Necrotizing Soft-Tissue Infection

The surgical emergency · cut, do not wait · imaging must never delay the operating room

To the OR *now*

SURGERY IS BOTH THE DIAGNOSIS AND THE TREATMENT

Urgent exploration and debridement, and do not delay it for imaging. CT may show fascial gas or fluid tracking, but **a normal CT does not exclude the diagnosis** and the time spent obtaining it is time the infection spends advancing along fascial planes, which it does far faster than it changes the skin above. **Antibiotics and resuscitation are adjuncts to the knife, not alternatives to it. Mortality is driven almost entirely by time to first debridement.**

RED FLAGS *the skin looks better than the patient, which is the point*

THE EARLY, SUBTLE SIGNS

Pain out of proportion to the visible findings is the classic and earliest clue, followed by **rapid spread over hours** that you can mark and watch, **systemic toxicity or shock**, and **firm, woody induration extending beyond the erythema**. **Early skin changes are unimpressive** because the necrosis is in the fascia, not the dermis.

THE LATE, OBVIOUS SIGNS

Hemorrhagic bullae, dusky or frankly necrotic skin, crepitus from gas-forming organisms, "dishwater" gray fluid at exploration, and **skin that has become numb** from destruction of cutaneous nerves. **By the time these appear the diagnosis is late**, and the patient should already be in the operating room.

LRINEC SUPPORTS, IT DOES NOT EXCLUDE

A low LRINEC score does not rule out necrotizing infection, and a meaningful proportion of confirmed cases score low. Use it to raise suspicion, **never to stand down**. **If you are thinking about the diagnosis, call surgery.** That instinct is the test with the best performance here.

THE THREE TYPES *they differ in host, organism and tempo, and type 2 catches out the healthy*

Type	Who, and where	Organisms and features
Type 1 *polymicrobial, commonest*	**Diabetes, obesity, peripheral vascular disease, immunosuppression.** Perineum (**Fournier gangrene**), abdominal wall, post-surgical wounds	**Mixed aerobes and anaerobes**, including Enterobacterales, streptococci, Bacteroides and Peptostreptococcus. **Gas is common**, from anaerobic fermentation.
Type 2 *monomicrobial*	**Young and previously healthy patients**, often with trivial or no visible trauma. Limbs	**Group A Streptococcus**, sometimes with S. aureus. **May present with streptococcal toxic shock syndrome**, and it advances extremely fast. **The absence of comorbidity is not reassuring here.**
Type 3 *clostridial*	**Penetrating trauma, injection drug use, bowel surgery**	**Clostridium perfringens and septicum. Gas gangrene with crepitus and rapid myonecrosis**; **C. septicum should prompt a search for occult colorectal malignancy.**

EMPIRIC ANTIBIOTICS *broad cover plus clindamycin, and the clindamycin is not there for its spectrum*

Agent	Role
Piperacillin-tazobactam 4.5 g q6h or **meropenem 1 g q8h**	Broad Gram-negative and anaerobic cover for the polymicrobial type 1 infection you cannot yet exclude.
Vancomycin, 25 to 30 mg/kg load	MRSA cover until cultures return. Substitute **linezolid** where toxin suppression is also desired.
Clindamycin 900 mg q8h *the key addition*	**Added for toxin suppression, not for its antibacterial spectrum.** It inhibits bacterial protein synthesis and therefore **shuts off exotoxin and M-protein production**, which drive the shock in streptococcal disease. It also **works in high inoculum where penicillin fails**, because penicillin needs actively dividing organisms and stationary-phase bacteria downregulate their penicillin-binding proteins, the **Eagle effect**. **Continue it until the patient is stable and the source is controlled.**
Targeted therapy	**Group A Streptococcus or Clostridium: penicillin plus clindamycin.** De-escalate the rest on operative cultures once the source is controlled.

AFTER THE FIRST OPERATION *one debridement is almost never enough*

PLANNED RE-EXPLORATION

Return at 24 h, and again until there is no further necrosis. The first operation cannot define the final margin, because the infection continues to declare itself along the fascia. **Most patients need two or more debridements**, and failing to plan the second is how the infection outruns the surgery.

SUPPORT THE PHYSIOLOGY

Aggressive resuscitation for massive fluid and protein losses through the open wound, comparable to a burn. Track **lactate, CK, renal function**, and provide ICU organ support and early nutrition. Plan reconstruction and rehabilitation once the wound is clean.

ADJUNCTS: LOW PRIORITY

IVIG is sometimes used in streptococcal toxic shock to neutralize superantigen, but the evidence is weak. **Hyperbaric oxygen is unproven and must never delay or replace debridement.** Neither is a reason to postpone an operation.

TELLING IT FROM CELLULITIS *the distinction that decides whether this patient goes to a ward or an operating room*

Feature	Necrotizing infection	Cellulitis
Pain	**Out of proportion, then anesthetic skin** as nerves are destroyed	Proportionate to the visible inflammation, and sensation stays intact
Border and depth	**Poorly defined, woody induration extending well beyond the erythema**	Erythema and induration broadly coincide, with a definable edge
Tempo	**Advances over hours**; mark the edge and it visibly moves	Advances over days, and stabilizes on appropriate antibiotics
Systemic state	**Toxic, shocked, confused, disproportionate to the skin findings**	Usually well, or febrile without hemodynamic compromise
Response to antibiotics	**None.** Failure to improve in 24 to 48 h should trigger surgical exploration	Improves within 24 to 48 h
The safe error	**Exploring a cellulitis costs an incision; observing a necrotizing infection costs the limb or the patient.** When the two cannot be separated at the bedside, explore.	

PEARLS & PITFALLS

- **Pain out of proportion to unimpressive skin is the diagnosis** until surgery says otherwise.
- **Never wait for imaging.** A normal CT does not exclude it, and the delay is what kills.
- **Add clindamycin for toxin suppression**, not for coverage. It works where penicillin alone fails.
- **Book the second look before you leave the OR.** One debridement is rarely enough.

References: IDSA practice guidelines for the diagnosis and management of skin and soft tissue infections · World Society of Emergency Surgery guidelines on skin and soft tissue infections · Wong et al, LRINEC score, *Crit Care Med* 2004 · Stevens et al, the Eagle effect and clindamycin in streptococcal infection.

Educational aid; verify doses against local protocol, renal function, and patient factors.