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Research Article

Study of diabetic ulcer with surgical complications of diabetes, their outcome and management modalities in 72 cases studied in Navi Mumbai

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ABSTRACT

Background: Diabetes and its long term major complications include septic, vascular (either micro vascular or macro vascular) and neuropathic lesions which affect the various anatomical regions of the body. Majority of admissions to surgical wards is due to these surgical complications of diabetes. So this is a study of these surgical complications of diabetes, their outcome and management modalities.
Methods: This "Clinical study of surgical complications of diabetes" consists of a study of minimum of 50 or more cases admitted to surgical wards of Dr. D Y Patil hospital & research centre, from June 2010 to Oct 2012. A series of 72 cases were compiled for this study during this period. This study is to know more about the mode of presentation, clinical features and outcome of management of surgical complication of diabetes mellitus.
Results: In present study, 30 cases were conservatively managed with meticulous debridement. 13 cases underwent incision & drainage and came for regular follow-up. 10 cases underwent disarticulation of toes. Four patients underwent below knee amputations whereas 8 patients underwent above knee amputations and 7 patients needed split skin grafting for covering of raw area.
Conclusions: Patients on irregular medication usually from age group 51-60 majorly male who undergo trauma (lower limb >>upper limb) are prone to diabetic ulcer complication. Mortality in these patients is due to complications. Conservative management is the mainstay of this condition followed by I & D and finally amputation.

Keywords: Diabetic ulcer, Diabetic foot, Ulcers, Diabetes mellitus

INTRODUCTION

"Diabetes Mellitus" is a syndrome with metabolic, vascular, neuropathic components that are interrelated.[1] Metabolic syndrome due to alterations of

1. Carbohydrate
2. Fat
3. Protein metabolism

Secondary to absent or markedly diminished insulin secretion or ineffective action of insulin. Vascular syndrome consists of abnormalities in both large vessels (macroangiopathy) and small vessels (microangiopathy.) Macroangiopathy cause cerebrovascular accidents (strokes), cardiovascular (MI) and peripheral vascular diseases. Finally a variety of abnormalities occur in peripheral nervous system. These neuropathic changes are due to metabolic alteration as well as vascular causes.

Once regarded as a single disease. Diabetes is now seen as a heterogeneous group of diseases, characterized by a state of chronic hyperglycemia resulting from a diversity of etiologies, environmental and genetic acting jointly.[2]

Defective production and action of insulin is the underlying cause. It is a long term disease with variable manifestations and progression.

Diabetes is an "Ice berg" disease. Recent estimates across word wide are 4% in adults i.e., 145 million now affected. By 2025 it is projected to be 5.4% amounting to an alarming 300 million. Major burden is occurring in developing nations like India At present incidence is 2.4% in rural, 4-11% in urban population of india.[3] Prevalence of diabetes mellitus increase after age of 40 years, 15-20% after age of 65 years.

Diabetes is leading cause of peripheral vascular disease.

A person with diabetes is

*20 times more likely to develop gangrene

*30-40 times risk of a major amputation

The cost of health care and burden over the families is huge, eventually causing a staggering economic instability to the nation. Hence it's worthwhile to know more about diabetes, its implications, and its surgical aspects in depth.

Diabetes exhibits following points from surgical point of view:

Surgical conditions which are etiologically related to diabetes (like carbuncles).

Surgical conditions whose symptoms, course and management are altered by diabetes (traumatic ulcer).

Surgical conditions which are associated with diabetes but not related to it (like elective surgery in diabetes).

So the objectives and aim of the study is to know more about the mode of presentation, clinical features and outcome of management of surgical complication of diabetes mellitus.

This study "Surgical complication of diabetes mellitus" is a study of clinical and management aspects of surgical complications among diabetic patients admitted to surgical wards of Dr. D.Y. Patil Hospital & Research Centre from June 2010 to October 2012.

Though diabetes is a physician's domain surgeon plays an important part in the management of surgical complications. In fact many admissions to surgical wards are due to surgical complications of diabetes mellitus.

Aims and objectives of the study are:

1. To study the age, sex, regional pattern, socio-economic pattern, nutritional status of the patients presenting with complications of diabetes.
2. To study the mode of presentation, type of lesions, duration of diabetes prior to the onset of lesions and the risk factors like hypertension etc.
3. To study the various anatomical distribution of the lesions.
4. To study the various modalities of treatment available in the hospital.
5. To study the outcome of each modality practiced in the hospital.
6. To study the pre-operative and post-operative management of diabetic patients during surgery.

METHODS

This "Clinical study of surgical complications of diabetes" consists of a study of minimum of 50 or more cases admitted to surgical wards of Dr. D Y Patil hospital & research centre, from June 2010 to Oct 2012. A series of 72 cases were compiled for this study during this period. Analytical data obtained is compared and discussed with the data available in the literature. Each case is studied elaborate history was taken; a thorough general physical examination was done along with meticulous examination of the local lesions. Relevant lab investigations were carried out as depicted in the proforma.

Each patient was treated according to the respective problems. Generally, all the patients admitted for surgical complications were first made to get fasting blood glucose. In case the patient was detected as diabetic for the first time plain insulin of appropriate dosage was started according to the fasting blood glucose level. If the patient was a known diabetic on oral hypoglycemic agent was switched over plain insulin. All these patients were required to have a eighth hourly urine sugar chart for monitoring the effectiveness of insulin therapy. In required cases daily fasting blood sugar was also done.

Patients who presented with features of ketoacidosis were treated appropriately with aggressive insulin therapy, IV fluids, and antibiotics. And once stabilized patient received subcutaneous 8th hourly insulin dose.

A strict diabetic diet was advised to the patients. A diet enriched with vitamins B, C and E was given along with supplementation of minerals like zinc and chromium. In cases of patients who were anaemic either oral iron supplementation or blood transfusions were done to improve the general condition. Broad spectrum antibiotics like cephotaxime, gentamycin and metronidazole combination usually was initiated. In case of ischaemic lesions vasodilators like complamina retard (Xanthitol), pentoxyfylline were started. Antiplatelet drugs like ecosprin 75 mg once daily, clopidogrel 75 mg OD were initiated to improve local blood circulation.

In patients with septic lesions like abscess, furuncles and carbuncles, incision drainage, excision was done either under local anesthesia or under general anesthesia. Pus was taken for culture and sensitivity.

Ulcers were treated according to their merit. A thorough debridement which included slough excision was done. Wounds were dressed with gauzes medicated with glycerin - mag sulphate. This reduced the inflammatory oedema and helped in separation of slough. Dirty ulcers were also treated with hydrogen peroxide solution to help in separating the slough. In some ulcers with adherent slough, a collagenase preparation like salutyl was used. For some ulcers infected with pseudomonas as evidenced by the colour of discharge and pus culture sensitivity report, were treated locally with diluted vinegar (diluted acetic acid solution). Clean ulcers were dressed with povidone iodine solution preparations. Ulcers with healthy granulation tissue which were ready for grafting were dressed with wet saline dressings.

Severe foot infections, spreading cellulitis, osteomyelitis of the bone, and gangrene of the toes and the feet were subjected to surgical treatment. For instance cellulite of the foot extending to the leg, multiple incisions were made. Minor amputations like toe amputation, disarticulation of the toes was 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 counseling was given regarding foot care, preventions 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

In present study, 30 cases were treated conservatively with meticulous debridement. Slough excision, regular dressing with providone iodine, glycerin mag sulphate. Appropriate antibiotics were given, insulin therapy was started, diabetic diet enriched with vitamins was given, and strict diabetic control with everyday FBS, 8th hourly urine sugar chart was maintained. 13 cases underwent incision & drainage and came for regular follow-up. 10 cases underwent disarticulation of toes, out of this one patient underwent disarticulation of left metacarpophalangeal joint of left hand. Four patients underwent below knee amputations whereas 8 patients underwent above knee amputations and 7 patients needed split skin grafting for covering of raw area.

DISCUSSION

The analysis of the study of 72 cases is as follows:

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 group of 51-60 years & highest number of cases seen was also in 51-60 years.

Table 1: Age incidence.

Age (years)	Number 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

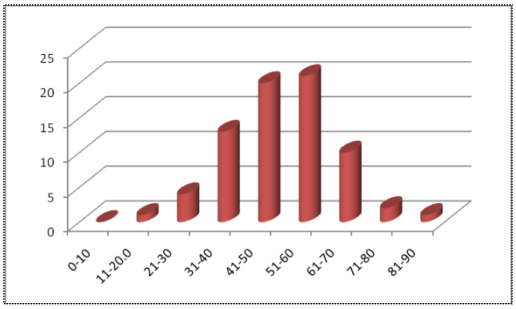

Figure 1: Age distribution chart.

International study done by Wheel-lock and Root (1969)[4] according to this the youngest patient was 32 years and oldest patient was 89 years.

Table 2: Age of the patient.

Study	Youngest age	Oldest age
Wheel-lock and Root series	32	89
Present study	18	85

The data available in our study is almost similar to that of the international study regarding the age incidence**.**

Sex

Of 72 cases of study 49 cases were men while 23 were women. The ratio of male: female is 2.13:1. Male incidence is higher for the following reasons:

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

Table 3: Sex distribution.

No. of cases studied	Males	Females
72	49	23
Percentage	68.03	31.94
Ratio	2.13	1

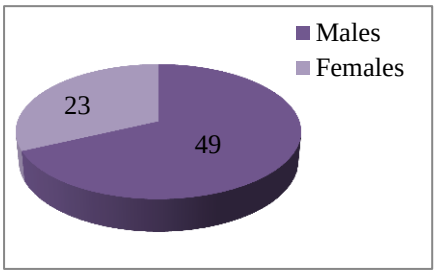

Figure 2: Sex distribution.

Socio-economic status

Nearly about 65% of patients were from lower socio-economic status basically farmers. Though in western literature incidence is higher in higher state of society.

Region

40 cases were from urban area whereas 32 cases were from rural area.

Table 4: Regional distribution.

Total cases	Cases	Percentage
Urban	40	55.55
Rural	32	44.44

This is in confirmation with western literature which says that urban population are more prone for diabetic complications.

Occupation

It was seen that these complications occurred in group who were prone to injuries like farmers (agriculture).

Table 5: Incidences in occupation.

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

It is self-explanatory that complications occur in group which is prone to trauma and injuries. Series also says that the diabetic complications can occur in sedentary groups, as in housewives who constituted 15 % of cases.

Obesity

In our study the number of patients who were obese were 21 while remaining 51 were ill-nourished

Table 6: Nutritional status.

No. of cases	Obese	Non obese
72	21	51

According to literature diabetes is more common in obese but in our study non obese patients were more common as most of the patients were of lower socioeconomic status.

Past history of diabetes

Table 7: Past history of diabetes.

No. of patients	Known diabetics	Diagnosed after admission
72	50	22

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 diabetes that were usually on oral hypoglycemic agent.

Patients with longer duration of previous history of diabetes were likely to develop arteriosclerosis and acceleration of atherosclerosis and prone to neuropathies. So these led to ischemic limbs and ulcers of the foot.

History of trauma

Nearly 58 patients in this series of 72 patients had past history of trauma and subsequently lesions developed. Preceding trauma is most often the cause for problems due to

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

Duration of onset

In our study the minimum period for onset of lesion was 2 days to 40 days. The average duration was 2-3 weeks. The delay in seeking treatment is due to ignorance of patients.

Duration of hospitalization

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

Mortality

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

1. Cerebrovascular/cardiovascular accidents
2. Ketoacidosis
3. Septicemia

Duncan series[5] (1969) showed mortality rate of 10.1%.

Table 8: Mortality.

	Duncan's series	Present study
No. of cases studied	364	72
No. of cases expired	36	3
Percentage	10.1	4.16

Signs and symptoms

Patients presented with various symptoms usually with non-healing wounds, claudication of the limbs, rest pain and gangrene of extremities. Table 9 shows the varied signs and symptoms.

Table 9: Symptomatology chart.

Symptoms	Percentage
Polyuria	23
Polydypsia	25
Loss of weight	50
Fever	40
Inability to walk	75
Ulceration	60
Claudication	24
Rest pain	25
Generalised weakness	75
Impaired sensation of the foot	40
Impaired pulsations	40
Trophic changes	65
Coldness of the feet	20
Gangrene	35
Impaired refluxes	30
Signs of ketoacidosis	3
Regional lymphadenopathy	75

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. Lower limb affliction is more due to many factors.

1. Ischaemia due to atherosclerosis & arteriosclerosis
2. Neuropathy
3. Prone to trivial injury like shoe bites, corns, callosities and most of the patients in present study walked bare foot.

Table 10: Anatomical distribution of lesions.

Sites	Number of cases	Percentage
Lower limb	54	57
Upper limb	7	9.7
Back	4	5.05
Periurethral	3	4.16
Neck	2	2.7
Chest wall	1	1.38
Perianal	1	1.38

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 had overlapping.

Table 11: Types of surgical complications.

Type of lesions	Number of patients	Percentage
Septic lesions	67	94
Neuropathies	33	45.3
Ischaemia	36	50

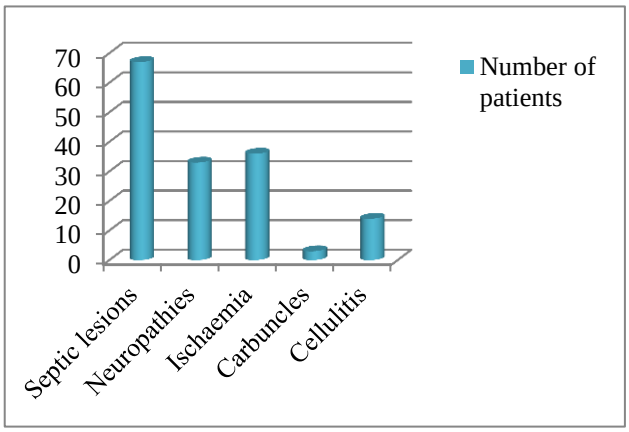

Figure 3: Types of lesions.

In present study it was seen thai septic lesions 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.

Table 12: Types of septic lesions.

Lesions	Number of patients	Percentage
Ulcers	30	41.6
Gangrene	16	22
Abscess	10	13.8
Carbuncles	3	4.1 6
Cellulitis	14	19.4

So it can be seen that ulcers formed the majority of septic lesions in our study with 40% followed by gangrene 16%, cellulitis with 14%, and then abscess and carbuncles.

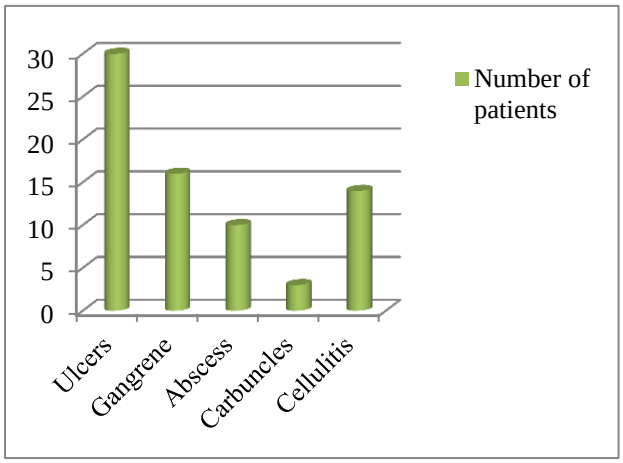

Figure 4: Distribution of various septic lesions.

Table 13: Incidence of septic lesions.

Series	Warren Lecompton (1969)	Pennsylvania Hospital (1969)	Present study
No. of cases	818	614	72
Septic lesions	213	358	67
Percentage	26	58.3	94

So in present study the incidence of septic lesions is very high as compared to the available data.

This is due to the number of patients taken for study is 72 and also that majority of patients are ignorant about the nature of disease and delay in seeking treatment.

Organisms isolated from septic lesions

Majority of septic lesions yielded staphylococcus aureus and then pseudomonas followed by E. coli, Klebsiella and Proteus.

Pus and culture sensitivity was done and most of the organisms were resistant to ampicillin, gentamycin, penicillin. Mild sensitivity to ciprofloxacin, moderately sensitive to cephalosporin's like cefotaxime, amikacin.

Table 14: Bacteriology.

Bacteria	No. of cases	Percentage
Staphylococcus	30	41.66
Pseudomonas	28	38.88
E.coli	6	8.33
Klebsiella	3	4.16
Proteus	2	2.77
Others	3	4.16

Neuropathic lesions

In this series of 72 cases of surgical complications of diabetes 33 patients were found to have peripheral neuropathy clinically. The age of patients varied from 40-80 years and the average age of incidence is around 55 years. All these patients were known diabetics with past history of diabetes ranging from 3 years to 25 years. Patients gave history of parasthesia, hyperaesthesia, tingling numbness and weakness of the feet. On examination, trophic changes of the toes, absent sweating, absent sense of fine touch, vibration, pain, sensory modalities was seen.

Table 15: Number of cases presenting with neuropathic lesions.

	Root series (1955)	Bankalo series (1960)	Duncan's series (1969)	Present study
Total number of cases	3174	150	354	72
Number of cases with neuropathy	1206	74	125	33
Percentage	37.99	49.33	35.3	45.3

Table 16 shows different signs elicited in all these patients and it is compared with Rundle[6] series and it can be seen that both the series had almost similar results.

Table 16: Signs of neuropathy.

Signs	Rundle series		Present study	
	No. of cases	%	No. of cases	%
Poor Achilles' tendon reflex	125	-	33	78
Poor patellar reflex	117	93	30	88
Decreased cutaneous sensations	63	50	17	50
Impaired vibrating sense	57	46	13	39

In all these cases other causes of neuropathy like leprosy, syphilis and spinal cord disorders were excluded by

1. Absence of nerve thickening
2. VDRL-test
3. Plain X-ray evaluation of the joints

Peripheral neuropathy is a major cause of foot lesions due to diabetic microangiopathy, vasonervosa of the digital nerves are involved resulting in demyelination. Hence decreased coetaneous sensation, proprioception, pain perception and joint sense.

It also affects the motor fibers resulting in atrophy of intrinsic muscles and loss of arches of the foot. Autonomic fibers are involved resulting in loss of sweating and temperature regulation. Due to all these features trivial injury are left unnoticed which get infected and cause non healing trophic ulcers.

Ischemic lesions

In this study of 72 cases, 36 patients had ischemic lesions. Out of them 16 cases had gangrenous lesions of the toes and foot, either dry or wet gangrene.

The youngest patient age was 36 years whereas oldest was 85 years.

Table 17: Age presentation of ischemic lesions.

Age	Present series	Wheel-lock & Root series
Youngest age	36	34
Oldest age	85	89
Average	58	68

It can be seen that the average age in present study is lesser than that of the series in the literature whereas the youngest and the oldest age presentation is almost similar.

Table 18: Incidence of ischemic lesions.

	Pennyslyvania Hospital series	Present study
No. of cases	614	72
No. of ischemic lesions	275	36
Percentage	44.78	50

The incidence of ischemic lesions in 72 cases was 50% i.e., accounted to 36 patients. The incidence in present study is higher than compared to the available literature as the number of patients taken for study is only 72.

Table 19: Incidence of gangrene.

	Bell's series (1960)	Present study
No. of cases studied	946	72
No. of cases with gangrene	236	16
Percentage	24.9	22

So it be seen that incidence of gangrene in present study is almost similar to that of Bell's series.

Table 20: Sex distribution of gangrenous lesions.

No. of cases studied	Bell's series	Present study
Male	446	49
Incidence of gangrene	116	11
Percentage	26	23
Female	500	23
Incidence of gangrene	120	7
Percentage	24	30

In present study the incidence of gangrene amongst male is almost similar as compared to the western literature while the incidence of gangrene in female is higher as compared to the literature.

Table 21: Various treatment modalities.

	No. of cases	Percentage
Conservative	30	41.6
Incision & drainage/excision	13	18.05
Disarticulation	10	13.8
Transmetatarsal amputation	-	-
Below knee amputation	4	5.55
Above knee amputation	8	11.1
SSG skin grafting	7	9.72

In present study, 30 cases were treated conservatively with meticulous debridement. Slough excision, regular dressing with providone iodine, glycerin mag sulphate. Appropriate antibiotics were given, insulin therapy was started, diabetic diet enriched with vitamins were given, strict diabetic control with everyday FBS, 8th hourly urine sugar chart was maintained.

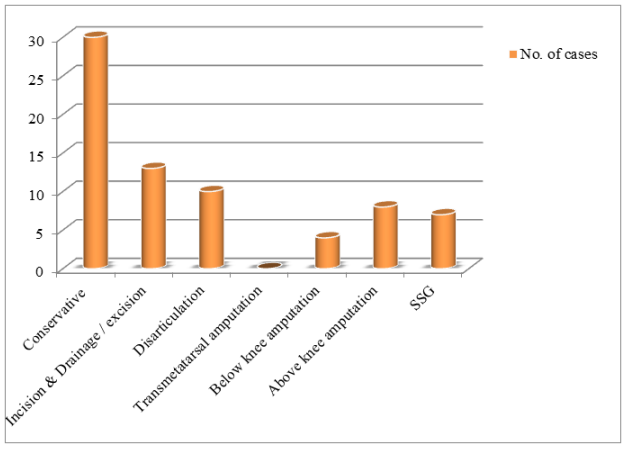

Figure 5: Type of treatment.

13 cases underwent incision & drainage and came for regular follow-up. 10 cases underwent disarticulation of toes, out of this one patient underwent disarticulation of left metacarpophalangeal joint of left hand. Four patients underwent below knee amputations whereas 8 patients

underwent above knee amputations and 7 patients needed split skin grafting for covering of raw area.

Amputation rate

Amputation rate in present study is 12 i.e., 12 cases of out 16 cases of gangrene needed amputation that amounts to 75%. This rate is higher compared to the Collen's[7] series due to the following reasons:

a) Patient coming to our hospital are usually ignorant about the nature of disease. So the gangrene was spreading and life threatening.

b) The number of patients in present study is only 72 as compared to 215 in the literature. All the patients, post amputation were referred for rehabilitation and were provided with prosthesis and crutches.

Table 22: Amputation rate.

	Collen's series	Present study
No. of cases with gangrene	215	16
No. of amputations	83	12
Percentage	38.6	75

CONCLUSIONS

1. Surgical complications are more prevalent in the age group of 51-60 years. Male individuals are more prone as they are usually working outdoor and are exposed to trauma. Also complications are more prevalent in urban individuals.

2. Majority of patients who develop complications are known diabetics on irregular treatment and who give the history of trivial injury before the onset of lesions and have a longer hospital stay.

3. Mortality of these patients is mainly due to septicemia, ketoacidosis and cardiovascular diseases.

4. Lower limbs are most commonly involved followed by upper limbs.

5. Septic lesions are common complications followed by ischemic lesions and neuropathic lesions.

6. Among septic lesions, ulcers constitute the major bulk, followed by gangrene, cellulitis and then abscess.

7. Conservative management is the primary modality of treatment for ulcers, followed by I & D, excision of carbuncles respectively. Disarticulation of toes and fingers which were gangrenous formed the 3rd modality. Finally when lesions failed to respond to conservative treatment or if it was found that it was spreading gangrene major amputations were done.

8. However this study is a study of small number of cases of 72 which is too small to draw any definite conclusions.

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