

Profile of Clinical Infections in Patients suffering from Diabetes Mellitus in A Tertiary Care Centre of Vidarbha Region of India

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Abstract

Background: Diabetes Mellitus is widely prevalent and most common metabolic disorder of both developing and developed countries. It leads to many associated complications including weakness of defense mechanism in our body. Infections are relatively more common and soft tissue infections are the commonest amongst them. Hence we have planned the study to know the status of soft tissue infections in diabetes mellitus patients of Vidarbha region of India which is a central part of country. **Material and Methods:** Patients suffering from diabetes mellitus with or without soft tissue infections hospitalized or attending out patients department (OPD) of Government Medical College Nagpur were included in the study. Out of 305 enrolled cases 102 (33.45%) patients were suffering from soft tissue infections. The profile of soft tissue infectious was studied by aerobic culture on blood agar and McConkey agar. **Results:** Commonest type of clinical infection was diabetic foot 35 (34.31%) followed by Non healing ulcer 34 (33.33%). Commonest single organism was E. Coli 15 (14.70%) followed by Coagulose +ve Staphylococci 11 (10.62%). No growth was seen in 20 (19.60%) cases. 2(66.66%) Pseudomonas was isolated from 3 osteomyelitis infections. In 28 E. Coli, 27(96.42%) strains were sensitive to Cephalexin followed by 15(15.57%) strains were sensitive to Gentamycin and 5(17.85%) strains were sensitive to Ampicillin and 12 (42.85%) strains were sensitive to Norfloxacin. **Conclusion:** Common soft tissue infections are diabetic foot and non-healing ulcers. It is basically a polymicrobial flora with gram +ve and gram -ve bacteria. E.coli, Klebsiella pneumoniae, Staphylococcus aureus and Pseudomonas aeruginosa are commonest bacterial pathogens. Bacterial isolates are generally multidrug resistant. Infections are more common with increase in associated factors.

Key words: Diabetes Mellitus, Microalbuminuria, Soft tissue infection.

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Introduction

Diabetes Mellitus is widely prevalent and most common metabolic disorder of both developing and developed countries. It leads to many associated complications including weakness of defense mechanism in our body. Diabetes associated complications are responsible for long term morbidity and premature mortality. Infections are relatively more common and soft tissue infections are the commonest amongst the diabetes associated complications.

Diabetic foot ulcers and other infections are more common in diabetes mellitus patients and some infections occur exclusively in them¹. Foot infections are the most common soft tissue infections in patients with diabetes^{1,2}. Potential complications include osteomyelitis, amputation and death. Earlier studies suggests that there infections are usually polymicrobial³. Certain microorganisms are more common cause of infections in diabetic patients. Among these organisms, Staphylococcus aureus is generally considered an important pathogen¹ causing

monomicrobial infection or it could be polymicrobial infection caused by facultative gram negative bacilli like E.coli, Klebsiella, etc³. In many instances, it is unclear whether the isolates are pathogenic or merely colonizers. Because of the bacteriological complexities and potentially grave consequences of infections it is recommended that this patient be treated with adequate antibiotic therapy, preferably by hospitalization than an outpatient basis².

In diabetes mellitus patients, ischemia and peripheral neuropathy are the major factors leading to ulcer, a lesion that usually serves as portal of entry for soft tissue, bony or even systemic infection⁴. Hence we have planned the study to know the status of soft tissue infections in diabetes mellitus patients of Vidarbha region of India which is a central part of country.

Materials and Methods

In the present study a total of 305 patients suffering from Diabetes Mellitus with or without soft tissue infections were enrolled. All the patients were from Vidarbha region of India, either attending or hospitalized at Government Medical College and Hospital Nagpur, a tertiary care centre of central India. All the patients were diabetic and either with or without soft tissue infections. Patients suffering other metabolic disorders or associated metabolic diseases or any related complications were excluded from the study. Before the study patients were examined and investigated for presence of diabetic complications like retinopathy, neuropathy, nephropathy, coronary artery disease, peripheral vascular disease, cardiovascular events etc and excluded from the study. A total of 100 age and sex matched controls were also included in the study.

Out of enrolled 305 patients, 102 were identified as soft tissue infected cases. Pus/wound swabs were collected from 102 patients of diabetic mellitus with soft tissue infections. Two swabs were collected; one was stained with gram stain and examined under the microscope. The second swab was inoculated on blood agar and Mc Conkey agar and incubated aerobically overnight at 37°C. After incubation, the growth was identified by colony morphology, smear examination and standard biochemical reactions⁵. The antibiotic sensitivity was tested whenever required by Kirby Bauer's disc

diffusion technique³ employing the antibiotics as per the policy of the Hospital for different bacteria.

Results

Out of 305 patients of diabetes mellitus, 203(66.55%) patients were without soft tissue infections and 102(33.45%) were with soft tissue infections. Male population was 220(72.15%) while female patients were 85(27.85%) with male to female ratio as 2.6 to 1 and mean age of total patients 49.66. 203(66.55%) patients of were without infections and 102 (33.45%) were with infections. 166(54.45%) patients from total 305 cases were on oral anti diabetic therapy and 139(45.55%) were on insulin. 76(74.50%) infected cases were on insulin while in non infected group number was 75(36.95%). In oral anti diabetic group, 128(63.05%) patients were without infections while 38(37.25%) patients had infections.

In non infected group 84(41.38%) patients out 203 had hyperglycemia while number of hyperglycemic was 76(74.50%) out of 102 patients in infected group. In non infection group 93(45.82%) patients were hypertensive while in infected diabetes group 41 (40.20%) cases were hypertensive. In diabetes with infection group 60(58.80%) patients had duration of illness above 5 years while duration of illness above 5 years was observed less (100=49.27%) in without infection group.

Table- 1: Profile of clinical infections

Clinical Infections	Number (%)
Diabetic foot	35 (34.31)
Non healing ulcer	34 (33.33)
Cellulites	15 (14.70)
Abscess	08 (7.84)
Fracture with infected wounds	07 (6.86)
Osteomyelitis	03 (2.94)
Total	102 (100)

Out of 102 soft tissue infections maximum number belonged to diabetic foot i.e. 35(34.31%) followed by 34(33.33%) non healing ulcer 15(14.70%) cellulites and 8(7.84%) abscess (Table- 1). In the total of 102 soft tissue infections, it was interesting to note that there were 20(19.60%) cases in which no growth of organisms from infections were

observed. E. Coli 15(14.70%) was the commonest single organisms isolated from any infections followed by Coagulose +ve Staphylococci 11(10.62%), Klebseilla Pneumoniae 8(7.84%) and Pseudomonas ariginosa 7(6.86%). In polymicrobial group; two organisms were isolated in which E.coli + Klebseillo pneumoniae 9(8.82%) was commonest followed by Klebseilla pneumoniae + Pseudomonas ariginosa 8(7.84%) table- 2.

Table- 2: Isolated Organisms from infections

Isolated Organism	Number (%)
E. Coli	15 (14.70)
Coagulose +ve Staphylococci	11 (10.62)
Klebseilla pneumonia	8 (7.84)
Pseudomonas ariginosa	7 (6.86)
Proteus mirabilis	5 (4.90)
Beta-haemolytic streptococci	3 (2.94)
Citrobacter species	1 (0.98)
E. coli + Klebseilla pneumonia	9 (8.82)
Klebseilla pneumoniae + pseudomonas aeruginosa.	8 (7.84)
Klebseilla pneumoniae + proteus mirabilis	8 (7.84)
Coagulase +ve staph + pseudomonas aeruginosa.	3 (2.94)
E.coli + Coagulase +ve Staph	4 (3.92)
No growth	20 (19.60)
Total	102 (100)

2(66.66%) Pseudomonas was isolated from 3 osteomyelitis infections, 3(20%) Coagulase +ve Staph from 15 cellulitis, 6(17.64%) E. coli from 34 non healing ulcer, 5(14.42%) E. coli from 35 diabetic foot and 4(11.42%) Coagulase +ve staph. In polymicrobial group, 2(28.57%) klebseilla pneumoniae + proteus mirabilis found in 7 infected fracture cases followed by 5(14.28%) E. Coli + Klebseilla pneumoniae from 35 diabetic foot, 1(14.28) E. coli + Klebseilla pneumoniae from 7 fracture with infection and 4(11.42%) Klebseilla pneumonia + Pseudomonas aeruginosa from 35 diabetic foot. There was 1(33.33%) case of no growth of organisms in 3 osteomyelitis infection and 6(40%) no growth of organisms in 15 cellulitis infections.

In 28 E. Coli, 27(96.42%) strains were sensitive to Cephotaxim followed by 15(15.57%) strains were sensitive to Gentamycin and 5(17.85%)

strains were sensitive to Ampicillin and 12 (42.85%) strains were sensitive to Norfloxacin. In 24 Klebseilla pneumoniae, 23(96.83%) strains were sensitive to Cephotaxim, 11(45.83%) strains were sensitive Gentamycin and 10(51.66%) strains were sensitive to Norfloxacin. In 13 proteus mirabilis, 10(76.92%) strains were sensitive 9(69.23%) Gentamycin and 8(61.53%) strains were sensitive to Ampicillin and 10(76.96%) strains were sensitive Norfloxacin. In 18 pseudomonas aeruginosa, 12(66.66%) strains were sensitive to Cefotaxim and 8(44.44%) strains were sensitive to Norfloxacin. Out 18 coagulase +ve staph strains 14(77.77) strains were sensitive to Cefotaxim and 10(50.55%) strains were sensitive to Gentamycin.

Association of infections with various factors in diabetes mellitus cases are shown in table 3. Each associate factor was named as factor A, factor B, factor C and factor D (Insulin therapy: Factor A, Raised Blood sugar: Factor B, Raised Blood Pressure: Factor C, Increased duration: Factor D).

In group I, out of 21 cases, 7(33.33%) patients had soft tissue infection with single factor B followed by 7(25%) soft tissue infections in 28 patients with factor D. In group II, out of 20 patients with factor A and B had 12(60%) cases of soft tissue infections followed by 4(44.44%) soft tissue infections in 9 patients. In group III 18(72%) soft tissue infection observed in 25 patients, those having three factors (A+B+D). In group IV in 32 patients, those having all four factors (A+B+C+D), 23(71.87%) patients had soft tissue infections. In group V in 37 patients, 4(10.8%) soft tissue infections cases were without any factors (Table- 3).

Discussion

In the present study out of 102 patients of diabetes mellitus with infections, 82 (80.40%) were male and 20(19.60%) were females. The mean age in this study was 50.22(11.57%), the mean age of male patients was 50.32(11.58%) and the mean age of female patients was 43.81(11.89%). Maximum number of patients belonged to age group 41-50 i.e.32 (31.37%) and 28 (27.45%) in age group 51-60 years. Out of 203 patients of Diabetes mellitus without soft tissue infection 138 (67.98%) were males, and

65 (32.02 %) were females. The mean age in this study was 49.11(13.58%), the mean age of male patients was 49.11(13.58%) and the mean age of female patients was 47.03(10.74%). Majority of patients belonged to age group 41-50 i.e 70 (34.48%) followed by 56 (27.58%) in age group above 60 years. Ramchandran et al (1982)⁶ reported more or less similar findings showing maximum prevalence of type II cases above 50 years. Regarding sex distribution

males predominated over females in the ratio of 1.34:1. Smriti Agnihotri et al (2001)⁷ found that majority of cases (about 69%) in type II diabetes belonged to age group of 41-60 years while in type I most of the cases (about 70%) were found in age group of 11-30 years. The findings of other authors in type II diabetes mellitus in relation to age and sex are almost similar to our findings.

Table- 3: Various factors associated with infections

Group	Associated Factors	Patients	Infection (%)
Single Factor			
I	Factor A	18	02 (11.11)
	Factor B	21	07 (33.33)
	Factor C	17	02 (11.76)
	Factor D	28	07 (25)
	Total	84	18
Any two factors			
II	Factor A + Factor B	20	12 (60)
	Factor A + Factor C	4	0 (0)
	Factor A + Factor D	13	03 (23.10)
	Factor B + Factor C	12	01 (8.33)
	Factor B+ Factor D	9	04 (44.44)
	Factor C + Factor D	17	01 (5.88)
	Total	75	21
Any three factors			
III	Factor A+ Factor B+ Factor C	16	8 (50)
	Factor A + Factor B+ Factor D	25	18 (72)
	Factor A+ Factor C+ Factor D	11	03 (27.27)
	Factor B + Factor C+ Factor D	25	07 (28)
	Total	77	36
All four factors			
IV	Factor A + B + C + D	32	23 (71.87)
	Total (A + B + C + D)	268	91 (33.95)
V	All factors absent	37	4 (10.8)
	Total (I + II + III + IV + V)	305	102

Insulin therapy - Factor A, Raised Blood Sugar - Factor B, Raised Blood Pressure - Factor C, Increased duration - Factor D.

Soft tissue infections are most common complication in patients with diabetes. In present study, out of 102 infected patient, maximum number (35=34.31%) of patients presented diabetic foot followed by non-healing ulcer 34(33.33%) and cellulites 15(14.70%). Foot is the common site for the infections in

diabetes patients and can lead to serious complications including gangrene, osteomyelitis, septicemia or even death. In present study in two of the three osteomyelitis patients Pseudomonas aeruginosa 2(66.66%) was isolated followed by 3 (20%) E.coli from 15 cellulitis patients. Organisms isolated from the infection of diabetes mellitus mostly depends on

the site of infection, commensal and environment.

Charles S Sharp et al (1979)³ studied on superficial and deep tissue infection in infected diabetic gangrene. They took 58 superficial and deep cultures. The mean age of patient was 60.1 yrs with range of 40-80 yrs. and average duration of known diabetes mellitus. Similarly Lipsky BA et al (1990)² had obtained the specimen for culture from various lesions like ulcer, open wound, aspiration for any secretion abscess phlegmons, cellulites and curettage of tissue from base and edges of open lesions. Louie TJ et al (1976)⁸ had taken samples from twenty two infected diabetic patients. Twelve patients had non progressive neuropathic ulcer of long duration and eight had progressively enlarging ulcers associated with extensive cellulites. Louie TJ et al. (1976)⁸ when studied on aerobic and anaerobic bacteria in diabetic foot ulcers. There were a total of 116 isolated with an average 5.8 species per specimen (3.2 aerobes and 2.6 anaerobes). The principles isolated were bacteroids species (17) peptococci (16), proteus sp (11), enterococci (19), staphylococci aureus (7), corynebacterium diptheria (7) and Escherichia Coli (6). Charles S Sharp et al (1979)³ studied on superficial and deep tissues in infected diabetic gangrene isolated organisms were 1. Staph. Aureus 2. Proteus mirabilis & Vulgaris 3. E-Coli 4. Enterococci. Out of all these isolates Staph. Aureus, E. coli and enterococci were the predominant. Joshi N et al (1999)¹ isolated organisms from shallow and deep ulcer in soft tissue infection were aerobic gram positive cocci (eg. Staph aureus, Streptococci) from shallow ulcer and polymicrobial aerobic gram +ve cocci, strict anaerobes (e.g. bacteroides fragilis) and gram -ve bacilli (e.g. Ecoli) from deep ulcer.

In the present study antibiotic sensitivity profile of most of the isolates found to be multidrug resistant. The emergence of drug resistance is also seen with fluoroquinolones and third generation cephalosporins. Louie TJ et al. (1976)⁸ employed antimicrobial agents in treatment of diabetic foot ulcers which depends on associated clinical findings. Chronic lesions with minimal surrounding cellulites unlikely to benefit from systemic antibiotic treatment and the mainstay of therapy are local care and

avoidance of trauma. Indication for antimicrobial therapy extensive involvement of adjacent soft tissue osteomyelitis and sign of systemic infection. In these circumstances antimicrobial agents should be selected on the basis of likely pathogens with due consideration to both aerobic and anaerobic microorganisms. In the view of serious infections caused by these bacteria and dire consequences due to them it is advisable to treat these patients with broad spectrum antibiotics, taking in to consideration the profile of antibiotic resistance prevalent in these pathogens.

Prevalence of soft tissue infection of diabetic patient depends on associated factor like insulin treatment, raised blood sugar, raised blood pressure and duration of diabetes. Although in vitro finding have not yet been fully confirmed. But there is evidence that improving glycemic control in patients improves immune function. The efficiency of intracellular killing of organisms may improve better glycemic control⁵⁶. Similarly McMohan MM et al (1995)¹⁰ suggested that blood glucose should be closely controlled in diabetic patients with infections. Also Rassias AJ et al (1999)¹¹ observed that among diabetic patients undergoing heart surgery those given insulin infusion have better neutrophil function than those given intermittent insulin therapy.

In present study the risk of infections become more with increase in combination of associated factors. If only one factor was present, there were 18(21.42%) out of 84 patients with soft tissue infections. If any two factors were associated with diabetes mellitus there were 21(28%) out of 75 patients were with infections. When any three factors were associated in diabetes mellitus, there were 37(48.05%) out of 77 patients with infection and if all factors were associated as seen in 32 patients, 22(68.75%) patients had infections.

Conclusion

Common soft tissue infections in diabetes mellitus are diabetic foot and non-healing ulcers. It is basically a polymicrobial flora with gram +ve and gram -ve bacteria. E.coli, Klebsiella pneumoniae, Staphylococcus aureus and Pseudomonas aeruginosa are commonest bacterial pathogens. Bacterial isolates are generally multidrug resistant and resistance

must be considered for proper antibiotic therapy. Infections are common in patients on insulin therapy, with raised blood sugar, raised blood pressure and increased duration of illness. When diabetes mellitus associated factors increases, there are more chances of increase in rate of infections as immunity goes down in such situations.

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References

1. Joshi N, Caputo GM, Weitekamp MR, Karchmer AW. Infections in patients with Diabetes Mellitus. *NEJM* 1999; 16: 1906-1911. [[PubMed](#)]
2. Lipsky BA, Decoraro RE, Larson SA, Hanley ME, Ahroni JH. Outpatient management of uncomplicated lower extremity infections in diabetic patients. *Arch Int Med* 1990; 150: 790-793. [[PubMed](#)]
3. Sharp CS, Bessman AN, Wagner AN, Garland D, Reece E. Microbiology of superficial and deep tissue in infected diabetic gangrene. *Surg Gynec & Obst* 1979; 149: 217-219. [[PubMed](#)]
4. Carlisle HN et al. Comparison of properdin levels in general medical and hematological patients. *Am J Med Sci* 1961; 242:271. [[PubMed](#)]
5. Mackie and McCartney. *Practical Medical Microbiology*, 14th edition, Collee JG, Marmion BP, Fraser AG, Simmons A.
6. Ramachandran A, Snehlatha C, Latha E, Manmharan M, Vijay V. Impacts of urbanization on the life style and on the prevalence of diabetes in native Asian Indian population. *Diabetes Res Clin Pract* 1999; 44(3): 207-13. [[PubMed](#)]
7. Agnihotri S, Tewarson SL, Singh M, Bajaj S. Clinicopathological study of diabetes mellitus Hospital today 2001; VI (10): 595-599.
8. Louie TJ, Bartlett JG, Tally FP, Gorgbach SL. Aerobic and anaerobic bacteria in diabetic foot ulcers. *Ann Int Med* 1976; 85: 461-63. [[PubMed](#)]
9. Gallacher SJ, Thomson G, Frasier WD, Fisher BM, Gemmell CG, MacCurgh AC. Neutrophil bacteriocidal function in diabetes mellitus: evidence for association with blood glucose control. *Diabet Med* 1995; 12: 916-20. [[PubMed](#)]
10. McMohan MM, Bistran BR. Host defenses and susceptibility to infection in patients with diabetes mellitus. *Infect Dis Clin North Am* 1995; 9: 1-9. [[PubMed](#)]
11. Rassias AJ, Marrin Ca, Arruda J, Klhaleh DK, Beach M, Yeager MP. Insulin infusion improves neutrophil function in diabetic cardiac surgery patients. *Anaesth Analg* 1999; 88: 1011- 6. [[PubMed](#)]