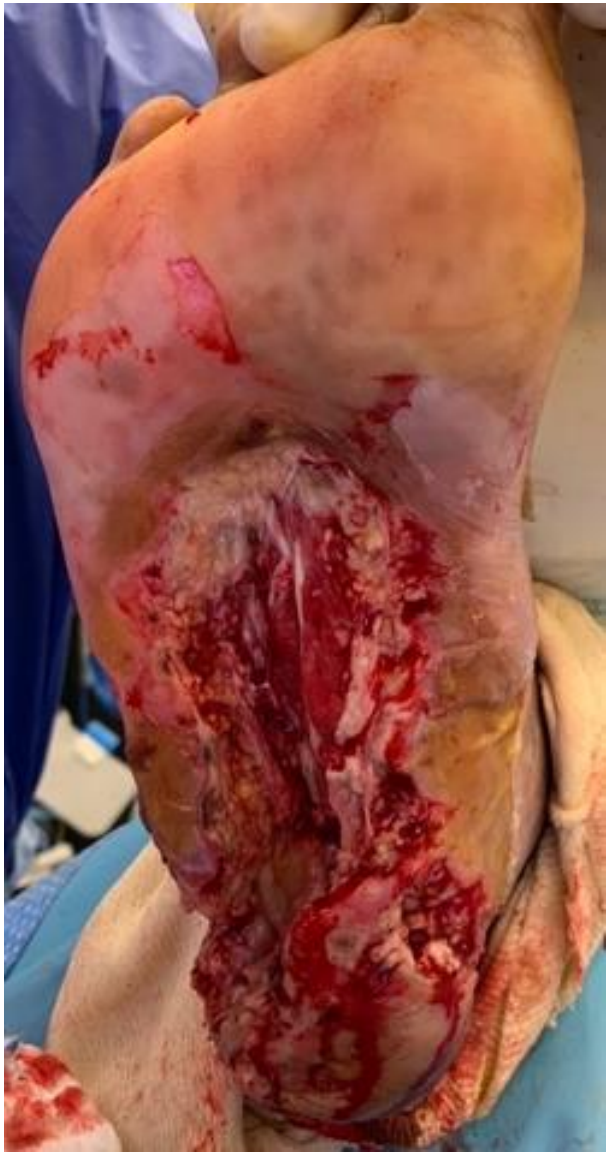
Necrotizing Soft Tissue Infections

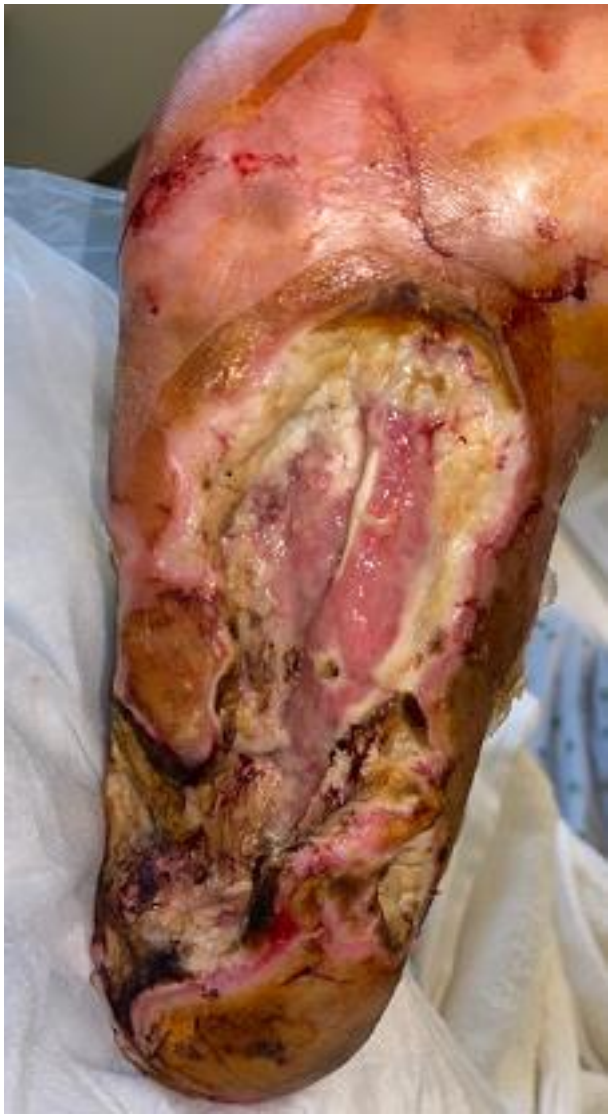
Distinctions

- Polymicrobial (type I)
  - Predisposing
    - Diabetic ulcers
    - Decubitus ulcers
    - Hemorrhoids
    - Rectal fissures
    - Episiotomies
    - Colonic, Gynecologic or Urologic procedures
  - Associated with gas in the soft tissue

- Common terms:
  - Fourniere's Gangrene – breach of the GI/GU tracts
    - Abrupt onset – spread from perineum to contiguous areas (buttock, genitalia, abdominal wall)
  - Ludwig's Angina – breach of Head & Neck fascia
    - Submandibular space associates with posterior molars and odontogenic infections
    - Involvement includes submandibular, sublingual, submental, pharyngeal and cervical spaces

- Monomicrobial (type II)
  - Predisposing
    - Any Age Group
    - No pre-disposing medical conditions
  - Most Common Organisms (GAS & MRSA)
  - Tissue destruction mediated by Exotoxin release causing tissue hypoxia; platelet/leukocyte complex
    - Acute pain and rapid destruction of healthy tissue
    - Intense pain seen in occlusion of arterial supply (ie. MI)
    - Tissue being destroyed will not bleed – thrombi and fibrin clots in post-capillary venules and arterioles

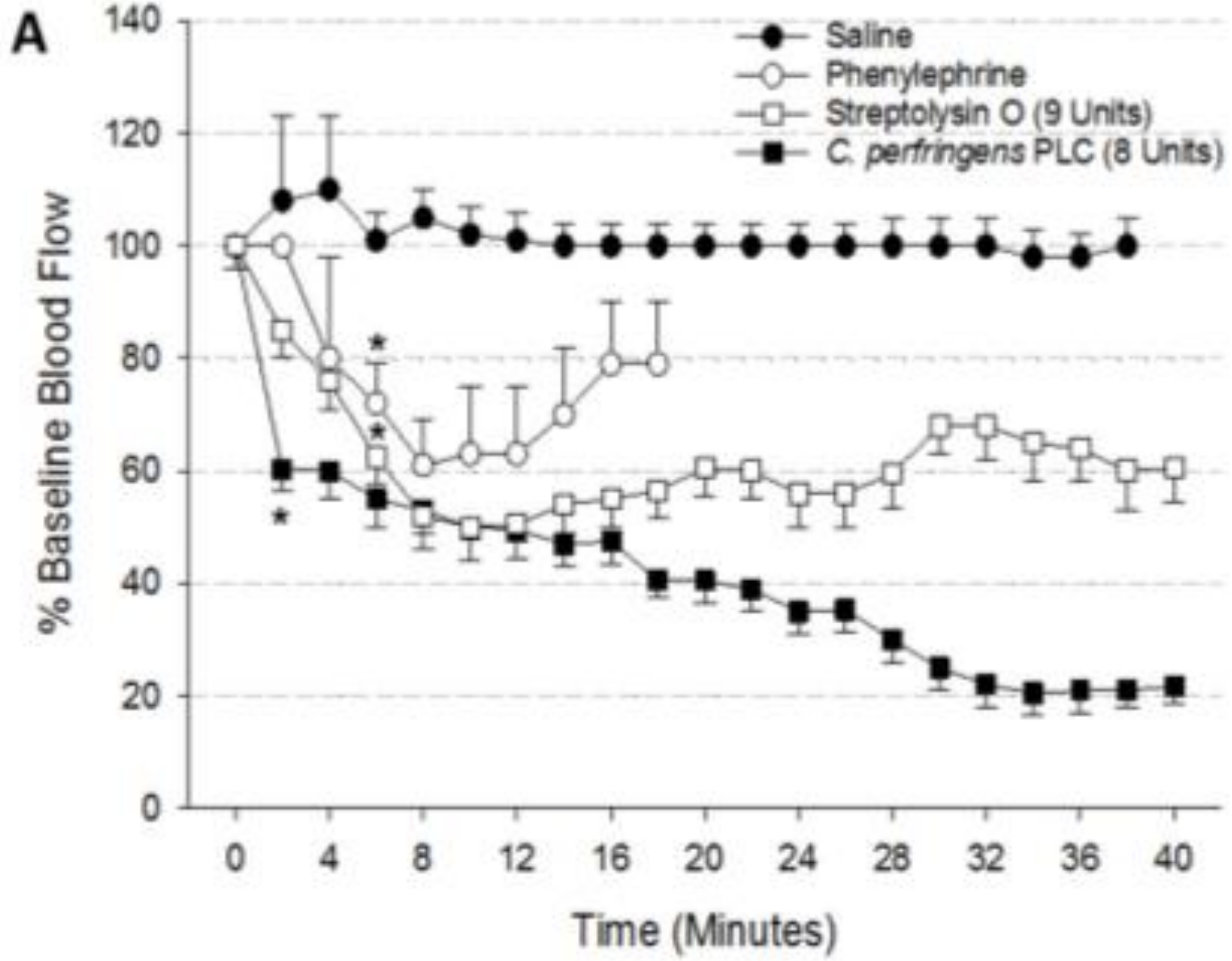




- Tissue Destruction
  - Rapid bacterial spread via protease activity damaging the ECM, leading to loss of fibrous attachments hence widespread involvement

- Pain
  - Mediated by ongoing tissue destruction
  - Toxin-mediated peripheral nerve stimulation
    - Alpha-hemolysin – S. aureus
  - Limited inflammation response
    - Toxin-mediated granulocyte chemoattractant cleavage – Group A Strep

- Perfusion Deficits
  - Rat abdominal musculature model
  - Streptolysin-O (GAS) & alpha-toxin C. perfingens – within 2 min perfusion limited, >40min irreversibly
  - Application of vasopressin causes transient perfusion deficits (5- 10min)
  - Video-microscopy
    - No vasoconstriction noted
    - Time-dependent, progressive intra-vascular thrombosis
    - Notable that neutrophil depletion and inhibition of platelets prevented toxin-mediated flow deficits


A
140
120
100
80
60
40
20
0
% Baseline Blood Flow
0
4
8
12
16
20
24
28
32
36
40
Time (Minutes)
Saline
Phenylephrine
Streptolysin O (9 Units)
C. perfringens PLC (8 Units)
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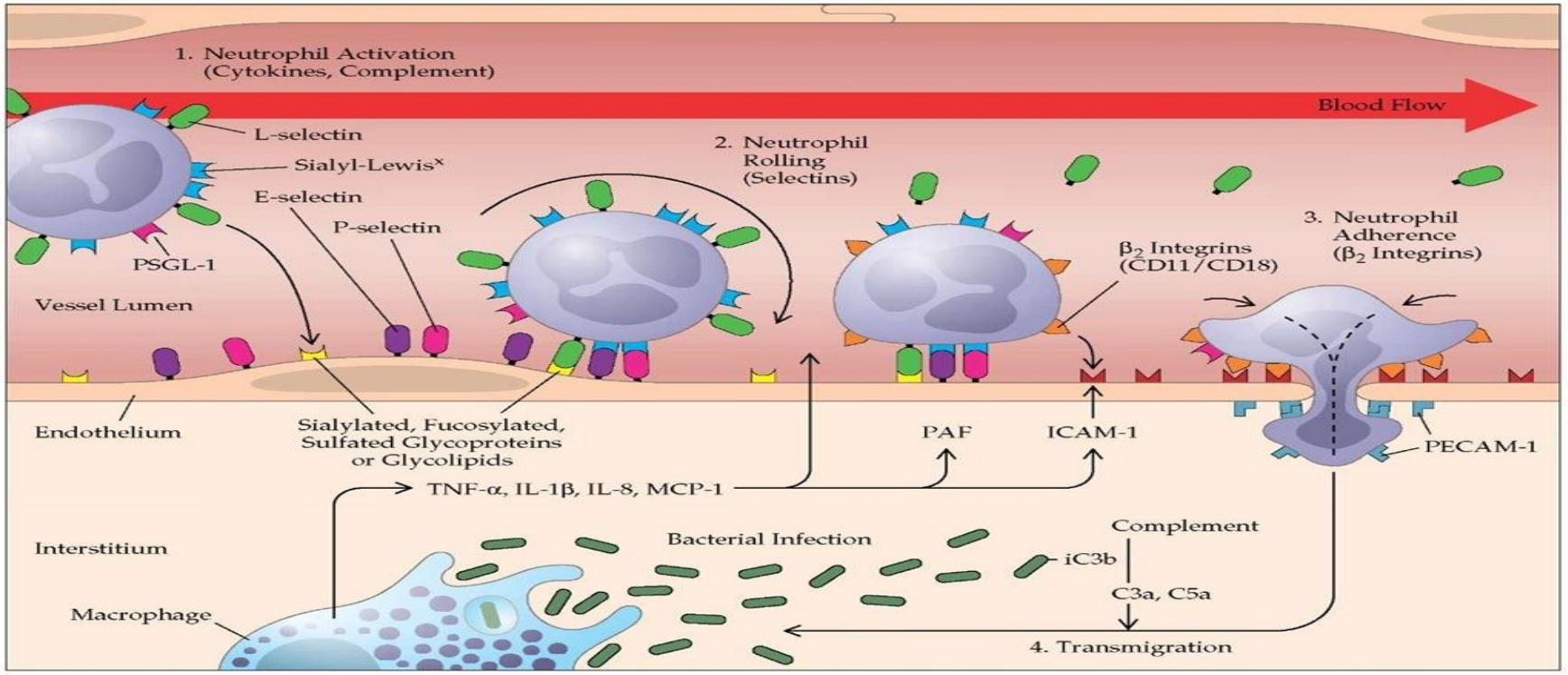
- Absence of Tissue Inflammatory Response
  - Paralysis of Neutrophil diapedesis due to Platelet adherence and toxin-mediated
  - Toxin-mediated breakdown of signaling for neutrophil-endothelial chemotaxis



- Group A Streptococcal – related
  - Defined portal of entry vs. spontaneous

- **Defined Portal**
  - minor traumatic lacerations, insect bites, drug injections, surgical incisions, etc
  - Initial mild erythema in 24-72h turns dusky, bullous, frank necrosis/sloughing
  - Look for bacteremia, metastatic lesions

- **Spontaneous/ no known portal of entry**
  - in 50% of patients – sometimes non penetrating muscle trauma or bruising
  - Onset fevers and crescendo pain – often malaise, diarrhea, anorexia within 1st 24 hours
  - **cutaneous manifestations** may be initially **absent**
  - Mortality up to 70% with delay in diagnosis as consideration of deep vein thrombophlebitis, severe muscle strain, amongst others are considered

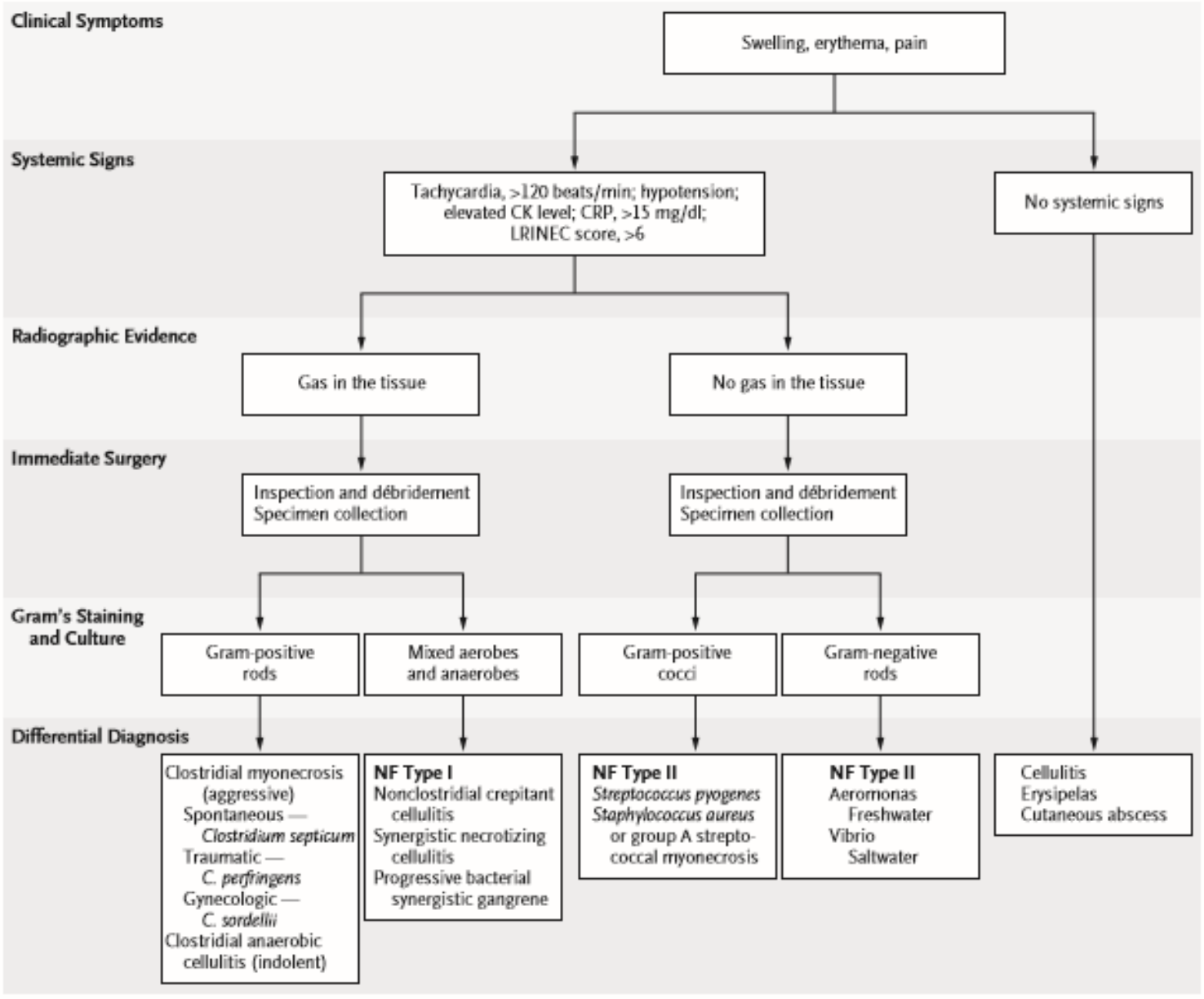
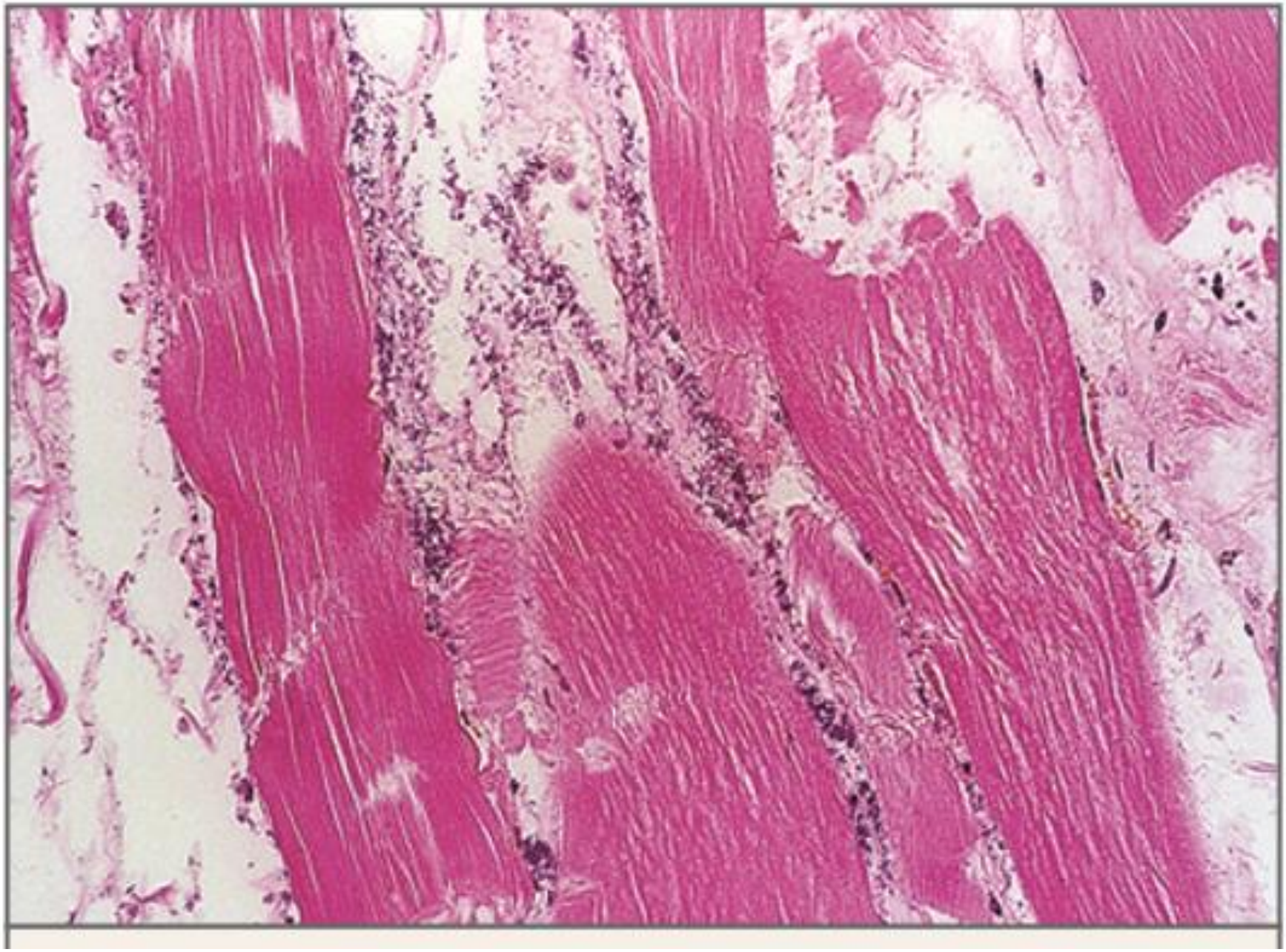


Figure 2. Algorithm for the Diagnosis of Necrotizing Infections.

In the algorithm, early clinical signs and symptoms and available results of laboratory tests and imaging studies are used to establish the diagnosis and cause of a diverse array of skin and soft-tissue infections. CK denotes creatine kinase, CRP C-reactive protein, LRINEC Laboratory Risk Indicator for Necrotizing Fasciitis, and NF necrotizing fasciitis.

- Gas in the tissue – crepitus, imaging
- Thickening or hyperintensity of intermuscular fascia on MRI
- Tissue biopsy/culture showing destruction of myocytes, paucity of phagocytes
- LRINEC score (scale 0-13)
  - CRP, WBC, Hgb, Na, Gluc, Creat
  - Score 5.8 or greater has positive predictive value 57-92% but negative predictive value 86-96%
  - In children median LRINEC is only 3.7%

- Surgical Intervention
  - Goal
    - to identify extent of involvement
    - Decision on debridement vs. amputation
    - Obtain tissue cultures
  - Re-inspection of surgical site in 24h and continued every 24-48h till necrotic tissue no longer present
  - Findings: dull-gray fascial separation from fat, presence of gas, edema, purulence, dish-water drainage, necrotic tissue, thrombosed perforating vessels



- Pharmacologic
  - IDSA: polymicrobial
    - Vancomycin or Linezolid +
    - Piperacillin/Tazobactam, Ceftriaxone/Flagyl or Carbapenem
    - Seek guidance from local anti-biogram
  - Group A Strep
    - Clindamycin + Penicillin x 10-14days
    - Caution monotherapy as resistance US 15%, China 95%
  - Duration – once source-control is obtained and sepsis has resolved there is no further antimicrobial coverage may be unnecessary

- Capillary leak syndrome
  - Diffuse endothelial damage, fluid requirements, hypoalbuminemia
- Intravascular Hemolysis
  - Hematocrit as surrogate as opposed to Hgb
- Cardiomyopathy
  - Supportive measures (pressors, assist-devices)
  - Can fully resolve in 3-24m

- Adjunctive Therapies
  - Hyperbaric Oxygen:
    - 57 studies from 1997-2003 showed no conclusive evidence of benefit
    - Recent studies showing some evidence of change in inflammatory and vaso-active markers
  - IVIG
    - Neutralize extracellular toxins
    - Not recommended in GAS –related
      - 2017 study well-controlled – 4127 pt no effect on mortality or length of hospital stay