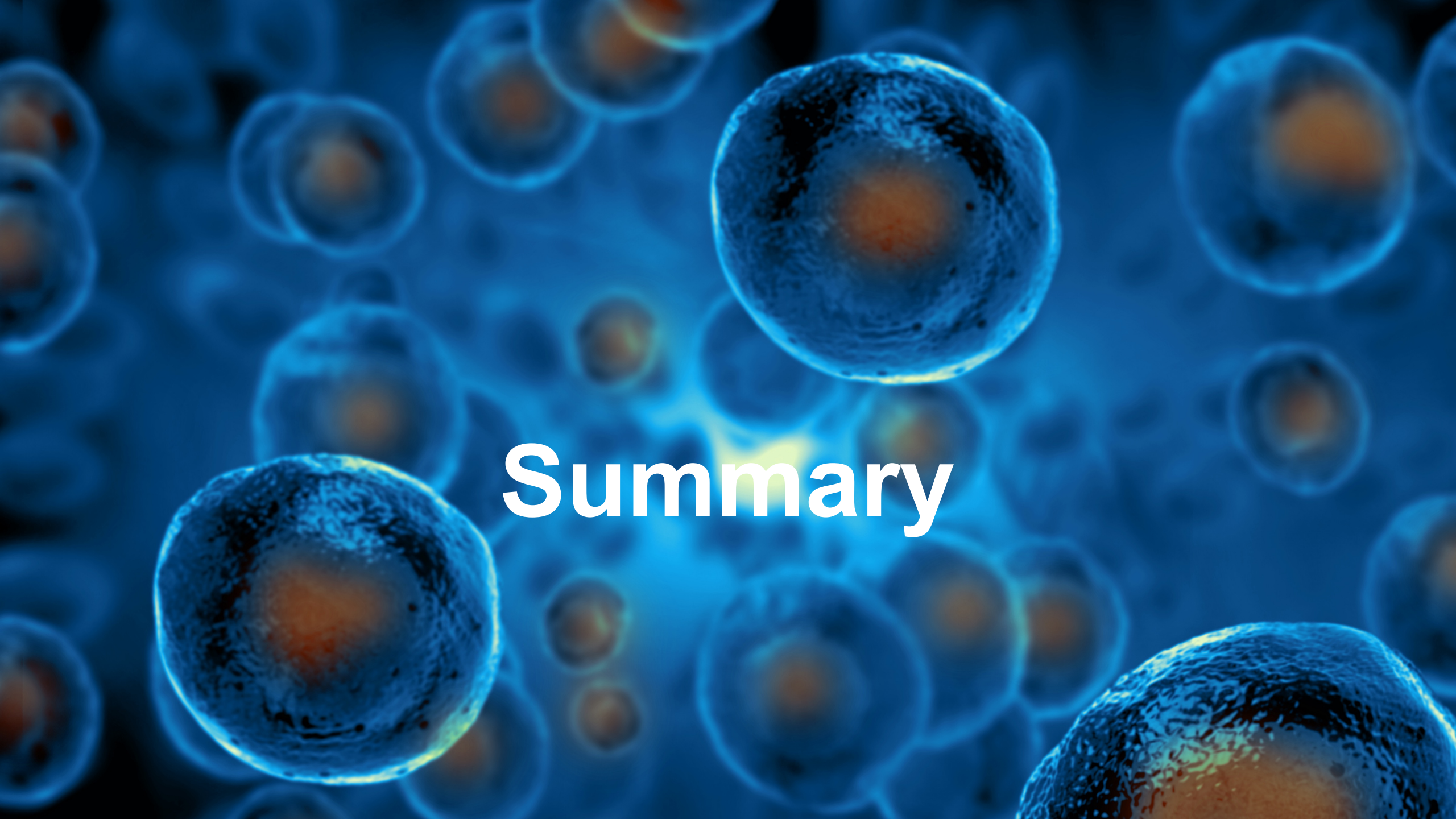

**DELIVER AND DRESS:** Apply skin cells back to patient and apply dressings (~10 min)

**PREPARE:** Process skin using the autologous cell harvesting system (~20 min)



**HARVEST:** Obtain skin sample w/ dermatome in OR (1 $cm^2$ treats up to 80 $cm^2$)

**Hirobe T. *Dermatol Sin*. 2014;32(4):200-204. Freedberg IM, et al. *J Invest Dermatol.* 2001;116(5):633-640.**


Summary

# Summary

- Wound bed preparation is key to wound closure
- Preoperative planning should include
  - Nutrition/metabolic concerns
  - Therapy/mobility
  - Wound care/scarring
- Mitigating donor site morbidity decreases scarring, pain, and length of stay

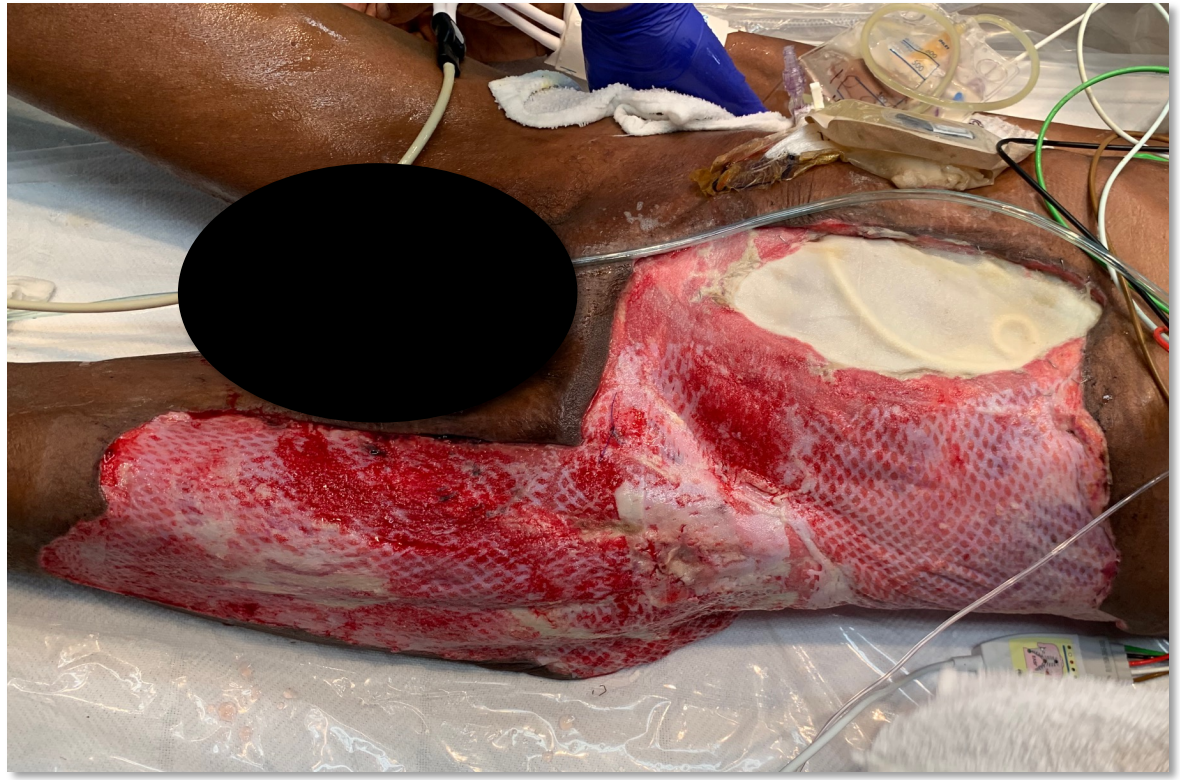

Case Examples

# Case 1: Necrotizing Soft Tissue Infection

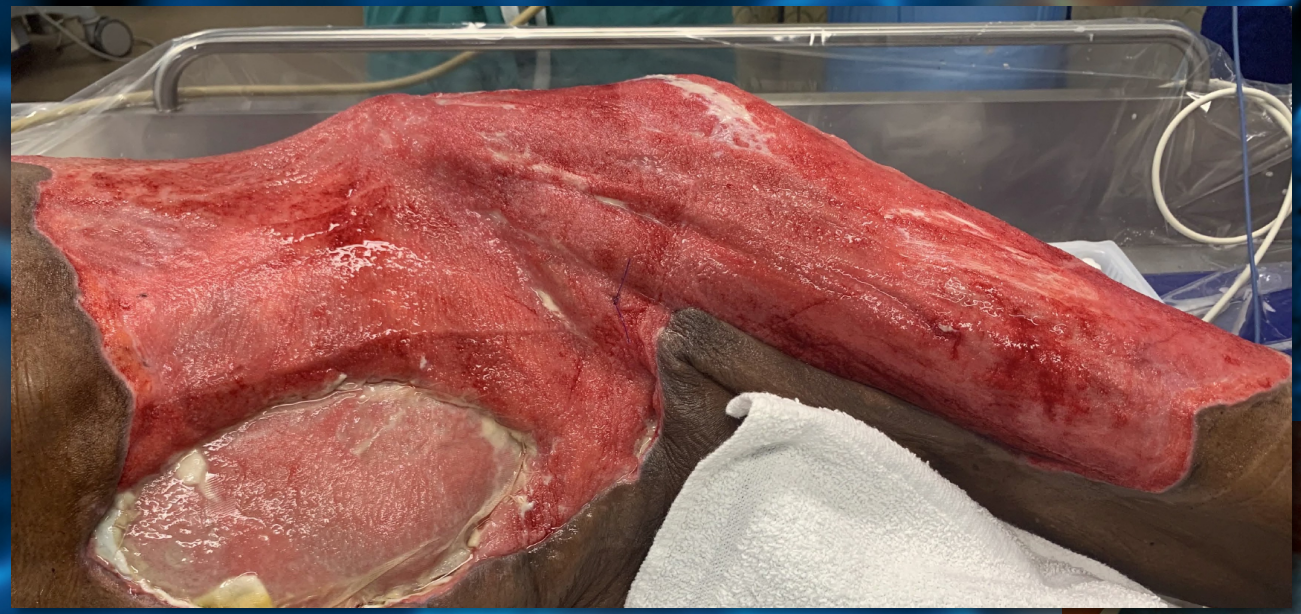
| | |
|---|---|
| Age: | 67 yo male with necrotizing soft tissue infection |
| History: | NSTI after robotic APR, neoadjuvant XRT, and chemo |
| Gender: | Male |
| Wound: | Open abdomen, abdomen, back, and thigh |
| Disposition: | From hospice to inpatient to rehab |

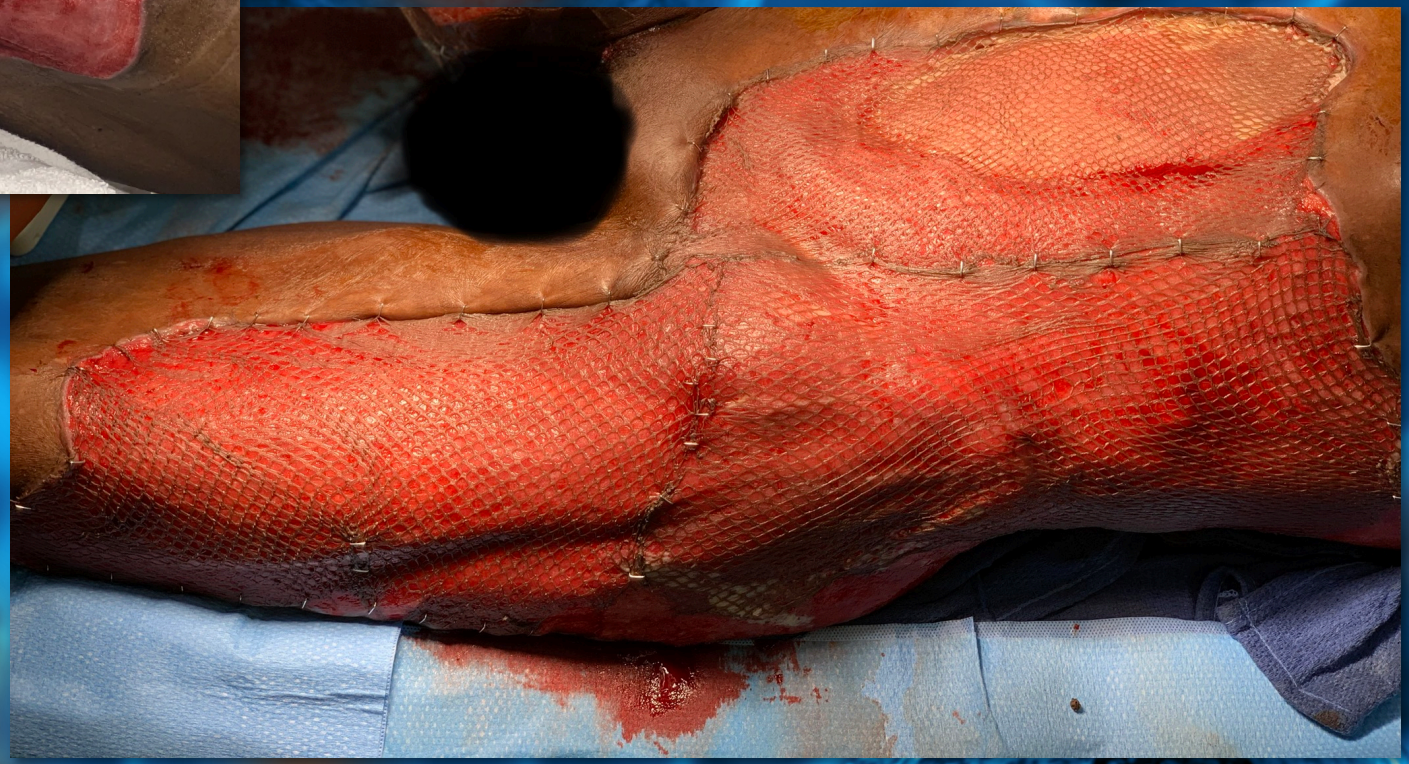
**APR = abdominoperineal resection; XRT = radiotherapy.**

# 7 Days Post-application of Dermal Substitute to Muscle/Fascia: Abdomen with Biologic Hernia Mesh



# 3:1 mesh STSG with ASCS

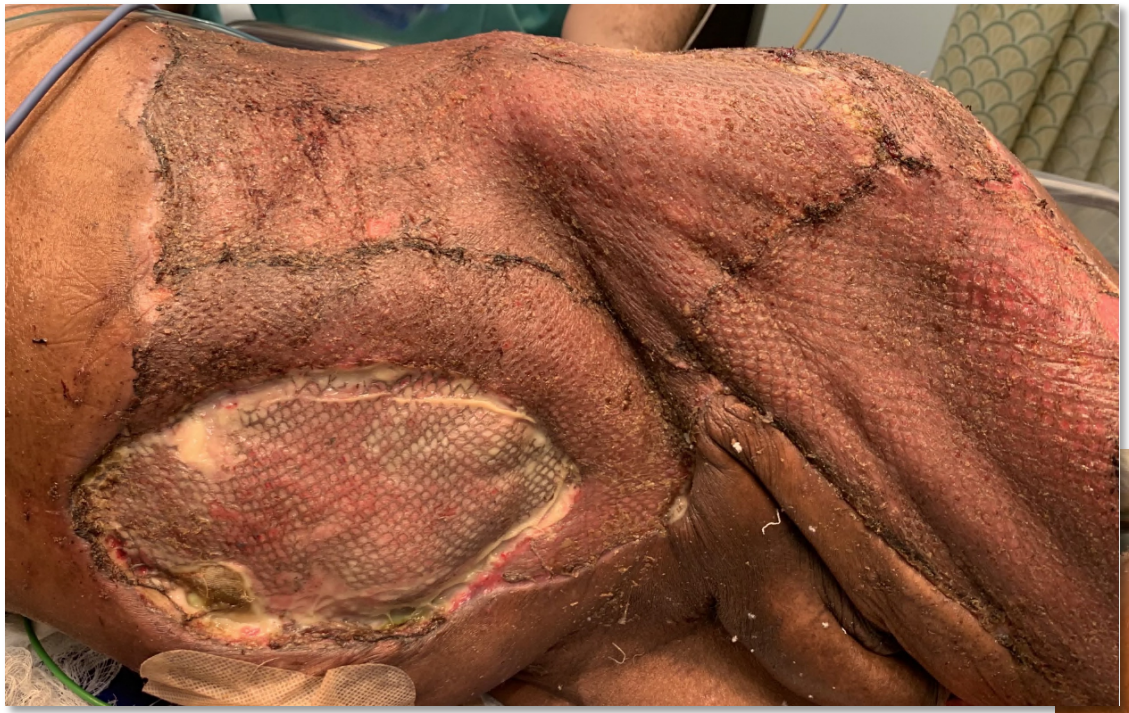


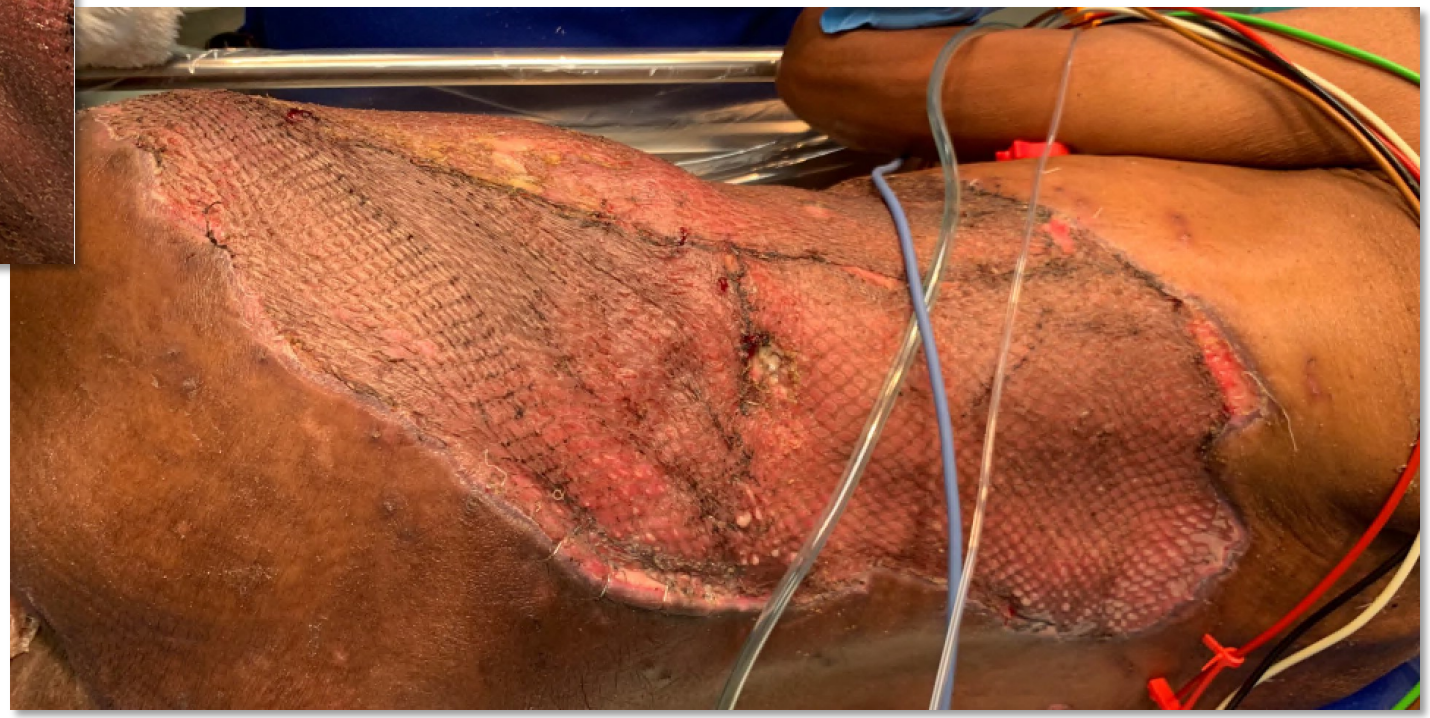


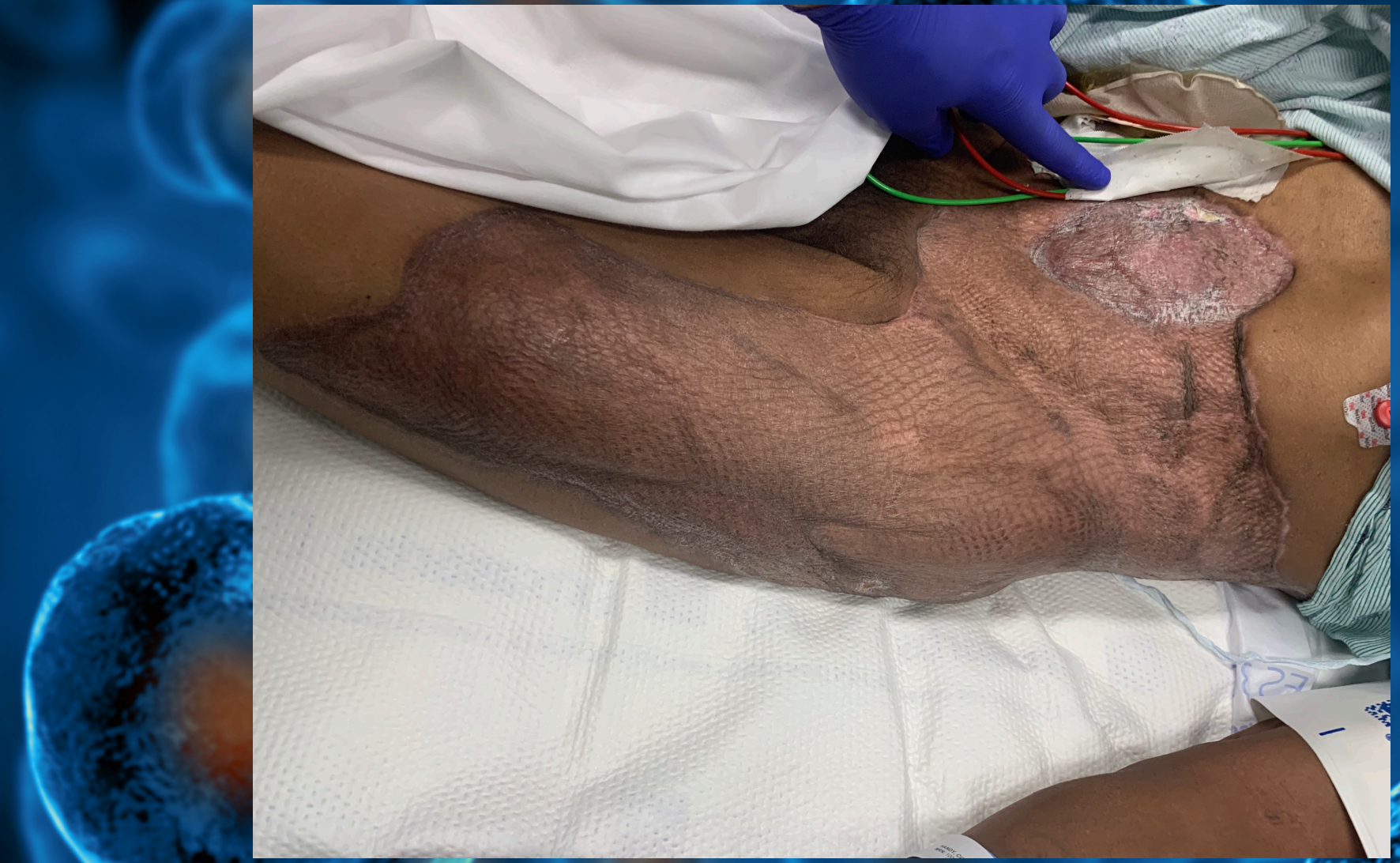
- 7 days post-application absorbable polyglactin mesh
- 14 days post-application dermal substitute

ASCS = autologous skin cell suspension.

# 7 Days Post-application 3:1 Mesh STSG and ASCS



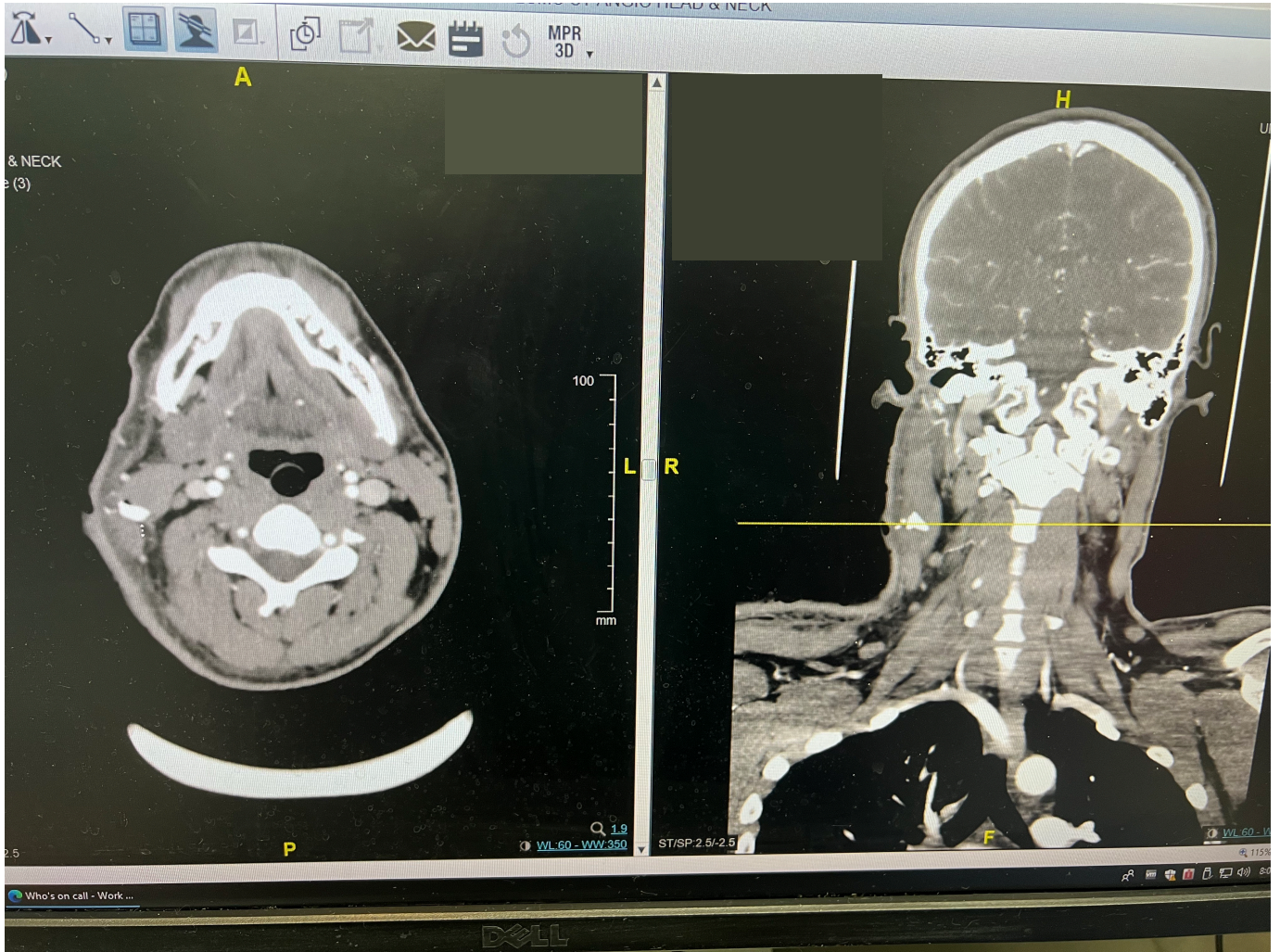




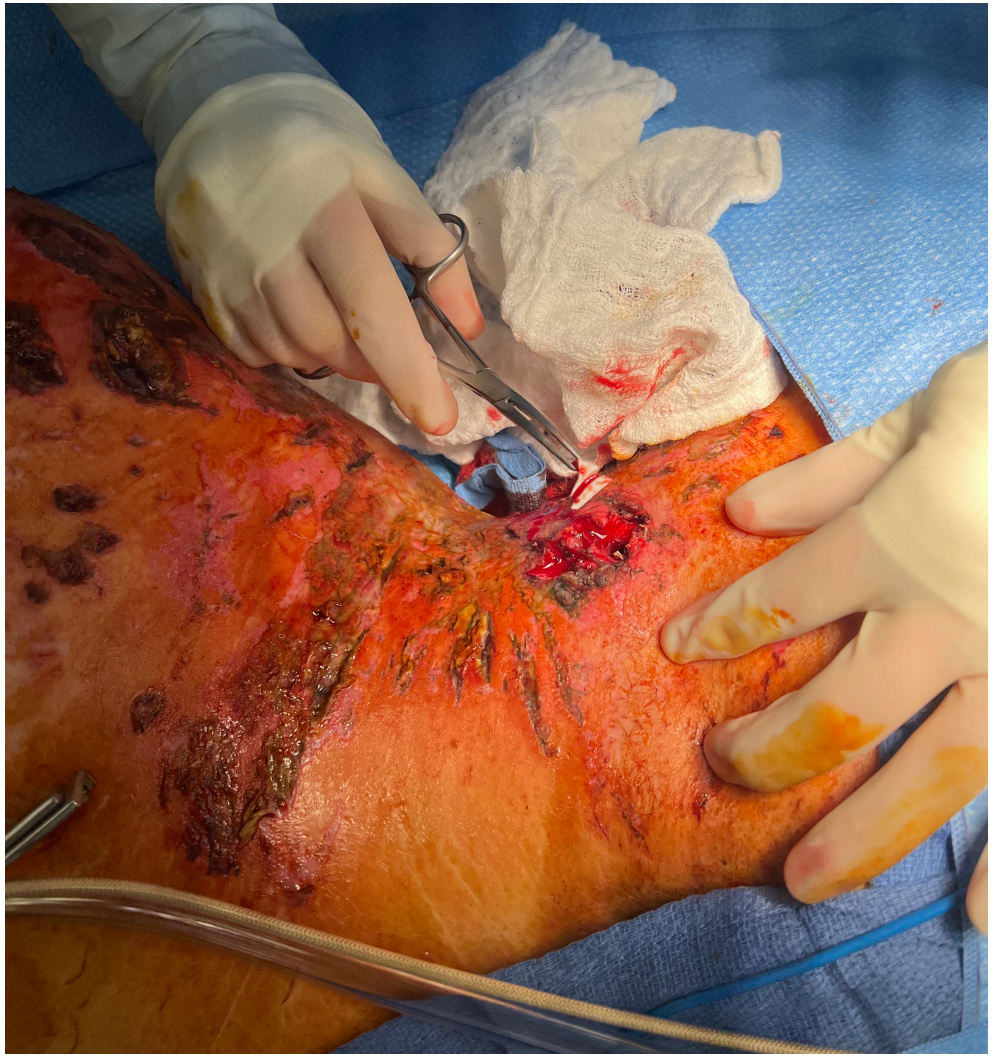
# Case 2: Blast Injury

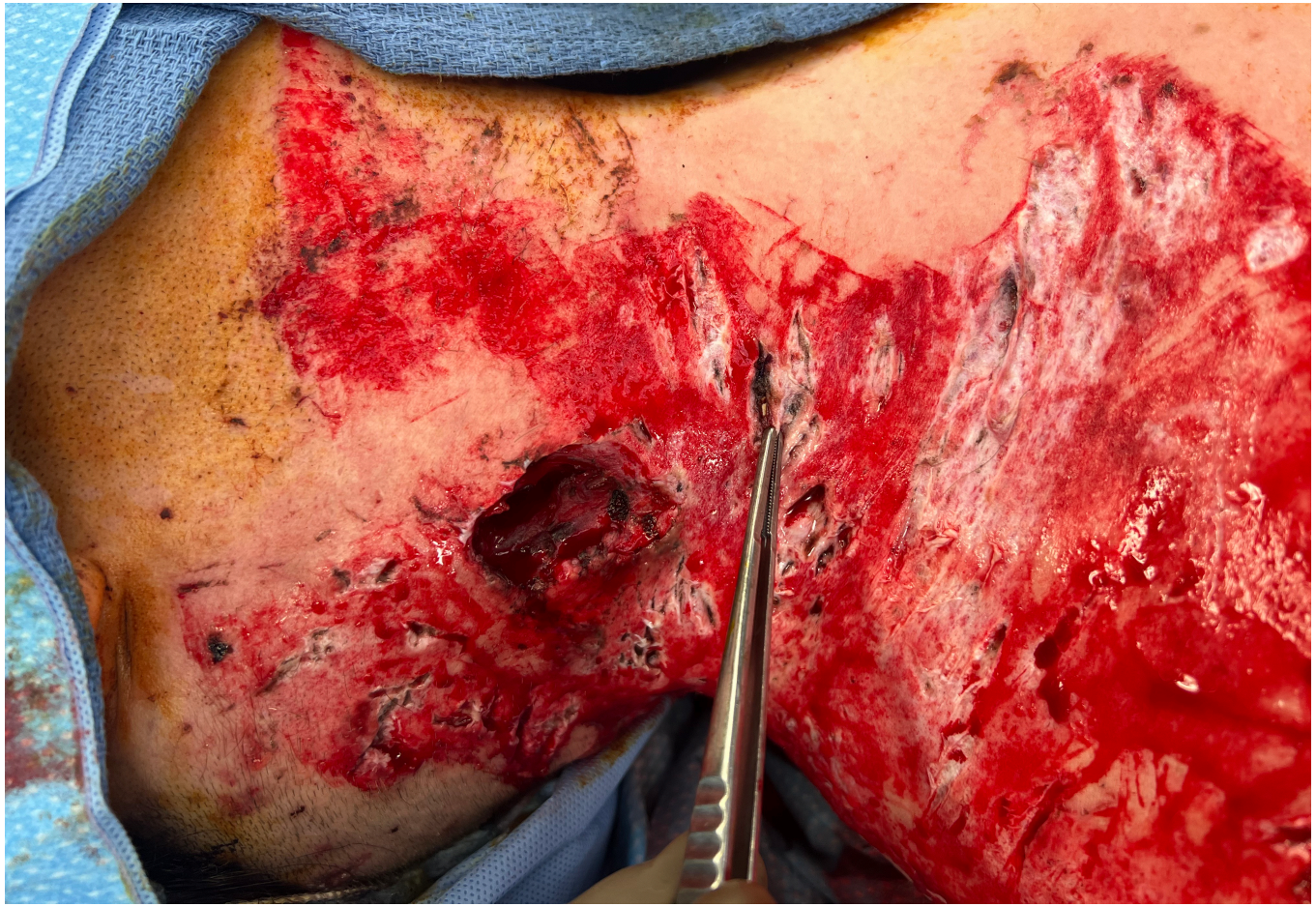
| | |
|---|---|
| Age: | 20-year-old |
| Gender: | Male |
| History: | Fireworks |
| Mechanism: | Blast |
| Disposition: | Home |

# Day of Injury

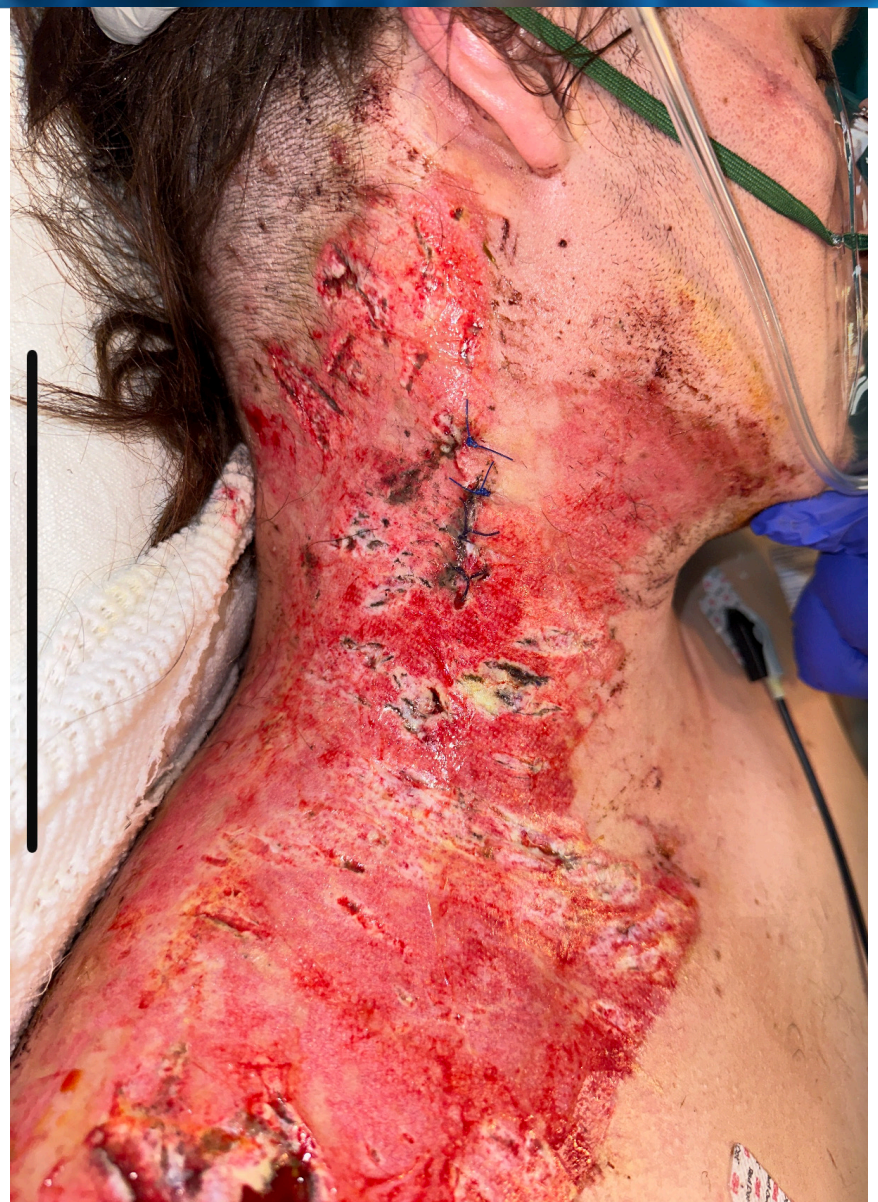


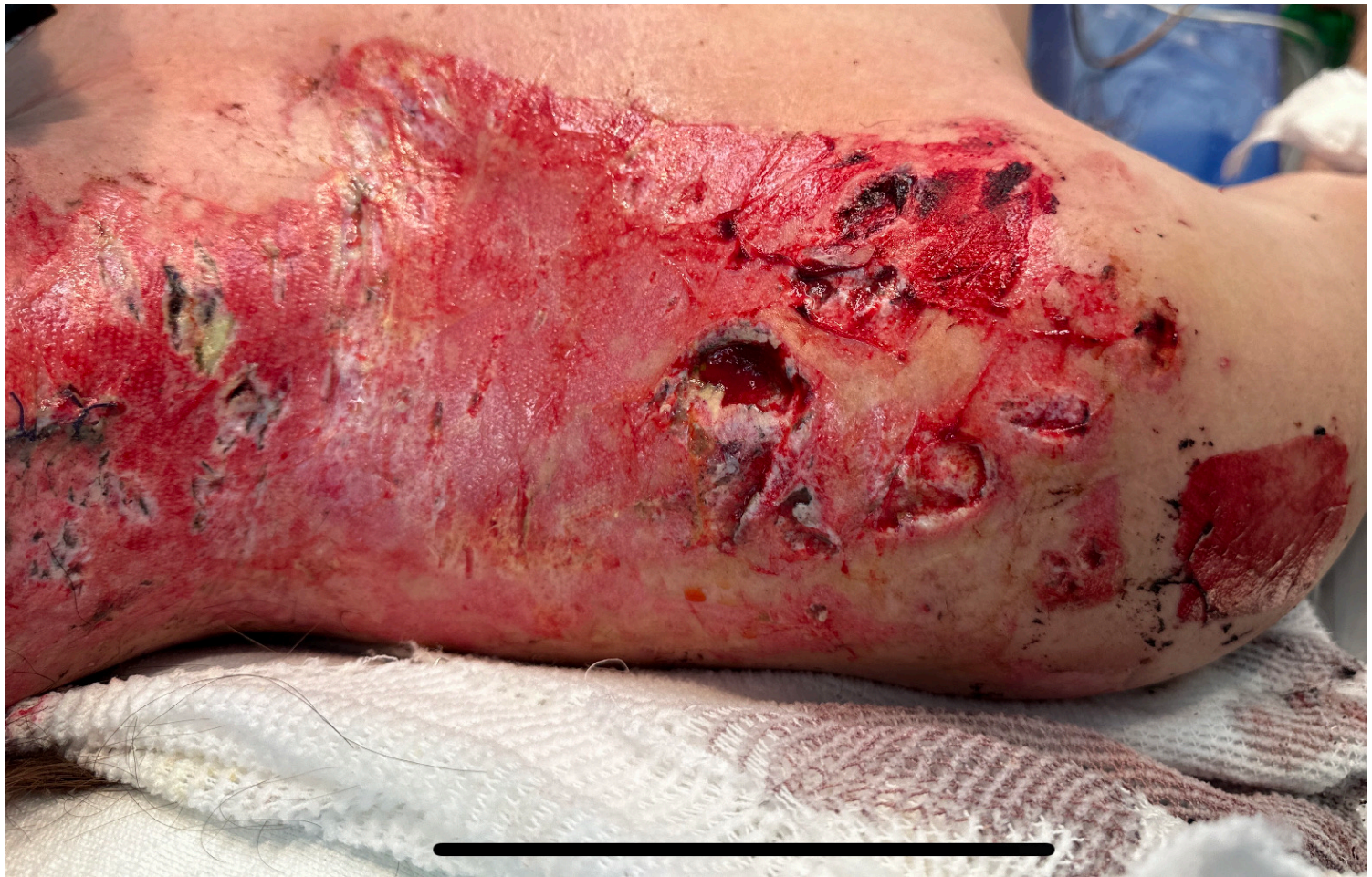
# Intraoperative



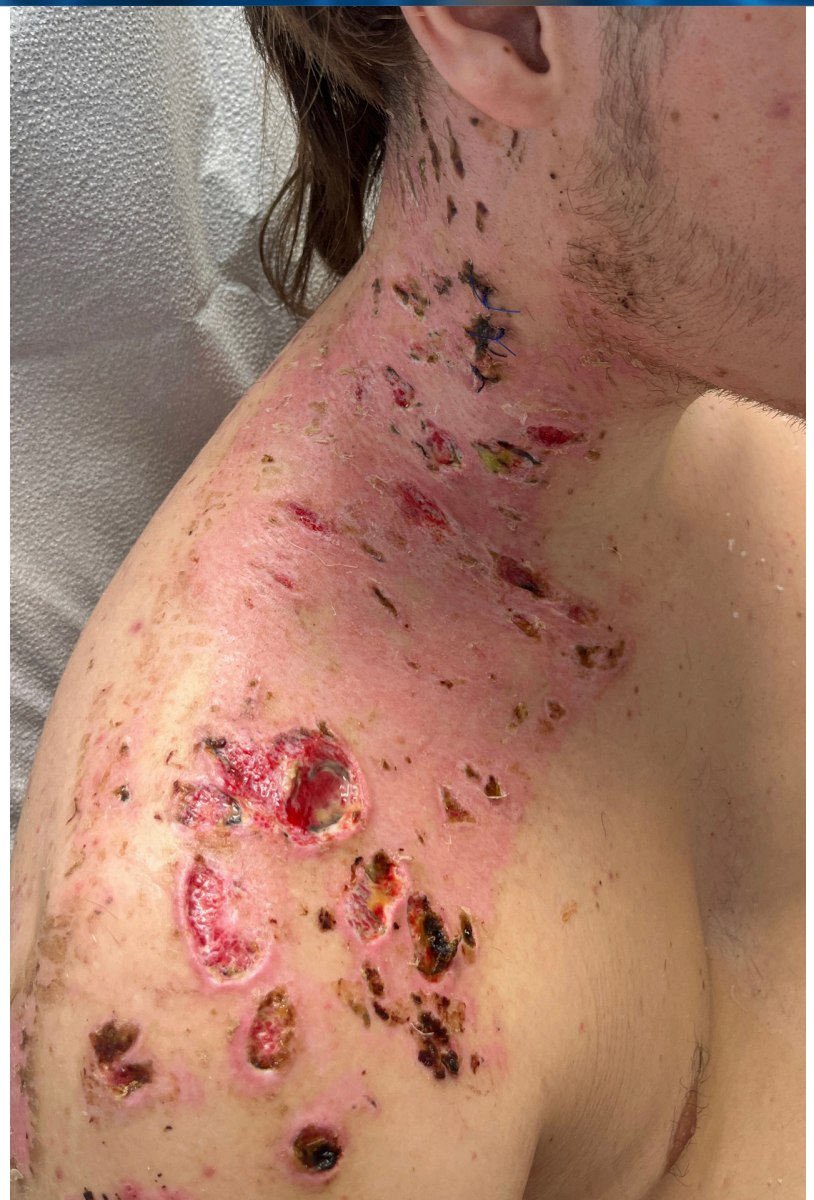


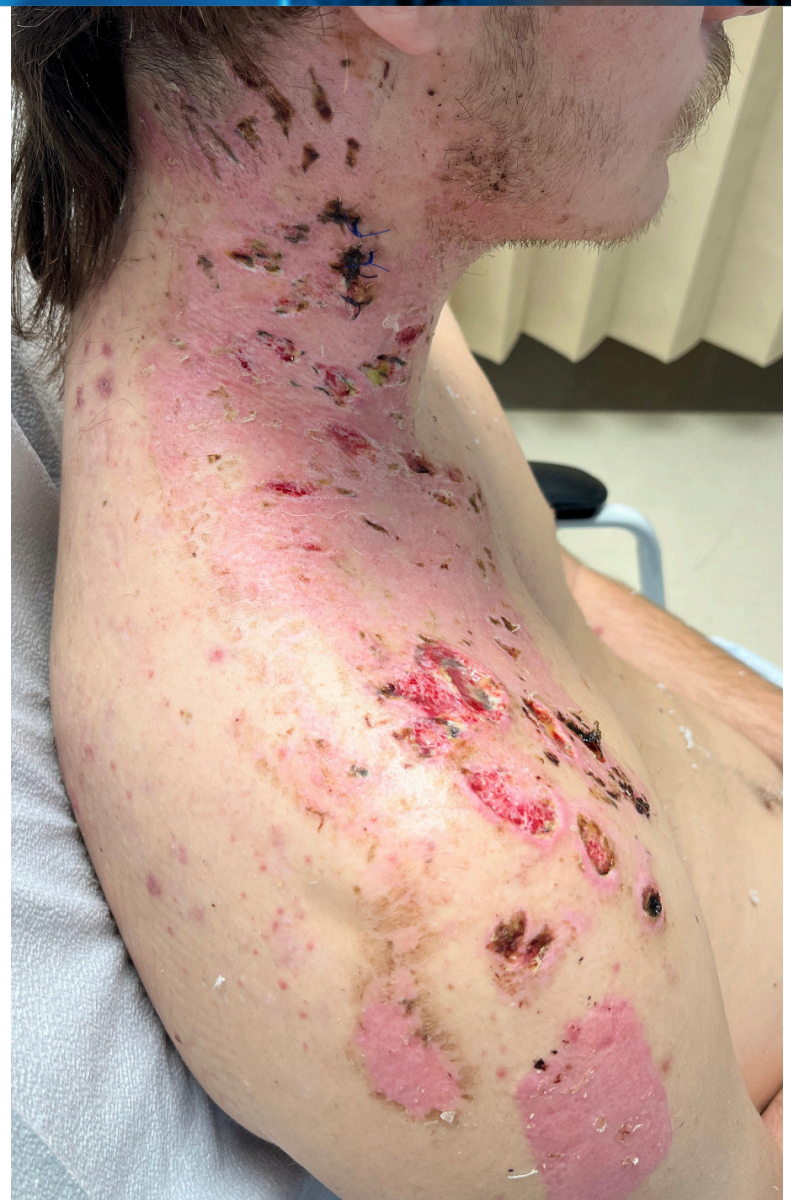
# Post-op Day 2

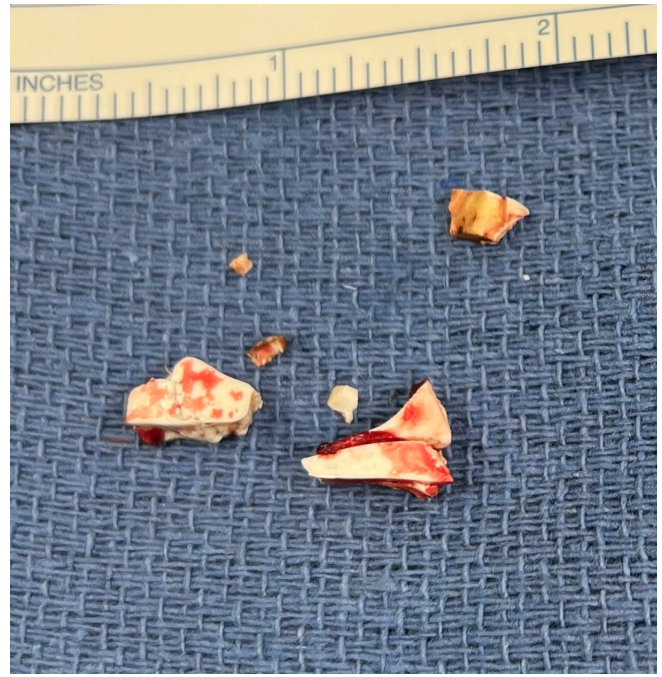




# Post-op Day 9

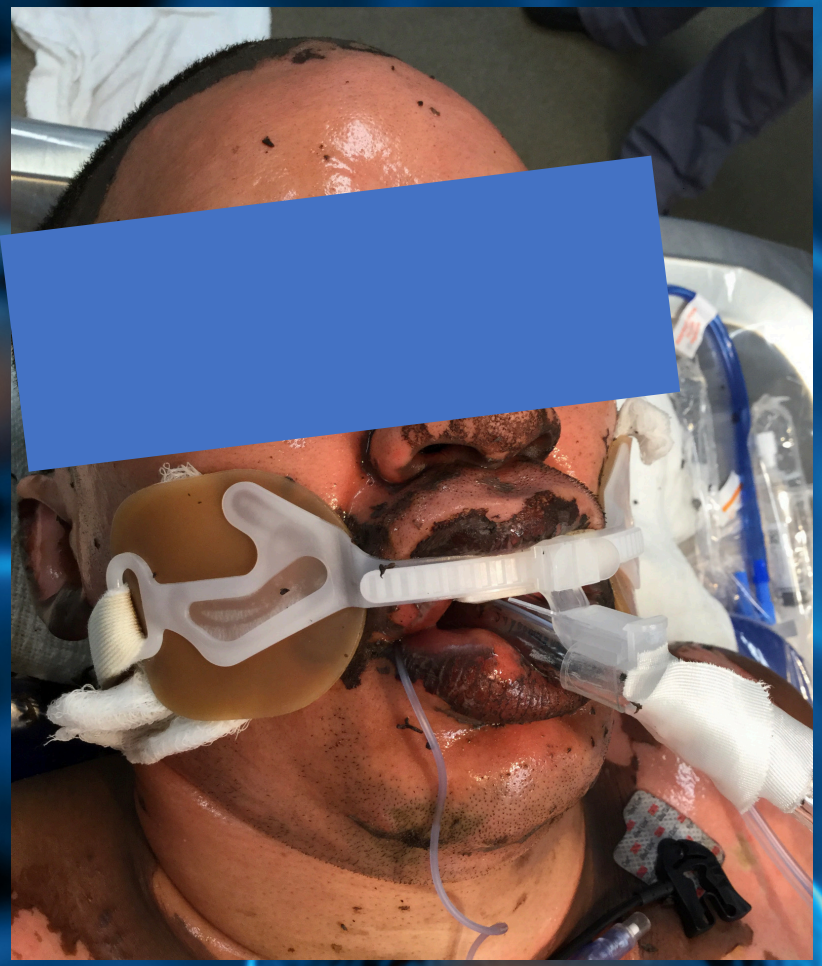


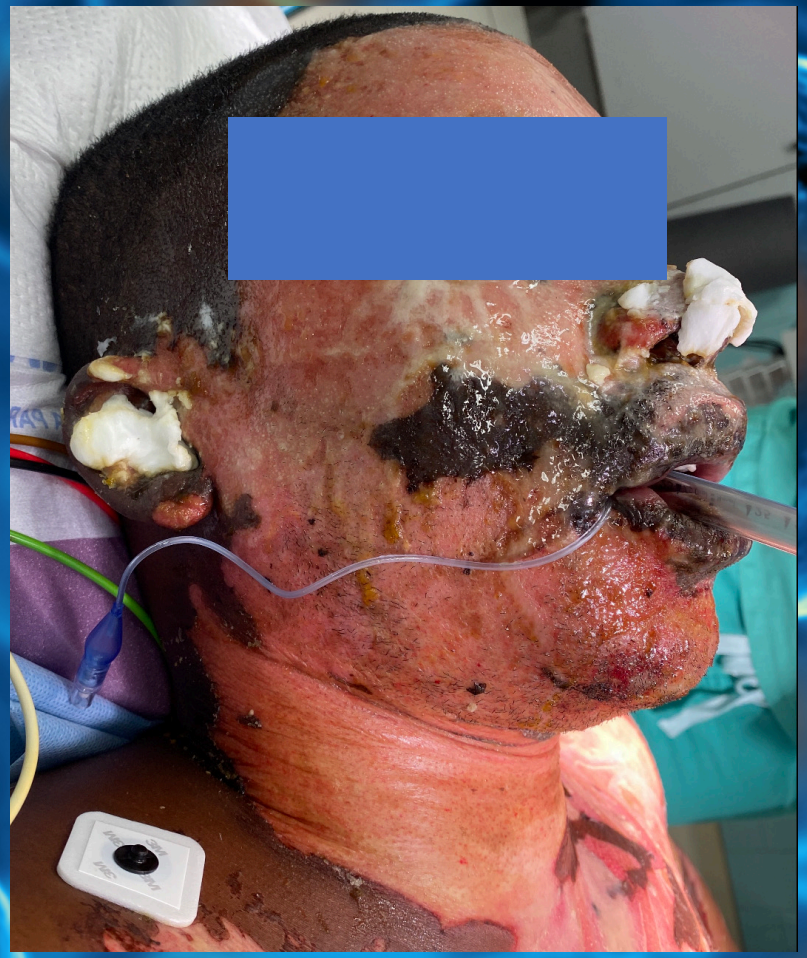




# Case 3: Burn Injury

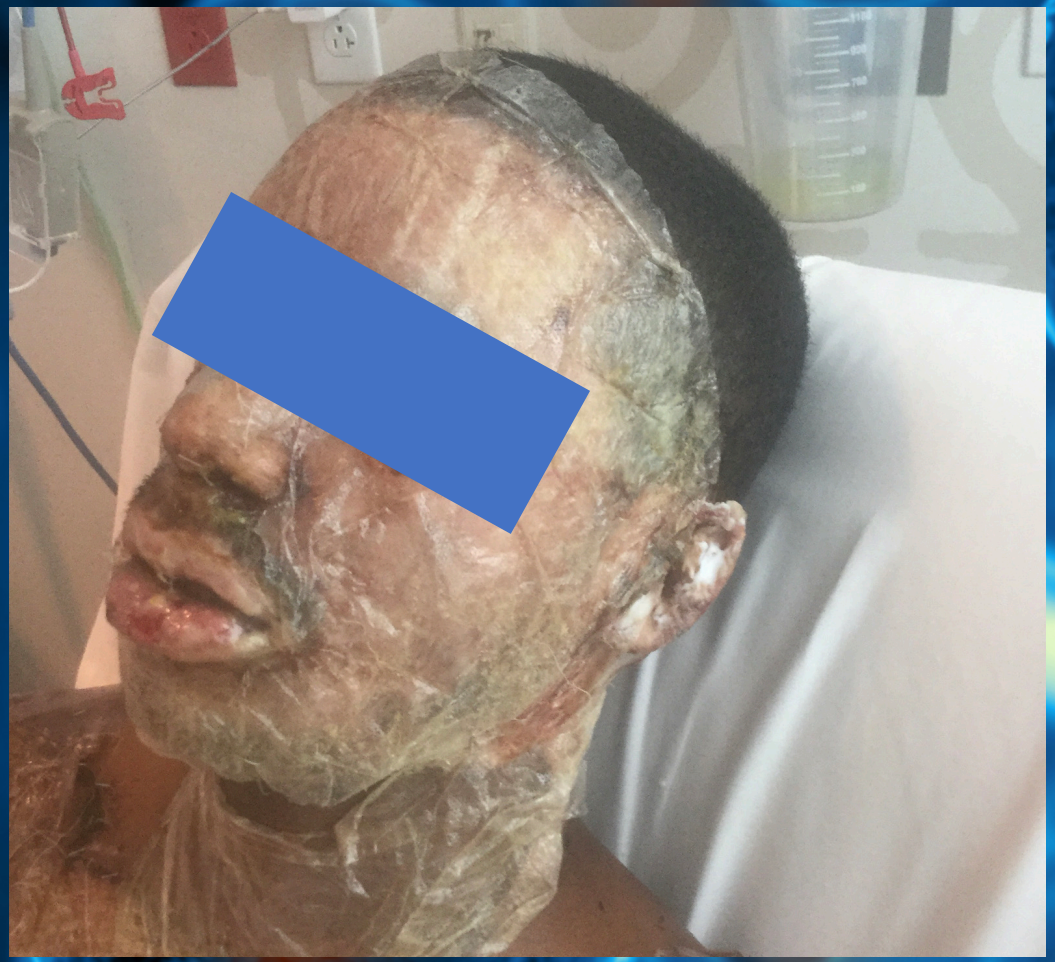
| | |
|---|---|
| Age: | 33-year-old |
| Gender: | Male |
| History: | 20% TBSA burn with inhalation injury |
| Mechanism: | Flame |
| Disposition: | Home |
| Length of stay: | 17 days |



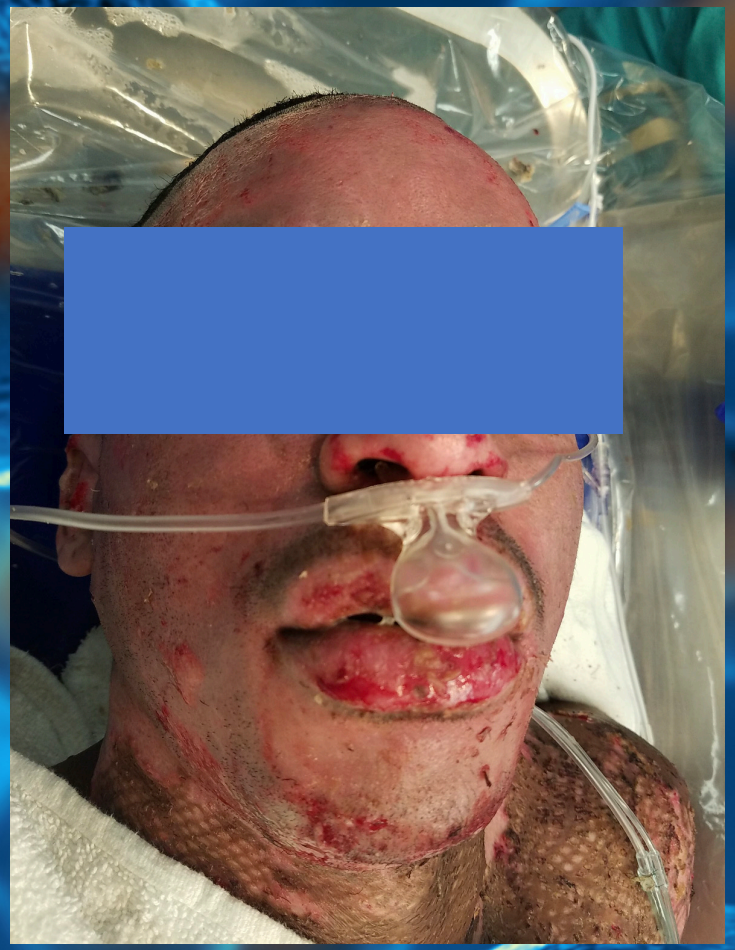


Admission

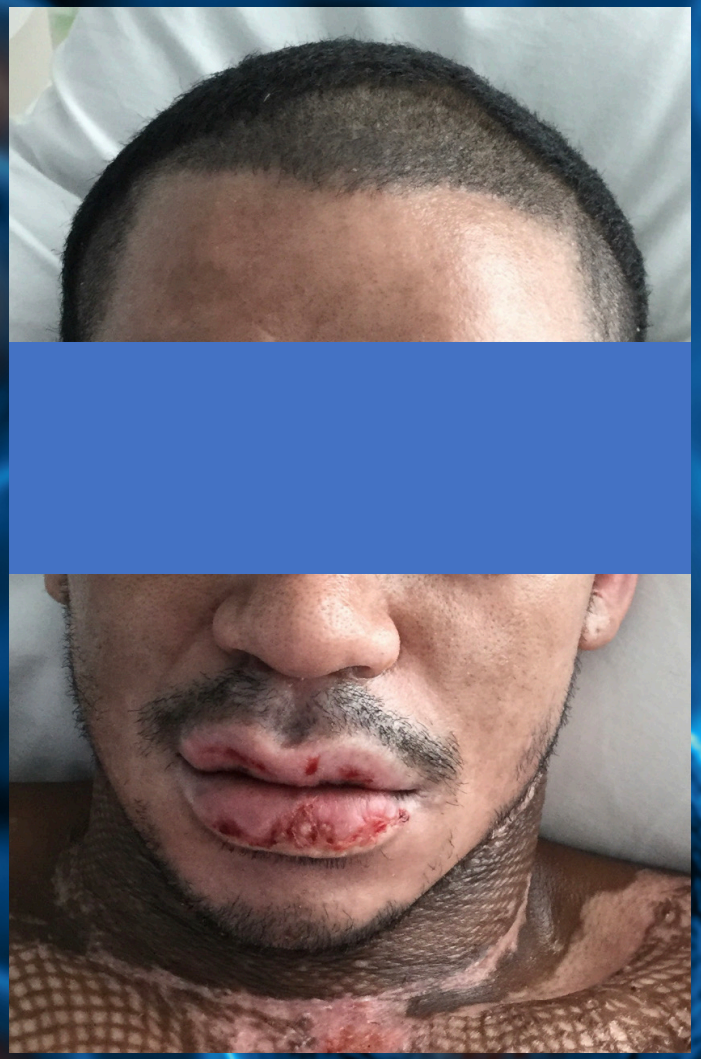
Hospital Day 3 Pre-op



Post-op Day 4

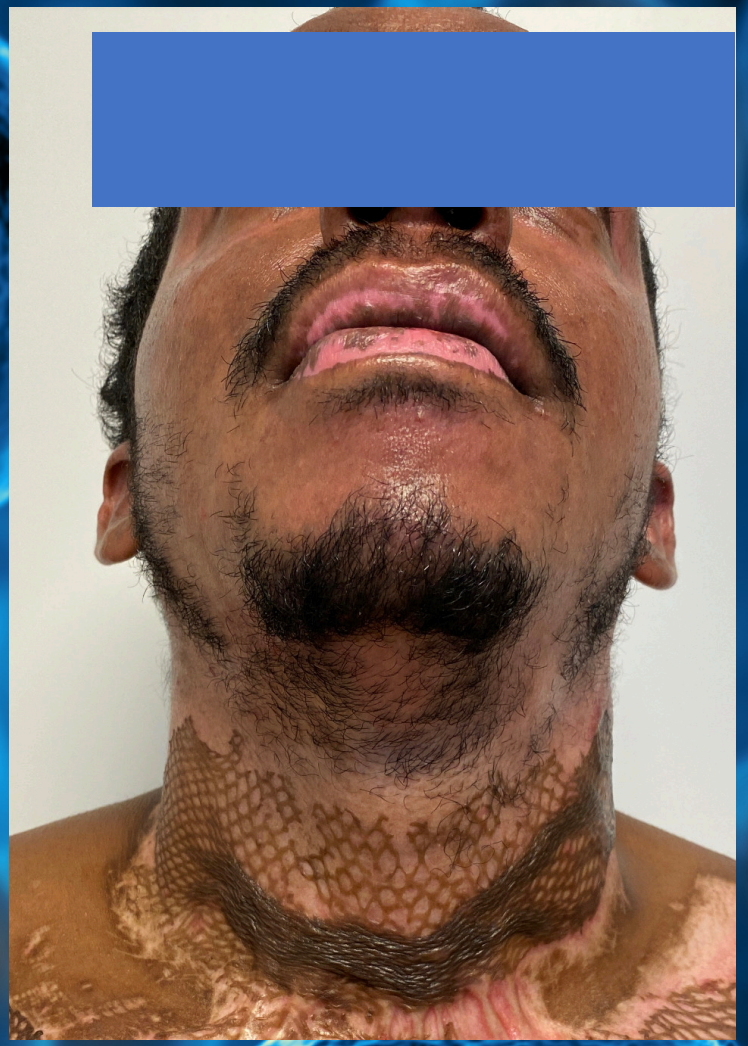


Post-op Day 7



Post-op Day 10

Post-op Day ~30



Post-op 2 Months