

A WEATHER FORECAST

It is gonna be cold

It is gonna be gray

It is gonna last for the rest of your life

Groundhog day

Bill Murray



GOETHE

**Art is long, Life short, Judgment difficult,
Opportunity transient**



NECROTISING SOFT TISSUE INFECTIONS

25 YEARS OF EXPERIENCE AT THE UIHC BURN
UNIT

HISTORY OF NECROTIZING SOFT TISSUE INFECTIONS (NSTI)

Hippocrates:400 B.C. First known clinical description of soft tissue infection

Jones: 1871 Hospital Gangrene infections in confederate soldiers in Chamborozo hospital, Richmond Va.

Fournier:1883 Perineal soft tissue infections ,La Semaine Medicale

Meleney: 1924 acute hemolytic streptococcal gangrene

Wilson:1952 “Necrotizing Fasciitis”

EPIDEMIOLOGY

Incidence: 0.4 cases in 100,000 population

- 500-1500 cases in the US/year
- 130 cases at UIHC last year

Mortality

- 20-30% nationwide
- 5% at UIHC

2:1 M:F ratio nationwide

1:1 ratio at the UIHC



WHAT IS NEC. FAS. ?

A severe and extensive necrosis of the superficial fascia and subcutaneous fat with destruction of those tissues

Gram + and – bacteria involved

Very rarely Clostridial species identified

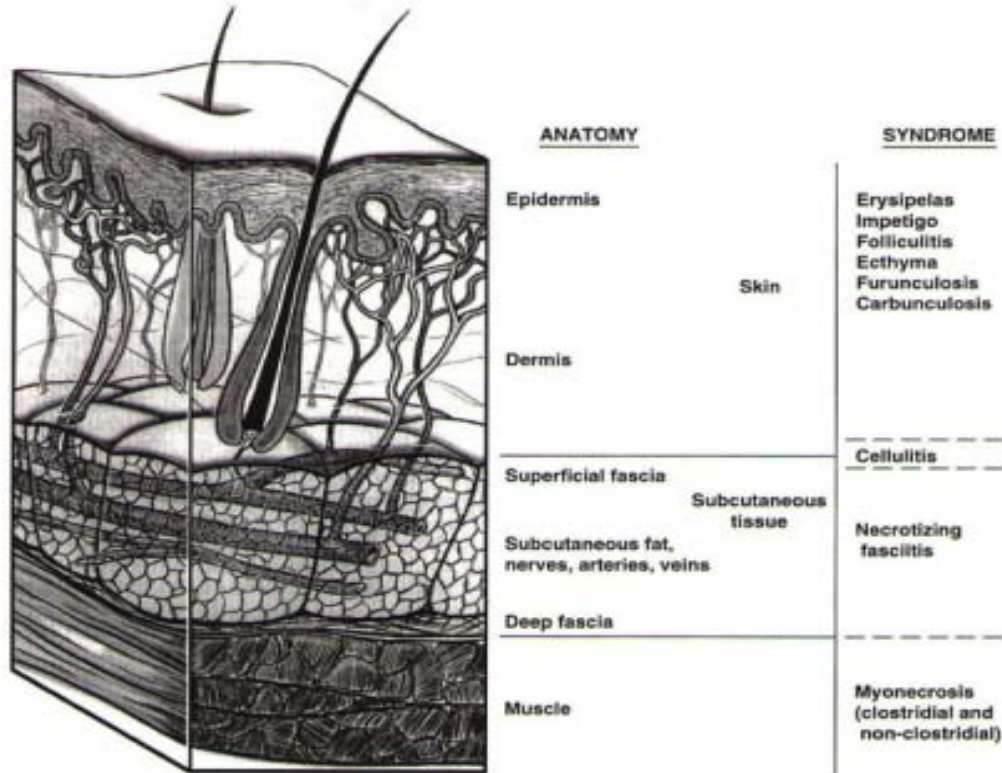
SIX CLINICAL CRITERIA OF NEC. FAS.

- 1) Necrosis of the superficial fascia with undermining of the surrounding tissues
- 2) Systemic toxic reaction with altered mental status
- 3) Absence of muscle involvement
- 4) No Clostridia species isolated
- 5) No arterial inflow occlusion
- 6) Pathological exam of debrided tissue shows intense leukocytic infiltration, focal fascial and surrounding tissue necrosis and thrombosis of microvasculature

ref: Fisher's criteria



PATHOGENESIS



Organisms spread along the superficial and deep fascial planes

Leads to vascular occlusion, ischemia and tissue necrosis

CLINICAL COURSE OF NEC. FAS.


Early = mild low grade cellulitis, indolent abscess 1-7 days

Late = tissues become swollen, inflamed, painful


Later = skin develops blisters, bullae, epidermolysis

Rapid progression due to thrombosis of the nutrient vessels, secondary tissue death and rapid spread necrosis leading to death

CLINICAL COURSE OF NEC.FAS.

- Systemic effects: fever, chills, altered CNS function, unstable VS
 - Complications: metastatic abscesses and cellulitis
 - Death : 20-66% mortality rate (older literature)
- 

RISK FACTORS

- Chronic disease: diabetes, lower extremity venous insufficiency
 - Age > 50 years
 - Obesity/ malnutrition
 - Immunocompromised host
 - Alcoholism, drug abuse
 - pregnancy
- 

ETIOLOGY OF NEC. FAS.

Break in the mechanical skin barrier

Inoculation of the subcutaneous tissues

- chronic skin disorders (venous stasis, eczema, psoriasis,
- acute injuries (minor trauma, acute folliculitis, surgical incisions)

ETIOLOGY OF NEC.FAS.

Absence of portal of entry

- non-penetrating blunt trauma
- Hematogenous seeding

Healthy patient w/o underlying disease leads to a delay in
Dx and Tx

Bacteria need to reach a critical mass “quorum” then begin
the invasive process hence the period of incubation

DIAGNOSIS OF NEC. FAS.

History and Physical examination of the patient !!!!! This is a simple diagnostic test that works every time.

Gram Stain – objective test , sample from the center of the necrotic lesion.

Microbiology: group A Streptococcus pyogenes , Coliforms, Staphylococcus Aureus, Bacteroides species, and rarely Clostridium septicum

IMAGING OF NEC. FAS.

Radiology

- Plain x-ray shows gas in tissues only 30% of cases
- Ultrasound: not useful
- MRI or CT cannot differentiate infection from cellulitis



DIAGNOSIS OF NEC. FAS.

- Microscopic exam of frozen tissues (not commonly used)
- Radiography/CT/MRI : no more sensitive or specific than physical examination of the patient

DEMOGRAPHICS FROM ADMISSIONS 2002-2007/ OR DOES THE SOURCE OF CARE INFLUENCE OUTCOME?

214 patients

Initial admitting service


- Trauma/Burns 203 (95%)
- Other 11 (5%)

PATIENT DATA

- Female **38%**
 - Male **62%**

 - Age (years) **50** (Range: 4-88, SD=14)
 - BMI **38** (Range: 18-79, SD=14)


 - Length of stay (days) **25** (Range: 1-223, SD=24)

 - HbA₁C **8.2** (Range: 5.1 - 13.4, SD=2.5)
 - WBC **20,000** (Range: 5.5 - 84.6, SD=10.6)
- 

PATIENT DATA

- Acute traumatic wound **14%**
 - Chronic wound **15%**
 - No obvious source **71%**

 - Perineum **40%**
 - Extremity **53%**

 - Total Debridement Operations **1** (Range: 1-5, SD=0.7)
 - Time to 1st operation (days*) **2** (Range: 1-17, SD=2)
 - BSA excised (%) **5** (Range: 1-22, SD=4)
- 

INFECTIOUS AGENTS, OUTCOMES

N=214 PTS.

- Streptococcus only 6%
- Staphylococcus only 8%
- Polymicrobial ie Coliforms 64%
- No tissue cultures 22%

- Antibiotic duration (days) **14** (Range: 1-109, SD=13)

- Mortality overall 8%
- Mortality for Trauma/Burn service 6%
- Mortality for Other Services 36%

SOURCE OF TREATMENT OUTCOMES

Admitting Team N=214	Mean Age (Years)	Percent Diabetic	Percent Cardiac Disease		Average Time to 1 st OR (Hospital Days*)	Percent Mortality p=0.009
Other n=11	59	45	33		4	36*
Trauma/ Burns n=203	50	55	36		2	6*

TREATMENT OF NEC. FAS.

Stabilize the vital signs, resuscitate rapidly with iv fluids, pressors , glycemic control

Antibiotics : No single antimicrobial will cover all possible pathogens : must treat the clinical scenario with broad spectrum antibiotics until culture data

Debridement

When the patient is resuscitated to goals of physiologic stability (if possible) ie adequate urine output, resolving acidosis, pulse and pressure restored

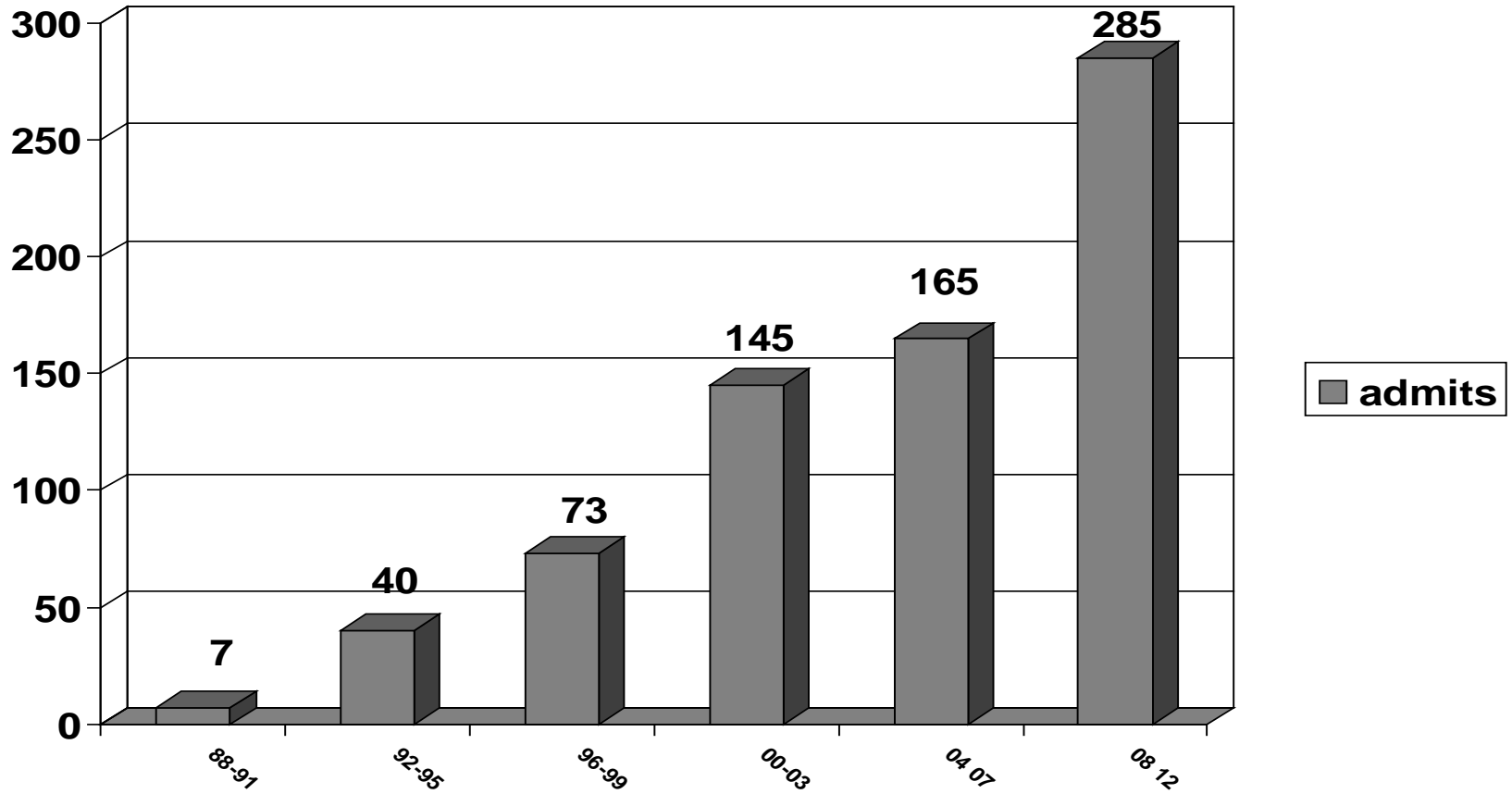
OPERATE and **REMOVE ALL** affected and contaminated tissue

Or... explain the value of ongoing sepsis to your patient

WHEN TO OPERATE?

- Make a diagnosis NOW
- Resuscitate if needed
- Debride ALL involved tissue to living tissue margins

NEC. FAS. ADMITS 25 YRS.



25 YRS DEMOGRAPHICS

Total NSTI admits = 715 (8.7% of total burn center admits)

- Male/Female % = 54/46
- Total deaths = 6.3% at 30 days
- Male/ Female deaths = 51%/49%

FOURNIER'S GANGRENE

- **Perineal involvement**
 - **Antecedent vulvar, genital ,peri-rectal or perianal infections**
 - **Perineal operative procedures**
 - **Prodrome of 3-5 days**
 - **Rapid advancement along vascular and lymph channels**
 - **Cultures: Coliform species**
- 



7/29/07



7/30/07

7/30/07



TYPE 2 INFECTIONS

Streptococcus A>C>G>B

- Staph aureus increasingly isolated as well

Minor cut or abrasion

Incubation 6-48 hours

Progresses over a few hours

Involves skin, fascia and muscle

Risk Factors

- Healthy individuals
- Peripheral vascular disease, DM

Common sites

- Extremities

TYPE 2 INFECTIONS

Presentation

- Severe pain out of proportion with clinical findings
- Rapidly advancing erythema
- Gangrenous tissues



TYPE 2 INFECTIONS

Streptococcal Toxic Shock Syndrome

- Incidence: 50-80% of the patients
- Release of cytokines induced by *Streptolysin O* & *Exotoxin A*
- Multi-system organ failure
- Mortality rate historically 30-100%
- UIHC mortality = 6.3%

CLOSTRIDIAL MYONECROSIS

Principally *C. perfringens* but *C. novyi* and *C. septicum* also seen

Predisposing event

- Deep trauma with gross contamination
- Surgical wound
- Hematogenous spread from colonic lesion

Incubation Period 2-3 days; then explosive spread

CLOSTRIDIAL MYONECROSIS

Presentation

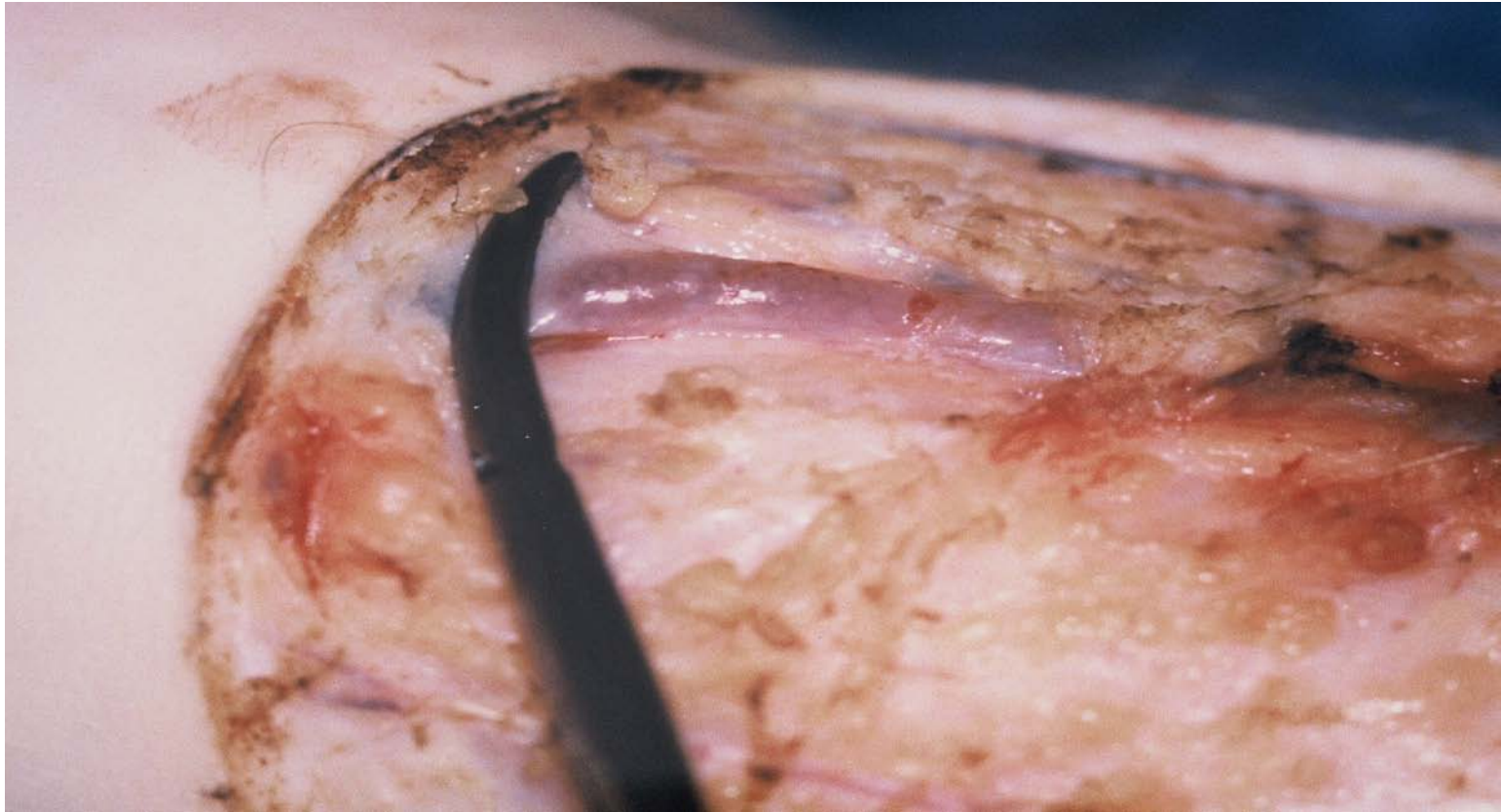
- Severe pain out of proportion to clinical findings
- Erythema and cutaneous blisters
- Gangrene
- Crepitus
- Brown foul smelling discharge
- Loss of motor function



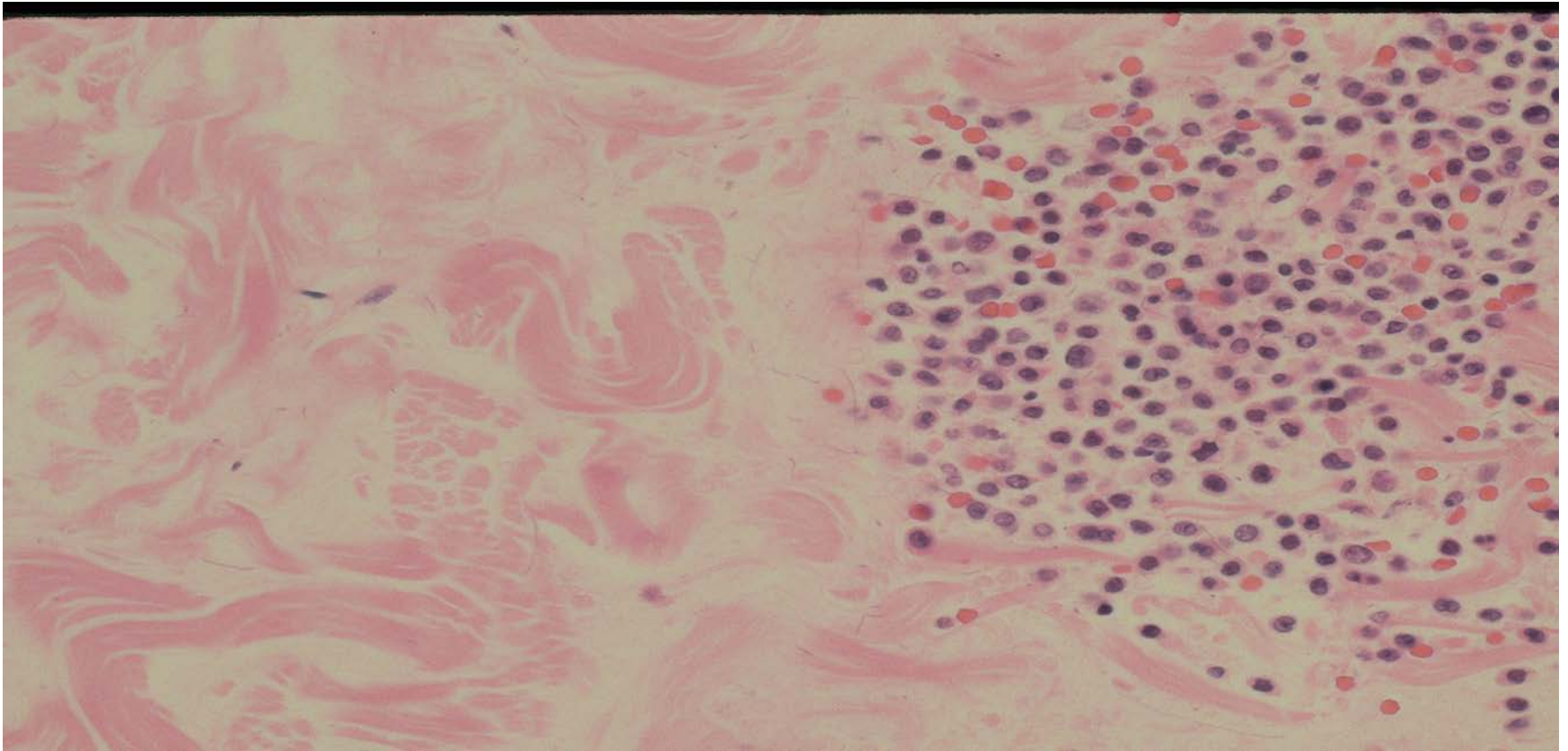
16 Y/O WITH ENCROACHING SEPSIS



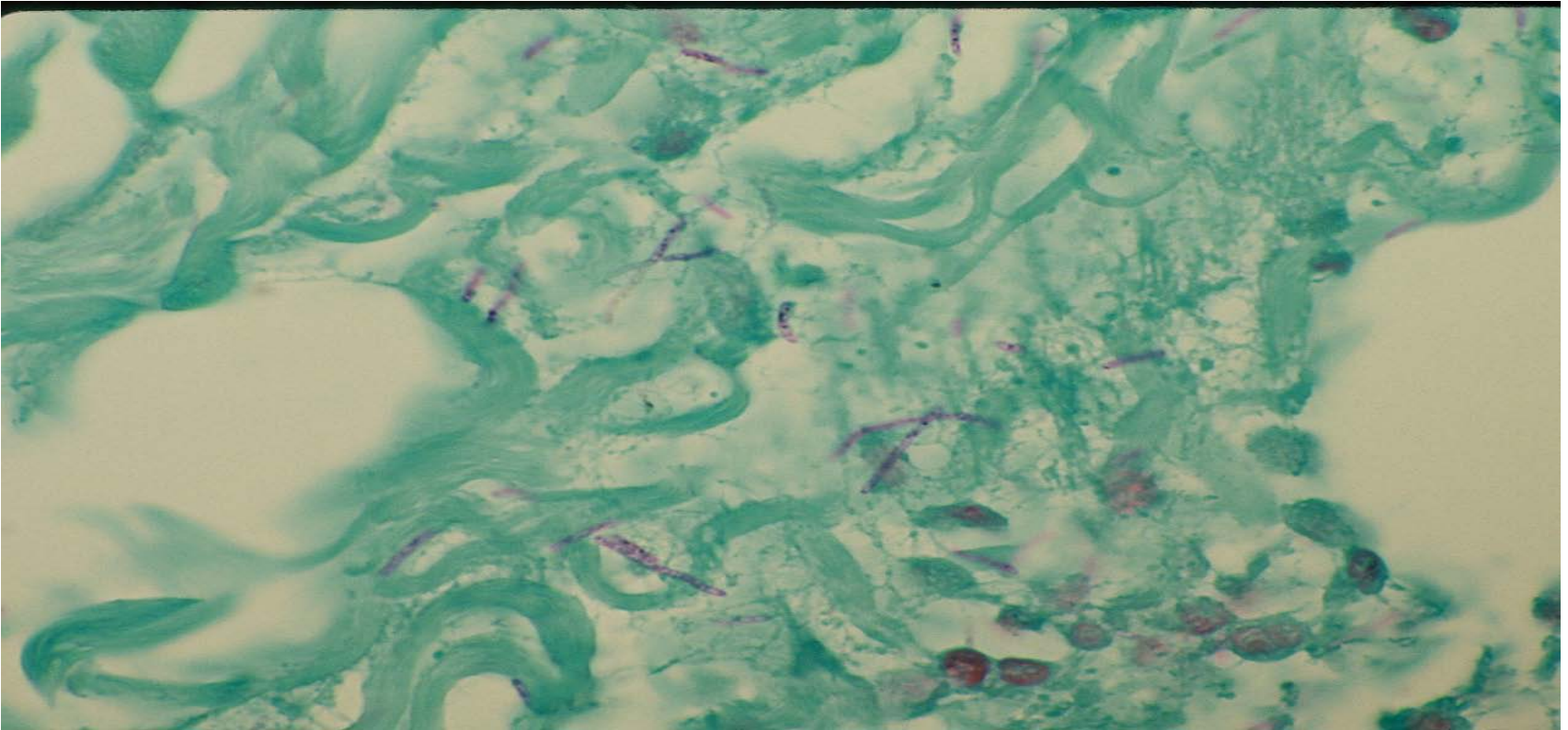
GAS IN SAPHENOUS VEIN



PATHOLOGIC EXAMPLE



GIEMSA STAIN OF SEPTIC TISSUE



POST OPERATIVE TREATMENT

- Continued Resuscitation
- Antibiotic Therapy
- Wound Care
- Nutrition
- Rehabilitation
- Wound Closure: Second operative intervention for wound closure

TREATMENT

Hyperbaric Oxygen

Mindrup,S.R., Kealey G.P., Fallon B. Journal of Urology 2005;173:1975-1977

- Necrotizing Fasciitis
 - Lack of randomized data
 - Some studies show improved survival and others show no difference
- Clostridial infections
 - Lack of randomized data
 - HBO toxic to clostridia; decreases the production of α -toxin
 - May be beneficial , only canine data.

Long Term Outcomes

Table 1. Demographics and follow-up of the cohort

Variable	N	Mean	Median	SE	Maximum	Minimum
Age at presentation (yr)	345	49.3	49	0.8	86	1
Follow-up (yr)	345	3.3	2.4	0.2	15.7	0.1
Time to death (yr)	87	9.2	10.7	0.47	15.0	0.1
Count of comorbidities	226	1.7	1	0.1	7	0
Body mass index (kg/m ²)	160	39.3	36.0	1.0	80.2	18
Weight (kg)	228	113.4	104.0	2.8	320.0	13

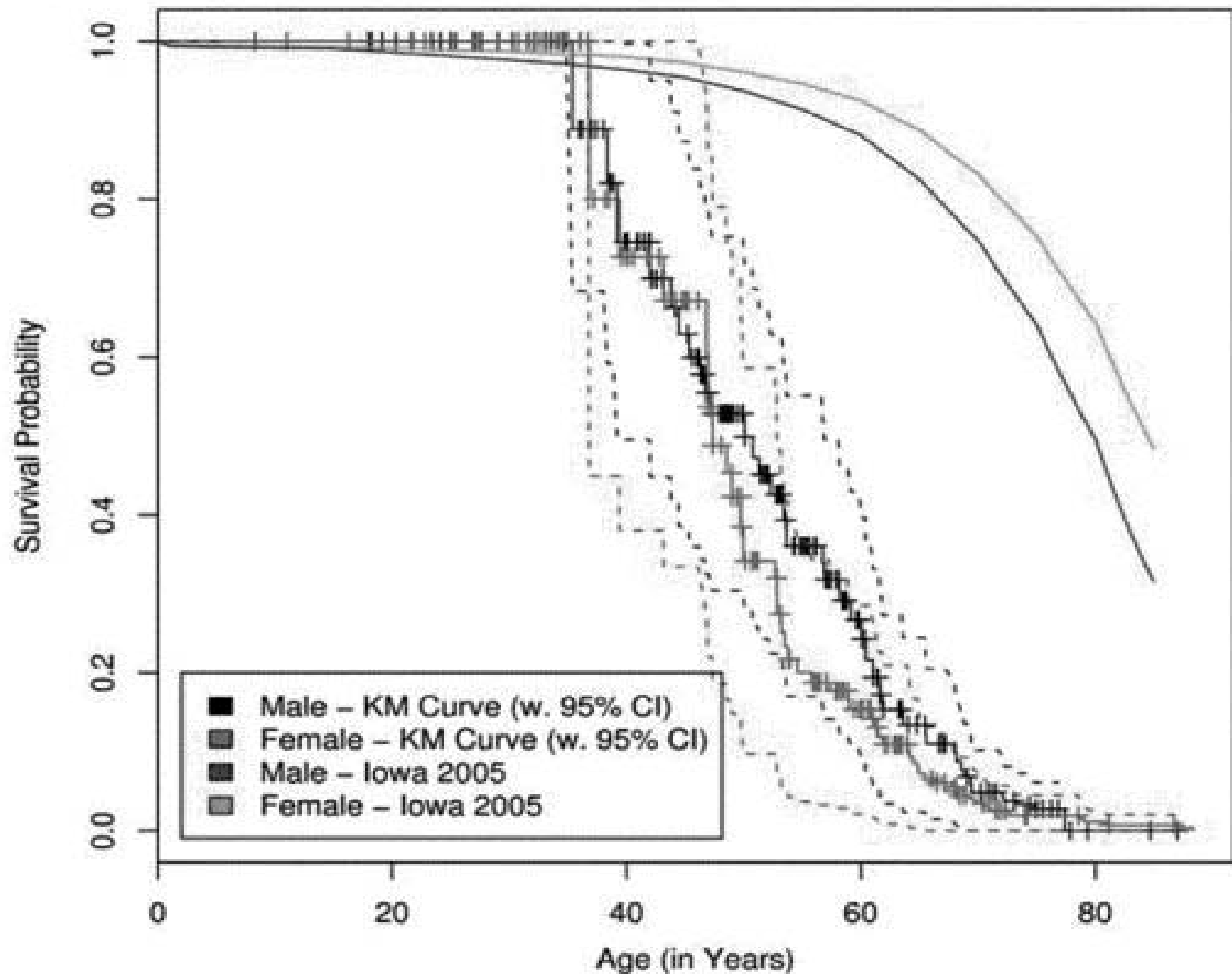
Table 1. Demographics and follow-up of the cohort

Long-Term Outcomes of Patients With Necrotizing Fasciitis.

Light, Timothy; Choi, Kent; Thomsen, Timothy; Skeete, Dionne; Latenser, Barbara; Born, Janelle; RN, BSN; Lewis, Robert; Wibbenmeyer, Lucy; Shyamalkumar, Nariankadu; Lynch, Charles; MD, PhD; Kealey, Gerald

Journal of Burn Care & Research. 31(1):93-99, January/February 2010.
DOI: 10.1097/BCR.0b013e3181cb8cea

Kaplan Meyer (KM) Survival Curves of Necrotizing Fasciitis Patients Compared to Age and Gender Matched Statewide Controls



PROPHYLAXIS OF TYPE 2 INFECTIONS

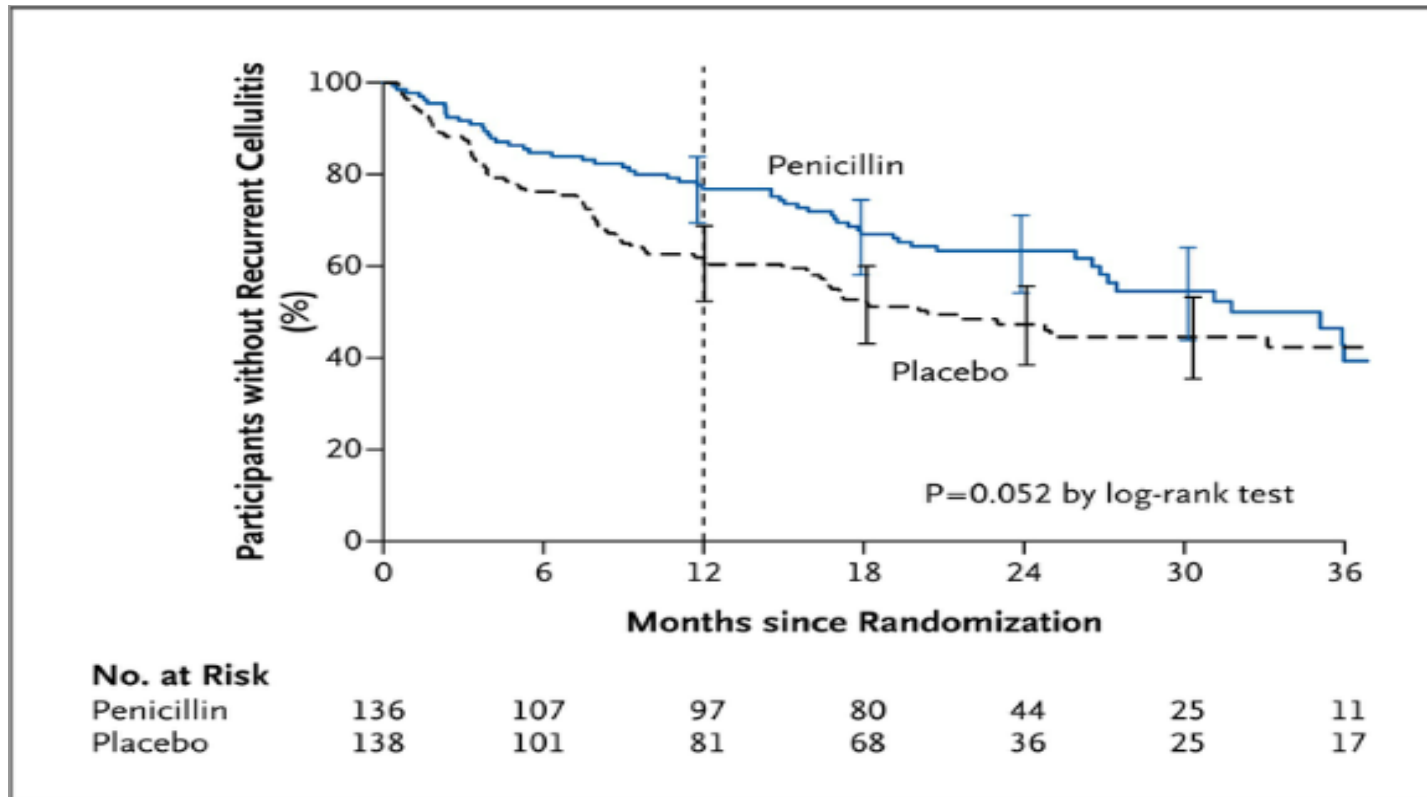
Penicillin to prevent recurrent leg cellulitis

Thomas et al, NEJM 2013;368:1696-1703

Randomized controlled trial of penicillin in 274 patients

- three year followup
- reduced incidence of recurrent infections
- recrudescence of infection when abx stopped

ANTIBIOTIC PROPHYLAXIS



MAIN POINTS

Delay in diagnosis increases mortality

- Wong et al: age, ≥ 2 comorbidities, delay in surgery adversely affected outcome
- Delay in surgery >24 hours associated with increased mortality
- Elliot et al: delay in first debridement increased mortality

Complete debridement of any and all involved tissues at initial operation (this is the most common treatment failure)

Early involvement of Burn Service, i.e. wound care technology

Long Term follow-up shows shortened life expectancy for all groups

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- 15) Light et al, Long term outcomes in patients with necrotizing fasciitis; *JCBR* 31(1)93-99 Jan/Feb 2010

T.S. ELIOT

*We shall not cease from exploration
And the end of all of our exploring
Will be to arrive where we started
And know the place for the first time*

Four Quartets





PROPHYLAXIS



2 YEARS LATER

Abstract – “Incidence of death in NSTI patients during the first two years after treatment ” Kealey and Lewis, European Burn Society 2005

!0% / year mortality in NSTI patients during each of the first two years after infection

NOT dying of recurrent infection

3-5% recurrent infection, no deaths



THE TEAM

Joe Chung, Barbara Latenser, Bob Lewis, Tim Light, Lucy
Wibbenmeyer

The Burn Center Nurses and all others who work there

The Patients who entrust themselves to our care

Thank you all



TYPE 1 INFECTIONS

Fournier's Gangrene

- Perineum
- Preceded by perianal or ischiorectal abscesses, GU procedures, or spontaneous



