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## ASPECTS ON CALCANEAL FRACTURES

av

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## ABSTRACT

This thesis deals with calcaneal fractures. The impetus for this work was to answer the question as to whether to operate or not on calcaneal fractures.

The thesis consists of 4 articles. Two of these are interpretations of the results from a clinical multicentre randomized controlled trial (RCT) that was performed in the Stockholm area between 1994-98. Eighty-two patients were randomized to either surgical or non-surgical treatment. The inclusion criteria were intra-articular calcaneal fractures with a minimum displacement of 2mm, as shown by CT-radiograms.

The first article is a presentation of the study in accordance with the Consolidated Standards of Reporting Trials (CONSORT) statement. The material is presented as the result from the effect of either surgical or non-surgical treatment.

The non-surgical treatment was elevation and early movement without weight bearing until healed. The surgical treatment was open reduction and internal fixation (ORIF) when a reduction in swelling and blisters made it possible. The surgery was performed with a lateral extensile approach, aiming for anatomical reconstruction and fixation with plates and screws. The postoperative regimen was similar to the non-surgical treatment. The treating doctor evaluated the cohort clinically several times during the first months.

The patients were followed-up by an unbiased surgeon at 1 year and 8-12 years after the fracture. The primary outcome instruments used were the SF-36 and the VAS-Calcaneal score. We also used the American Orthopaedic Foot and Ankle Society (AOFAS) hind foot score and Olerud Molander Ankle (OM) score.

At 1 year, 76 patients were available and at 8-12 years, 58 patients were available for follow-up. At both times demographic data was similar in both groups in all aspects.

In 57% of the patients the surgical result of reduction was <2mm step or gap and in 10% >5mm (failure). This was evaluated with CT postoperatively. Postoperative superficial infections occurred in 8 patients (19%) and deep infections in 2 patients (4%). (One fistula and one uncontrolled infection leading to BKA)

In the first study it was found that there was no statistical significance in the outcome regardless of whether operated or not. There was a tendency towards superiority of surgery after 8-12 years in both SF-36 and VAS-calcaneal scores. The risk for complications was higher with surgical treatment. The prevalence of post-traumatic radiographically diagnosed arthrosis was higher in the non-surgical group, but the need for subtalar arthrodesis was not increased.

In the second article we evaluated the intra- and interobserver reliability and reproducibility of three different classifications for calcaneal fractures. Three examiners (2 radiologists and 1 orthopaedic surgeon) evaluated the films of 51 calcaneal fracture patients, twice with an interval of 5 months. Interobserver reliability was measured with Fleiss' kappa and the intraobserver reproducibility with Cohen's Kappa.

Poor agreement was found both between observers and within observers for Sanders, Zwipp's and Letournel's classifications. The results of this study showed that the tested fracture classification systems (FCS) had some limitations regarding their interobserver reliability and intraobserver reproducibility. All of the obtained kappa values were less than 0.5 indicating less than 50% agreement, which limits the usefulness of the classifications. However, Sanders and Zwipp's classifications have correlated with guiding the treatment and predicting the prognosis. All these parameters should be borne in mind when using these FCSs in clinical practice. CT

scanning helped evaluate the extension of fracture lines into the calcaneo-cuboid joint better than plain X-ray.

In the third article the RCT material is analysed from a different viewpoint: Which treatment performs best? The same patients were divided according to their results in the VAS-calcaneal score at 8-12 years follow-up. This gave two groups with 28 patients in each. (2 patients were excluded as they had a result on the median value of the cut-off).

The results of scoring with SF-36, AOFAS and the OM score showed good correlation with the VAS-calcaneal score. The demographic data between the groups showed no difference. It was found that in the better group significantly more patients were involved in light labour and underwent operative treatment with better restoration of the anatomy (Bohler's angle and articular anatomy).

Even though the sample size is small the study suggests that operative treatment with restoration of Bohler's angle and articular surface in patients with light labour and no secondary gain provide superior results in Dislocated Intra Articular Calcaneal Fractures (DIACF). This emphasizes that the definitive decision-making of DIACF is multi-factorial and there is a spectrum of results and trends such as patient demographic features that should be considered in choosing the treatment option.

The fourth article is a retrospective study on a patient data that was developed from all hospitals in Stockholm. All patients that had been operated with an arthrodesis following a calcaneal fracture between 1970-90 were asked to participate and all 29 patients agreed. They were evaluated with Plain WB X-ray, and CT in two planes (as in the RCT). The same patient outcome protocol with VAS-calcaneal score, SF-36, AOFAS and OM-score were used. The radiographic elements were evaluated according to the residual deformity classification developed by Zwipp and Rammelt.

These patients had a poor clinical outcome and it was noted that they had major anatomic residual deformities. The poor outcome was compared to our earlier data in the RCT and compared to other studies. This pointed towards the remaining deformity as the likely cause of pain and that in the case of a reconstruction, care should be taken to correct all possible pain causes with the reconstruction.

Perspective:

From this study the impression is gained that the benefits with surgery for calcaneal fractures are outweighed by the risks of surgery. To end up with an amputation is not what patients have in mind. With the increasing risks of infection a less invasive approach or non-surgical management seems to be the solution for many calcaneal fractures. The lower the risk the more benefit of surgical handling. From the conclusions gained in these studies, surgery will not be for everyone. Careful selection of patients and evaluation of their individual needs is mandatory. To avoid surgery when comorbidities are present as well as risk factors is a skill that cannot be underestimated. After all the non-surgical functional treatment can be good in most patients.

It is my opinion that calcaneal fractures primarily and even for late reconstructions, would benefit from being handled by calcaneal specialists. There is enough information suggesting that these fractures and the complexity involved in their handling will benefit from a systematic evolution in care and technical know-how. These injuries should be referred to those surgeons who treat enough cases to maintain their skill and knowledge.