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The Clinical Spectrum of Various Infections in Diabetic Patients Other Than Diabeic Foot

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Abstract:
Diabetes is one of the most common co-morbid illness in India. Being an immunocompromised state, one of its long term complications is infection. Morbidity and mortality due to this complication is a major health issue. This study is aimed to evaluate and manage the different infections in diabetic patients other than diabetic foot infections. To describe the lesions, we treat, study and compare the outcomes and identify measures to decrease morbidity and mortality due to diabetic infections.

Keywords: *Antibiotics, Incision and Drainage, Wound debridement, Complications, Glycemic control.*

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AIM OF THE STUDY:
The purpose of this study is

1. To study about the incidence of various infections in diabetic patients other than foot infections and determine the most common infection among them.
2. To study about the common etiology and its distribution in various age groups
3. To create awareness among the public regarding diabetic infections and their prevention.

I. Introduction:

Diabetes mellitus is a heterogeneous group of metabolic disorders characterized by chronic hyperglycemia, with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both. The effects of diabetes mellitus include long term damage, dysfunction and failure of various organs including eyes, kidneys, heart and blood vessels. Hyperglycemia sufficient to cause pathologic functional changes may often be present before the diagnosis is made. Sometimes diabetes is discovered by the presence of a complication.The majority of cases of diabetes mellitus fall into two categories- type 1 and type 2 diabetes mellitus. Individuals with type 1 diabetes mellitus are prone to ketosis and unable to produce endogenous insulin. Type 2, formerly known as non-insulin dependent diabetes mellitus [NIDDM] accounts for 90-95% of the cases detected. Type 2 diabetes mellitus is characterized by hyperglycemia in the presence of hyperinsulinemia due to peripheral resistance. Gestational as well as genetic defects and endocrinopathies are recognized as other types of diabetes mellitus.

The incidence of infections is higher in diabetic patients and such infections result in complications and death than in otherwise healthy individuals. In diabetic patients, a number of factors complicate the assessment of risk of infections and resulting complications. The most basic problem is determining the appropriate population at risk which is difficult to obtain for diabetes. Like other chronic diseases, in diabetes mellitus, historic controls are of limited utility, given the expected improvements in the general health of a population, the development of more effective diagnostic methods, earlier medical intervention, expanded therapeutic options and availability of more active and better tolerated antimicrobials. A number of factors including duration of illness, severity of non-infectious complications, concurrent illness, level of glycemic control result in a heterogeneous group of individuals at risk in a narrow time frame. Some infections that may be particular to diabetes, like emphysematous cholecystitis are uncommon and information regarding risk factors and management are limited.

To acknowledge and overcome such limitations, it is important for careful individualization in the approach to diagnosis and therapy for any diabetic patient with suspected or proven infection.

II. Methodology:

1. Type of study: Prospective and observational study
2. Approval : Prior to conducting the study, approval was obtained from the ethical committee of Thanjavur Medical College, Thanjavur.
3. Study place :Thanjavur medical college and hospital, Thanjavur- 613 004
4. Study Period :2018 October to 2020 October
5. Sample size :62
6. Inclusion criteria :

-All patients in age group 25-85 years
-Patients with proven / newly diagnosed diabetes mellitus

7. Exclusion criteria :

-Patients who did not give consent
-Paediatric age group
- Patients with intracranial/ intrathoracic infections
-Patients with diabetic foot infections

8. Investigations:

-Blood investigations- Routine blood sugar, Fasting and postprandial blood sugar, H bA1c, Renal function tests, Liver function tests
-wound swab, pus culture & sensitivity, Urine culture & sensitivity

9.Study procedure:

Method of sampling was non-random, purposive.Data were collected by detailed history, thorough clinical examination, biochemical tests and were recorded in the pre-designed proforma. Age, sex, socioeconomic status, duration and type of diabetes, examination findings, blood investigations , swab of the wound and treatment provided are collected. Treatment was carried out by both medical and surgical means. Antibiotics-aminoglycosides, cephalosporins, penicillin derivatives were used.

10.Operational definitions:

Abscess: Localised collection of pus
Cellulitis: Inflammation of subcutaneous connective tissue
Necrotizing fasciitis: necrotizing soft tissue infection along fascial planes with or without cellulitis
Fournier's gangrene: a type of necrotizing fasciitis that occurs around the genitalia
Empyema gall bladder: collection of pus in the gall bladder as a complication of cholecystitis
Gangrene: Macroscopic death of tissue
Pyocele: Collection of pus between the covering layers of testis (tunica vaginalis)
Balanoposthitis: inflammation of the prepuce and glans penis
Emphysematous pyelonephritis: Necrotizing infection of renal parenchyma with the presence of air
Epididymo-orchitis: Inflammation of epididymis and testis

11.Variables studied:

Dependent variable: Diabetic infections
Independent variable-
Age
Sex
Other co-morbidities
Pus culture & sensitivity findings
Surgeries performed

12. Ethical consideration

All the patients/ legal guardians were given an explanation of the study and about the investigative and operative procedures with their merits and demerits, expected results and possible complications. If he/ she agreed then the case had been selected for the study. The study did not involve any additional investigation or any significant risk. It did not cause economic burden to the patients. The study was approved by the institutional review board prior to the commencement of data collection. Informed consent was taken from each patient/ guardian. Data were collected by approved data collection form.

13.Data collection

Data were collected by pre-tested structured questionnaire. Data were collected from all the respondents by direct interview after getting informed written consent from them or from their legal guardian.

14. Data analysis
Data analysis was done both manually and by using computer. Calculated data were arranged in systemic manner, presented in various table and figures and statistical analysis was made to evaluate the objectives of this study with the help of Statistical Package for Social Science (SPSS).
Analysis and Results

This cross sectional study estimated the prevalence of infections in diabetes mellitus patients other than diabetic foot.
Among the total study populations(62) with diabetes mellitus most of them were diagnosed with type 2 diabetes ie 98.4% and remaining 1.6 %were belong to type 1 diabetes mellitus.

The following observations were made of the data collected from studies.

Results are divided into two sections :
1) Descriptive statistics using frequency distribution .
2) Inferential statistics using chi square test and fisher exact test .

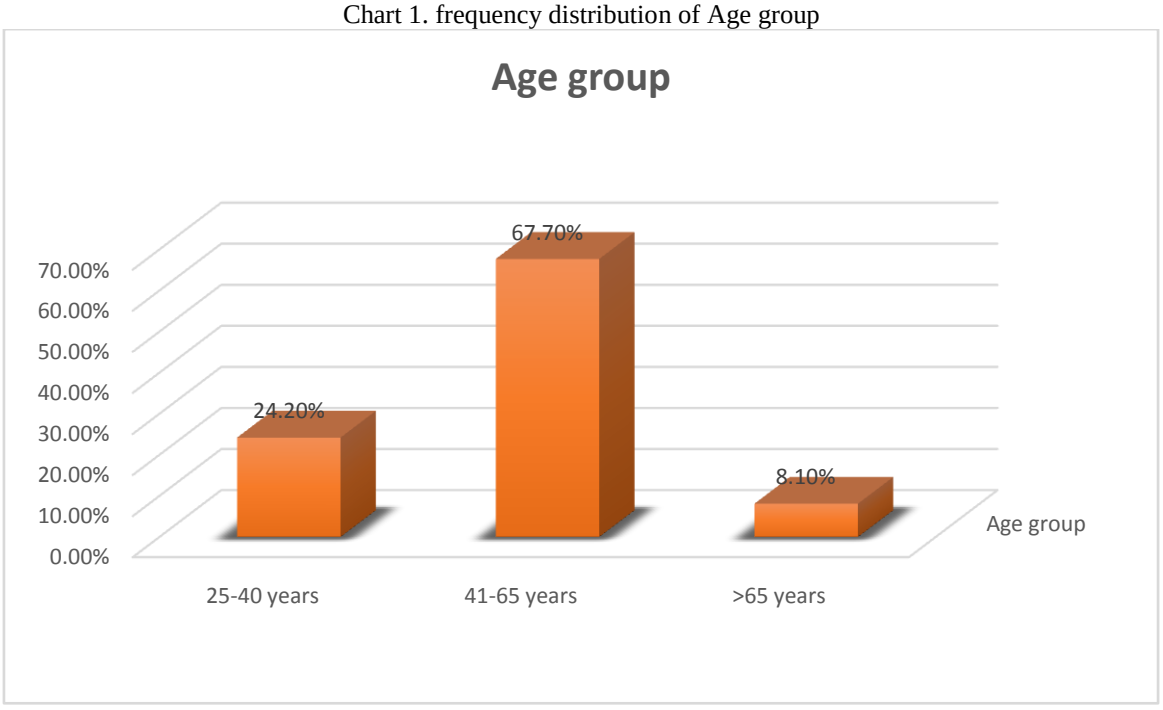
Descriptive statistics using frequency distribution
AGE GROUP

Table 1.frequency distribution of Age group

S.no	Age group(years)	Frequency (62)	Percent (%)
1.	25-40	15	24.2
2	41-65	42	67.7
3	>65	5	8.1

Among the study populations , Age ranged from 26 to 85 years with mean age 50.5 years of age and SD-11.909 Maximum cases were in 4^{th} to 6^{th} decades of life .

Chart 1. frequency distribution of Age group



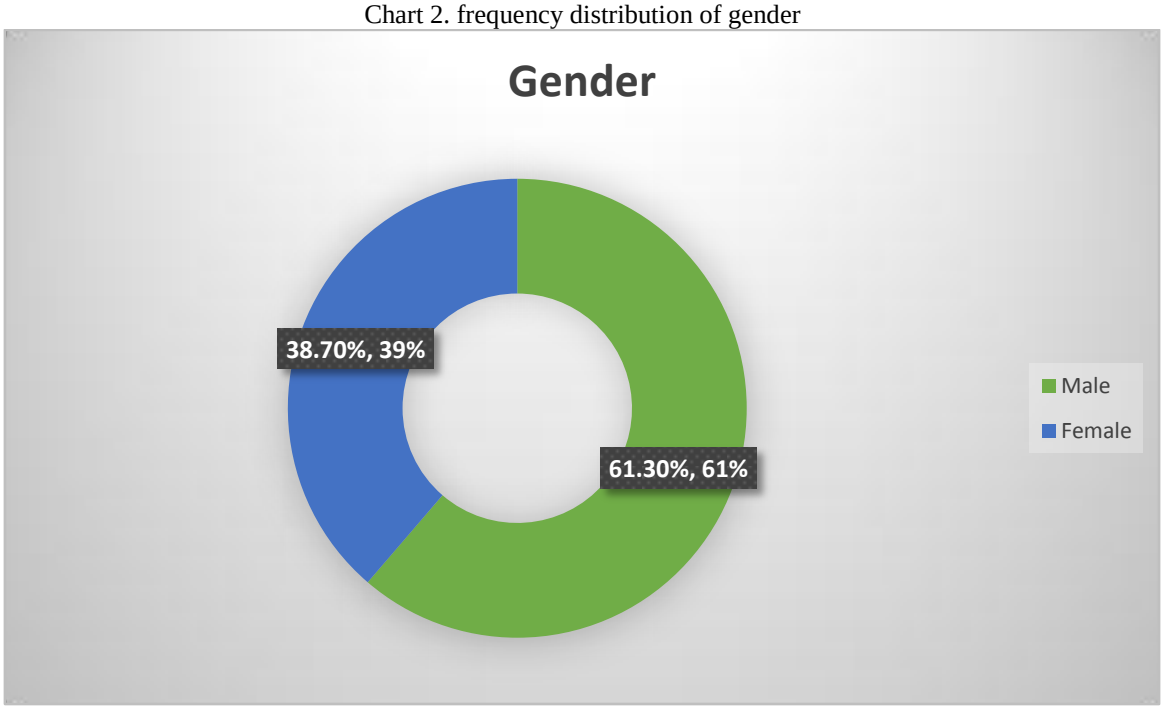
Gender

Table 2.frequency distribution of gender

S.no	Gender	Frequency (62)	Percent (%)
1.	Male	38	61.3
2	Female	24	38.7

A total of 62 patients selected for the study out of which 38 were male (61.3%) and 24 were female(38.7%).

Chart 2. frequency distribution of gender

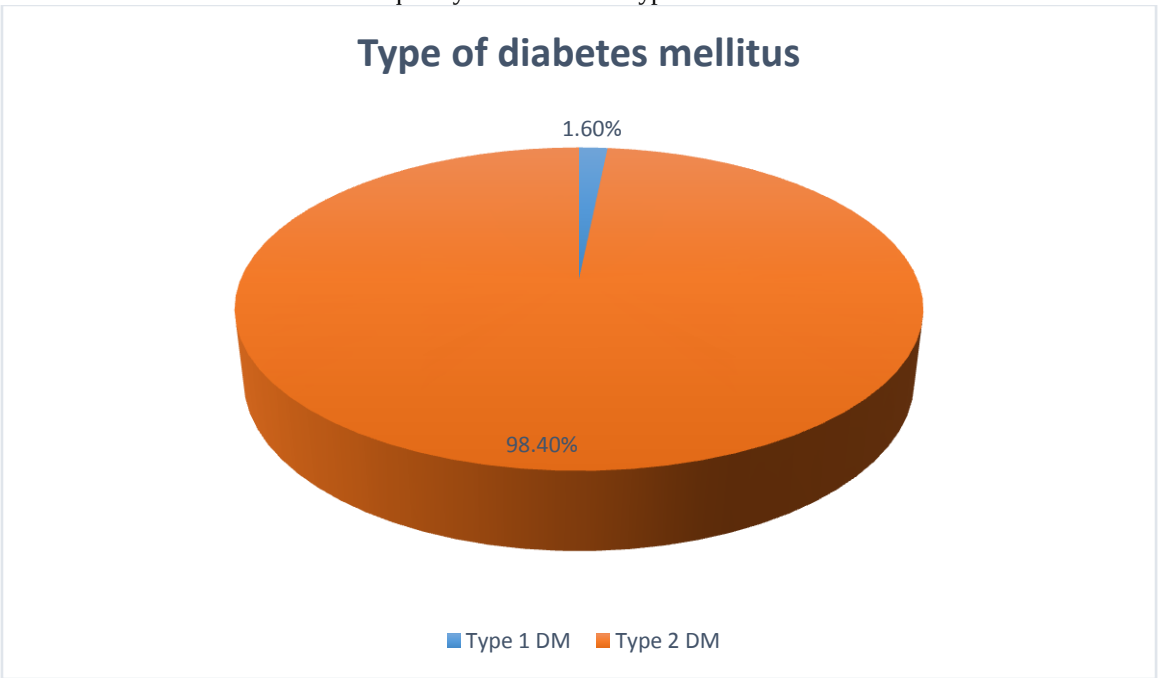


Type of diabetes mellitus

Table 3.frequency distribution of Type of diabetes mellitus

S.no	Type of diabetes mellitus	Frequency (62)	Percent (%)
1.	Type 1	1	1.6
2	Type 2	61	98.4

Chart 3. frequency distribution of type of diabetes mellitus



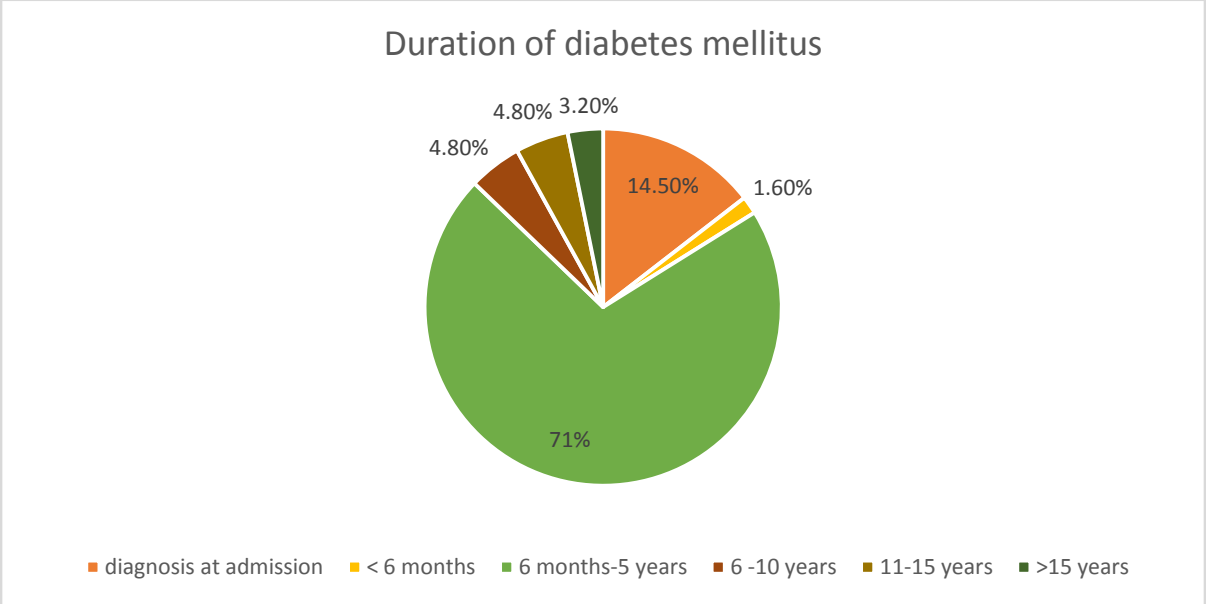
Duration of diabetes mellitus

Table 4.frequency distribution of duration of diabetes mellitus

S.no	Duration of diabetes mellitus	Frequency (62)	Percent (%)
1.	Diagnosis at admission	9	14.5
2	<6 months	1	1.6
3	6 months-5 years	44	71
4	6-10 years	3	4.8
5	11-15 years	3	4.8
6	>15 years	2	3.2

Among the study population,most of the patient 71% were diagnosed with DM within 6 months to 5years.

Chart 4. frequency distribution of duration of diabetes mellitus



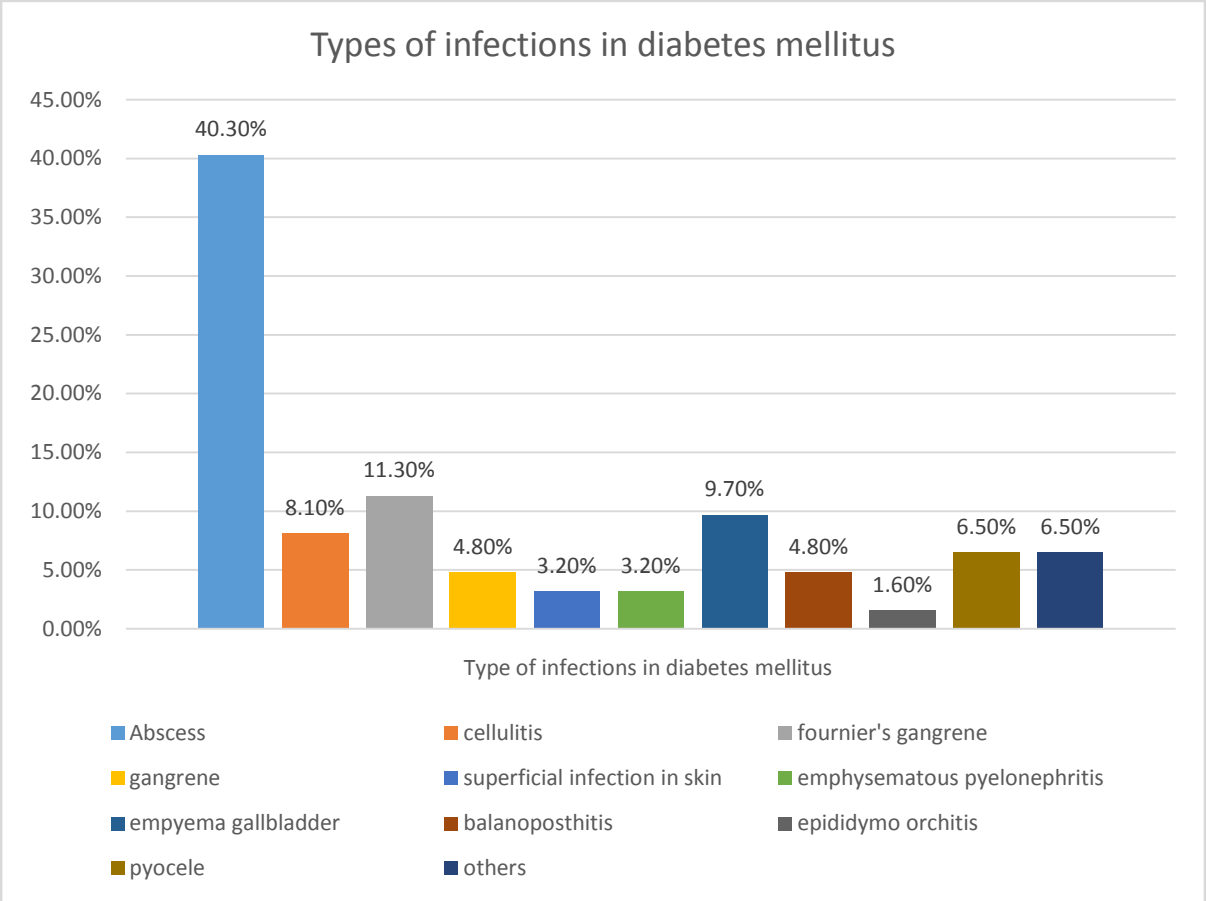
Types of infections in diabetes mellitus

Table 5.frequency distribution of Types of infections in diabetes mellitus

S.no	Type of infections in diabetes mellitus	Frequency (62)	Percent (%)
1.	Abscess of various sites	25	40.3
2	Cellulitis of various sites	5	8.1
3	Fournier ‘s gangrene	7	11.3
4	Gangrene of various sites	3	4.8
5	Superficial infections of skin	2	3.2
6	Emphysematous pyelonephritis	2	3.2
7	Empyema gallbladder	6	9.7
8	Balanoposthitis	3	4.8
9	Epididymo orchitis	1	1.6
10	Pyocele	4	6.5
11	Others	4	6.5

Among total study populations ,most of the diabetic patients 40.3% were infected with abscess of various sites such as hand, lumbar region,ovarian,perianal,periurethral,breast,facial abscess,thigh region etc…
Next to it were Fournier ‘s gangrene 11.3% were infected . and least were epididymo orchitis ie 1.6% , other types of infection include raw area hand, infected sebaceous cyst, non healing ulcer, surgical site infections.

Chart 5. frequency distribution of type of infections in diabetes mellitus



Treatment of current infections in diabetes patient

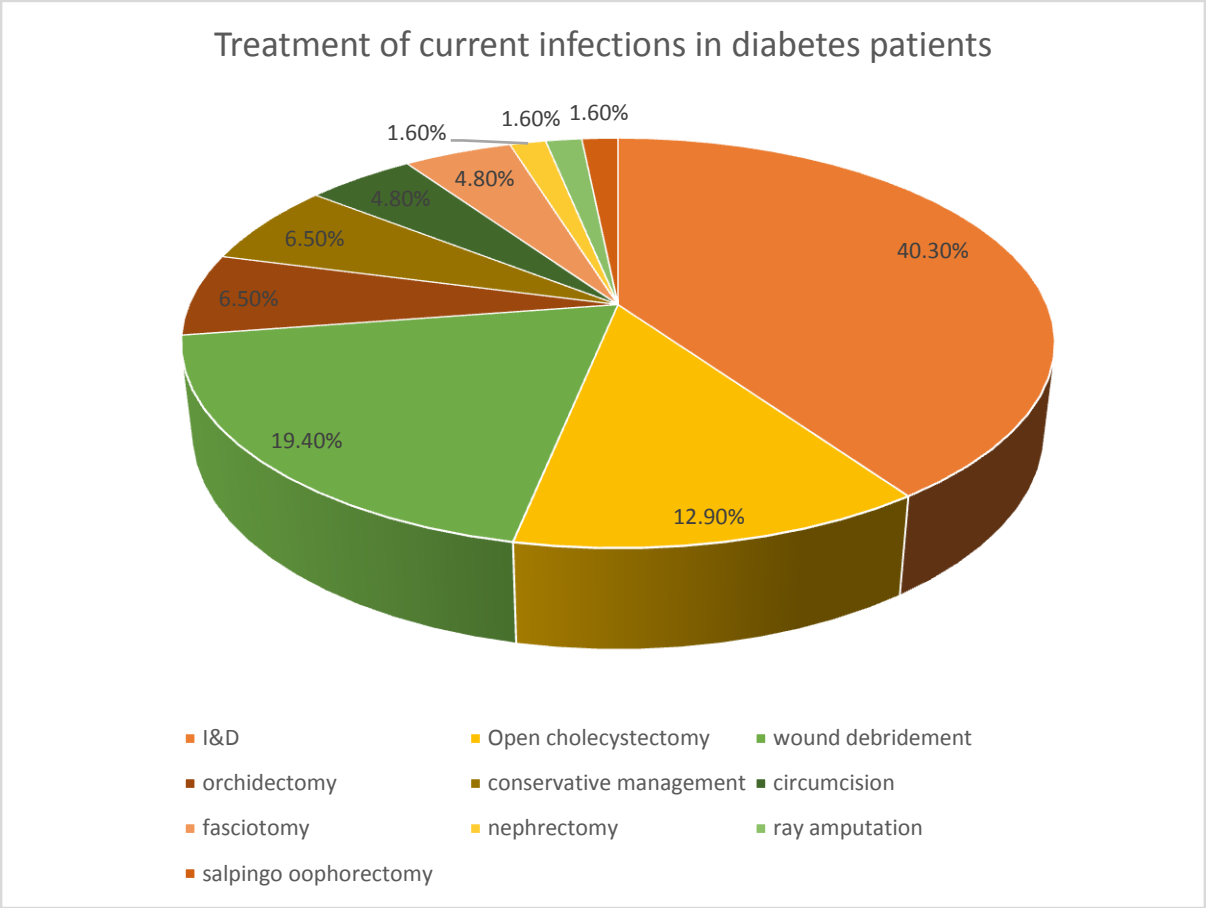
Table 6.frequency distribution of treatment of current infections in diabetes patient

S.no	Treatment of current infections	Frequency (62)	Percent (%)
1.	Incision and drainage	25	40.3
2	Open cholecystectomy	8	12.9
3	Wound debridement	12	19.4
4	Orchidectomy	4	6.5
5	Conservative management	4	6.5
6	Circumcision	3	4.8
7	Fasciotomy	3	4.8
8	Nephrectomy	1	1.6
9	Ray amputation	1	1.6
10	Salpingo oophorectomy	1	1.6

Among the study population most of them were treated surgically 93.5% .and remaining 6.5% were treated by conservative management .

Among the surgical treated patients ,most of them 40.3% were treated by incision and drainage .next to it were wound debridement 19.4%, and least were treated with nephrectomy ,salpingo oophorectomy and ray amputation.

Chart 6. frequency distribution of Treatment of current infections in diabetes patients

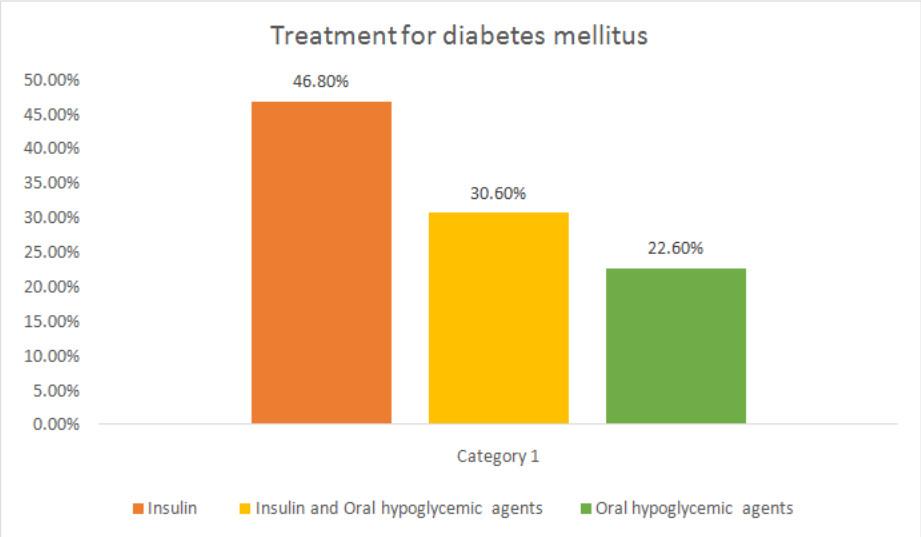


Treatment for diabetes mellitus

Table 7.frequency distribution of Treatment for diabetes mellitus

S.no	Treatment for diabetes mellitus	Frequency (62)	Percent (%)
1.	Insulin	29	46.8
2	Insulin and oral hypoglycemic agents	19	30.6
3	Oral hypoglycemic agents	14	22.6

Chart 7. frequency distribution of Treatment for diabetes mellitus

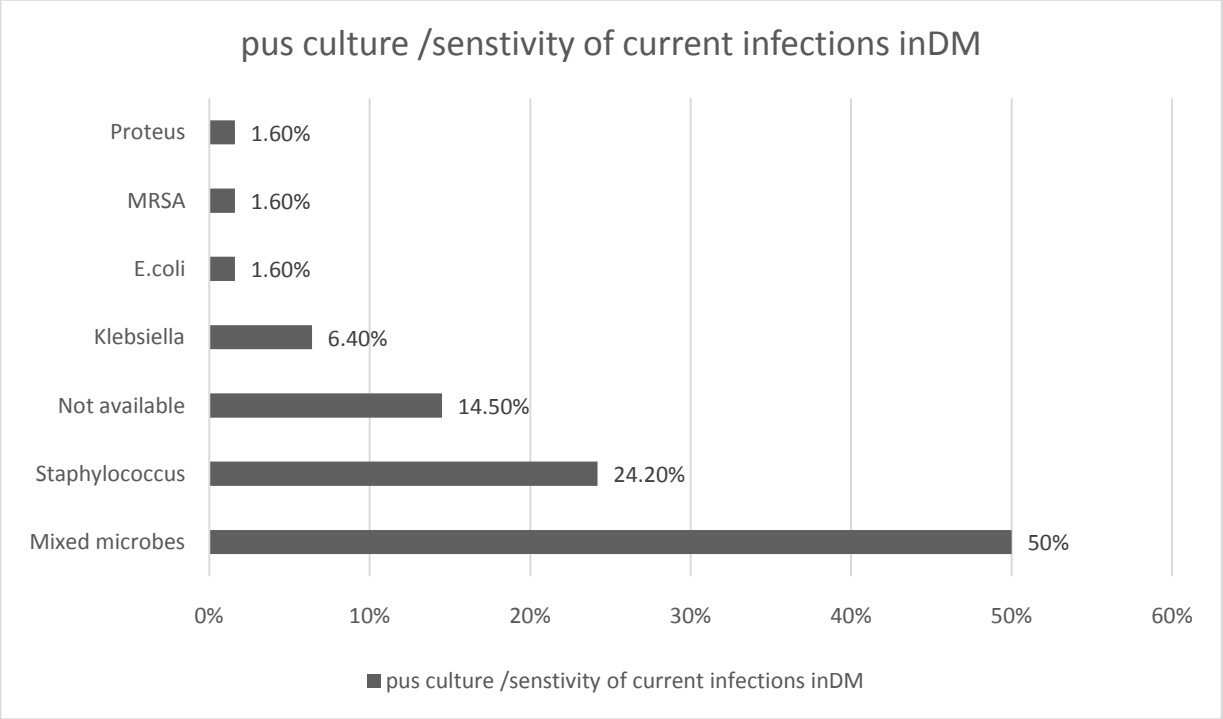


Pus culture/sensitivity of infections in DM

Table 8.frequency distribution of Pus culture/sensitivity of infections in DM

S.no	Pus culture/sensitivity of infections in DM	Frequency (62)	Percent (%)
1.	Mixed microbes	31	50
2	Staphylo coccus	15	24.2
3	Not available	9	14.5
4	klebsiella	4	6.4
5	E.coli	1	1.6
6	MRSA	1	1.6
7	Proteus	1	1.6

Chart 8. frequency distribution of Pus culture/sensitivity of infections in DM



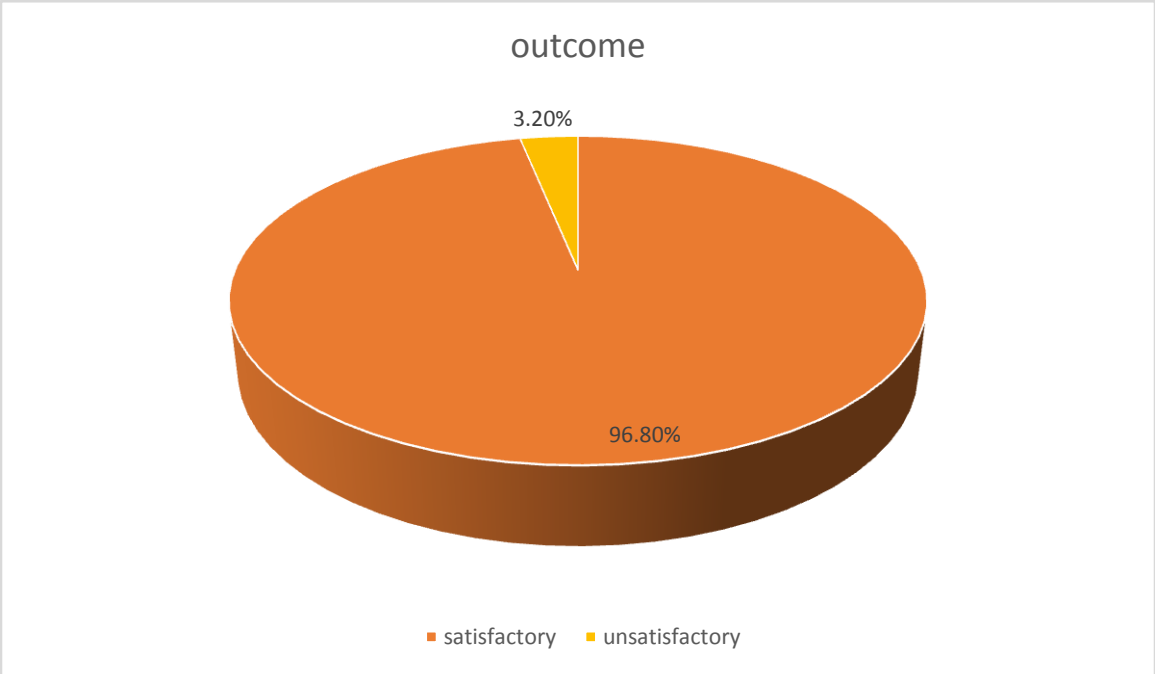
Outcome

Table 9.frequency distribution of outcome for treated diabetes mellitus patients

S.no	Outcome	Frequency (62)	Percent (%)
1.	Satisfactory	60	96.8
2	Unsatisfactory	2	3.2

Among the total study population ,most of them 96.8% attained satisfied outcome.

Chart 9. frequency distribution of outcome of treated diabetes mellitus patients



Inferential statistics using chi square test and fisher exact test .
Current infections in DM versus age group

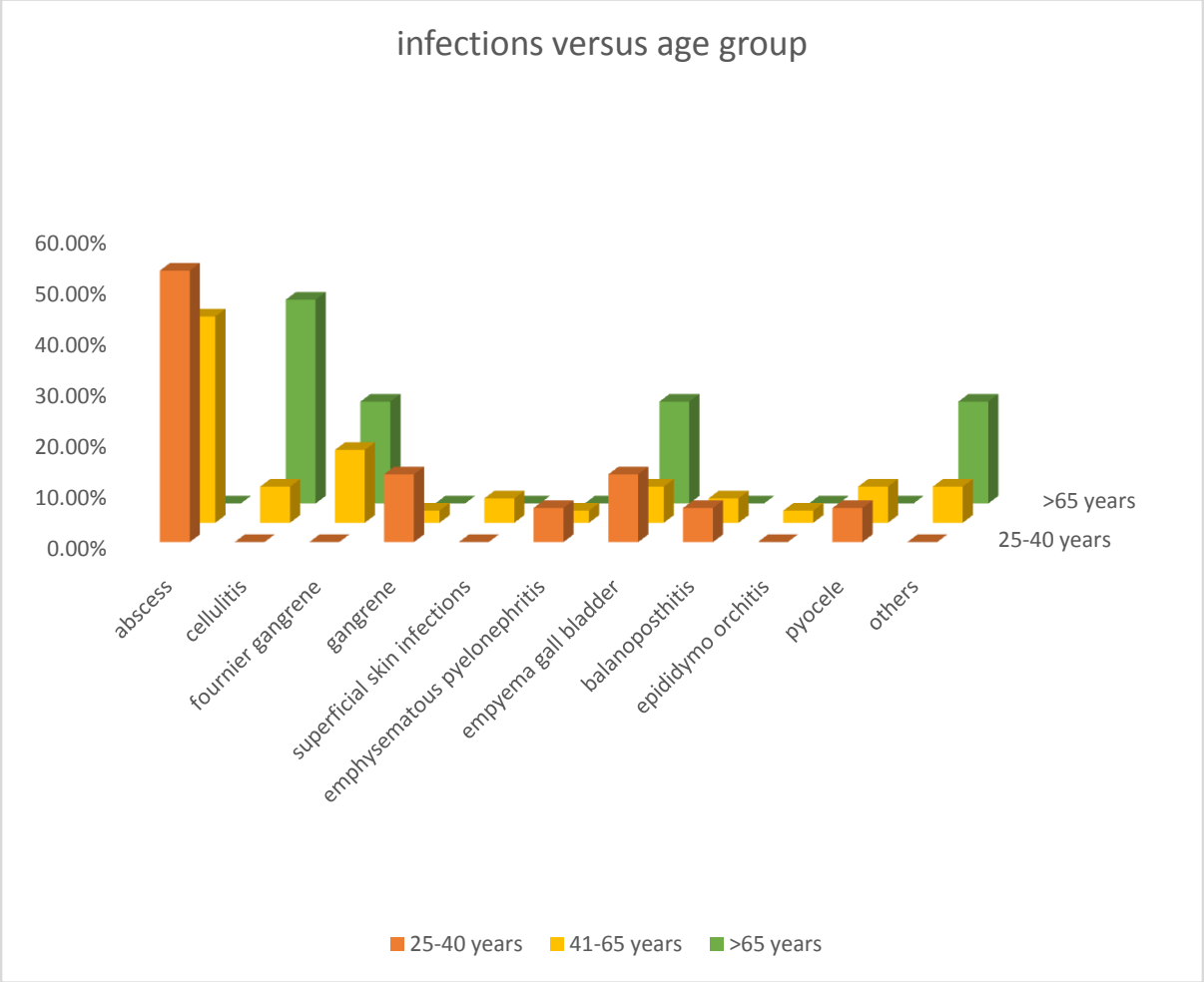
Table.10 comparing current infections of DM versus Age group

S.no	Current infections in DM patients	Age group (years)			Total
		25-40 years	41-65 years	>65 years	
1	Abscess of various site	8 , 53.3%	17, 40.5%	0 0	25, 40.3%
2	Cellulitis of various site	0 0	3, 7.1%	2, 40%	5 8.1%
3	Fournier gangrene	0 0	6 , 14.3%	1, 20%	7, 11.3%
4	Gangrene of various site	2, 13.3%	1, 2.4%	0 0	3 4.8%
5	Superficial infections of skin	0 0	2, 4.8%	0 0	2 , 3.2%
6	Emphysematous pyelonephritis	1 , 6.7%	1 2.4%	0 0	2, 3.2%
7	Empyema gall bladder	2, 13.3%	3, 7.1%	1, 20%	6 9.7%
8	Balanoposthitis	1, 6.7%	2, 4.8%	0 0	3 4.8%
9	Epididymo orchitis	0 0	1, 2.4%	0 0	1 1.6%
10	Pyocele	1, 6.7%	3, 7.1%	0 0	4, 6.5%
11	Others	0 0	3, 7.1%	1, 20%	4, 6.5%
12	Total	15, 100%	42, 100%	5, 100%	62 , 100%

PVALUE-0.186 (P value <0.05 significant) p value derived from fisher exact test.

Among the study population ,abscess of various sites are more common among 25-45 years of age followed by 41-65 years of age groups.cellulitis ,fournier's gangrene,empyema gallbladder and other infections were common among >65 years of age groups.

Chart .10 comparing current infections of DM versus Age group



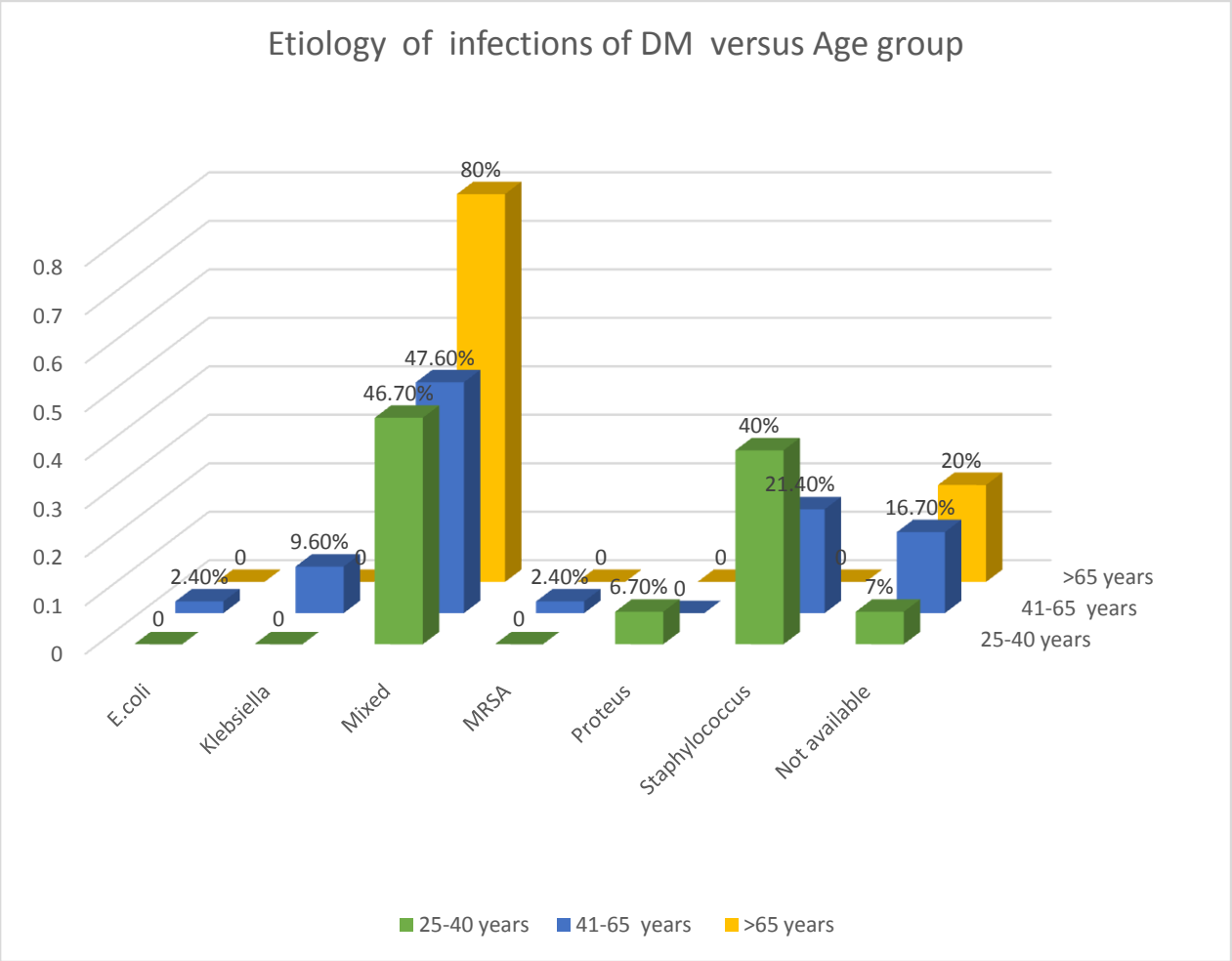
Etiology of infections in DM versus Age group

Table.11 comparing Etiology of infections of DM versus Age group

S.no	Etiology of infections in DM patients	Age group (years)			Total
		25-40 years	41-65 years	>65 years	
1	E .coli	0 0	1, 2.4%	0 0	1, 1.6%
2	Klebsiella	0 0	4, 9.6%	0 0	4, 6.4%
3	Mixed	7, 46.7%	20, 47.6%	4, 80%	31, 50%
4	MRSA	0 0	1, 2.4%	0 0	1 1.6%
5	Proteus	1, 6.7%	0 0	0 0	1 1.6%
6	staphylococcus	6, 40%	9, 21.4%	0 0	15 24.2%
7	Not available	1, 6.7%	7, 16.7%	1, 20%	9, 14.5%
Total		15, 100%	42, 100%	5, 100%	62, 100%

PVALUE-0.689 (P value <0.05 significant) p value derived from fisher exact test.
Among the study populations, mixed infection were common among all age groups.next to it were staphylococcus .

Chart .11 comparing Etiology of infections of DM versus Age group



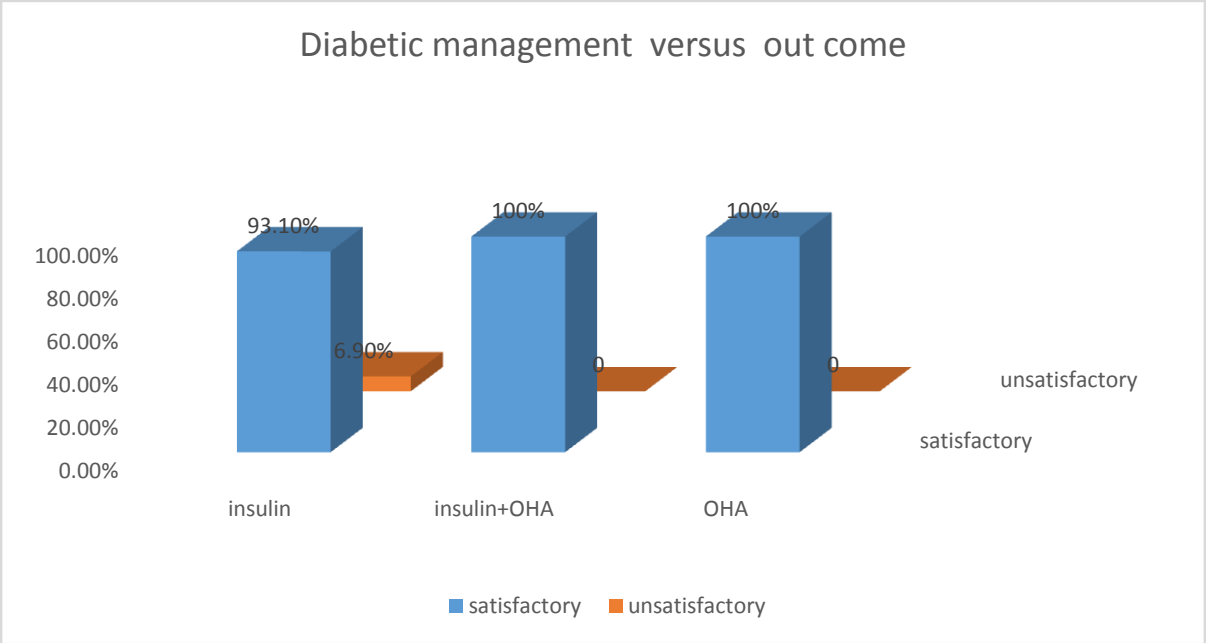
Diabetic management versus out come

Table.12 comparing Diabetic management versus out come

S .no	Diabetic management	Outcome		Total
		Satisfactory	Unsatisfactory	
1	Insulin	27 93.1%	2 6.9%	29 100%
2	Insulin +oral hypoglycemic agent	19 100%	0 0	19 100%
3	Oral hypoglycemic agent	14 100%	0 0	14 100%
4	Total	60 96.8%	2 3.2%	62 100%

PVALUE-0.709 (P value <0.05 significant) p value derived from fisher exact test.

Chart ..12 comparing Diabetic management versus out come



III. Discussion:

Diabetes is associated with complications in its long run. Infections is one of the most common reasons for hospitalization. As observed in our study, it is more common in males. More common age group is 41-65 in our study. Abscesses (at various sites) was found to be the most common infection. Mixed infection, includes aerobes and anaerobes is common. Most cases presented late and the major contributing factors for late presentation are poor knowledge about the disease, undetected diabetes and poor glycemic control. Most cases needed surgical management and insulin for glycemic control.

IV. Conclusion:

Infections in diabetic patients are troublesome, source consuming, and producing disability, morbidity and mortality. PREVENTION IS THE BEST TREATMENT. Patient education and strict glycemic control can reduce the burden of diabetic infections. Lifestyle modifications such as dietary factors and physical activity are vital for glycemic control and thereby prevention of infections in diabetic patients. Early diagnosis and hospitalization, appropriate treatment including medical and surgical treatment can reduce the morbidity and mortality and improve the outcome of the disease.

References:

[1]. Robbins SL, Tucker AW Jr. The cause of death in diabetes : a report of 307 autopsied cases.
[2]. Seymour A, Phear D. The causes of death in diabetes mellitus. A study of diabetic mortality in the Royal Adelaide Hospital from 1956 to 1960.
[3]. Sasaki A, Horiuchi N, Hasegava K, et al. Mortality and causes of death in type 2 diabetic patients : a long term followup study in Osaka district, Japan.
[4]. Kesler 2 mortality experience of diabetic patients: a twenty-six year followup study.
[5]. Van der Meer JWM. Defense in host defense mechanisms.
[6]. Perillie PE, Nolan JP, Finch SC. Studies of the resistance to infection in diabetes mellitus.
[7]. Brayton RJ, Stokes PE, Schwartz MS et al, Effect of alcohol and various diseases on leucocyte mobilization phagocytosis and intracellular bacterial killing.
[8]. Mowat AJ, Baum J. Chemotaxis of polymorphonuclear leukocytes from patients with diabetes mellitus.
[9]. Valerius NH. Eff C, Hansen NE, et al. Neutrophil and lymphocyte function in patients with diabetes.
[10]. Tater D, Tepaut B, Becrovicyl JP, et al. Polymorphonuclear cell derangements in type 1 diabetes.
[11]. Bybee JD, Rogers DE. The phagocytic activity of polymorphonuclear leukocytes obtained from patients with diabetes mellitus.
[12]. Rayfield EJ, Ault MJ, Keusch GT et al. Infection and diabetes: the case for glucose control.
[13]. Tan JS, Anderson JL, WatanakunakomC et al. Neutrophil dysfunction in diabetes mellitus.
[14]. Peterson CM, Jones RL, Koenig RJ et al. Reversible hematologic sequale of diabetes mellitus.
[15]. Bagdade JD, Stewart M, Walters E. Impaired granulocyte adherence: a reversible defect in host defense in patients with diabetes mellitus.
[16]. Bagdade JD, Walters E. Impaired granulocyte adherence in mildly diabetic patients: effects of Tolazolamide treatment.
[17]. Andersen B, Goldsmith GH, SpagnuoloPJ. Neutrophil adhesive dysfunction in diabetes mellitus: the role of cellular plasma factors.
[18]. Dziatkowiak H, Kowsalka M, Denys A. Phagocytic and bactericidal activity of granulocytes in diabetic children.
[19]. Repine JE, Clawson CC, Goetz FC. Bactericidal function of neutrophils from patients with acute bacterial infection and from diabetes.

[20]. Shah SV, Wallian JD, Ellien SD. Chemiliminisence and superoxide anion production of leukocytes from diabetic patients.
[21]. Li YM, Glycation ligand binding motif in lactoferrin: implications in diabetic infection.
[22]. Jubiz W, Draper RE, Gale J et al. Monocyte function in Diabetes mellitus.
[23]. Glass EJ, Stewart J, Matthews DM et al. Impairment of monocyte lectin-like activity in type 1 diabetes mellitus.
[24]. Katz S, Klein B, Elian I et al. Phagocytic activity of monocytes from diabetic patients.
[25]. Geisler G, Aalmdal T, Bennedson J et al. Monocyte function in diabetes mellitus.
[26]. Hill HR, Augustine NH, Rallison ML et al. Defective monocyte chemotactic response in diabetes mellitus.
[27]. Kitahara M, Eyre HJ, Lynch RE et al. Metabolic activity of diabetic monocytes.
[28]. Offenbacher S, Salvi GE, Induction of prostaglandin release from macrophages by bacterial endotoxin.
[29]. Casey JI, Heeter BJ, Klyshevich KA, Impaired response of lymphocytes of diabetic patients to antigens of diabetic patients.
[30]. Spreet DP, Silva J Jr. Abnormalities of in-vitro lymphocyte response to mitogens in diabetic children during ketoacidosis.
[31]. Bailey and Love short practice of surgery 27th edition.
[32]. Joslin's Diabetes Mellitus 14th edition.

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