# A STUDY OF SECONDARY BACTERIAL INFECTIONS IN DIABETES MELLITUS

*Tirupati Reddy Chirra[1], Sakuntala Putrevu[2]*

*[1]Assistant Professor, Department of General Medicine, Osmania Medical College/Osmania General Hospital, Hyderabad, Telangana.*
*[2]Assistant Professor, Department of General Medicine, Osmania Medical College/Osmania General Hospital, Hyderabad, Telangana.*

**ABSTRACT**

**BACKGROUND**

Diabetes mellitus has been associated with increased rates of infections. Diabetic patients have more frequency and severity of infections. Evidence from clinical studies for a causal relation between diabetes and common infections is, however, limited and not consistent. The reason for this includes incompletely defined abnormalities in cell mediated immunity and phagocyte function associated with hyperglycaemia and also less vascular perfusion of the tissues. Hyperglycaemia aids the colonisation and also growth of a variety of organisms. Fungal infections like candida are more commonly seen in the patients who are suffering from persistent hyperglycaemia. Many common infections are more frequent and also more severe in diabetic population, whereas rare infections are seen almost every day seen in diabetic patients. These infections should be sought, in particular with patients presenting with hyperosmolar hyperglycaemic state. This study puts in a sincere effort to study and understand the patterns of infection burden commonly encountered in the diabetic mellitus patients. This study is intended to help the practising physicians and diabetologists to understand and help the patients to recover from the disease.

**METHODS**

Three hundred twenty patients who were freshly diagnosed diabetics were included in the study. The study group included males predominantly and a few female candidates. So gender based statistical analysis could not be done.
The study was done in the Department of Medicine, Osmania Medical College, Hyderabad, Telangana. The study was done from June 2013 to May 2014.

**RESULT**

In upper respiratory tract infections, 31 patients had acute rhinolaryngitis, 11 patients had acute sinusitis and 14 had acute otitis media. In lower respiratory tract infections, 139 had acute bronchitis, 6 had pneumonia, 59 patients had exacerbation of COPD and asthma and 19 patients had influenza. In urinary tract infection, 19 patients had cystitis, 9 patients had acute pyelonephritis. In Bacterial skin and mucous membrane infection, 7 otitis externa patients were there, 2 cellulitis and 4 furuncles or abscess on nose were present. In mycotic skin and mucous membrane infections, 3 were thought to have skin candida infections. There is a strong association of the infections in the diabetic mellitus patients ($P<0.05$).

**CONCLUSION**

Diabetes Mellitus depresses the immunity and causes a plethora of infections. This study helps the practising physicians to understand the common secondary infections and thus help them to take immediate measures to prevent further complications and arrest the natural progression of the disease.

**KEYWORDS**

Diabetes mellitus, Infections, Immunity, Fungal, Bacterial.

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**INTRODUCTION:** Diabetes Mellitus is a complex metabolic disorder which has affected 285 million people worldwide. It has been projected to affect around 438 million worldwide by 2030. In 1985, there were around 30 million which were affected. So the number of cases of diabetes mellitus has risen dramatically. It is often called as an iceberg disease because until the complications set in majority of the patients will not know of its existence.

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*Corresponding Author:*
*Dr. Tirupati Reddy Chirra,*
*# 2-12-19, Annapurna Colony, Uppal, Hyderabad.*
*E-mail: suchitra@gmail.com*
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India contributes a majority of its share to this statistics. Majority of the times it exists as a silent disease and need not be told the fact that it has been underreported worldwide as the cause of morbidity and mortality. A recent estimate is that it is the fifth most common cause of death worldwide. Several distinct types of diabetes mellitus are caused by the complex interaction of genetic factors and the environmental factors. Aetiological classification includes the factors contributing to insulin hyposecretion, underutilisation of glucose and increased production of glucose. Dysregulation of the metabolic functions associated with diabetes mellitus causes pathophysiologic changes in almost every organ system that is known to impose tremendous burden on the patients with diabetes and also on the already over-

burdened treating health care system. Type-1 and Type-2 are the two broad categories of diabetes mellitus. Type-1 is the result of insulin deficiency. It is almost always seen in young people and the destruction of the islet of pancreas is the leading cause.

The autoimmunity against the B-cells that are present in the islets of Langerhans is the known cause for the destruction. Type-2 is caused due to insulin resistance and also insulin production process can be hampered. Other causes that mimic the diabetes are known as the specific types of diabetes are known. These can again be broadly classified into genetic defects of beta cell function characterised by mutation, genetic defects in insulin action, diseases of the exocrine pancreas, endocrinopathies, drugs or chemical induced, infections of the pancreas, uncommon forms of immune-mediated diabetes, other genetic syndromes including Down syndrome, Huntington chorea that are always associated with Diabetes Mellitus and in recent times gestational diabetes mellitus. Chronic complications of diabetes mellitus affects almost all organ systems and are responsible for the majority of the morbidity and mortality associated with the disease. Chronic complications can be categorised into that affecting the vascular components and that which will not include the vascular system. The risk of chronic complications seen in Diabetes Mellitus increases as the duration of the disease is more. It also depends on the degree of hyperglycaemia. The complications become apparent only after two decades of hyperglycaemia.

Diabetes mellitus has been associated with increased rates of infections.[1-3] Diabetic patients have more frequency and severity of infections. Evidence from clinical studies for a causal relation between diabetes and common infections is, however, limited and not consistent.[4-6] The reason for these infections is the decreased immunity in the human body. The reason for this includes incompletely defined abnormalities in cell mediated immunity and phagocyte function associated with hyperglycaemia and also less vascular perfusion of the tissues. Hyperglycaemia aids the colonisation and also growth of a variety of organisms. Fungal infections like candida are more commonly seen in the patients who are suffering from persistent hyperglycaemia.[7-10] Many common infections are more frequent and also more severe in diabetic population, whereas rare infections are seen almost every day seen in diabetic patients. These infections should be sought, in particular with patients presenting with hyperosmolar hyperglycaemic state. Pneumonia, urinary tract infections and soft tissue infections are all seen more commonly in the diabetic patients. In general, the organisms that cause pulmonary infections are similar to those found in the non-diabetic population. Gram-negative organisms like Staphylococcus aureus and tuberculosis bacteria are more frequently seen to cause infections in diabetes mellitus. Urinary tract infections are a result of common bacterial infections like E. Coli and also fungal and yeast species are commonly observed.

Complications of the urinary tract infections include emphysematous pyelonephritis and emphysematous cystitis. Furunculosis, superficial candida infections and vulvovaginitis are increased. Diabetic patients have an increased rate of colonisation of S. aureus in the skin fold and nares. Wound infections are quiet commonly encountered in post-surgical wards in diabetic individuals. It is a known fact that strict diabetic control renders the physicians and surgeons in managing the post-surgical complications in an efficient manner. Skin infections are quite common in diabetics. Most commonly encountered are protracted wound healing and skin ulcerations. Diabetic skin spots begin as erythematous area and evolve into an area of circular hyperpigmentation. Minor mechanical trauma can result in this and is a known factor causing worry in the elderly population. Bullous diseases such as bullosis diabeticorum are more commonly seen. Necrobiosis lipoidica diabeticorum is a rare disorder which is commonly encountered in young women who are diabetic.

It usually is first encountered in pretibial region which are populated and then they gradually enlarge and darken and then develop irregular margins with atrophic centres which ultimately progresses into ulceration. They may or may not be painful as the neuropathy is known to set in diabetic patients. Vitiligo is one more entity which will be encountered frequently in common practice. Generalised or localised granulomas and scleredemas are also studied to have a higher impact on diabetic population. Lipohypertrophy can occur in insulin injection sites. Xerosis and pruritus are common. This study puts in a sincere effort to study and understand the patterns of infection burden commonly encountered in the diabetic mellitus patients. This study is intended to help the practising physicians and diabetologists to understand and help the patients to recover from the disease.

**AIMS AND OBJECTIVES:** To study and understand the infection pattern in Diabetes Mellitus.

**MATERIALS AND METHODS:** Three hundred twenty patients who were freshly diagnosed diabetics were included in the study. The study was done in the Department of Medicine, Osmania Medical College, Hyderabad, Telangana. The study was done from June 2013 to May 2014.

**Inclusion Criteria:**

1. The study subjects were aged between 40 to 50 years.
2. Fresh cases who were freshly diagnosed diabetics were only included for the study.
3. Only newly acquired infections were considered for the study.

**Exclusion Criteria:**

1. <40 years and >50 years were excluded. This was done to minimise the age related bias.
2. Previously known diabetics were excluded from the study.

Detailed history was taken and prompt immediate treatment for diabetes was started. These patients were followed and the commonly encountered infections were noted for the study period. The study group included males predominantly and a few female candidates. So gender based statistical analysis could not be done. Symptoms of the infection was found and noted. Swabs were taken and sent to the Department of Microbiology to find out the positive culture. All the statistics were done using latest SPSS software 2015, California.

| | Mean | Std. Deviation |
|---|---|---|
| Age | 44.64 | 3.12 |

***Table 1: Mean Age of the Study Population***

| Symptoms of the Disease | Total | Percentage |
|---|---|---|
| Upper Respiratory Tract Infection | 56 | 17.5% |
| Lower Respiratory Tract Infection | 223 | 69.68% |
| Urinary Tract Infection | 28 | 8.75% |
| Bacterial Skin and Mucous Membrane Infection | 13 | 4.06% |
| Mycotic Skin and Mucous Membrane Infection | 3 | 0.93% |

***Table 2: Frequency of Symptoms of Different Diseases***

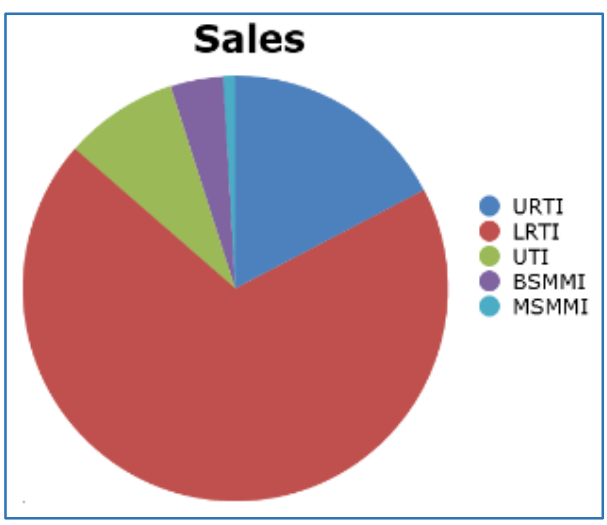


***Fig. 1: Symptoms of the Different Diseases***

| Infections | Culture Positivity | | $X^2$ value | p value |
|---|---|---|---|---|
| | Present (%) | Absent (%) | | |
| Upper Respiratory Tract Infection | 7(18.4) | 49(17.4) | 8.920 | 0.030 |
| Lower Respiratory Tract Infection | 21(55.3) | 202(71.6) | | |
| Urinary Tract Infection | 8(21.1) | 20(7.1) | | |
| Bacterial Skin and Mucous Membrane Infection | 2 (5.3) | 11 (3.9) | | |
| Mycotic Skin and Mucous Membrane Infection | Nil | 03 | | |

***Table 3: Test for Significance***

There is a strong association of the infections in the diabetic mellitus patients (P<0.05). Table 4: Incidence of new episodes of infection in patients with diabetes mellitus.

| Infections | |
|---|---|
| Upper respiratory tract infections:<br>• Acute rhinolaryngitis<br>• Acute sinusitis<br>• Acute otitis media | <br>31<br>11<br>14 |
| Lower respiratory tract infections:<br>• Acute bronchitis<br>• Pneumonia<br>• Exacerbation of COPD or asthma<br>• Influenza | <br>139<br>6<br>59<br><br>19 |
| Urinary Tract Infection:<br>• Cystitis<br>• Acute pyelonephritis | <br>19<br>09 |
| Bacterial skin and mucous membrane infection<br>• Otitis externa<br>• Cellulitis<br>• Furuncle/abscess nose | <br>7<br>2<br>4 |
| Mycotic skin and mucous membrane infection<br>• Skin candida infections | <br>3 |

**DISCUSSION:** Diabetes Mellitus patients as discussed earlier are at increased risk for developing common infections. In this study, we were able to study associations of diabetes with common infections involving different organ systems. Statistically significant associations were found out between the incidence of infections and diabetes mellitus. In our study, the mean age of the study population was 44.64 years with a standard deviation of 3.12 years. The symptoms of different diseases that were found included upper respiratory tract infections in 56 patients, Lower respiratory tract infections were found in a majority of cases and were found in 223 cases.

Urinary tract infections were found in 28 cases, bacterial skin and mucous membrane infections were found in 13 cases and mycotic skin and mucous membrane infections were found to be in 3 patients. In upper respiratory tract infections, 31 patients had acute rhinolaryngitis, 11 patients had acute sinusitis and 14 had acute otitis media. In lower respiratory tract infections, 139 had acute bronchitis, 6 had pneumonia, 59 patients had exacerbation of COPD and asthma and 19 had influenza. In urinary tract infection, 19 patients had cystitis, 9 patients had acute pyelonephritis. In Bacterial skin and mucous membrane infection, 7 otitis externa patients were there, 2 cellulitis and 4 furuncles or abscesses on nose were present. In mycotic skin and mucous membrane infections, 3 were thought to have skin candida infections. There is a strong association of the infections in the diabetic mellitus patients. ($P<0.05$).

In a study conducted by L. M. A. J. Muller et al,[11] Cystitis, acute rhinolaryngitis, dermatomycosis, and acute bronchitis were the most common infections for which people attended their general practitioner, whereas pleuritis, abscess of the nose, and nonspecific urethritis were rare diseases. The incidence of infections in the diabetes populations was equal to or greater than that in the control population. The difference in the study might be due to the fact that the populations studied are different. Environmental and geographical distribution of diabetes mellitus is well documented. The disease actually depends on the socioeconomic status of the population as well. In our country, we belong to different anthropological background when compared to the other study.[11] There are several controlled studies documenting an increased risk of skin and mucous membrane infections in patients with diabetes.[12,13] Many aspects of immunity are altered and diseased in patients with diabetes mellitus. Leukocyte, particularly Polymorphonuclear type's function is depressed and acidosis is also present, this doubles the effects. Its chemotaxis, adherence and phagocytosis will be affected. Antioxidant systems involved in bactericidal activity will be pathologically impaired. The study to support humoral immunity pathogenicity is limited, but responses to vaccines appear to be normal. Skin responses to antigen prick test challenges and measures of T-cell function may be depressed.

**CONCLUSION:** Diabetes Mellitus depresses the immunity and causes a plethora of infections. This study helps the practising physicians to understand the common secondary infections and thus help them to take immediate measures to prevent further complications and arrest the natural progression of the disease.

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