Necrotizing Fasciitis of the Lower Extremity: Risk Factors, Surgical Strategies and Adjunctive Treatments Associated with Improved Survival – A Case Series of 26 Consecutive Patients

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BACKGROUND

Necrotizing fasciitis (NF) is a life-threatening, rapidly progressive, bacterial infection that causes fascia, muscle, and subcutaneous tissue necrosis. The infection travels along avascular fascial planes and diagnosis is generally delayed due to delayed skin involvement. The current consensus (UpToDate and CDC, meta-analysis) for Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) ≥ 8 the in-hospital mortality is 20-35%.

METHODS

Serial surgical debridements were performed bi-weekly to excise non-viable tissue including all fascia, necrotic muscle, and skin. After each debridement the tissue defect was covered with Fish Skin Graft fragments1 (FSGf) to promote granulation coverage over the bone, tendons, vascular bundles, and muscle defects. The twice a week surgical cadence allowed time for the FSGf to promote new granulation tissue and optimized its hemostatic, anti-inflammatory and antibacterial properties. The FSGf was directly covered with a Negative Pressure Wound Therapy hydrophilic sponge (NPWT hydrophilic)2. No contact layer was placed between the sponge and FSGf. Care was taken to only cover the open wound with the NPWT hydrophilic sponge to avoid maceration of the intact skin. Retention sutures were placed in the wound margins to bring the skin over the NPWT hydrophilic sponge, to minimize retraction of the wound edges. The wound and surrounding skin was covered with a thin hydrophobic sponge with a silicone border (PandP) to provide a dual layer of negative pressure therapy. Debridements continued until there was a healthy granulating wound bed and all vital structures (bone, tendon, vascular bundles) were covered. A solid or fenestrated sheet of FSG was then applied to cover any residual tissue defect and PandP NPWT was utilized for one week without changing the dressing. If wound healing was delayed FSG was applied in the office. (Case series 1 and 2)

RISK STRATIFICATION

LRINEC:

Among 26 patients with necrotizing infections and documented LRINEC scores, major amputation occurred in 14 patients (54%). When stratified by LRINEC score, patients with scores 5–7 had a major amputation rate of 29% (2/7), whereas those with scores ≥8 had a major amputation rate of 63% (12/19), corresponding to a 2.2-fold increased risk (Fisher's exact p ≈ 0.046). Further stratification demonstrated a stepwise relationship: patients with scores 8–10 experienced major amputation in 54% (7/13), and those with scores ≥11 a major amputation rate of 83% (5/6). Study data indicates a clear inflammatory response between LRINEC score and risk of major limb loss. Correspondingly, limb salvage decreased from 71% in the LRINEC score 5–7 group to 37% in theLRINEC score≥8 group (Figure 1).

Absolute Neutrophil-to-Lymphocyte Ratio:

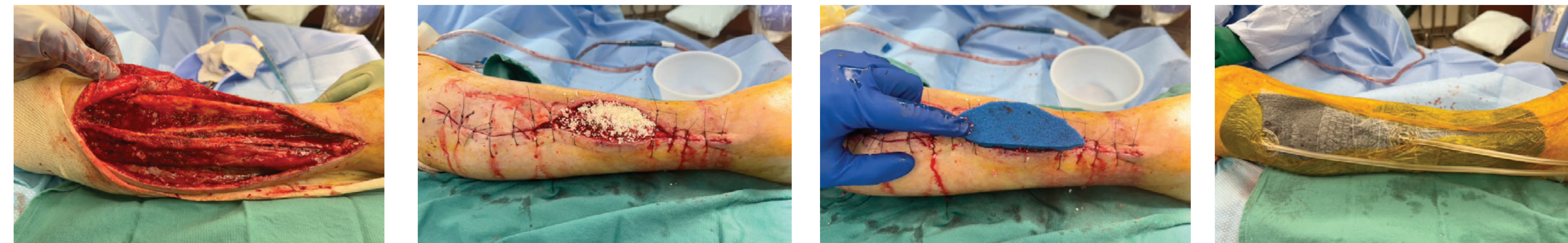
The neutrophil-to-lymphocyte ratio (NLR) at admission was significantly higher in patients who underwent amputation compared to those who achieved limb salvage. The median NLR in the salvage group was 14.8 (6.5–18.8), whereas the median NLR in the amputation group was 22.5 (15.4–40.9). Using the Mann–Whitney U test, the difference was statistically significant (U = 25, Z = – 3.04, p ≈ 0.0024).

CCI:

Similarly, Charlson Comorbidity Index (CCI) scores were higher in the amputation group, median 4 (1–8) compared with the salvage group, median 2 (0–4). These results indicate that both systemic inflammation (LRINEC, NLR) and baseline comorbidities (CCI) contribute to the mortality and risk of limb loss in necrotizing soft tissue infections.

CASE 1:

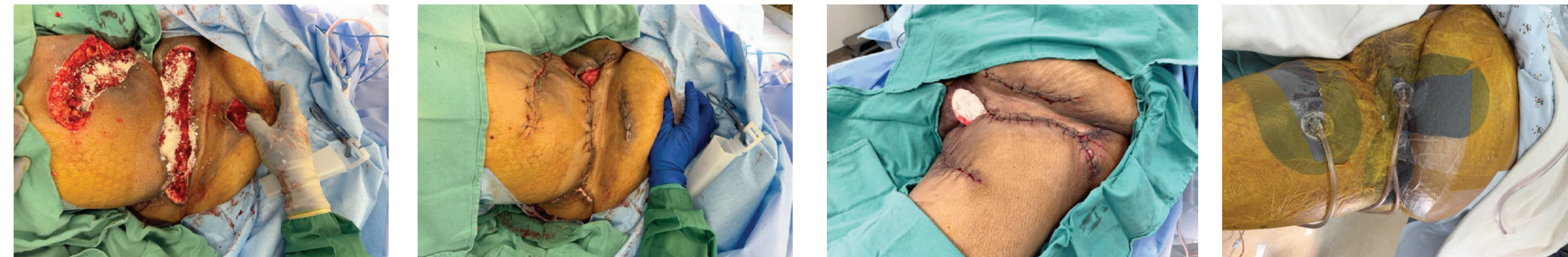
Patient History: 58 yo who developed a poly-microbial necrotizing fasciitis secondary to blunt trauma and compartment syndrome.
Wound History: Status post 4 debridements with serial applications of FSGf and NPWT. FSG was used to cover exposed bone, anterior tibial vessels and fill in the muscle defect.



Exposed tibia, fibula, and vascular bundle | Wound bed with granulation tissue with FSG | NPWT hydrophilic sponge | PandP sponge covering NPWT hydrophilic

CASE 2:

Patient History: 49 yo with necrotizing fasciitis of the abdominal, pelvis and thigh secondary to opportunistic gut bacteria.
Wound History: Status post 6 debridements with serial applications of FSGf and NPWT. FSG was used to develop granulation tissue in deep adipose tissue wound bed.



Abdomen, pelvis and thigh wound with tissue reinforcement with FSG | Wounds healing with residual area of granulation tissue | FSG sheet covering the residual wound | PandP NPWT over FSG

FIGURE 1:

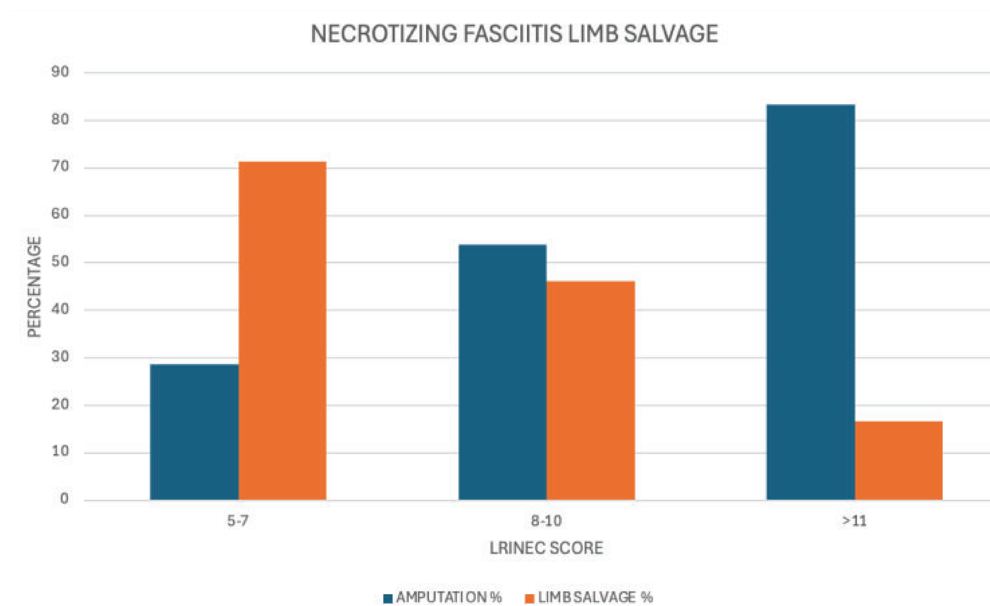
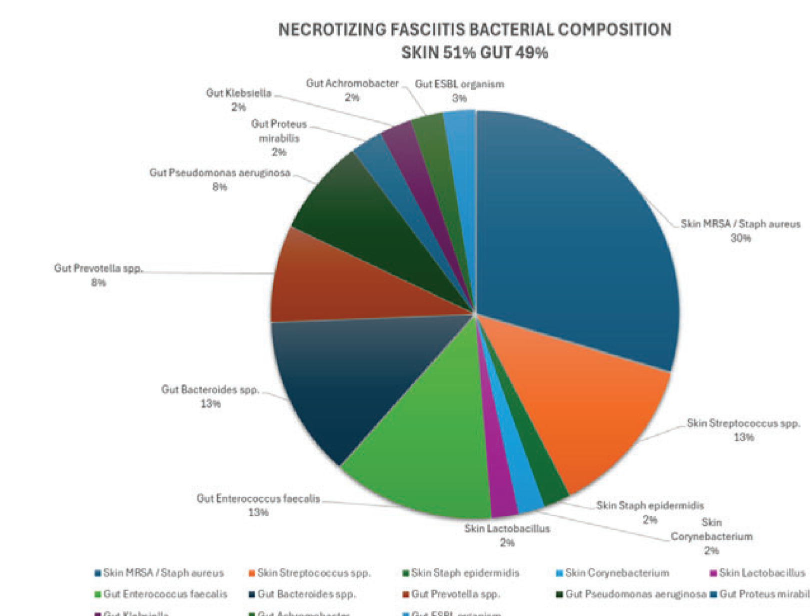


FIGURE 2:



RESULTS

The surgical technique utilizing FSG and dual layer NPWT resulted in a limb salvage rate of 59%, major amputation rate of 31% and a mortality of 1%. This compares favorably to a meta-analysis mortality rate of 20-35%. There were an average of four surgeries for the limb salvage patients. Surgical delay demonstrated rapid biochemical deterioration with average LRINEC increase of 8 points with 7 day delay. Initial LRINEC score > 8 had 50% incidence of major amputation and initial LRINEC score >11 had a 30% mortality. Infections were equally divided between poly-microbial and mono-microbial. True "classic" Group A Strep infections were rare, with only 2 cases. The polymicrobial infections included opportunistic gut bacteria including anaerobes. Resistant organisms (MRSA, ESBL) were present in 23% of the cases (Figure 2).

CONCLUSION

This case series illustrates promising outcomes with a protocol emphasizing early and aggressive serial surgical debridements, supplemented by adjuvant Fish Skin Graft (FSG) and dual-layer negative pressure wound therapy (NPWT). The observed in-hospital mortality of 1% and major amputation rate of 31% represent substantial improvements relative to historical and national averages (typically 20–35% mortality and 20–50% major amputation in lower-extremity NF). Risk stratification using the LRINEC score revealed a clear correlation with adverse outcomes. Higher initial scores >8 for amputation risk and >11 for mortality highlight its utility as a prognostic tool to guide urgency of intervention. These findings suggest that broad spectrum antibiotics combined with timely source control and innovative wound management adjuncts (FSG and duallayer NPWT) may enhance limb salvage and survival in lower-extremity NF.

REFERENCES

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2 Solventum, Veraflow Cleanse Choice Complete Dressing, Peel and Place Dressing Kit, St. Paul, MN