Asymptomatic bacteriuria in patients with Type-2 Diabetes mellitus

Authors
Dr Mythreini B S¹, Dr M. K. Uthaya Sankar²*, Dr R. Gopal³, Dr I. S.S. Suman Babu⁴
¹PG Resident, ²Professor of Medicine, ³Professor of Microbiology, ⁴Assistant Professor
Department of General Medicine
Sri Manakula Vinayagar Medical College and Hospital, Puducherry-605107, India
*Corresponding Author
Dr M.K. Uthaya Sankar

Abstract
Introduction: Asymptomatic bacteriuria is a common problem in patients with diabetes mellitus it is more common in females if untreated it leads to life threatening complications like pyelonephritis, emphysematous cystitis, perinephric abscess and renal papillary necrosis.

Objective: This study was conducted to know the prevalence and clinical profile of asymptomatic bacteriuria in patients with diabetes

Methodology: Type-2 DM patients with asymptomatic urinary tract infection was selected and urine culture, antibiotic sensitivity pattern was studied.

Results: Among 80 diabetics patients 46(57.5%) had asymptomatic bacteriuria. Escherichia coli were the most prevalent organism and was sensitive to Nitrofurantoin in 89.5% cases and meropenem in 68.4% cases.

Introduction
Diabetes mellitus is a common metabolic disorder characterised by variable degrees of insulin resistance, impaired insulin secretion and increased glucose production. According to WHO India had 69.2 million people living with diabetes in 2015. Nearly 98 million people in India may develop type-2 diabetes by 2030. Diabetes produces various complications like diabetic ketoacidosis, hyperosmolar nonketotic hyperglycaemia, lactic acidosis, microvascular (neuropathy, nephropathy, and retinopathy) and macrovascular complication (cerebrovascular accident, cardiovascular disease, and peripheral vascular disease). Diabetic patients have an increased risk of infections, especially urinary tract infection is the most frequent site. Urinary tract infection may be symptomatic and asymptomatic. Many urinary tract infections are asymptomatic and whether symptomatic urinary tract infections are preceded by asymptomatic bacteriuria. Urinary tract infections are likely to be more severe in diabetic than non-diabetic patients.

Asymptomatic bacteriuria is defined as >10⁵ colony forming unit (CFU) per ml of 1 or 2 bacterial species in clean voided midstream urine sample from an individual without symptoms of a urinary tract infection like dysuria, frequency, urgency, abdominal pain, and fever. Some studies showed that prevalence of ASB was detected in 33.2% of participants; 38.3% in diabetics and
26.1% in non-diabetics. Various impairments in the immune system such as impaired migration, intracellular killing, phagocytosis and chemotaxis of polymorphonuclear leukocytes seen in diabetic patients and neuropathic complications such as impaired bladder emptying may all contribute to the pathogenesis of urinary tract infections. Factors that were found to enhance the risk for UTI in diabetic include age, metabolic control, and long-term complications primarily diabetic nephropathy and cystopathy. UTI is one of the most important cause of morbidity in diabetic patients. Untreated asymptomatic bacteriuria predisposes the individual to recurrent UTI which can cause renal diseases like pyelonephritis, emphysematous cystitis, perinephric abscess, bacteraemia and renal papillary necrosis. Hence this study was done to know the proportion of type-2 diabetic patients with asymptomatic bacteriuria and to analyse the organisms responsible for asymptomatic bacteriuria and its anti-microbial sensitivity pattern.

Materials and Methods
Study Area and Design
This study was done at Sri Manakula Vinayagar Medical College and Hospital from March 2019 to September 2019 for a period of 7 months. Sri Manakula Vinayagar Medical College is a tertiary care hospital located at Madagadipet, Puducherry. The study design employed was a cross sectional study.

Study Participants
The sample size was calculated to be 80 patients using the formula $4pq/d^2$ where $p=$prevalence $q=100-p$, $d$-relative precision of 20% with 10% non-response rate. Study participants were those who got admitted in the wards of the medicine department with diabetes.

Patients included were those all patients who are admitted or attending OPD with type-2DM and diagnosed as urinary tract infection based on urine microscopy between in the age group of 20-80 years. H/O of antibiotic therapy in previous two weeks, patients with anatomical anomalies of urinary tract, urinary catheterization, and previous history of urinary tract infection were excluded.

Methodology
Patients with type-2 DM who are diagnosed with urinary tract infection based on urine routine were identified after getting informed consent and questionnaire was used to identify the patients with symptomatic or asymptomatic urinary tract infections. If patient are asymptomatic a clean catch mid-stream urine sample was collected in a sterile container and processed in the microbiology laboratory of Sri Manakula Vinayagar for urine culture and antibiotic sensitivity and resistance pattern. Blood samples was collected for complete blood count, and renal profile. The prevalence of asymptomatic bacteriuria among 80 diabetic patients and organisms responsible for it, antimicrobial sensitive and resistance pattern of asymptomatic bacteriuria was noted.

Statistical Analysis
Data was entered into Microsoft excel data sheet and was analysed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square was used as test of significance for qualitative data. Continuous data was represented as mean and standard deviation. Independent t test was used as test of significance to identify the mean difference between two quantitative variables. MS Excel and MS Word was used to obtain various types of graphs such as bar diagram, pie diagram.

Results
A total of 80 diabetic patients were selected in this study. Out of 80 diabetic patients in the study group 46(57.5%) were found to have asymptomatic bacteriuria and 34(42.5%) were found to have symptomatic bacteriuria. Among 46 asymptomatic bacteriuria patients 33 were females and 13 were males [Table 1 & 2]. Majority of patients were in the age group of mean 58.3 years. The distribution of urine isolates in asymptomatic bacteriuria is presented in [Table 3]. Among 46
patients 25(54.4%) had presence of organisms in urine and 21(45.6%) participants had no growth.

**Table 1:** Distribution of Asymptomatic bacteriuria in type 2 DM patients

| Group          | Number | Percentage |
|----------------|--------|------------|
| Asymptomatic   | 46     | 57.5       |
| Symptomatic    | 34     | 42.5       |
| Total          | 80     | 100.0      |

**Figure-1**

![Patients Group](image)

**Table 2:** Gender distribution in asymptomatic bacteriuria

| Gender | Number | Percentage |
|--------|--------|------------|
| Male   | 13     | 28.3       |
| Female | 33     | 71.7       |
| Total  | 46     | 100.0      |

**Figure-2**

![Gender distribution type II DM patients](image)

**Table 3:** Distribution of urine isolates among asymptomatic bacteriuria patients

| Urine isolates | Number | Percentage |
|----------------|--------|------------|
| Absent         | 21     | 45.6       |
| Present        | 25     | 54.4       |

**Figure-3**

![Bacterimia](image)

**Table 4:** Mean and SD value of age and various laboratory parameters in this study

| Parameter                  | Mean (SD) |
|----------------------------|-----------|
| Age                        | 58.3 (11.2) |
| FBS                        | 175.2 (78.3) |
| PPBS                       | 256.8 (86.7) |
| Duration of DM (Years)     | 7.8 (3.4)  |
| Urea                       | 38.8 (25.4) |
| Creatinine                 | 1.5 (1.2)  |
| Total count                | 10067.4 (3641.9) |

**Figure-4**

![Yes No](image)

**Table 5:** Behavioural characteristics

Among the behavioural characteristics studied 38% were alcoholic and 38% were smoker

| Behavioural | Yes n (%) | No n (%) |
|-------------|-----------|----------|
| Alcoholic   | 8 (17.4)  | 38 (82.6) |
| Smoking     | 8 (17.4)  | 38 (82.6) |
The most common organisms isolated was Escherichia coli 19(76.0%) followed by klebsiella pneumoniae 4(16.0%), Enterococcus faecium 4(4.0%), klebsiella Aeruginosa 4(4.0%). [Table 6]

**Table 6:** Distribution of urine isolates among diabetics with asymptomatic bacteriuria  

| Urine isolates     | Number | Percentage |
|--------------------|--------|------------|
| E. coli            | 19     | 76.0       |
| Enterococcus faecium | 1     | 4.0        |
| Klebsiella Pneumoniae | 4    | 16.0       |
| Klebsiella Aeruginosa | 4    | 4.0        |
| **Total**          | **25** | **100.0**  |

Antibiotic sensitivity pattern for E.coli was Nitrofurantoin (89.5%) followed by meropenem (68.4%), and gentamycin (47.4%) and resistant pattern for E.coli was ampicillin followed by ceftriaxone and ceftazidime. [table 7 & 8].

**Table 7:** Antibiotics sensitivity pattern for organisms among patients with asymptomatic bacteriuria  

| Urine isolates    | Number | Nitrofurantoin | Ceftriaxone | Ceftazidime | Ampicillin |
|-------------------|--------|----------------|-------------|-------------|------------|
| E.coli            | 19     | 17 (89.5%)     | 0 (0)       | 5 (26.3%)   | 2 (10.5%)  |
| Enterococcus faecium | 1     | 1 (100.0%)     | 5 (26.3%)   | 1 (100.0%)  | 0 (0)      |
| Klebsiella Pneumoniae | 4    | 2 (50.0%)      | 2 (50.0%)   | 1 (25.0%)   | 2 (50.0%)  |
| Klebsiella Aeruginosa | 1    | 1 (100.0%)     | 1 (100.0%)  | 0 (0)       | 0 (0)      |

| Urine isolates    | Number | Gentamycin | Norfloxacin | Tobramycin | Cefazolin | Meropenam |
|-------------------|--------|------------|-------------|------------|-----------|-----------|
| E.coli            | 19     | 9 (47.4%)  | 6 (31.6%)   | 5 (26.3%)  | 6 (31.6%) | 13 (68.4%)|
| Enterococcus faecium | 1     | 1 (100.0%) | 0 (0)       | 1 (100.0%) | 1 (100.0%)| 1 (100.0%)|
| Klebsiella Pneumoniae | 4    | 2 (50.0%)  | 1 (25.0%)   | 2 (50.0%)  | 2 (50.0%) | 2 (50.0%) |
| Klebsiella Aeruginosa | 1    | 0 (0)      | 1 (100.0%)  | 1 (100.0%) | 1 (100.0%)| 0 (0)     |
Table 8: Antibiotics resistant pattern for organisms among patients with asymptomatic bacteriuria

| Urine isolates              | Number | Nitrofurantoin | Ceftriaxone | Ceftazidime | Ampicillin |
|-----------------------------|--------|----------------|-------------|-------------|------------|
| E.coli                      | 19     | 2 (10.5%)      | 14 (73.7%)  | 14 (73.7%)  | 17 (89.5%) |
| Enterococcus faecium        | 1      | 0 (0)          | 0 (0)       | 0 (0)       | 1 (100.0%) |
| Klebsiella Pneumoniae      | 4      | 2 (50.0%)      | 2 (50.0%)   | 3 (75.0%)   | 2 (50.0%)  |
| Klebsiella Aeruginosa       | 1      | 0 (0)          | 0 (0)       | 1 (100.0%)  | 1 (100.0%) |

*In E.coli out of 19, antibiotic resistance culture is not done for Norfloxacin one patient (5.3)
* In E.coli out of 19, antibiotic resistance culture is not done for Tobramycin in four (21.0%) Patient
*In E.coli out of 19, antibiotic resistance culture is not done for Cefazolin one patient (5.3)

*In E.coli out of 19, antibiotic resistance culture is not done for Meropenem 5 (26.3) patient
*In Klebsiella Pneumoniae out of 4, antibiotic resistance culture is not done for Meropenem for one patient (25%).

Figure-7

![Sensitivity pattern to antibiotics](image_url)

Figure-8

![Resistance pattern to various drugs](image_url)
Discussion
In our study the prevalence of asymptomatic bacteriuria among 80 diabetic patients was significantly higher 57.5%, this study results was very similar with other study done by Kalpana Devi Venkatesan et al (32%) in 2015 and 32.2% by Marie E A Bissong 2013 and Shubham Singhal et al showed 28.2% prevalence in 2014.

However, our study showed higher prevalence when compared to other studies. In this study ASB was more in diabetic females when compared to males like previous study Awadh A et al showed fivefold significant bacteriuria in females compared to males and in Kalpana Devi Venkatesan et al in 2015 showed females are more risk of developing ASB than males. Among 46 ASB patients, significant growth was found in 54.4% and 45.6% patients showed no growth. Shadma Yaqoob et al in 2018, Edward J. Boyko et al in 2004, Girishbabu R.J et al in 2013, Mainak Banerjee et al in 2019, and G. Ranjani et al in 2017 all these studies showed that E. coli was the prevalent organism. In this study also showed E. coli was the most prevalent etiological agents in ASB in type-2 diabetes. Klebsiella pneumoniae is the second most common organisms followed by enterococcus faecium. In our study E. coli were sensitive to nitrofurantoin (89.5%), meropenem (68.4%) and gentamycin (47.4%) Girishbabu R.J et al study showed E. coli was 100% sensitive to imipenem and 90% sensitive to nitrofurantoin.

Conclusion
Among 80 diabetics patients the prevalence of asymptomatic bacteriuria was 57.5% in this study. Females are at more risk of developing asymptomatic bacteriuria than males. Among 46 asymptomatic patient significant growth was found in 25 (54.4%) and while 21 (45.6%) patients showed no growth. Escherichia coli was the most prevalent organisms and sensitive to Nitrofurantoin 89.5%, meropenem 68.4% and gentamycin 47.4% and resistant to ampicillin 89.5%, ceftriaxone 73.7%, and ceftazidime 73.7% and resistant to ampicillin 89.5%, ceftriaxone 73.7% and ceftazidime 73.7%.

References
1. Kalpana Devi Venkatesan, Senthil Chander, Karthiga Loganathan, Kalavathy Victor. Asymptomatic bacteriuria in diabetic patients. International Journal of contemporary Medical Research 2015: 77.83.
2. Bissong ME, Fon PN, Tabe-Besong FO, Akenji TN. Asymptomatic bacteriuria in diabetes mellitus patients in Southwest Cameroon. African health sciences. 2013;13(3):661-6.
3. Singhal S, Himanshu D, Vaish AK, Singh M, Rana H, et al. A Study of Asymptomatic Bacteriuria in North Indian Type 2 Diabetic Patients. J Diabetes Metab. 2015;6:620
4. Awadh A, Al-Rashidi, Ahmed Bakhiet, Ayla Turkmani, Abdulrahman Al-Shehry. Asymptomatic bacteriuria among type 2 diabetes mellitus patients in primary care centre in Saudi arabia. International Journal Of Advanced Research 2017;1158-1164.
5. Yaqoob S, Shukla V, Singh M, Shukla P, Haider F. A comparative study of the prevalence of asymptomatic bacteriurea (ASB) among elderly diabetics and non diabetics with their antibiotic resistant pattern. Indian Journal of Microbiology Research. 2018;5(3):339-41.
6. Boyko EJ, Fihn SD, Scholes D, Abraham L, Monsey B. Risk of urinary tract infection and asymptomatic bacteriuria among diabetic and nondiabetic postmenopausal women. American journal of epidemiology. 2005 Mar 15;161(6):557-64.
7. Girish Babu RJ, Prakash R, Prashanth HV, Chandrasekar SC. Asymptomatic bacteriuria in patients with Diabete..
mellitus. National Journal of Laboratory Medicine. 2013;2:11-13.

8. Banerjee M, Majumdar M, Kundu PK, Maisnam I, Mukherjee AK. Clinical profile of asymptomatic bacteriuria in type 2 diabetes mellitus: An Eastern India perspective. Indian journal of endocrinology and metabolism. 2019 May;23(3):293.

9. Ranjani G. Asymptomatic bacteriuria in type 2 diabetic women patients who are attending Medicine OPD of Government Dharmapuri Medical College, Dharmapuri.

10. Sharma BD, Bansal R, Gupta B. Asymptomatic bacteriuria in diabetics. Journal, Indian Acad Clin Med. 2012 Jan;13(1):55-9.