Optimizing Complex Reconstruction and Reducing Surgical Site Complications:

A Case-Based Approach to Using Aseptically Processed Allografts and Placental Membranes

Supported by an educational grant from MTF Biologics

Faculty

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Faculty Disclosures

- **Jimmy Chim, MD**
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  Advisory Board: Sanara MedTech; Solventum, Medical Surgical Business;
  Consultant, Speakers Bureau: Solventum, Medical Surgical Business; Appulse; Aroa; Integra Life Sciences; MTF Biologics; Smith & Nephew; Urgo Medical; Sanara MedTech, MolecuLight Inc.

- **Edward S. Lee, MD, MS**
  Advisory Board: MTF Biologics; Research: Abbvie; Plastic Surgery Foundation; American Orthopedic Foot and Ankle Society; Speakers Bureau: Avita Medical

Polling Question

CAMPs tissue forms (which include placental and dermal allografts) should only be used primarily for wound healing and not for surgical use.

A) True

B) False

Polling was pre-recorded

Learning Objectives

- Recognize the impact of surgical care complications on post-operative infections, and identify patient populations at risk for surgical site compromise
- Explore the key literature for aseptically processed allografts and placental membranes and their efficacy in managing complex reconstruction and incision management
- Examine case study outcomes utilizing aseptically processed allografts and placental membranes to decrease the risk of surgical site complications and to optimize the results of complex reconstruction

Optimizing Wound Healing: Are We Doing Enough?

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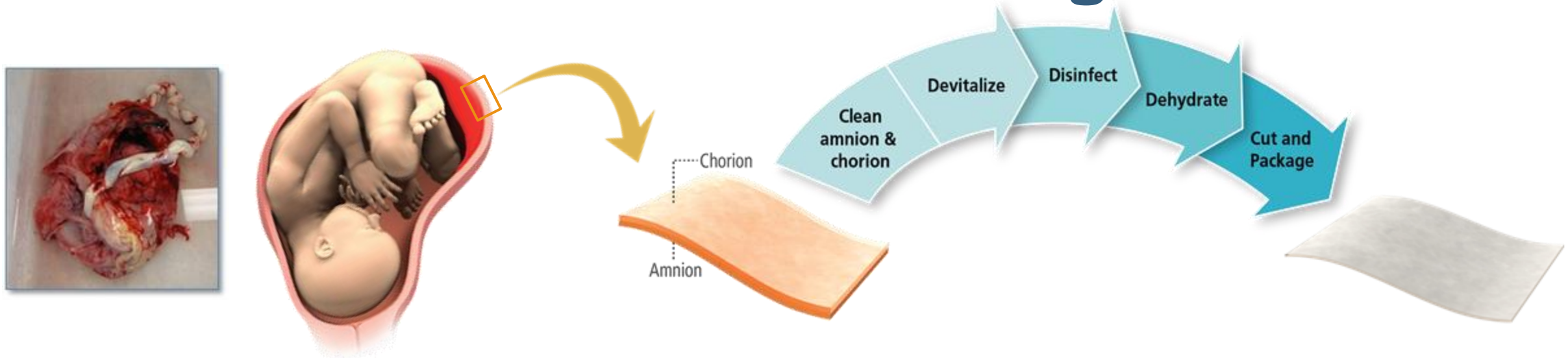
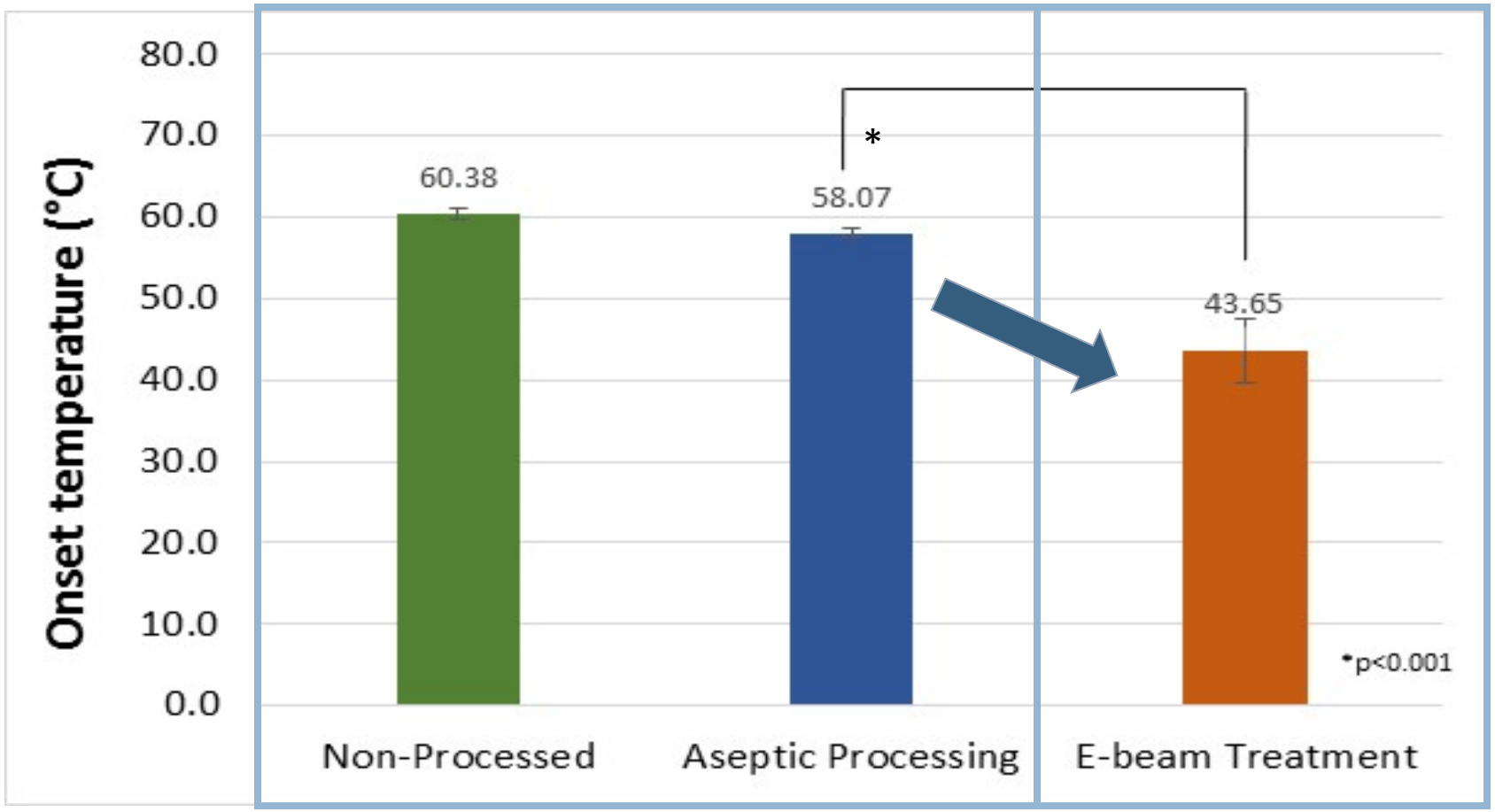
Dehydrated Amnion/Chorion Membrane Processing



- Pre-screened healthy mothers donate their placentas immediately after birth (scheduled C-section)
- Only **avascular** amnion/chorion layers are processed
- **Aseptically processed** without irradiation (terminal sterilization) in **Class 10** clean-room (**1000x** cleaner than OR)
- Validated chemical disinfection method achieves SAL 10^{-6} (1)
- Each lot released on USP<71> Sterility Tests
- Providing safest, highest quality graft 20

[1] Phipps A, et al. *Cell Tissue Bank.* 2017;18(4):505-515.

Processing Strategy Impacts Placental Tissue Structure



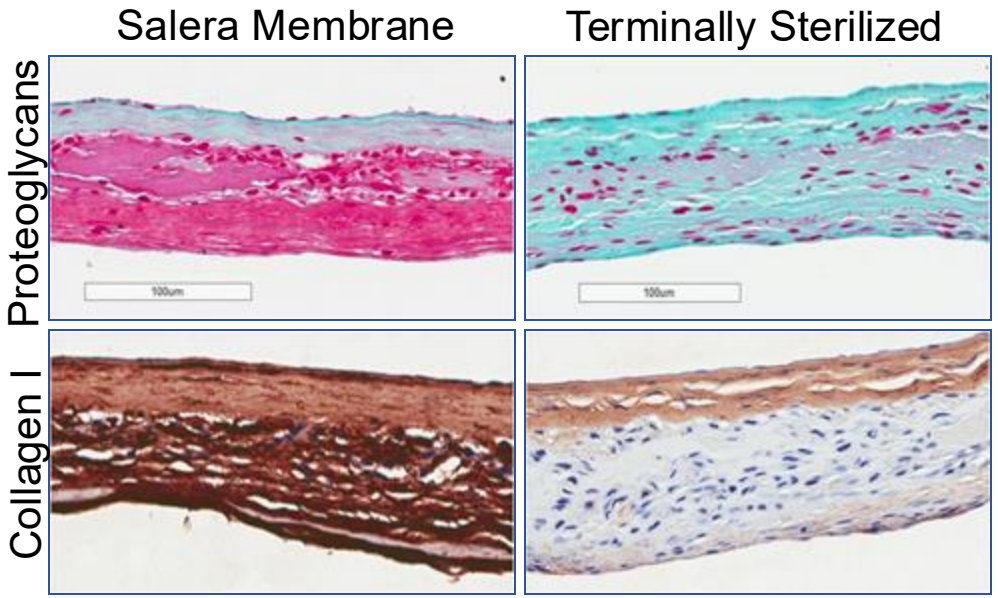
Preserved collagen stability

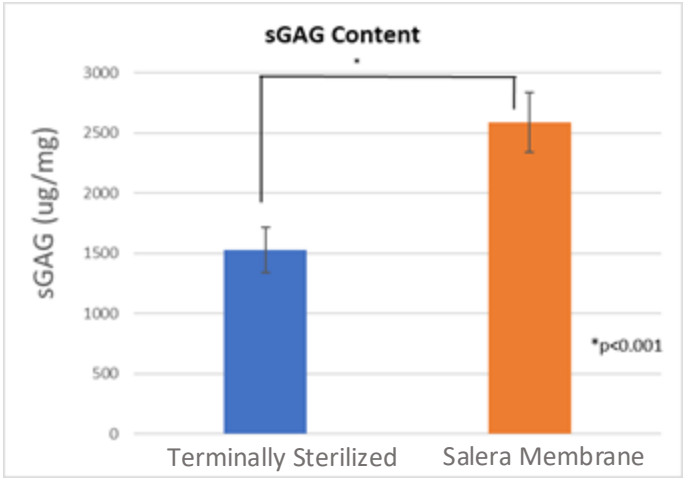
Decreased collagen stability

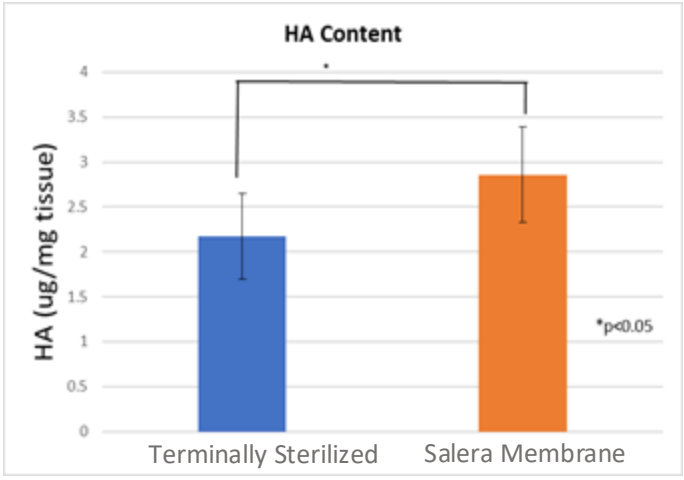
Decreased collagen stability with E-beam treatment > tissue degraded quickly

Madans A, et al. SAWC FALL. 2016

Decreased Matrix Proteins in Terminally Sterilized Placental Membranes





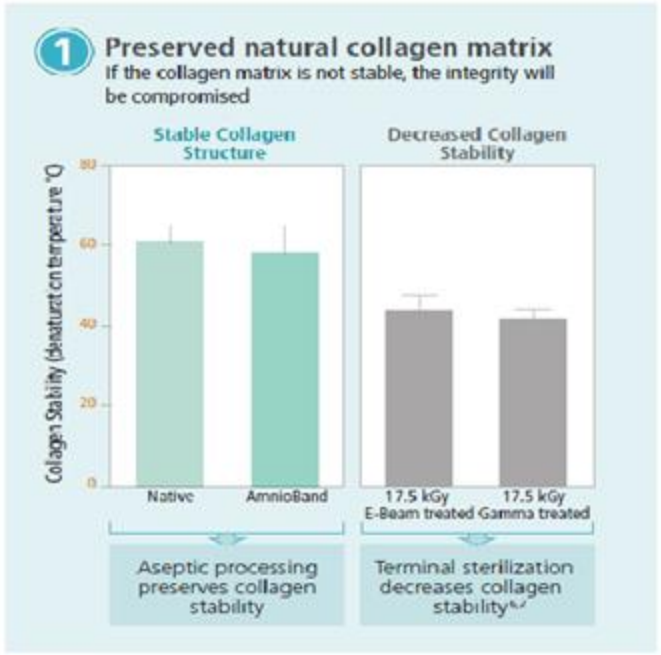


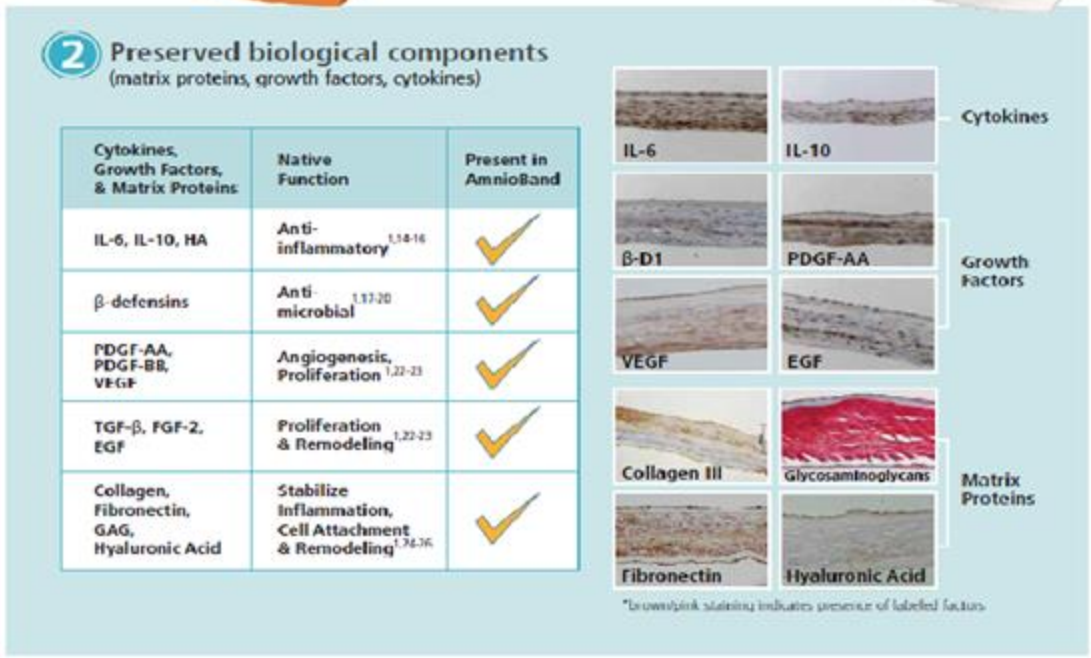
Denatured matrix proteins (decreased staining)

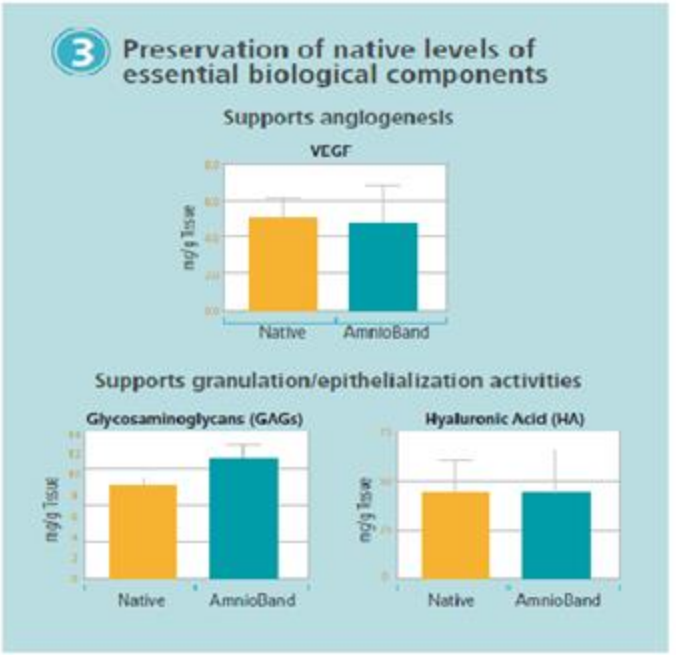
Significantly lower levels of GAG and HA in terminally sterilized placental tissue (degraded GAG/HA proteins – disrupted protein structure)

Aseptic Processing Preserves the Natural Scaffold

1. Preserves collagen stability
2. Preserves biological components
3. Preserves native levels of essential biological components







Chnari E. *et al.* SAWC FALL 2014. Las Vegas

Madans A. et al. SAWC FALL 2016. Las Vegas

Supports Wound Healing Activities

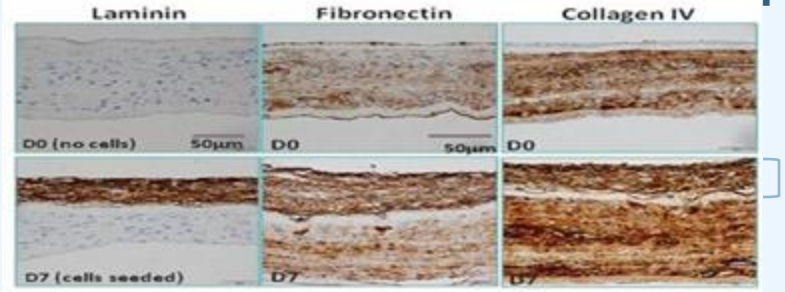
Supports granulation activities (secretion of new matrix proteins)

Supports angiogenic activities (formation of new blood vessels)

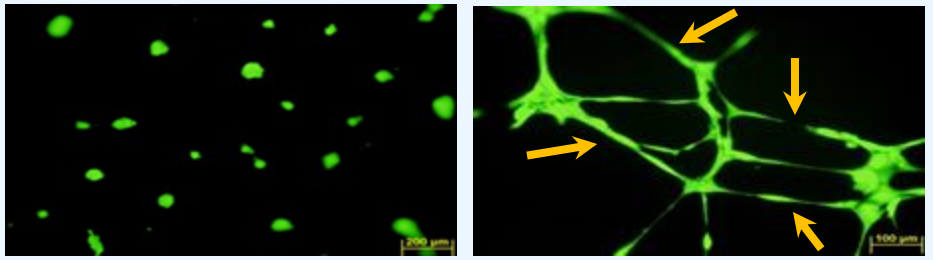
Supports epithelialization activities (enhanced migration)

Wound Closure

Extensive secretion of new matrix proteins

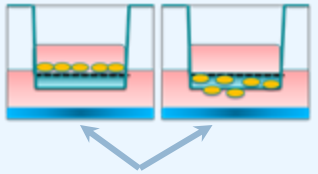


New Blood Vessel Formation

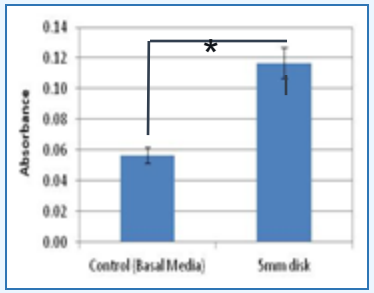


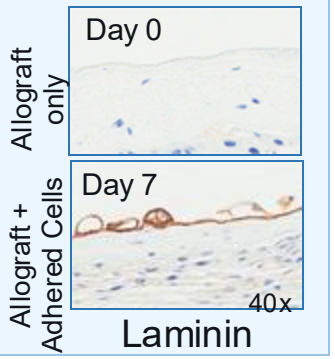
Control (Basal Media) AmnioBand Extract

Enhanced Migration



Placental allograft membrane





Huang YC, et al. SAWC SPRING 2015. San Antonio. Dasgupta A, et al. SAWC SPRING 2016. Atlanta.

Preserved Anti-Microbial Properties

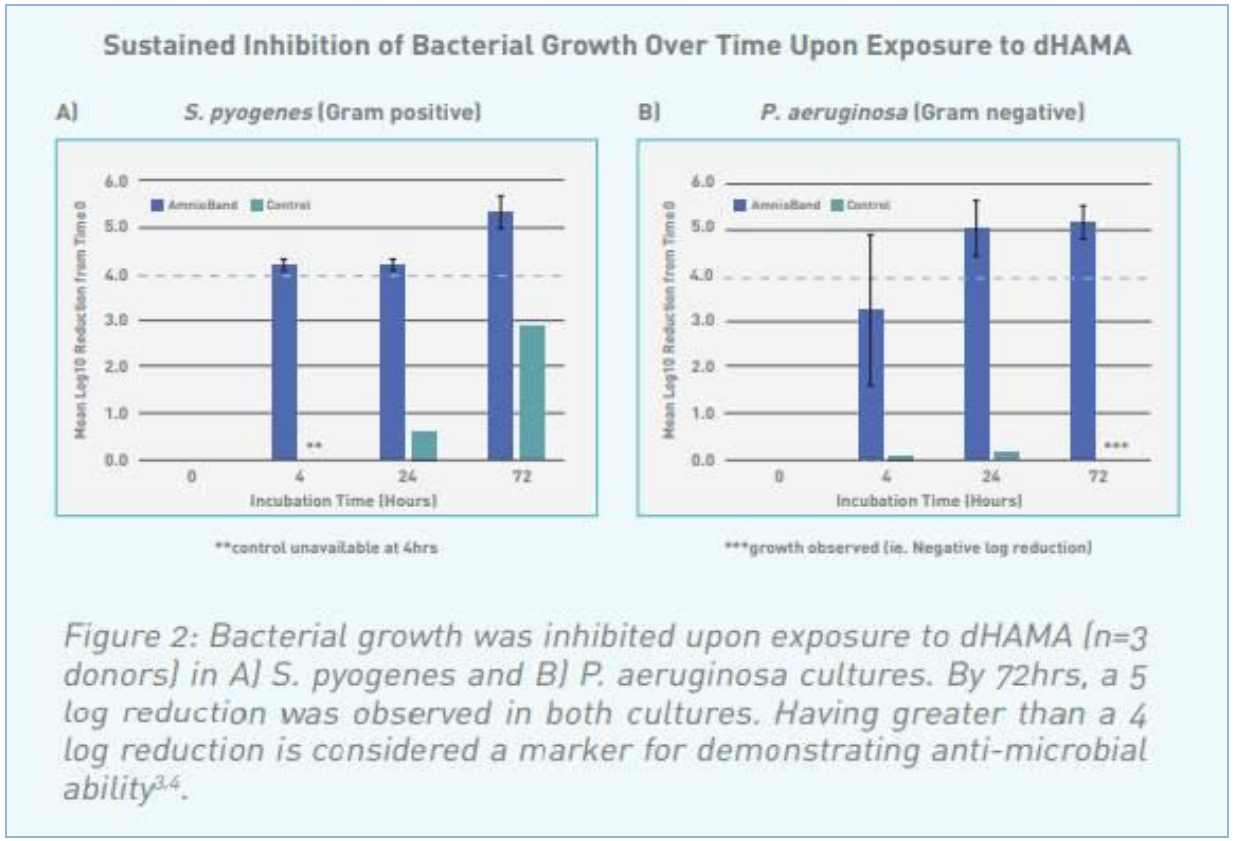


Figure 2: Bacterial growth was inhibited upon exposure to dHAMA (n=3 donors) in A) S. pyogenes and B) P. aeruginosa cultures. By 72hrs, a 5 log reduction was observed in both cultures. Having greater than a 4 log reduction is considered a marker for demonstrating anti-microbial ability[3,4].

- Conducted planktonic assays to examine log reduction in pathogenic organisms
  - Modified AATCC* Test Method 100 is a standard test method to quantitatively assess antimicrobial activity
  - Performed at an external lab (WuXi Apptec)
- 4-5 log reduction (10,000-100,000 count reduction) observed in both bacterial cultures, which are found in surgical wounds
  - *Pseudomonas aeruginosa* (Gram-negative)
  - *Streptococcus pyogenes* (Gram-positive)
- What does this data mean?
  - Functional anti-microbial properties are preserved in the MTF amniotic tissue

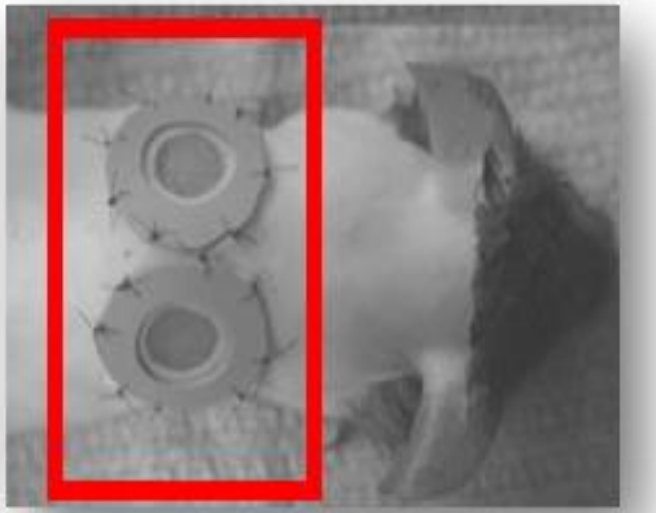
Dasgupta A. *et al*. SAWC SPRING 2016. Atlanta. American Association of Textile Chemists and Colorists (AATCC)

Mechanism of Action Data: db/db Mouse Study

The DB/DB Mouse Splinted Excisional Model

db/db Murine Model: For Type II Diabetes

Full Thickness Splinted Excisional Wound: Heal via Granulation



Dr Galiano's lab (Northwestern University)


Experimental Cell Research

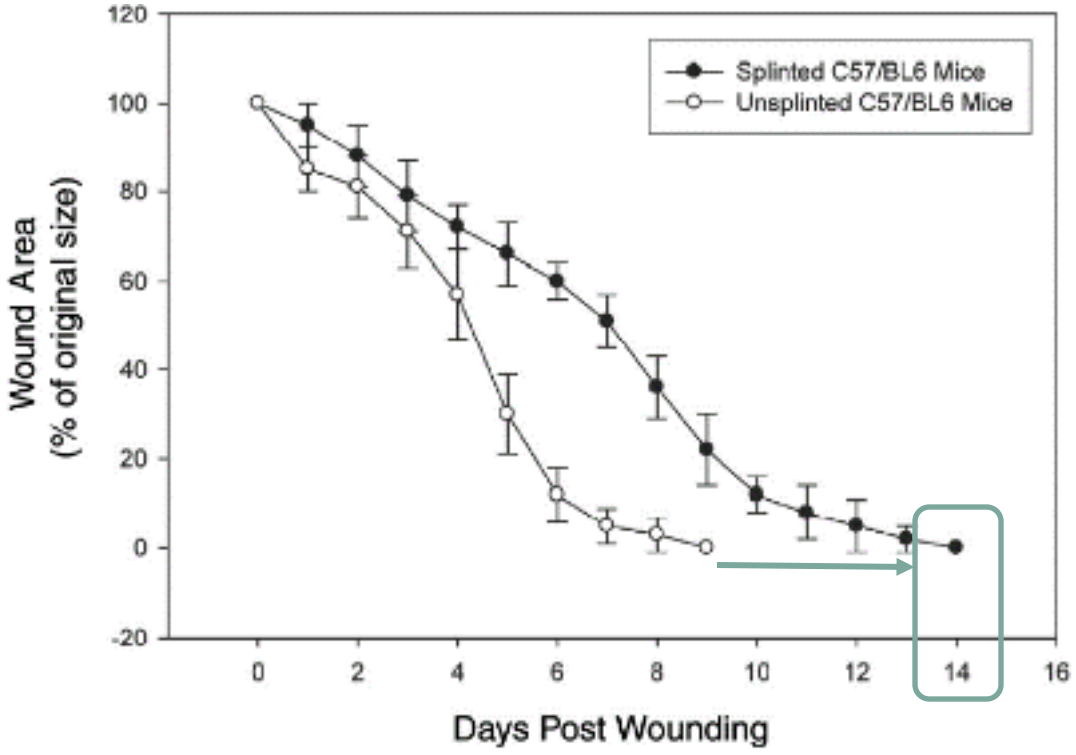
A dehydrated, aseptically-processed human amnion/chorion allograft accelerates healing in a delayed murine excisional wound model

Dolivo D, *et al*. 2021
(Placental Allograft Membrane)

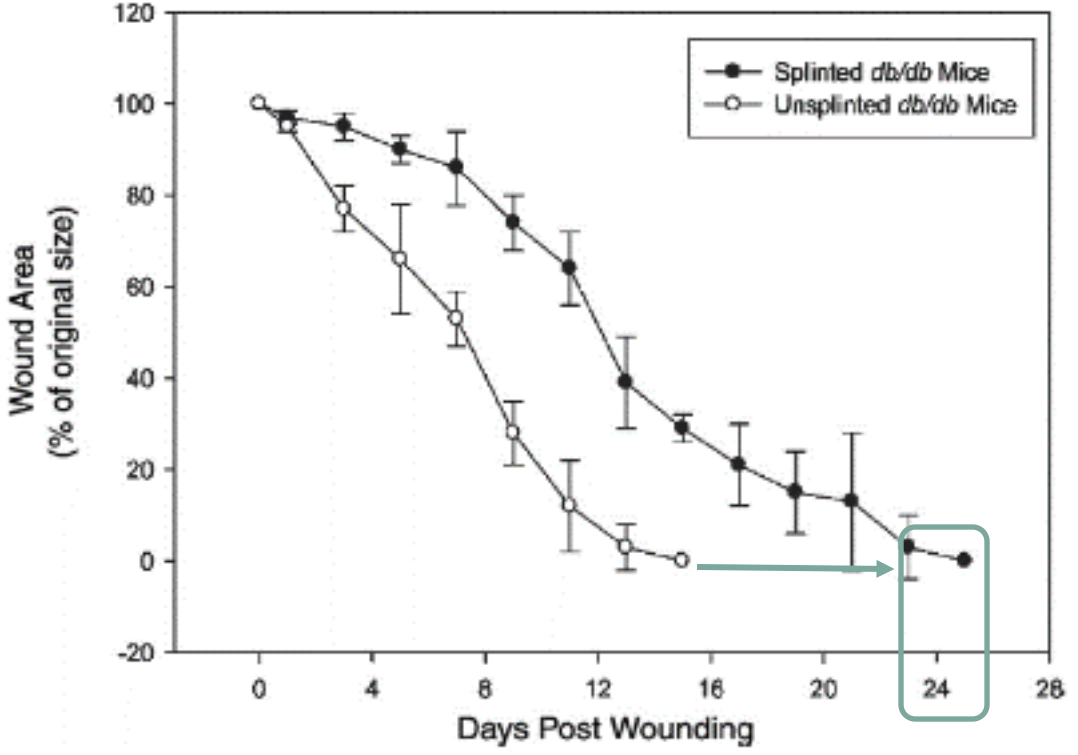
- Developed by Northwestern University in 2004
- **GOAL**: Model delayed Type II diabetic human wound healing via granulation
- Genetic mutation causes overconsumption of food > at 4-8 wks, elevated blood glucose levels
- Designed to address healing via granulation and not contracture (a criticism in rodent models)

Dolivo D, et al. *Exp Cell Res*. 2021;400(2):112512.

The DB/DB Mouse Splinted Excisional Model



Normal splinted mice heal via **granulation,** not contracture



Diabetic mice take **longer to heal (slower rate of healing)** compared to control mice.

Galiano RD, et al. *Wound Repair Regen*. 2004;12(4):485-492.

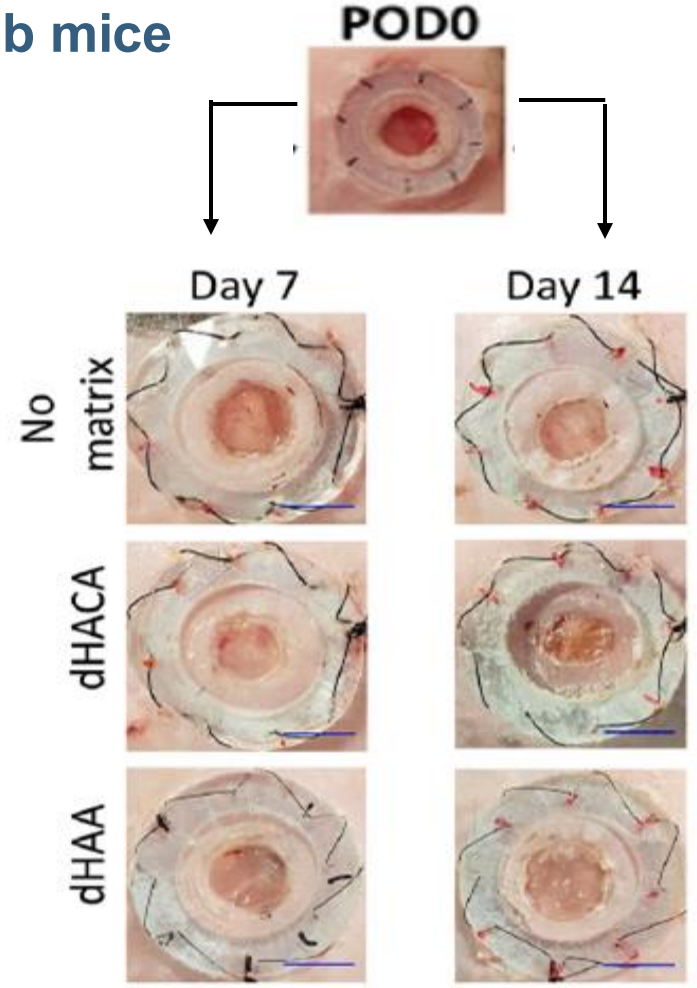
Mechanism of Action Study Design

Full-thickness splinted excisional wounds on the dorsum of db/db mice

- **3 conditions tested**
  1. Control (no tissue) + SOC
  2. dHACA (dehydrated human amnion/chorion allograft) + SOC
  3. dHAA (dehydrated human amnion allograft) + SOC

- **Dressings: Mepitel & Tegaderm**

- **Outcomes: at D7 & D14**
  - Inflammation modulation (M1/M2)
  - Granulation tissue formation (Ki67, granulation tissue area)
  - Angiogenesis (CD31+)
  - Epithelialization (epithelialization gap, K14 staining)
  - Remodeling/minimizing fibrosis (gene expression of pro-fibrotic genes)



Dolivo D, et al. *Exp Cell Res.* 2021;400(2):112512.

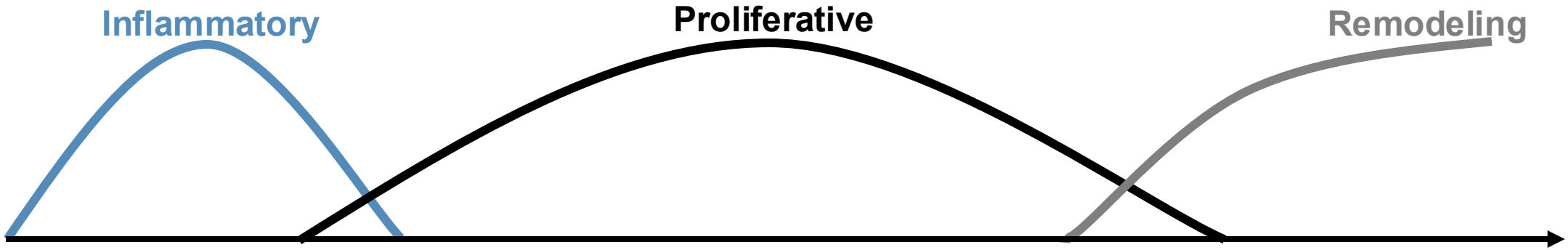
Key Findings in dHACA MOA Study

- Application of dHACA is associated with
  - **Reduction of the inflammatory phenotype of macrophages (M1) at early time-points** (modulation of inflammation)
  - **Increased cell proliferation and formation of granulation tissue**
  - **Good vascularization** of the wound bed
  - Enhanced rate of wound closure by **significantly smaller epithelial gap**
  - **Suppression of pro-fibrotic processes (decreased gene expression)**

- The same observations did NOT hold for a similarly processed amnion only graft
  - Indicating that the chorion layer is important in this setting

Dolivo D, et al. *Exp Cell Res.* 2021;400(2):112512.

dHACA Supports All Phases of Wound Healing

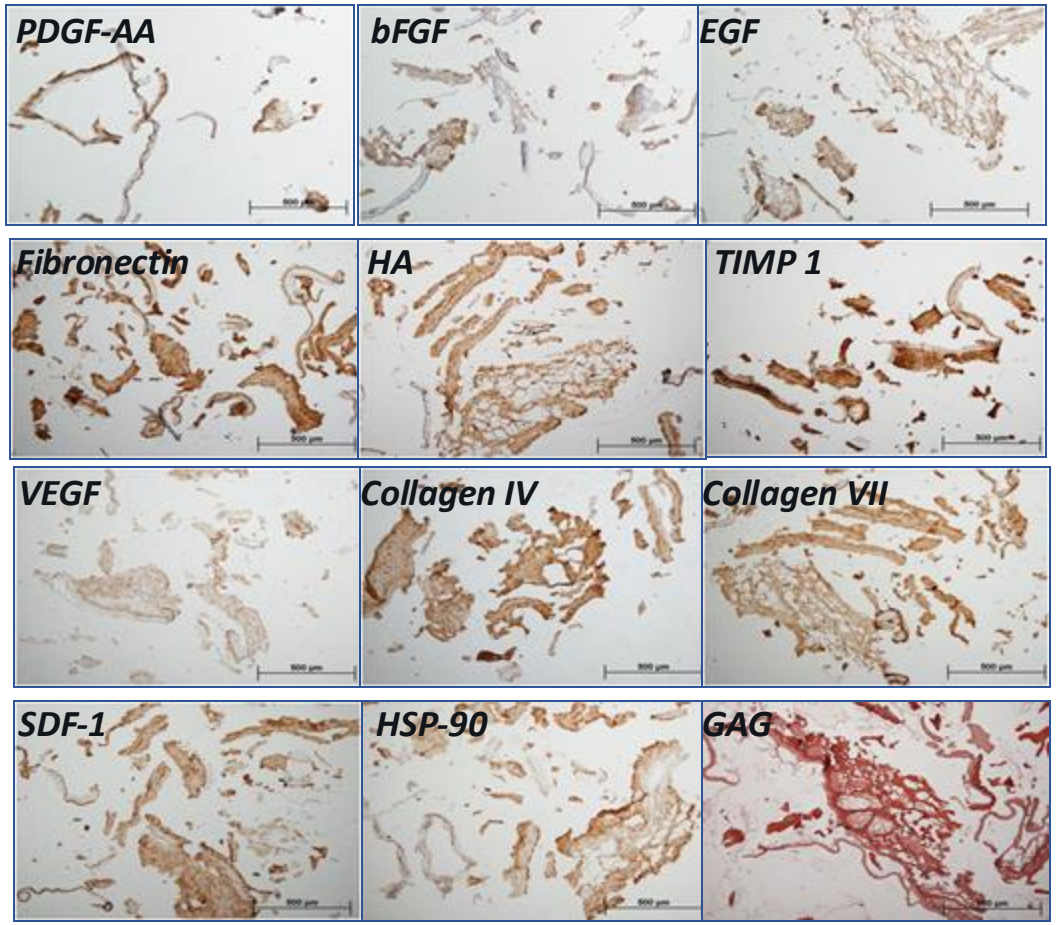


	Chronic >Acute State	Inflammation Modulation	Cell Proliferation	Granulation Tissue	Angiogenesis	Re-epithelialization	Cell Infiltration Graft Remodeling	Anti-Fibrotic
dHACA		+	+	+	+	+		+
Based on	Gene expression	M1/M2 polarization	Ki67 staining	H&E image analysis	CD31 staining	Epithelial gap	Trichrome staining	Gene expression

- Versatile tissue addressing all phases of wound healing
- Useful in chronic/complex wounds with modulating inflammation
- Supports all activities in proliferation/remodeling stages (cell proliferation, granulation, angiogenesis, epithelialization)
- May support anti-fibrotic wound remodeling and repair

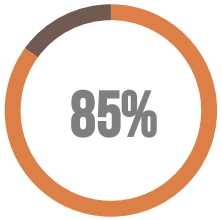
Dolivo D, et al. *Exp Cell Res*. 2021;400(2):112512.

Biological Components Preserved in Mini-Membranes



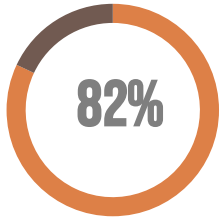
Growth Factors and Cytokines	Native Function	Matrix Proteins	Native Function
B-defensin	Anti-microbial[7-10]	Col I	Scaffolding for Cell Migration and Cell Attachment[22-24]
IL-6; IL-10	Anti-inflammatory[11-16]	Col III	
PDGF-AA; PDGF-BB	Angiogenic[17-21]	Col IV	
EGF	Cell Proliferation and Remodeling[17-21]	Col VI	
FGF-2		Fibronectin	
TGF		Hyaluronic Acid	

Summary of Chronic Clinical Outcomes



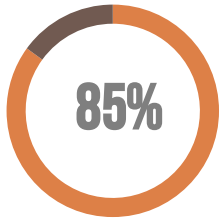
DiDomenico, et al. 40 Patient Prospective, Multi-center Blinded RCT in DFU

- **85%** vs 25% SOC only wounds closed at 12 wks
- Over 3 times more patients healed at 12 wks



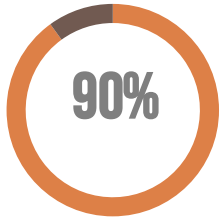
DiDomenico, et al. Retrospective, Crossover Study in DFU

- **82%** closed at 12 wks, after failing SOC only in original 40 Patient Prospective Study
- 60% wound area reduction in two treatments of AmnioBand Membrane



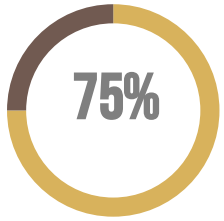
DiDomenico, et al. 80 Patient Prospective, Multi-center Blinded RCT in DFU

- **85%** vs 33% SOC only wounds closed at 12 wks
- Complete closure in half the time as compared to SOC



Glat, et al. Prospective, Multi-center, Comparative RCT in DFU

- **90%** vs 40% TESS+SOC wounds closed at 12 wks (AmnioBand vs Apligraf)
- Twice as many patients healed in 12 wks



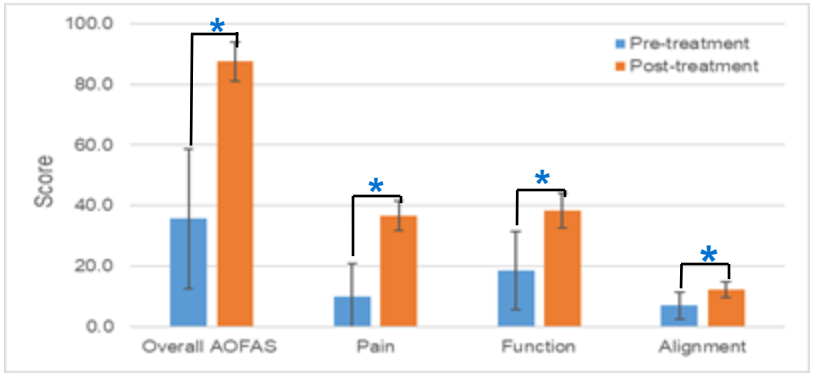
Serena, et al. 60 Patient Prospective, Multi-center, Blinded RCT in Venous Leg Ulcers

- **75%** vs 30% wounds closed at 12 wks vs SOC only compression bandages
- >80% mean wound area reduction with dHACA treatment at 12 wks

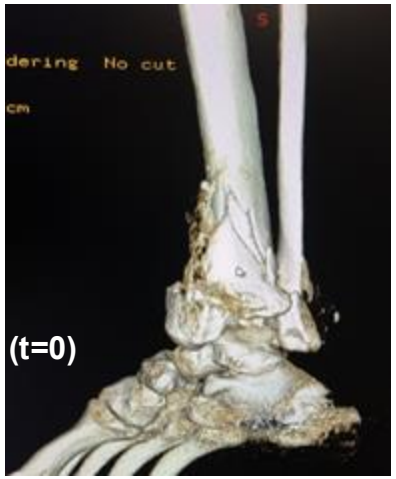
Dehydrated Amnion/Chorion Graft in Incisional Management

- **Goal:** Evaluate complications (pain, swelling, dehiscence) associated with foot/ankle (F/A) interventions
- **Study Design/Metrics:**
  - 21 patient retrospective case series; 1 yr follow-up
  - Patient safety, qualitative images, functional scores (AOFAS)
- **Outcomes**:
  - Significantly improved overall AOFAS scores vs pre-treatment
  - Decreased inflammation, swelling/pain
  - **NO wound dehiscence**
  - Improved patient quality of life (wearing shoes, walking)
- **Conclusion**: ***Dehydrated amnion/chorion graft*** appears to provide improvement in F/A surgical interventions

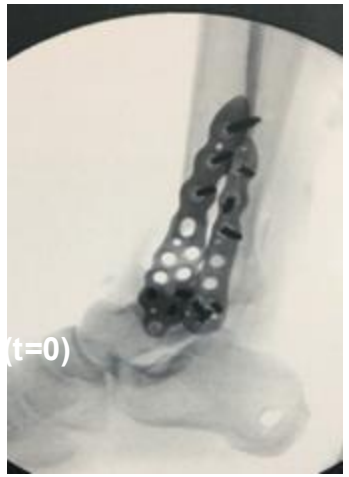
AOFAS
American Orthopedic Foot and Ankle Score; widely used to evaluate progress of patients post-F/A surgery



Ankle fracture (crushed distal tibia)



Bone removed/filled with femoral head and external fixator



1 wk post-op (very little swelling)

3 wks (incision site healed, no dehiscence)

Tacktill C, et al. *Int Wound J*. 2022;19(8):1922–1930.

Properties

- Promote healing
- Reduce pain
- Provide matrix for cellular migration and proliferation
- Reduce inflammation
- Antibacterial properties

High-Risk Incision

- Median sternotomy

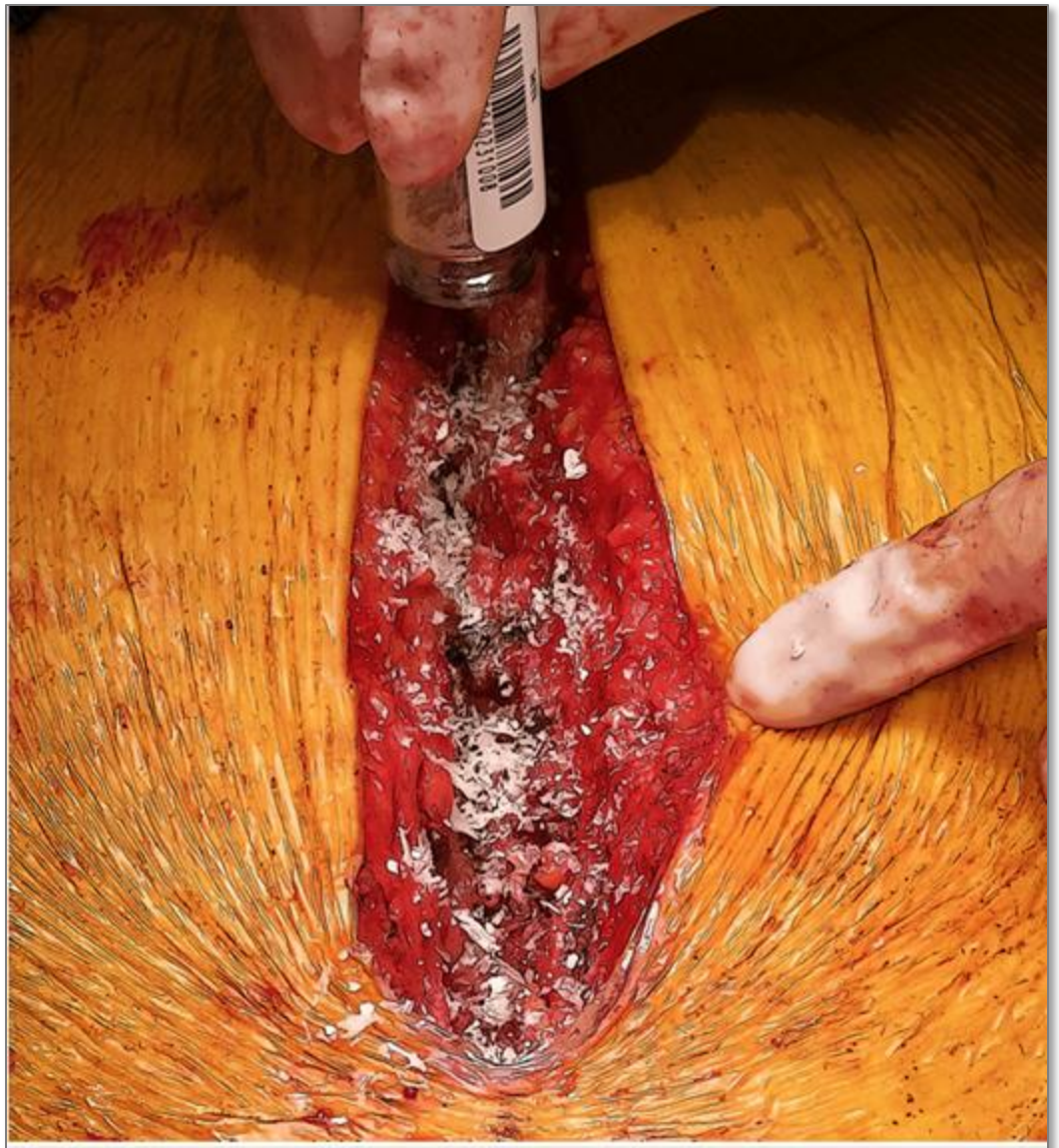


FIGURE 2: Median sternotomy showing the reapproximated sternum with the aACPA spread into the wound.

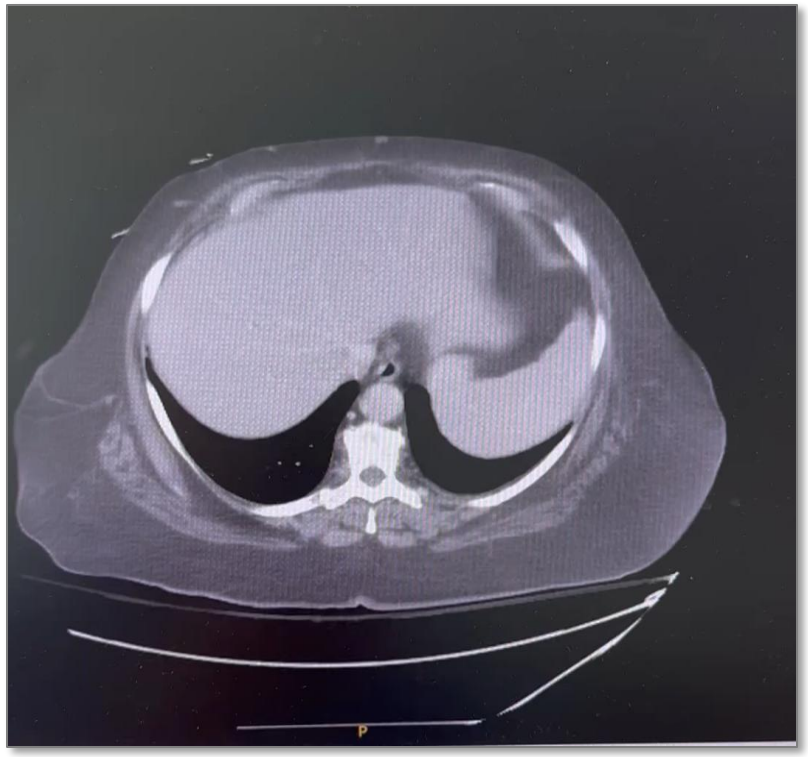
Khalpey, et al. *Cureus.* 2024;16(11):e73322.

Mechanism of Action

- TGFbeta: regulate inflammatory response, deposition of ECM, and remodelling of wounds
- PDGF: proliferation and migration of fibroblasts and smooth muscle cells
- VEGF: angiogenesis
- ECM in the minimally processed aseptic technique without irradiation leaves a scaffold for cell migration, proliferation, and differentiation

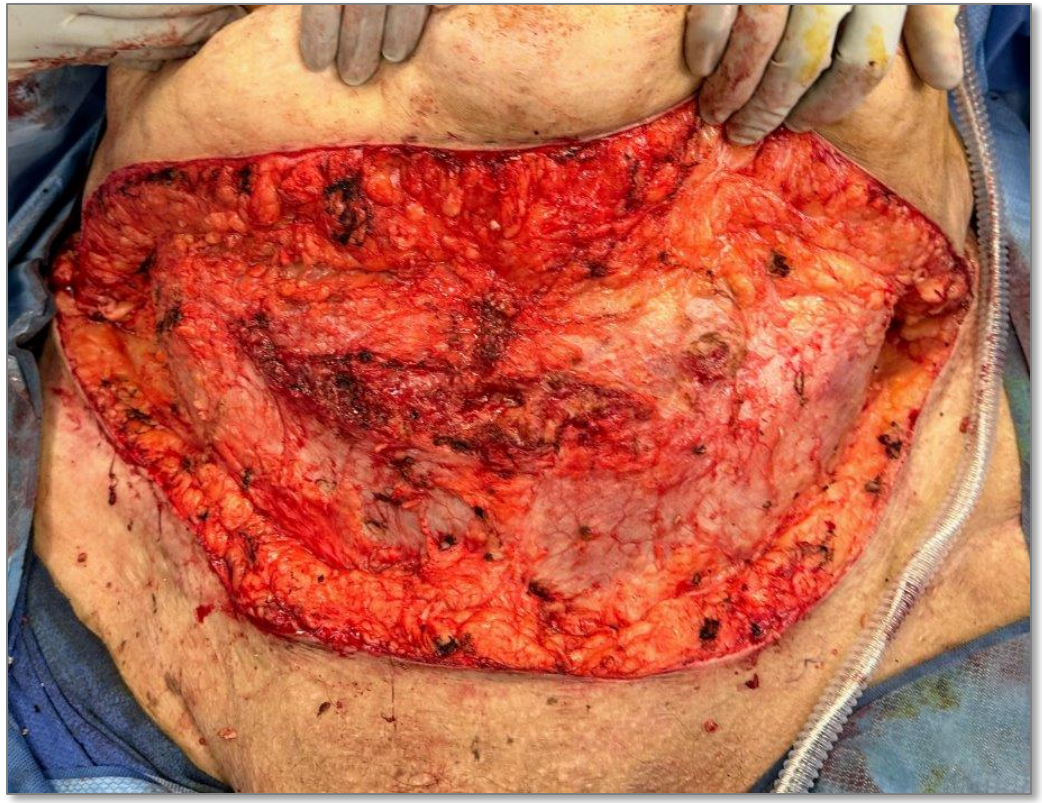
Polling Question

Abdominal Wound



- 67y Female, endometrial adenocarcinoma
- Trifecta of disease: HTN/DM/hyperlipidemia, obesity, CKD, asthma; BMI 50+
- Underwent attempted vaginal hysterectomy, converted to open; then developed A-fib, hypotension, pressors, anticoagulated, dehiscence, infection... WWYD?

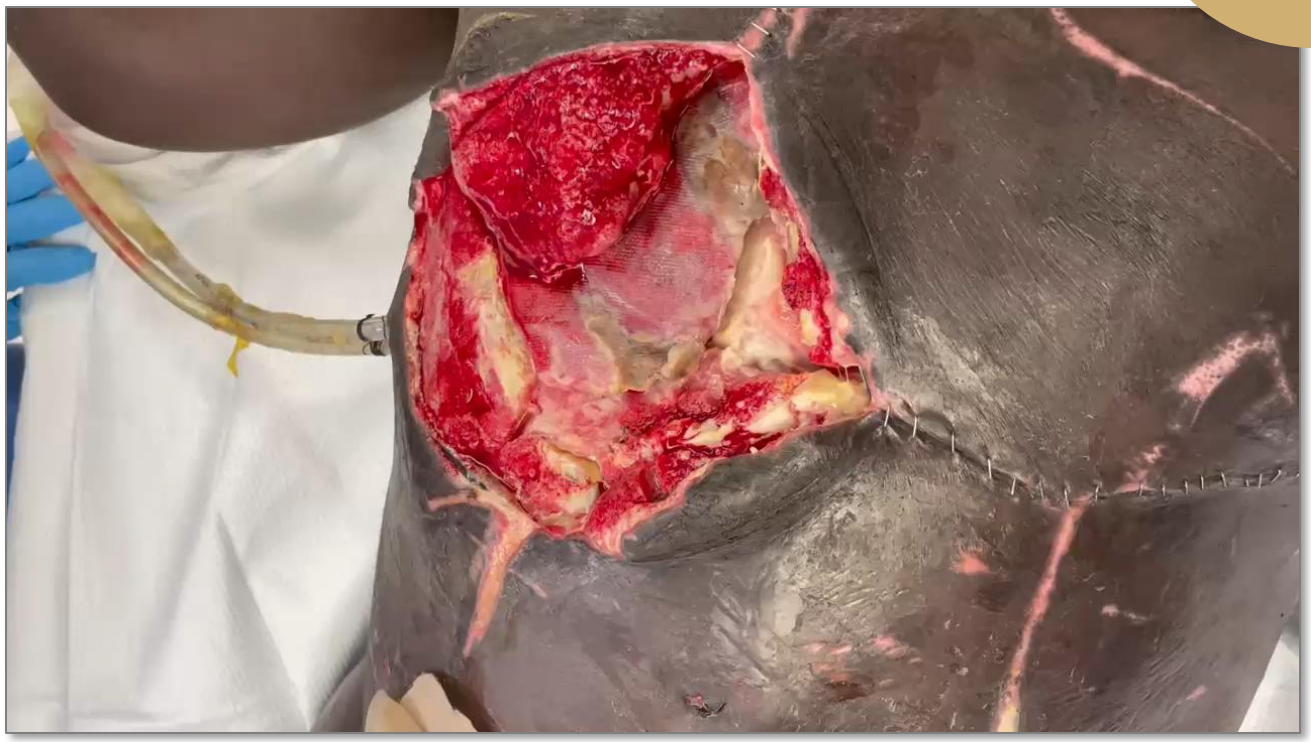
Polling was pre-recorded



- Mutiple debridements, repair of fascia, dehydrated amnion/chorion graft, VAC, eventual panniculectomy and closure
  - Panniculectomy alone has a 100% complication rate

Polling Question

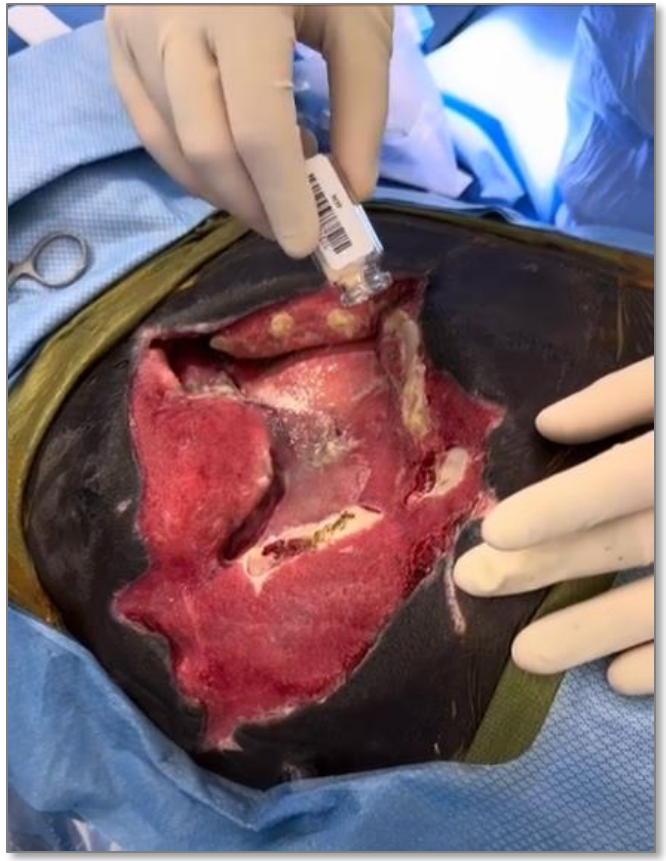
WWYD?

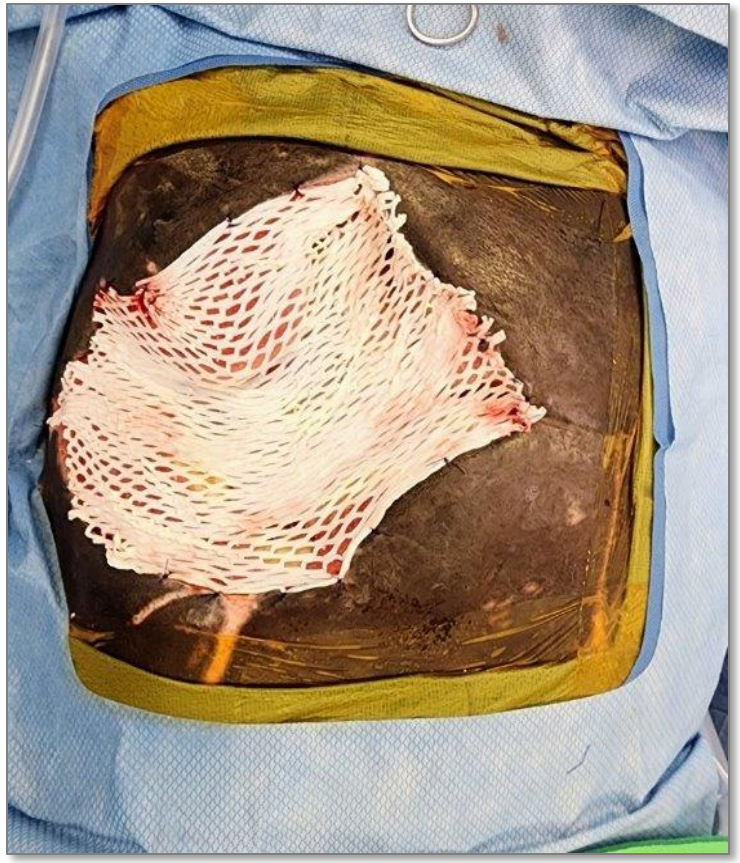


A. Local wound care
B. Debride and NPWT
C. Debride, placental graft, NPWT
D. Call for help

Polling was pre-recorded

Question 2





Summary

- Multimodal therapy for wound healing and complex incisional management
- Placental grafts reduce inflammation, increase angiogenesis, promote wound healing, and have antimicrobial effects
- Placental grafts are all processed differently, and processing affects functionality

Reticular Acellular Dermal Matrix (ADM) Wound Reconstruction

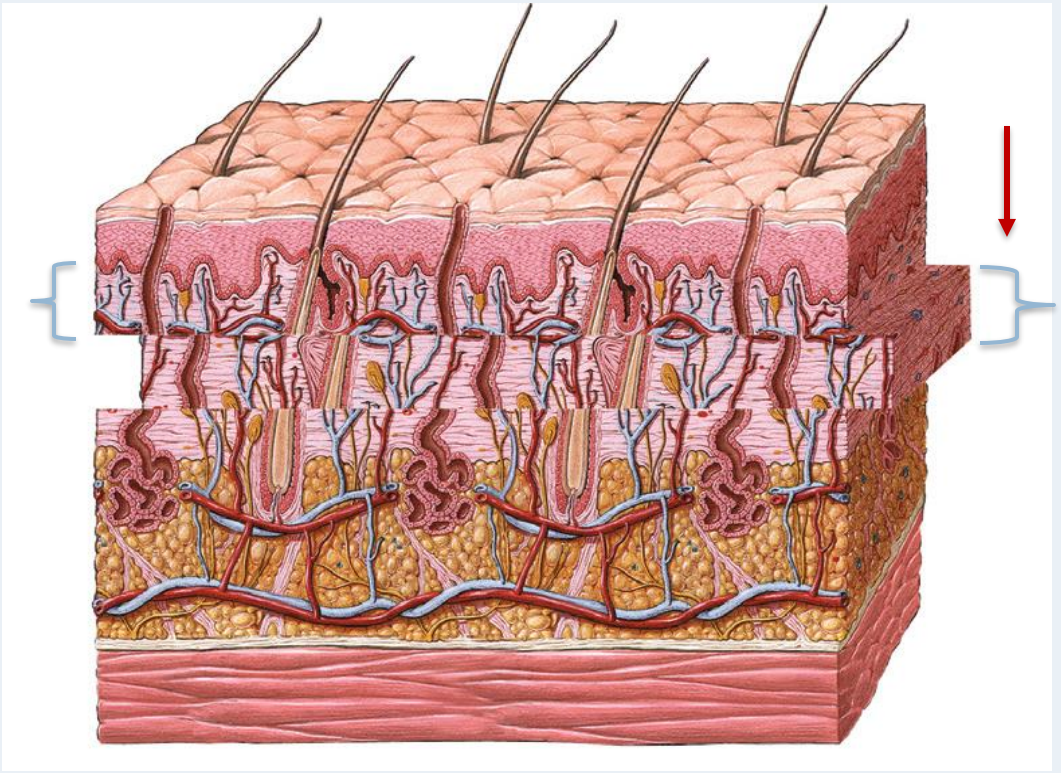
Jimmy Chim, MD
Chief, Division of Plastic & Reconstructive Surgery
Banner University Medical Center, Phoenix, AZ
Assistant Professor of Surgery
University of Arizona College of Medicine, Phoenix, AZ

ADM Reconstruction

ADM = acellular dermal matrix.

Human Reticular Acellular Dermal Matrix

Papillary or superficial dermis



Move away from epidermis, structure opens up

Reticular dermis

Open structure leads to greater cell attachment

Nilsen TJ, et al. *Aesthet Surg J.* 2016;36(Suppl 2):S7-S22.

ADMs in Wound Healing

Acellular Dermal Matrix Favorably Modulates the Healing Response after Surgery

Miriam I. du Plessis, B.S.
Patrick S. Cottler, Ph.D.
Chris A. Campbell, M.D.

Charlottesville, Va.

Plastic and Reconstructive Surgery • August 2022

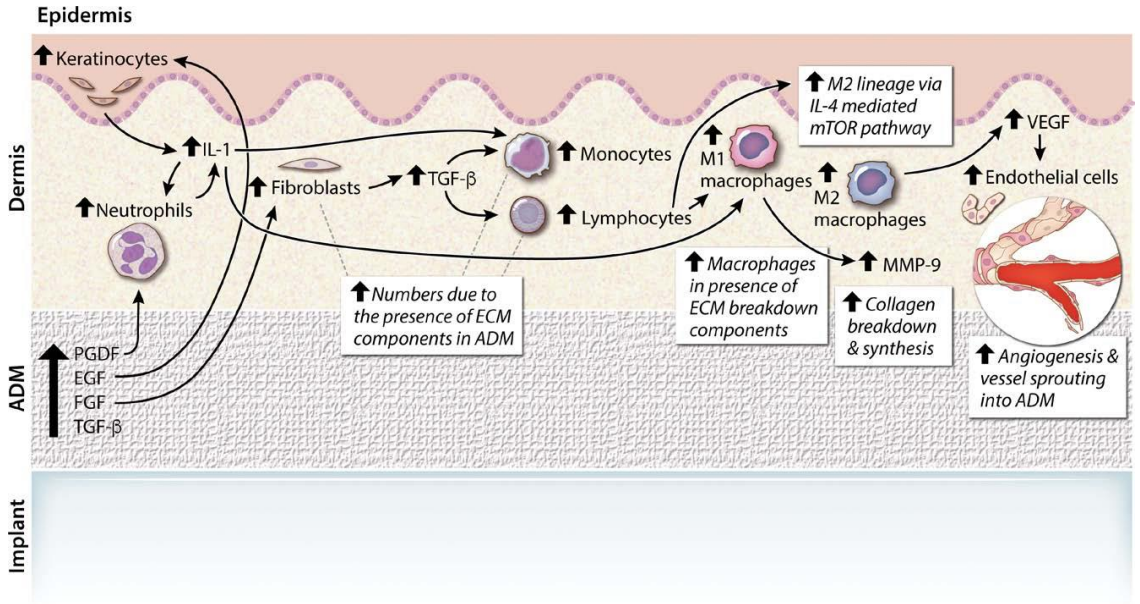


Fig. 4. Diagram of molecular and cellular mechanisms amplified by the presence of acellular dermal matrix. This figure demonstrates the relationships of the epidermis, dermis, acellular dermal matrix, and synthetic implant in a breast reconstruction clinical scenario. *Bold arrows pointing upward* represent the cellular constituents, growth factors, and mechanisms that are up-regulated because of the presence of acellular dermal matrix.

- Cytokines
- Growth factors
- Receptors in ECM
- Increased expression
- EGF, FGF, PDGF, TGF

Du Plessis MI, et al. *Plast Reconstr Surg*. 2022;150(2):290e-299e.

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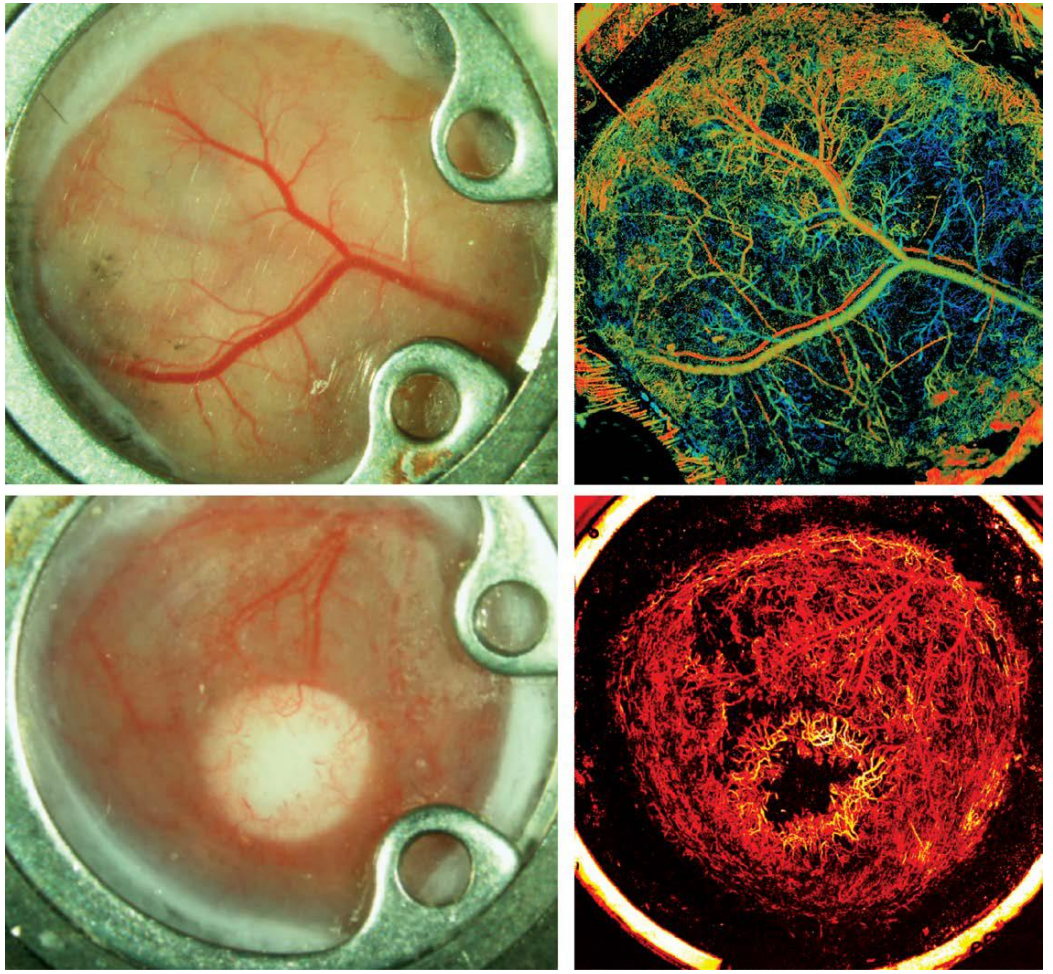
- 65% vs 35% neovascularization
- 90%-100% vs 50%-60% oxygen saturation



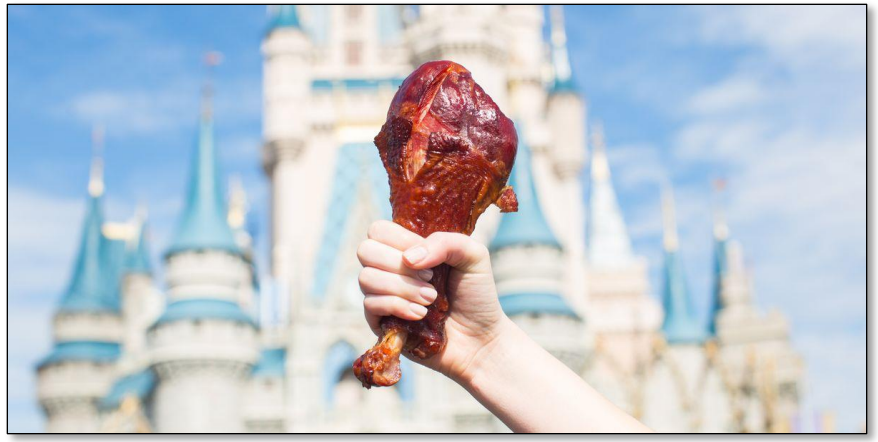
Clinical Cases:
Wound Modulation and Vasculogenesis

Reticular ADM Wound Reconstruction

68y Male Vasculopathy

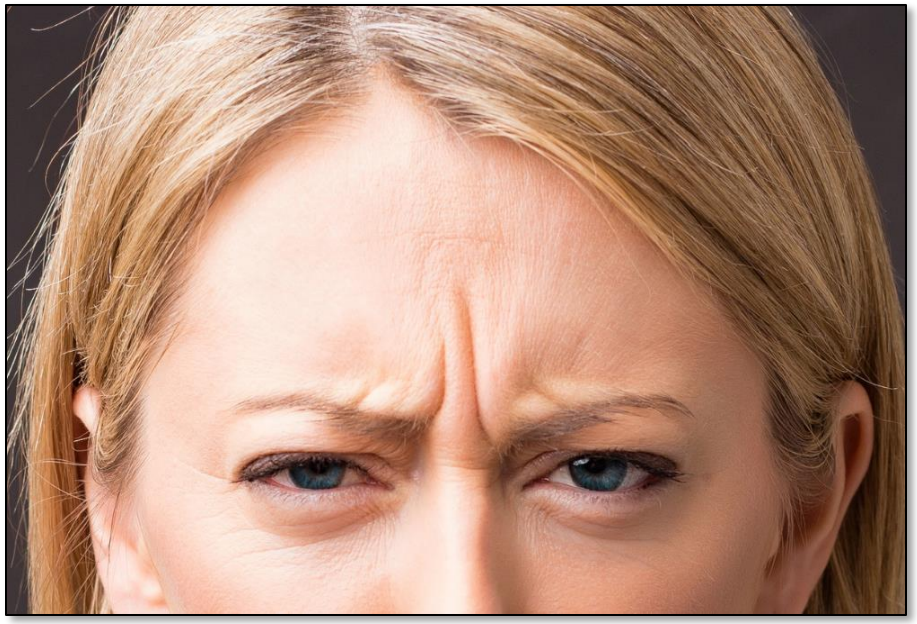
- 68y Male, vasculopathy
- Left TMA wound
- CKD
- CHF
- CAD s/p CABG
- PAD s/p multiple bypasses
- HTN
- DM
- AAA
- R BKA

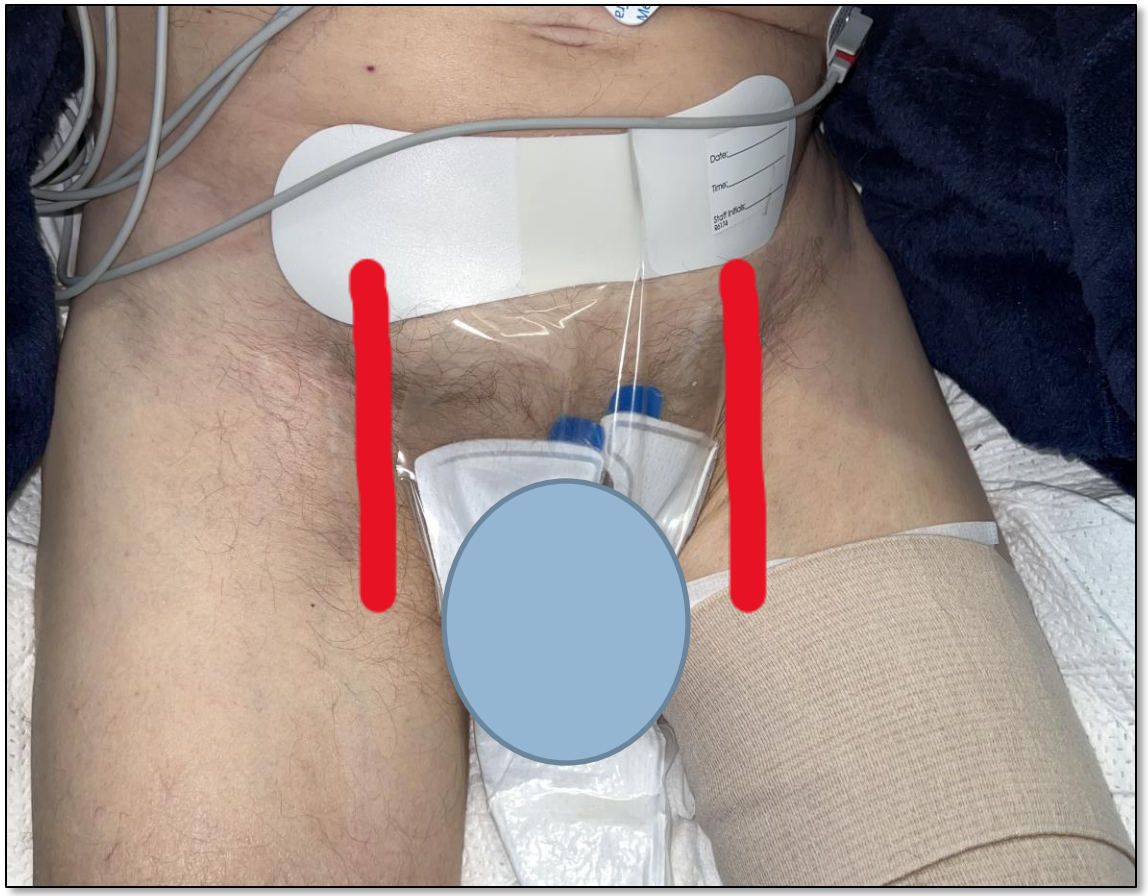
"Turkey Drumstick is here, Room #8"



TMA = transmetatarsal amputation; CKD = chronic kidney disease; CHF = chronic heart failure; CAD = coronary artery disease; CABG = coronary artery bypass graft; PAD = peripheral artery disease; HTN = hypertension; DM = diabetes mellitus; AAA = abdominal aortic aneurysm; R BKA = right below-knee amputation.

The “Elevens” of Vascular Surgery





Day 0

POD 7: Book for the OR!

POD = post-operative day.

POD 17/POD 0: STSG

STSG = split-thickness skin graft.

POD 5 from STSG

2-3 Wks s/p STSG

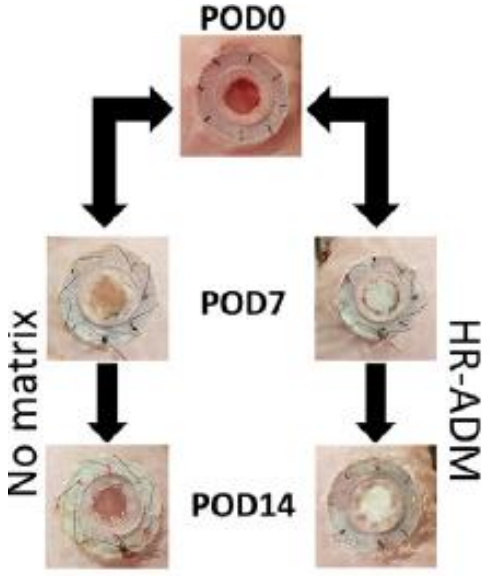
Decellularized Human Allograft

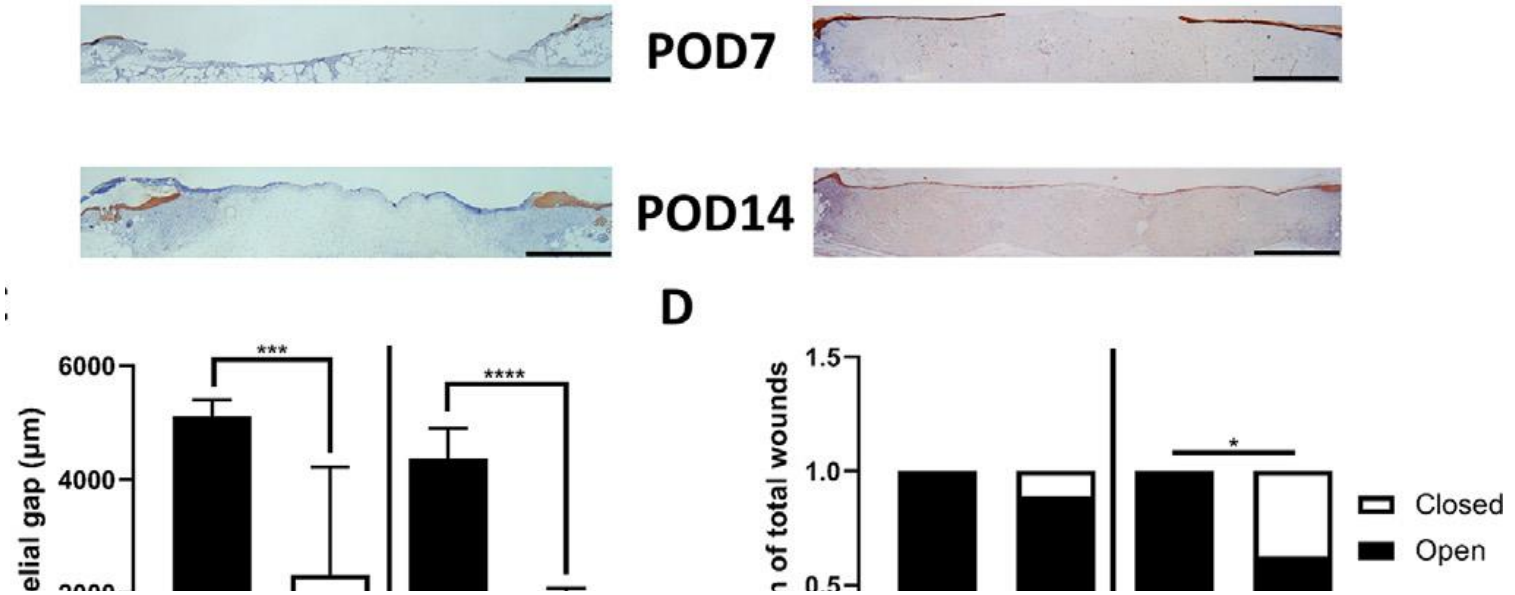
Application of decellularized human reticular allograft dermal matrix promotes rapid re-epithelialization in a diabetic murine excisional wound model

David Dolivo[1], Ping Xie[1], Chun Hou[1,2], Yingxing Li[1], Abigail Phipps[3], Thomas Mustoe[1], Seok Hong[1,*], Robert Galiano[1,*]

[1] *Department of Surgery, Division of Plastic Surgery, Northwestern University Feinberg School of Medicine, Chicago, Illinois, USA*
[2] *Department of Plastic and Cosmetic Surgery, First Affiliated Hospital of Guangzhou Medical University, Guangzhou, China*
[3] *MTF Biologics, Edison, New Jersey, USA*

Cytotherapy 23 (2021) 672–676





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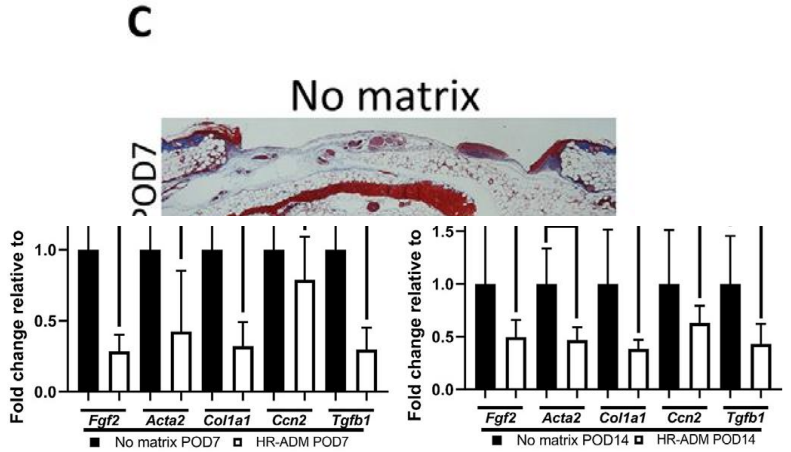
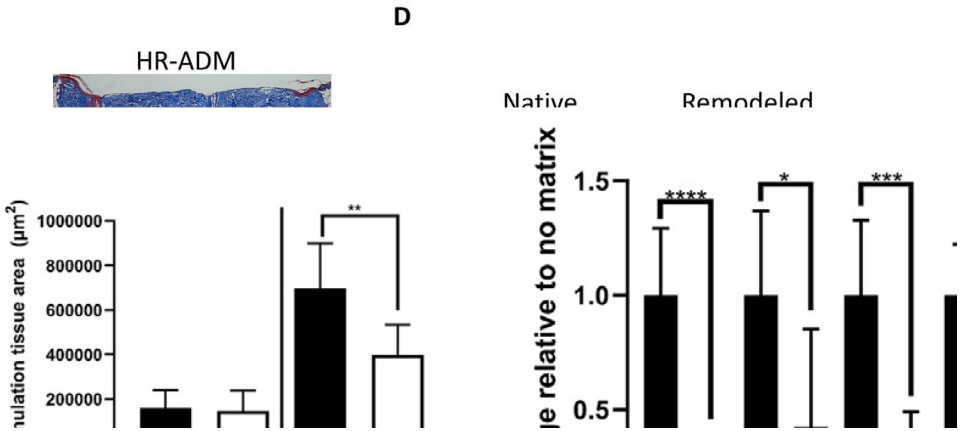


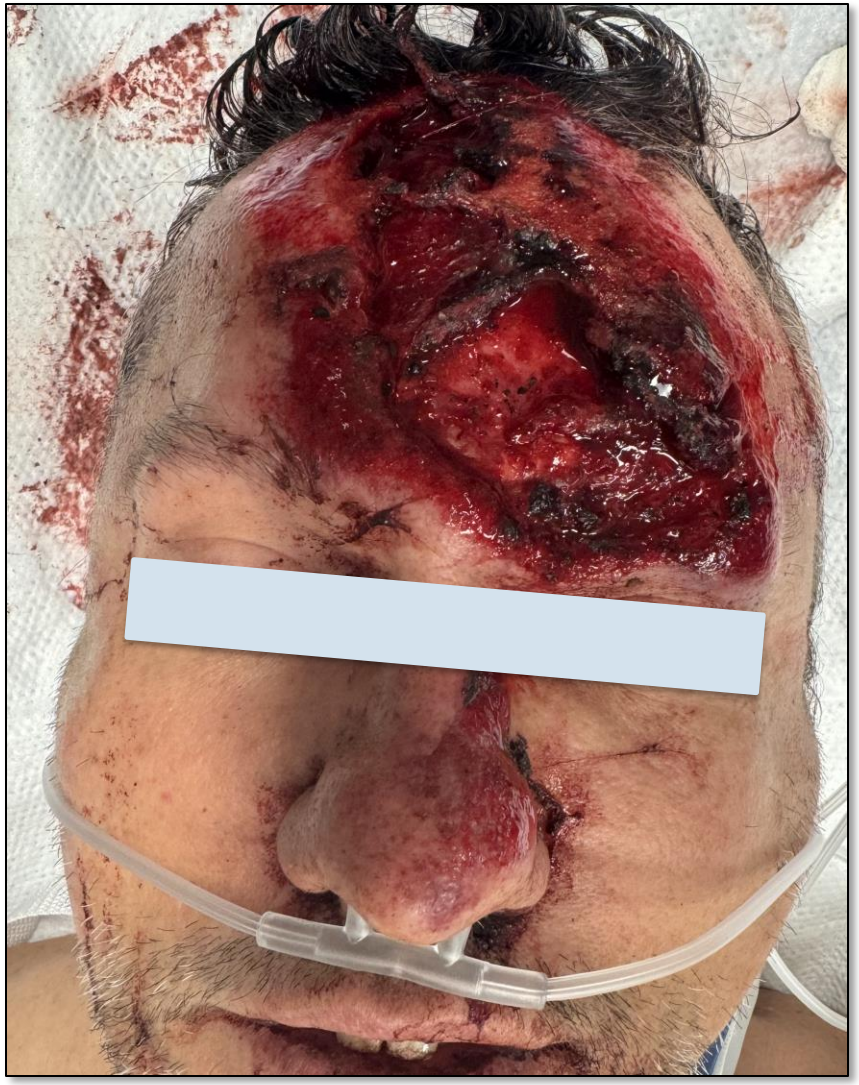


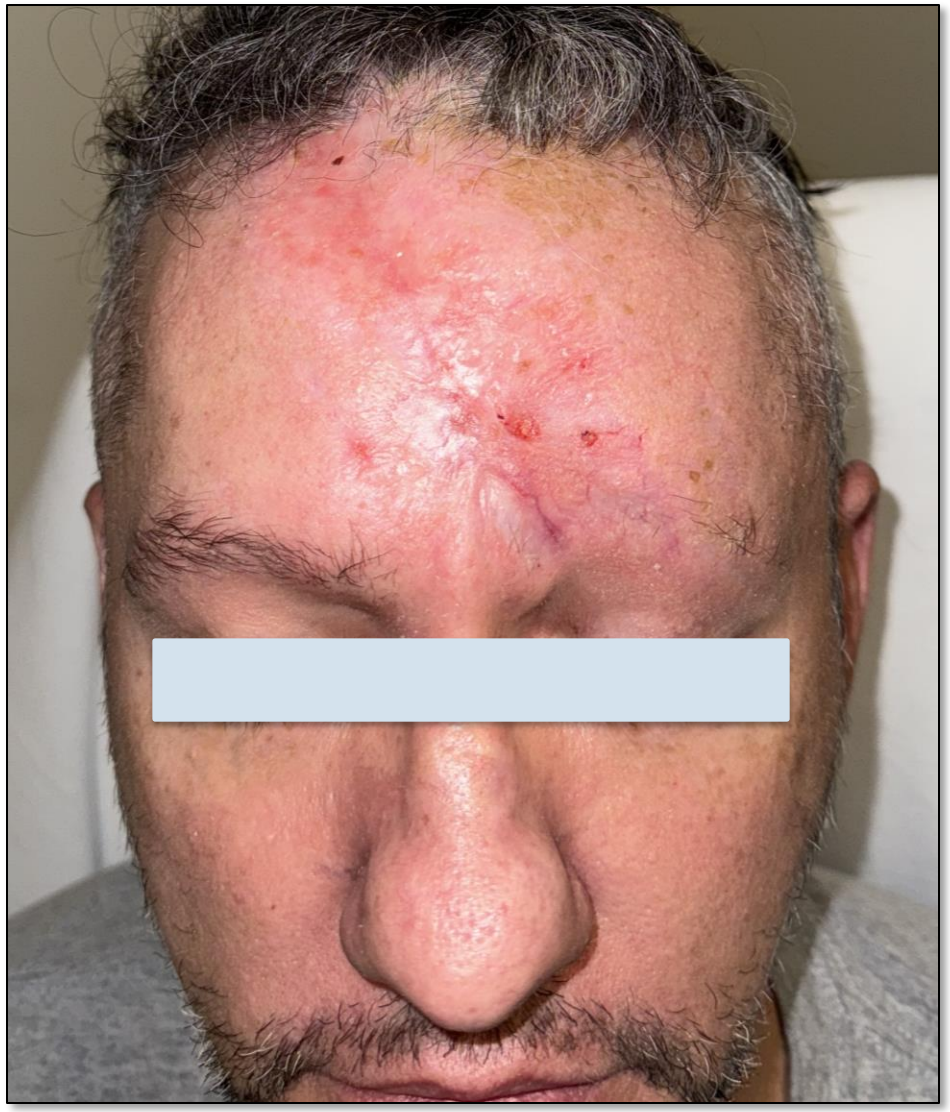
- Normally, a wound builds granulation tissue, the re-epithelization occurs over top
- **Reticular dermis actually down-regulated granulation formation**
- Replacement dermal scaffold for re-epithelialization

Dolivo D, et al. *Cytotherapy*. 2021;23(8):672-676.

Clinical Cases:
Bridge to Re-Epithelialization

Reticular ADM Single-Stage Reconstruction





My Protocol

Operating Room

- Debridement
  - Get rid of dead tissue
  - Bleeding edges
- Irrigation and scrubbing
  - High volume, LR/NS
  - Antimicrobial wound lavage, povidone-iodine
  - Scrub brush
- Grafting of rADM
  - Chromic sutures
  - Staples
- NPWT (VAC) with a fenestrated non-stick interface

Post-Op

- NPWT (VAC) x 1wk
- NPWT (VAC) removed in clinic @ 1wk
- Ointment + xeroform change Qday
- Follow every 2-3wks
- STSG??

Questions for the Audience

What Would You Do?

92y Female s/p Fall

- 92y Female GLF on Eliquis
- Likely developed pressure necrosis from hematoma
- A-fib
- HTN
- Malnourished
- Ex-smoker
- Severe pulmonary hypertension

Polling Question

What Would You Do?

A) No surgery

B) Debride

C) Debride + Skin Graft

D) Debride + Local Flap

E) Debride + Free Flap

Polling was pre-recorded

POD 7

Polling Question

What Would You Do?

A) Local wound care

B) Debride

C) Debride + Skin Graft

D) Debride + Local Flap

E) Debride + Free Flap

Polling was pre-recorded

Clinical Pearls

- rADM is an effective allograft for neodermis regeneration
- rADM can be utilized to achieve single-stage reconstruction in select patients
- rADM can be combined with placental tissue to achieve optimal results in high-risk patients

Cases

Michael N. Desvigne, MD, FACS, CWS, FACCWS
Plastic and Reconstructive Surgery
Wound Care and Hyperbaric Medicine
Abrazo Arrowhead Hospital and Wound Clinic
Glendale, AZ

“The only surgeon that does not get complications is the one that does not operate.”

My mentor…

Abdominoplasty (1 Wk)

Why Be Concerned about Surgical Incisions?

- 8.2 million people at risk for surgical site infection (SSI) annually[1]
- SSIs are 21.8% of all healthcare-associated infection (HAI)[2]
- Complications with incisions can lead to severe consequences
  - Of the top 5 HAIs, SSI makes up 33.7% of the $9.8 billion cost to the US healthcare system each year[1]
  - SSIs increase the average length of hospital stay by 9.58 days at an additional cost of $38,656[3]
  - Other common complications include: dehiscence, hematoma, seroma formation[4-6]

The Centers for Medicare & Medicaid Services emphasize the need to decrease costs and improve care by identifying hospital-acquired conditions that will NOT be reimbursed, including 3 types of SSIs.[1]

(1) Zimlichman E. *JAMA Intern Ed*. 2013;173(22):2039-2046. (2) Magill SS. *NEJM*. 2014;370:1198-1208. (3) Shepard J. *JAMA Surg*. 2013;148(10):907-914. (4) Riou JP. *Am J Surg*. 1992;163:324-330. (5) Wilson JA. *Adv Skin Wound Care*. 2004;17:426-435. (6) Abbas SM. *ANZ J Surg*. 2009;79:247-250.

High-Risk Patients

- Comorbidities
- Obesity
- Smoking
- Reoperation

Unaffordable Surgical Complications

- **Vascular**
  - Avoiding GRAFT exposure
- **Neurosurgery**
  - Avoiding CRANIUM or DURA exposure
- **Ortho and Podiatry**
  - Avoiding HARDWARE or TENDON exposure
- **General Surgery/Surgical Oncology**
  - Avoiding MESH exposure
- **Plastic Surgery**
  - Avoiding IMPLANT exposure

Algorithmic Approach

- **Wound management**
  - Cellular proliferation — placental membrane
- **Incisional management**
  - Flat surface — placental membrane
  - Irregular surface and/or large surface area — placental mini membrane
- **Anticipating post-surgical complications**
  - Cellular proliferation — placental membrane or mini membrane
- **Optimizing surgical outcomes**
  - Cellular proliferation
    - Flat surface — placental membrane
    - Irregular surface and/or large surface area — placental mini membrane

Aseptically Processed Allografts:
Solutions for Complex Reconstruction

Incisional Management

Biological Properties of Amnion/Chorion

- **From published literature, demonstrated to be**
  - Non-immunogenic: cells do not express HLA-A and -B antigens[1-3]
  - Anti-adhesive/anti-scarring: limits fibroblast activity and reduces risk of fibrosis[4-8]
  - Anti-inflammatory: inhibits expression of inflammatory cytokines[9-12]
  - Anti-microbial: adheres closely to wound; contains anti-microbial peptides[13-16]

[1] Szerekes-Bartho J, 2002
[2] Ueta M, et al. 2002
[3] Veenstra van Nieuwenhoven AL, et al. 2003
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[5] Lee SB, et al. 2000
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[8] Kieran I, et al. 2013
[9] Tseng SCG, 2001
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[11] Solomon A, et al. 2005
[12] Higa et al. 2005
[13] Talmi YP, et al. 1991
[14] Kjaergaard N, et al. 2000
[15] Stock SJ, et al. 2007
[16] King AE, et al. 2007

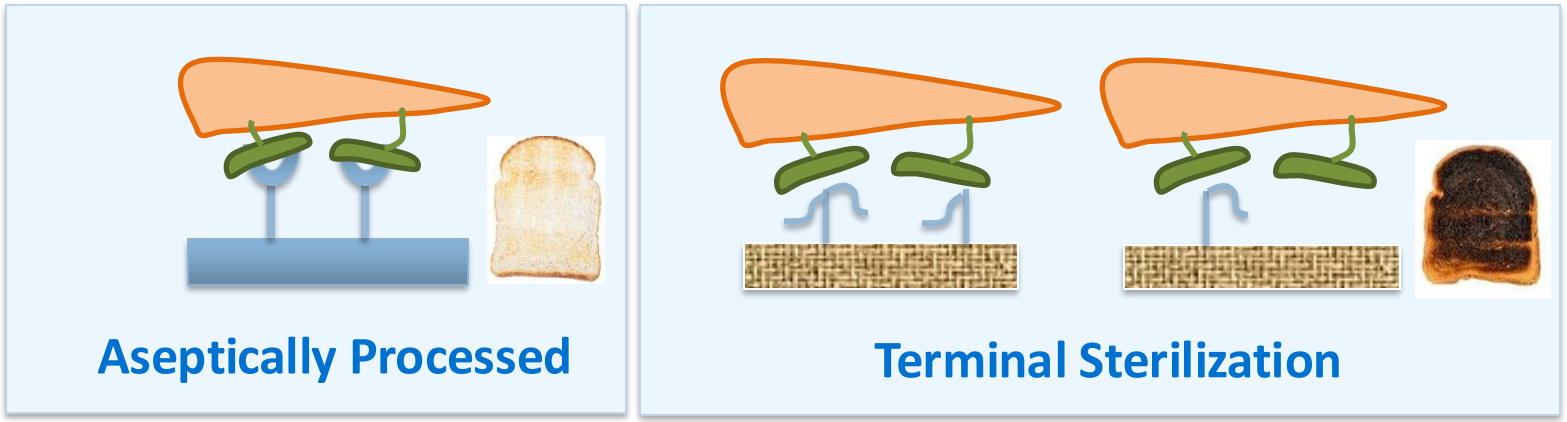
Placental Allograft Membrane

Placental Allograft
Mini Membrane

Processing Matters!

- **Provides safe, quality tissue most similar to native, autograft tissue**
  - Achieves the same sterility (SAL 10^{-6}) as terminally sterilized tissue[1]
  - Preserves tissue structure, matrix proteins and signaling cues[2]

- **Terminal sterilization alters tissue properties of native tissue**
  - Denatured tissue structure and matrix proteins[3]
  - Compromised binding sites for cell attachment and cell signaling function[4]

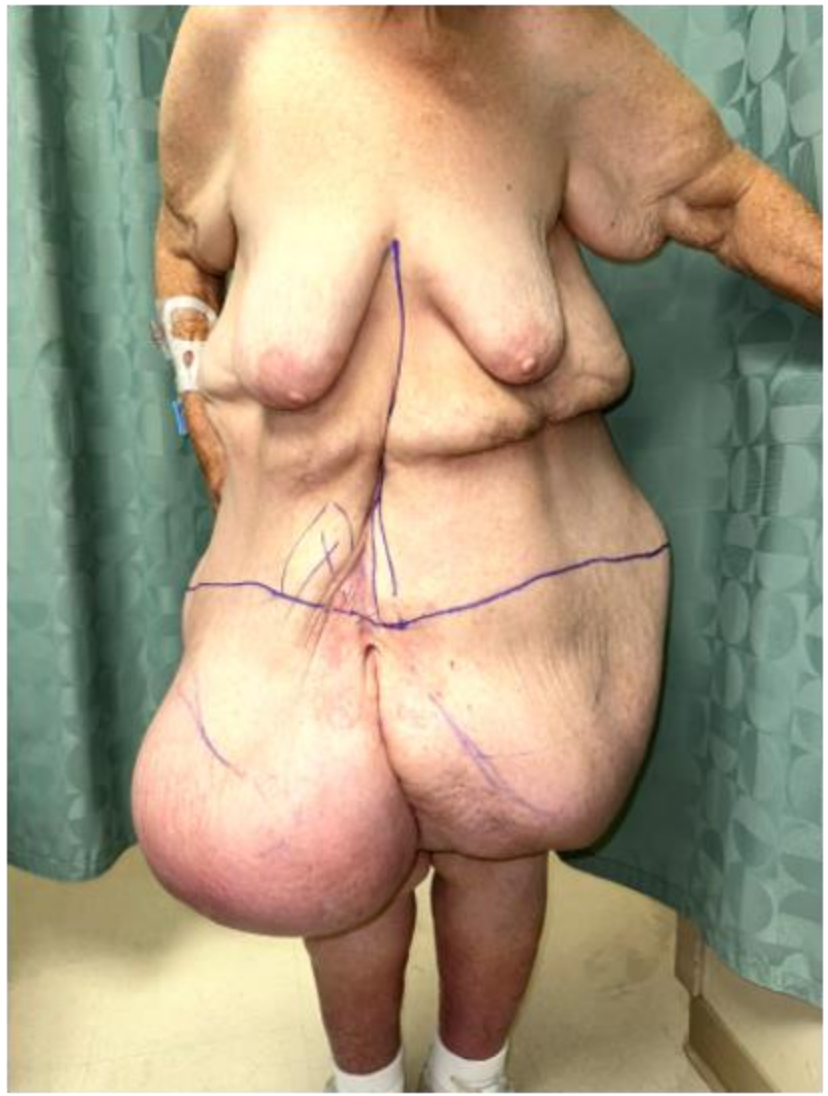


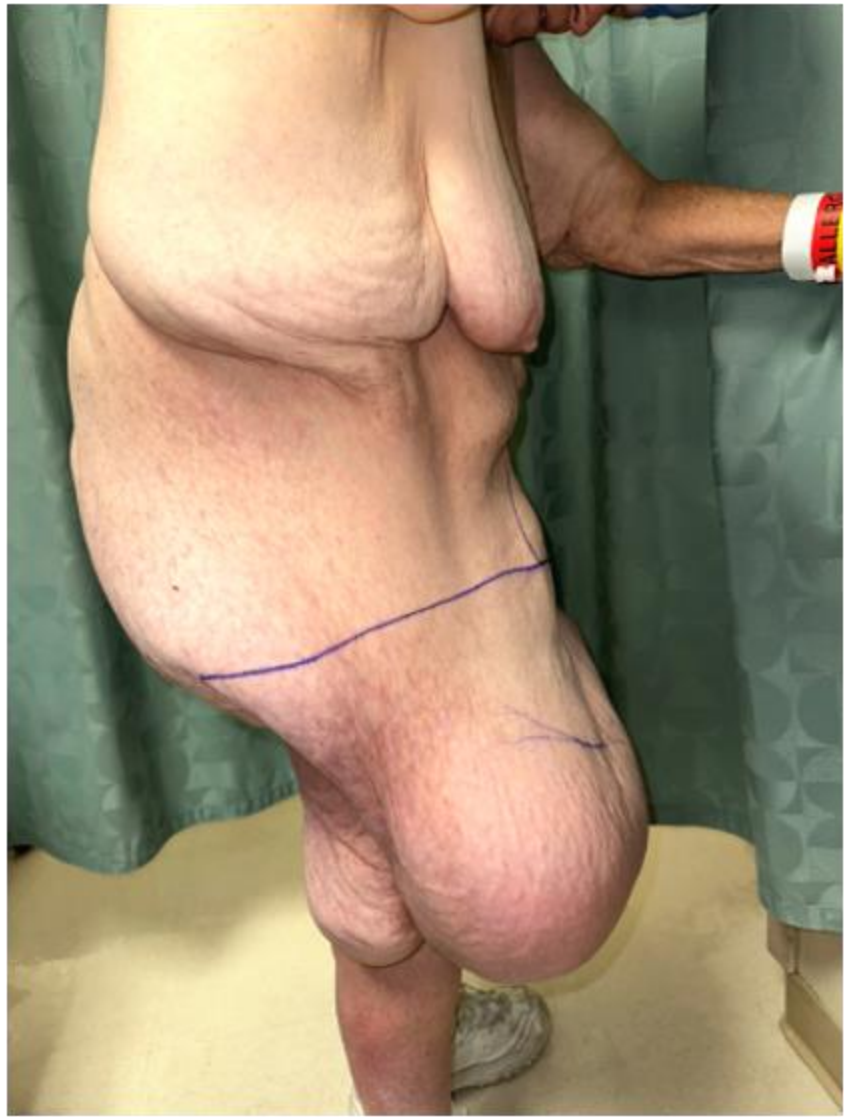
[1] Phipps A, et al. *Cell Tissue Bank*. 2017;18(4):505-515. [2] Dasgupta S, et al. *Exp Cell Res*. 2016;347(1):123-132. [3] Badylak SF, et al. *Acta Biomater*. 2009;5(1):1-13. [4] Matuska AM, et al. *J Biomed Mater Res B Appl Biomater*. 2015;103(2):397-406.

Case Summary: Panniculectomy

- 63y Female with ventral hernia and excessively large pannus presents for hernia repair and panniculectomy
- Medical history
  - Chronic neck pain, HTN
- Surgical history
  - Previous hernia repair
- Treatment
  - Taken to OR for ventral hernia repair and panniculectomy
  - Placental allograft placed to optimize healing
  - Negative pressure therapy (NPT) initiated immediately following closure

Panniculectomy (Day 1)





Panniculectomy (Day 1)

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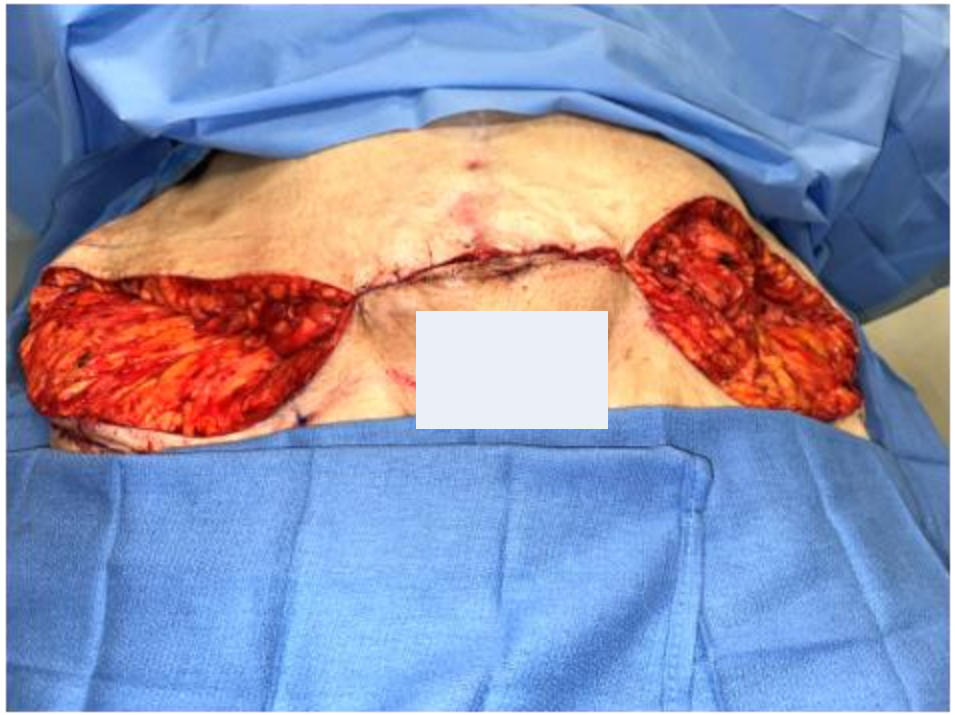

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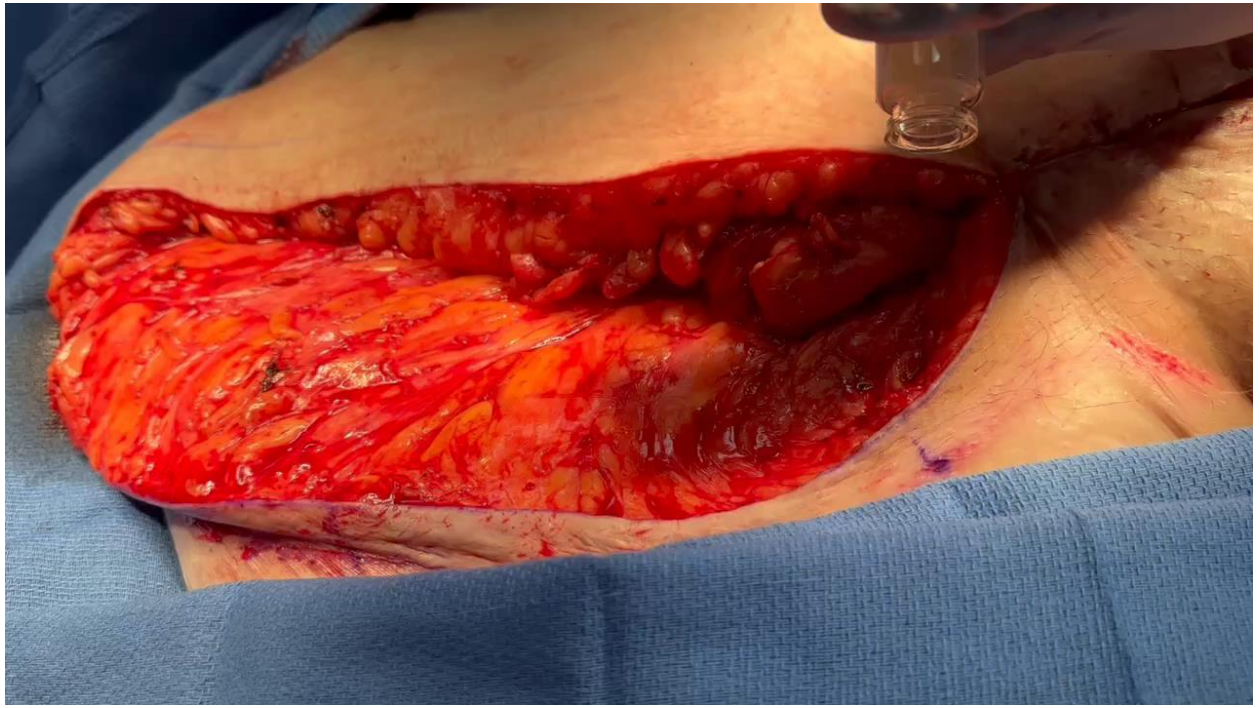
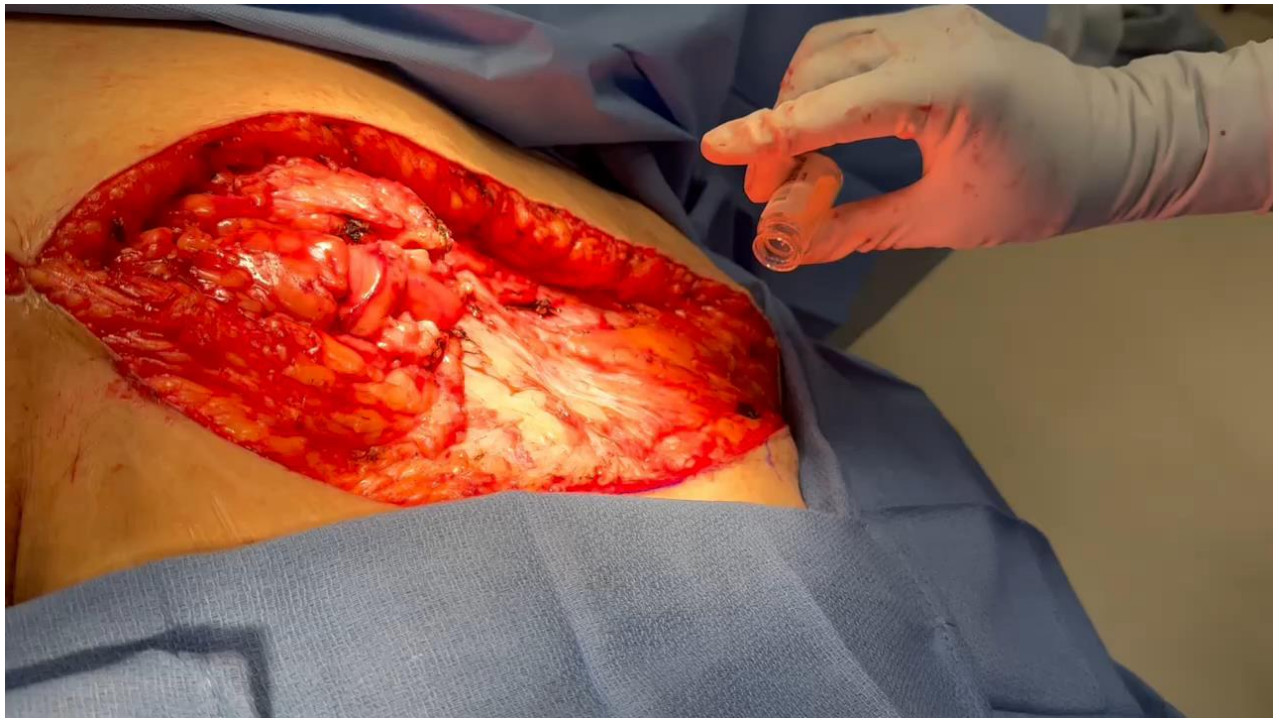


Panniculectomy (Day 1)



Panniculectomy (Day 1)

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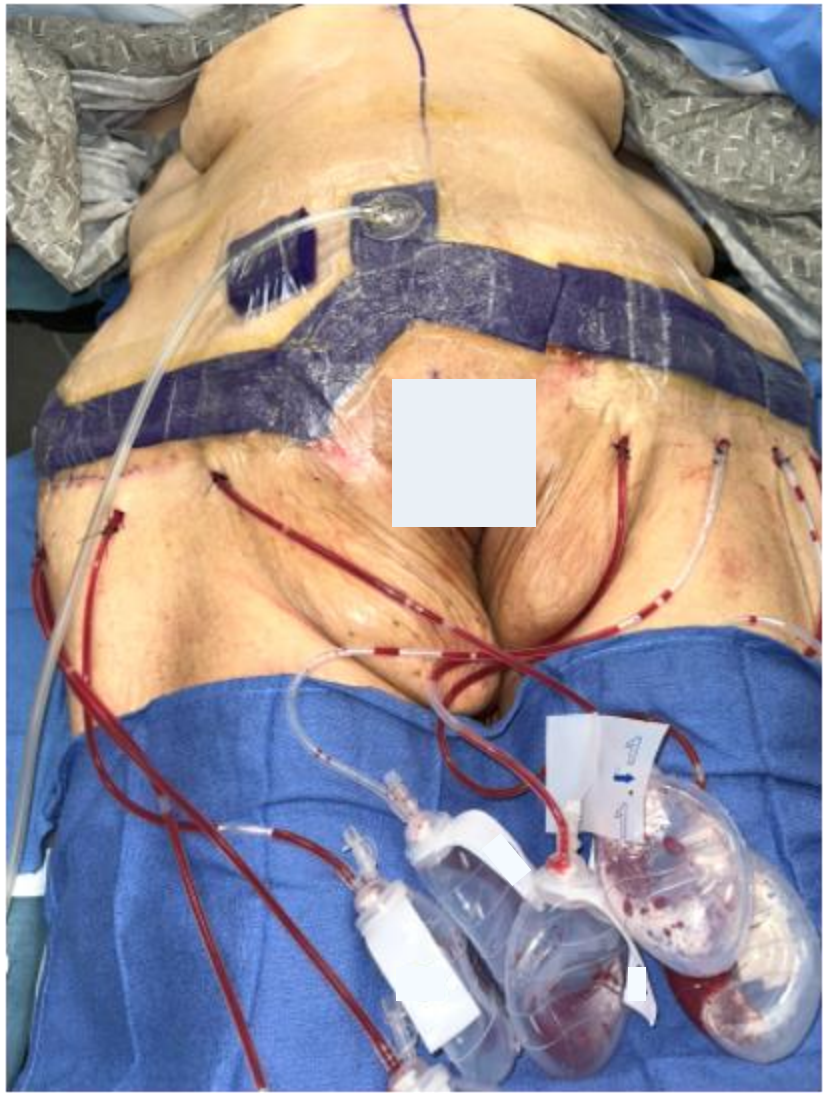
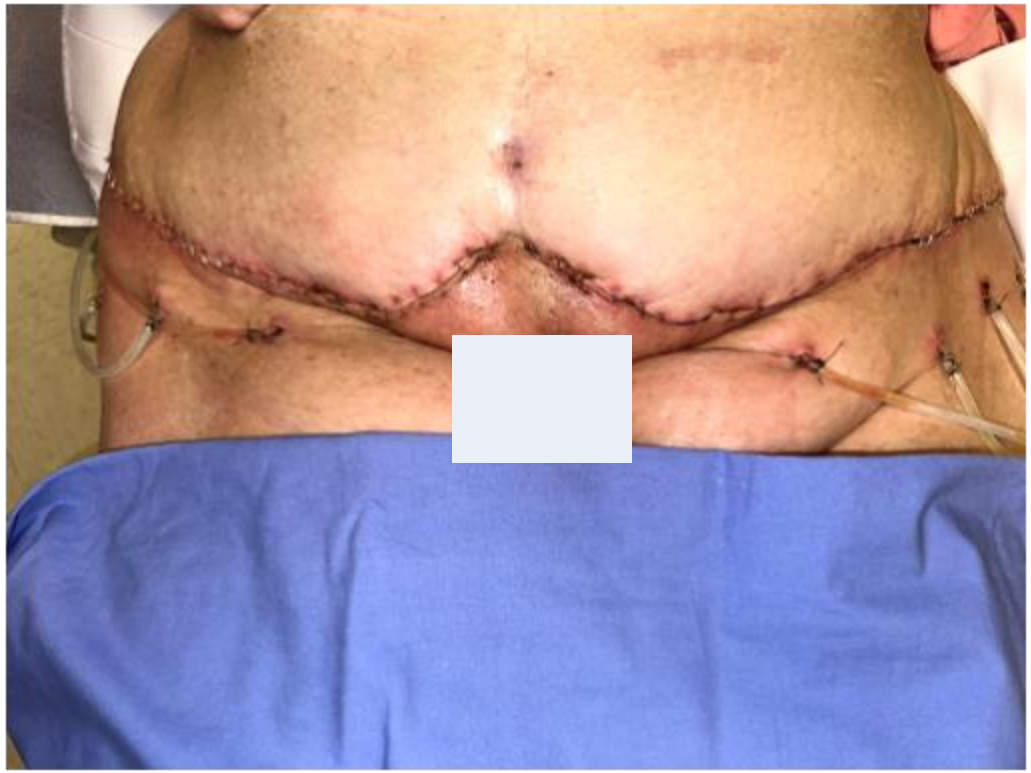
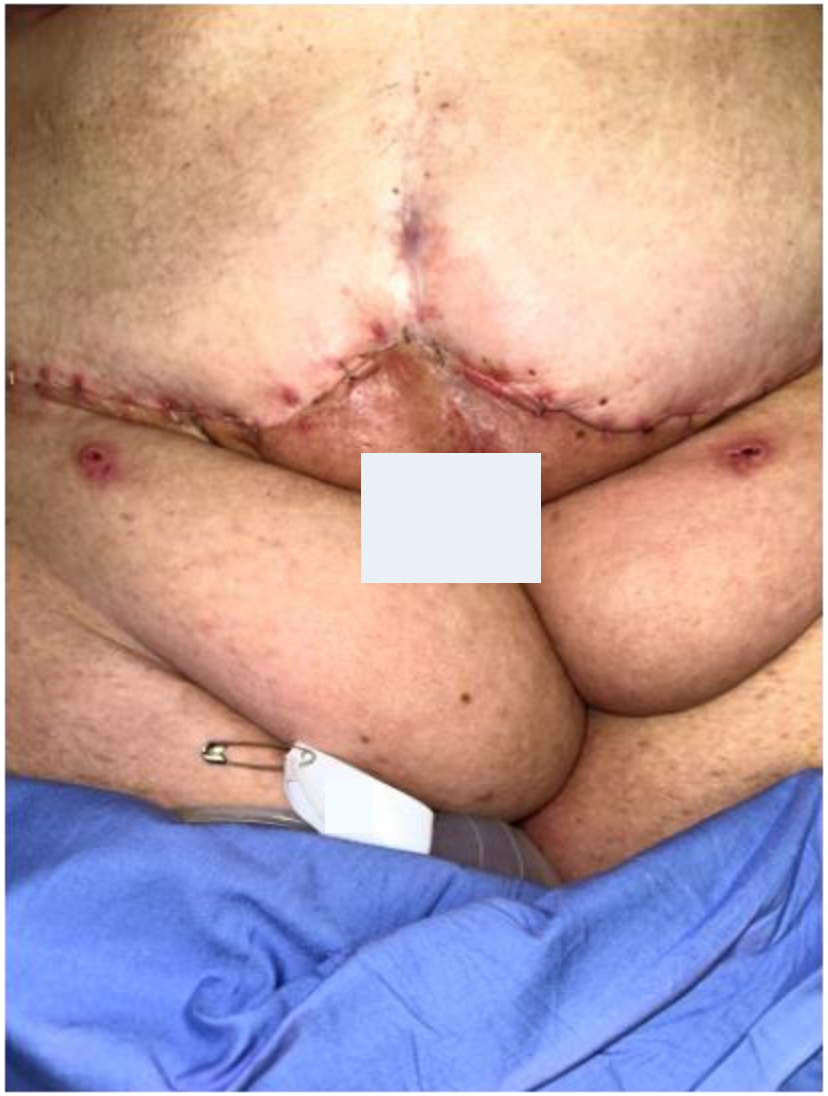


Panniculectomy (Day 14)



Panniculectomy (Day 21)



Panniculectomy (Day 28)

Panniculectomy (Day 28)

A Backup Plan for Plastic Surgical Reconstruction when Plan “A” Fails:

Aseptically Processed Meshed Reticular Acellular Dermal Matrix in Soft Tissue Reconstruction

A Backup Plan for Plastic Surgical Reconstruction when Plan A Fails: Use of Aseptically Processed Meshed Reticular Acellular Dermal Matrix in Soft Tissue Reconstruction

Michael N. Desvigne, MD, FACS, CWS, FACCWS; Krista Bauer (Montgomery), RN, WCC, OMS; Jody Wolfe, BSN, MBA, RN; CWOCN, Ashley L. Wardman, LPN.
Plastic & Reconstructive Surgery, Wound Care & Hyperbaric Medicine, Abrazo Arrowhead Hospital and Wound Clinic, Glendale, AZ

INTRODUCTION

Flap mobilization and closure is the mainstay of treatment in soft tissue reconstruction. Successful outcomes are only achieved when there is adequate tissue for transfer. When there is a relative tissue deficiency, needed procedures may become more challenging and complex such as free tissue transfer, and outcomes may be compromised, resulting in flap failure.

Aseptically processed meshed human reticular acellular dermal matrix (HR-ADM)* is unique in that it comes from the reticular dermal layer that provides an open network structure to support tissue ingrowth and serve as a scaffolding. While these tissue forms are known to assist with soft tissue support for secondary healing or split thickness grafting, this dermal matrix may also be used as an adjunct to flap transfer which may then allow for coverage of vital structures if flap failure occurs, perhaps reducing the need for additional surgery and or more complex procedures.

METHODS/RESULTS

We evaluated 5 cases of soft tissue reconstruction (2 are presented here) where there was a paucity of tissue for flap transfer and or concern for flap failure resulting in exposure of vital structures such as bone, tendon or vascular graft. Wound etiologies included pressure ulcerations of the trunk (n=3), full thickness necrosis of the groin (n=1), and a diabetic foot ulcer (DFU) in a poorly perfused lower extremity (n=1). Aseptically processed meshed HR-ADM was placed prior to flap inset to serve as a scaffolding to support tissue ingrowth following flap transfer. Postoperatively incisional management was supported with dehydrated human placental mini-membrane** and negative pressure therapy. In this series of cases, postoperative complications occurred including dehiscence n=4 and flap failure due to poor perfusion. Despite the postoperative complications, incorporation of the meshed HR-ADM allowed delayed primary closure n=2, secondary healing n=3. The DFU case was noteworthy as a failed tarsometatarsal amputation (TMA) that occurred in a poorly perfused lower extremity after the meshed HR-ADM had been placed prior to the TMA. Following flap failure, secondary healing was successful without need for more proximal amputation.

DISCUSSION

Meshed HR-ADM has properties that allow tissue integration and incorporation. Patients with soft tissue deficits requiring flap reconstruction may benefit from meshed HR-ADM for additional support and may serve as a backup to allow for coverage of vital structures. While distant flaps and free tissue transfer are still considered the standard of care, these procedures may carry a higher risk of complications and or failure. The use of meshed HR -ADM in these patients may help create a scaffolding for tissue incorporation to allow for coverage of vital structures, reducing the need for more complex surgical intervention.

CASE 1

Patient Information: 42 year old female with incomplete quadriplegia from GSW. Presented with necrotic sacral ulcer, stage 4. Seen and managed at outside wound clinic with progressive worsening ulcer. Admitted for surgical intervention.
Medical History: Urostomy
Social History: Lives independently
Treatment: Taken to OR for excision ulcers and flap closure. Meshed HR-ADM placed for tissue scaffolding. Human Placental Mini-Membrane Allograft placed to optimize healing. NPT initiated for incisional management immediately following closure.
Outcome: Dehiscence at 3 weeks. Meshed HR-ADM incorporated. Closure performed.


Figure 1A. Wound at initial presentation (Day 1)


Figure 1B. Placement of dehydrated human placental mini-membrane (Day 1)


Figure 1C. Placement of meshed HR-ADM (Day 1)


Figure 1D. Flap Closure


Figure 1E. Flap dehiscence. Dermal matrix incorporated. (Day 21)


Figure 1F. Secondary closure performed (Day 21)

CASE 2

Patient Information: 79 year old female s/p percutaneous Aortic valve repair complicated by bleed and hematoma right groin resulting in full thickness necrosis.
Medical History: Aortic valve stenosis, CHF, HTN, Obesity
Treatment: NPWTi-d initiated. Taken to OR for staged debridement and NPWTi-d. Taken to OR for definitive flap closure. Meshed HR-ADM placed for tissue scaffolding, and just in case Plan A fails. Human Placental Mini-Membrane Allograft placed to optimize healing. NPT initiated for incisional management immediately following closure.
Outcome: Dehiscence at 4 weeks. Meshed HR-ADM incorporated. Closure performed at 6 weeks.


Figure 2A. Full thickness necrosis groin (Day 1)


Figure 2B. Applied 3M™ V.A.C Veraflo Cleanse Choice™ (Day 1)


Figure 2C. Eschar removed (Day 3)


Figure 2D. Continued to remove non-viable tissue (Day 5)


Figure 2E. Cavity went down to vessel. Applied 3M V.A.C. Whitefoam dressing to protect vessel in combination with 3M V.A.C. Veraflo Cleanse Choice dressing with hypochlorous acid solution. (Day 7)


Figure 2F. Femoral artery exposed (Day 10)


Figure 2G. Applied placental mini-membrane allograft (Day 14)


Figure 2H. Applied meshed HR-ADM and traditional 3M™ V.A.C.® Therapy (Day 14)


Figure 2I. Staged layer closure to protect the vessel. Then applied 3M™ Prevena™ Customizable Dressing for 7 days. (Day 14)


Figure 2J. Small dehiscence (Day 26)


Figure 2K. Progressive dehiscence. Deep soft tissue exposed. Dermal matrix fully incorporated. (8 weeks)


Figure 2L. Returned to OR for irrigation and closure (8 weeks)


Figure 2M. Applied human placental mini-membrane allograft (8 weeks)


Figure 2N. Surgical closure (8 weeks)


Figure 2O. NPT placement for incisional management (8 weeks)


Figure 2P. Healed (3 months)

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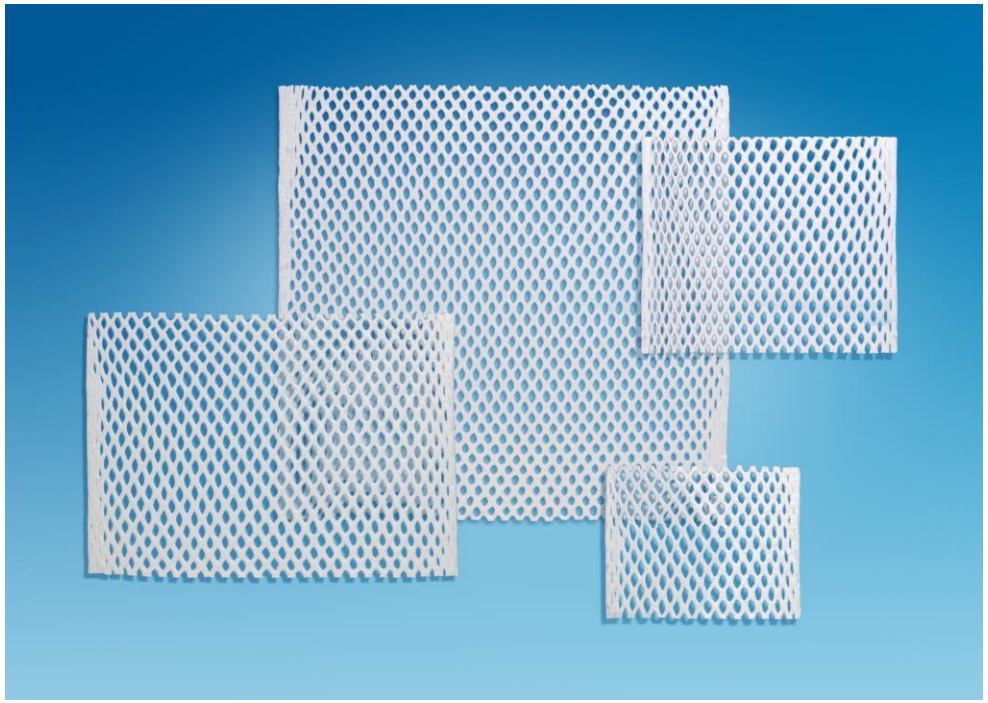
3.DiDomenico LA, Orgill DP, Galiano RD, et al. Use of an aseptically processed, dehydrated human amnion and chorion membrane improves the likelihood and rate of healing in chronic diabetic foot ulcers: A prospective, randomized, multi-centre clinical trial in 80 patients. Int Wound J 2018; 15: 950-957.
4.Zelen CM, Orgill DP, Serena TE, et al. An aseptically processed, acellular, reticular, allogenic human dermis improves healing in diabetic foot ulcers: A prospective, randomized, controlled, multicenter follow-up trial. Int Wound J 2018: 1-9

***Somagen® Reticular Dermal Matrix (MTF Biologics, Edison, NJ)** ****Salera® Placental Allograft (MTF Biologics, Edison, NJ)**

Presented at SAWC Spring 2025

HR-ADM Key Benefits

- First of its kind meshed reticular dermal allograft
- Ready-to-use allograft saves valuable OR time
- Pliable, conforms to the anatomy
- Compatible with advanced wound care modalities like NPWT (“designed to be used with NPWT”)
- Versatile meshing ratio allows to address a variety of wounds sizes/needs
- Available in 4 sizes that cover areas ranging from 48cm^2 to 476cm^2
- 18-month shelf life at ambient temperature

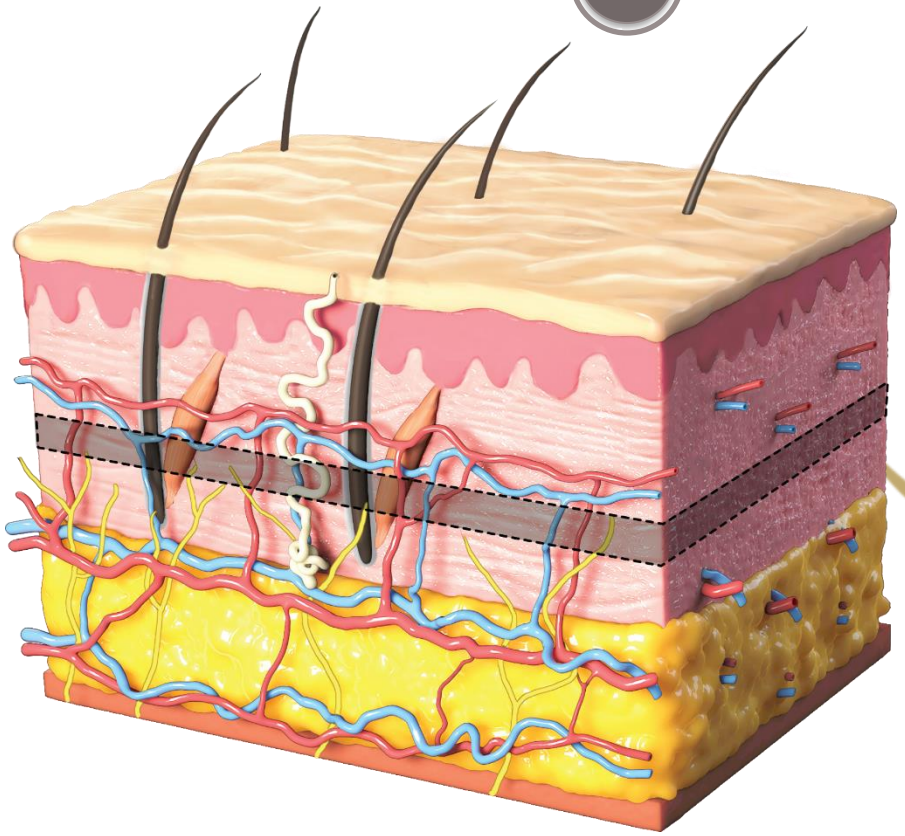


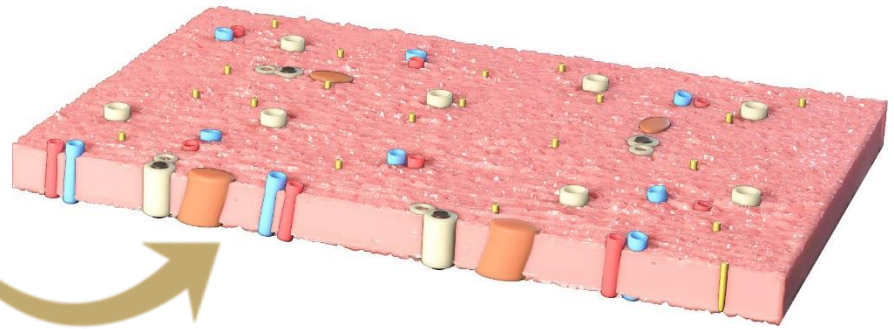
HR-ADM Meshed

From donor to recipient…

1 2 3 4 5

2 Deep reticular layer isolated





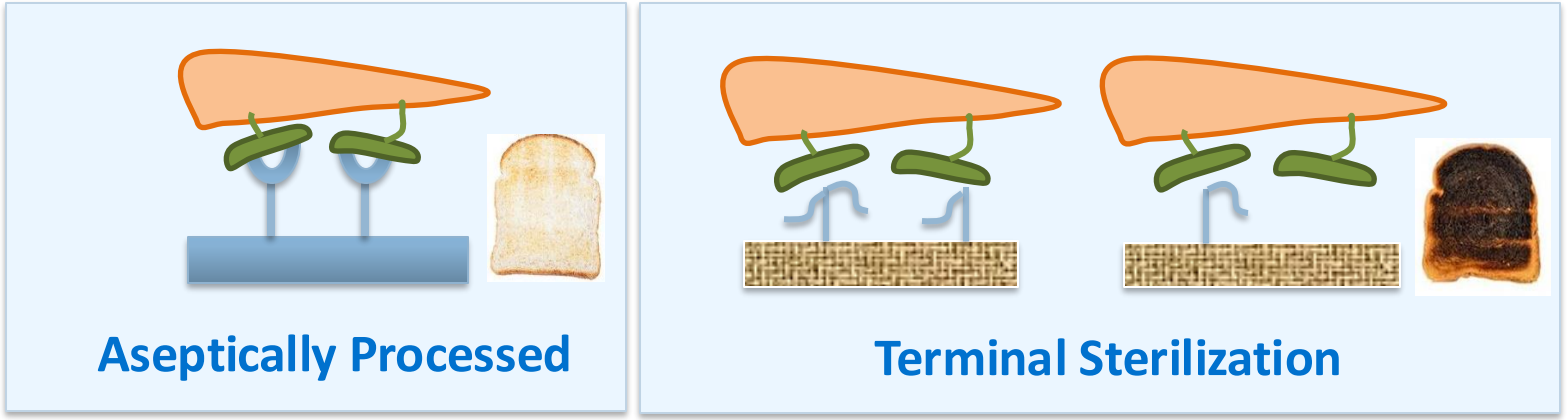
Novel deeper dermal layer (MTF proprietary)

- More open tissue structure
- Supports cell attachment/infiltration
- Facilitates graft integration

Processing Matters!

- **Provides safe, quality tissue most similar to native, autograft tissue**
  - Achieves the same sterility (SAL 10^{-6}) as terminally sterilized tissue[1]
  - Preserves tissue structure, matrix proteins and signaling cues[2]

- **Terminal sterilization alters tissue properties of native tissue**
  - Denatured tissue structure and matrix proteins[3]
  - Compromised binding sites for cell attachment and cell signaling function[4]



[1] Phipps A, et al. *Cell Tissue Bank*. 2017;18(4):505-515. [2] Dasgupta S, et al. *Exp Cell Res*. 2016;347(1):123-132. [3] Badylak SF, et al. *Acta Biomater*. 2009;5(1):1-13. [4] Matuska AM, et al. *J Biomed Mater Res B Appl Biomater*. 2015;103(2):397-406.

HR-ADM Incorporates

WEEK 1

WEEK 2

WEEK 3

WEEK 4

WEEK 5

WEEK 6

Idea

If meshed HR-ADM has properties that allow tissue integration and incorporation, perhaps patients with soft tissue deficits requiring flap reconstruction may benefit from meshed HR-ADM for additional support.

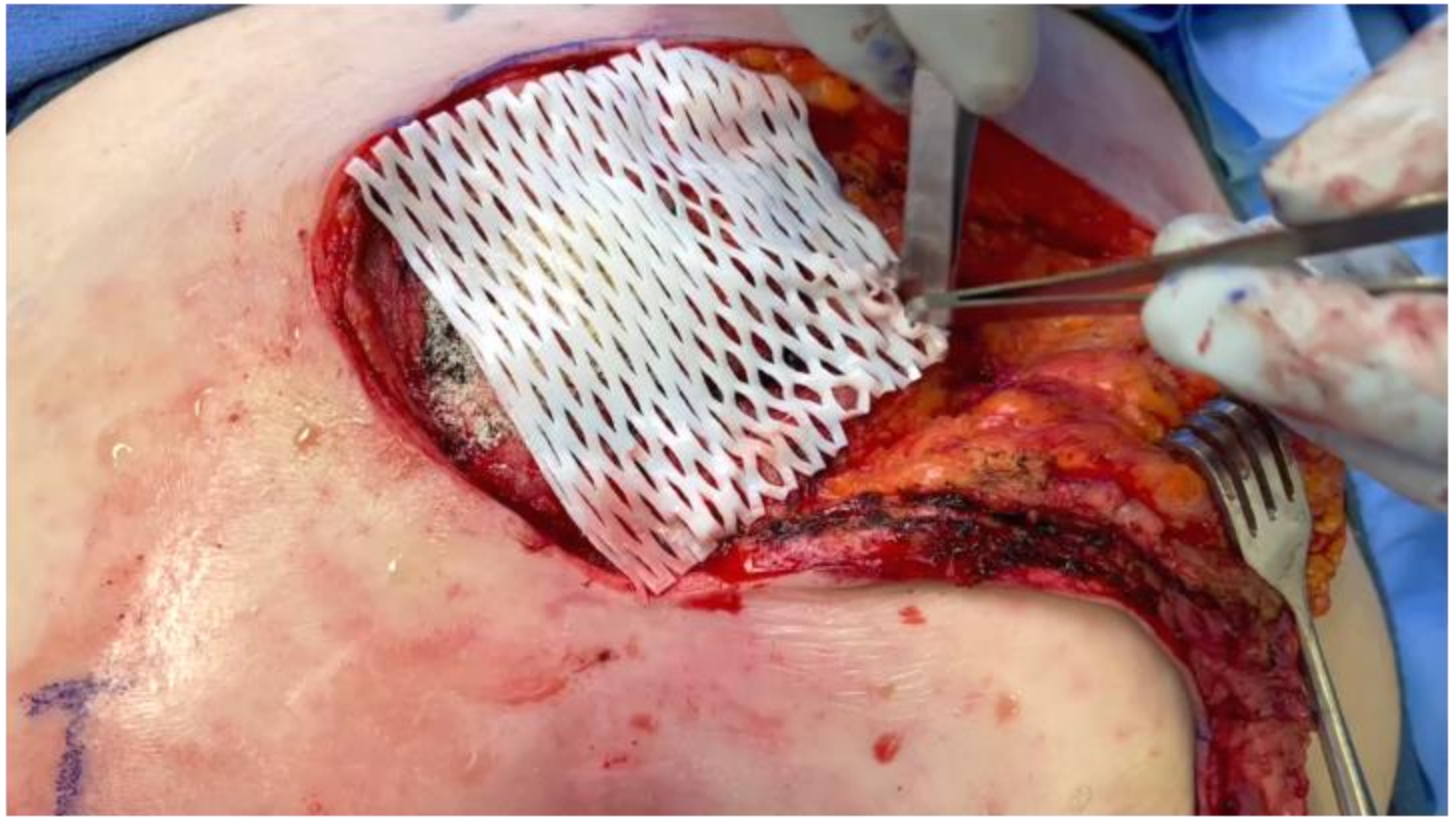
Case Summary: Sacral Ulcer Stage 4

- 42y Female, incomplete quadriplegia from GSW; presents with necrotic sacral ulcer, stage 4 managed at outside wound clinic; progressively worsening ulcer; admitted for surgical intervention
- Medical history
  - Urostomy
- Social history
  - Lives independently
- Treatment
  - Taken to OR for excision ulcers and flap closure
  - HR-ADM placed for tissue scaffolding
  - Placental allograft placed to optimize healing
  - NPT initiated immediately following closure
  - Outcome: Dehiscence at 3 wks; HR-ADM incorporated; closure performed

Sacral Ulcer, Stage 4 (Day 1)

Sacral Ulcer, Stage 4 (Day 1)

Sacral Ulcer, Stage 4 (Day 1)



Sacral Ulcer, Stage 4 (Day 1)

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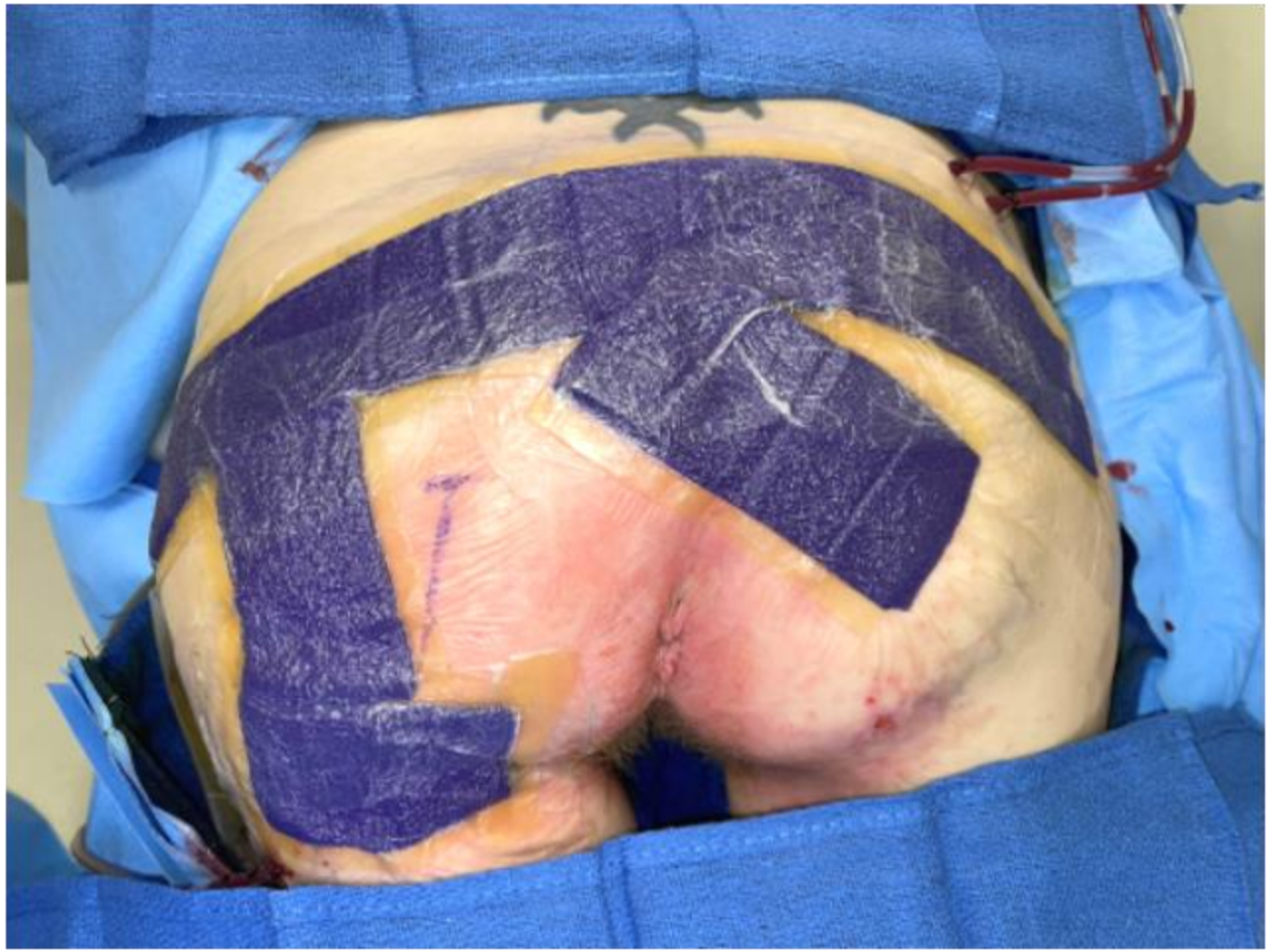
Sacral Ulcer, Stage 4 (Day 1)



Sacral Ulcer, Stage 4 (Day 21)

Sacral Ulcer, Stage 4 (Day 21)

Case Summary: Full Thickness Necrosis Groin

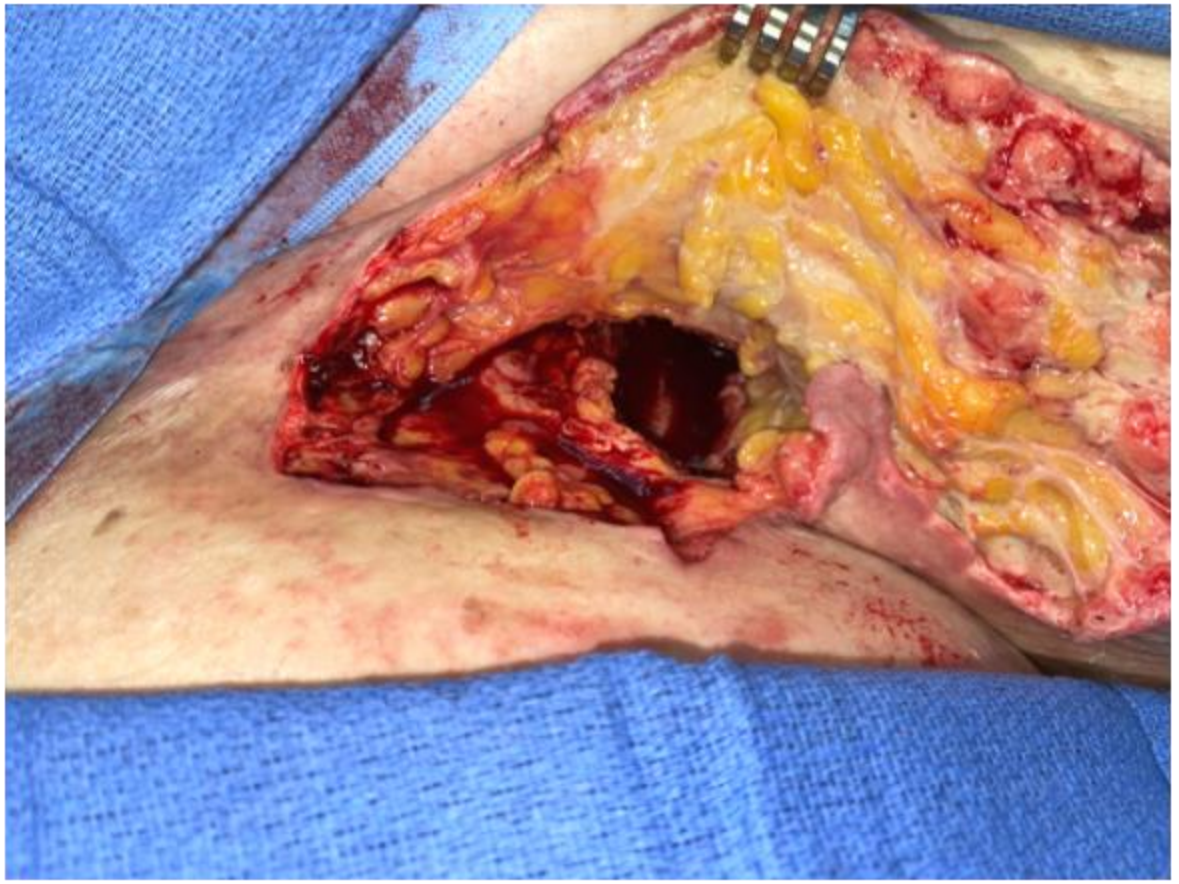
- 79y Female s/p percutaneous aortic valve repair complicated by bleed and hematoma right groin resulting in full thickness necrosis
- Medical history
  - Aortic valve stenosis, CHF, HTN, obesity
- Treatment
  - NPWTi-d initiated
  - Taken to OR for staged debridements and NPWTi-d
  - Taken to OR for definitive flap closure
  - HR-ADM placed for tissue scaffolding, AND just in case Plan “A” fails
  - Placental allograft placed to optimize healing
  - NPT initiated for incisional management immediately following closure
  - Outcome: Dehiscence at 4 wks; HR-ADM incorporated, closure performed at 6 wks

Full Thickness Necrosis Groin (Day 1)

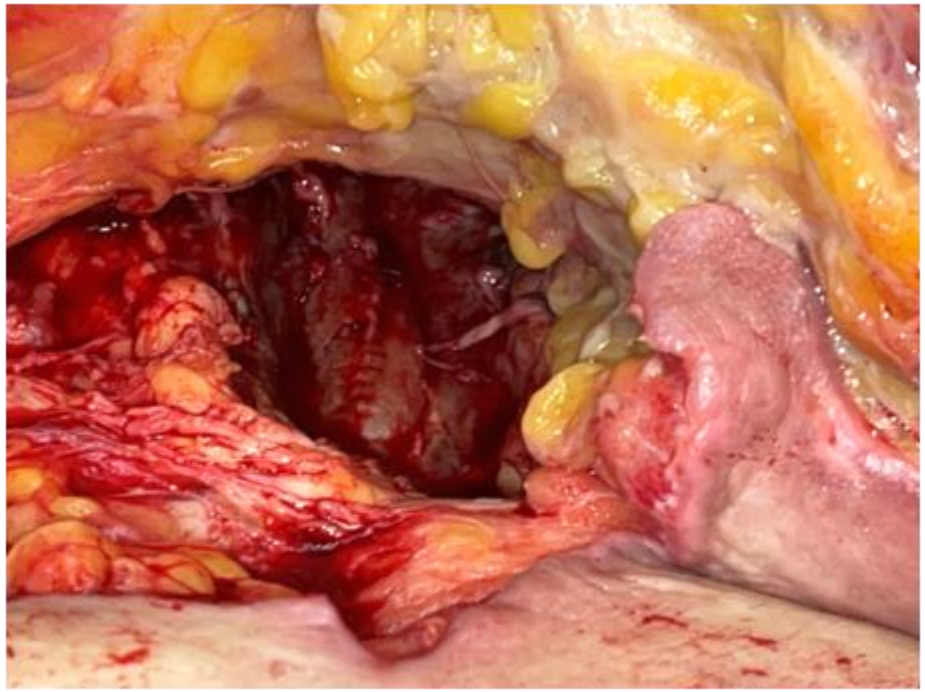
Full Thickness Necrosis Groin (Day 1)

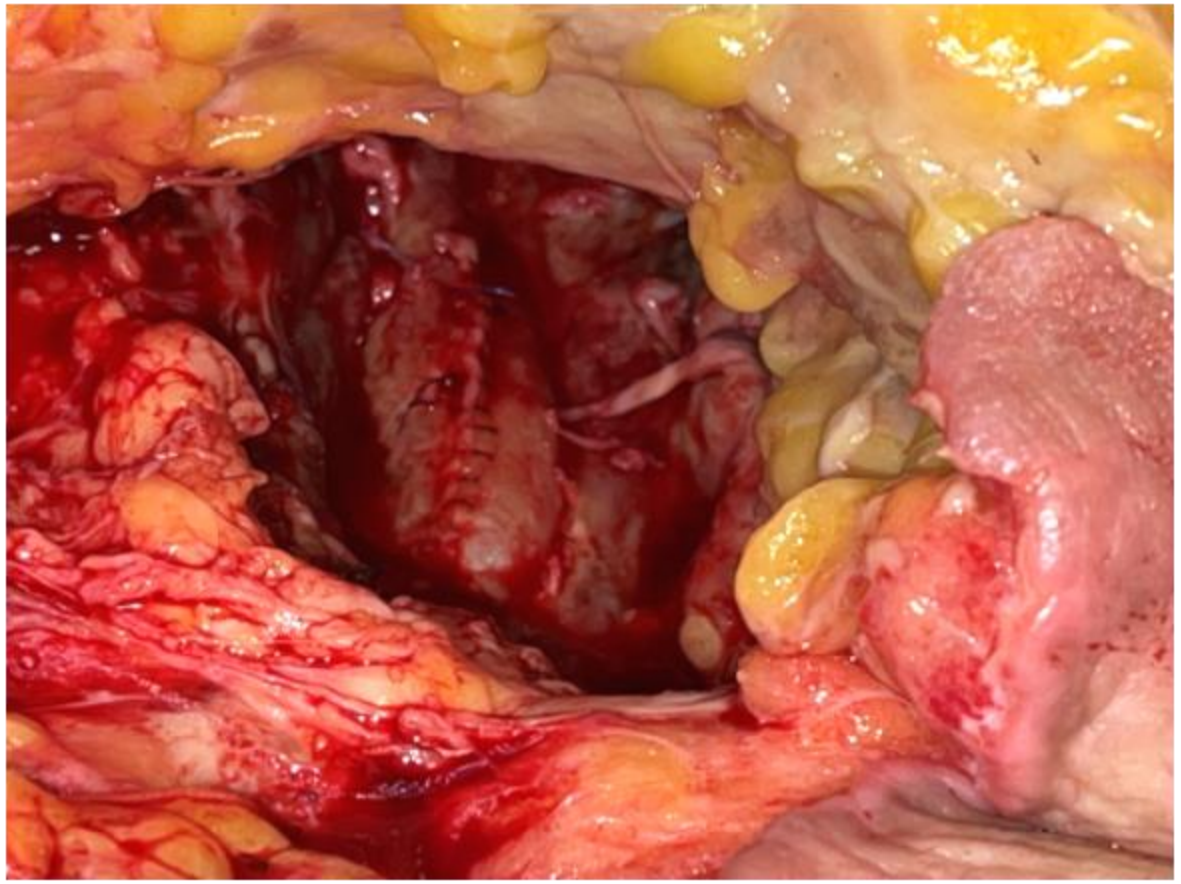
Full Thickness Necrosis Groin (Day 3)

Full Thickness Necrosis Groin (Day 5)



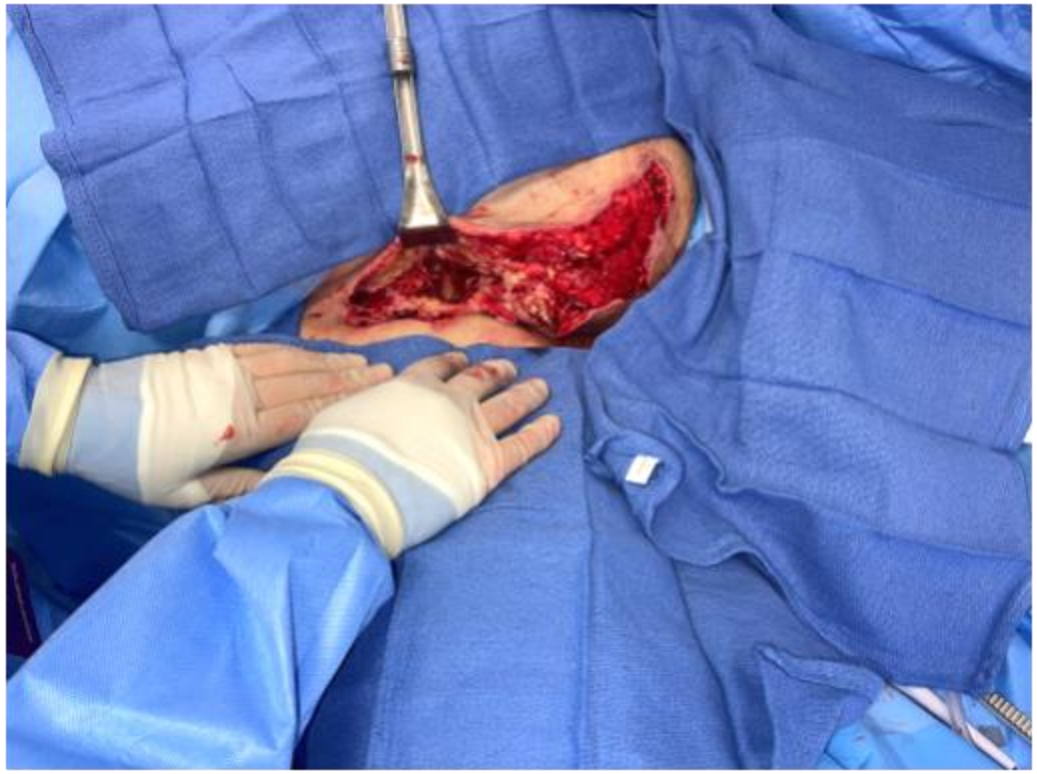
Full Thickness Necrosis Groin (Day 5)

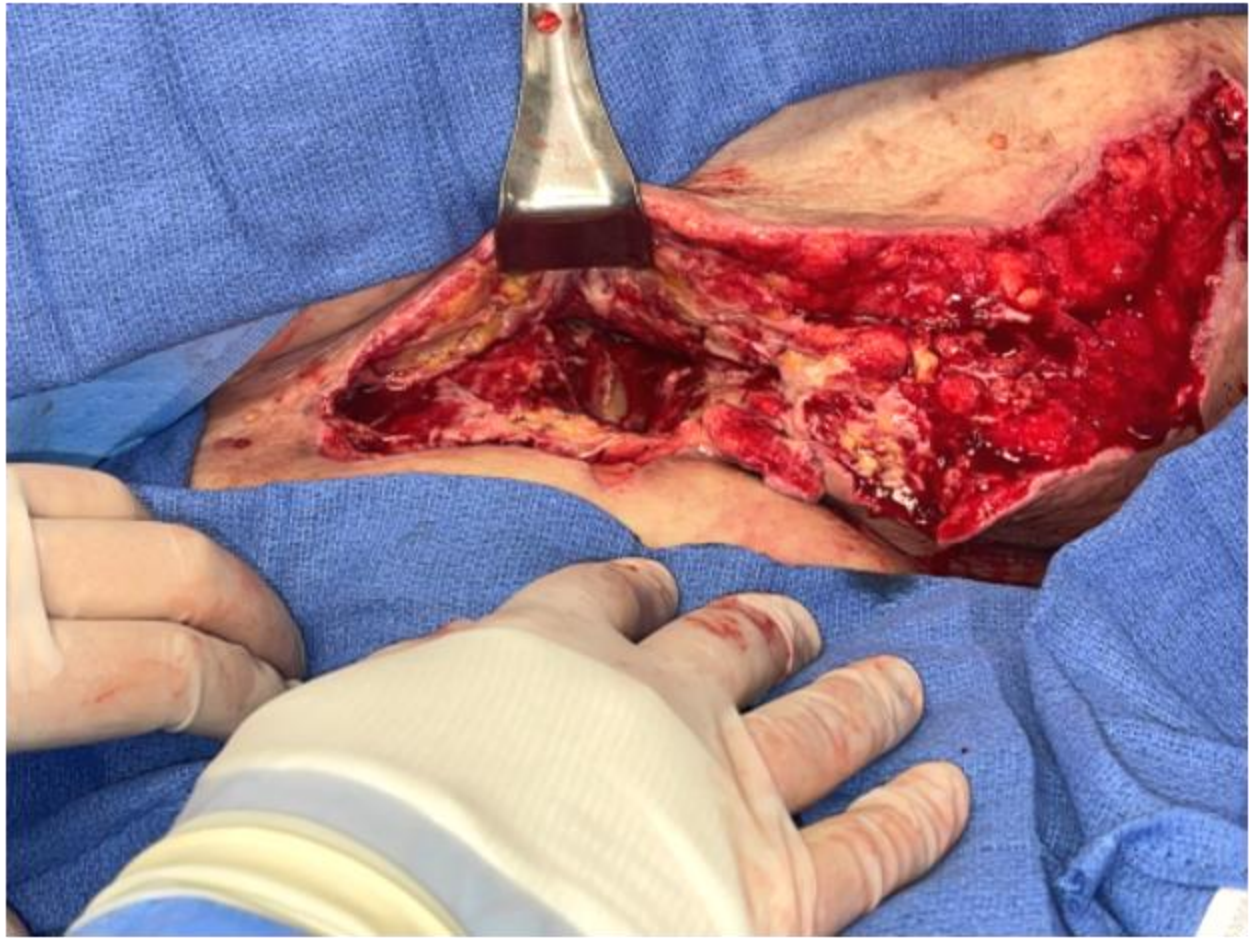




Full Thickness Necrosis Groin (Day 7)

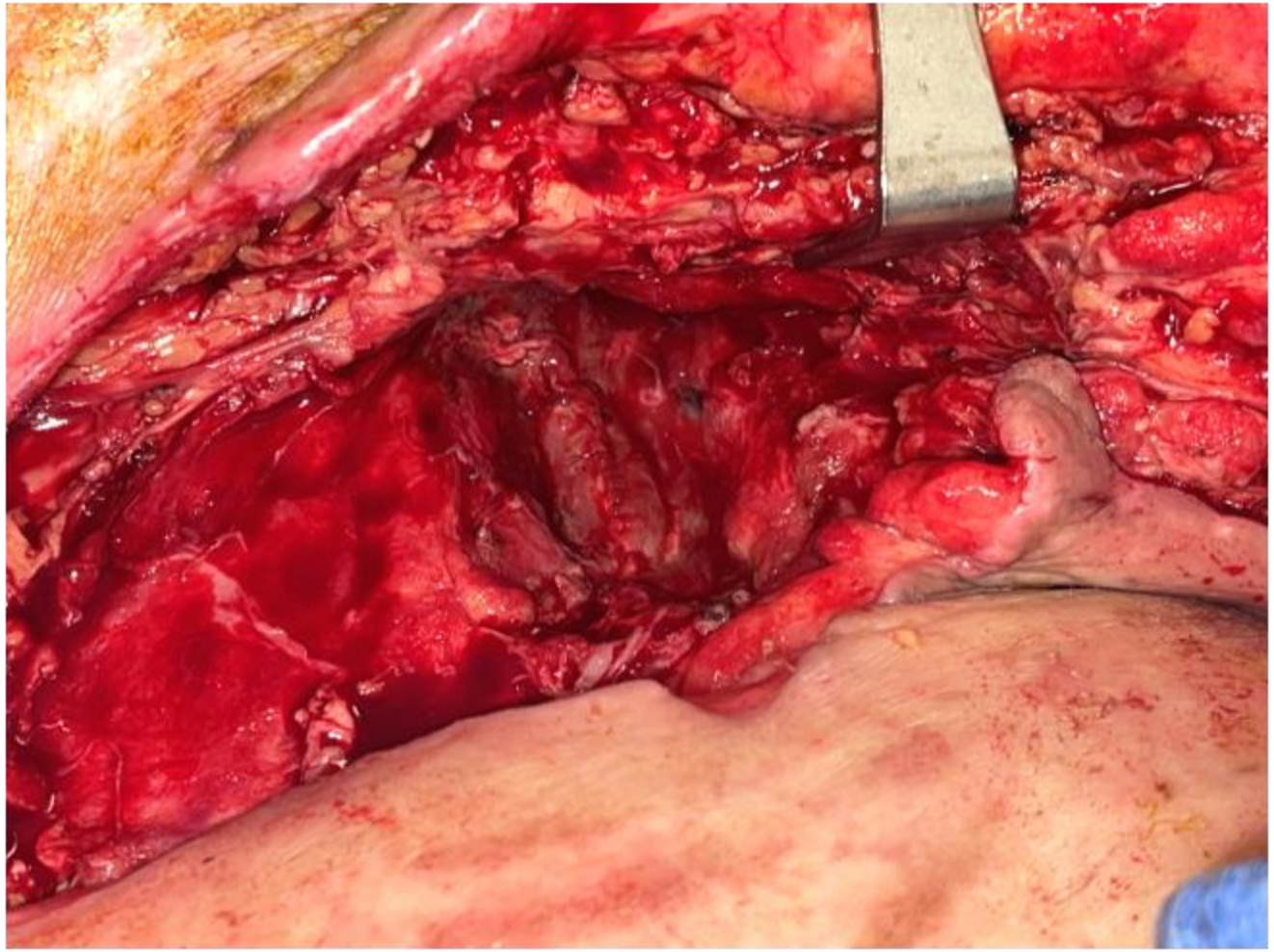
Full Thickness Necrosis Groin (Day 7)



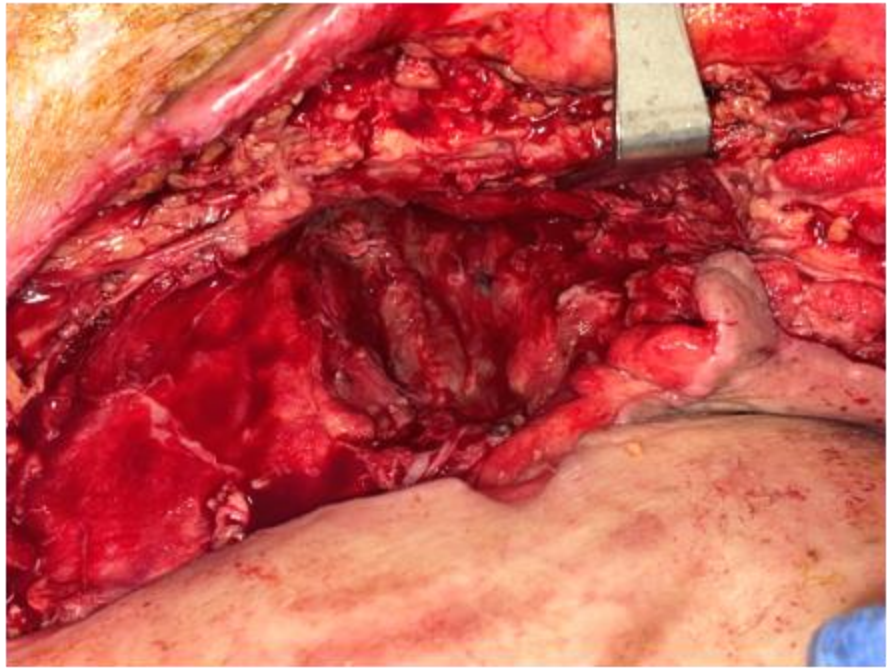


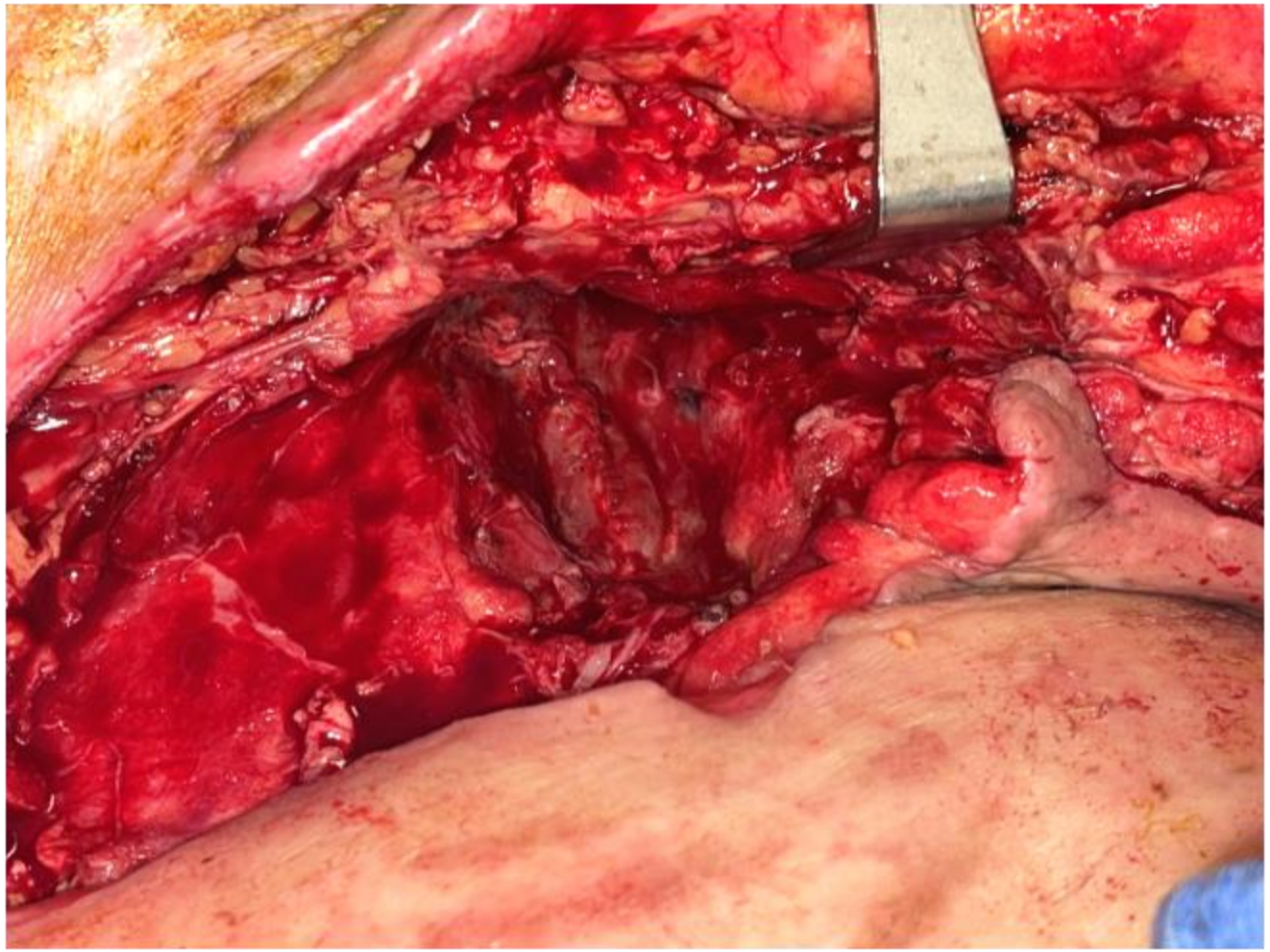
Full Thickness Necrosis Groin (Day 10)

Full Thickness Necrosis Groin (Day 10)

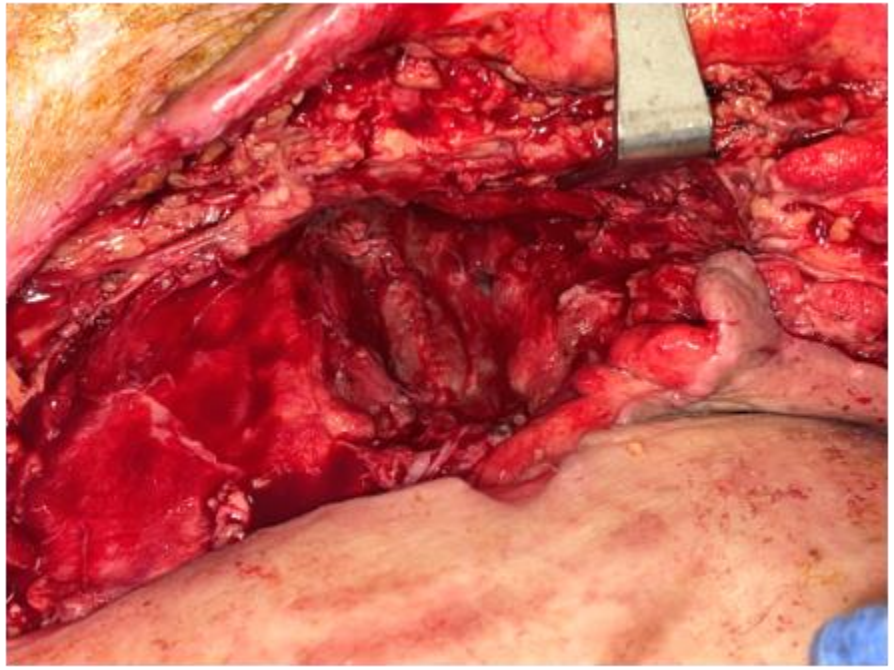


Full Thickness Necrosis Groin (Day 10)



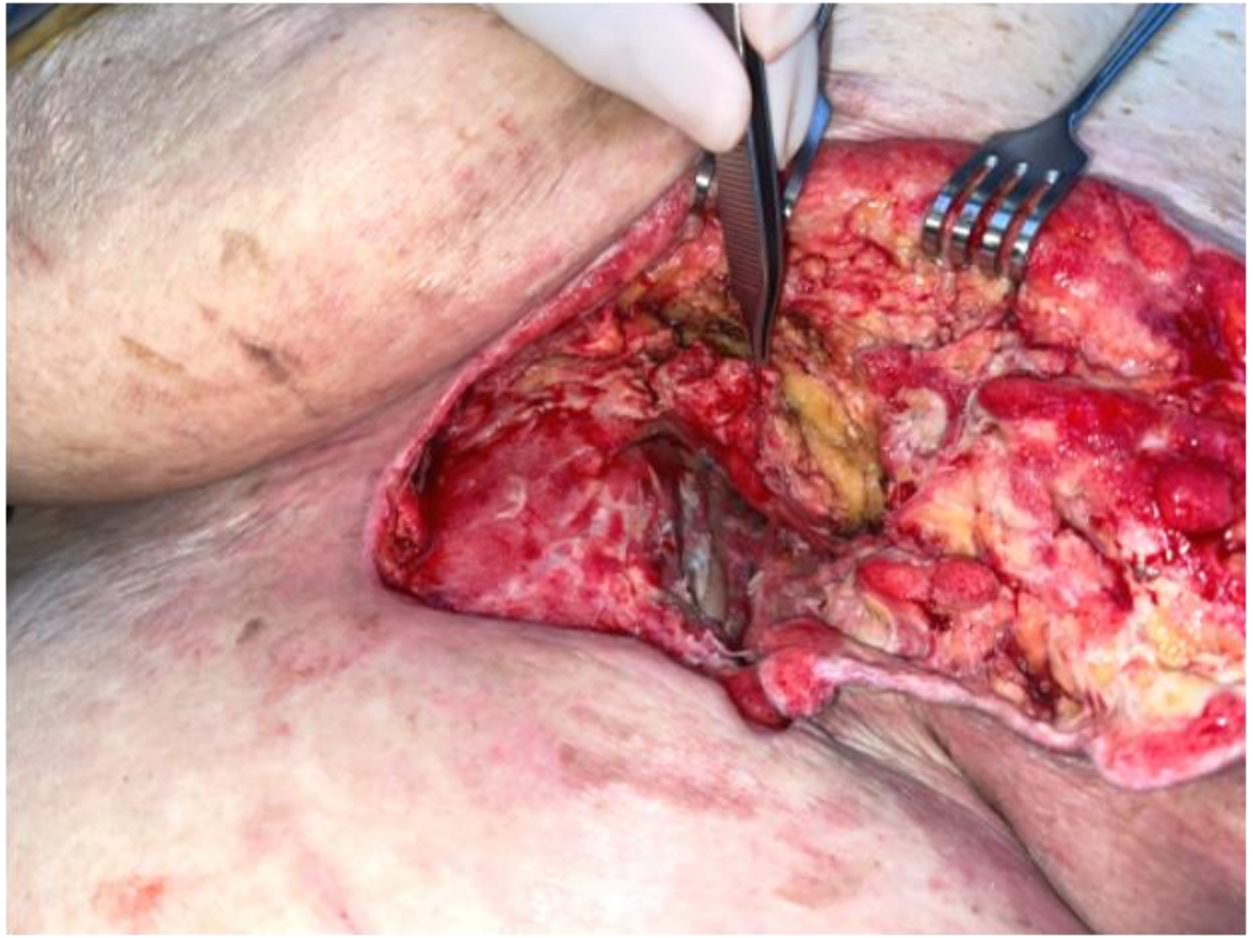


Full Thickness Necrosis Groin (Day 10)

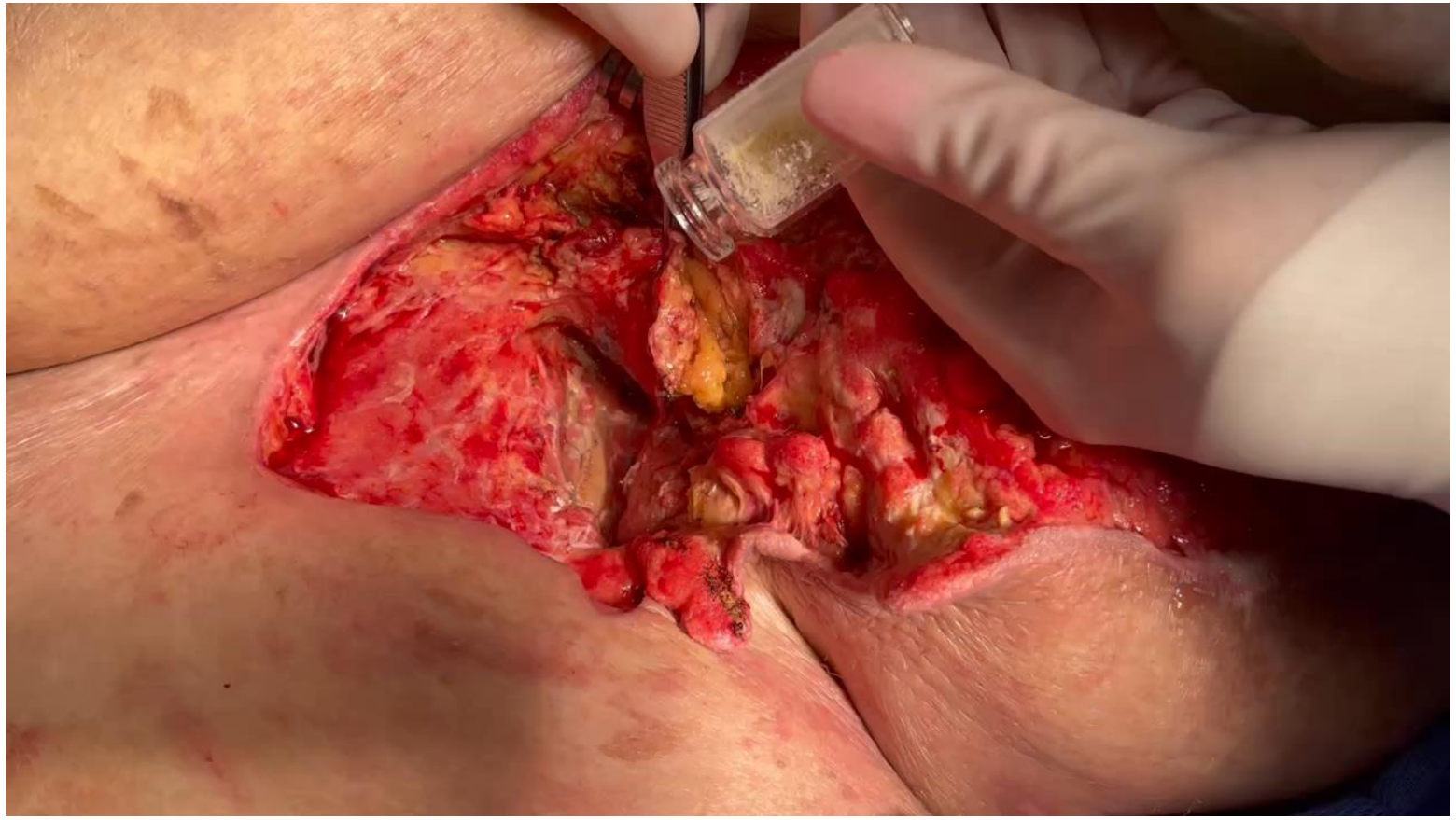


Full Thickness Necrosis Groin (Day 14)

Full Thickness Necrosis Groin (Day 14)



Full Thickness Necrosis Groin (Day 14)



Full Thickness Necrosis Groin (Day 14)

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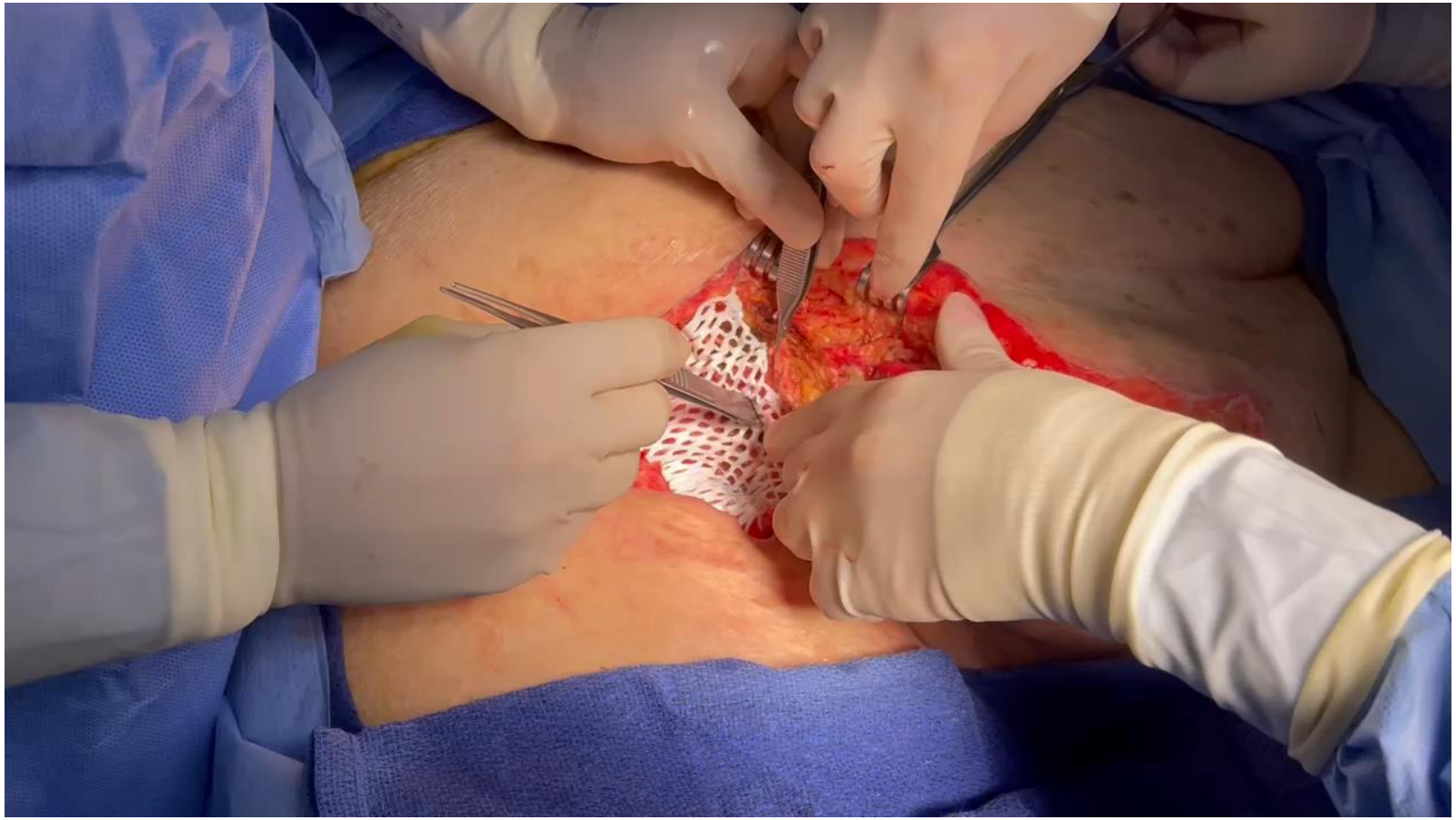
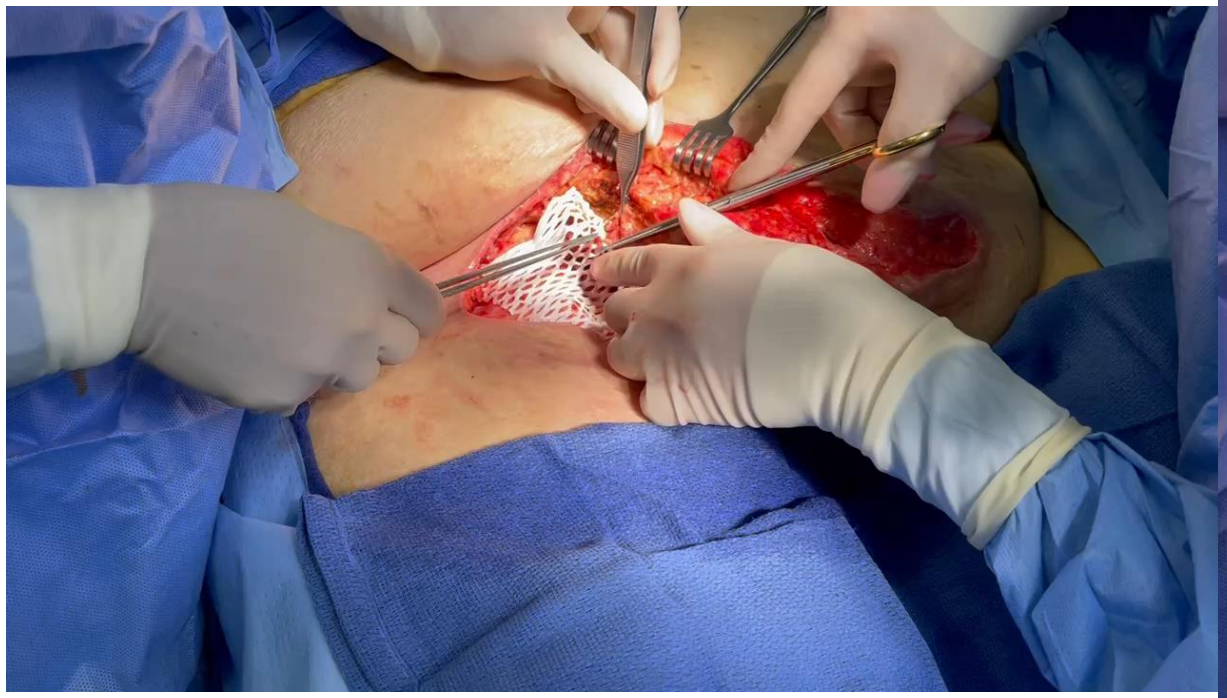
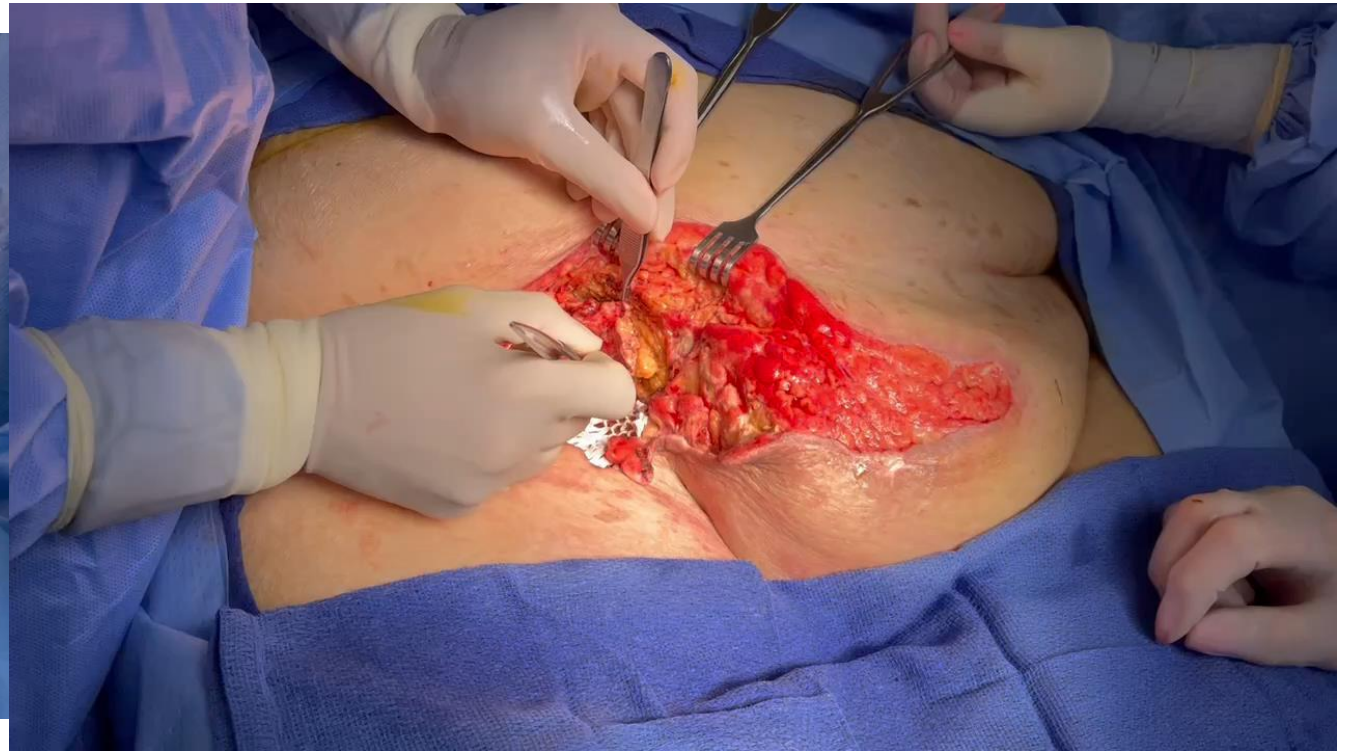
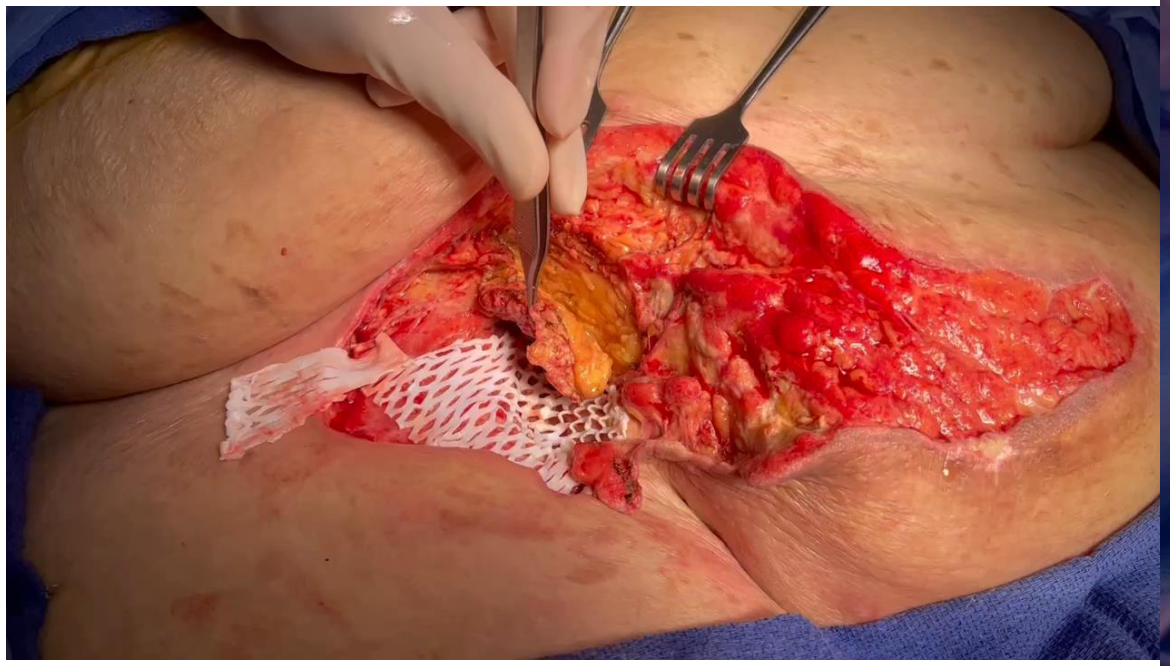


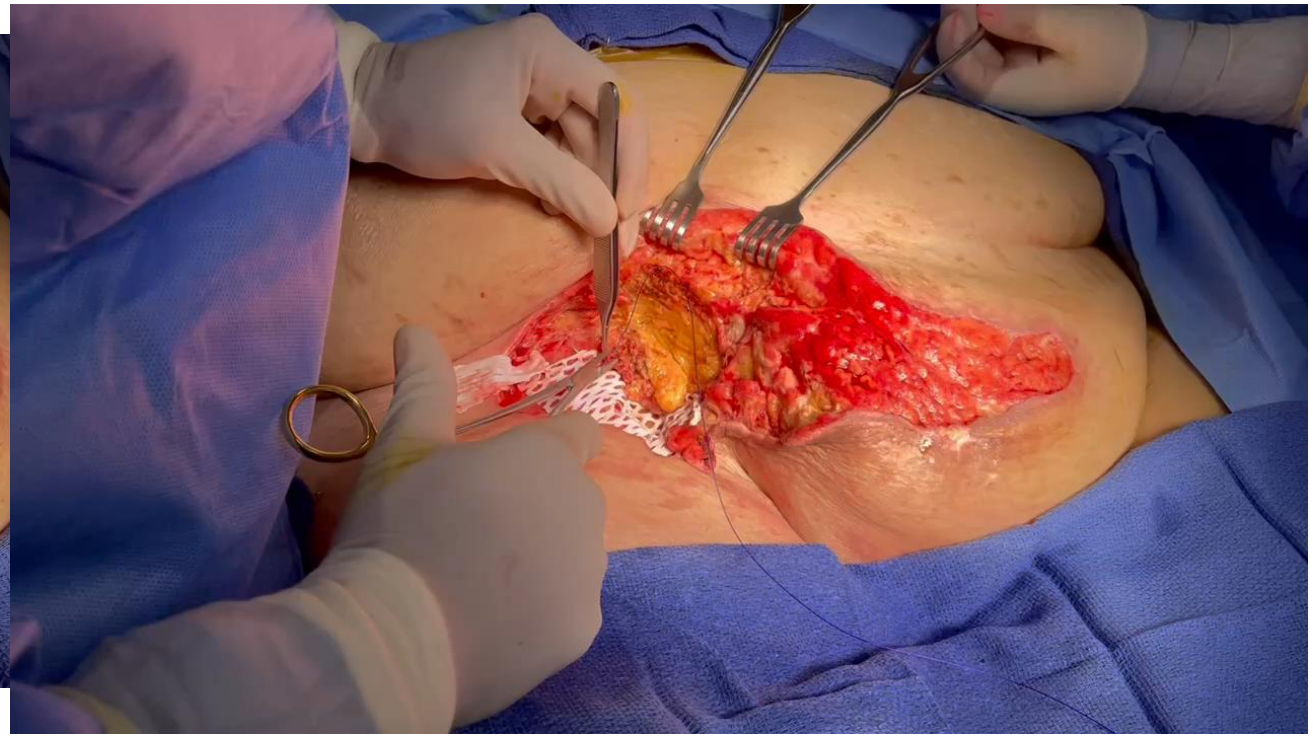
Full Thickness Necrosis Groin (Day 14)



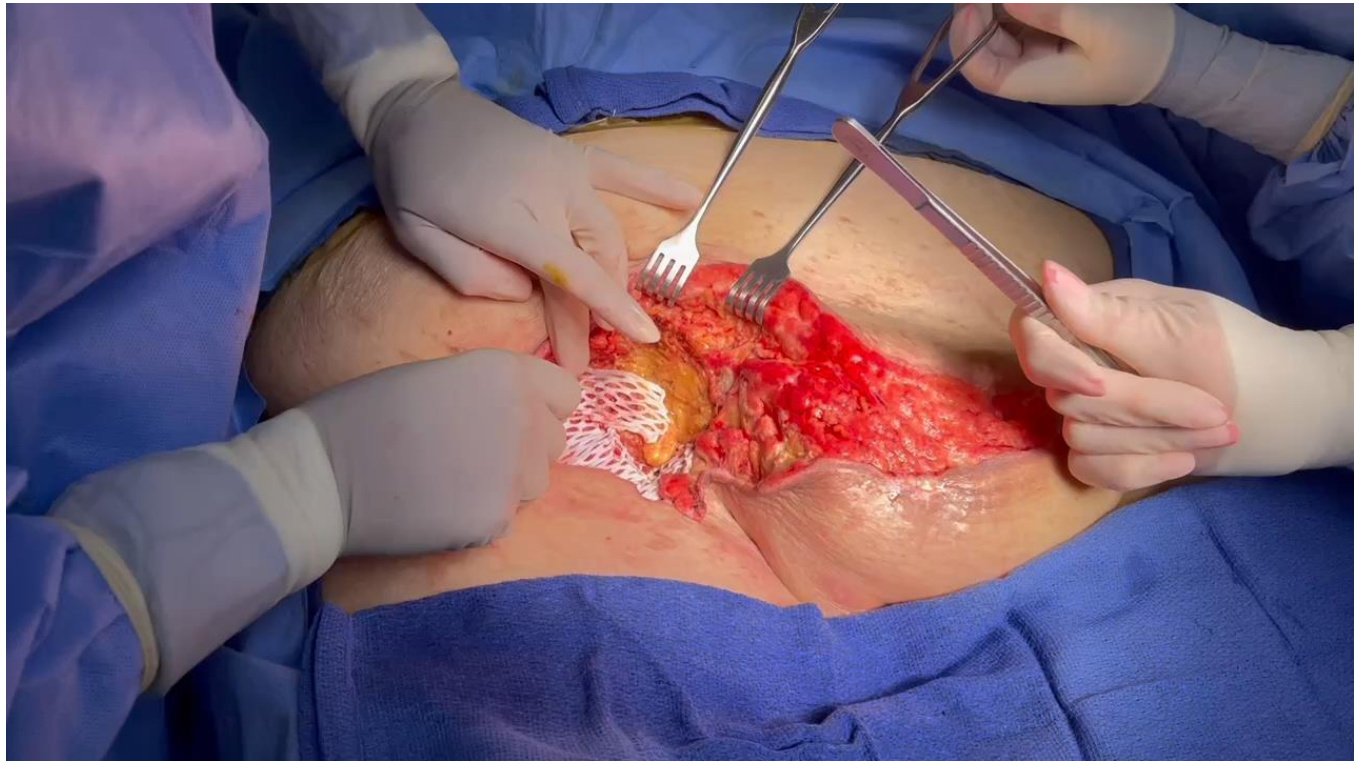


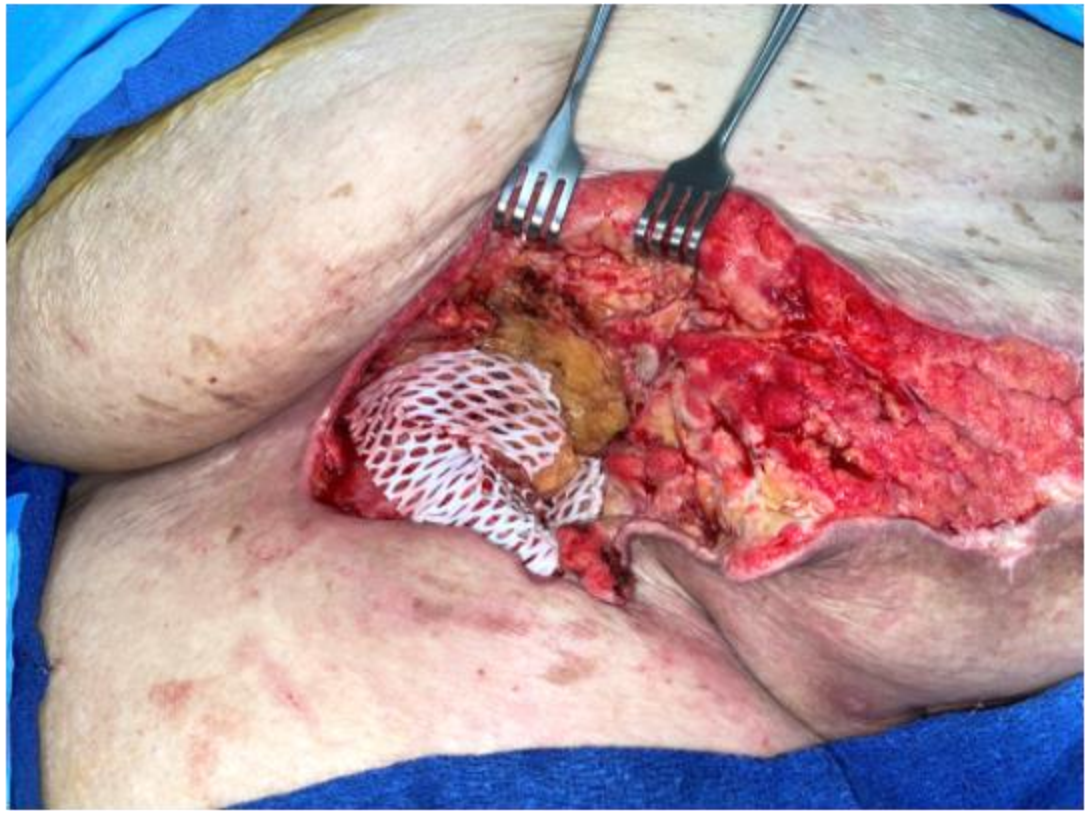
Full Thickness Necrosis Groin (Day 14)



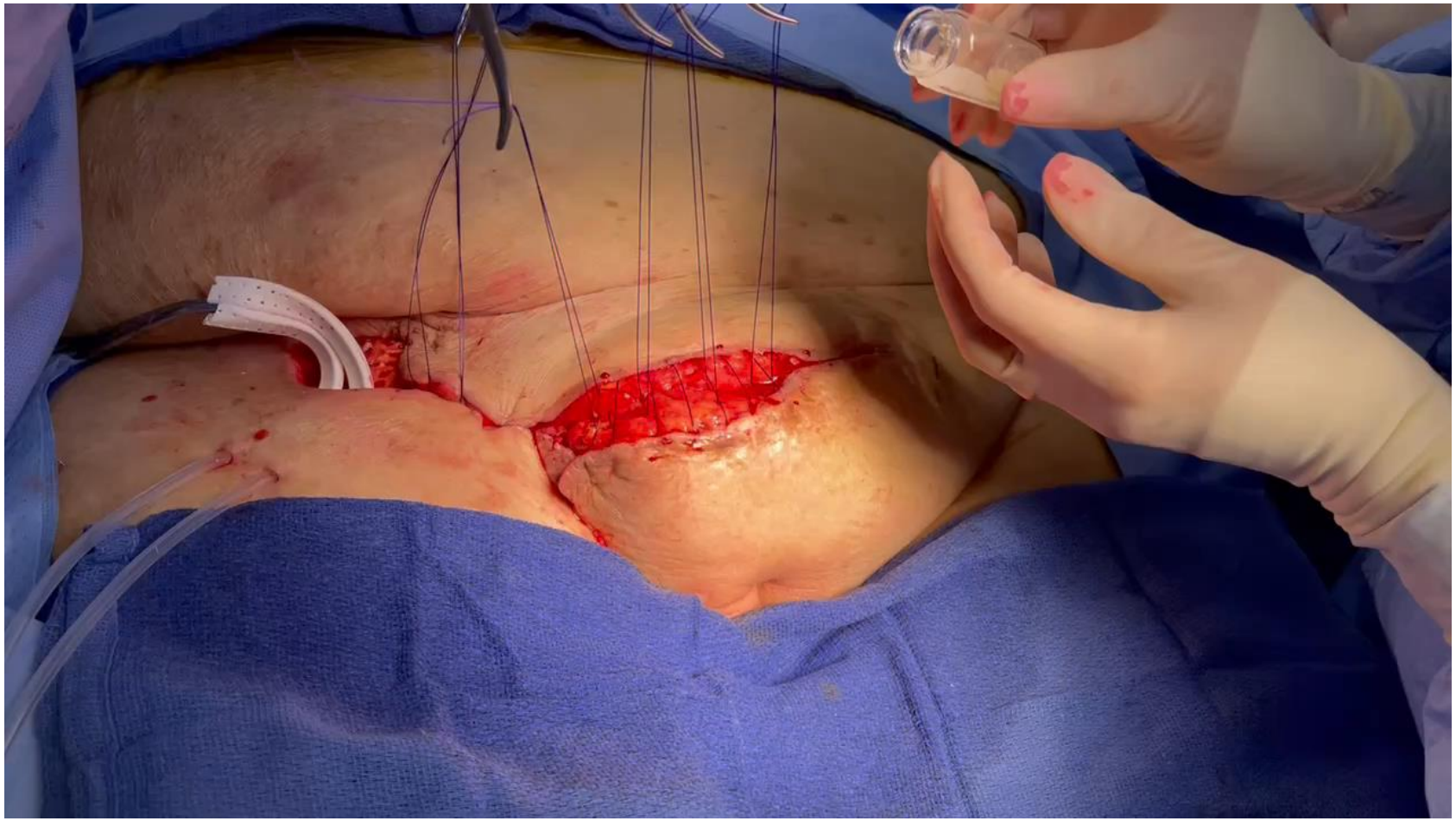


Full Thickness Necrosis Groin (Day 14)





Full Thickness Necrosis Groin (Day 14)



Full Thickness Necrosis Groin (Day 14)

Full Thickness Necrosis Groin (Day 14)

Full Thickness Necrosis Groin (Day 24)

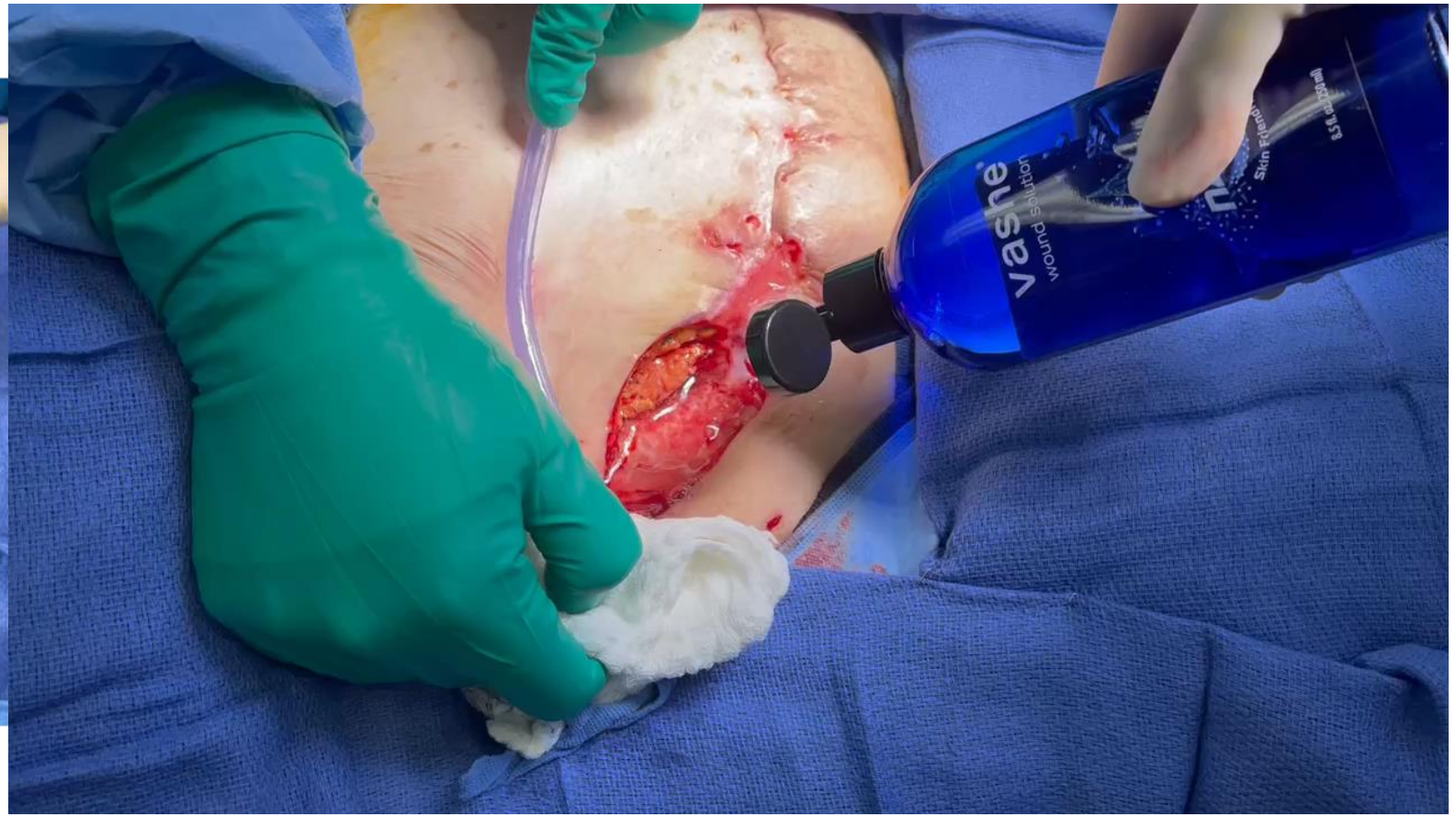
Full Thickness Necrosis Groin (Day 26)

Full Thickness Necrosis Groin (6 Wks)

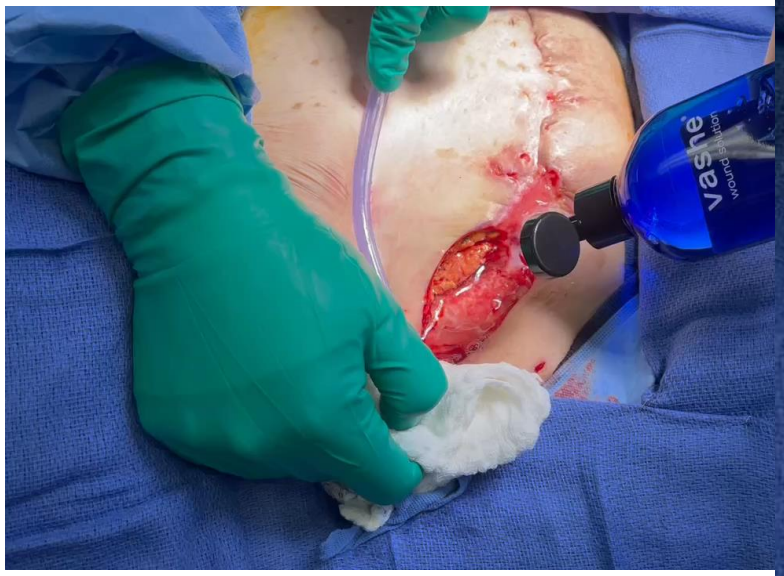
Full Thickness Necrosis Groin (6 Wks)

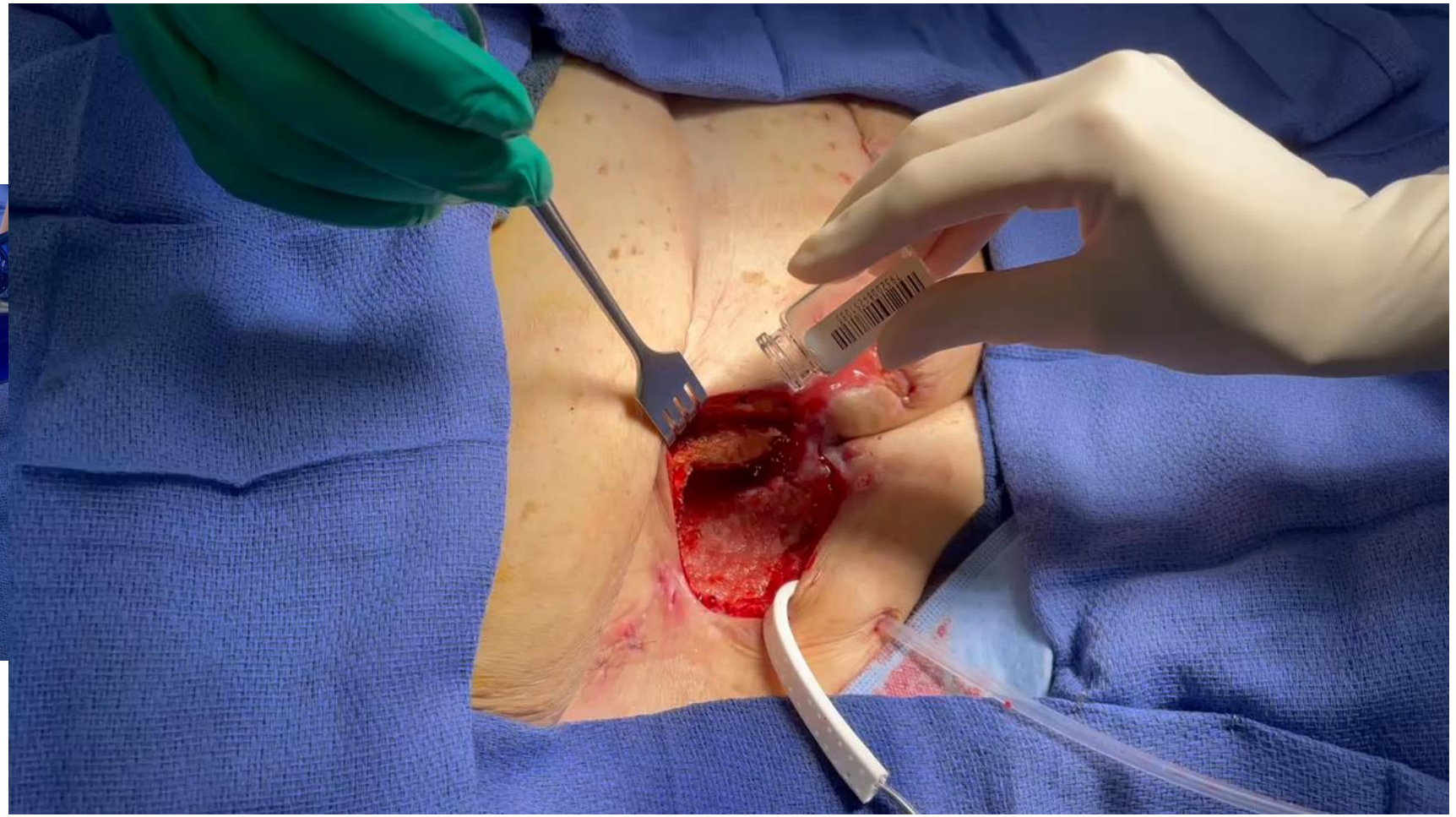
Full Thickness Necrosis Groin (8 Wks)

Full Thickness Necrosis Groin (8 Wks)



Full Thickness Necrosis Groin (8 Wks)





Full Thickness Necrosis Groin (8 Wks)

Full Thickness Necrosis Groin (3 Months)

Polling Question

Aseptic processing is beneficial over terminal sterilization because:

A. Terminal sterilization alters tissue properties of native tissue
B. Terminal sterilization results in denatured tissue structure and matrix proteins
C. Terminal sterilization causes compromised binding sites for cell attachment and cell signaling function
D. All of the above

Polling was pre-recorded

Summary

- Aseptically processed allografts, including placental and HR-ADM, have benefits over terminally sterilized tissue by maintaining the integrity of the matrix proteins and extracellular matrices
- Patients who are at high risk for surgical complications may benefit from the use of aseptically processed placental allograft to optimize healing
- Patients with soft tissue deficits requiring flap reconstruction may indeed benefit from meshed HR-ADM for additional support
- The use of HR-ADM in these patients may help create a scaffolding for tissue ingrowth to help support flap transfer
- Additionally, as a “BACKUP PLAN” if dehiscence occurs, the use of HR-ADM may allow for adequate soft tissue coverage for secondary healing and/or closure