

SURGICAL COMPLICATIONS OF DIABETES MELLITUS IN AND AROUND KALABURAGI

S. S. Karbhari¹, Puneeth Thalasta², Vamsi Krishna C³, Ravi Dhaded⁴

¹Professor, Department of General Surgery, M. R. Medical College, Kalaburagi.

²Postgraduate Student, Department of General Surgery, M. R. Medical College, Kalaburagi.

³Postgraduate Student, Department of General Surgery, M. R. Medical College, Kalaburagi.

⁴Professor and HOD, Department of General Surgery, M. R. Medical College, Kalaburagi.

ABSTRACT**BACKGROUND**

Diabetes is an ancient disease, epidemic and an economic burden for the present era. Diabetes and its longterm major complications include septic, vascular (either microvascular or macrovascular) and neuropathic lesions which affect the various anatomical regions of the body. Majority of admissions to surgical wards are due to these surgical complications of diabetes.

The objectives are to study the surgical complications of diabetes, their outcome and management modalities aimed at studying age, sex, regional pattern, socioeconomic pattern, mode of presentation, type of lesions, various modalities of treatment available in the hospital, and outcome of each modalities practised in the hospital.

MATERIALS AND METHODS

This is a descriptive study of 72 cases of diabetes mellitus with surgical complications like carbuncles, foot ulcers, neuropathy, etc. admitted in surgical wards of Basaveshwar Teaching and General Hospital, during the period extending from June 2015- May 2016.

RESULTS

It was found that these complications usually occur in the age of 51-60 years. The ratio of male: female is 2.13:1. And men who worked outdoors like agriculturists were commonly affected with these complications. Nearly 58 patients in this series of 72 had past history of trauma and subsequently lesions developed. The common lesions are septic lesions of the foot in the form of ulcers, cellulitis and gangrene, followed by vascular and neuropathic lesions. Most of them were managed conservatively. 13 cases underwent incision & drainage and came for regular followup, 10 cases underwent disarticulation of toes. 4 patients underwent below-knee amputations, whereas 8 patients underwent above-knee amputations and 7 patients needed split skin grafting for covering of raw area. Mortality rate of this series of 72 patients was 4.16% (n=3).

CONCLUSION

It was concluded that the known male diabetics with trivial injuries, on irregular treatment, who work outdoors usually present with lesions requiring admission and intervention. Commonly affected site is lower limb followed by upper limb.

KEYWORDS

Septic; Vascular; Neuropathic; Ulcer; Gangrene; Diabetes.

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BACKGROUND

Diabetes Mellitus is a syndrome with metabolic, vascular, neuropathic components that are interrelated.¹

Once regarded as a single disease, diabetes is now seen as a heterogeneous group of diseases, characterised by a state of chronic hyperglycaemia resulting from a diversity of aetiologies, environmental and genetic, acting jointly.² At present incidence is 2.4% in rural, 4-11% in urban population of India. Diabetic foot infections are commonest reasons for hospital admission in diabetic patients.³

Objectives

So, this is a study of these surgical complications of diabetes, their outcome and management modalities aimed at studying age, sex, regional pattern, socioeconomic pattern, mode of

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Corresponding Author:

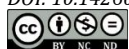
Dr. S. S. Karbhari,

Professor, Department of General Surgery,

M. R. Medical College, Kalaburagi.

E-mail: sharankarbhari@gmail.com

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presentation, type of lesions, various modalities of treatment available in the hospital, outcome of each modalities practised in the hospital.

MATERIALS AND METHODS

This is a descriptive study of 72 cases of diabetes mellitus with surgical complications like carbuncles, foot ulcers, neuropathy, etc. admitted in surgical wards of Basaveshwar teaching and general hospital, during the period extending from June 2015- May 2016.

Each case studied had elaborate history taking, a thorough general physical examination was done along with meticulous examination of the local lesions. Relevant lab investigations were carried out.

Known diabetic patients were switched over to plain insulin based on measured RBS value 8th hourly. Newly diagnosed patients were started on plain insulin based on monitored random blood sugar levels. Each patient was treated according to the respective problem.

Ulcers were treated according to their merit. Debridement and regular dressing were done based on infection and healing status of the ulcer.

Severe foot infections, spreading cellulitis, osteomyelitis of the bone, and gangrene of the toes and the feet were subjected

to surgical treatment. For cellulitis of the foot extending to the leg, multiple incisions were made. Minor amputations like toe amputation, disarticulation of the toes were done for gangrene of the toes. In case of gangrene with spreading cellulitis of foot, forefoot amputation was done. In severe cases of infections and gangrene spreading to the foot and to the leg, major amputations like below knee/above knee or hip disarticulation was done. At the time of discharge, counselling was given regarding foot care, prevention of ulcer. Patient was asked to follow up regularly for residual ulcers. Patients were also asked to report to diabetic clinics for further diabetic management and treatment.

RESULTS

	DM Type 1	Type 2
Polyuria and thirst	++	+
Weakness and fatigue	++	+
Polyphagia with weight loss	++	-
Peripheral neuropathy	+	++
Vision disturbances	+	++
Often asymptomatic	-	++
Prone to severe ketoacidosis		-
Recurrent vaginal infections	+	+++

Table 1. Clinical Features

- + positive clinical feature
- ++ significant
- +++ more significant
- absent

Laboratory Findings in Diabetes Mellitus

Tests of Urine Glucose and Ketone Bodies as well as Whole Blood or Plasma Glucose Measured in Samples-

- I. Basal condition and after administering glucose are important in evaluation.
- II. Tests for glycosylated haemoglobin help in evaluation and assessment of effectiveness of therapy.
- III. Measurement of C peptide levels, insulin levels.
- IV. In view of atherosclerosis risk being higher in diabetes – serum cholesterol, triglycerides.

Urine Analysis

- Glucose in urine levels effects the glucose levels at time of urine formed.
- So early morning sample correlates to glucose overnight. So double void technique is employed.
- Overnight sample is discarded.
- Empty bladder completely. Void after ½-hour - test for glucose in the urine.
- However, this is not an accurate test- hence blood glucose has largely replaced urine sugar level.
- Urine sugar monitoring is done by dipstick paper strips coated with reagents and dye. Based on levels of urine sugar colour changes.
- Previously Benedict’s/Fehling’s tests were done bed side, these are largely replaced by dipsticks now.

Blood Glucose Testing

Normal Values FBS, 70-110 mg/dL (4-6 mmol/L) Venous Blood Samples can be used. Tests are Done by-

- Enzymatic.
- Calorimetric.

- Automated methods.

Capillary Blood Samples are used in Self-Monitoring, used in Portable Devices, Run by Batten- Monitoring Done at Home.

- 1 and 2 generations of these devices available.
- Timing of devices range from 12 - 45 sec.
- Latest device is Accu-Chek 'instant'. Requires only - 2-5 mL of blood.
- Third generation is still in the developmental stage, it is noninvasive, it runs on infrared absorption, allows quantification of glycaemia flowing in capillaries used over ear lobes and finger beds.

Glycosylated Haemoglobin Assays

Haemoglobin undergoes non-enzymatic condensation of glucose of free amino groups of globin molecule, due to chronic hyperglycaemia. So higher the level of hyperglycaemia higher the level of glycosylated haemoglobin. Since the half-life of RBC is 120 days this reflects the metabolic control of diabetes over the last 4 months.

Major part is HbA_{1c}, about 6% remaining is HbA_{1a} and HbA_{1b}. The normal range is 5-8%. Anything more than 12-15% reflects poor glycaemic control.

Serum Fructosamine

This is due to glycosylation of serum proteins. This reflects the glycaemic control of last 2 weeks.

Diagnosis of Diabetes Mellitus Diagnostic Criteria³

1. Symptoms of diabetes (thirst, polyuria, unexplained weight loss) and random plasma glucose level >200 mg/dL (11.1 mmol/L).
2. Fasting plasma glucose >126 mg/dL (7 mmol/L) after overnight 8 hrs. fast.
3. 2 hrs. plasma glucose >200 mg/dL (11.1 mmol/L) during standard 75 g of oral glucose tolerance test.

Diagnosis of diabetes can be made by any one of the above criteria but should be confirmed by any one of following three methods-

1. **Oral Glucose Tolerance Test-** An oral glucose tolerance test is rarely indicated these days as taking fasting blood glucose level in clinical situations has become the standard.
 - > FBS is easier to perform faster and acceptable to the patients.
 - > Less expensive.
 - > More reproducible.

Indications for OGT

- I. FBS between 110 and 126 mg/dL i.e. impaired fasting glucose.
- II. Women who had delivered infants >4.1 kg and who have recurrent vaginal infections,
- III. Men with erectile dysfunction.

Preparation for the test

- Patient should be on low carbohydrate diet i.e. 150-200 g/day in previous 3 days of the test.

- Patient fasting from midnight to test day.

Procedure

75 g of glucose in 300 mL of water is given to adults. It should be consumed within 5 minutes. Blood samples are obtained at 0 and 120 minutes after ingestion of glucose (Earlier blood samples were drawn at 30, 60, 90 minutes which are not required now).

Interpretation

FBS >126 mg/dL and 2 hrs. RBS >200 mg/dL is considered as diabetes. False positives occur in patients who are malnourished, bedridden and in those with infections, emotional disorders, and on drugs like diuretics, OCP and steroids.

	Normal Glucose Tolerance	Impaired Glucose Tolerance	Diabetes Mellitus
FBS	<110	110-125	> 126
2 hrs. after glucose	<140	>140 <200	>200

Table 2. Classification of Diabetes Mellitus According to Glucose Values

- 2. Measurement of Insulin Levels-** Normal insulin level in the plasma is 5-20 μU/mL. It can rise up to 50-130 μU/mL during glucose tolerance test and return to 30 μU/mL after 2 hours.
- 3. Intravenous Glucose Tolerance Test-** This is performed by giving a rapid infusion of glucose followed by serial plasma glucose measurements to determine the disappearance rate of glucose per minute.

Disappearance rate reflects the patient's ability to dispose of a glucose load.

Indications for Intravenous Glucose Tolerance Test:

- Screening sibling at risk for type 1 diabetes.
- Patients with gastrointestinal malformations.

Preparation for this test is same as that of OGT.

Test: 50 g of glucose/1.7 m² BSA is given in the form of 25% or 50% glucose solution over 2-3 minutes. In the opposite arm IV line is established and blood is drawn at 0, 10, 15, 20 and 30 minutes. Then the values of the blood glucose levels is plotted against time in a graph. 'K' is calculated as 0.693.

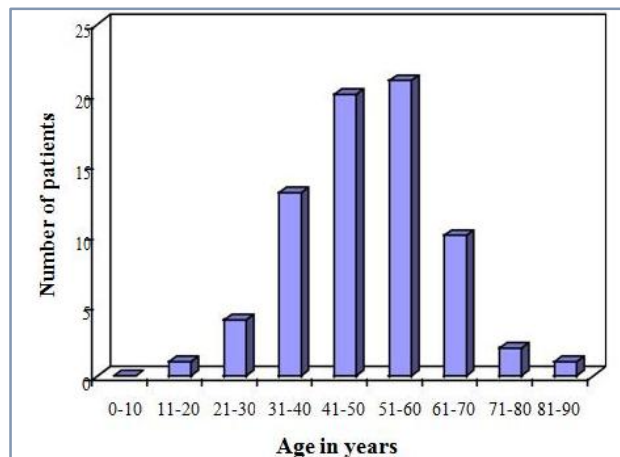
$$K(\text{glucose}) = \frac{0.693 \times 100}{t/2}$$

t/2 = Time required for glucose to fall to half of its concentration 'K' is - 1% min in diabetes.

- 1. Age-** Of 72 cases studied, the youngest patient was 18 years of age who was a juvenile diabetic and oldest was 85 years. Average age of incidence was in the group of 51-60 years and the highest number of cases seen was also in 51-60 years.

Age in Years	No. of Patients	Percentage
0-10	-	-
11-20	1	1.38
21-30	4	5.5
31-40	13	18.05
41-50	20	27.77
51-60	21	29.16
61-70	10	13.8
71-80	2	2.70
81-90	1	1.38

Table 3. Age Distribution



Graph 1. Age Distribution Chart

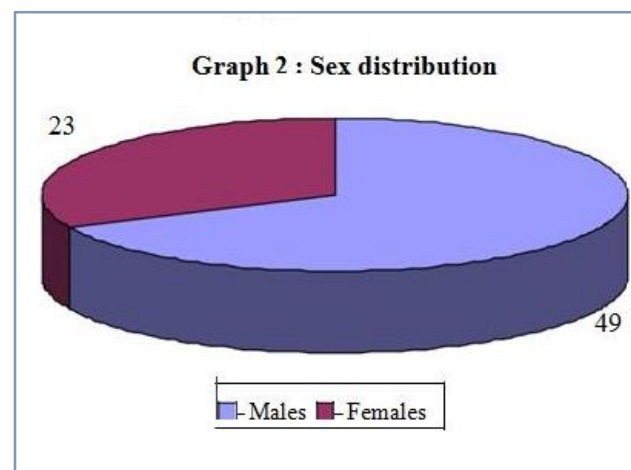
- 2. Sex-** Of 72 cases of study, 49 cases were male while 23 were female. The ratio of male: female is 2.13:1.

Male incidence is higher for the following regions-

- Men are bread winners, work in the fields, farms and hence exposed to trauma.
- Smoking habits are higher in men and hence peripheral arterial disease coexists with diabetes which flare up the lesions.

No. of Cases Studied	Males	Females
72	49	23
Percentage	68.03	31.94
Ratio	2.13	1

Table 4. Sex Distribution



3. Socioeconomic Status- Nearly about 65% of patients were from lower socioeconomic status basically farmers. Though in western literature incidence is higher in higher status of society.

4. Region- 40 cases were from urban area whereas 32 cases were from rural area.

Total cases	Cases	Percentage
Urban	40	55.55
Rural	32	44.44

Table 5. Regional Distribution

5. Occupation- It was seen that these complications occurred in group who were prone to injuries like agriculturists.

Occupation	No. of Patients	Percentage
Agriculture	25	34.72
Manual labourers	15	20.83
Housewife	11	15.27
Peon	1	1.3
Businessmen	1	1.3
Clerks	4	5.5
Teacher	5	6.94
Tailor	3	4.16
Student	2	2.7
Retired	4	5.5

Table 6. Incidence in Occupation

6. Past History of Diabetes

- The known diabetics were 50 whereas 22 were detected after admission.
- The duration of disease varied from 3 months to 25 years and around 40% of patients were on irregular treatment for diabetics who were usually on oral hypoglycaemic agents.

No. of Patients	Known Diabetics	Diagnosed after admission
72	50	22

Table 7. Past History of Diabetes

7. History of Trauma- Nearly 58 patients in this series of 72 had past history of trauma and subsequently lesions developed-

- Patients are unaware of trivial injury due to neuropathy.
- Poor blood supply leads to diminished healing.
- A state of hyperglycaemia acts as a good nidus for infection.

8. Duration of Onset- In our study, the minimum period for onset of lesion was two days to 40 days. The average duration was 2-3 weeks.

9. Duration of Hospitalisation- The minimum period was 4 days to maximum of 64 days. Average is around 30 days in present study.

10. Mortality

Out of 72 patients, 3 patients expired that constitutes to 4.16%. This is due to-

1. Cerebrovascular, cardiovascular accidents.
2. Ketoacidosis.
3. Septicaemia.

11. Different Anatomical Sites Affected- Present study shows that the commonest site for lesions was lower limb constituting 75% of cases followed by upper limb with 9%, then back, periurethral abscess with 4%. One patient presented with perianal abscess.

12. Surgical Complications of Diabetes

In present series, the major surgical complications of diabetes were recognised as a) septic, b) ischaemic, c) neuropathic. Though most of these lesions were overlapping.

In present study, it was seen that septic lesion was the leading complication with 68 patients. However, in more than 35% of patients, more than 2 types of complications were seen. In septic lesions, various types of lesions were seen.

Lesions	Number of Patients	Percentage
Ulcers	30	41.6
Gangrene	16	22
Abscess	10	13.8
Carbuncles	3	4.16
Cellulitis	14	19.4

Table 8. Types Of Septic Lesions

13. Neuropathic Lesions- In this series of 72 cases of surgical complications of diabetes, 33 patients were found to have peripheral neuropathy clinically.

14. Ischaemic Lesions

- In this study of 72 cases, 36 patients had ischaemic lesions.
- Out of them, 16 cases had gangrenous lesions of the toes and foot, either dry or wet gangrene.
- The youngest patient's age was 36 years whereas oldest was 85 years.

	No. of Cases	Percentage
Conservative	30	41.6
Incision & Drainage/Excision	13	18.05
Disarticulation	10	13.8
Below-knee amputation	4	5.55
Above-knee amputation	8	11.1
Split skin grafting	7	9.72

Table 9. Various Treatment Modalities

Glycaemic Values

FBS	No. of Patients
<110	2
110-120	2
121-130	6

131-140	2
141-150	15
151 and Above	40
Newly Diagnosed	5
Total	72
According To Fasting Blood Glucose Levels	

PPBS	No. of Patients
<140	2
141-150	2
151-160	3
161-170	2
171-180	6
181-190	10
191-200	20
Above 200	22
Newly Diagnosed	5
Total	72
According to Postprandial Blood Glucose Levels	

DISCUSSION

Diabetic foot infections are commonest reasons for hospital admission in 4 patients. In patients with diabetes mellitus, problems involving the lower extremities are common affecting 1 out of 4 patients. Foot ulceration is a leading cause for hospitalisation, a multifactorial process involving the various intrinsic factors of diabetes as well as external forces or events leading on to injury.

Triad of Neuropathy, Susceptibility to infection, and Vascular insufficiency is the aetiopathology for diabetic ulcers. Even a trivial injury like tight socks can cause significant lesions later.⁵

Summary

Of 72 cases, the youngest was 18 years of age, a juvenile diabetic and oldest was 85 years old. The average incidence of complications was in 51-60 years of age group.

- Male: Female ratio is 2.13: 1. The increased male ratio is to the fact that men generally work outdoors in fields, and hence prone to trauma.

- Disease is more prevalent in urban population i.e. 55% which is in conformity with other series.
- The study showed that complications of diabetes is common in agriculturists and labourers who are prone to injuries to the extremities.
- In our series, lower socioeconomic status is more prone to complications. This is due to the fact that this section of society seek help from our hospital.

CONCLUSION

- Surgical complications are more prevalent in the age group of 51-60 years. Male individuals are more at risk as they usually work outdoors and are exposed to trauma.
- Lower limbs are most commonly involved followed by upper limbs.
- Septic lesions are common complications followed by ischaemic lesions and neuropathic lesions.
- Among septic lesions, ulcers, constitute the major bulk, followed by gangrene, cellulitis and then abscess.
- Mortality of these patients is mainly due to septicaemia, ketoacidosis and cardiovascular diseases.
- Regular screening and careful clinical examination with personal care are cornerstones in managing surgical complications.

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