

# Effect of chronic heavy smoking on proximal humerus fractures healing

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## Introduction

Cigarette smoking is associated with increased risk of osteomyelitis and delayed union/non-union in long bone fractures. However, the effect of cigarette smoking on the outcome of proximal humerus fracture remains unknown. The proximal humerus is a common site of fracture in the elderly and usually linked to bone fragility. In this retrospective comparative study, we analysed the effect of chronic heavy smoking on closed proximal humerus fracture and overall outcomes.



## Materials and Methods

Over a 5-Year period, 1752 patients were treated with proximal humerus fractures in our institution. Chronic heavy smoking was defined as daily smoking of greater than 20 cigarettes per day for over 20 years. 118 met the inclusion criteria. An age and sex matched control group (n=118) (non-smokers, closed fractures) were randomly selected for comparison purposes. Fractures were classified as per the Neer classification system. Patient demographics, pre-existing co-morbidities, medication, mechanism of injury, and clinical details including surgical procedures were collected.

Primary outcome factors studied were time to fracture union and wound 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

The mean age of the heavy smokers group (31 males, 87 females) was 57 years. In the control group (45 males, 73 females), the mean age was 46 years. Other associated injuries between the groups included hip and distal radius fractures. For the chronic heavy smokers group, 14 patients required surgical fixation. The rest were treated conservatively. For the control group, 10 patients required surgery and the rest were treated conservatively. None of the patients in both cohorts suffered from diabetes mellitus.

Primary outcomes	CHS group	CHS group		Control
		Conservative	Surgical	
<b>Time to wound healing</b>				
Mean (weeks)	6	6	7	2
Minimum-Maximum	3-8	3-7	3-8	1-2
Standard deviation	±2	±2	±2	±1
<b>Time to union</b>				
Mean (weeks)	12	11	14	9
Minimum-Maximum	10-19	10-15	12-19	7-10
Standard deviation	±2	±1	±2	±1

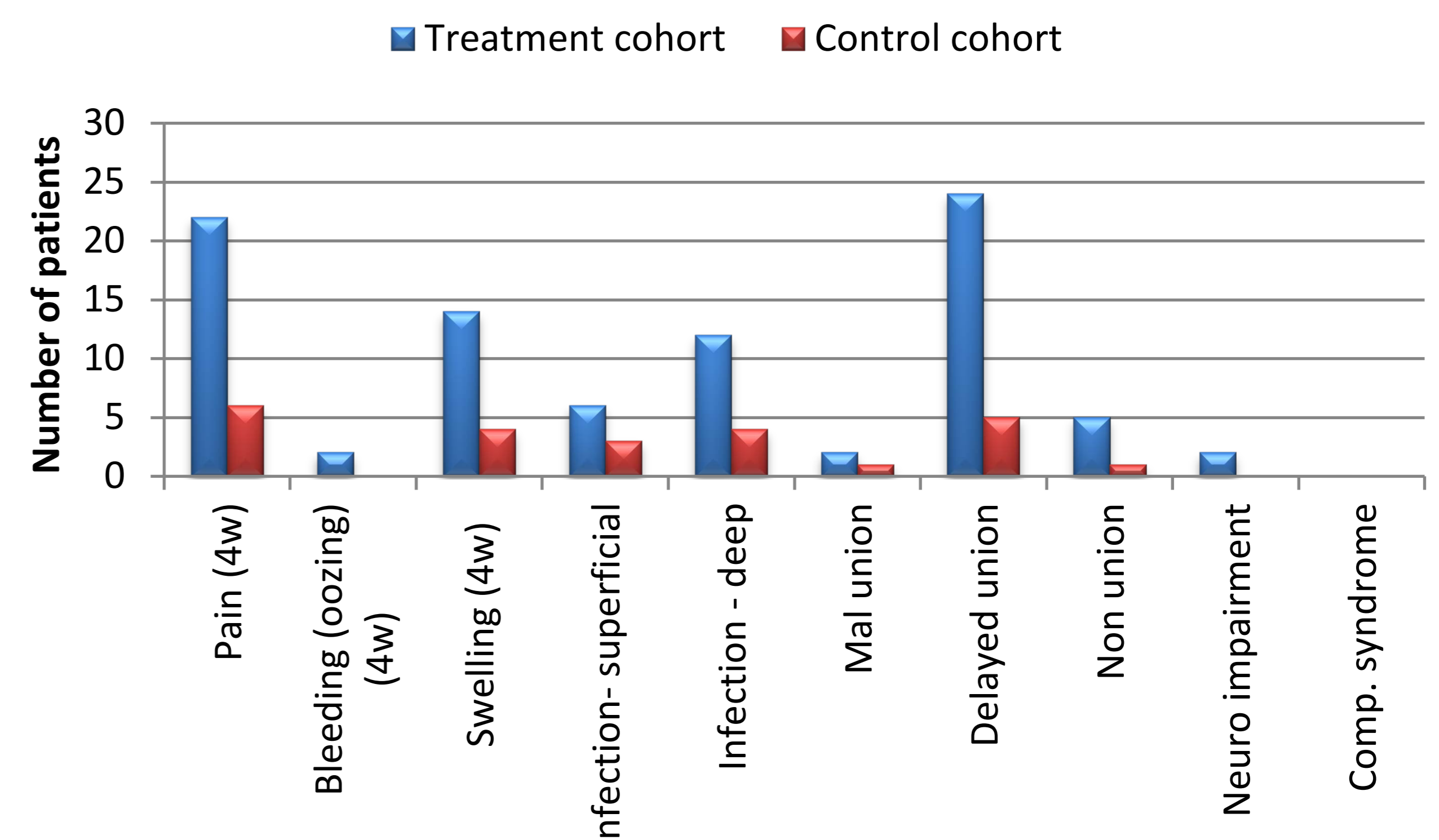
Primary outcomes of the conservatively-treated and surgically-treated chronic heavy smokers (CHS) sub-groups and the control group.

For the conservatively treated cohort, chronic heavy smokers were more likely to suffer from delayed fracture healing (mean 11 weeks [range 10-15] when compared to the control group (mean 9 weeks [range 7-10] (p=0.004). Other significant differences were identified when comparing soft tissue healing (p=0.021) and postoperative pain (at 4 weeks) (p=0.08), (see table at the bottom of the first column).

For the surgically treated cohort, chronic heavy smokers showed a statistically significant delay in fracture healing (mean 14 weeks [range 12-19] when compared the control group (p<0.001). Further analysis revealed a significant correlation between chronic smoking and postoperative delayed wound healing (p=0.005), duration of postoperative pain (p<0.001) and surgical site infections (p=0.002).

Secondary outcomes	CHS group n=118	Control n=118	CHS vs. C	
			Pearson	Fisher
Pain (4w)	22	6	<.001**	.002*
Bleeding (oozing) (4w)	2	0	-	-
Swelling (4w)	14	4	<.001**	.002*
Infection- superficial	6	3	.002*	.003*
Infection - deep	12	4	<.001**	.003*
Mal union	2	1	0.242	0.321
Delayed union	24	5	<.001**	.002*
Non union	5	1	.002*	.005*
Neuro impairment	2	0	-	-
Comp. syndrome	0	0	-	-

Secondary outcomes of the chronic heavy smokers (CHS) and control groups.



Secondary outcomes II	CHS group	Control
Satisfactory RoM (4w)	96	103
Mobility at last R/V		
Same to before injury	92	109
Dependent – worse	14	6

Secondary outcomes of the chronic heavy smokers (CHS) and control groups.

## Discussion

Damage to the blood vessels lining and disturbance to the lipids level in the blood stream have been reported to be caused by the chemicals in tobacco. As a result, many pathologies can arise due to atheroma formation. In our study, it is expected that the pathological damage caused by long-term excessive smoking resulted in significant reduction in the blood supply to the fractured area and hence, reduced oxygenation. This in turn may have led to delayed union and poor wound healing and other more complications.

## Conclusion

Chronic heavy smokers with proximal humerus fractures are likely to suffer from delayed fracture union when compared to non-smokers. Patients with this injury requiring surgical fixation were reported to suffer from poor wound healing, postoperative pain and deep surgical infection.