SURGICAL TREATMENT OF RETROCALCANEAL BURSITIS

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ABSTRACT

Purpose: The purpose of this systematic review is to analyze the results of surgical treatments for chronic retrocalcaneal bursitis (RB).

Methods: MEDLINE, CINAHL, Embase and the Cochrane Library (1945-December 2010) were systematically searched with the following terms: calcaneal AND (prominence OR exostosis) OR ((retrocalcaneal OR calcan*) AND (burs* OR exosto* OR prominence)) OR Haglund[tw] OR Haglund's[tw] OR ((retrocalcaneal OR calcan*) AND (ostectom* OR osteotom* OR resect*)). Therapeutic studies on ten or more subjects with RB were eligible. Quality was assessed using the GRADE scale and Downs and Black scale.

Results: Of 876 reviewed abstracts, 15 trials met our inclusion criteria evaluating 547 procedures in 461 patients. Twelve trials reported an open surgical technique; three studies evaluated endoscopic techniques. Differences in patient satisfaction favoured the endoscopic technique. The complication rate differed substantially, favouring endoscopic surgery over open surgery.

Conclusions: There are many different surgical techniques to treat RB. Regardless of technique, resecting sufficient bone is essential for a good outcome. Even though the level of evidence of included study is relatively low it can be concluded that endoscopic surgery is superior to open intervention for RB. More evidence is a necessity to be more conclusive regarding the best surgical treatment.
INTRODUCTION

Chronic Retrocalcaneal bursitis (RB) is an inflammation of the bursa located between the Achilles tendon and the posterior border of the calcaneus. This entity was first described by Painter in 1898. The first successful surgical treatment was performed by Haglund and described in 1928. Although it is often seen together with an insertional Achilles tendinopathy or a superficial bursitis, these are not the same. Aetiology, injury mechanism, treatment and rehabilitation differ between these insertional Achilles problems. Chronic RB was previously known as Haglund deformity, pump bump’s, winter heel or else. Recently it was proposed not to use these confusing terms and use chronic retrocalcaneal bursitis instead. Chronic RB is therefore the term used in this systematic review. Multiple surgical treatments have been described for the treatment of chronic RB. This has led to a large pool of different techniques. Hitherto the treatment, conservative or surgical, of chronic RB has not been systematically evaluated. This systematic review evaluates all surgical treatments for chronic RB. The aim is to provide a clear overview of the best available surgical treatment modality for chronic RB. The primary goal is to evaluate the efficiency of the provided treatment based on patient satisfaction and complication rate. Other outcome that may influence the advice of treatment will be evaluated as well. We hypothesized that endoscopic treatment would lead to higher patient satisfaction and a lower complication rate compared with open surgical techniques.

METHODS

A systematic review of the literature was performed. The databases of MEDLINE, EMBASE (Classic) and CINAHL (1947 to January 2011) were searched using the following terms: calcaneal AND (prominence OR exostosis) OR ((retrocalcaneal OR calcane*) AND (bursa* OR exostosis OR prominence)) OR Haglund[tw] OR Haglund's[tw] OR ((retrocalcaneal OR calcane*) AND (ostotom* OR resect*)). In addition the Cochrane Database of Clinical and Randomized Controlled Trials were searched using the search term “Bursitis” AND “Calcaneal” or “Haglund”. Finally, a Google Scholar search was performed using the following search terms: “Bursitis” AND “Calcaneal” or “Haglund”. Inclusion criteria included therapeutic studies reporting data on the outcome of RB. Studies reporting on Haglund's exostoses/disease/syndrome etcetera were only eligible if these entities were synonymous to chronic RB. No age restriction was established for the study population as chronic RB may also affect children. The study data must include data of a pain scale, AOFAS score or patient satisfaction. Only studies with a minimum of ten treated patients were included. There were no language barriers. Excluded were therapeutic studies of Achilles insertional tendinopathy, superficial calcaneal bursitis or non-specified Achilles tendon problems.
Studies combining the results of chronic RB with other pathologies were also excluded. Primary outcome measures were patient satisfaction and complication rate (divided in major and minor); secondary outcome measures consisted of change in numeric pain score (e.g. VAS) change in AOFAS score and other (subjective) outcome questionnaires.

All studies were independently assessed by two reviewers. These reviewers identified all titles and abstracts independently and excluded irrelevant articles. Any remaining difference between reviewers was settled by discussion. Authors of the included studies were contacted by e-mail or phone to retrieve any necessary additional data. The two reviewers independently extracted data for the aforementioned outcomes using a data extraction form. Differences were settled by discussion between all authors. To simplify data extraction and analysis, complications were divided in ‘major’ and ‘minor’ (Table 1). The quality of included studies was assessed by means of the validated quality assessment scale of Downs and Black. It is a frequently used scale to assess the methodological quality of randomized and non-randomised articles included in systematic reviews. Its use is advised by the American Agency of Healthcare Research and Quality and the British National Health Service. In addition, all included studies were measured on methodological quality and risk of bias according the GRADE quality assessment scale. The two review authors assessed the quality independently. Differences were settled by discussion between all authors.

### RESULTS

After the results were combined and duplicates were removed, the search retrieved 876 articles. On the basis of title, abstract and study design 797 articles were excluded (Fig. 1). We selected 79 articles for full text evaluation, of 16 articles however the full text could not be retrieved. A review of references of full-text articles resulted in eight new articles. Thus a total of 71 full-text articles were reviewed. We excluded 48 articles based on the full text (no outcome data or unrelated to chronic RB). Of the 23 remaining articles, five were excluded based on aberrant or un-interpretable definitions of Haglund syndrome.

<table>
<thead>
<tr>
<th>Major complications</th>
<th>Minor complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT rupture</td>
<td>Discomfort</td>
</tr>
<tr>
<td>Any reoperation</td>
<td>Superficial infections</td>
</tr>
<tr>
<td>DVT</td>
<td>Minor wound problems</td>
</tr>
<tr>
<td>Deep infections</td>
<td>Scar tenderness/hypertrophy</td>
</tr>
<tr>
<td>Neuralgia</td>
<td>Mild form of paresthesia</td>
</tr>
<tr>
<td>Reflex dystrophy</td>
<td>Prolonged hospitalization</td>
</tr>
</tbody>
</table>
Surgical treatment of retrocalcaneal bursitis

...three articles were excluded because more recent publications analyzed the same data with longer follow-up. The 15 remaining studies were included in this systematic review (Table 2, 3).

Population characteristics
The number of patients with chronic RB in the 15 included studies was 461 (47% male and 53% female, three studies did not specify gender); these patients underwent 547 procedures. Overall, the weighted mean age was 38 years [range 6-82 years]. The subgroup open surgical treatment, compromising 397 procedures in 316 patients (38% male and 62% female) had a weighted mean age of 34 years [range 6-82 years]. In the endoscopic subgroup (145 patients, 150 procedures) the male:female ratio was 63:37 with a weighted mean age of 47 years [range 16-77 years]. Multiple different questionnaires were used (Table 2).
Table 2: Overview and characteristics of included studies.

<table>
<thead>
<tr>
<th>Author, Journal Year</th>
<th>Evidence</th>
<th>N patients (N feet)</th>
<th>Mean age (range) N of ♂</th>
<th>Method of Diagnosis</th>
<th>Duration of symptoms in mon. (range)</th>
<th>Inclusion criteria</th>
<th>Exclusion Criteria</th>
<th>Follow-up in mon. (range)</th>
<th>Intervention</th>
<th>Primary outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson18 CORR 2008</td>
<td>III</td>
<td>62 (66)</td>
<td>32 (19-82) 40♀</td>
<td>X-lat, MRI*</td>
<td>&gt;2 (NR)</td>
<td>Symptomatic Haglund's deformity (defined as chronic RB), failed conservative treatments. Minimal 12 months follow-up</td>
<td>Other surgical approach, concommitant surgery</td>
<td>16 (12-23)</td>
<td>Open Central approach</td>
<td>AOFAS</td>
</tr>
<tr>
<td>Ångermann19 F &amp; Ankle In 1990</td>
<td>IV</td>
<td>35(43)</td>
<td>23 (6-64) 23♀</td>
<td>X-lat</td>
<td>&gt;3 (NR)</td>
<td>Chronic RB, failed conservative treatment</td>
<td></td>
<td>72 (12-144)</td>
<td>Open</td>
<td>Satisfaction</td>
</tr>
<tr>
<td>Chen21 2001</td>
<td>IV</td>
<td>21 (30)</td>
<td>57 (39-76) 24♀</td>
<td>X-lat</td>
<td>NR</td>
<td>Tender Haglund's deformity (defined as chronic RB), failed conservative treatments. Positive parallel pitch lines</td>
<td></td>
<td>72 (36-120)</td>
<td>Open</td>
<td>Satisfaction</td>
</tr>
<tr>
<td>DeVries22 J. F&amp;ASurg 2009</td>
<td>IV</td>
<td>17 (22)</td>
<td>51.6 (24-73) 12♀</td>
<td>MRI</td>
<td>20 (NR)</td>
<td>Painful Haglund's deformity (defined as chronic RB) and partial AT tear</td>
<td>Surgery without complete AT detachment, previous surgery at same heel Age &lt;18</td>
<td>40.1 (6-105)</td>
<td>Open</td>
<td>VAS</td>
</tr>
<tr>
<td>Nesse25 ACTA Ort Scan 1994</td>
<td>IV</td>
<td>23 (35)</td>
<td>21 (16-43) 16♀</td>
<td>Clinical findings</td>
<td>NR</td>
<td>Symptomatic Haglund's heel (defined as pain &amp; thickening lateral to AT)</td>
<td></td>
<td>36 (12-72)</td>
<td>Open</td>
<td>VAS</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Year</td>
<td>Study Duration</td>
<td>Age (Range)</td>
<td>Gender</td>
<td>Imaging</td>
<td>Diagnosis</td>
<td>Treatment Details</td>
<td>Satisfaction</td>
<td>Procedure/Technique</td>
<td>AOFAS</td>
</tr>
<tr>
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<td>---------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Ortmann²</td>
<td>2007</td>
<td>28 (20)</td>
<td>52 (22-75)</td>
<td>16♀</td>
<td>X-lat, MRI</td>
<td>NR</td>
<td>Chronic RB, Haglund deformity on X-Lat. Failed conservative treatments, no previous surgery</td>
<td>35 (3-62)</td>
<td>Endoscopic technique</td>
<td></td>
</tr>
<tr>
<td>Schepsis²²</td>
<td>1994</td>
<td>21 (14)</td>
<td>46.9 (38-59)</td>
<td>9♀</td>
<td>NR</td>
<td>20.2 (14-45)</td>
<td>Chronic RB, failed conservative treatment</td>
<td>78 (12-156)</td>
<td>Open</td>
<td></td>
</tr>
<tr>
<td>Watson⁷</td>
<td>1994</td>
<td>13 (14)</td>
<td>34.4 (16-62)</td>
<td>9♀</td>
<td>X-lat</td>
<td>22 (3-62)</td>
<td>Chronic RB, no insertional Achilles calcification</td>
<td>52 (2.6-94)</td>
<td>Open</td>
<td>AOFAS</td>
</tr>
<tr>
<td>Pauker²⁶</td>
<td>1992</td>
<td>22 (28)</td>
<td>39 (16-67)</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>Chronic RB, failed conservative treatment</td>
<td>156 (36-240)</td>
<td>Open</td>
<td></td>
</tr>
<tr>
<td>Byani²⁰</td>
<td>1993</td>
<td>22 (37)</td>
<td>NR</td>
<td>NR</td>
<td>X-lat, par pitch line</td>
<td>&gt;6 (NR)</td>
<td>Symptomatic heel pain, limitation of activity, inflammation over prominence</td>
<td>36 (9-84)</td>
<td>Open</td>
<td></td>
</tr>
<tr>
<td>Lehto²⁷</td>
<td>1994</td>
<td>25 (28)</td>
<td>32.3 (17-56)</td>
<td>9♀</td>
<td>X-lat, US</td>
<td>&gt;6 (NR)</td>
<td>Chronic RB, failed conservative, inability to continue sports swelling of retrocalcaneal bursa on ultrasonography</td>
<td>80.4 (24-132)</td>
<td>Open</td>
<td></td>
</tr>
<tr>
<td>Scholten²⁹</td>
<td>2006</td>
<td>36 (39)*</td>
<td>35 (16-50)</td>
<td>16♀</td>
<td>X-lat</td>
<td>&gt;6 (NR)</td>
<td>Chronic RB, Painful soft-tissue swelling failed conservative</td>
<td>54 (24-90)</td>
<td>Endoscopic technique</td>
<td>Ogilvie Harris</td>
</tr>
<tr>
<td>Taylor³⁰</td>
<td>1986</td>
<td>42 (69)</td>
<td>20 (10-56)</td>
<td>9♀</td>
<td>X-lat</td>
<td>NR</td>
<td>Haglund's disease (defined as chronic RB)</td>
<td>81 (4-240)</td>
<td>Open (Keck &amp; Kelly)</td>
<td></td>
</tr>
<tr>
<td>Sella²⁹</td>
<td>1998</td>
<td>13 (16)</td>
<td>52 (15-76)</td>
<td>9♀</td>
<td>X-lat parallel pitch lines new versie</td>
<td>21 (NR)</td>
<td>Failed conservative treatment, symptomatic Haglund's syndrome (defined as RB)</td>
<td>42 (36-48)</td>
<td>Open</td>
<td>AOFAS</td>
</tr>
</tbody>
</table>

AT= Achilles tendon  * = Authors were contacted to provide these data  
NR=Not reported  
X-lat= lateral conventional radiographic imaging of ankle
Table 3. Overview of surgical technique, complication rate, clinical results, patient satisfaction and quality assessment per study (categorized for open and endoscopic technique). The totals and weighed means are provided for the open surgical subgroup and the endoscopic subgroup.

<table>
<thead>
<tr>
<th>Open surgical techniques</th>
<th>Number of evaluated Procedures</th>
<th>Procedure</th>
<th>Interventions</th>
<th>Complications</th>
<th>Decrease in pain score / Change in subjective questionnaire (range)</th>
<th>Satisfaction / Other Outcome data</th>
<th>Downs Quality Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Procedure &amp; AT involvement</td>
<td>Major</td>
<td>Minor</td>
<td>AOFAS pre-operative: 54 (10-72)</td>
<td>AOFAS post-operative: 86 (10-100)</td>
</tr>
<tr>
<td>Anderson 18</td>
<td>35</td>
<td>Open</td>
<td>Prone Lateral</td>
<td>Anchor reattachment if &gt;50% of AT was detached. Resection of posterior superior process and retrocalcaneal bursa</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>31</td>
<td>Open</td>
<td>Prone Central (Tendon-Split)</td>
<td>Anchor reattachment if &gt;50% of AT was detached. Resection of posterior superior process and retrocalcaneal bursa</td>
<td>1</td>
<td>3</td>
<td>AOFAS pre-operative: 48 (10-67)</td>
</tr>
<tr>
<td>Angermann 19</td>
<td>40</td>
<td>Open</td>
<td>NR Lateral</td>
<td>Resection of posterior superior process by means of osteotome</td>
<td>0</td>
<td>4</td>
<td>patient satisfaction</td>
</tr>
<tr>
<td>Chen 21</td>
<td>30</td>
<td>Open</td>
<td>Supine Medial</td>
<td>Preop antibiotics. Resection of posterior superior process</td>
<td>NR</td>
<td>NR</td>
<td>patient satisfaction</td>
</tr>
<tr>
<td>DeVries 22</td>
<td>22</td>
<td>Open</td>
<td>Prone Medial J</td>
<td>Complete AT detachment. Resection of posterior superior process and retrocalcaneal bursa</td>
<td>1</td>
<td>3</td>
<td>VAS pre-operative: 7.9 (2-10)</td>
</tr>
<tr>
<td>Biyani 12</td>
<td>37</td>
<td>Open</td>
<td>Prone lateral</td>
<td>Resection of posterior superior process with power saw</td>
<td>3</td>
<td>11</td>
<td>patient satisfaction</td>
</tr>
<tr>
<td>Lehto 14</td>
<td>28</td>
<td>Open</td>
<td>NR bilateral</td>
<td>No AT involvement. Resection of posterior superior process and retrocalcaneal bursa</td>
<td>4</td>
<td>0</td>
<td>patient satisfaction</td>
</tr>
<tr>
<td>Open surgical techniques</td>
<td>Number of evaluated Procedures</td>
<td>Procedure</td>
<td>Position</td>
<td>Approach</td>
<td>Major</td>
<td>Minor</td>
<td>Complications</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------------------------</td>
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<td>----------</td>
<td>----------</td>
<td>-------</td>
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<td>---------------</td>
</tr>
<tr>
<td>Nesse&lt;sup&gt;16&lt;/sup&gt;</td>
<td>35</td>
<td>Open</td>
<td>NR</td>
<td>34 medial 1 lateral</td>
<td>NR</td>
<td>NR</td>
<td>VAS pre-operative: 55 (15-90) VAS post-operative: 15 (0-88)</td>
</tr>
<tr>
<td>Pauker&lt;sup&gt;26&lt;/sup&gt;</td>
<td>19</td>
<td>Open</td>
<td>NR</td>
<td>18 lateral 10 medial</td>
<td>NR</td>
<td>NR</td>
<td>patient satisfaction</td>
</tr>
<tr>
<td>Schepsis&lt;sup&gt;77&lt;/sup&gt;</td>
<td>21</td>
<td>Open</td>
<td>Prone</td>
<td>Medial J</td>
<td>No AT involvement. Retrocalcaneal bursa was not removed</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Taylor&lt;sup&gt;15&lt;/sup&gt;</td>
<td>61</td>
<td>Open</td>
<td>Prone</td>
<td>Lateral</td>
<td>Keck &amp; Kelly osteotomy</td>
<td>1</td>
<td>109</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Open</td>
<td>Prone</td>
<td>Lateral</td>
<td>Zadek osteotomy</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Sella&lt;sup&gt;99&lt;/sup&gt;</td>
<td>16</td>
<td>Open</td>
<td>Supine</td>
<td>Lateral</td>
<td>Resection of posterior superior process and retrocalcaneal bursa</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Watson&lt;sup&gt;71&lt;/sup&gt;</td>
<td>14</td>
<td>Open</td>
<td>Prone</td>
<td>Posterolateral</td>
<td>AT detached and reattached with non-absorbable sutures. Resection of posterior superior process and retrocalcaneal bursa</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 3. Continued

<table>
<thead>
<tr>
<th>Open surgical techniques</th>
<th>Number of evaluated Procedures</th>
<th>Procedure</th>
<th>Intervention</th>
<th>Complications</th>
<th>Decrease in pain score / Change in subjective questionnaire (range)</th>
<th>Satisfaction / Other Outcome data</th>
<th>Downs Quality Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Position</td>
<td>Approach</td>
<td>Procedure &amp; AT involvement</td>
<td>Major</td>
<td>Minor</td>
</tr>
<tr>
<td>Totals</td>
<td>397</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17 (4.3%)</td>
<td>160 (40%)</td>
</tr>
<tr>
<td>Open techniques</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endoscopic techniques</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jenosch(^2)</td>
<td>81</td>
<td>Endoscopic</td>
<td>Supine</td>
<td>Two portal ECP</td>
<td>Two portal ECP (van Dijk technique)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Ortmann(^4)</td>
<td>30</td>
<td>Endoscopic</td>
<td>Supine</td>
<td>Two portal ECP</td>
<td>Two portal ECP (van Dijk technique)</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Scholten(^2)</td>
<td>39*</td>
<td>Endoscopic</td>
<td>Prone</td>
<td>Two portal ECP</td>
<td>Two portal ECP (van Dijk technique)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 (0.7%)</td>
<td>2 (1.3%)</td>
</tr>
</tbody>
</table>

NR = Not reported
* = Authors were contacted to provide these data
* = data acquired through author
AT = Achilles tendon
ECP = Endoscopic Calcaneoplasty
Quality assessment of included studies

All 15 included studies were retrospective in design, one was a retrospective comparative. The weighted mean score on the Downs and Black quality assessment scale was 13.3 [range 9-18 points] out of a possible 32 points for all studies. Subdivided, the open procedures scored 12.9 points [range 9-18 points]; the endoscopic group scored 14.7 point [range 14-16 points]. In addition, the quality of included studies was assessed and rated by means of the GRADE classification (Table 2). Each included study, open or endoscopic, was graded either “low” or “very low” (Table 3). Given the large heterogeneity in outcome measures used and the heterogeneity between trials, as well as the mediocre methodological quality, there is an extensive risk of significant bias. We therefore refrained from pooling data; data are presented as weighted means and summed percentages; no additional analyses were performed due to the significant risk of bias (Table 3).

Open Surgical treatment

Fourteen open surgical techniques were evaluated in twelve studies. Five studies reported on a lateral approach, three used a medial approach, whereas four studies combined or changed their approach case specific. One study compared a lateral approach with a central approach and one study did not clearly specify the approach used (Table 3). In every technique the posterosuperior calcaneal process was resected; all but one also excised the retrocalcaneal bursa. One study performed a calcaneal wedge osteotomy (Zadek or Keck & Kelly), the bursa and posterosuperior calcaneal process were removed dependant on the performed technique. Because of these differences summed data must be interpreted with caution. It is not possible to compare different surgical techniques with each other because the power of the studies is insufficient. However, substantial differences were found regarding complication ratio, patient satisfaction and questionnaires. Three studies reported a relative low patient satisfaction, as a large group of patients (30-42%) reported a poor or unchanged outcome after surgery. Six studies reported opposite results with a good or excellent satisfaction in 81-95% of the patients. The disappointing results led authors to be reluctant to advice open surgery for patients with chronic RB. Likewise, the number of complications differed greatly. One study, describing the results of 66 procedures, reported 109 minor complications (165%). The mean complication ratio of all studies describing open surgical treatment was 45% (Table 3). Of the 177 documented complications 17 (10%) were major and 160 (90%) minor. The large difference herein may be the result of detailed documentation, the number however is of such a proportion it remains interesting what the cause of this difference could be. In spite of the varying results in patient satisfaction and complication rate, all subjective questionnaires showed a substantial increase post-operatively (Table 3). Most authors state it is important for the outcome of surgery that enough bone is resected in order to minimize the impingement possibility and reoccurrence of complaints. Despite the knowledge
and focus thereof the number of reoperations is relative high; of all major complications (18) eight were reoperations. A possible explanation for persisting symptoms after open surgery is inferior visualization compared to arthroscopic intervention. In case of a medial approach the lateral side is difficult to visualize, a sharp lateral calcaneal rim may be missed and cause post-surgical problems. Likewise with a lateral approach: the medial side is difficult to visualize, hence the medial calcaneal rim is susceptible for post-surgical problems. Multiple studies point to the long lasting complaints or prolongation of symptoms after surgery, a one or two year prolongation has been reported repeatedly; however almost all patients became satisfied after a longer follow-up moment\textsuperscript{34,38}. Post-operative treatment differed largely if recorded at all\textsuperscript{10,34}. Immediate weight bearing was advocated by two studies\textsuperscript{32,37}. The shortest period of non weight bearing was 2-3 weeks, if no extensive tendon release was performed\textsuperscript{33,40}. The longest period of non-weight bearing was 6 to 8 weeks\textsuperscript{31,42}. A few studies reported on sports resumption or full activity\textsuperscript{33}. A broad range was found with a minimum of 5.4 months, up to a maximum of two years\textsuperscript{34}. Certain post-operative treatment protocols and/or sports resumption advice may have led to a large gap between the time of surgery and return to sports or normal daily activity. This probably affected the patient satisfaction and outcome of surgery.

**Calcaneal Osteotomy**

Only one study on the use of calcaneal osteotomies for chronic RB was included in this review\textsuperscript{10}. This is in contrast to the many non-clinical publications this subject, and the consensus that calcaneal osteotomy is a much used and evaluated treatment for chronic RB\textsuperscript{46-50}. Multiple studies on calcaneal osteotomies were found with the search. All but one however were literature reviews or expert opinion without reporting clinical results of the procedure. These reviews discussed the use of correction osteotomies of the calcaneus to address chronic RB and all reported good outcomes\textsuperscript{46,47,49}. It is remarkable that only one clinical study on calcaneal osteotomy could be included in this systematic review. Hence, and despite these previous reviews, the patient based clinical evidence for correction osteotomies of the calcaneus in chronic RB seems to be very limited.

**Endoscopic treatment**

Three studies described endoscopic surgical techniques to treat chronic RB\textsuperscript{9,36,41}. They evaluated 147 patients, who underwent 150 procedures. One study outlined the results with patients operated in a supine position, one with patients in prone position and one used either position (Table 3). The posterosuperior calcaneal process and retrocalcaneal bursa was resected in all cases. A proper comparison of supine position versus prone position is not possible as the total number of studies differentiating herein is insufficient. However the results of the included studies reveal no substantial difference in patient satisfaction or complication ratio (Table 3). To evaluate patient satisfaction, two studies used the Ogilvie
Harris score\textsuperscript{36,41}. These studies reported on 117 patients, 65 (56%) patients had an excellent satisfaction, 40 (34%) good, 7 (6%) unchanged and 5 (4%) poor. Ortmann did not use the Ogilvie Harris score but reported comparable high patient satisfaction in 30 procedures of which 29 (97%) had either an excellent or good outcome, 1 (3%) unchanged or poor\textsuperscript{9}. The complication ratio was low, only one (0.7%) major complication occurred in the entire endoscopic group (150 procedures). Additionally two (1.3%) minor complications were reported. All studies stated that every patient was content with the small scar. There were minor differences in post-operative treatment. Immediate weight bearing was allowed by one study\textsuperscript{41}. Partial weight bearing was advised for two weeks by the other studies, hereafter gradual full weight bearing was allowed\textsuperscript{8,36}. The duration to sports resumption varied between 6 and 12 weeks.

**Open versus endoscopic treatment**

The AOFAS was used by one study in the endoscopic group; hence it cannot be used to compare the two interventions\textsuperscript{8}. Overall patient satisfaction differed between both techniques. 91\% of the endoscopic group had either an excellent or good satisfaction, 5.2\% felt unchanged and 4.5\% reported a poor satisfaction. In the open group the 77\% reported an excellent or good satisfaction, 13\% unchanged and 10\% poor. This distinction is likely to be caused by the less extensive postoperative care in combination with short rehabilitation period and quick resumption of daily activities after an endoscopic procedure\textsuperscript{8,9,11}. In addition the superior cosmetic results have a beneficial effect on patient satisfaction\textsuperscript{8}. Finally and probably the most important factor is the difference in complication ratio. An increased complication rate was found consistently in the studies evaluating open surgery compared to the endoscopic studies. Only one major complication occurred in 150 procedures in the endoscopic group (0.7\%); in the open surgical group however, 17 (4.3\%) major complications were reported (Table 3). The difference between the two interventions was even larger regarding minor complications; two (1.3\%) were documented in the endoscopic group compared to 161 (44\%) minor complications in the open group. This data however is significantly influenced by the complication rate of one study (in the open group), as Taylor et al documented 118 minor complications in 69 procedures\textsuperscript{10}. Excluding this study would still result in a substantially larger complication ratio compared to endoscopic procedures with 4\% major and 13\% minor complications. Many authors focus on the resection of a sufficient amount of bone\textsuperscript{8,11,25,29,31,36,39,41}. Eight reoperations were necessary in the open group due to an insufficient resection of bone. No reoperations were documented in the endoscopic group, all authors specifically noted that resection of a sufficient amount of bone is essential for a good outcome. Therefore all stated the surgeon must evaluate for impingement per-operatively and check for this under direct vision.
DISCUSSION

To our knowledge, this is the first systematic review evaluating the surgical treatment for chronic RB. Previous studies have focused on insertional problems of the Achilles tendon, one evaluated study did include patients with chronic RB the remaining articles however did not. This study evaluated 15 studies on the surgical treatment of chronic RB. 547 procedures in 461 patients were evaluated; 12 trials reported on an open surgical technique, whereas three studies evaluated endoscopic techniques. Based on patient satisfaction the endoscopic technique is favoured over open procedures; 91% had an excellent or good satisfaction after an endoscopic procedure whereas 73% had an excellent or good satisfaction after an open procedure. The complication rate differed substantially, favouring endoscopic surgery over open surgery; one major complication occurred in 150 procedures in the endoscopic group (0.7%) whereas 17 (4.3%) major complications were reported in the open surgical group (table 3). The difference between the two techniques was even larger regarding minor complications; two (1.3%) were documented in the endoscopic group and 161 (44%) were found in the open group. Finally most authors state that adequate bony resection is essential for successful surgical intervention, regardless of chosen surgical technique. A previous prospective comparative study evaluated two different treatment regimes for retrocalcaneal bursitis. In this well performed study an open approach was compared with an endoscopic approach. This study was excluded as it did not meet the inclusion criteria of this review; not only patients with chronic RB but also patients with insertional Achilles tendinopathy were included. Despite the exclusion, the results of the study by Leitze et al. are interesting to compare to the results of this review. Leitze concluded that both techniques provided a significant improvement. A minor (nonsignificant) difference was found in post-operative AOFAS score favouring endoscopic surgery. It was concluded that an experienced surgeon may prefer the endoscopic procedure, as operating time is shorter and visualization is superior. The complication rate between the techniques differed largely; in favour of the endoscopic technique. Finally, less extensive postoperative care in combination with a cosmetically superior result was reported after endoscopic surgery. These results are comparable to the findings of this systematic review. The quality of included studies, assessed by means of the Down and Black scale and GRADE classification, revealed a poor level of methodological quality in most studies (Table 3). As no randomized controlled trials were included, caution should be taken with the interpretation of the findings of this study. It has been stressed repeatedly that quality assessment is important, regardless of the evidence of included studies. In addition it has been pointed out that in spite of a possible low methodological quality, the outcome is of clinical importance. The most important limitation for this systematic review is the low level of evidence of identified studies and the substantial risk of bias in these studies (Table 3). In addition a
large limitation of this, or any study regarding pathology of the Achilles tendon or related
hereto, is the long lasting terminological hoax surrounding these pathologies. For
this systematic review, we used strict inclusion criteria for the definition of chronic RB. This
may have resulted in the exclusion of some studies based only on the used terminology
in these articles. However, the outcome of these excluded studies are comparable
to the included studies: most studies show a good outcome after surgical intervention
(open or endoscopic) and a superior outcome with an endoscopic approach. Because chronic RB differs from other insertional Achilles pathology, the results of this
analysis are largely dependent on the proper diagnosis and terminology of the included
studies. If included studies lacked precision to differentiate between these entities, patients with insertional Achilles tendinopathy (IAT) instead of chronic RB may
have been included. Even though all studies reported that the diagnosis was based on
clinical findings and radiographic imaging (showing an enlarged posterosuperior calcaneal
process) patients’ symptoms may have been based on IAT instead of chronic RB. It has
been documented repeatedly that an enlarged process is seen frequently in patients with
IAT. In addition, IAT and chronic RB may occur simultaneously, if patients have this
combination and are treated only for chronic RB a minimal effect of intervention can be
expected. The outcome of surgical intervention between these different pathologies have
been compared by Watson. He reported different results between these pathologies while
the surgical intervention was the same. This reemphasizes the difference between these
entities. Despite the low level of quality of available studies, the outcome is of clinical
importance. There are evident differences in outcome between techniques. Endoscopic
interventions show a consistent low complication rate with consistent high patient satisfac-
tions compared to open surgical techniques. In addition, the post-operative treatment
showed marked differences in duration of immobilization and period of none- or partial
weight bearing all favoring the endoscopic technique. Finally, and again favoring the en-
doscopic technique sports resumption and performing normal daily activities was sooner
achieved after an endoscopic intervention. Authors publishing on endoscopic intervention
state that the procedure requires experience. Inexperienced surgeons should therefore be
trained prior to performing the procedure. For a better comparison of outcomes it is vital
that future studies clearly state the treated pathology (i.e. by means of a broadly used
terminology) and document their diagnostic methods in detail.

CONCLUSION

There are many different surgical techniques to treat RB. Regardless of technique resecting
sufficient bone is essential for a good outcome. Even though the level of evidence of
included studies is relatively low, it can be concluded that endoscopic surgery is superior
to open operative intervention for chronic RB. More evidence and a clear description of the treated pathology are a necessity to be more conclusive regarding the best surgical treatment.
REFERENCES


