The association between body mass index and the severity of proximal humerus fractures: effect on fracture union and soft tissue healing

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Introduction
Obesity is becoming endemic especially in the developed world. There is now enough scientific evidence to link obesity to musculoskeletal problems. The incidence of proximal humerus fractures is rising and they are mostly linked to osteoporosis in the elderly. In general, they result from low-energy trauma following a mechanical fall, and more predominant in females. We investigated the relationship between the body mass index and these fractures in postmenopausal females.

Materials and Methods
The inclusion criteria included females >45 years of age with good health status and no mental health issues, not diabetic nor suffer from neuromuscular weakness, not requiring a walking aid and no history of falls or previous fractures. 822 patients met the inclusion criteria and mechanism of injury was a mechanical fall in 92% of the cohort. Patients were classified according to their BMI into 4 categories: (1) underweight, (2) normal weight, (3) overweight and (4) obese. Fractures were classified as per the Neer classification system. 82 patients underwent surgical fixation and the rest were treated conservatively.

Radiological union required clear evidence of bridging callus and bony callus; 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
Overweight and obese females are more likely to sustain 4-part proximal humerus fracture with >1cm displacement when compared to normal weight (p<0.001) and underweight (p<0.001) females.

Further analysis of the surgical cohort, revealed a significant correlation when it comes to postoperative delayed wound healing (p=0.002), duration of postoperative pain (p=0.002) and surgical site infections (p=0.005), when compared to the conservatively managed group.

Discussion and Conclusion
It was traditionally thought that more weight would have a positive effect upon bone but recent findings associate it with reduced bone quality. Just as starvation increases the risk of fracture, obesity affects osteoclastic microenvironment and can have an adverse effect on bone and calcium metabolism. Adipose tissue has a direct and indirect hormonal effect and even the location of fat deposition can have varying effects upon the rate of fractures per skeletal site. The current evidence confirms that the severity of the fracture is increased in overweight and obese postmenopausal females. Furthermore, surgical fixation in 3-part and 4-part fracture tends to be associated with delay in fracture union and increase wound healing problems.