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Original Research Article

A study on the prevalence of risk factors and presence of diabetic foot ulcers in T2DM patients in K. R. Hospital, Mysuru

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ABSTRACT

Background: India is one of the top ten diabetes mellitus (DM) countries. Thus, the aim of this study was to survey the prevalence of DFU risk factors and DFU prevalence among type 2 diabetes mellitus (T2DM) patients.
Methods: An epidemiological study was conducted on an outpatient basis in K. R. hospital, Mysuru. All T2DM participants were ≥ 18 years were included. Demographic and foot care behavior were assessed using minimum data sheet (MDS). Meanwhile, presence of risk factors was evaluated for neuropathy and presence of angiopathy was evaluated with ankle brachial index (ABI) by using a hand-held doppler both dorsal and posterior tibial.
Results: At the end of study, 249 T2DM participants were enrolled. The prevalence of DFU risk factors was 55.4% (95% CI: 53.7% - 57.0%), and prevalence of DFU was 12% (95% CI: 10.3% - 13.6%).
Conclusions: Even though the prevalence of DFU is high, identification associated factors for presence of risk and DFU has not been integrated into national guideline. Thus, preventive strategies should be introduced at early stage to prevent presence of risk and DFU.

Keywords: Diabetic foot, Risk factor, Ulcer

INTRODUCTION

Top 10 countries in the prevalence of diabetes are India, China, USA, Indonesia, Japan, Pakistan, Russia, Brazil, Italy, Bangladesh.[1]

One of the major complications of DM is the development of diabetic foot ulcer (DFU).[2] International working group on diabetic foot (IWGDF) has proposed neuropathy and angiopathy as the main risk factors for development of DFU.[3] Role of these risk factors has been explained biomechanically and biologically.[4,5]

In general, neuropathy is determined by demography factors, while the development of DFU is mainly related to trauma, neuropathy and deformity.[6,7] The main complications of DM in India are neuropathy (13%-78%), microvascular complications (16%-53%) and DFU (7.3% - 24%).[8,9]

Foot infections are the most common problems in persons with diabetes. These individuals are predisposed to foot infections because of a compromised vascular supply secondary to diabetes. Local trauma and/or pressure (often in association with lack of sensation because of neuropathy), in addition to microvascular disease, may result in various diabetic foot infections that run the spectrum from simple, superficial cellulitis to chronic osteomyelitis.

Compromise of the blood supply from microvascular disease, often in association with lack of sensation because of neuropathy, predisposes persons with diabetes mellitus to foot infections. These infections span the

spectrum from simple, superficial cellulitis to chronic osteomyelitis. Infections in patients with diabetes are difficult to treat because these individuals have impaired microvascular circulation, which limits the access of phagocytic cells to the infected area and results in a poor concentration of antibiotics in the infected tissues.

Table 1: People with diabetes.

Rank	Country	Year 2000 (mill)	Year 2015 (mill)	Year 2030 (mill)
1	India	32	65	80
2	China	21	33	42
3	USA	18	23	30

In addition, diabetic individuals can not only have a combined infection involving bone and soft tissue called fetid foot, a severe and extensive, chronic soft-tissue and bone infection that causes a foul exudate, but they may also have peripheral vascular disease that involves the large vessels, as well as microvascular and capillary disease that results in peripheral vascular disease with gangrene.[3-7] Except for chronic osteomyelitis, infections in patients with diabetes are caused by the same microorganisms that can infect the extremities of persons without diabetes. Gas gangrene is conspicuous because of its low incidence in patients with diabetes, but deep-skin and soft-tissue infections, which are due to gas-producing organisms, frequently occur in patients with these infections.

In general, foot infections in persons with diabetes become more severe and take longer to cure than do equivalent infections in persons without diabetes. Staging in diabetic foot infections is applicable only in cases of chronic osteomyelitis that require surgery. Thus, objective of this epidemiological study is to evaluate prevalence of associated risk factors and DFU among T2DM patients in K.R. Hospital, Mysuru, Karnataka, India.

METHODS

Sample size was calculated by using power analysis equation, where P refers to the lifetime prevalence of DFU as 25%. Thus, our calculated sample size was 288 participants. Study populations were all T2DM patients who attended the hospital from May 2016 to February 2017 for DM therapy. Inclusion criteria were T2DM patients who were ≥ 18 years old, this was our denominator and presence of DFU was numerator of study. T2DM patients who attended the hospital for other treatments other than DM were excluded.

Statistical analysis

Both ordinal and nominal data were described as absolute values and percentages (n, %), while continuous data were reported as mean and standard deviation. Univariate data were analyzed by $\chi 2$ test or Fisher exact test for categorical and Independent 't' test for continuous data.

RESULTS

At the end of the study, 249 people participated, and here is the analysis.

Table 2: Compilation of data, analysis and tabulation of results.

		Risk			DFU		
		No risk	Presence of risk	Total	No DFU	Presence of DFU	Total
		N=90	N=159	N=249	N=219	N=30	N=249
Age	18-30	50	13	63	61	2	63
	30-45	24	37	61	52	9	61
	45-60	11	69	80	66	14	80
	60+	5	40	45	40	5	45
Sex	Male	49	100	149	129	20	149
	Female	41	59	100	90	10	100
Smoking	Yes	60	140	200	175	25	200
	No	30	19	49	44	5	49
DM Therapy	OHA	15	90	105	86	19	105
	Insulin	67	55	122	113	9	122
	Untreated	8	14	22	20	2	22
Duration of DM	<10	68	112	180	170	10	180
	11-20	17	23	40	31	9	40
	21-30	2	7	9	5	4	9
	>30	3	17	20	13	7	20

Participants without any risk are 90, with risk 159 (with neuropathy 14, neuropathy and/or deformity 64, and neuropathy and/or deformity and/or ischemia 81), history of DFU 14, history of amputation 3 and current DFU 30 out of 249 participants.

Overall, prevalence of presence of risk factors (excluding history and presence of DFU) is 55.4% (95% CI 53.7% - 57.0%) and prevalence for DFU (including history and presence of DFU) is 12.0% (95% CI: 10.3% - 13.6%).

DISCUSSION

A diabetic foot is a foot that exhibits any pathology that results directly from diabetes mellitus or any long-term (or "chronic") complication of diabetes mellitus.[10] Presence of several characteristic diabetic foot pathologies such as infection, diabetic foot ulcer and neuropathic osteoarthropathy is called diabetic foot syndrome.

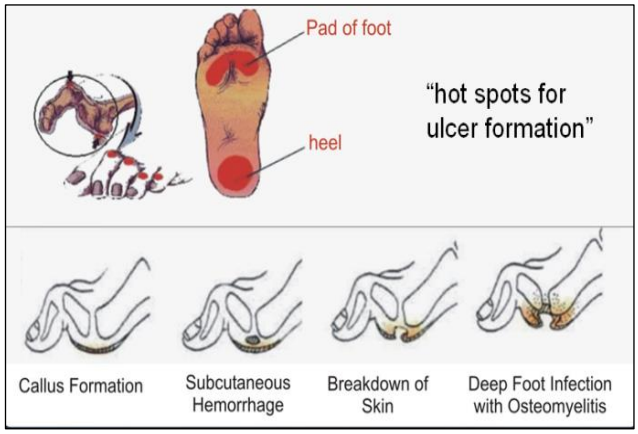

Figure 1: Illustration of ulcer formation.

Due to the peripheral nerve dysfunction associated with diabetes (diabetic neuropathy), patients have a reduced ability to feel pain. This means that minor injuries may remain undiscovered for a long while. People with diabetes are also at risk of developing a diabetic foot ulcer. Research estimates that the lifetime incidence of foot ulcers within the diabetic community is around 15% and may become as high as 25%.[11]

In diabetes, peripheral nerve dysfunction can be combined with peripheral artery disease (PAD) causing poor blood circulation to the extremities (diabetic angiopathy). Around half of patients with a diabetic foot ulcer have co-existing PAD.[12] Where wounds take a long time to heal, infection may set in and lower limb amputation may be necessary. Foot infection is the most common cause of non-traumatic amputation in people with diabetes.[13]

Prevalence of risk and DFU are higher in India.[14] The current study found that prevalence of risk (neuropathy and angiopathy) in this study was 55.4%. These findings are within global prevalence of risk 40%-70%. Meanwhile, current prevalence of DFU is 12%, in comparison with global prevalence 1.4%-5.9%.[15] In addition, our study also confirmed high prevalence of DFU in home care setting 26.0%.[16]

Diabetes mellitus is a disorder that primarily affects the microvascular circulation. In the extremities, microvascular disease due to glucose-coated capillaries limits the blood supply to the superficial and deep structures. Pressure due to ill-fitting shoes or trauma further compromises the local blood supply at the microvascular level, predisposing the patient to infection, which may involve the skin, soft tissues, bone, or these combined.

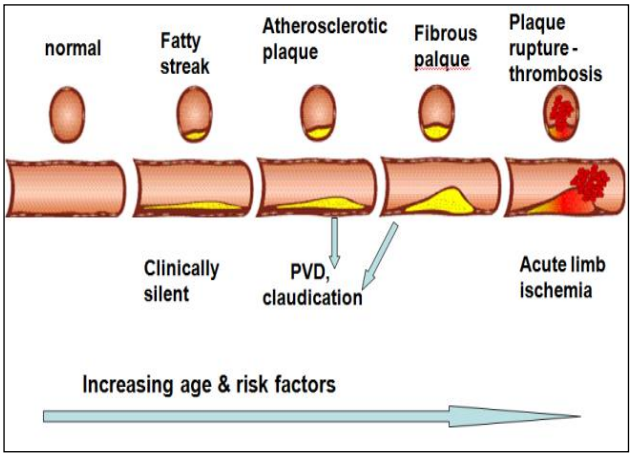

Figure 2: The atherothrombotic process.

Diabetes also accelerates macrovascular disease, which is evident clinically as accelerating atherosclerosis and/or peripheral vascular disease. Most diabetic foot infections occur in the setting of good dorsalis pedis pulses; this finding indicates that the primary problem in diabetic foot infections is microvascular compromise.

Impaired microvascular circulation hinders white blood cell migration into the area of infection and limits the ability of antibiotics to reach the site of infection in an effective concentration. Diabetic neuropathy may be encountered in conjunction with vasculopathy. This may allow for incidental trauma that goes unrecognized (e.g., blistering, penetrating foreign body)

Prevention of diabetic foot may include optimising metabolic control (regulating glucose levels); identification and screening of people at elevated risk for diabetic foot ulceration; and patient education to promote foot self-examination and foot care knowledge. Patients would be taught routinely to inspect their feet for hyperkeratosis, fungal infection, skin lesions and foot deformities. Control of footwear is also important as repeated trauma from tight shoes can be a triggering factor.[15] There is however only limited evidence that patient education has a long-term impact as a

preventative measure.[16] Of all methods proposed to prevent diabetic foot ulcers, only foot temperature-guided avoidance therapy was found beneficial in RCTs, according to a meta-analysis.[15,16] Treatment of diabetic foot can be challenging and prolonged; it may include orthopaedic appliances, antimicrobial drugs and topical dressings.[16]

Most diabetic foot infections (DFIs) require treatment with systemic antibiotics. The choice of the initial antibiotic treatment depends on several factors such as the severity of the infection, whether the patient has received another antibiotic treatment for it, or whether the infection has been caused by a micro-organism that is known to be resistant to usual antibiotics (e.g. MRSA). The objective of antibiotic therapy is to stop the infection and ensure it does not spread.

It is unclear whether any antibiotic is better than any another for curing infection or avoiding amputation. One trial suggested that ertapenem with or without vancomycin is more effective than tigecycline for resolving DFIs. It is also generally unclear whether different antibiotics are associated with more or fewer adverse effects.[14]

CONCLUSION

Diabetic Foot is complicated by PVD but needs to be identified. Smoking worsens the problem and may cause limb loss. If identified early many limbs and lives can be saved. Endovascular therapy- innovative and useful.

Awareness has improved in the last decade about vascular diseases. Availability of synthetic grafts is a breakthrough. Bypass is more affordable. With plenty of latest techniques overall limb salvage is better and mortality is reduced. Even though the prevalence of DFU is high, identification associated factors for presence of risk and DFU has not been integrated into national guideline. Thus, preventive strategies should be introduced at early stage to prevent presence of risk and DFU.

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