Necrotizing fasciitis: classification, diagnosis, and management.
Lancettotto, Tuccci, Salmaso, Bassetto, Padova, Italy

Abstract
Necrotizing fasciitis (NF), a life-threatening infection of the soft tissues, is a medical and surgical emergency. It is characterized by rapid onset of widespread inflammation and necrosis starting from the fascia, muscles, and subcutaneous fat, with subsequent necrosis of the overlying skin. Early diagnosis, immediate and extensive radical debridement of necrotic tissue, and appropriate antibiotic and intensive general support avoid massive systemic diffusion of the infective process and are the cornerstones of successful treatment. However, early diagnosis is missed or delayed in 85% to 100% of cases in large published series: because of the lack of specific clinical features in the initial stage of the disease, it is often underestimated or confused with cellulitis or abscess. Mortality rates are still high and have shown no tendency to decrease in the last 100 years: unfortunately, the prevalence of the disease is such that physicians rarely become sufficiently confident with NF to be able to proceed with rapid diagnosis and management. This review covers the literature published in MEDLINE in the period January 1, 1970, to December 31, 2010. Particular attention is given to the clinical and laboratory elements to be considered for diagnosis.

A wide variety of diagnostic tools have been described to facilitate and hasten the diagnosis of NF, but the most important tool for early diagnosis still remains a high index of clinical suspicion.

Necrotizing Fasciitis of the abdomen and chest from axillary abscess secondary to MRSA

Reconstructive Ladder

a. Radical Debridement of all non-viable tissue
b. IV antibiotic therapy
c. NPWT
d. Rotational Flaps and skin grafts as needed to obtain wound closure

The reconstructive ladder in necrotizing fasciitis of the chest wall
Karsten Knobloch, Joern Kedekor and Peter M. Vogl

Abdominal Wounds Secondary to Mesh Infections

44y.o. with multiple chronic abdominal wounds and a large abdominal wall defect s/p multiple procedures presenting with sepsis secondary to infected Marlex mesh
49 year-old female complex past medical history multiple prior attempts at closure of a recurrent incisional hernia with polypropylene mesh developed a chronically infected anterior abdominal wound with exposed mesh along with hernia recurrence.

Extraordinary Cases: Abdominal Wounds & Myocutaneous Flaps

ABDOMINAL WALL WITH MULTIPLE DEFECTS SECONDARY TO PREVIOUSLY DRAINED ABSCESS CAVITIES FROM INFECTED MESH

Excised skin, infected mesh
RESIDUAL ABDOMINAL WALL DEFECT MANAGED WITH NPWT AS A BRIDGE TO ABDOMINAL WALL RECONSTRUCTION

Extraordinary Cases: Abdominal Wounds & Myocutaneous Flaps

Evidence for Replacement of an Infected Synthetic by a Biological Mesh in Abdominal Wall Hernia Repair.

Establish diagnosis
- Patient perioperative condition
- Define the anatomy/understand the defect
- Indications/limitations of prosthetics/bioprosthetics
- Wound preparation and control of infection
- Distinguish contamination from infection and treat appropriately
- Management of complications (including prosthetic-related)
- Account for concomitant disease processes which relate to the abdominal wall
- Postoperative management

Enterocutaneous Fistula
Extraordinary Cases: Abdominal Wounds & Myocutaneous Flaps

Proximal Diversion of the Small or large bowel if possible can facilitate enteral nutrition support which is key to the management of enterocutaneous fistulae and anastomotic leak.

Albumin = 1.8 g/dl

Extraordinary Cases: Abdominal Wounds & Myocutaneous Flaps

- Eradication of sepsis, appropriate wound management, establishment of nutritional support, and restoration of normal physiology were attempted.
- Definitive surgical management was deferred for at least 6 months after the last abdominal surgical intervention.

Challenging Wounds and the Use of Negative Pressure Wound Therapy

- Control of viscera with allowance for drainage
- Treatment of primary underlying disease
- Complicated by respiratory and renal failure and sepsis
- Severe protein calorie malnutrition

Managing the open abdomen with meshed biologic graft
In patients with paraplegia, the first pressure ulcer occurs after 74.79±61.34 months from the onset of the disease. Pressure ulcers most commonly occur over the ischial tuberosity. The most effective surgical treatment of pressure ulcers is closure of the wound using myocutaneous flaps (use of the hamstrings); fasciocutaneous flaps were the most commonly used method in patients who underwent surgery for the second time. 

"IT TAKES A VILLAGE AND YOU HAVE TO HAVE A PROGRAMATIC APPROACH"
Extraordinary Cases: Abdominal Wounds & Myocutaneous Flaps

Factors affecting decision for Flap closure

Wound Bed
Malnutrition
Extent of osteomyelitis time on IV antibiotics
Co Morbidities
Spasticity/contractures
Patient Compliance

Contraindications:
Tabacco abuse
Medical & Mental In-Stability

THE FACTS:

Smokers should be advised to stop smoking prior to elective surgery or when recovering from wounds resulting from trauma, disease, or emergent surgery.


We conclude that smoking attenuates epidermal healing and may enhance extracellular matrix degradation. Three months of abstinence from smoking does not restore epidermal healing, whereas 4 weeks of abstinence normalizes suction blister MMP-8 levels. These findings suggest sustained impaired wound healing in smokers and potential reversibility of extracellular matrix degradation.


In conclusion, this study suggests increased risk of random-pattern skin flap necrosis after side stream exposure to cigarette smoke.

Trunk, abdomen, and pressure sore reconstruction.
Rubayi S, Chandrasekhar BS. Department of Surgery, Rancho Los Amigos National Rehabilitation Center, Downey, CA 90242, USA.

SUMMARY: Chest wall reconstruction is indicated following tumor resection, radiation wound breakdown, or intrathoracic injury. Principles of wound closure and chest wall stabilization, where indicated, are discussed. Principles of abdominal wall reconstruction continue to evolve with the introduction of new bioprosthetics and the application of functional concepts for wound closure. The authors illustrate these principles using commonly encountered clinical scenarios and guidelines to achieve predictable results.

Pressure ulcers continue to be devastating complications to patients' health and a functional hazard when they occur in the bedridden, in patients with spinal cord injuries, and in patients with neuromuscular disease. Management of pressure ulcers is also very expensive. The authors describe standard options for treatment of the chest, abdomen, and back and pressure ulcers in all anatomical areas.

Perioperative Counseling/Compliance
Co-morbid Conditions: Osteomyelitis
Malnutrition

Postoperatively, a strict protocol should be adapted to ensure the success of the flap procedure.
Successful Truncated Osteomyelitis Treatment for Chronic Osteomyelitis Secondary to Pressure Ulcers in Spinal Cord Injury Patients
Robert Marriott, MD, and Salah Rubayi, MD, FACS

In cases of pressure ulcer management with bony involvement, bone pathologic diagnosis of chronic osteomyelitis allows for a shorter antibiotic course with better results when the offending tissue has been adequately debrided and closed with viable tissue flap coverage, than simple long-term (4–6 weeks) antibiotic treatment. Because of the extreme contaminated nature of these wounds, if such therapy works in these patients, it may be applicable to chronic osteomyelitis in more varied contaminated surgical cases involving bone.

CRITICAL STUDY BECAUSE THIS SUBSET OF PATIENTS NEED TO BE OUT OF BED TO COMPLETE REHAB, AND IMPROVE QUALITY OF LIFE

Dtsch Arztebl Int. 2012 Apr;109(14):257-64, Treatment algorithms for chronic osteomyelitis. Walter G1, CONCLUSION: Surgery combined with anti-infective chemotherapy leads to long-lasting containment of infection in 70% to 90% of cases. Suitable drugs are not yet available for the eradication of biofilm-producing bacteria.


Conclusions: This is one of the largest cohort studies of pressure ulcer-related pelvic osteomyelitis to date. Significant variations existed in diagnostic approach. Most patients received antibiotic; those treated with a combined medical-surgical approach had fewer hospital readmissions.

Biochemical Differences

**Healing Wounds**
- ↑ Cell mitosis
- ↓ Pro-inflammatory cytokines
- ↓ MMPs
- ↑ Growth factors
- Cells capable of rapid response

**Chronic Ulcers**
- ↓ Mitogenic activity
- ↑ Pro-inflammatory cytokines
- ↑ MMPs
- Varied levels of growth factors
- Senescent cells

17 Schultz GS & Mast BA (1998)

Increased needs to support healing and offset nutrient losses and altered nutrient utilization:
- Chronic inflammation/stress
- Increased oxidative stress = altered and increased nutrient utilization: ARG, GLN, Cystine, Protein, calories, Vit A, B, C, & E; Cu, Zn, Mg, & more
- Heavy Exudate = protein, calories, fluid & micronutrient/zinc losses
- Chronic wound drainage has 8 x the amount of matrix metallo-proteases. MMPs contain protein and zinc

Nutrition Support

- Nutrition Support
Loss of Lean Body Mass/Malnutrition Due To Illness

- Loss of LBM
- Arginine & Glutamine become essential amino acids
- Inflammatory Response:
  - Increase in catecholamine
  - Increase in cortisol
  - Decrease in insulin
  - Increase in growth hormone
  - Decrease in testosterone
  - Decrease/Increase in growth hormone
  - Decrease in testosterone
  - Elevated blood pressure
  - Increased endogenous production of cytokines
  - Increased production of complications

20% loss of body protein
Significantly impair physiologic functions. An IWL of 15% or more is associated with a 20% loss of body protein (Hill, 1992).

Surgical Management of Pressure Ulcers During Inpatient Neurologic Rehabilitation: Outcomes for Patients With Spinal Cord Disease

Abhishek Srivastava, MD, et al, Department of Psychiatric and Neurological Rehabilitation, National Institute of Mental Health and Neurosciences, Bangalore, Karnataka, India

Conclusions: All outcome variables showed significant improvement at follow-up with good ulcer healing rate (67.5%), low initial complication (15.6%) and recurrence rate (17.3%), and good neurologic (56.5%) and functional (F, 0.059) recovery. Timely surgical interventions are necessary for Stage III to IV pressure ulcers, and simultaneous inpatient rehabilitation significantly improves outcome of patients with spinal cord disease.

TENSOR FASCIA LATA ROTATIONAL FLAP CLOSURE OF TROCHANTERIC DECUBITUS ULCER WITH OSTEOMYELITIS

A proposed protocol for the surgical treatment of pressure sores based on a study of 337 cases. A. Margara, et al

We compare outcomes in period 1985–1992 with that since 1992, when our present protocol was adopted. The latter protocol is based on rigorous assessment of the preoperative general and specific conditions, the use of specific flaps for each involved region, and appropriate domiciliary medical assistance [3, 5, 17]. The choice of a specific myocutaneous flap depends on two factors:

(a) a flap which is specifically indicated for the area involved, and
(b) the ability of the chosen flap to be re-harvested if the decubitus recurs.

The rigorous use of these criteria has improved the results in terms of initial healing and thus significantly reduced the recurrence rate.

Extraordinary Cases: Abdominal Wounds & Myocutaneous Flaps

We describe two extraordinary cases: abdominal wounds and myocutaneous flaps.

1. Large volume necrotic sacral wound
2. Large volume sacral wound
3. V-Y advancement flap closure
4. Extraordinary Cases: Abdominal Wounds & Myocutaneous Flaps

Round two for this 50y.o. paraplegic who presented with recurrent sacral & bilateral trochanteric decubiti osteomyelitis, 8 years after primary flap reconstruction of both hips.
**Extraordinary Cases: Abdominal Wounds & Myocutaneous Flaps**

**22 y.o. patient s/p MVA with slow recovery from anoxic brain injury, did not receive adequate care in a local SNIF.**

- **The results of flap surgery were excellent in 32 (86-48%) patients,**

  - good in 4 (10.81%) patients and poor in 1 (2.7%) patient.

  - Partial flap necrosis (7.2%), low incidence of PrU recurrence rate at flap site (5.4%) and overall PrU recurrence (11.4%) were the complications observed.

  - Improvisation of classic and modified techniques of flap surgery along with reinforcement of general care principles of paraplegia can be effective in minimising complications often associated with PrU reconstructive surgery thus improving the ultimate outcome.

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**NPWT: a Bridge to Flap, Control Large Wound, and/or Promote Primary Wound Healing**

**Patients should not be transported off of the low air loss mattress or its equivalent for a minimum of four to six weeks & dry dressing.**

**Patients should call the office at 856-3900 for follow up appointment.**

**NPWT: a Bridge to Flap, Control Large Wound, and/or Promote Primary Wound Healing**

**Questions**

- **Matthew J. Finnegan, MD, FACS, FCCWS**
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**PERIOPERATIVE FLAP CLINICAL PATHWAY**

- **All patients receiving flap care should be notified as to what measures are being completed and the outcomes of their wound.**

- **Patients with multiple co-morbidities should have a medical consult in hospital and appropriate follow up.** They used close monitoring in the SNIF or Rehab for the day that they choose.

- **All patients are required to move from side to side on a standard 2 hour rotating schedule until monitoring is normal and intravenous fluids are no longer necessary.**

- **No extra padding/seat to be added. This may cause additional pressure.**

- **Patients need Foley catheters for 6 weeks to prevent urinary contamination of the flap.**

- **If they do not have a colostomy, fecal bag or aggressive care to prevent any stool contact with the flap is mandatory.**

- **Cleanse incision and drain sites (if applicable) with NSS or wound cleanser. Apply Bacitracin lightly, adhesive & dry dressing for two weeks post flap.** Incisions may be debridged for necrotic tissue. Medipore tape should be used. No silk tape.

- **After four weeks for sacral flap and 6 weeks for an incision flap, Dr. Finnegan or his nurse practitioner will check on your incision protocol.**

- **IV antibiotics will be ordered for all patients.** Most patients require twice-a-day IV antibiotics. Patients with honey infection or severe cellulitis will need IV antibiotics. **Patients with a history of diabetes will require an increased dose of insulin for wound healing and all post incision accordingly.** Any changes in the medications will be called directly to the health care provider.

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**PERIOPERATIVE FLAP CLINICAL PATHWAY**

- **Please review all existing medications with the patient, to comply with current medication procurement regulations.**

- **Giving of medications that may adversely affect wound healing is contraindicated.**

- **Dressings should be changed every 24 hours. Dr. Finnegan or his nurse practitioner will check on your incision protocol.**

- **Patients should not be transported off of the low air loss mattress or its equivalent for a minimum of four to six weeks.**

- **NPWT: a Bridge to Flap, Control Large Wound, and/or Promote Primary Wound Healing**

- **Questions**

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