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Chapter 1

Introduction

Aim of thesis

A degenerative rotator cuff tear is a highly prevalent disorder, occurring in 50% of people over 60 years of age. In two thirds of cases the tear is small and asymptomatic. However, half of these tears become larger over time and develop symptoms.[1-3] Smaller tears are associated with a younger patient population (45 to 65 years of age) requiring proper arm function in their daily job for economic reasons, and larger tears are associated with an elderly population (older than 65 years of age) experiencing an impairment in their activities of daily living due to pain and loss of function.

Reported results of conservative and surgical treatments vary to a great extent.[4] Rotator cuff repair is associated with a relatively high retear rate of 15% to 25% in small- to medium-sized tears and up to 90% in massive tears with clinical outcome ranging from good to poor. Furthermore, postoperative rehabilitation may vary from 4 to 12 months with a risk of postoperative stiffness. Whereas rotator cuff tears were mainly treated conservatively in the past, there has been a dramatic increase in operative repair over the past two decades.[5] There have been several changes in the evaluation and treatment of cuff tears: new insights in the development of tears have been developed by determining risk factors, like nicotine abuse, hypercholesterolaemia, contralateral cuff tear and genetic predisposition.[6-9] Also, improvements in preoperative evaluation of the rotator cuff using ultrasound and magnetic resonance imaging with arthrography have led to higher accuracy in the diagnosis of rotator cuff tears.[10] Thirdly, there have been considerable advances in surgical instrumentation and operative technique.[11]

Shoulder symptoms are not necessarily the result of an observed rotator cuff tear. This implies there may be several etiological mechanisms leading to shoulder pain, related to a diagnosed rotator cuff tear in some but not all patients. So, a patient presenting with shoulder pain combined with a degenerative rotator cuff tear poses a challenging problem to the clinician treating this patient. It is difficult to decide whether or not the tear is the origin of the pain and whether or not the tear will need surgical treatment. Nowadays both patients and doctors have a tendency to opt for a surgical treatment regime.[12] This is despite the usually self-limiting behaviour of pain and functional impairment, the extensive and painful rehabilitation period after

repair surgery and the inconsistent outcome with relatively high retear rates. Given the above, there is a need for a better decision-making process to optimize treatment in patients with an observed cuff tear. The goal of this thesis is to create better understanding in the evaluation, clinical outcome and surgical treatment of degenerative rotator cuff tears. To this end, the thesis will focus on both the preoperative evaluation and the clinical outcome. More specifically, the preoperative use of MR imaging and biomechanical evaluation to improve decision-making will be discussed, and clinical results related to surgical techniques will be discussed. Moreover, one chapter will specifically focus on the development of tears in one of the larger subpopulations of rotator cuff tear patients, namely patients with rheumatoid arthritis.

Thesis outline

Most rotator cuff tear classification systems do not provide an indication for treatment and prognosis.[13] A useful classification system should provide information which guides in the decision-making for a specific treatment regime and on the prognosis of the condition. Furthermore, it should be accurate and reproducible in order to have good reliability. The Geometric Classification, as proposed by Davidson[14], does give an indication for treatment and prognosis and could be useful to optimise the treatment of patients with rotator cuff tears. In **Chapter 3** we set out to assess the intraobserver and interobserver agreement (reliability) among experienced observers on the Geometric Classification of rotator cuff tears using magnetic resonance arthrography, and thereby evaluate whether the classification is useful as a practical tool in daily practise.

To provide adequate treatment it is necessary to discriminate patients with symptomatic rotator cuff tears from the asymptomatic ones. For this purpose a practical and efficient measuring instrument is desirable. Symptomatic rotator cuff tears can be associated with upward migration of the humeral head.[15] Adductor co-activation during active arm abduction has been reported to reduce subacromial narrowing and pain in rotator cuff tear patients.[16] The purpose of **Chapter 4** is to describe the design of an easy-to-use method to evaluate adductor co-activation in

order to prevent pain as a result of humeral head cranialization and to identify symptomatic cuff tear patients.

In patients with rheumatoid arthritis (RA), structural changes by proliferative synovitis (pannus), leading to articular destruction, tendinitis, rotator cuff tears, fatty muscle infiltration, and muscle atrophy, result in upward migration of the humeral head and painful subacromial impingement due to muscle imbalance and the inability of the compensatory co-contraction of the adductor muscles.[17-19] The importance of the shoulder in upper limb function mandates early detection and treatment of rotator cuff disease before irreversible functional loss sets in. The aim of **Chapter 5** is to evaluate the use of simple AP-radiographs and ultrasound for the assessment of rheumatoid shoulders looking at the association between the progression of rotator cuff tears, upward migration of the humeral head and severity of the disease activity caused by RA.

Over the past decade there has been a shift from (mini-)open to all-arthroscopic repair technique in rotator cuff surgery. However, the most effective method of repair is controversial given that both techniques have good clinical outcome. Several studies have been published comparing the results of the mini-open to the all-arthroscopic repair procedure.[20-22] Unfortunately these studies were conducted in a retrospective and non-randomised setting with relatively small numbers. In **Chapter 6** a prospective randomised controlled trial is described between two commonly used techniques, all-arthroscopic versus mini-open, for rotator cuff repair surgery. Consequently a recommendation on the operative technique to be used for these tears is formulated.

In the past subscapularis tendon tears were often overlooked. However, with the advancement in MR imaging and arthroscopic experience these tears are currently being recognized as an important clinical entity.[23-25] **Chapter 7** evaluates the clinical effectiveness of all-arthroscopic repair of degenerative subscapularis tendon tears. It is hypothesised that repair of these tears provides good outcome and that recognition of this tear pattern is an important aspect in the treatment of rotator cuff disease.

There is an increasing number of patients seeking medical attention for a massive, contracted rotator cuff tears with patients wanting to be more active at higher age.

However, the clinical outcome of primary repair of these tears is inconsistent and associated with a high retear rate.[26-28] When performed successfully, repair of massive cuff tears can be associated with good long-term results and may prevent joint degeneration.[26-31] When a surgical treatment is chosen, there is a need for a reliable surgical procedure with predictable outcome. In chapters 8 and 9 surgical treatment modalities for massive cuff tears are discussed. The purpose of **Chapter 8** is the introduction and evaluation of a novel arthroscopic side-to-side repair technique for the treatment of massive, contracted supraspinatus and infraspinatus tendon tears: the Shoestring Bridge Technique. In patients where the tear is deemed irreparable a Reversed Shoulder Arthroplasty has gained popularity over the last years. However, a tendon transfer can be a valuable alternative. It is a biomechanically logical solution in these degenerative conditions that uses healthy autologous tendon tissue to restore mobility and decrease pain.[32,33] **Chapter 9** describes the largest series available in the literature of Teres Major tendon transfers for irreparable posterosuperior rotator cuff tears. The aim is to evaluate the clinical outcome and create awareness among shoulder surgeons for this promising technique.
In Chapter 10 the main conclusions of this manuscript are discussed.

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