

Original Research Article

Diabetic foot – A clinical study: Early surgical intervention is a key to early cure and rehabilitation in accordance with the international consensus on the Diabetic foot

Umesh Kumar Chhabra^{1*}, Sandeep Kumar Goyal², Satish Kumar Bansal¹, Gopal Singal³

¹Associate Professor, ²Assistant Professor, ³Professor

Department of General Surgery, Maharaja Agrasen Medical College (MAMC), Agroha, Hisar, Haryana, India

*Corresponding author email: drumesh75@gmail.com

	International Archives of Integrated Medicine, Vol. 3, Issue 1, January, 2016.	
	Copy right © 2016, IAIM, All Rights Reserved.	
	Available online at http://iaimjournal.com/	
	ISSN: 2394-0026 (P)	ISSN: 2394-0034 (O)
	Received on: 04-01-2016	Accepted on: 10-01-2016
	Source of support: Nil	Conflict of interest: None declared.
How to cite this article: Umesh Kumar Chhabra, Sandeep Kumar Goyal, Satish Kumar Bansal, Gopal Singal. Diabetic foot – A clinical study: Early surgical intervention is a key to early cure and rehabilitation in accordance with the international consensus on the Diabetic foot. IAIM, 2016; 3(1): 110-115.		

Abstract

Background: Diabetes mellitus is as old as mankind and perhaps humans know it from early ages. It is one of the most deeply studied diseases and is still un-understandable ailment that humans deal with. As we are digging deeper into the molecular basis of the disease, mind boggling results are coming out. It is not a single disease but a constellation of diseases that it gives birth to i.e. the complications. The main aim of this study was to evaluate the ultimate outcome of patients who present with lower limb complications related to diabetes mellitus type – 2 by early surgical intervention and to prevent infections to establish and become deep seated and involve deeper structures like muscles, bones or joints and to minimize the chances of amputation by early intervention. This study was carried out in Maharaja Agrasen Medical College, Agroha, Hisar, Haryana, India.

Material and methods: The present prospective study was carried out on 150 patients who were suffering from foot ulcers in type – 2 diabetes mellitus and were randomly selected. The selected patients were evaluated for the presence of complications like peripheral vascular disease, and

neuropathy. The ulcers were swabbed, cultured and early surgical intervention was done after which wounds were dressed with either of the following: Saline gauze, Povidone-iodine, Hydrogel, Hydrocolloid base, Human Recombinant Platelet derived Growth Factor.

Results: 150 patients (100%) required early debridement, 83 patients (55.33%) required Split Skin Grafting, 5 patients (3.33%) required flap, 38 patients (25.33%) did not require any further surgical treatment and their wounds healed with dressing alone, 24 patients (16%) required amputation.

Conclusions: Patient characteristics, such as sex, age, poor glycemic control, presence of peripheral vascular disease, peripheral neuropathy and delayed surgical intervention have a poor outcome in form of complete wound healing in patients with Diabetic foot.

Key words

Diabetes mellitus, Glycosylated hemoglobin (HbA1c %), Trauma, Infection, Peripheral neuropathy, Gangrene, Early surgical intervention.

Introduction

The World Health Organization (WHO) defines diabetic foot as the lower limb of a diabetic patient that has the potential risk of pathologic consequences, including infection, ulceration and/or destruction of deep tissues, associated with neurological abnormalities, various degrees of peripheral vascular disease and/or metabolic complications of diabetes mellitus.

Diabetes mellitus is characterized by chronic hyperglycemia and disturbances of carbohydrate, fat and protein metabolism associated with absolute or relative deficiency in insulin secretion and/or insulin action [1].

Diabetes is known for its micro and macro vascular complications like retinopathy, neuropathy, nephropathy, cardio-vascular and peripheral vascular disease. One of the most devastating complications of diabetes mellitus is 'Diabetic Foot' which is responsible for > 50% non-traumatic major limb amputations [2].

Foot ulceration precedes majority of amputations in diabetics. Prevention and early treatment of foot ulcers requires multidisciplinary approach from nurses, podiatrists, doctors and Orthotists at primary care level supported by hospital foot clinics. Where diabetic care is poor, role of surgeon is as amputator; where care is good the role is of debrider and vascular reconstructor.

Many organisms are found in diabetic foot ulcers. Superficial ulcers are mainly colonized by staphylococcus or streptococcus species while deep infections like osteomyelitis and abscess result from a combination of aerobic and anaerobic micro-organisms (gram positive cocci, gram negative bacilli like Escherichia Coli, Proteus and Klebsiella spp. and anaerobes including bacteroids and peptostreptococci) [3, 4, 5]. Wagner [6] classified diabetic foot lesions into various grades to guide the management.

Modified Wagner's Classification [7]

Grade	Lesion
0	High risk foot, no ulcer A. Ischemic B. Infected
1	Superficial Ulcer A. Ischemic B. Infected
2	Deeper ulcer to tendon or joint capsule A. Ischemic B. Infected
3	Deep ulcer with abscess, osteomyelitis or joint sepsis A. Ischemic B. Infected
4	Localized gangrene – Forefoot or heel A. Ischemic B. Infected

5	Gangrene of whole foot A. Ischemic B. Infected
---	--

Diabetes mellitus is the commonest endocrine disorder. Rapid increase in the cases has been recorded in last decade more so in urban population. The prevalence is 6-9% in urban population and 3-5% in rural population. In India males are affected more than females in contrast to western countries [8].

Material and methods

The present prospective study was carried out on 150 patients who were suffering from foot complications in type – 2 diabetes mellitus in Maharaja Agrasen Medical College, Agroha, Hisar, Haryana, India during the period 2011 – 2015.

After explaining the procedures and motto of the study informed written consent was taken. Institutional ethical committee approval was taken prior to the study.

Each selected subject underwent detailed history and physical examination.

Diabetes mellitus was diagnosed according to American Diabetes Association (ADA) revised criteria [9].

Peripheral vascular disease (PVD) was diagnosed by ankle brachial pressure index (ABPI) [10].

ABPI \leq 0.5: Almost certainly have PVD

ABPI 0.5 – 0.9: Likely to have PVD repeat at 3 months

ABPI \geq 0.9: Unlikely to have PVD

Peripheral Neuropathy was diagnosed by history of numbness, paraesthesia, tingling and/or burning sensation. It was confirmed by touch sensation by 10 gm monofilament and ankle reflex [11].

Glycosylated Hemoglobin (GHb) often abbreviated as HbA1c, is a form of hemoglobin (a blood pigment that carries oxygen) that is bound to glucose. The blood test for HbA1c is routinely performed in people with type 1 and type 2 diabetes mellitus. HbA1c levels are reflective of how well diabetes is controlled. HbA1c levels are reflective of blood glucose levels over the past 6-8 weeks and do not reflect daily ups and downs of blood glucose [12]. Every patient enrolled in study had HbA1c done.

Expected values of GHb: HbA1c%

Non diabetic: 4.5 – 6

Good control: 6.1 – 8

Fair control: 8.1 – 9

Poor control: > 9

Ulcer characteristics: All ulcers were examined following same protocol.

- a. Location of ulcer
- b. Shape and size of ulcer
- c. Edge and margin of ulcer
- d. Base and margin of ulcer
- e. Discharge from ulcer
- f. Depth of ulcer
- g. Surrounding skin

All ulcers were swabbed and were sent for culture and sensitivity. Antibiotics were prescribed as per above report and response of wound infection.

Where the ulcers did not heal completely by dressings alone but were infection free and had red granulation tissue, such ulcers were covered by split skin grafting. Patients with gangrene underwent appropriate amputations and redo surgeries.

All patients were followed up till discharge from Surgery ward with completely healed wounds and were referred to Department of Medicine for follow up for glycemic control.

Results

As per **Table – 1**, maximum number of patients (53.2%) were in 51 – 60 years age group followed by 61 – 70 year age group (20%) and 5 patients were above the age of 70 years. There were 100 male patients and 50 female patients.

Table – 1: Distribution of patients according to age and sex.

Age group	Sex				Total	
	Male		Female			
	No.	%	No.	%	No.	%
30-40	5	3.3	5	3.3	10	6.6
41-50	15	10	10	6.6	25	16.6
51-60	60	40	20	13.32	80	53.3
61-70	20	13.3	10	6.6	30	20
71-80	0	0	5	3.3	5	3.3

As per **Table – 2**, history of trauma of was present in 83.3% of cases. Clearly trauma is the inciting event for infection to set in. Trauma included unnoticed injury to the foot, frictional injuries, shoe bites and scratching for an itch.

Table – 2: Distribution of patients with history of trauma.

History of trauma	No.	%
Present	125	83.3
Absent	25	16.7

As per **Table – 3**, forefoot ulcers were commonest (73.3%) followed by Midfoot ulcers (16.7%). Distribution of patients according to Modified Wagner's Grade was as per **Table - 4**.

Table – 3: Distribution of patients according to ulcer site.

Site	No.	%
Forefoot	110	73.3
Midfoot	25	16.7
Hindfoot	5	3.3
Ankle	10	6.7

As per **Table – 5**, 90 out of 150 patients (60%) had poor glycemic control as evidenced by HbA1c value greater than 9%. 24 out of these 90 patients (16%) underwent amputations.

Table – 4: Distribution of patients according to Modified Wagner's Grade.

Modified Wagner's Grade	No.	%
0	A	0
	B	0
I	A	25
	B	20
II	A	15
	B	20
III	A	0
	B	40
IV	A	0
	B	25
V	A	0
	B	5

Table – 5: Distribution of patients according to HbA1c%.

HbA1c (%)	No.	%
5 – 6	45	30
6.1 – 7	5	3.3
7.1 – 8	5	13.3
8.1 – 9	5	6.7
9.1 – 10	5	3.3
10.1 – 11	45	30
11.1 – 12	30	10
12.1 – 13	10	3.3

As per **Table – 6**, 56.7% ulcers were unhealthy (having slough and/or discharge) at end of 1st week. At the end of 2nd week 5 ulcers healed as disarticulation from metatarso-phalangeal joint was done with primary suturing. By the end of 8th week 96.7% ulcers completely healed because of early surgical intervention in form of early debridement, disarticulations, amputations, split skin grafting and meticulous dressings. 5 ulcers on heel healed slowly and required rotation flap. All ulcers healed by the end of 10th week.

Discussion

The spectrum of diabetic complications is very wide and to an extent unpredictable. Foot problems are the most common indication of admission in the surgical ward in diabetic population. They account for 20% of all hospital admissions among the diabetics. Approximately 50% of all non traumatic amputations occur in diabetics with foot complications. Although diabetes mellitus has many complications, like peripheral vascular disease, neuropathy, nephropathy, retinopathy, cerebrovascular, cardiovascular, gastropathy, diabetic ketoacidosis, and diabetic ketoacidotic coma, none cause as much suffering to the patient as foot complications. In India, although awareness in general public about health problems has increased, still we find that patients, even from affluent class do not seek medical help until they have reached a state where the surgeon has nothing much left to do, he finds his role as an amputator. One such disease is diabetic foot.

Table – 6: Distribution of patients according to post procedure ulcer condition.

Duration (at the end of weeks)	Condition of ulcer					
	Unhealthy		Healthy		Healed	
	No.	%	No.	%	No.	%
1 st	85	56.7	65	43.3	0	0
2 nd	55	36.7	90	60	5	3.3
4 th	0	0	100	66.7	50	33.3
8 th	0	0	5	3.33	145	96.7
10 th	0	0	0	0	150	100

Conclusion

Strict glycaemic control and aggressive surgical treatment are the key factors for the salvage of already compromised limb due to various other complications associated with diabetic foot [13-16].

References

1. Kahn CR, Weire GC, Lea and Febiger; Joslin's Diabetes Mellitus. 13th edition. Philadelphia 1994; p. 193 – 94
2. Reiber GE, Pecoraro RE, Koepsell TD. Risk factors for amputation in patients with diabetes mellitus; Ann Intern Med., 1992; 117: 97-105.
3. Joslin EP. The menace of diabetic gangrene. N. Engl J Medi., 1934; 211: 16-20.
4. Lipsky BA, Pecoraro RE, wheat LJ. The Diabetic Foot: soft tissue and bone infection. Infect Clin North Am., 1990; 4: 409-32.
5. Wheat LJ, Allen SD, Henry M, et al. Diabetic foot infections: Bacteriologic analysis. Arch Intern Med., 1986; 146: 1935-40.
6. Wagner FW. Algorithms of diabetic foot care, In: Levin ME, O'Neil LW eds. The Diabetic Foot, 2nd edition. St. Louis: Mosby Yearbook; 1983, p. 291-302.
7. Young MJ. Classification of ulcers and its relevance to management, The foot in diabetes 3rd edition. 61 – 72 UK, 2000 from Ravikant, Lakvinder Oncology and Surgery update 2003.
8. Das VK. Text book Of Medicine, 3rd edition. 1996; p. 395-403.
9. Groves RW, Schmidt Lucke JA. Recombinant Human GM-CSF in the treatment of poorly healing wounds, Adv skin wound care, 2000; 13(3pt1): 107-112.
10. Abbott RD, Brand FN, Kannel WB. Epidemiology of some peripheral arterial findings in diabetic men and women, Experiences from the Framingham Study. American Journal of Medicine, 1990; 88: 376-381.
11. Flynn MD, Tooke JE. Aetiology of diabetic foot ulceration, a role for the microcirculation? Diabet Med., 1992; 8: 223-225.
12. Boyko EJ, Ahroni JH, Stensel V, Frosberg RC, Davignon DR, Smith DG. A

- prospective study of risk factors for foot ulcers. The Seattle Diabetic Foot Study. *Diabetic Care*, 1999; 22(7): 748-757.
13. Zafar A. Management of Diabetic foot, two year's experience. *J Ayub Med Coll, Abbotabad*, 2001; 13(1): 14-16.
14. Kidmas AT, Nwadiaro CH, Igun GO. Lower limb amputations in Jos, Nigeria. *East Afr Med J.*, 2004; 81(8): 427-29.
15. Robbins JM, Nicklas BJ, Augustine S. Reducing the rate of amputations in acute diabetic foot infections. *Cleve Clin J Med*, 2006; 73(7): 679-683.
16. Anichini R, Zecchini F, Cerretini I, Meucci G, Fusili D, Alviggi L, Seghieri G, De Bellis A. Improvement of diabetic foot care after the implementation of International Consensus on The Diabetic Foot (ICDF), results of a 5 year prospective study. *Diabetes Res Clin Pract*, 2006 July 19, Epub.