A Case Of Midshaft Humerus Nonunion In A 36 Year Old Intellectually Disabled Man
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Citation

Abstract
A 36 year old intellectually disabled fully dependent, right hand dominant man sustained an isolated humeral shaft fracture following an assault. Initial non-operative management failed with the result of non-union of the humerus. An attempt at plate fixation also failed. He was thus assessed by our team with regards to his fracture non-union. A redo open reduction internal fixation with bone graft was performed with successful results one year post operation.

CASE REPORT
A 36 year old intellectually disabled, fully dependent, right hand dominant man sustained an isolated right humeral shaft fracture following an assault in which he was pushed to the ground. (Figure 1). He was a resident of a high level care nursing home. He was brought to the emergency department by a carer, where he was assessed and his right arm was placed in a U-slab (Figure 2). Arrangements were made for outpatient follow-up.

Figure 1

He did not attend either of his two week or 6 week outpatient appointments. At two weeks post fracture an attempt was made by the clinic to contact the hostel and a message was left on their answering machine. He presented to the orthopaedic outpatient clinic at 8 weeks post injury. Whilst he was unable to communicate his carers said he often complained of pain to the right arm. X-ray demonstrated no evidence of union of the fracture (Figure 3 and 4). The attending carer stated that the U-slab had been removed within 48 hours of discharge from the emergency department by the patient. After discussion with his carer and legal guardian a decision was made to proceed with operative management with the aim of pain control and facilitating his management at the care facility.

Figure 2
He was initially managed with a “WAVE plate” and one intra-fragmentary screw as a means of fixation during the surgery. The surgeon was satisfied with the procedure and reported good bone purchase with 6 cortices on either side of the fracture. Figure 5 a & b show intra operative Images and Figure 6 is an intra operative photograph of the fixation.
At 6 weeks post open reduction internal fixation (ORIF) there was evidence of a clinical deformity. X-rays revealed the screws had dislodged from the bone and there remained no evidence of fracture union (Figure 7).

**Figure 8**

At this time it was decided that revision surgery was necessary. Pre-operatively there was clinical evidence of a gross deformity to the humerus (Figures 8 and 9). The initial plate was removed from the fracture and a longer locked compression plate along with a reconstruction plate and cancellous bone graft were added. (Figure 10a & b). The operation involved careful dissection as much of the anatomy was now distorted from the prior surgery.

**Figure 9**

**Figure 10**

**Figure 11**
At 12 months post revision surgery the patient showed clinical and radiological evidence of union. His carers reported he had not been complaining of pain and had not been functionally limited by his humerus (Figure 11).

DISCUSSION

Delayed union or non-union following fracture of the humerus is an infrequent but debilitating complication. The great majority of fractures of the midpart of the humeral shaft heal uneventfully when treated non-operatively. Whilst non-union of the humerus is not a common complication the literature reports the incidence to be as high as 13% for both non-operative and operative management. Poor patient compliance such as in this case makes treating mid shaft humerus fractures complicated by non-union all the more complex.

Non-union of the humerus may result in significant morbidity, possibly requiring numerous operative procedures to treat and may leave the patient with functional deficits. Such cases of non-union can present particular challenges in management including malalignment, infection and soft tissue compromise. The available literature regarding long-term outcomes and treatment guidelines following non-union of humeral fractures is sparse. Fixation options vary throughout the literature whilst the results following fixation vary to a much lesser extent. The literature recommends fixation options including intramedullary nails, external fixators, different plating techniques and the option to complement all of these with cortical or other bone graft material.

Locked plates are now considered a better option with regards to effectively treating long bone non-union in the upper limb. However, it has been shown that the primary cause of non-union of the humeral shaft is insufficient surgical technique with inadequate exposure or choice of implant, once surgical intervention has commenced. We now know that locked screw plates provide more secure fixation of fractures, especially in weak bone, however the price might be a reasonably high complication rate. Thus it is important to question why we may fail. Numerous variables play a role including patient factors, surgeon factors and operative factors. Plates that are too short can often be the reason for failure. However, the two complications most commonly described in the literature are (1) technical complication in plate positioning, length of screws or secondary screw cutout which strongly influence the final clinical result and (2) specific complications related to the locked plate including pseudoarthrosis and plate fractures.

Studies on repair following non-union of midshaft humerus fractures are best documented for compression plating. However, due to the complication rate Marti et al concluded that a standardised treatment with an anterolateral approach, neurolysis of radial nerve, decortication, compression plating, and autogenous bone graft has proved to have a high union rate (93%) and few complications. Further studies have also discussed the importance of achieving a high degree of cortex-to-cortex stability, with the main factor for success being a stable fracture achieved by securing fixation of at least six cortices proximal and distal to the non-union site. However, this does not take into account the advantage of locking plates with the LCP or the ability to use both bicortical and unicortical locking screws which have increased holding power. Rubel et al compared the use of one versus two plates following non-union of humeral fracture in a biomechanical study. They conclude that a two plate construct with the plates at right angles is mechanically stiffer than a single plate construct. This may be useful in the situation of non-union of the mid shaft of the humerus where rigid stabilisation would be preferential. A theoretical concern when using two plates rather than one is the increased amount of soft tissue dissection required in order to place the second plate at 90 degrees to the first. This is widespread throughout the orthopaedic literature. Although this is a major concern in acute fractures, Rubel et al believe that in the case of non-unions the large and careful dissection needed to correct the deformity, debride the fibrous tissue and identify the nerves allows application of the second plate without further exposure. Furthermore, the addition of a second plate did not increase the rate of
treatment failure or complications.  

References
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