

Peripheral Focused Ultrasound Therapy Enhances Wound Healing Without Increasing Infection Risk in Embedded Object Models

Novel Strategies for Atypical Burn Care

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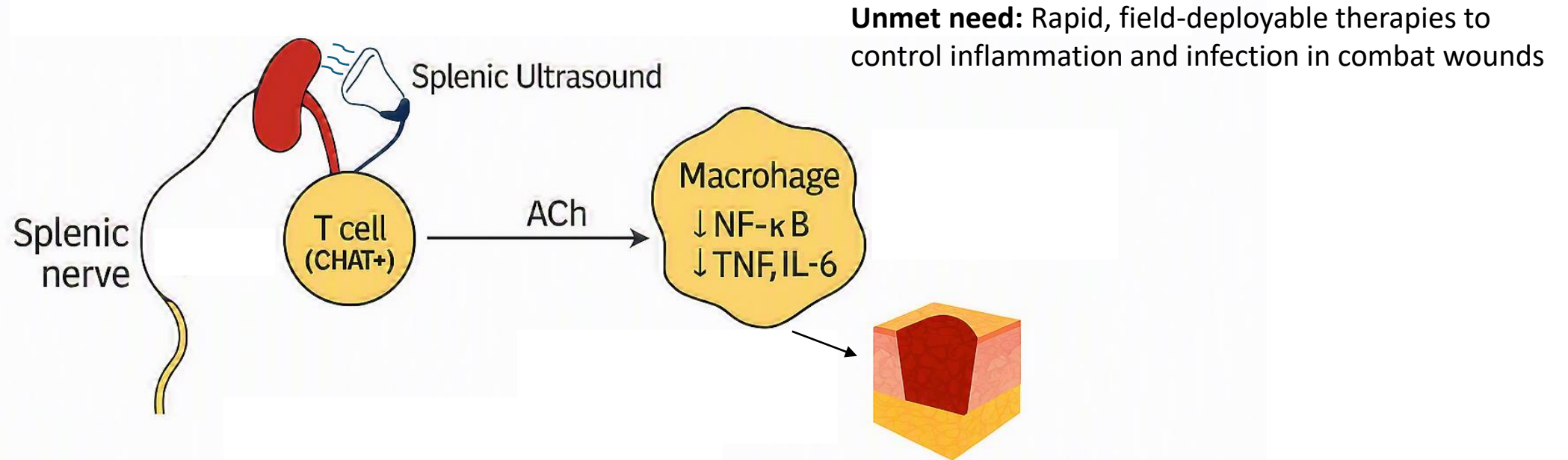
Disclosure

Christine Morton is an employee of GE HealthCare and GE HealthCare has filed US and international patent applications describing methods, devices, and systems for precision organ-based ultrasound neuromodulation.

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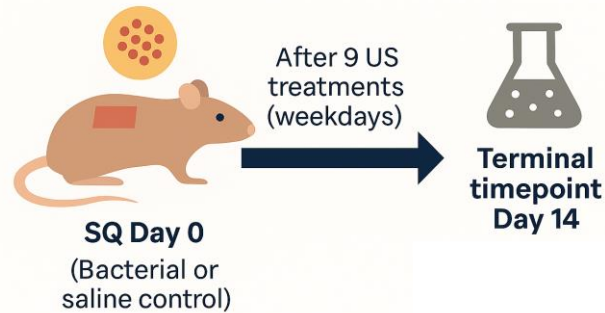
Splenic Ultrasound Accelerates Wound Healing via Neuroimmune Modulation

Targeting the cholinergic anti-inflammatory pathway to modulate early immune responses and influence wound healing outcomes

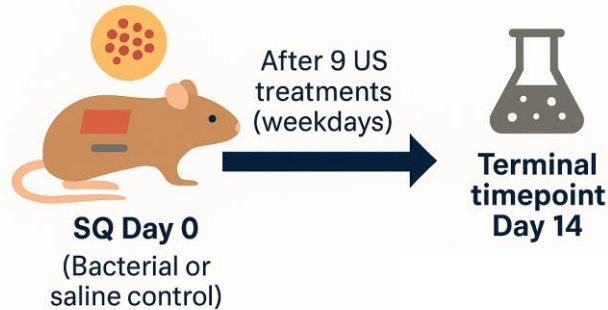


Ultrasound may result in productive inflammation and reduce bacterial burden to accelerate distal wound healing in a rodent burn and infection model

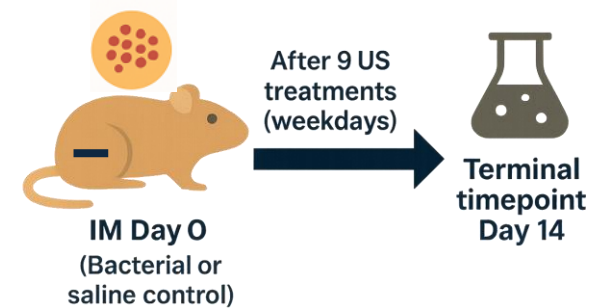
Experiment 1. Thermal Injury and *S. aureus* Inoculation in Rats



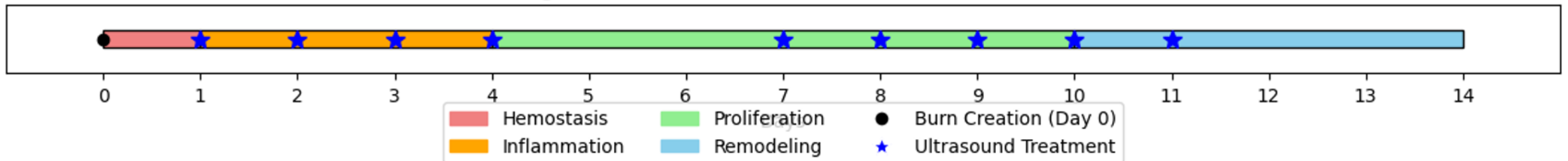
Experiment 2. Thermal Injury with SQ-Embedded Object



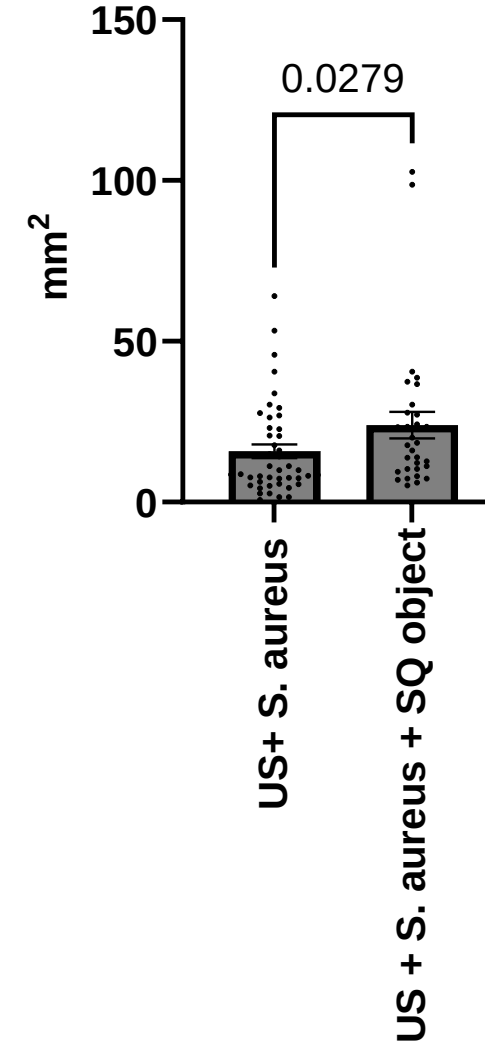
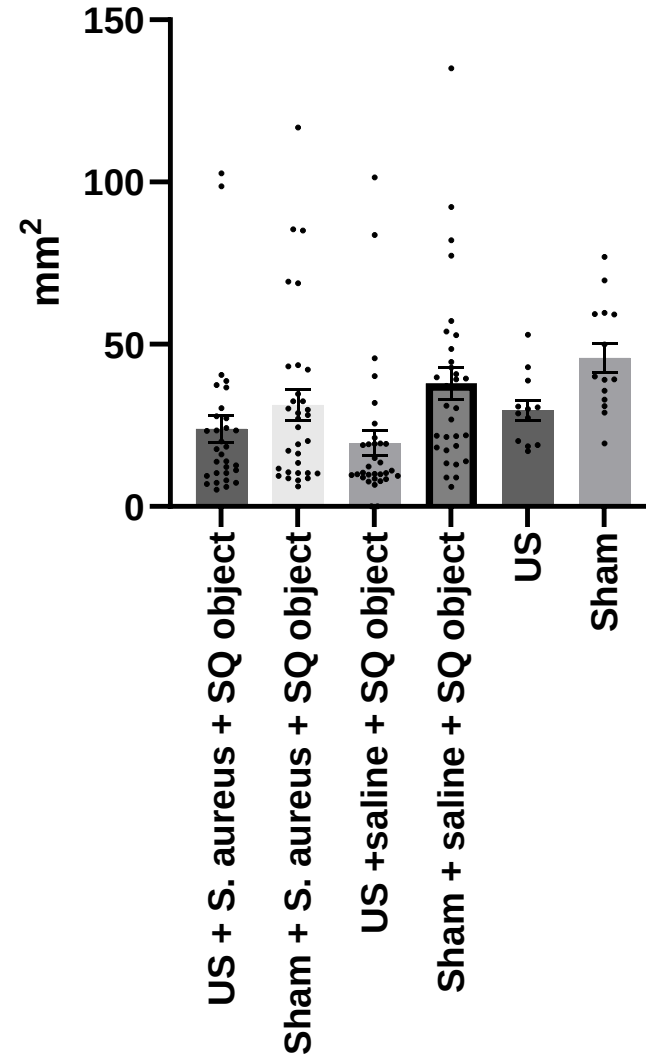
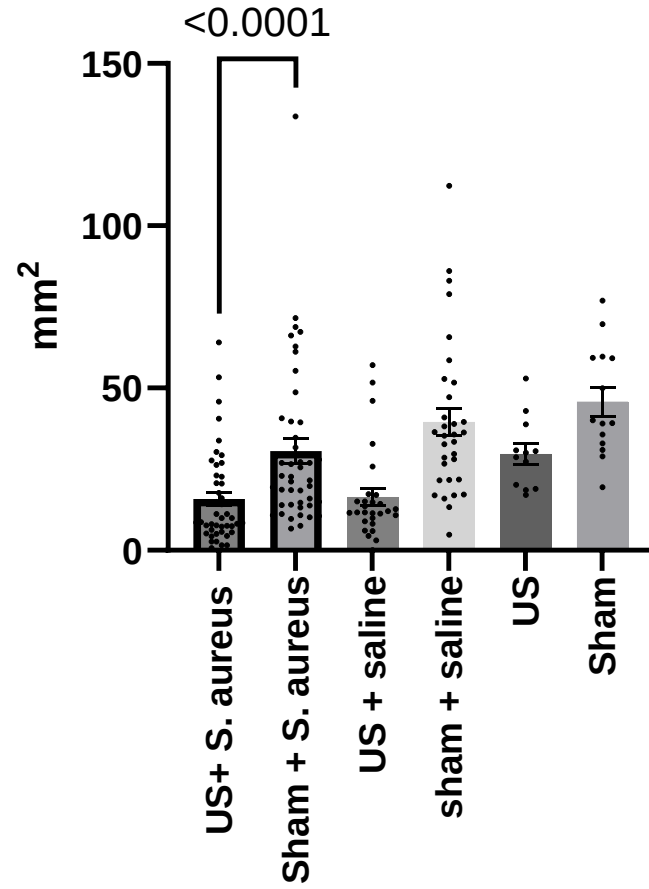
Experiment 3. IM-Embedded Object to the Gluteus Maximus



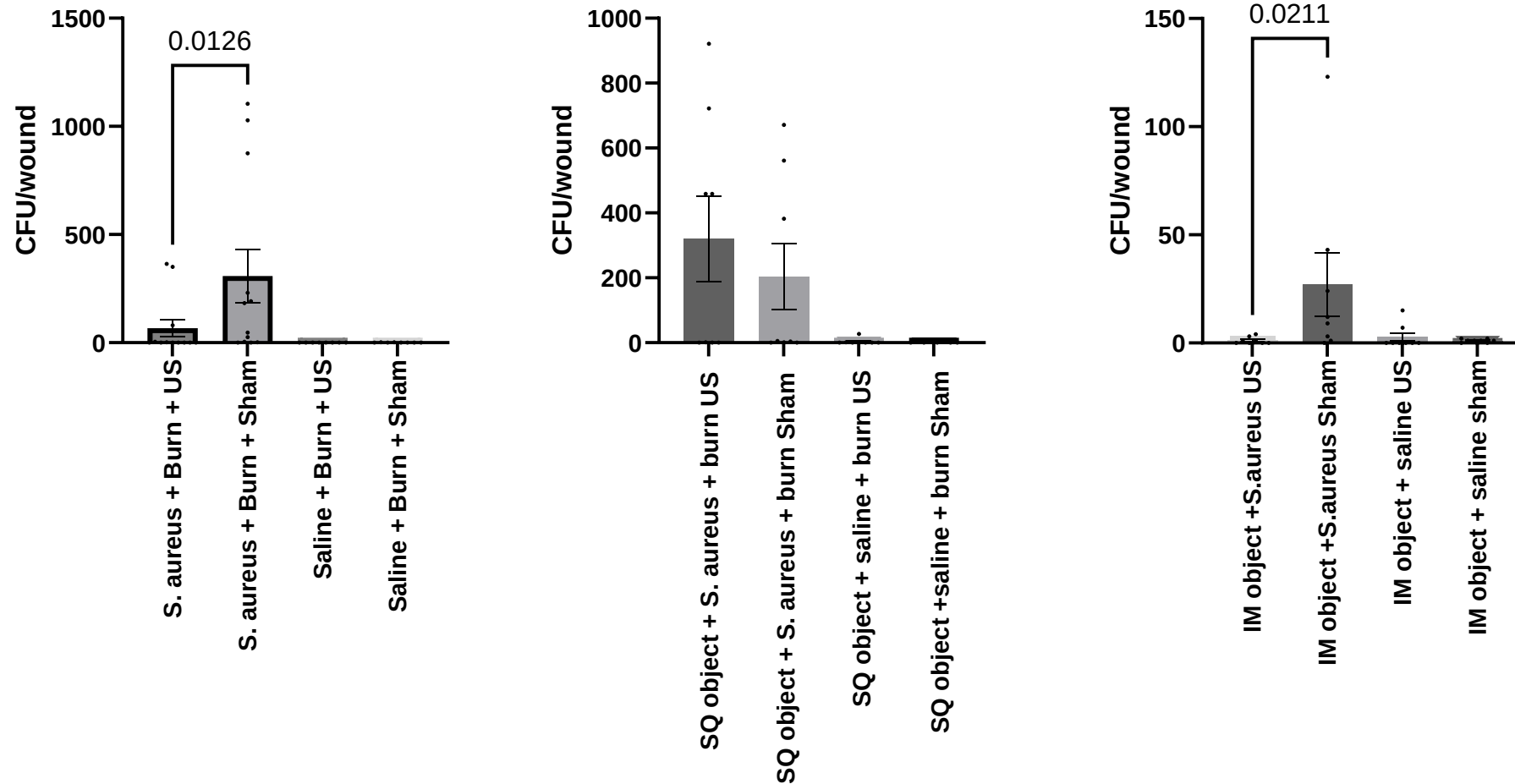
- Thermal injuries were created on the backs of Sprague Dawley rats using a heated brass rod (4 injuries; 20 second exposure) N=8
- 2×10^5 CFU *S. aureus* was inoculated with each wound.
- Bacteria (or saline) laden RFID chips (embedded object) were injected either subcutaneously or intramuscularly
- Focused ultrasound was directed to the spleen for 3 minutes daily on weekdays starting 24 hours after injury
- Tissue harvested for bacterial burden determination, flow cytometry and single cell transcriptomics



Ultrasound-treated animals showed reduced wound area at endpoint



Lower bacterial burden observed in ultrasound-treated wounds



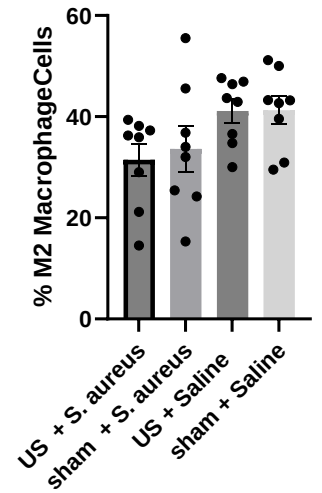
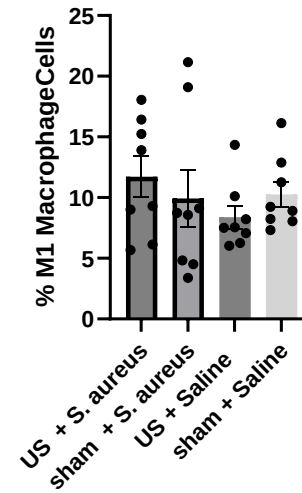
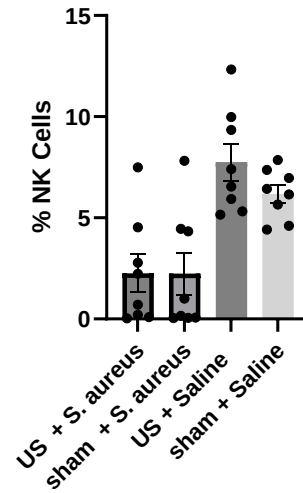
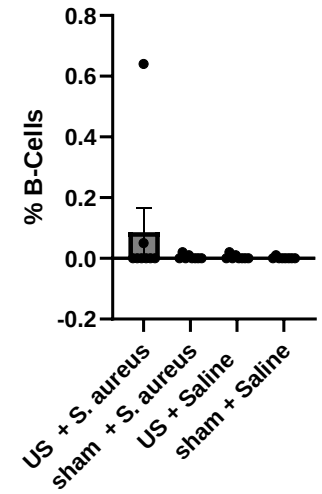
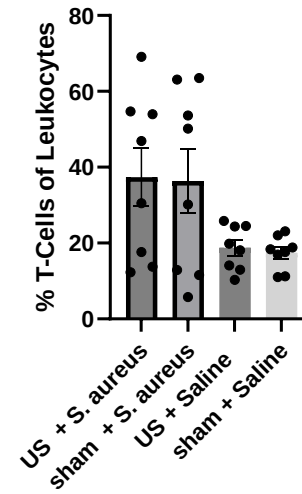
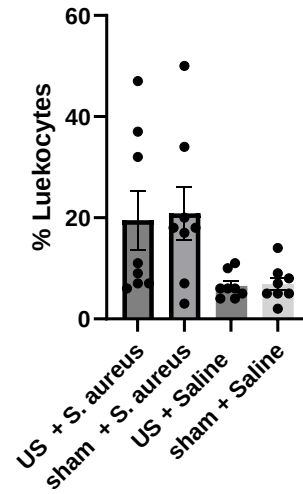
There was no detectable bacterial growth from blood cultures suggesting that sepsis was not present

Key Findings

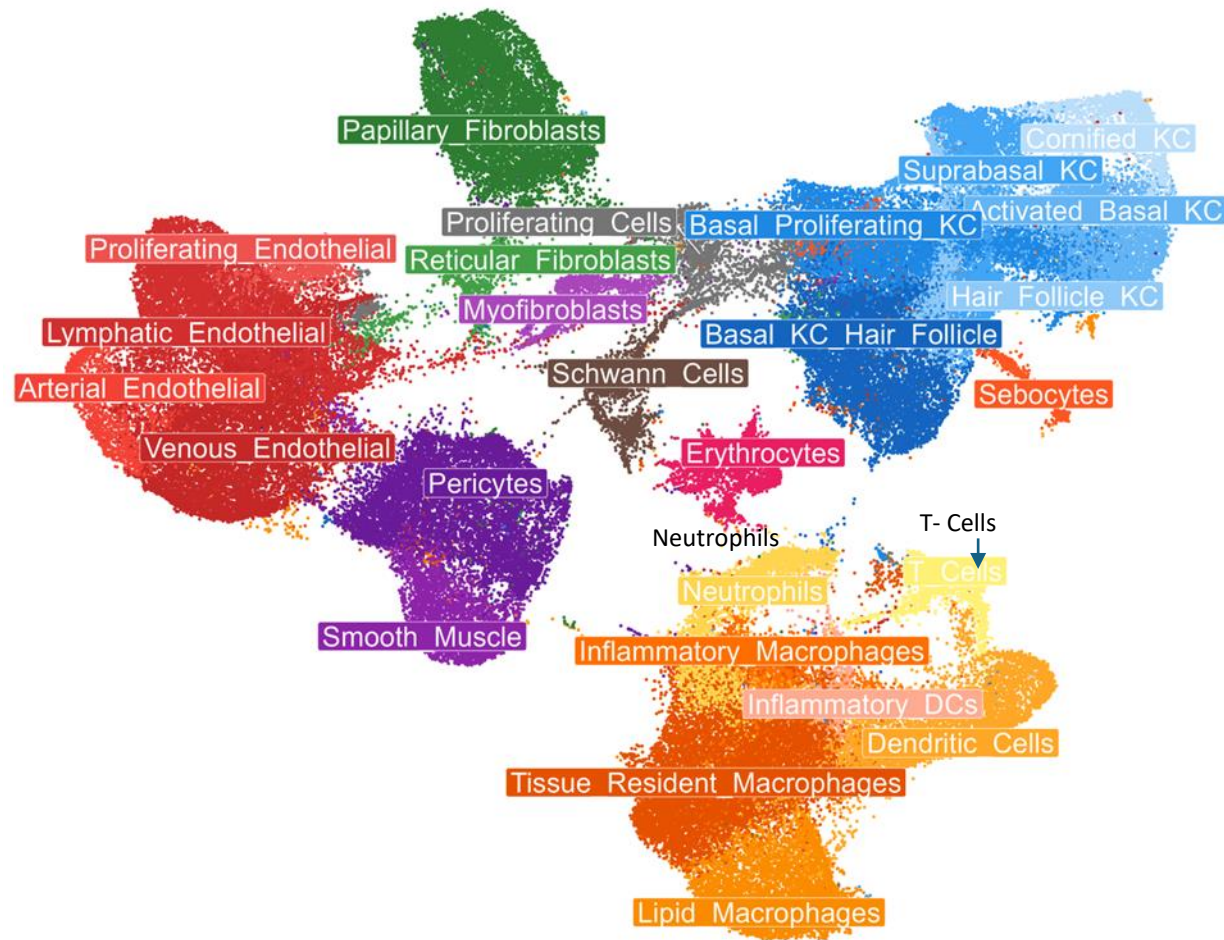
Ultrasound-treated animals exhibited reduced wound area and bacterial burden

No detectable bacteremia was observed in any group in this study

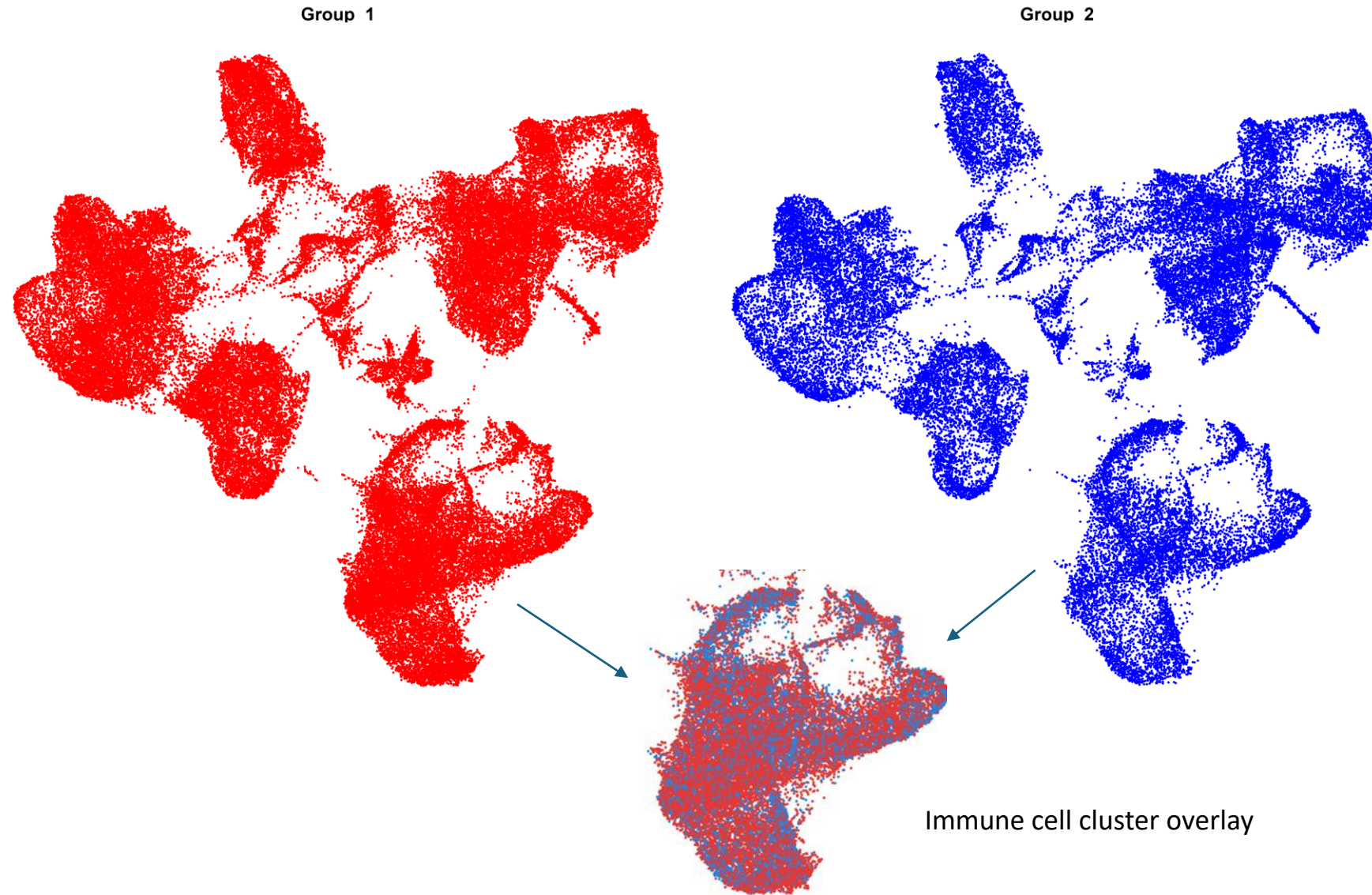
No major differences in immune cell composition were observed at Day 14



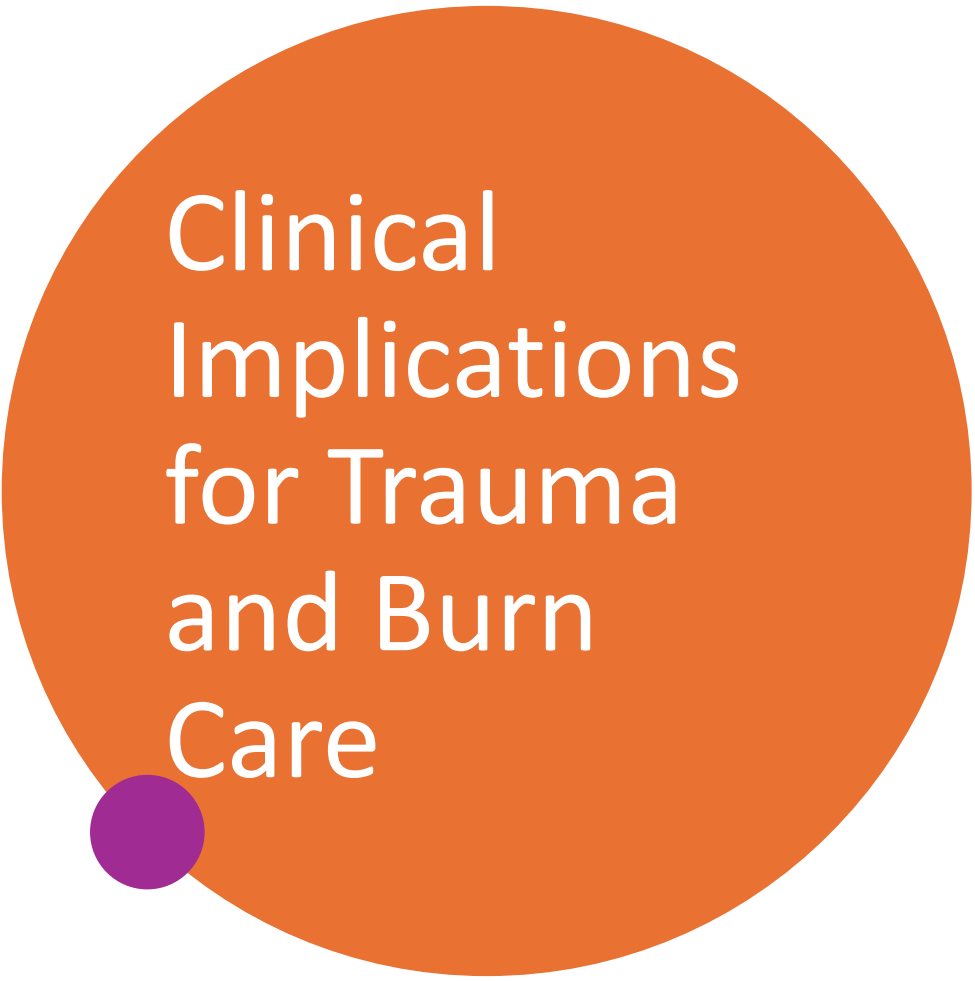
scRNAseq UMAP visualization of isolated cells from burn wounds 24 hours after first treatment



Separated by treatment



Ultrasound treatment was not associated with major changes in immune cell composition, but was associated with differences in transcriptional profiles



Clinical Implications for Trauma and Burn Care

1. May help address an unmet need
 - Severe burns and trauma → high infection risk + dysregulated inflammation
 - Limited tools to modulate immune response early
2. Advantages of ultrasound approach
 - Noninvasive (no surgery required)
 - Rapid, bedside deployable
 - Potentially compatible with unstable or polytrauma patients
 - Scalable in resource-limited / battlefield settings
3. Potential applications
 - Burn wound infection management
 - Combat casualty care
 - Acute trauma / ICU settings
 - Adjunct to antibiotics and standard wound care

Summary

Peripheral Focused ultrasound treatment is associated with:

- Associated with reduced wound size and lower bacterial burden in this model
- No detectable bacteremia observed
- No major changes in immune cell composition at Day 14
- Early transcriptomic data suggest modulation of inflammatory pathways

From a mechanistic perspective:

- We did not observe major differences in immune cell composition at later timepoints
- However, early transcriptomic data showed coordinated differences in gene expression across immune cell populations

These findings suggest that ultrasound may improve wound healing by enhancing early immune responses, rather than simply advancing the timing of repair pathways

Acknowledgments

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GE HealthCare study team

Feinstein Institute for Medical Research scRNAseq team