

Surgical enhancement of fracture healing - operative vs. nonoperative treatment

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Abstract.

Although the success story of surgical fracture treatment led to a tremendous improvement of treatment outcome for certain fractures such as femur or tibia shaft fractures, the overall benefit of surgical versus conservative treatment remains controversial for several types of fractures. For this sake, we carried out a narrative review of high-level of evidence studies comparing treatment outcomes in fractures with controversial debates on the value of surgical therapy in clavicle, proximal humerus, olecranon, ankle, calcaneus and Jones fractures. We identified eight studies (Level-I and -2) with functional and quality of life outcomes in these fractures.

Only in Jones fractures of the fifth metatarsal bone, bone healing and functional outcomes were significantly better after surgical compared to conservative treatment. In terms of patient-related quality of life, surgical treatment was not found to be superior compared to conservative treatment in all the above-mentioned fractures. In many trials, lower nonunion rates after surgical treatment were offset by complications due to the surgical procedure. Nonunion after conservative treatment often seemed to have only limited impact on functional results.

However, the comparability of studies was limited due to age-differences between patients. Therefore, we emphasize the need for further investigations to determine which patient-related factors favor a conservative treatment approach and for whom surgery is the best option.

Key words

Fracture Operative Non-operative Functional outcome Treatment

Treatment options for fractures are numerous, ranging from conservative treatment methods to various internal or external fixation procedures as well as partial or complete joint replacement. Between 2005 and 2013, an increase of 21% in the number of internal fixation procedures was recorded in Germany, partly due to introductions of technical innovations such as locking plates [1,2]. Nevertheless, consensus among surgeons is still lacking as to which fractures and for which patient surgical treatment is beneficial. Nowak et al. surveyed 134 orthopedic surgeons about their opinion regarding appropriate treatment of proximal humeral fractures. While consensus on minimally dislocated

fractures was high, a strong disagreement in more complex fractures was found. In three-part fractures, treatment strategies varied between plate fixation, hemiarthroplasty and total reverse shoulder arthroplasty, whereby approximately one third each preferred one of the methods mentioned above [3].

Although several studies compared the possible procedures in terms of functional outcomes and their complications, the resulting information were frequently limited due to lack of evidence as well as methodical issues. [4]. However, recent high-quality studies have highlighted these issues and have given some evidence-based answers comparing functional outcome, quality of life and complication rates. For this purpose, this article provides an overview of the current state of evidence of surgical versus conservative treatment of fractures in which appropriate treatment is still controversially discussed

Fractures of the proximal humerus are common, especially in older individuals. They account for 5 to 6% of all adult fractures. The surgical neck is usually involved, since osteoporosis is one of the main risk factors for those typically metaphyseal fractures [9]. In Germany, an increase of 39% in surgical procedures for fractures of the proximal humerus was recorded from 2005 to 2013 [1]. In contrast to increasing surgery rates, a Cochrane review from 2015 still emphasizes limited evidence base regarding the treatment of choice, especially in complex fractures. Furthermore, the included studies did not show superiority of surgical versus conservative treatment. The authors could not provide clear recommendations on the type of conservative and surgical care [10]. The Proximal Fracture of the Humerus Evaluation by Randomization (PROFHER) study group compared conservative and surgical treatment for displaced humeral fractures in a prospective RCT. 258 patients were eligible, including 18 Neer one-part fractures with nine patients each in surgical group (SG) and nonsurgical group (NSG), 128 Neer two-part fractures (65 SG vs. 63 NSG), 93 Neer three-part fractures (46 SG vs. 47 NSG), and 11 Neer four-part fractures (5 SG vs. 6 NSG). Surgical treatment most often involved locking plates (n = 90), followed by hemiarthroplasty (n = 10), intramedullary nails (n = 4), and other surgery (n = 5).

Conservative treatment consisted of broad arm type sling (n = 82) or collar and cuff (n = 35) with three patients receiving a hanging cast. The functional outcome measured by the Oxford shoulder score (OSS) did not differ significantly between the two groups at any point of time (6, 12, and 24 months post-injury). Furthermore, the comparative groups ranked equal in the Short Form 12 (SF-12) mental and physical component scores. Slightly more surgical treated patients (24.0% vs. 18.4%) experienced complications. However, these results were not statistically significant. Assuming that age and tuberosity involvement would have significant impact on the outcome, subgroup analyses evaluated the impact of age or fracture type on functional outcome.

However, no differences emerged between the subgroups of patients aged >65 years and <65 years, as well as between tuberosity involvement and no tuberosity involvement, respectively [11]. With reference to the above-mentioned study, another research group allocated 88 patients either to surgical treatment using a Philos locking plate (Depuy-Synthes, Solothurn, Switzerland) or non-operative treatment consisting of wearing a collar-cuff sling for 3 weeks. The rehab protocol was identical for both groups. In contrast to the PROFHER-Trial this study focused on displaced two-part proximal humerus fractures in patients aged ≥ 60 years. Outcome measurement was conducted by blinded assessors evaluating the DASH score for primary outcome in addition to the Constant score, the visual analogue scale for pain (VAS), the quality of life questionnaire 15D, the EuroQol Group's 5-dimension self-reported questionnaire EQ-5D and OSS. In line with the PROFHER study, there were no statistical or clinically significant between-group differences at any point of assessment (3, 6, 12, and 24 months post-injury) [2].

After 24 months, in both studies the patients achieved similar results in the OSS [2,11]. The complication rate in this trial was quite low (3.4%) and all of them concerned surgical treated patients [2]. There was a considerable lower complication rate in this trial compared to the PROFHER trial, which is most likely attributable to the fact that mainly experienced upper limb surgeons performed the interventions compared to 66 different surgeons of 30 centers in the PROFHER trial [2,11]. Despite the overall good quality of these RCTs, some severe limitations remain. On the one hand, the PROFHER study considered only diabetes among comorbidities, while Launonen et al. included neurological diseases as well. On the other hand, no information about osteoporosis as well as other comorbidities was given, which would be expected to influence fracture healing and functional outcome. Further, long-term outcome data are missing, which is an often-encountered problem in clinical studies, not only in the orthopedic field. Nevertheless, both trials were designed as prospective RCTs, providing some high-quality evidence that surgical treatment is not superior to non-surgical. Therefore, the existing literature does not support the trend of increased surgical interventions in proximal humeral fractures.

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