

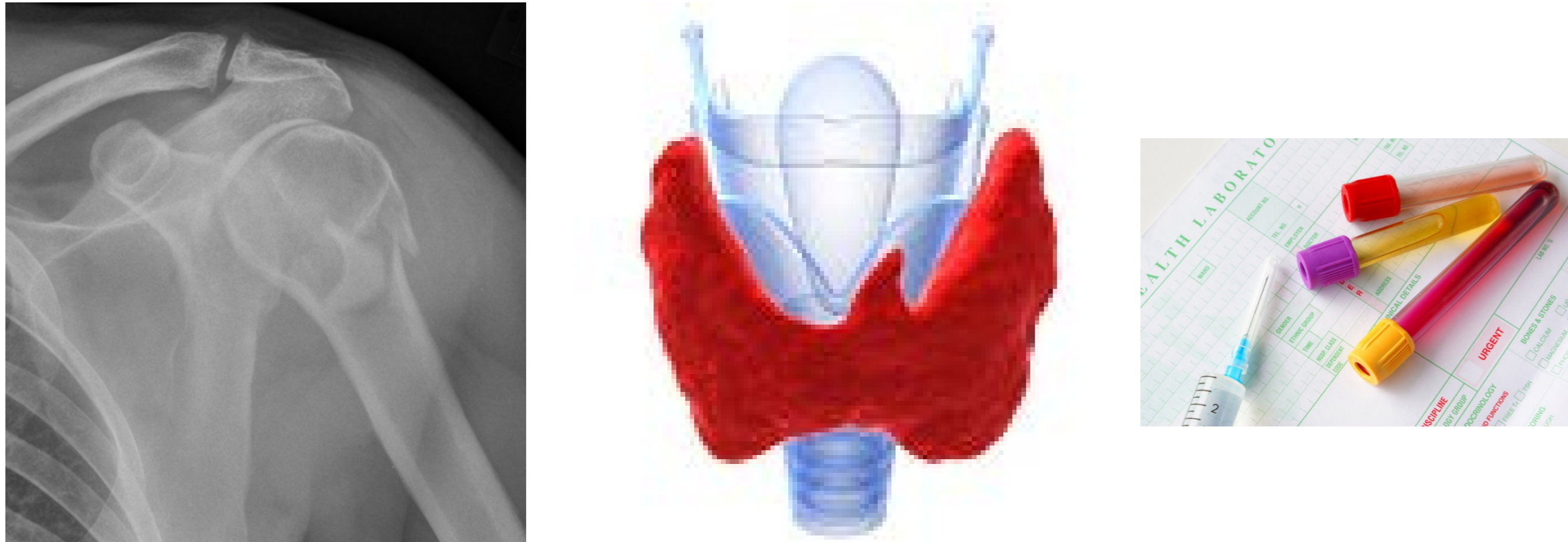


W. Jerjes, J. Callear, P. Giannoudis

Academic Unit of Trauma & Orthopaedics, University of Leeds, Leeds, United Kingdom

## Introduction

Thyroid hormones affect bone remodelling in patients with thyroid disease by acting directly or indirectly on bone cells. It has traditionally been known that hyperthyroidism is a risk factor for osteoporosis and fractures. In this study, we investigated the effect of poor thyroxin control on hypothyroid patients with proximal humerus fracture.



## Materials and Methods

Out of 1752 patients, 61 patients (17 males and 44 females) met the inclusion criteria (closed fracture, and known hypothyroidism controlled with thyroxin supplements). 9 patients underwent surgical fixation while the rest had non operative management. An age and sex matched control group (n=61) were randomly identified and confirmed not to suffer from any hormonal disorders or on any medication that may affect bone metabolism. Both groups were also matched to their Neer classifications and treatment requirements.

For the operative group, serum thyroxin was documented at 4 different intervals: pre-operative, immediate post-operative, late post-operative and 1st outpatient clinic follow-up (within 4 weeks of surgery). For the conservatively managed group, serum thyroxin was documented at 2 different intervals: admission to hospital and 2 weeks post injury while visiting their general medical practitioner.

Primary outcome factors studied were degree of thyroxin control, 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, patients with poor thyroxin level control (n=3) compared to good thyroxin control (n=6) in the first 4 weeks postoperatively required longer time to achieve fracture union (14 weeks compared to 12 weeks). In the conservatively managed group, patients with poor thyroxin level control (n=14) compared to good thyroxin control (n=38) in the first 2 weeks post injury required longer time to achieve fracture union (12 weeks compared to 10 weeks).

Primary outcomes	HT group	HT group		Control
		Conservative	Surgical	
<b>Time to wound healing</b>				
Mean (weeks)	4	4	5	3
Minimum-Maximum	3-5	3-5	4-7	2-3
Standard deviation	±1	±1	±1	±1
<b>Time to union</b>				
Mean (weeks)	12	11	13	10
Minimum-Maximum	10-14	10-12	12-14	6-8
Standard deviation	±2	±2	±2	±1

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

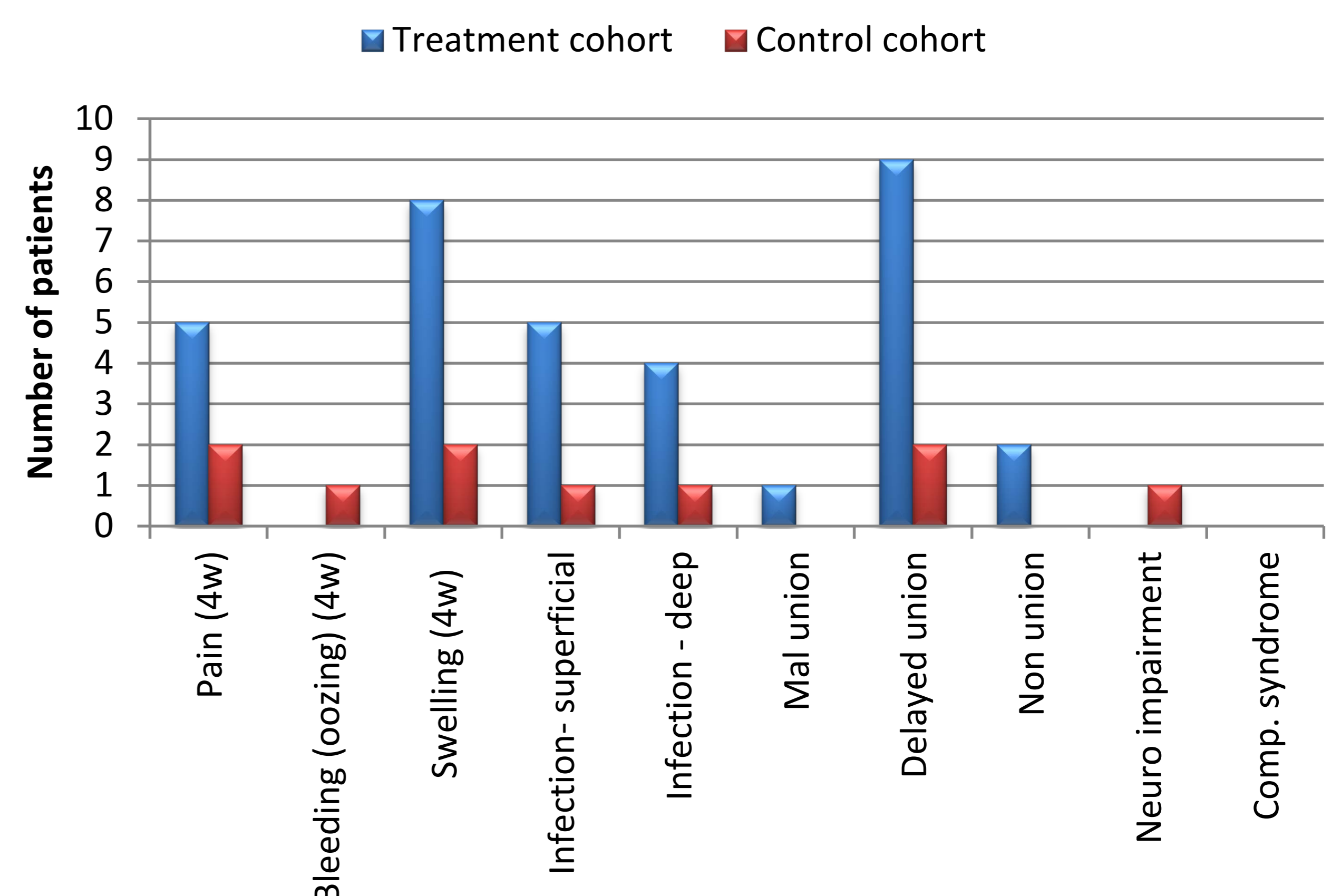
Comparing the operative group time to union (mean 13 weeks) to the conservatively managed group (mean 11 weeks) and control group (mean 10 weeks) revealed statistical significance of p=0.01 and p<0.001, respectively.

Comparing the operative group soft tissue healing [time to wound healing] (mean 5 weeks) to the conservatively managed group (mean 4 weeks) and control group (mean 3 weeks) revealed statistical significance of p=0.05 and p=0.005, respectively.

Assessment of secondary outcome factors revealed a significant correlation between poor thyroxin level control in hypothyroid patients and incidence of swelling (P=0.01), pain (P=0.003) and overall increase in healing time (P=0.024).

Secondary outcomes	HT group	Control	HT vs. C	HT vs. C
	n = 61	n = 61	Pearson	Fisher
Pain (4w)	5	2	.001*	.003*
Bleeding (4w)	0	1	-	-
Swelling (4w)	8	2	<.001**	.001*
Infection- superficial	5	1	<.001**	.002*
Infection - deep	4	1	.001*	.003*
Mal union	1	0	.021*	.031*
Delayed union	9	2	<.001**	.001
Non union	2	0	-	-
Neuro impairment	0	1	-	-
Comp. syndrome	0	0	-	-

Secondary outcomes of the hypothyroid (treatment) and control groups.



Secondary outcomes	HT group	Control
	n = 61	n = 61
Satisfactory RoM (4w)	52	57
<b>Mobility at last R/V</b>		
Same to before injury	50	55
Dependent – worse	2	0

Secondary outcomes of the hypothyroid (treatment) and control groups.

## Discussion

Hypothyroidism is characterised by decreased bone resorption, decreased bone formation and increased bone mineral density in both trabecular and cortical bone. Levels of the three bone resorption markers namely pyridinoline, deoxypyridinoline and β-crosslaps are reduced when compared with euthyroid controls.

## Conclusion

Hypothyroid patients with poor thyroxin level control sustaining proximal humerus fractures are more likely to suffer from fracture healing problems including delayed union.