Outcome In Ankle Fractures In Diabetic Vs Non- Diabetics

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Abstract

Background: Ankle fractures in diabetic patients have always been considered difficult injuries and previous studies in this field showed that the incidence of complication can be in the range of 32%3 to 42.3%6.

Aims: The aim of this study was to assess the outcome in ankle fractures in diabetic population and to find out reasons for any results contrary to previous studies.

Methods: We performed a case control study comparing a group of 24 diabetic patients, with ankle fractures, with a group of 48 non-diabetic patients demographically similar for age, gender, type of injury, treatment provide and length of follow-up. In diabetic group 9 were treated conservatively and 15 had ORIF while in non-diabetic group 16 were treated conservatively and 32 underwent operative treatment. The diabetic and non-diabetic groups were followed up for mean periods of 50.3 months and 43.1 months respectively and on the conclusion of the study a clinic was arranged in April 2003 and the outcome was assessed according to the 100 point Maryland foot score.

Results: In the diabetic group 4 patients while in the non-diabetic group 7 patients developed complications. None of the 72 patients in this study required further surgery. The mean Maryland foot score of diabetic group was 95.08 and that of non-diabetic group was 93.79.

Conclusion: Our study shows that in the presence of optimal control of diabetes mellitus and careful patient selection for type of treatment, these lesions can result in an outcome comparable to non-diabetic patients with similar injuries ($p = 0.086$).

INTRODUCTION

Diabetes Mellitus (DM) has always been recognised as a significant co-morbidity when treating an ankle fracture. The treatment is difficult and challenging in terms of both wound healing and fracture healing. There is significant controversy in regard to the best treatment option i.e. whether to treat these injuries conservatively by closed reduction and immobilisation cast or by open reduction and internal fixation (ORIF).We performed a case-controlled study to compare the outcome in diabetic patients with ankle fracture with a matched group of non-diabetic patients. Previous studies in this controversial area showed that the incidence of complication can be in the range of $32\%_3$ to $42.3\%_6$ and can even result into amputations$_7$.

In 2000 Flynn et al published their experience of 25 diabetic patients treated for ankle fractures. They found that the risk of infection in diabetic group was 4 times higher than non-diabetic control group (32% vs. 8%). This series included only closed fractures. In 1998 McCormack and Leith compared the results of management of displaced malleolar fractures in 26 diabetic patients with those of a matching group of 26 non-diabetic patients. In this series 11 out of 26 diabetic patients developed complications compared with none in non-diabetic group. In 1995 Low and Tan observed that the incidence of infection is increased in diabetic population. This series included only 10 diabetic patients, which is statistically insignificant to draw any conclusions.

In our unit we observed a very low complication rate in diabetic patients. We looked at results retrospectively to find the reason for lower complication rate in diabetic patients treated for ankle injuries including closed and open fractures. The aim of our study is to show that in the presence of optimal diabetic control by long-term multi-disciplinary input and judicious use of antibiotics the outcome in diabetic population ankle fractures could be

comparable to control group.

PATIENTS AND METHODS

Between January 1995 and February 2002, all diabetic patients treated in our institute with ankle factures were identified from the database. Those who died due to causes not related to ankle injury or as a result of surgical complication or were not contactable due to any other reason were excluded from the study. The selected group included 24 diabetic patients with 44-B and C lesions according to AO classification[7] that signifies trans-syndesmotic ankle fractures and supra-syndesmotic ankle fractures respectively. The same database was used to identify a group of 48 non-diabetic patients demographically similar for age, gender, type of injury, treatment provided and length of follow-up. (Table 1 and 2)

Figure 1

Table 1: Patient details

	DIABETIC GROUP	NON-DIABETIC GROUP
TOTAL No.	24	48
MEAN AGE (Years)	62.9	60.3
MEAN FOLLOWUP (Months)	50.3	43.1
MALE	9	13
FEMALE	15	35
M/F RATIO	1:1.66	1:2.66

Figure 2

Table 2: Patient divisions according to type of injury

FRACTURE TYPE	DIABETIC GROUP	NON-DIABETIC GROUP
UNIMALLEOLAR	8	17
BIMALLEOLAR	12	22
TRIMALLEOLAR	2	4
OPEN	2	5

Patients were divided into two groups according to treatment provided, closed reduction and immobilization in below knee cast or open reduction and internal fixation (table 2). All the patients who underwent ORIF received prophylactic intravenous antibiotics (first dose of 1.5gm cefuroxime at induction of anaesthesia followed by six doses of 750mg cefuroxime eight hourly intravenously). Those allergic to Penicillin were given four dose of Erythromycin (1 gram, intravenous 12 hourly).

The diabetic and non-diabetic groups were followed up for mean periods of 50.3 months and 43.1 months respectively and on the conclusion of the study a clinic was arranged in April 2003 and the outcome was assessed according to the 100 point Maryland foot score. Fisher's exact test was used to compare the statistical significance of the outcome in the two groups.

Maryland foot score comprises of 100 point. It helps in objective assessment of foot and ankle for pain, function, cosmosis and motion. It designates 45 points for pain starting with 45 for no pain to 5 points for disabled. For function it has various criteria including gait, distance walked, stability, support required (crutch, cane, wheelchair), limp, shoe, stair, terrain and designates maximum of 40 points. It also assigns 10 points to cosmosis and 5 points for motion at ankle, sub-talar, midfoot, metatarsophalangeal joint.

In the catchment area of our institute a multi-disciplinary team is responsible for management of diabetes mellitus. On diagnosis of diabetes mellitus the patient is referred to diabetic clinic run by Diabetic Nurse Specialist (DNS). DNS organises appointments with Ophthalmologist, Dietician, chiropodist and Diabetologist. After initial assessment and investigations, patients are issued a glucometer for frequent blood sugar level assessments at home. These patients are regularly followed on 3 monthly bases in diabetic clinic where they are assessed by clinical history, examination and blood and 24 Hour urine tests.

On admission to the ward for an ankle fracture regular medication of all the patients were recorded and it was noticed that all diabetic patients were on Aspirin 75mg once daily and statins. Blood samples were taken for measurement of glycosylated haemoglobin level (HbA1c), which gives a measurement of glycaemia control in past 120 days. A Diabetologist was requested to review the patient, to optimise patients' medical condition. Decision regarding suitability of a patient for surgery was made in conjunction with the Diabetologist.

RESULTS

Out of 24 patients in diabetic group, 5 were insulin dependent and 19 were non-insulin dependent diabetics controlled by oral hypoglycaemic agents. The mean duration of illness before injury to ankle was 13.2 years (4 to 30).

In the diabetic group 13 patients had HbA1c of <7.0, 5 were in the group of HbA1c of 7.1 to 8.0 and 5 had readings of >8.0. The mean Maryland foot score of diabetic group was 95.08 and that of non- diabetic group was 93.79. Fisher's exact test was employed, $p = 0.086$, which is not significant statistically. None of the 72 patients in this study underwent a secondary surgical procedure.

In the non-diabetic group 1 patient developed skin blisters, 4 developed wound infection treated with course of

intravenous followed by oral antibiotics for 5 days, 1 case of DVT and one case of malunion was noted (Table 5).

Figure 3

Table 3: Patient divisions according to treatments

	DIABETIC GROUP	NON-DIABETIC GROUP
POP-CAST	9	16
ORIF	15	32
TOTAL	24	48

Figure 4

Table 4: Recommendation of treatment according to HbA1c

Haemoglobin A1c	Comments
< 6.5	Ideal value
6.2 to 7.5	Adequate
7.0 to7.9	Acceptable
> 8.0	Treatment indicated

In the diabetic group 1 patient developed skin blisters at fracture site, 1 patient developed wound infection post operatively and was treated successfully with course of intravenous followed by oral antibiotics, 2 patients went into malunion (Table 5)

Figure 5

Table 5: Complications

COPLICATIONS	DIABETIC GROUP	NON-DIABETIC GROUP
BLISTERS	1	1
WOUND INFECTIONS	1	4
MALUNION	2	1
DVT	0	1
TOTAL	**4**	**7**

DISCUSSION

There is a general consensus that ankle fractures in diabetics are difficult injuries to treat, whatever the treatment modality is employed. The most important step in treating these lesions is preoperative assessment and consideration of the glycemic control of the patient as this group of population is at high risk of developing complications.

Diabetes causes long-term changes in vascular and neurological systems on cellular level. Vascular disease in DM takes two forms, Macroangiopathy that affects larger arteries by formation of atherosclerotic plaque and Microangiopathy that affects arterioles and capillaries by thickening the basement membrane of these vessels. The later is also responsible for the neural complications[9]. Three distinct processes contribute to the aetiology of complications in DM: ischemia, neuropathy and sepsis. Endothelial dysfunction has been demonstrated in DM and occurs before the onset of atherosclerosis[8].

The normal endothelium plays a central role in the maintenance of vascular haemostasis through a balanced production of vasodilator and vasoconstrictor substances called autacoids. Endothelium derived vasodilators including nitric oxide (NO), endothelium derived hyperpolarizing factors and prostacyclin (PG 12) relaxes vascular smooth muscles in both arteries and veins. NO and PG 12 also inhibit platelets aggregations. Vasoconstrictors, from the sympathetic nerves, the circulation and the endothelium, like nor-epinephrine, angiotensin-II, thromboxane A2 and endothelin –1 provide a counter balancing effect on vascular tone.

Abnormal endothelial function has been demonstrated in type 1 and 2 diabetes mellitus and occurs before the onset of atherosclerosis. In DM the release and/or bioavailability of NO are diminished. It is not clear at this stage whether it is due to decrease production or increased degradation of NO, or increased production of vasoconstrictor agents.

Dyslipidemias particularly decreased HDL cholesterol, increased triglycerides, increased intermediate density lipoproteins levels are common in DM. Studies in human and porcine models show that hypercholesteroleima is associated with endothelium dependant vasodilatation dysfunction even in the absence of atherosclerotic plaques. These changes include increased generation of reactive oxygen species.

Today our better understanding of aetiology of the complications in DM, dictates towards a multi-disciplinary and more aggressive treatment of DM, from the onset/diagnosis of the DM. This includes lifestyle intervention such as weight reduction, daily regular exercise, complete cessation of active and passive smoking, diet control, use of lipid lowering agents (e.g. statins), aspirin and agents which provide sustained glycemic control over 24 hour period (Type 2 DM) or long acting insulin or the combination of both.

In our study all the diabetic patients were treated aggressively by the multi-disciplinary team and were all found to be on statins and low dose aspirin, in addition to agents for glycemic control and had regular monitoring by serum levels of glycosylated haemoglobin. Majority of them (17/24) had readings of <7.5%, two had readings of 7.6% to 8.0 % and only five patients had readings of >8.0%.

CONCLUSION

In conclusion our study shows that these challenging injuries can be treated satisfactorily with the help of aggressive multi

disciplinary treatment of DM, careful patient selection for decision of treatment modality, judicious use of antibiotics can result in a outcome comparable to the non-diabetic population (p=0.086). This is contrary to the previous studies in this field.

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