NECROTIZING FASCIITIS:
THE DIFFICULT TO TREAT BACTERIAL INFECTIONS IN SURGICAL PATIENTS

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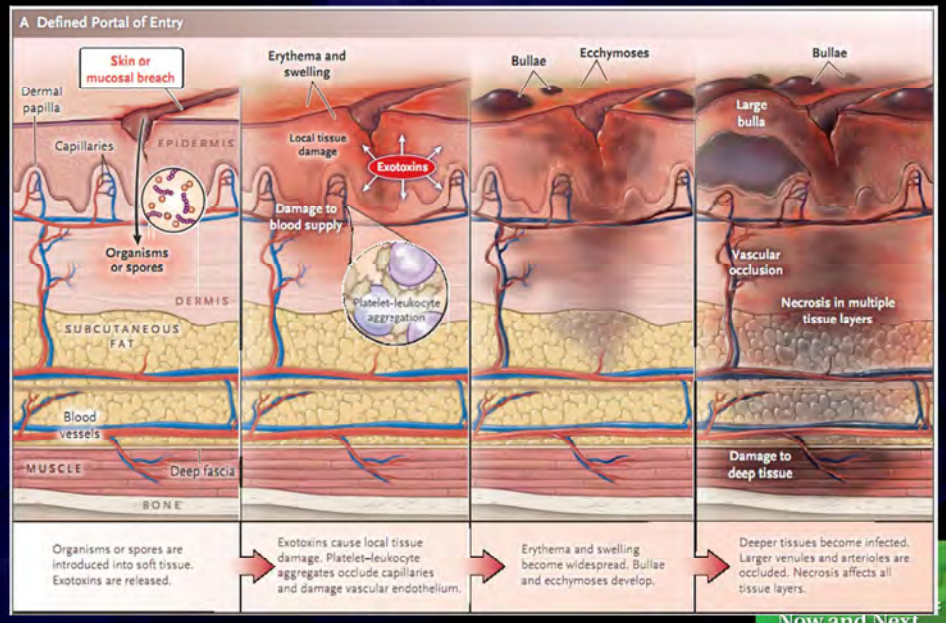
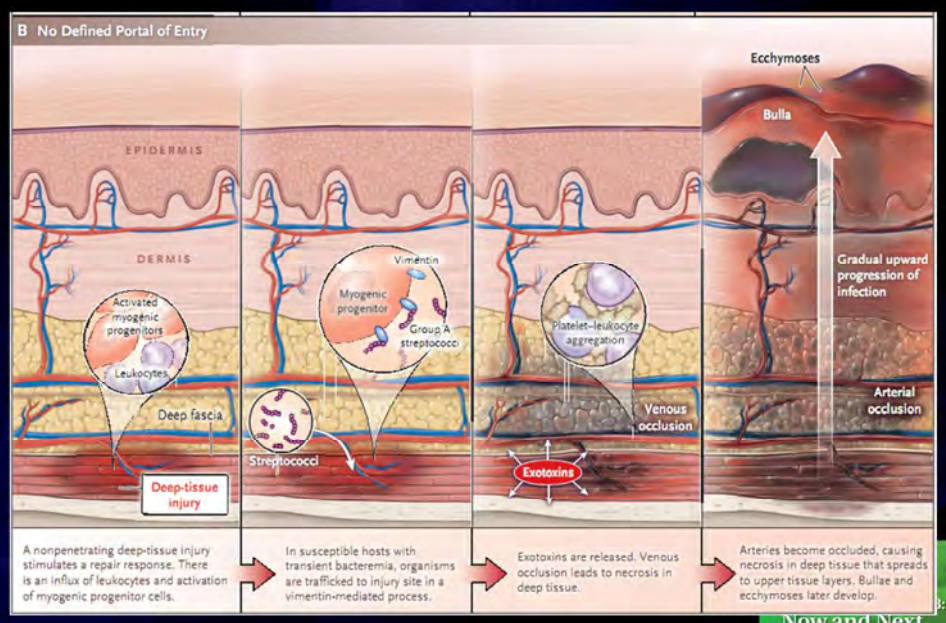
Pathogenesis



Now and Next

Stenvens DL, NJM, 2017

Pathogenesis



Now and Next

Stenvens DL, NJM, 2017

Clinical Presentation

Pain out of proportion to exam and systemic toxicity should suggest possibility of NF

Fascial necrosis occurs with involved fascia

Table 2

Physical findings on admission (Wong et al, 2003)

Physical finding	Patient (%)
Tenderness	97.8
Erythema	100
Warm skin	96.6
Bullae	45
Crepitus	13.5
Necrosis of skin	13.5
Hypotension	18
Fever (temp over 38°C)	52.8
Tachycardia (pulse over 100bpm)	74.2

Table 3. Symptoms/Signs Associated with Necrotizing Soft-Tissue Infection at the Time of Admission

Finding	Percent of patients[6] (n = 89)	Percent of patients[31] (n = 192)	Percent of patients[32] (n = 22)
Erythema	100	66	95
Pain or tenderness beyond margins of erythema	98	73	95
Swelling	92	75	86
Crepitus or skin necrosis	13	31	0
Induration	12	45	
Bullae	45	23	41
Fluctuance	11		
Fever	53	32	
Hypotension	18	11	

Sarani B, J Am Coll Surg. 2009 Feb;208(2):279-88

Parameter	Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value (%)
Tense edema	38	100	100	62
Bullae	24	100	100	57
White blood cell count ^{3}/L	81	76	77	80
Sodium <135 mmol/L	75	100	100	77
Chloride <95 mmol/L	30	100	100	55
Blood urea nitrogen	70	88	88	71
Gas on roentgenogram	39	95	88	62

Rodriguez RM: Am J Emerg Med, Jan 2006

TABLE 4

The Laboratory Risk Indicator for Necrotizing Fasciitis score

VALUE	POINTS
C-reactive protein, mg/dL	
< 150	0
> 150	4
White blood cell count, × 10⁹/L	
< 15	0
15–25	1
> 25	2
Hemoglobin level, g/dL	
> 13.5	0
11–13.5	1
< 11	2
Sodium level, mmol/L	
≥ 135	0
< 135	2
Creatinine level, mg/dL	
≤ 1.6	0
> 1.6	2
Glucose level, mg/dL	
≤ 180	0
> 180	1

LRINEC

(Laboratory Risk Indicator for Necrotizing Fasciitis)

RISK CATEGORY	POINTS	PROBABILITY
Low	≤ 5	< 50%
Intermediate	6–7	50%–75%
High	≥ 8	> 75%

REPRINTED FROM ANAYA DA, DELLINGER EP. NECROTIZING SOFT-TISSUE INFECTION: DIAGNOSIS AND MANAGEMENT. CLIN INFECT DIS 2007; 44:705–710, BY PERMISSION OF OXFORD UNIVERSITY PRESS.

Wong CH. The LRINEC score, Crit Care Med 2004;32:1535–41
Anaya DA, Necrotizing soft-tissue infection. Clin Infect Dis 2007;44:705–10

Demographic data and patient characteristics (Total n=294)

Characteristics	NNSTI	NF	p-value
Gender Male n(%)	115 (57.2)	59(63.4)	0.313
Female n(%)	86(42.8)	34(36.6)	
Age year (mean±SD)	59.11±18.5	58.23±16	0.691
Diabetic mellitus n(%)	65(32.3)	45(48.4)	0.008
Chronic kidney disease n(%)	34(16.9)	14(15.1)	0.688
Hypertension n(%)	112(55.7)	47(50.5)	0.407
Cirrhosis n(%)	10(5)	8(8.6)	0.233
Body mass index (BMI) mean±SD	27.07±8.62	24.86±5.87	0.019
Duration of onset day (mean±SD)	4.81±3.41	3.86±2.75	0.020

Clinical presentations

Clinical presentation	NNSTI	NF	p-value
Presenting symptoms			
Fever n(%)	73(36.3)	52(55.9)	0.002
Pain n(%)	87(43.3)	31(33.3)	0.107
Presenting signs			
Erythema n(%)	170(84.6)	74(79.6)	0.289
Warm n(%)	93(46.3)	46(49.5)	0.610
Swelling n(%)	169(84.1)	74(79.6)	0.667
Skin bleb n(%)	24(11.9)	45(48.4)	<0.001
Skin necrosis n(%)	6(3)	34(36.6)	<0.001
Tenderness n(%)	122(60.7)	54(58.1)	0.669
Temperature (C°) mean±SD	36.98±3.21	37.39±1.19	0.230
Pulse rate mean±SD	87.63±16.55	99.08±15.56	<0.001
Systolic blood pressure mean±SD	132.33±25.72	117.4±30.6	<0.001
Diastolic blood pressure mean±SD	74.91±15.49	70.84±17.26	0.046

Laboratory presentations

Laboratory presentation	NNSTI (mean±SD)	NF (mean±SD)	p-value
WBC (/μL)	13,238.5±6941.64	18,973.19±7967.5	<0.001
Neutrophil (%)	76.17±14.51	86.34±7.79	<0.001
Hemoglobin (g/dL)	11.82±2.31	11.07±2.97	0.036
Platelet (x1000/μL)	263.31±150.43	255.45±161.41	0.908
Na^+ (mEq/L)	134.41±4.81	131.48±5.6	<0.001
K^+ (mEq/L)	3.55±1.18	3.68±0.96	0.609
Cl^- (mEq/L)	98.5±9.43	94.44±11.93	0.003
HCO_3^- (mEq/L)	25.72±9.45	21.81±4.7	<0.001
BUN (mg/dL)	20.03±15.93	25.49±19.06	0.020
Cr (mg/dL)	1.28±0.9	1.64±1.3	0.020
Alb (mg/dL)	3.36±0.56	2.86±0.63	<0.001
BS (mg/dL)	145.72±79.02	167.36±104.17	0.277

Imaging

- Plain x-ray; not sensitive
- CT scan; more sensitive fascial thickening on CT had 80% sensitivity for diagnosis, IV contrast not helpful
- MRI has a sensitivity of 90% to 100%, but specificity of only 50% to 85%
- Ultrasonography detect superficial abscesses, not sufficiently sensitive/specific for diagnosis not be routinely used

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Soft tissue gas from invasive Gr. A *Streptococci*

Fournier's gangrene

Bedside finger test

- This is carried out under local anaesthesia, with an incision of 2 cm down to the deep fascia.
- Gentle probing with the index finger is performed at the level of the deep fascia.

Signs of NF

- lack of bleeding
- Malodorous "dishwater pus"
- Lack of normal tissue resistance to blunt finger dissection

Table 3
Microbiologic organisms recovered from original wounds

Organism	N	n	%
Aerobic			
Streptococci	182	83	45.6
Enterococci	182	61	33.5
Staphylococci	182	64	35.2
Escherichia coli	182	57	31.3
Proteus sp	182	38	20.9
Other gram-negative rods[a]	182	76	41.8
Anaerobic			
Peptostreptococci	131	45	34.4
Bacteroides species	128	70	54.7
Clostridium perfringens	129	12	9.3
Other clostridial species	128	17	13.3
Other anaerobic species	128	27	21.1
Fungal species	171	9	5.3

Elliott DC, Ann Surg 1996;224:672–83.

Microbiology of necrotizing fasciitis

Gram positive	n (%)
Staphylococcus aureus	16 (14.82)
Staphylococcus aureus-MRSA	2 (1.85)
Staphylococcus epidermedis	4 (3.70)
Streptococcus pyogenes	16 (14.82)
Streptococcus spp.	5 (4.63)
Streptococcus viridan	2 (1.85)
Streptococcus agalactia	5 (4.63)
Streptococcus bovis	1 (0.93)
Streptococcus pnemoniae	1 (0.93)
Enterococcus faecalis	10 (9.26)
Bacillus spp.	2 (1.85)

Gram negative	n (%)
Escherichia coli	4 (3.70)
Escherichia coli -ESBL	8 (7.41)
Klebseilla pneumoniae	7 (6.48)
Pseodomonas aeruginosa	9 (8.33)
Pseudomonass spp.	2 (1.85)
Acenitobacter baumaneii	2 (1.85)
Acenitobacter baumaneii-MDR	2 (1.85)
Proteus mirabilis	4 (3.70)
Citrobacter spp	1 (0.93)
Enterobacter Cloacae	1 (0.93)
Samonella gr B	1 (0.93)
Aeromonas hydrophilia	1 (0.93)
Morganella moeganii	1 (0.93)
Edwardsiella tarda	1 (0.93)

Microbiology

Type	Bacterial cause	Region
1.Polymycrobial infection	Aerobe and anaerobe E.coli, Klibsiella, Proteus, Bacteroides,Clostridia, Streptococcus,Staphylococcus)	Abdomen Perineum Leg
2.Monomicrobial infection	Streptococcal pyogenes Staphylococcus aureus Clostridial species	Arm Leg
3.Monomicrobial infection	Marine vibrios Aeromonas hydrophilia	Arm Leg

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Distinguishing features of necrotizing soft tissue infections

	Depth of involvement	Usual pathogens	Predisposing event	Incubation period	Rate of progression	Characteristic features
Polymicrobial necrotizing fasciitis (type I)	fascia and muscle	obligate and facultative anaerobes	wound	long (48–96 h)	hours to days	foul-smelling drainage
Streptococcal gangrene (necrotizing fasciitis type II)	skin, fascia, muscle	group A>C>G>B streptococci	minor cut or abrasion	short (6–48 h)	a few hours	distinct margins
Gas gangrene (clostridial myonecrosis)	muscle	traumatic: *C. perfringens* > *C. novyi* atraumatic: *C. septicum*	contaminated wound gastrointestinal lesion, but no local insult	short (6–48 h)	a few hours	extreme systemic toxicity
Non-clostridial myonecrosis	muscle and fascia	obligate and facultative anaerobes or *A. hydrophila*	wound	variable (12–96 h)	hours to days	soft-tissue gas when polymicrobial aetiology

DiNubile MJ, Lipsky BA. J Antimicrob Chemother. 2004;53(suppl 2):ii37-ii50.