



Clinical study

# Necrotizing soft tissue infections developing from pressure ulcers



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## KEYWORDS

Pressure ulcer;  
Soft tissue infection;  
Necrotizing fasciitis;  
Bacteremia

**Abstract** *Aim of the study:* Necrotizing soft tissue infections (STIs) are serious complications that may arise from pressure ulcers. However, there are few studies on this important issue. In addition, diagnostic criteria for necrotizing STIs developing from pressure ulcers and infected pressure ulcers are not well established. *Methods:* We defined necrotizing STIs developing from pressure ulcers based on clinical findings. Based on the definition, we retrospectively analyzed the medical records of 24 elderly patients with this condition to determine patient age, gender, comorbid disease, laboratory findings, wound location, bacteriology, and treatment outcomes.

*Results:* In the examined population, necrotizing STIs developed primarily from pressure ulcers over the sacrum. Dementia and diabetes mellitus were also frequently observed in patients with necrotizing STIs. The average Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score was relatively low. Bacterial cultures from the debrided deep tissues exhibited mixed infections of gram-positive cocci and gram-negative bacilli, except 1 case. Anaerobic pathogens were isolated from 18 patients (72%), and 7 patients (29%) developed bacteremia. None of the cases were preceded by wounds dominated by granulation tissue. Surgical intervention, combined with antibacterial therapy involving intravenous carbapenem or cephem, was successfully used in most cases.

*Conclusion:* Necrotizing STIs arising from pressure ulcers are generally caused by mixed pathogens and exhibit symptoms that are milder than those of necrotizing fasciitis caused by group A *Streptococcus*.

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## Introduction

Necrotic tissue is always present in deep pressure ulcers, and soft tissue infections (STIs) often develop from the necrotic tissue. Some necrotizing STIs, such as necrotizing fasciitis (NF) and gas gangrene are potentially life threatening. NF is characterized by extensive, rapidly progressive necrosis of the fascia, followed by necrosis of the subcutaneous tissue, with an overall mortality rate of 25–30% [1,2]. However, the clinical features of necrotizing STIs developed from pressure ulcers are not well documented [3]. Necrotizing STIs have a significant impact on patients with pressure ulcers because these STIs dramatically increase wound volume and often induce sepsis. Although pressure ulcers develop over bony prominences and infected pressure ulcers have been previously reported [3,4], STIs may also extend beyond the pressure ulcer lesion. Therefore, studies are required to characterize these necrotizing STIs that develop from pressure ulcers.

Generally, NF is the most severe STI and is accompanied by systemic symptoms, including fever and shock. Moreover, NF often leads to sepsis. Therefore, the clinical features of necrotizing STIs are important in the management of pressure ulcers. In addition, whether necrotizing STIs that develop from pressure ulcers show clinical features distinct from fulminant NF (type II NF) is unclear. However, the etiology of necrotizing STIs that develop from pressure ulcers is not well understood. Furthermore, the terminology of “necrotizing STIs from pressure ulcers” and “pressure ulcer infections” has not been defined. This study aimed to investigate the characteristics of necrotizing STIs that develop from pressure ulcers.

## Methods

### Cases

All patients in this study were observed at a medical center with 300 beds; more than 90% of the patients hospitalized at the medical center were aged >65 years. This retrospective review examined patient medical records created between January 2005 and December 2012. The records of patients who had necrotizing STIs that developed from pressure ulcers were analyzed. This study complied with the ethical tenets for human experimentation outlined in the 1975 Declaration of Helsinki.

The pressure ulcers were staged according to the National Pressure Ulcer Advisory Panel

(NPUAP) criteria, with the wound locations being described according to the bony prominence over which they developed. All patients were analyzed with regard to the recorded surgical interventions, laboratory data, and microbiological and histological findings. The Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score [5] was calculated for each patient on the day of hospital admission using clinical laboratory data comprising white blood cell counts and levels of glucose, C-reactive protein (CRP), sodium, serum creatinine, and hemoglobin. Information about age, gender, anatomical location of the pressure ulcer, antibacterial treatments, and 30-day mortality were extracted from each patient’s medical record.

### Definition and diagnosis of necrotizing STIs that develop from pressure ulcers

Necrotizing STIs, including necrotizing fasciitis, gas gangrene, and other clinical entities, cause necrosis of the subcutaneous tissue, fascia, and muscle. However, deep pressure ulcers also result in soft tissue necrosis. To distinguish between the 2 conditions, necrotizing STIs were defined as shown in Fig. 1. Necrotizing STIs were defined as those extending beyond the area immediately over the bony prominence and were, therefore, not limited to the primary ischemic tissue generated by excessive pressure.

In this study, necrotizing STIs that developed from pressure ulcers were diagnosed by a board-certificated dermatologist. In brief, the diagnosis was determined based on the presence of necrotic fascia and fat tissue, accompanied by direct observations during surgical debridement and/or pathological findings and/or computed tomography evidence of the presence of gas within the soft tissue adjacent to the pressure ulcer. Infections limited to necrotic tissue and developing as a result of pressure-induced ischemia were excluded (Fig. 1).

## Results

### Patient characterization

During the 8-year study period, 624 hospitalized patients were diagnosed with pressure ulcers; 24 (4%) were diagnosed with necrotizing STIs that developed from pressure ulcers (Table 1). Among the 24 patients with STIs, the average age was 82.9 (range, 65–98) years and 14 (58%) were female.

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