WEST AFRICAN JOURNAL OF MEDICINE

ORIGINAL ARTICLE

Audit of Diabetic Soft Tissue Infection and Foot Disease in Accra

Vérification des tissus mous des infections et des maladies diabétiques du pied à Accra

E. Asumanu*, R. Ametepi†, C. T. Koney‡

ABSTRACT

BACKGROUND: **Soft tissue infection and foot disease are well known complications among diabetes mellitus patients. With an increasing prevalence of diabetes mellitus in Africa, management of these complications is expected to become a major problem.**

OBJECTIVE: **To audit the surgical management of diabetic soft tissue infection and foot disease over a two-year period in Accra, Ghana.**

METHODS: **A prospective study of all patients admitted to the General Surgical Unit of the 37 Military Hospital between May 2005 and April 2007 was conducted. Diabetic patients with soft tissue infections and foot disease were selected for study. Doppler studies using a monopolar 8 MHz Nicolet vascular probe was used in assessing the ankle to brachial pressure index (ABPI). Patients were managed based on admitting diagnosis and outcomes were noted.**

RESULTS: **Eighty (8.3%) of 966 surgical patients had diabetes mellitus and soft tissue infection or foot disease. The peak age of presentation of diabetics with soft tissue infection or foot disease was 50–59 years. Diabetic foot disease (53.0%) was the commonest followed by cellulitis of the leg and other soft tissue infections. Overall amputation rate was 33.3% while mortality was 8.8%.**

CONCLUSION: **Foot infections, cellulitis, abscesses and gangrene are the common surgical complications of diabetes mellitus patients in Ghana. Abscess of the hand is the commonest non-foot soft tissue surgical complication and had good outcomes. Overall, females presented earlier and had better outcomes than males. WAJM 2010; 29(2): 81–85.**

Keywords: **Diabetes mellitus, soft tissue infection, diabetic foot disease, ulcer.**

RÉSUMÉ

CONTEXTE: *infection des tissus mous et les maladies du pied sont des complications connues et chez les patients diabétiques. Avec une prévalence croissante du diabète sucré en Afrique, la gestion de ces complications est appelé à devenir un problème majeur.*

OBJECTIF: *l'audit de la prise en charge chirurgicale des tissus mous infection diabétiques et les maladies du pied sur une période de deux ans à Accra, au Ghana.*

MÉTHODES: *Une étude prospective de tous les patients admis à la Surgical Unit général de l'hôpital militaire de 37 entre mai 2005 et avril 2007 a été menée. Les patients diabétiques atteints d'infections des tissus mous et de fièvre ont été sélectionnés pour étude. Doppler en utilisant un monopolaire 8 MHz Nicolet sonde vasculaire a été utilisé dans l'évaluation de la cheville à l'index de pression systolique (IPS). Les patients ont été gérées en fonction de l'admission et les résultats de diagnostic ont été notées.*

RÉSULTATS: *Quatre-vingt (8,3%) de 966 patients opérés avaient un diabète sucré et l'infection des tissus mous ou de fièvre. L'âge maximal de la présentation des diabétiques avec une infection des tissus mous ou maladie de la fièvre a été 50-59 ans. La maladie du "pied diabétique (53,0%) était plus fréquente suivie par la cellulite de la jambe et d'autres infections des tissus mous. taux d'amputation globale était de 33,3% tandis que la mortalité était de 8,8%.*

CONCLUSION: *Les infections des pieds, de la cellulite, les abcès et la gangrène sont les complications chirurgicales commune des patients diabétiques au Ghana. Abcès de la main est non plus fréquente des tissus mous du pied de chirurgie de la complication et avait de bons résultats. Dans l'ensemble, les femmes présentées plus tôt et avaient de meilleurs résultats que les garçons. WAJM 2010; 29(2): 81–85.*

Mots-clés: diabète sucré, infection des tissus mous, diabétique fièvre, des ulcères.

Depatments of *General Surgery, E-mail: easumanu@yahoo.com †Medicine, E-mail: ralphametepi@yahoo.co.uk ‡Anaesthesia, E-mail: carolinekoney@yahoo.co.uk 37 Military Hospital, Accra. Ghana.
Abbreviations: ABPI, Aankle-Brachial Pressure Index

INTRODUCTION

Soft tissue infection and foot disease are a common and undesirable complication of diabetes mellitus. Because the burden of diabetes care and the attendant complications affect all aspects of society, it has become a public health concern globally.[1–4] In developing countries, increasing prevalence of diabetes and emergence of resistant strains of bacteria are among several factors contributing to the burden of infection-related complications. The increase in diabetes mellitus in Africa has been attributable in part to urbanization and the adoption of Western lifestyle.[5–9] Variations in the type and epidemiology of diabetes between urban and rural areas have also been noted in Africa.[6,9]

Infection-related complications are noted among the commonest surgical presentations of diabetics.[4,7] The diabetic patient has a greater susceptibility to infections that arise from several aspects of an altered immunity.[10–14] Other factors such as nutrition and economic cost to the patient and society play significant roles in the surgical care of the diabetic patient.

The in-hospital burden of care as a consequence of these factors is borne largely by the General Surgical Unit. Although there have been much published work on diabetes, there has been no previous published study on the surgical aspects of diabetes mellitus in Ghana[5–7, 9]. The purpose of this study was to determine the prevalence and management of diabetic soft tissue infections and foot disease in General Surgical practice in a developing country.

SUBJECT, MATERIALS, AND METHODS

A prospective study of all patients admitted to the General Surgical Unit of the 37 Military Hospital between May 2005 and April 2007 was conducted to determine the prevalence and management of diabetic soft tissue and foot disease. Diabetic patients with soft tissue infection and foot disease were selected for analysis. The description of diabetic foot disease used was as previously repoted.[1] The criteria for inclusion into the study were (a) diagnosis of diabetes mellitus and (b) presence of soft tissue infection and/or foot disease. Exclusion criteria included patients less than 12 years of age, diabetic patients admitted or managed for non soft tissue disorders and patients managed at the outpatient clinics.

Patient Assessment

All patients admitted with soft tissue infections were screened for diabetes mellitus and those found positive were recruited into the study. Blood glucose monitoring was done using glucometer strip version 6 by finger prick method. Patients were diagnosed as diabetes mellitus and classified as Type 1or Type 2. Type 2 was defined as non-insulin dependent diabetes mellitus, and/or age above 40 years with or without associated metabolic syndromes. Patients were assessed and managed with the assistance of physicians, physio-therapists, dieticians, nurses and anaethetists as a multidisciplinary team. Peripheral vascular assessment was done clinically by assessing radial, carotid, abdominal, femoral and dorsalis pedis and/or posterior tibial vessels. Doppler studies using a monopolar 8 MHz Nicolet vascular probe was used in assessing the ankle:brachial pressure index (ABPI) for selected patients with foot disease as previously described[15]. ABPI, as a tool for vascular assessment, was calculated as the ratio of systolic pressure at the ankle using the Doppler over the posterior tibial, to the brachial systolic pressure. The results were classified as normal (0.9–1.2), moderate ischemia (0.8–0.6), severe ischaemia (0.5 or less) and above normal or neuropathic (more than 1.2). Sensory neuropathy was assessed using the patient's perception of presence or absence of sensation as a Modified Neuropathy symptom Score (M.N.S.S). A positive score indicates normal perception and a negative score indicates sensory neuropathy. Patients who were prepared for theatre were managed with initial glucose control using a modified Alberti's regieme[17].

Diagnosis and Treatment Protocols

Patients were managed based on admitting diagnosis. Cellulitis was managed empirically with ampicillin and cloxacillin. Necrotising fasciitis was managed with debridement of affected areas and polymicrobial antibiotic cover. Abscesses were drained and managed with conservatively. The term Diabetic foot disease was defined for the purposes of the study to include neuropathic, and vasculopathic ulcers with or without gangrene. Neuropathic ulcers were those in which patients had noticeable impairment of foot sensation and/or insignificant pain arising from the ulcer. Vasculopathic ulcers had no impairment of sensation in affected areas and/or significant rest pain. Non classified foot diseases were those with features not characteristic of any of the above and included various forms of fasciitis of the foot and leg with or without associated systemic toxemia.

Wound care was done with daily normal saline dressing and intermittent surgical debridement. Antibiotic therapy was empirical with the aim of covering both aerobic and anaerobic organisms. Clindamycin, and ciprofloxacin/gentamycin or flucloxacillin and metronidazole were used to cover aerobic and anaerobic organisms. Topical antibiotics were not used in these patients. Antibiotics were used during the acute phases of care when exudation was present. Patients with clean chronic ulcers were managed with local wound dressing and crepe bandaging without antibiotic usage. Patients were referred for skin grafting when healthy granulation tissue was present. Those with gangrene had amputation done lowest level possible with the aim of limb conservation.

RESULTS

A total of 966 consecutive patients that were admitted to the surgical unit over the period were studied. Out of this 80 (8.3%) patients were diabetic patients with soft tissue or foot disease. The age characteristics of patients with different types of diabetes are shown in Table 1.

Diabetic soft tissue and foot disease were common in patients aged 40 years and above with peak incidence of 50–59 years and a mean of 54 years. Twenty-two (2.3%) of the 966 surgical patients were newly diagnosed diabetics. Twenty-two (27.5%) of the 80 diabetic patients were newly diagnosed on admission. Of

the diabetic patients with soft tissue and foot disease 28.8% were classified as type 1 diabetic and 71.3% were type 2 diabetics.

Type 2 diabetes was the commonest type among both sexes. Positive family history was found in 5.6% of newly diagnosed and 25% of Type 2 diabetics respectively.

No precipitating factors were identified in 80% of cases. The most commonly recognized aetiological association in foot related lesions was trauma in 20% of patients. Using the modified neuropathy symptom score (M.N.S.S) for diabetic foot disease, 34.3% of all patients had peripheral neuropathy.

The results of the ABPI are shown in Table 2. Out of the thirty-four diabetic foot disease patients selected for assessment, 3(8.7%) had abnormal ABPI and 4(11.8%) had an ABPI greater than

Table 1: Distribution of Patients by Age and Type of Diabetes

Age (Years)	Type 1 DM	Type 2 DM	Total N(%)
20 – 29	1	0	1 (1.3)
30 – 39	2	0	2 (2.5)
40 – 49	2	5	7 (8.8)
50 – 59	7	25	32(40.0)
60 – 69	6	16	22 (27.5)
70 – 79	5	11	16 (20.0)
Total	**23(28.8)**	**57(71.3)**	**80 (100.0)**

Table 2: Results of Aankle-Brachial Pressure Index in Nine Patients

ABPI	Number(%)
>1.2	4(44.4)
0.9 –1.2	2(22.2)
0.6– 0.8	2(22.2)
<0.5	1(11.1)
Total	**9(100.0)**

1.2. Twenty-five (73.5%) diabetic foot patients were unable to have ABPI assessment either as a result of extent of ulceration, oedema, gangrene, or cost.

Table 3 shows the frequency of presenting disorders. Female patients presented early as shown by a high prevalence of cellulitis followed by foot ulcers while male patients presented late with foot ulcers and gangrene. Diabetic foot ulcers and gangrene constituted 42(53%) of cases, followed by cellulitis and abscesses. Newly diagnosed diabetics presented with foot ulcers, gangrene and abscesses. The common sites of abscesses were palmar followed by interscapular areas. Miscellaneous types of lesions included two cases of Fournier's gangrene, and one case each of parotid abscess and surgical site infection in an undiagnosed diabetic.

Response to antibiotics treatment did not show any marked improvement with newer generation antibiotics. Clindamycin with ciprofloxacin was found satisfactory in acute diabetic ulcers. Fourteen (33.3%) lower limb amputations were done, made up of five above knee, three below knee, five ray and one transmetatarsal amputation. Amputations were not done in two patients for failure to consent to surgery. Two patients had amputation of fingers for hand infections. Out of the 80 patients seen during the study period, 7 (8.8%) died. Four diabetic foot patients had renal impairment and sepsis, one died from necrotizing fasciitis with sepsis, two died from sepsis following refusal of amputation. Overall hospital stay ranged from one week to three months with an average of six weeks. Diabetic foot ulcer patients stayed longest with an average duration of two months while those with abscesses stayed averagely for one–two weeks.

DISCUSSION

Diabetic foot disease describes a heterogeneous group of diabetes-related disorders of the foot which includes both infective and non-infective conditions that have been linked to a wide variety of etiological associations, pathological forms and clinical severity.[1] Soft tissue infection on the other hand describes only the infective conditions which affect the skin and subcutaneous tissues of the body. Foot infections are a common problem in developing countries where diabetes mellitus is an emerging problem. Already, the phenomenon of increasing prevalence of diabetes mellitus in developing countries has been reported in previous studies.[8,9,15]

Overall, soft tissue and foot disease constitute 8.3% of General Surgical admissions and about a quarter of those admitted diabetic patients were newly diagnosed. The high incidence of undiagnosed diabetics poses a major public health challenge in developing countries. As patient population increases, it is projected that the economic impact of diabetic complications will become a major concern in the surgical care of the diabetic patients.[2,18,19]. Currently, most diabetic patients in Ghana are managed in physician out- patient clinics. As the prevalence of surgical complications increases, the out-patient burden of diabetes care will be transferred to inpatient care and it has the potential of affecting overall quality of surgical inpatient care.

The commonest presentation of diabetic patients at the general surgical unit were diabetic foot infection and ulcers. This is in contrast to Western patterns where most foot ulcers are related to vascular diseases such as venous and peripheral arterial disease. Our study shows that diabetic foot

Table 3: Distribution of Patiets by Lesion, Sex and Type of Diabetes

Type of Lesion	Number of Cases				
	M	F	Type 1	Type 2	Total N(%)
Cellulitis	3	12	3	12	15 (18.8)
Fasaites	1	4	1	4	5 (6.25)
Abscess	6	6	1	11	12 (15.0)
Diabetic Foot Ulcer	16	9	12	13	25 (31.3)
Diabetic Foot Gangrene	11	6	4	13	17 (21.3)
Others	5	1	2	4	6 (7.5)
Total	**42**	**38**	**23**	**57**	**80 (100.0)**

ulcers and gangrene constituted 53% of the infection-related complications with 21% of these patients having gangrene at presentation. Various classifications are available for diabetic foot patients, wounds and surgery.[20] These classifications help to define and guide management of diabetic foot disease.

Cellulitis of the leg, the second commonest foot disease, did not show much difference from the non-diabetics in clinical presentation and response to penicillin based regimes. Diagnosis was by eliciting clinical signs and treatment was empirical. The use of imaging though advocated in detecting deep seated infection is expensive.[21] Palmar abscesses were managed with incisions and drainage followed by antibiotics. Most of the palmar infections resulted in abscesses, chronic ulcers, and gangrene with loss of digits – a group of presentations referred to as Tropical Diabetic Hand Syndrome.[7] This was found commonly among newly diagnosed diabetics. There was one case of Fournier's gangrene and necrotizing fasciitis of the abdominal wall complicating laparoscopic surgery.

Response to antibiotic treatment in diabetic soft tissue disease showed that empirical treatment provides satisfactory outcomes. The use of third generation antibiotics did not provide any observed benefits over contemporary antibiotics provided coverage was appropriate. Clindamycin in combination with ciprofloxacin was found useful in diabetic foot ulcers at the early stages of treatment.

The study observed that non-foot soft tissue infections generally had better outcomes than foot disorders. Females also had better outcome than males. Amputation remains one of the key indicators of severe diabetic foot disease. The study recorded amputation rates of 33.3% among diabetic foot patients, 64.3% of these were below knee amputations. Overall mortality rate was 8.8% and case specific mortality for diabetic foot was 14.3%. While overall mortality among diabetic patients appears low compared to others in the sub-region, morbidity is quite high.[7] Most of the deaths occurred from sepsis and renal failure and patients usually have a short hospital stay averaging one week. Mortality was higher for newly diagnosed than known diabetics probably from pre-existing end organ damage.

One out of every four patients with soft tissue complication was a newly diagnosed diabetic. Similar results have been reported in other developing countries.[22] Nearly two percent of all surgical admissions were newly diagnosed diabetics with males predominating. Results of the study show that type 2 is the predominant form of diabetes mellitus and this is consistent with previous studies[9]. Although Type 1 disease occurs early in age, the study found most patients presenting with complications later in life.

A major precipitating factor in the initiation of diabetic foot disease is sensory peripheral neuropathy. The study found peripheral neuropathy in 34% of diabetic foot disease patients but only 20% of all patients recounted any history of trauma which suggests either presence of a sensory neuropathy, or a minor degree of injury or both. These findings imply a high prevalence of sensory neuropathy from this study, a finding similar to other studies.[23] The study also shows that the common site of soft tissue infections is the exposed parts of the body, notably the feet.

Sex of patients influenced their disease presentation and outcome.[24] Female patients presented early with acute disorders such as cellulitis, abscesses and fasciitis while males presented with late complications such as ulcers and gangrene. This may reflect a behaviour pattern that males tend to seek medical assistance late and have poor outcome. This may contribute to the observed high mortality among male diabetic patients.[25]

Conclusion

Foot infections, cellulitis, abscesses and gangrene are the common surgical complications of diabetes mellitus patients in Ghana. Abscesses of the hand are the commonest non-foot soft tissue surgical complications with good outcomes. The peak incidence of diabetic infections is in the age group 50–59 years with about quarter been newly diagnosed. Females presented earlier and had better outcomes than males.

REFERENCES

1. Younes NA, Ahmad AT. Diabetic Foot Disease. *Endocrine Practice.* 2006; **12:** 583–592.
2. American Diabetes Association. Economic Cost of Diabetes in the U.S in 2007. *Diabetes Care* 2008; **31:** 596–615.
3. Robbins JM, Webb DA. Diagnosing Diabetes and Preventing Re-Hospitalisation. The Urban Diabetes Study. *Med Care* 2006; **44:** 292–296.
4. Kao LS, Knight MT, Lally KP, Mercer DW. The Impact of Diabetes in Patients with Necrotising Soft Tissue Infections. *Surgical Infections.* 2005; **6:** 427–438.
5. Amoah AG, Owusu SK, Adjei S. Diabetes in Ghana: A Community Based Prevalence Study in Greater Accra. *Diabetes Research and Clinical Practice.* 2002; **56:** 197–205.
6. Osei K, Schuster DP, Amoah AG, Owusu SK. Diabetes in Africa. Pathogenesis of Type 1 and Type 2 Diabetes Mellitus in Sub-Saharan Africa: Implications for Transitional Populations. *Journal of Cardiovascular Risk* 2003; **10:** 85–96.
7. Abbas ZG, Gill GV, Archibald LK. The Epidemiology of Diabetic Limb Sepsis: An African Perspective. *Diabetic Medicine* 2002; **19:** 895–899.
8. King H, Aubert RE, Herman WH. Global Burden of Diabetes, 1995- 2025: Prevalence, Numerical Estimates and Projections. *Diabetic Care* 1998; **21:** 1414–1431.
9. Whiting DR, Hayes L, Unwin NC. Diabetes in Africa. Challenges to Health Care for Diabetes in Africa. *J Cardiovascular Risk* 2003; **10:** 103–110.
10. Joshi N, Caputo GM, Weitekamp MR, Karchmer AW. Infections in Patients with Diabetes. *N Eng J Med* 1999; **341:** 1906–1912.
11. Valerius NH, Eff C, Hansen NE, Karle H, Nerup J, Soeberg B, Sorensen SF. Neutrophil and Lymphocyte Function in Patients with Diabetes Mellitus. *Acta Med Scand* 1982; **211:** 463–467.
12. Delamaire M, Maugendre D, Moreno M, Le Goff MC, Allanic H, Genetet B. Impaired Leucocyte Functions in Diabetic Patients. *Diabet Med* 1997; **14:** 29–34.
13. Gallacher SJ, Thomson G, Fraser WD, Fisher BM, Germell CG, MAcCuish AC. Neutrophil Bactericidal Function in Diabetes Mellitus: Evidence for Association with Blood Glucose Control. *Diabet Med* 1995; **12:** 916–920.

14. Muchova J, Liptakova A, Orszaghova Z, Garaiova I, Tison P, Carsky J, Durakova Z. Antioxidant Systems in Polymorphonuclear Leucocytes of Type 2 Diabetes Mellitus. *Diabet Med* 1999; **16:** 74–78.

15. Watkins PJ. The Diabetic Foot. *British Medical Journal* 2003; **326:** 977–979.

16. Unwin N, Setel P, Rashid S, Mugusi F, Mbanya JC, Kitange H, Hayes L. Non-Communicable Diseases in Sub-Saharan Africa: Where do they Feature in the Health Research Agenda? *Bulletin of the World Health Organization* 2001; **79:** 947–953.

17. Alberti KG. Diabetic Emergencies. *Br. Med Bull* 1989; **45:** 242–63.

18. Ray JA, Valentine WJ, Secnik S, Oglesby AK, Cordony A, Gordois A *et al.* Review of the Cost of Diabetes Complication in Australia, Canada, France, Germany, Italy and Spain. *Curr Med Res Opin* 2005; **21:** 1617–1629.

19. Ohinmaa A, Jacobs P, Simpson SH, Johnson JA. The Projection of Prevalence and Cost of Diabetes in Canada: 2000 to 2016. *Canadian Journal of Diabetes* 2004; **28:** 116–123.

20. 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:** 1–66.

21. Cook TA, Rahim N, Simpson HC, Glland RB. Magnetic Resonance Imaging in the Management of Diabetic Foot Infection. *British Journal of Surgery* 1996; **83:** 245–248.

22. Prabha AA, Abraham A. Risk Factors for Postoperative Complications in Sixty Diabetic Patients. *Int. J Diabetes Dev. Ctries*. 2004; **24:** 115–9.

23. Reiber GE, Vileikyte L, Boyko E J, Aguila MD, Smith DG, Lavery LA et al. Causal Pathways for Incidence of Lower Extremity Ulcers in Patients with Diabetes from Two Settings. *Diabets Care* 1999; **22:** 157–162.

24. Gregg EW, Gu Q, Cheng YL, Narayan KMV, Cowie CC. Mortality Trends in Men and Women with Diabetes, 1971–2000. *Annals of Internal Medicine* 2007; **147:** 149–155.