

The Outcomes of Management of Necrotizing Soft Tissue- Infections in Lower Limbs of Diabetic Patients



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Abstract: Necrotizing soft tissue infection (NSTI) of the lower limb in diabetic patients (pts) is a common serious problem and is often associated with serious complications such as increased morbidity and mortality. The study aimed to assess 3 years (yrs) experience of NSTI and to review treatment and outcome in diabetic pts at Al Thoura Teaching Hospital between May 1ST 2014 –30th April 2017, over a period of 3 yrs. 24 cases of NSTI of lower limbs in diabetic pts were admitted in the period of MAY 1ST 2014 –30th April 2017. Assessment and analyzing details about their presentation, clinical features, predisposing factors, treatment offered, and outcomes were performed. 16 male and 8 female pts with a mean age of 56.4 yrs (range of 39- 78 yrs) were included. Majority of patients were in the age group of 50 to 70 yrs. The most important risk factors were (glycosylated HbA1c > 9.5% in 91.66%), smoking (58.33%), hypertension and hyperlipidemia (66.66% & 83.33% respectively). Neuropathy was found in 62.5% and PVD in 50%. The total involved feet are 27. The port of infection was mostly by previous unhealed feet ulcer 48.1%. The most operated surgical procedure is aggressive frequent necrectomy (51%). Multiple toes amputations and extended tarsal amputation were needed in 29.6% and 20.8% respectively. The need for grafting, flap advancement after surgical control of infection was needed in 6 cases. The failure rate of conservative surgery was 11.11%. Complete healing was in 70.37% of cases. The morbidity rate was high in all patients in this study 92.59%. The mortality rate was 3.7%. We conclude that NSTI of lower limbs is a life-threatening infective condition, common among diabetic patients, and early diagnosis with immediate and frequent surgical debridement could reduce systemic complications, morbidity, and mortality considerably.

Keywords: PVD (peripheral vascular disease), DFS (Diabetic foot syndrome), Necrotizing soft tissue infection (NSTI), patient (pts), osteomyelitis (O.M).

INTRODUCTION

Diabetes is a common disease affecting one million patients in the UK, about 2% of the whole population (Griffiths, 2002). Diabetic foot is a serious complication of diabetes mellitus and in some cases is the initial presentation of undiagnosed diabetes (Zafar, 2001). Diabetic foot syndrome (DFS) is a complex and heterogeneous disorder that affects 1 out of 5 patients with diabetes at least once in his or her lifetime with relevant con-

sequences both on lower limb survival and general morbidity (Levin, 1995). Up to 15% of patients with diabetes will develop DFS at least once in their lives. Individuals with diabetes have at least a 10-fold greater risk of being hospitalized for soft tissue and bone infections of the foot than the individuals without diabetes (Boyko & Lipsky, 1995). The Necrotizing soft tissues infection (NSTI) is a severe, serious, and maybe lethal complications of DFS. The NSTI is generally defined as any severe progressive infectious

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process affecting the skin, subcutaneous tissue, adipose tissue, superficial or deep fascia, ligaments, tendons, sheaths, joint capsules, and joints. The commonest predictor to this type of infection is a poorly controlled DM with or without previous foot ulceration. The foot ulcerations and infections associated with diabetes were the second most common cause of necrotizing fasciitis, and 15.2% of cases of necrotizing fasciitis were due to foot ulcerations and infections associated with diabetes (Elliott, Kufera, & Myers, 1996). The presence of Peripheral neuropathy which has been estimated to affect about 50% of patients, and PVD which affects as many as 40% of patients with diabetes with long duration of disease (Levin, 1995; Reiber, Boyko, & Smith, 1995), immunopathy, patient negligence to local minor trauma or mild infection, all these factors worsened the condition and lead to rapid progressive invasion threatening limb and life. The key of management is by early diagnosis and prompt surgical management that can reduce complications, morbidity and mortality rate. The aim of this study was to analyze the outcomes of treatment of necrotizing soft-tissue infections of the lower limbs of diabetic patients and to determine factors associated with limb salvage and mortality.

MATERIAL AND METHODS:

We have conducted a prospective a study by the same surgical team for 24 patients (27 feet/legs) with necrotizing soft tissue infection cases admitted to the surgical department At El- Thoura Teaching Hospital. These emergency cases were diagnosed with severe necrotizing infection during 3 years period from 1st May 2014 to 30th April 2017. All patients were treated with multiple radical surgical debridements with a combination of broad-spectrum antibiotics and metronidazole.

All cases were collected and analyzed during this period of study. Information used in the study: demographic data, types of DM, and

the underlying risk factors like smoking, hypertension, hyperlipidemia, renal impairment, and glycosylated Hb at time of presentation. The presence of neuropathy, ischemia, previous foot ulcer, mechanism of infection entry, main operative finding, location and extent of infection, X-ray finding, types of surgery done, and the outcome of the treatment, Mortality, and hospital stay.

RESULTS

24 diabetic patients (pts) with necrotizing foot infection (NSTI) were admitted to the surgical department as an emergency during the period from May 1st, 2014 to 30th April 2017 for urgent major surgical interventions to control the infection and to save limb and life. All pts were treated primarily with immediate aggressive and frequent conservative surgery (in the form of radical excision of all devitalized/necrotic tissues). The mean age for the cases included in the study was 56.4 years, age range: 39- 78 years. Most of pts ages were in 6th and 7th decades (ages of negligence), both forming 66.6% of all cases in the study group. The male patients seem to be more affected by double than female pts (male: female ratio 2:1). The duration of diabetes mellitus (DM) ranges from 15- 30 yrs. Type II DM was almost in all cases in this series 91.66%, type I DM was less present in our study 8.33%. Risk factors among the study group are shown in (Table 1).

Table (1).Risk factors

Factor		NO	%
Gender	Men	16	66.66
	women	8	33.33
Age [yrs]	mean	56.4 yrs	
	range	39- 78yrs	
Types of Dm	Type I:	2	8.33
	Type II:	22	91.66
Underlying Risk/systemic factors:	HbA1C (> 9.5%)	22	91.66
	SMOKING	14	58.33
	HTN	16	66.66
	Renal impairment	5	20.83
	Hyperlipidaemias	20	83.33
Neuropathy	Sensation lost	15	62.5
	Charcot ankle	1	4.1
Ischaemia	IHD	7	29.16
	TIA, CVA	3	12.5
	PVD	12	50%
Previous Feet Ulcer/sinuses (13)(54.16%)	Underling chronic osteomyelitis	5	20.83
	Trophic/neuropathic	4	16.66
	Ischaemic	4	16.66
Previous vascular intervention: (PTA/ BY P ASS)		5	20.83

The most important risk for necrotizing infection was poorly/ uncontrolled diabetes with glycosylated HbA1c > 9.5%, which was found in most of the cases included in the study 91.66%, followed by smoking which was found only in all male pts in the study 58.33% (as Libyan females do not smoke). The other two important coexisting systemic factors are hypertension and hyperlipidemia which form 66.66% and 83.33% respectively, as the later factor is directly related to high glycosylated HbA1c. Most of renal impairment precipitated by septicemic events of severe necrotizing infections where found in about 5th of the cases included in this series. As kidneys of diabetic pts are prone to nephropathy at any stage if the DM is not under control. The presence of neuropathy, which was detected by loss of sensation, was found in 62.5% of the study group (this explains negligence minor trauma & simple infection). The lack of joint stability with no sensation of the position of a joint (Charcot ankle joint) was found in 4.1% of the cases. Half of the cases (50%) had obvious peripheral ischemic signs on both feet and legs in

the form of skin changing toes, naildeformities, and feeble/ absent distal pulses. Other ischemic events (IHD, TIA, CVA) were found in 41.66% of pts. The presence of previous feet ulcer/ sinuses were found in more than half of the cases (54.16%) which were important predictors of losing limb in future. One fifth, 20.8%, of all pts in the study were exposed before to surgical/radiological vascular intervention. The total involved feet are 27 (as 3 cases in the study were a bilateral involvement). The port of infection to the feet was mostly by previous pre-existing unhealed feet ulcer, which was found in about half of the cases 48.1%, (table 2). Other sources of infections are due to feet injury from glasses, needle, nail, spikes, and blunt traumas were found in about 18.51%. The acute nail infection (acute paronychia) and neglected calluses were found in 11.11% & 7.4% respectively. 14.8% of cases had an unknown mechanism of entry of microorganisms to the soft tissues of the susceptible feet to the infections. All cases were presented clinically with a characterized offensive smell noted by family or by the patient himself, and symptoms and signs of severe in-

flammation like fever, anorexia, vomiting, gangrene, and multiple skip lesions (table 2). local signs of redness, swelling, crepitus, wet

Table (2).Source of infections, the outcomes of the management.

		Total Involved Extremities	27	100 %
Mechanism of entry of infection (portal of entry of infection)	- Foot injury (glass, needle, nail, spike)		3	11.11
	- Acute paronychia		3	11.11
	- Previous ulcer		13	48.14
	- Callosities		2	7.4
	- Trauma		2	7.4
	- Unknown		4	14.81
Sign of severe inflammation ± offensive discharge:	- Redness, swelling, Crepitus		14	51.85
	- Wet Gangrene		6	22.22
	- Multiple Skip lesions (fig)		7	25.92
Involvement of the limb (location of infection)	- involvement of the foot		11	40.74
	- foot and ankle		8	29.62
	- Foot ,ankle, leg		6	22.22
	- Foot ,ankle, leg and thigh		2	7.40
radiographic findings :	- XRAY [osteomyelitis]		8	29.62
	- Gas bubbles		5	20.83
	- Unremarkable		14	51.85
Operative findings: (with offensive pus)	- necrotizing cellulitis		6	22.22
	- necrotizing fasciitis		15	55.55
	- myonecrosis		6	22.22
TYPES OF CONSERVATIVE SURGERY DONE:	- Aggressive frequent necrectomy (2-6 times)		14	51.85
	- 1-3 Toes amputations + open necrectomy		8	29.62
	- Extended forefoot amputation		5	20.83
	- The need for Grafting/flaps		6	22.22
	- Arthrodesis of ankle		1	3.7
Failed conservative surgery	Pt requiring radical (major) surgery (B/K OR A/K amputations)		3	11.11
Treatment outcome (Long term result & complications)	- Complete healing		19	70.37
	- Chronic sinus		1	3.70
	- Chronic ulcer		2	7.40
	- Requiring surgery after 1 yr		2	7.40
Mortality			1	3.7
Number of days in the hospital	- < 1month		25	92.59
	- >1 months		2	7.4

Feet were only affected by infection In 40.74% of patients, and about one third of cases were foot&ankle involved, and about one fifth of cases 22.22% were foot, ankle, leg involved. The entire limb involved (one side) was found in 7.4% of cases in the group. Radiography was done for all pts with an unremarkable finding in about half of the cases (51.85%), and the other half 48.14% experienced signs of osteomyelitis (O.M) and gas bubble. All pts underwent primarily emergency conservative surgery with an operative finding of spreading necrotizing cel-

lulitis and fasciitis with offensive pus. Frank Muscle necrosis was found in 6 cases (22.22%). The most common surgical procedure is aggressive/ radical frequent debridement (necrectomy) 51% up to 6 times per case under regional/ general anesthesia which is a risk in some pts heart or brain ischemia. Multiple toes amputations and extended tarsal amputation were needed in some cases (29.6% & 20.8% respectively). The need for grafting or flap advancement after surgical control of infection on a healthy granulating wound was in 6 cases with accepted post-operative results. Fixation of an unstable an-

kle joint by Arthrodesis was in one case (3.7%).

The failure rate of conservative surgery was 11.11%, where 3 pts require major surgery (below or above knee amputations) due to the uncontrolled rapidly spreading infection that threatening pts life, after an extensive trial of preservation surgeries. All pts were checked for more than one year with good long term results of conservative surgery. Complete healing was in 70.37% of the cases, and the remaining was ulcer & sinuses in about 11.11%. The requirement for additional wound surgery (excision of residual O.M bone, debridement for recurrent infection) was in 2 cases (7.40%). The morbidity was high in all patients in the study. Most of pts (92.59%) stayed in hospital from 12 days to one month. In a few occasions, pts stayed for more than 4 weeks due to the need for reconstructive plastic (grafts/ flap advancement) surgeries. The mortality rate was 3.7%, one patient died because of the late presentation with worsened septicemia, acute renal shutdown and associated co-morbid conditions (ischemic heart disease and stroke).

DISCUSSION

Diabetes is increasing in prevalence, especially in developed nations. In the United States, the prevalence is estimated to be 7.3 percent of adults (Mokdad et al., 2001). Diabetic patients have always suffered from complications affecting the lower limbs. Foot infection and the subsequent amputation of a lower extremity are the most common causes of hospitalization among diabetic patients (Yönem, Cakir, Güler, Azal, & Corakci, 2001). NSTI is a severe form of foot infection and encountered a very serious and lethal conditions, characterized by an extensive necrosis of subcutaneous tissue spreading widely and rapidly to all tissues under the skin and may reach to the bone and joints. It appear normal at first skin, later it becomes affected with cellulitis with or without blis-

ters, then gangrenous patches will appear as skip lesions at advanced stage. It's commonly associated with prolonged poorly controlled diabetes. It affects all ages, especially in immune-compromised pts. In elderly pts, it is a life-threatening condition if not recognized, diagnosed and managed early. Clinically NSTI is classified to necrotizing cellulitis (if subcutaneous tissue and skin affected), as necrotizing fasciitis (if the deep fascia involved), and as myonecrosis (if muscular necrosis happened). NSTI is usually caused by polymicrobial mixed infection (gram +ve cocci, gram -ve bacilli and anaerobic bacteria). The four main factors of neuropathy in the presence of callus or deformity, PVD, penetrating injuries and ill-fitting footwear (Lavery, Peters, & Armstrong, 2008) together with immunopathy and high sugar in tissues give these MO opportunities for invading, destructing and spreading rapidly in foot and limb. The presence of peripheral vascular disease (PVD) interferes with the healing process of ulcers by reducing the amount of tissue oxygen and nutrients and thus lengthening ulcer healing time (A. Boulton, 1991, 1996; Murray & Boulton, 1995), and the presence of diabetic peripheral neuropathy and any degree of distal ischemia act together to put these patients at high risk of limb and life complications. The Peripheral diabetic neuropathy is present in 22–24% of patients who have diabetes (Abbott et al., 2002; Tesfaye et al., 2005). The presence of previous foot ulceration is a very important portal for microorganism to soft tissues and bones. It is estimated that 15-20% of patients with diabetes will develop an ulcer on their foot at some point (A. J. Boulton, Vileikyte, Ragnarson-Tennvall, & Apelqvist, 2005). Such foot ulcers do not heal easily, are difficult to treat, and are more prone to serious infection. The usual presentation of NSTI include pain, toxic symptoms including fever, sweating, nausea, vomiting, chills, and on local examination might found swelling, redness, hotness. The Finding of Crepitus in the

soft tissue is almost diagnostic for this condition but is not always present at the initial presentation. Blistering of the skin and soft tissue gas on radiographic examination are also highly indicative. The diagnosis can only be confirmed by immediate exploratory incision. In fact, Foot infections in diabetic pts are unpredictable, they can rapidly spread over a short period of time or even hours to involve an entire limb and thereby threatening the life. The key to a successful management of NSTI and to save limb and life is by: the first aim after early diagnosis focused on controlling the infection using a high dose of intravenous broad-spectrum antibiotics and metronidazole infusion to cover mixed aerobic and anaerobic M.O, and secondly an immediate surgical intervention by mean of Urgent, aggressive, frequent debridement with no hesitation of excising all unhealthy tissues, exposing tendons, bone, joints with local appropriate wound care which is the only way to reduce mortality rates. The delay in surgical excision of all necrotic tissues can lead to serious systemic complications which may lead to death. The Moderate-to-severe infections should receive aggressive irrigation and debridement with removal of all nonviable skin, soft tissue, and bone (Attinger, Bulan, & Blume, 2000; Frykberg, Wittmayer, & Zgonis, 2007; Wallace, 2007). The reported mortality of 30-40% reflects the inadequacy of conservative surgery in the treatment of this serious condition. The difficulties in treatment of NSTI are mainly due to a delayed diagnosis, late presentation, and delayed surgical interventions. The late presentation of patients to hospital may be due to family negligence, psychological factors, taking traditional treatment initially than early seeking medical advice. Its well-known that the foot infections in persons with diabetes are responsible for more hospital days than any other aspect of diabetes (Durham, Lukens, Campanini, Wright, & Smead, 1991; Gibbons & Eliopoulos, 1984; Nather et al., 2008), especially pts with NSTI who will

stay for longer period of time for daily wound care and debridement. The thinking of reconstructing the damaged limb should be delayed as possible until the wound becomes clean and fully granulating. Failure of conservative local debridement, lacking bone cover by healthy soft tissues, and infection is not under control or rapidly spreading are threatening patient life. The major amputations (below/ above) knees become necessary to preserve pts life, and to reduce hospital stay.

CONCLUSION

NSTI is a severe, serious infection, and often associated with high morbidity and mortality. The key of management is by early diagnosis, high dose of intravenous broad-spectrum antibiotics and metronidazole infusion together with immediate surgical aggressive debridement which shall improve the outcome.

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نتائج معالجة التهاب الأنسجة الغرغريني في الأرجل السكرية

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المستخلص: التهاب الغرغريني للأقدام السكرية هو مشكلة شائعة وخطيرة وعادة ما تكون مصحوبة بمضاعفات خطيرة مع زيادة في معدل التمرض ومعدل الوفيات. تهدف الدراسة إلى تقييم خبرة ومراجعة نتائج علاج هذا النوع من الالتهابات على مدى 3 سنوات في مستشفى الثورة التعليمي ما بين شهر مايو 2014 إلى شهر أبريل 2017. 24 حالة جمعت خلال الفترة المذكورة حيث تم أخذ البيانات وتحليلها والتي منها الصورة الإكلينيكية والعوامل المهيئة للمرض والعلاج المقدم ونتائجه. 24 حالة أدخلت المستشفى بالتهاب أنسجة غرغريني. 16 حالة ذكور و 8 حالات إناث مع متوسط عمر 56.48 سنة تتراوح الأعمار ما بين 39-78 سنة. أغلبهم ما بين 50 إلى 70 عاماً. أهم العوامل المهيئة للمرض كان السكر التراكمي أكثر من 9.5% بنسبة 91.66% متبوعاً بالتدخين (58.33%) ومرض ارتفاع ضغط الدم وارتفاع دهون الدم بنسب (66.66% و 83.33% على التوالي). الاعتلال العصبي كان موجوداً في 62.5% وأمراض الشرايين الطرفية كان في 50% من الحالات. عدد الأقدام/الأرجل 27 قدم. أكثر مدخل للالتهاب هو وجود قرحة سابقة مزمنة في القدم بنسبة 48.1%. أغلب تدخل جراحة أجري هو إزالة شديدة ومتكررة للأنسجة الميتة 51%. بتر متعدد لأصابع القدم وبتر ممتد لمقدمة القدم (29.6% و 20.8% على التوالي). الاحتياج إلى عمليات تجميل بعد السيطرة الجراحية على الالتهاب كان في 6 حالات. معدل فشل الجراحة التحفظية كان 11.11%. الشفاء التام كان في 70.37% من الحالات. بقاء قرحة وجيوب في 11.11%. معدل التمرض كان عالياً في جميع حالات الدراسة 92.59%. معدل الوفيات كان 3.7%. استنتجنا بأن الالتهاب النسيجي الغرغريني للأطراف السفلية هو التهاب مهدد للحياة. شائع بين مرضى السكري. التشخيص المبكر والتدخل الجراحي العاجل والمتكرر لإزالة الأنسجة الميتة يمكن أن ينقذ المضاعفات العامة ومعدل التمرض والوفيات بشكل كبير.

الكلمات المفتاحية: مرض الشريان الطرفية، متلازمة القدم السكرية، الالتهاب النسيجي الغرغريني للأقدام السكرية، الالتهاب العظمي.

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