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Handoll HH, Keding A, Corbacho B, et al. Five-year follow-up results of the PROFHER trial comparing operative and non-operative treatment of adults with a displaced fracture of the proximal humerus. *Bone Joint J* 2017;99-B:383-392.

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Sir,

We read with interest the article by Handoll et al,[1] which reports the five-year results of the PROFHER randomised trial comparing the surgical and non-surgical treatment of adults with a displaced fracture of the proximal humerus.

We have some concerns over a number of potentially misleading conclusions based on the otherwise generally rigorous analyses. These include the degree to which the study population is representative of the general population, a lack of differentiated analysis for the various surgical treatment modalities, the heterogeneity of surgical expertise, and the validity of the outcome scoring system.

Our main concern is the conclusion that there is no difference in patient-reported outcomes between operative and non-operative treatment for most adults with a fracture of the proximal humerus involving the surgical neck. While this might be true for the trial patients, we question whether it is applicable to the general population given the highly subjective inclusion criterion "displaced surgical neck fractures that do not meet the exact displacement criteria of the Neer Classification … where this reflects an individual surgeon's uncertainty (e.g. whether, or not, the surgical neck fracture should be treated surgically)". Consequently, whenever a surgeon was not sure how to treat a fracture, it was included in the study.

Less experienced surgeons could be more uncertain about treating patients and therefore include a higher proportion of "easier" cases. The level of experience of the surgeons in the study is not described, but 75% only operated on one or two patients (median one patient), during the 2.5 years' recruitment period. This is a low number, suggesting that the participating centres had limited experience with these fractures. This could explain the high proportion of one- and two-part fractures included (surgical: 59%, non-surgical: 58%).[2] Many surgeons would reasonably argue that one- and two-part fractures of the surgical neck can be treated effectively by closed means.[3] Surgeons excluded fractures for which, in their opinion, there was a clear indication for surgery.[2] Consequently, very few fractures with more than two parts (according to Neer) were randomised. This subjective assessment contributes to the trial being unrepresentative of fractures of the proximal humerus in general.

There is also a general consensus that the clinical prognosis of a proximal humeral fracture is related

to fracture type,[4] a more unfavourable prognosis being given as the number of parts involved and the degree of displacement increases. Having more trial patients with a good prognosis could dilute the real effects in patients with a poor prognosis.

To examine more complex fractures, the authors undertook a subgroup analysis of patients with (surgical: N = 58, non-surgical: N=58) and without (surgical: N = 18, nonsurgical: N=15) tuberosity involvement (as a proxy for Neer's classification[5]). However, these sample sizes are small, making it difficult to draw reliable conclusions. Additionally, the number of crossovers from the surgical to the non-surgical group (13%) was significantly higher than that from the non-surgical to the surgical group (2%), which should have warranted a per-protocol analysis (p-value < 0.001).

There was no analysis of the different types of surgical treatment. Numerous studies have been,[6] and are being, conducted to identify the best surgical option for various fractures of the proximal humerus.[7] A recent meta-analysis of RCTs indicated that although there is no overall difference in clinical outcomes between operative and non-operative treatments of displaced fractures of the proximal humerus, subgroup and sensitivity analyses suggested that heterogeneity might be due to the type of fracture and type of surgical intervention undertaken.[7] The authors recommend that future studies examine more homogeneous groups in order to differentiate between fracture types and surgical treatment types, and to minimise the risk of diluting observed treatment effects.

The PROFHER trial combines all types of surgical treatment but the results are generalised to include most adults with a fracture of the proximal humerus involving the surgical neck. This seems inappropriate for the reasons stated.

Finally, the primary endpoint (Oxford Shoulder Score, OSS) has not been validated for trauma patients. Pain is important to these patients but is poorly represented by the OSS. Moreover, the minimal clinically important difference (MCID) for the OSS has not been determined for the injured proximal humerus or shoulder arthroplasty (one of the surgical treatment options).[8] In the absence of this information, the investigators used an approximation derived from general considerations of MCIDs in other patient-reported outcomes.[8] However, clinically important differences between treatments could be under-reported by the OSS and thus underestimated.

We are concerned that the broadly generalised conclusion drawn by the authors could be used as the basis for clinical decision making for all fractures of the proximal humerus,[9] not just for those represented by this trial, and, perhaps more importantly, for care-purchasing decisions. Both carry the risk that patients who could otherwise benefit from surgery carried out by doctors with the greatest experience and surgical skills would be denied appropriate treatment.

Moreover, literature from continental Europe and the broader global orthopaedic trauma community suggests that the outcome of surgical treatment can be better than that of the British experience (including fewer complications).[10] A reduction of research efforts to improve the rational understanding of fracture care for the proximal humerus in the UK, based on the conclusions drawn from a single RCT such as the PROFHER, could thereby lead to avoidable harm.

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