ORIGINAL ARTICLE

Diabetic Foot: An Underestimated Public Health Problem with its Consequences

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ABSTRACT

Objective: To find out the frequency of different types of amputation in diabetic foot ulcer.
Material and Methods: The prospective study was conducted on 53 consecutive patients in Orthopedic Unit of Hayatabad Medical Complex, Peshawar, from July 2011 to June 2012 over a period of one year. All the patients who have diabetic foot ulcer of Wagner grade four and five were included in the study. Standard hip disarticulation, above knee amputation, trans- knee amputation below knee amputation and ray amputation were performed accordingly.
Results: There were total 53 patients in the study. Male patients were 30 while female were 23. Minimum age was 30 years, maximum 80 while average age was 58.26. According to Wagner grading, 9 patients were grade 4 and the rest were grade 5. Right side was involved in 25(47.2%) patients while left side was involved in 28(52.8%) patients. Amputation of big toe was done in 5(9.4%) patients, amputation of 2 toe in 2(3.8%) patients, amputation of 3 toe in 1(1.9%) patient, amputation of little toe in1(1.9%) patient, below knee amputation in 33(62.3%) patients, trans knee amputation in1 (1.9%) patient, above knee amputation in 9 (17%) patients and hip disarticulation was done in in1 (1.9%) patient.
Conclusion: The end results of prospective research on diabetic foot ulcers indicate that outcome is related to poor glycemic control and longer diabetes duration. Nontraumatic lower extremity diabetic ulcers and amputations are an important and costly problem to patients, health care systems, and the government.
Keywords: Diabetic Foot, Ulcer, Amputation, Wagner grade.

INTRODUCTION

In non insulin dependent diabetes mellitus (NIDDM) and insulin dependent diabetes mellitus (IDDM) there are two common and serious complications, the foot ulcers and amputations, which are associated with significant mortality[1]. Foot ulcers are lesions that involve a skin break with loss of epithelium, and that may extend into the dermis and deeper layers, sometimes involving bone and muscle; while amputation is the removal of a terminal, non-viable portion of the limb[2].

Diabetes is one the leading causes of amputation of the lower limbs throughout the world[3]. Amongst people who have diabetes, amputations are reported to be 15 times more common than amongst other people. 50% of all amputations occur in people who have diabetes.[4] Amputations are done when all the efforts to save the foot or leg are unsuccessful or the infection is causing extensive tissue damage. Infections of the diabetic foot can spread up into the leg. Sometimes the infection is so severe that the foot and possibly part of the leg must be amputated. A serious infection can be life-threatening. In these cases, an amputation may save life[4].

A recent epidemiological data on ulceration and amputation is reported to be the annual incidence of foot ulcers in the general diabetes population just over 2%[5]. Ulceration is much more common in patients with predisposing risk factors; annual incidence rates in neuropathic individuals vary from 5% to over 7%[6]. It is likely that more than 5% of diabetic patients have a history of foot ulcers[7], whereas the cumulative lifetime incidence may be as high as 15%[8].

Up to 85% of amputations are preceded by foot ulcers. It can therefore be presumed that any successes in reducing foot ulcer incidence will be followed by a reduction in the number of amputations. Diabetic patients with neuropathic risk factors incur five times more direct medical costs for ulcers and amputations, and live for 2 months less, than individuals without neuropathy[9].

In United States an average inpatient costs for lower limb complications in 1997 were: foot ulcers $16,580; toe or toe and other distal amputations $25,241; major amputations $31,436[10]. The average outpatient cost for one diabetic foot ulcer episode has

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been estimated at $28,000 over a 2-year period[10]. Proper and early diabetic foot care of these patients with ulcer of the foot or foot at risk may reduce medical cost as well as psychological cost.

We present this study to show the end results of diabetic foot ulcers' patients either admitted as an emergency or as elective case in orthopedic unit over a period of one year.

MATERIAL AND METHODS

The prospective hospital based study was conducted on 53 consecutive patients in Orthopedic Unit of Hayatabad Medical Complex, Peshawar, from July 2011 to June 2012 over a period of one year. All the patients who have diabetic foot ulcer of Wagner[11] grade four and five were included in the study. The severity of the ulcer was graded according to Wagner Classification[11] (Table 1).A thorough history of their diseases was taken, complete physical examination performed and investigations carried out. All the patients were counseled about their conditions which necessitated an urgency of the surgical procedure they had to undergo. Informed written consent was taken from all patients. Some of the patients were admitted on emergency basis and some admitted on elective basis. The techniques used for different amputations depended on the level of amputation and the condition necessitating it. Standard hip disarticulation, above knee amputation, trans- knee amputation below knee amputation and ray amputation were performed accordingly. Amputation site was either primarily closed or left open (and then delayed closure done) depending upon how clean or infected the wound is and subsequently debridement and dressing done. The analysis was performed using SPSS version 10. Frequency of different diseases leading to amputations was recorded.

RESULTS

There were total 53 patients in the study. Male patients were 30 while female were 23 (Table 2). Minimum age was 30 years, maximum 80 while average age was 58.26 (Std. Deviation10.15) (Table 3). According to Wagner grading, 9 patients were grade 4 and the rest were grade 5. Right side was involved in 25(47.2%) patients while left side was involved in 28(52.8%) patients (Table 4).

Amputation of big toe was done in 5(9.4%) patients, amputation of 2 toe in 2(3.8%) patients, amputation of 3 toe in1 (1.9%) patient, amputation of little toe in 1(1.9%) patient, below knee amputation in 33(62.3%) patients, trans knee amputation in 1(1.9%) patient, above knee amputation in 9(17%) patients and hip disarticulation was done in 1(1.9%) patient (Table 5). Three (5.66%) patients had amputation of toes which were again treated with below knee amputation. Four (7.54%) patients of below knee amputation were treated with above knee amputation. Three (5.66%) patients of above knee amputation and 9(17%) patients of below knee amputation had their stump left open. In 1 (1.9%) case of big toe amputation the wound were lift open.

Table 1: Wagner[11] Classification of diabetic foot ulcers

Grades	Description
Grade 0	No ulcer in a high risk foot.
Grade 1	Superficial ulcer involving the full skin thickness but not underlying tissues.
Grade 2	Deep ulcer, penetrating down to ligaments and muscle, but no bone involvement or abscess formation.
Grade 3	Deep ulcer with cellulitis or abscess formation, often with osteomyelitis.
Grade 4	Localized gangrene.
Grade 5	Extensive gangrene involving whole foot

Table 2: Gender of patients (n=53)

Gender	Frequency	%	Cululative%
Female	23	43.4	43.4
Male	30	56.6	100.0

Table 3: Statistics of age of patients

	Age
N	53
Mean	58.26
Median	60.00
Mode	60
Std. Deviation	10.15
Minimum	30
Maximum	80

Table 4: Side involvement of patients (n=53)

Side	Frequency	%	Cululative%
Left	28	52.8	52.8
Right	25	47.2	100.0

Table 5: Different types of amputation (n=53)

	Frequ-ency	%	Cululative %
Amputation of big toe	5	9.4	9.4
Above knee amputation	9	17.0	26.4
Amputation of little toe	1	1.9	28.3
Amputation of 2 toe	2	3.8	32.1
Amputation of 3 toe	1	1.9	34.0
Below knee amputation	33	62.3	96.2
Hip disarticulation	1	1.9	98.1
Trans knee amputation	1	1.9	100.0

DISCUSSION

Many complications can be associated with diabetes. Diabetes disrupts the vascular system, affecting many areas of the body such as the eyes, kidneys, and feet. Studies shows that lower-level amputations (toe, foot, and ankle) were more common in diabetes than in without diabetes (54.8% versus 29.9%). Above-the-knee amputations, which are more disabling than lower-level amputations, were less frequent in diabetes than without diabetes (16.0% versus 38.8%)[12]. Other studies show that the age-adjusted amputation rate calculated per estimated diabetic or total population is ~15-40 times higher for diabetic than for non diabetic individuals. The proportion of hospital discharges listing an amputation that also listed diabetes ranged from 45%-63%[13].

The standard treatment for diabetic foot according to Wagner's classification is Prevention for grade-0, Antibiotics and good glycemic control for grade 1. In grade-2 needs hospital admission, as they need surgical intervention along with antibiotics and glycemic control. Grade-3 requires some sort of amputation. In grade-4 wide debridement and amputation while in grade-5 the preferred treatment is below knee amputation[14].

Abbas et al[15] evaluated 627 diabetes patients in which 92 (15%) had foot ulcers. Of these 92 patients, 30 (33%) were selected for minor and major amputations while the rest were managed conservatively. By severity of ulcers, patients with Wagner score ≥ 4 were significantly more likely to have amputation than those < 4 to have neuroischaemic foot lesions ($P < 0.001$). The overall mortality rates for amputees and non-amputees in their study were similar (29%); the highest in-patient mortality rate (54%) was observed among patients with severe (Wagner grade ≥ 4) ulcers who did not undergo surgery[15].

Muqim et al[16] studied 100 diabetic foot ulcer with Wagner grades ranges from zero to five. In their study Males predominated with 62 % while females were 38 %, with male to female ratio of 3:2 which is comparable to our study in which male patients were 30 (56.6%) while female were 23 (43.4%). Forty-eight(48 %) needed amputation of different types, Toe / Rye's amputation was done in 32 patients, Syme's in 5 patients while 11 patients had below knee amputation. In their study they have only 25(25%) pateits with grade 4 or 5 ulcer while in the present study all the patient that were amputated were in grade 4 or 5[16].

In studies of diabetic outpatients, 6%-43% (depending on ulcer severity) of patients with diabetic foot ulcers ultimately have the most severe diabetic foot outcome, amputation[7]. There are two studies which found that foot ulcers preceded 84% and 85% of amputations, respectively[17,18].

Skoutas et al[20] studied 121 patients with Wagner grade 4 or above diabetic ulcer in which had some type of amputation in all patients. They had done re-amputation in 26 out of 121 patients[19].

A strategy should be followed in managing diabetic foot ulcer in which a single stage surgical approach with total excision of ulcer, broad exposure, correction of underlying osseous deformity and primary closure that should reduce the healing time, with no need for additional surgical procedures, result in decreased hospital stay and cost, also should reduce the recurrence rates[20].

The amputation which represents the most dramatic evolution of foot ulcer has profound psychosocial, economic and functional effects on diabetic patients. For these reasons a global strategy should be developed in order to reduce the incidence of diabetic foot ulcer. A systematic follow-up strategy in high risk patients is highly recommended. The patient education is one of the most important steps for the success of this strategy[21].

CONCLUSION

The end results of prospective research on diabetic foot ulcers indicate that outcome is related to poor glycemic control and longer diabetes duration. Nontraumatic lower extremity diabetic ulcers and amputations are an important and costly problem to patients, health care systems, and the government. Research is needed to address factors leading to amputation such as ulcer healing, management, and recurrence.

REFERENCES

1. Stuck RM, Sohn MW, Budiman-Mak E,Lee TA, Weiss KB. Charcot arthropathy risk elevation in the obese diabetic population. Am J Med 2008;121:1008–1014
2. Frykberg RG, Zgonis T, Armstrong DG, Driver VR, Giurini JM, Kravitz SR et al. Diabetic foot disorders: a clinical practice guideline (2006 revision). J Foot Ankle Surg 2006;45:S1–S66
3. Sohn MW, Lee TA, Stuck RM, Frykberg RG, Budiman-Mak E. Mortality risk of Charcot arthropathy compared with that of diabetic foot ulcer and diabetes alone. Diabetes Care 2009;32:816–821
4. Faglia E, Clerici G, Caminiti M, Quarantiello A, Curci V, Morabito A. Predictive values of transcutaneous oxygen tension for above-the-ankle amputation in diabetic patients with critical limb ischemia. Eur J Vasc Endovasc Surg. 2007; 33(6):731-736.
5. Skoutas D, Papanas N, Georgiadis GS, Zervas V, Manes C, Maltezos E et al. Risk Factors for Ipsilateral Reamputation in Patients with Diabetic Foot Lesions.

International J Lower Extremity Wounds. 2009; 8: 69-74.
6. Ezio F, Giacomo C, Maurizio C, Antonella Q, Vincenzo C Francesco S. Evaluation of Feasibility of Ankle Pressure and Foot Oxymetry Values for the Detection of Critical Limb Ischemia in Diabetic Patients. Vasc Endovascular Surg. 2010 44: 184-9.
7. Abbott CA, Carrington AL, Ashe H. The North-West Diabetes Foot Care Study: incidence of, andrisk factors for, new diabetic foot ulceration in a community-based patient cohort. Diabetic Med.2002; 20:377–384
8. Muller IS, Grauw WJ de, Gerwen WH van. Foot ulceration and lower limb amputation in type 2 diabetic patients in Dutch primary health care. Diabetes Care. 2002;25:570–574
9. Ragnarson-Tennvall G, Apelqvist J Prevention of diabetes-related foot ulcers and amputations: a cost-utility analysis based on Markov model simulation. Diabetologia. 2001; 44:2077–2087
10. Assal JP, Mehnert H, Tritschler HS, Sidorenko A, Keen H.'On your feet' workshop on the diabetic foot. J Diabet Comp.2002; 16:183–194
11. Wagner F, Levin M, & O'Neal L. Supplement: algorithms of foot care. In The Diabetic Foot. 1983. 3 rd ed. St. Louis, MO, CV. Mosby, 1983, p. 291–302.
12. Reiber GE, Vileikyte L, Boyko EJ. Causal pathway for incident lower extremity ulcers in patients with diabetes from two settings. Diabetes Care. 1999;22:157–162.
13. Carrington AL, Shaw JE, Van Schie CHM, Abbott CA, Vileikyte L, Boulton. Can motor nerve conduction velocity predict foot problems in diabetes over a six year outcome period? Diabetes Care. 2002; 25:2010–2015.
14. Reiber GE, Pecoraro RE, Koepsell TD: Risk factors for amputation in patients with diabetes mellitus: A case-control study. Ann Int Med.1992; 117:97-105.
15. Abbas GZ, Lutale J. K, Morbach S, Archibald L. K. Clinical outcome of diabetes patients hospitalized with foot ulcers, Dar es Salaam, Tanzania. Diabetic Medicine.2002;19(7): 575–579.
16. Muqim R, Griffin S, Ahmed M. Evaluation and management of diabetic foot according to wagner's classification;a study of 100 cases. J Ayub Med Coll.2003;15(3):39-42.
17. Pecoraro RE, Reiber GE, Burgess EM: Pathways to diabetic limb amputation: Basis for prevention. Diabetes Care. 1990; 13:513-21.
18. Widatalla AH, Mahadi SI, Shawer MA, Elsayem HA, Ahmed ME. Implementation of diabetic foot ulcer classification system for research purposes to predict lower extremity amputation int J Diabetes Dev Ctries. 2009 Jan-Mar; 29(1): 1–5.
19. Green, Melissa F, Aliabadi, Zarintaj, Green, Bryan T. Diabetic foot: evaluation and management. South Med J 2002;95(1):95-101.
20. Blume, Peter A. Single-Stage surgical treatment of non-infected diabetic foot ulcers. Plast Reconstr Surg 2002; 109 (2): 601-9.
21. Fontana E, Bulliard C, Ruiz J.Diabetic foot: a public health problem too often underestimated. Consequences and therapeutic possibilities. Praxis (Bern 1994). 2001 Dec 20;90(51-52):2261-5.