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Enheten för ortopedi och idrottsmedicin, Karolinska Institutet**

## **Ankle Fracture Surgery - Clinical and Epidemiological Aspects**

**AKADEMISK AVHANDLING**

som för avläggande av medicine doktorsexamen vid Karolinska Institutet  
offentligen försvaras i Thoraxaulan, Karolinska Universitetssjukhuset, Solna

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av

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# ABSTRACT

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Ankle fractures are one of the most common fractures treated in orthopaedic surgery today and the trend towards surgical treatment has increased over the past decades. The ankle is though a sensitive area for surgical intervention concerning the surrounding soft tissues and early soft tissue complications such as infection are dreaded. Later sequelae, such as gait deviation and post-traumatic arthritis, might also lead to significant morbidity for these patients. The aim of this thesis was firstly to describe the epidemiology of ankle fractures in a large population and trends over time. Secondly, the aim was to study complications following ankle fracture surgery and to assess possible risk factors for complications, both in a clinical setting as well as in a large population. Thirdly, the aim was to study the gait pattern following ankle fracture surgery with a three-dimensional gait analysis method focusing on the foot and ankle.

*Study I* is a population-based study of adult inpatients treated following ankle fractures in Sweden 1987-2004. The study included 91,410 patients, corresponding to a total annual incidence rate of 71 per 10<sup>5</sup> person-years. The annual increase of hospital admissions was 0.2% and was dominated by an increase in fracture incidence in the elderly women (0.9%). Mean age at admission was significantly higher in the female population.

*Study II* is a population-based study of complications in adult inpatients following open reduction and internal fixation of ankle fractures in Sweden 2005-2010. The study included 23,411 patients. Infection was the most common short term complication with an overall rate of 3.7%. The highest risk of infection was seen in patients with open fractures. Other risk factors were diabetes, increasing age, fracture type and transport accidents. The 90 day amputation and mortality rates were 0.04% and 0.5% respectively. The overall rate of diagnosis of post-traumatic osteoarthritis (OA) over the study period was 1.8%. Risk of post-traumatic OA was increased in the presence of previous short term complications such as technical failure and infection. Arthrodesis surgery followed the pattern of osteoarthritis, while intervention with prosthesis surgery was rare.

*Study III* and *Study IV* were clinical studies, where patients admitted to hospital after sustaining an ankle fracture requiring surgery were asked to participate in a follow-up study. The patients were assessed regarding risk factors for early post-operative complications, as well as possible gait deviations one year following surgery. 108 patients were included for early post-operative follow up where complications were defined as positive culture from surgical wound site and/or prescription of antibiotics because of suspected surgical site infection. The rate of positive cultures obtained was 10% and 19% of patients were treated with antibiotics. Age ( $\geq 60$  years) was found as a risk factor for both positive culture and for receiving antibiotics. Care related factors such as timing of surgery did not affect the outcome measures significantly. 18 of the above included patients accepted further follow up assessing gait pattern following surgery. The patients were examined after a mean time of 13 months post-operatively. Three-dimensional gait analysis with The Oxford foot model was performed to assess kinematic changes in the injured ankle joint or joints in the foot. Both the injured ankle joint and the forefoot were found to have a decreased range of motion as compared to the non-injured side and controls. The Oxford foot model was an objective way of assessing ankle fractures post-operatively.