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Necroziting fasciitis in the lower extremity secondary to the diabetic wounds

Bacakta diyabetik yaralara bağlı nekrozitan fasiit

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Amaç: Bacaktaki diyabetik yaralara bağlı gelişen nekrozitan fasiit (NF) nedeniyle tedavi edilen hastalar retrospektif olarak incelendi.

Çalışma planı: Çalışmaya bacağında diyabetik yaralara bağlı olarak NF gelişen 16 hasta (11 erkek, 5 kadın; ort. yaş 63; dağılım 50-82) alındı. Ek olarak, üç hastada koroner arter hastalığı, üç hastada ise diyabetik nefropatiye bağlı kronik böbrek yetmezliği vardı. Tüm hastalar fizik muayene, laboratuvar bulguları, direkt grafiler, kan basıncı, alınan kültür sonuçları, uygulanan tedaviler ve sonuçları açısından değerlendirildi. Hastaların hastanede kalış süresi ortalaması 26 gündü (dağılım 5-59 gün).

Sonuçlar: Dört hastada NF bacakla sınırlıyken, 10 hastada fasiit uyluğa uzanmıştı. İki olguda iki taraflı bacak tutulumu vardı. On bir hastada (%68.8) ağrı yakınması vardı. On dört hastada (%87.5) kretin kinaz değerinde artış görüldü. Direkt grafilerde yedi hastada (%43.8) yumuşak dokuda gaz görüldü. İlk cerrahi müdahale sırasında alınan kültürlerde dört hastada (%25) bir mikroorganizma, beş hastada (%31.3) ise birden fazla mikroorganizma üredi. İzole edilen 17 mikroorganizmanın 10'u (%58.8) enterobakter ailesinden idi. On bir hastaya (%68.8) dizüstü, üç hastaya (%18.8) dizaltı amputasyon yapıldı. Dört hastada ilk tedavi olarak kalça dezartikülasyonu uygulandı. İlk cerrahi girişimlerinden sonra ortalama beş kez (dağılım 2-21) debridman yapıldı. Dokuz hastada septik şok gelişti. Çoklu organ yetmezliği gelişen yedi hasta (%43.8) kaybedildi. Ölen hastalarda kreatin kinaz düzeyleri diğer hastalara göre anlamlı derecede yüksek bulundu ($p<0.05$).

Çıkarımlar: Diyabetik hastaların bacaklarında gelişen ve ölümcül bir enfeksiyon olan NF'de erken ve doğru tanı ve acil cerrahi tedavi hastalar için yaşam kurtarıcı olabilir.

Anahtar sözcükler: Debridman; diabetes mellitus/komplikasyon; ekstremite/cerrahi; fasya/patoloji/cerrahi; fasiit, nekrotizan/tanı/mikrobiyoloji/cerrahi; sağkalım oranı.

Objectives: The aim of this retrospective study was to evaluate patients who developed necrotizing fasciitis (NF) in the lower extremity secondary to diabetic wounds.

Methods: The study included sixteen patients (11 men, 5 women; mean age 63 years; range 50 to 82 years) who were treated for NF arising from diabetic wounds. Associated diseases were coronary heart disease in three patients, and chronic renal failure due to diabetic nephropathy in three patients. The patients were evaluated by physical examination, direct radiographs, blood pressure measurements, and cultures, and with respect to treatment methods and results. The mean hospitalization period was 26 days (range 5 to 59 days).

Results: Necrotizing fasciitis was confined to the leg in four patients, extended to the thigh in 10 patients, and was bilateral in two patients. Pain was encountered in 10 patients (68.8%). Fourteen patients (87.5%) had increased creatine kinase levels. Direct radiographs showed gas appearance in soft tissues in seven patients (43.8%). Cultures showed a single microorganism in four patients (25%), and multiple microorganisms in five patients (31.3%). Of seventeen microorganisms isolated, 10 (58.8%) were Enterobacter species. Eleven patients (68.8%) underwent above-the-knee, and three patients (18.8%) underwent below-the-knee amputations. Disarticulation of the hip was performed in four patients. The mean number of debridements was five (range 2 to 21) following the initial surgical intervention. Nine patients developed septic shock. Seven patients (43.8%) died due to multiple organ failure. Increased creatine kinase levels were significantly associated with mortality ($p<0.05$).

Conclusion: Early and accurate diagnosis and prompt surgical treatment may be life-saving in diabetic patients with NF of the lower extremity.

Key words: Debridement; diabetes mellitus/complications; extremities/surgery; fascia/pathology/surgery; fasciitis, necrotizing/diagnosis/microbiology/surgery; survival rate.

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Necroziting faciitis(NF),is a rare, rapidly progressive infection of subcutaneous tissue and fascia leading to thrombosis of the cutaneous microcirculation (1). It is probably the most rapidly progressive infection of soft tissue,which can spread to the whole extremity in hours(2,3). In the case of delayed diagnosis and treatment,the mortality rate can rise up to 70-100 % (4-6). When an orthopaedic surgeon faces a severe and mortal infection like this, he has to diagnose then perform surgical and reconstructive procedures immediately.

Improper injections, minor lacerations, deep wounds, surgical interventions and diabetic wounds can be a portal for entry of NF (7). In the presence of co-morbidities like diabetes mellitus, hypertension, intestinal malignancies or peripheral vessel disorders,the mortality rate increases (1-8). The diagnosis of NF may be difficult, since its clinical findings are similiar to abcess and cellulitis, and cutaneous presentation of a rapidly progressing infection is not noticeable(9).

Diabetic patients have a tendency to this infection due to disfunction of leukocytic fagocytosis and chemotaxis(10). Furthermore, wound healing problems, polyneuropathies and chronic vessel disorders in such patients are high risk factors for NF (8).

According to microbiologic cultures, NF is classified in two types (11). In type I infections there is usually an association of different synergistic micro organisms; non-A group streptococcus, aerobic and anaerobic bacteria are isolated. In type II NF, pyogenic streptococcus or staphylococcus are the agents.

In our study, patients with NF secondary to diabetic wounds were retrospectively evaluated. We tried to determine the clinical presentation, microbiologic features and risk factors affecting the mortality rate of NF.

Patients and method

Sixteen patients with NF in a lower extremity secondary to diabetic wounds were evaluated between 1999-2003 in our clinic (11 male, 5 female; mean age 63; range 50 to 82 years). Three patients had coronary artery disease and three of the patients had chronic renal failure secondary to diabetic nephropathy.

Severe pain, fever, diffuse swelling in the whole extremity, erythema, blue coloration of skin, haemorrhagic bullae and necrosis are looked for in physical examination. X-rays of the involved lower extremities were taken. The following operative findings were used for a definitive diagnosis: the presence of necrotic grayish fascia, demonstration of a lack of resistance of normally adherent muscular fascia to blunt dissection, lack of bleeding of fascia during dissection and presence of foul-smelling 'dish-water' pus.

In the presence of septic shock signs, such as tachycardia(pulse > 100 beats per minute), hypotension (arterial pressure below 90 mm Hg), patients were followed up in intensive care units.

Early debridement was performed.The boundaries of skin excision were determined according to the involvement and viability of infected tissues. Since fascia involvement was thought to be more widespread than indicated on the skin, debridement was continued to the viable tissue layer.Wounds were not closed. In the first 48 hours a second debridement was performed in cases where infection could not be controlled. Serum glucose irregulation (serum glucose level > 350 mg/dl), rapidly widespread involvement with muscles and septic shock were indications for amputation.

During the first physical evaluation and operative debridement, cultures of tissue specimens were obtained, infectious diseases department consulted and antibiotic therapy was initiated according to the culture results.

The relationship between the mortality rate and laboratory predictor variables such as total white blood-cell count, erythrocyte sedimentation rate, hyponatremia, C-reactive protein and creatine kinase values was evaluated with Mann-Whitney U-test, statistically; a p value of <0.05 was considered significant.

The hospitalization time of the patients was mean 26 days (range 5-59).

Results

At the first physical examination ten patients had NF in their calf; four in the thigh and in two patients both legs were affected.

Table 1. Findings of the patients

Finding	No	Percentage
Fever (38.0 °C)	3	18.8
Hypotension (P cystolic< 90mm Hg)	4	25.0
Hiponatremia (< 135 mEq/L)	6	37.5
Gas on X ray	7	43.8

Table 2. Mean values of laboratory tests related to mortality

Laboratory test	Mean value
WBC count (/mm_)	12700 (4500-25500)
Erytrocyte sedimentation rate (mm/hour)	71 (21-141)
Creatyn kinaese (UI/L)	352 (38-1433)
C-reactive protein (mg/ L)	9.8 (1.8-18.9)

The clinical findings and laboratory results of the initial diagnosis are shown in Table 1 and operative treatment procedures in Table 2. In eleven patients (68.8 %) there were complaints of pain. An increase in creatyn kinaese level was present in fourteen patients (87.5%). On plain radiographs there was gas in soft tissue in seven patients (43.8%). There was no significant relation between mortality and the following variables: total white blood count, erytrocyte sedimentation rate, C-reactive protein, hyponatremia. However, the increase of creatine kinase levels was significant ($p<0.05$).

A single organism was identified from the culture of the surgical material of the first surgical debridement in four (25%) patients (Type II NF), and more than one organism in five (31.3%) patients. In seven patients no organism was identified. Ten of the seventeen (58.8%)

organisms that were identified from cultures of these nine patients belonged to the enterobacteria family(Proteus, Citrobacter,Klebsiella), four of them (%23.5)were staphylococcal species and three (17.7%) acinetobacter species.

As treatment eleven patients (68.8%) underwent above the knee amputation, 3 patients (18.8%) below the knee amputation.Two of the patients who underwent above the knee amputation had to have hip disarticulation later. As first surgery two patients had hip disarticulation. After the first surgery, patients had serial debridements on average five times (range 2-21). (Table 3).

During hospitalization nine patients had septic shock. Seven patients (43.8%) died due to multiple organ failure.

Discussion

Patients with NF secondary to diabetic wounds usually exhibit with acute pain, swelling and fever. Tenderness and erythematous local abscess are signs of NF. Pain perception, which is an important sign of NF, is defective in diabetic patients due to polyneuropathy and neuralgic problems. In our patients swelling, crepitation and tenderness under palpation were seen in the affected area together with diabetic wounds.

The presence of non pitting edema extending beyond the erythematous skin patch distinguishes NF infection from erysipelas. When the disease progresses[13] the edema can become massive and patches of dusky blue discoloration and bulles are noted. Bulles are full of serous or brown-reddish 'dishwater' pus fluid. [12] Wong et al noted that the presence of bullae filled with serous fluid is an important diagnostic clue. (14) Weiss and Laverdiere also noted the formation of bullae early in the course of the disease.[15] Crepitation is uncommon but gas on plain radiographs is a common sign. Wong et al.[14] encountered gas on plain radiographs in 17% of their patients. Erythema and foul smelling discharge were seen in all patients and bulles were seen in 3 patients. Gas in soft tissues on plain radiographs were seen in 7 patients.(43.8%)

Reliance upon adjunctive diagnostic tests may

Table 3. Clinic presentations and treatments

	No	Percentage(%)
Localization		
Calf	6	37.5
Thigh	6	37.5
Trunk	4	25.0
Amputation level		
Below knee	3	18.8
Above knee	11	68.8
Level elevation	2	12.5
Hip disarticulation	2	12.5
Septic shock	9	56.3
Multiple organ failure	7	43.8
Exitus	7	43.8

delay diagnosis. Tang et al. believe that an accurate diagnosis of infection can be made clinically and that no investigation can replace meticulous and repeated physical examination. Laboratory study will reveal a significant WBC count and relative percentage of immature polymorphonuclear cells may be strikingly high. Raised creatine kinase level may be helpful in suggesting a deep seated infection (6, 16). In our patients increased serum ESR and leukocytosis were definite. In 14 patients (87.5%) increased levels of creatine kinase were seen. There was no significant relationship between the creatine kinase level and mortality

Angiothrombotic microbial invasion and liquefactive necrosis are seen in NF. Histologically, necrosis of the superficial fascia, PMNL infiltration of deep dermis and fascia, thrombosis and suppuration of veins and arteries coursing through the fascia and micro organism proliferation within the destroyed fascia are seen.[17] In our cases, diagnosis was made clinically and as surgery was generally carried out immediately,there was no opportunity for histological examination.

Fascia and skin can be easily separated in wound examination. NF secondary to wounds on legs can spread to the thigh, proximal hip and abdomen. Mortality can reach 75% due to DIC and multi organ failure secondary to septic shock if the abdominal wall is affected. Four of our patients had pelvic and abdominal involvement despite even hip disarticulation.

Isolation of micro organisms like clostridia that require a cultured anaerobic environment and Natiyoglicolate media is very difficult. Type 1 infections are mostly detected in diabetic patients and these are the most common type of infection (53%) according to Wong et al[14]. In another study streptococcus and enterobacteria were the most common isolated microorganisms [11]. In our study where 5 patients had type 1 NF and 4 patients type 2, the most commonly isolated micro organisms were enterobacteria and staphylococcus. Acinetobacteria was isolated in 3 patients' cultures, although this has not been commonly reported in published literature.

The use of broad spectrum antibiotics prior to admission may modify the clinical picture at the time of presentation. Antibiotherapy may mask the severity of the pathology [13]. It has been reported that many patients suffer from septic shock and multi organ failure due to random antibiotic usage for wounds.[3,20] Nine of our patients had a history of antibiotic usage before diagnosis, but this did not change our diagnosis.

Early diagnosis and aggressive surgical debridmant is the cornerstone principle in the treatment of NF (11). We performed early debridement and frequent checks for recurrent debridements if needed. (average 5, distribution 2-21). Eleven patients with severe infection underwent above the knee amputation, 3 below the knee amputation and 2 had hip disarticulation. Two of the patients who underwent previous above the knee amputation had hip disarticulation later.

Patients with septic shock and multi organ failure were followed up in intensive care units after surgery. Combined broad spectrum antibiotics were used before obtaining the culture results. Majeski and Alexander[21] emphasize nutritional hiperalimentation as an important adjunct to surgical debridement and antibiotic therapy. Some recommended hyperbaric oxygen therapy but its advantages are questionable[1]. Another treatment choice is IVIG therapy,[22] but we don't have any experience of these two treatment choices.

NF secondary to diabetic foot is serious and has a high mortality rate. NF must be suspected in patients with extremity pain of unknown cause. In the early phase of the disease it can easily be misdiagnosed as an abscess or cellulites by emergency room doctors or young orthopaedic surgeons. So an experienced doctor must be consulted and the patient must be evaluated together. In the diagnosis and treatment of NF, anaesthetists and infectious diseases doctors must be consulted. Early surgery is a cornerstone of the treatment.Doctors and the patient's relatives must be aware of the high mortality rate even if there has been prompt and careful evaluation of a patient with NF, especially those with proximal lesions.

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