

# Proximal humerus fractures in diabetic patients: surgery versus conservative management

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## Introduction

Diabetes mellitus is an endocrine disorder causing a metabolic abnormality of persistent hyperglycaemia leading to abnormal glycosylation of proteins, fats causing neuro-musculoskeletal disorders characterized by abnormalities of nervous tissue, joint and bone. The rates of diabetes especially Type II is increasing in the developed world and its attendant complications, through local and systemic effects of hyperglycaemia upon the microvasculature and upon soft tissue healing and wound infection rates, should not be overlooked in humerus fracture treatment. In this study, we investigated the association between patients with Diabetes Mellitus sustaining proximal humerus fractures and the effect on fracture and soft tissue healing outcomes.



## Materials and Methods

Out of 1752 patients, 98 patients (22 males and 76 females) met the inclusion criteria (closed fracture, and previously diagnosed with type 1 or 2 diabetes mellitus). 36 patients were of type 1 (mean age 51) and 62 were of type 2 (mean age 56). 12 patients underwent surgical fixation while the rest had conservative management.

An age and sex matched control group (n=98) were randomly identified and confirmed not to suffer from diabetes mellitus or other hormonal disorders. Both groups were also matched to their Neer classifications and treatment requirements.

For the operative group, baseline serum glucose was documented at 4 time-points: pre-operative, immediate post-operative, late post-operative and 1st outpatient clinic follow-up (within 4 weeks of surgery).

Primary outcome factors studied were degree of glycaemic control in the operative group, time to fracture union and soft tissue healing. Secondary outcome factors studied were postoperative complications, and the incidence of delayed union and non-union.

Radiological union required clear evidence of bridging callus and bony trabeculae traversing and obscuring the fracture line; while clinical union was a more subjective assessment of fracture stiffness. It is well known that these techniques have a number of limitations; however they continue to be the acceptable practice when assessing fracture union in the clinic. Both cohorts were followed up for a minimum period of 24 months.

## Results

In the operative group, DM I patients were more likely to suffer from poor glycaemic control postoperatively in terms of frequency (p=0.001) and severity of deviation from normal range (p=0.012), when compared to DM II patients. Further analysis showed significant difference in time to fracture union between DM I and DM II cohorts (mean 13 vs. 9 weeks, p<0.004) and DM I and control group (mean 13 vs. 8 weeks, p<0.003).

In the conservatively managed group, there was significant difference in time to fracture union between DM I and DM II cohorts (mean 11 vs. 9 weeks, p<0.003) and DM I and control group (mean 11 vs. 8 weeks, p<0.004). DM I patients were more likely to suffer delayed soft tissue healing (time to wound healing) when compared to DM II (p<0.021) and controls (p<0.029).

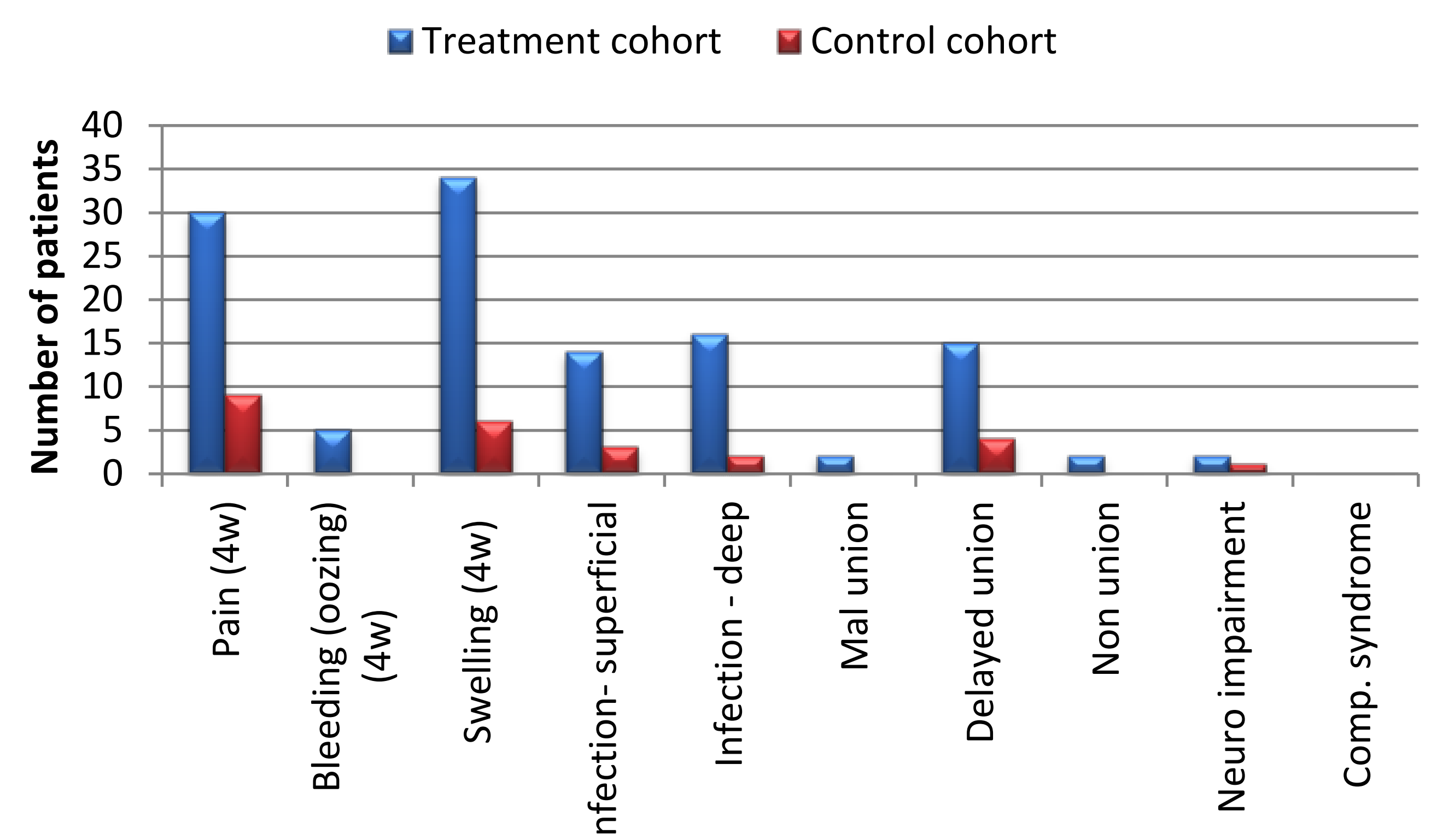
Primary outcomes	DM	DM I	DM II	DM	DM II	Control
	Conservative group			Surgical group		
<b>Wound healing</b>						
Mean (weeks)	5	5	4	6	6	2
Minimum-Maximum	3-7	2-7	3-5	3-7	3-7	1-3
Standard deviation	±1	±2	±1	±2	±2	±1
<b>Time to union</b>						
Mean (weeks)	11	11	9	13	10	8
Minimum-Maximum	7-14	8-14	7-13	8-15	8-14	6-8
Standard deviation	±2	±2	±2	±2	±2	±1

Primary outcomes of the conservatively-treated and surgically-treated diabetes mellitus sub-groups and the control group.

In the surgically managed group, there was significant difference in time to fracture union between DM I and DM II cohorts (mean 13 vs. 10 weeks, p=0.001) and DM I and control group (mean 13 vs. 8 weeks, p<0.001). DM I patients were more likely to suffer delayed soft tissue healing (time to wound healing) when compared to DM II (p=0.01) and controls (p=0.03).

Secondary outcomes	DM group	Control	DM vs. C	DM vs. C
	n = 98	n = 98	Pearson	Fisher
Pain (4w)	30	9	<.001**	.001*
Bleeding (oozing) (4w)	5	0	-	-
Swelling (4w)	34	6	<.001**	.002*
Infection- superficial	14	3	<.001**	.001*
Infection - deep	16	2	<.001**	.001*
Mal union	2	0	-	-
Delayed union	15	4	.001*	.003*
Non union	2	0	-	-
Neuro impairment	2	1	-	-
Comp. syndrome	0	0	-	-

Secondary outcome of the diabetes mellitus (treatment) and control groups.



Secondary outcomes	DM group	Control
	n = 98	n = 98
Satisfactory RoM (4w)	82	88
<b>Mobility at last R/V</b>		
Same to before injury	80	85
Dependent – worse	5	1

Secondary outcomes of the diabetes mellitus (treatment) and control groups.

## Discussion and Conclusion

Diabetes mellitus is known to cause significant macro- and micro-damage to the peripheral vascular system. This is likely to affect both soft tissue and bone healing. The disturbance to the nerve physiology may be linked to prolonged local pain. Patients with type I diabetes and poor peri-operative glycaemic control sustaining proximal humerus fractures are more likely to suffer from increase in time to union, delayed union and wound healing problems.