

PDF hosted at the Radboud Repository of the Radboud University Nijmegen

The following full text is a publisher's version.

For additional information about this publication click this link.

<http://hdl.handle.net/2066/138135>

Please be advised that this information was generated on 2021-09-22 and may be subject to change.

Guideline for diagnosis and treatment of subacromial pain syndrome

A multidisciplinary review by the Dutch Orthopaedic Association

Ron Diercks¹, Carel Bron², Oscar Dorrestijn¹, Carel Meskers⁴, René Naber⁵, Tjerk de Ruiter⁴, Jaap Willems¹, Jan Winters³, and Henk Jan van der Woude⁶

¹Netherlands Orthopedic Society, ²Royal Netherlands Association of Physical Therapy, ³Netherlands Association of General Practitioners, ⁴Netherlands Society of Rehabilitation Medicine, ⁵Netherlands Association of Occupational Medicine, ⁶Netherlands Society of Radiology.

Correspondence: r.l.diercks@umcg.nl

Submitted 14-01-23. Accepted 14-03-04

Treatment of “subacromial impingement syndrome” of the shoulder has changed drastically in the past decade. The anatomical explanation as “impingement” of the rotator cuff is not sufficient to cover the pathology. “Subacromial pain syndrome”, SAPS, describes the condition better. A working group formed from a number of Dutch specialist societies, joined by the Dutch Orthopaedic Association, has produced a guideline based on the available scientific evidence. This resulted in a new outlook for the treatment of subacromial pain syndrome. The important conclusions and advice from this work are as follows:

(1) The diagnosis SAPS can only be made using a combination of clinical tests. (2) SAPS should preferably be treated non-operatively. (3) Acute pain should be treated with analgetics if necessary. (4) Subacromial injection with corticosteroids is indicated for persistent or recurrent symptoms. (5) Diagnostic imaging is useful after 6 weeks of symptoms. Ultrasound examination is the recommended imaging, to exclude a rotator cuff rupture. (6) Occupational interventions are useful when complaints persist for longer than 6 weeks. (7) Exercise therapy should be specific and should be of low intensity and high frequency, combining eccentric training, attention to relaxation and posture, and treatment of myofascial trigger points (including stretching of the muscles) may be considered. (8) Strict immobilization and mobilization techniques are not recommended. (9) Tendinosis calcarea can be treated by shockwave (ESWT) or needling under ultrasound guidance (barbotage). (10) Rehabilitation in a specialized unit can be considered in chronic, treatment resistant SAPS, with pain perpetuating behavior. (11) There is no convincing evidence that surgical treatment for SAPS is more effective than conservative management. (12) There is no indication for the surgical treatment of asymptomatic rotator cuff tears.

Shoulder problems are common. Between 7% and 34% of adults have shoulder pain at times (Reilingh et al. 2008). The incidence of shoulder pain in primary care in the Netherlands is estimated to be 19 per 1,000 person-years—highest in women over 45 years and lower in young adults (Greving et al. 2012). In the Netherlands, the orthopedic diagnosis of “supraspinatus tendinitis” is made 50,000–60,000 times a year (source Prismant). The course, independent of the chosen therapy, appears to be unfavorable in terms of resumption of previous work, and after 1 year, a third of the patients still have some kind of restriction and/or pain (Reilingh et al. 2008, Greving et al. 2012). Neer (1983) developed the concept of “impingement syndrome”. This can be caused or aggravated by contact between the acromion and the rotator cuff while lifting the arm. However, this hypothesis cannot be substantiated with improved imaging and arthroscopic techniques. More value is placed nowadays on the role of degeneration of the rotator cuff tendons, eventually giving rise to the development of tears (Papadonikolakis et al. 2011). A direct relationship between the anatomical substrate, functional load and pain is not always explicitly present. Naming this condition “subacromial pain syndrome”, abbreviated to SAPS, describes the condition better.

SAPS is defined as all non-traumatic, usually unilateral, shoulder problems that cause pain, localized around the acromion, often worsening during or subsequent to lifting of the arm. The different clinical and/or radiological names, such as bursitis, tendinosis calcarea, supraspinatus tendinopathy, partial tear of the rotator cuff, biceps tendinitis, or tendon cuff degeneration are all part of SAPS.

As patients come into contact with various healthcare providers, it was deemed necessary—following the Dutch General practitioners guideline for shoulder complaints (Winters

Table 1. GRADE evidence levels of intervention studies

Evidence level of intervention study (examples)	
High	RCTs without severe limitations. Observational studies with very large effects and without severe limitations.
Moderate	RCTs with severe limitations. Observational studies with large effects and without severe limitations.
Low	RCTs with extremely severe limitations. Observational studies without severe limitations.
Very low	RCTs with extremely severe limitations and inconsistent results. Observational studies with severe limitations. Non-systematic clinical observations (e.g. case series and case reports).

Table 2. EBRO evidence levels of diagnostic accuracy research or research into etiology and prognosis

Evidence level	Diagnostic accuracy research	Etiology, prognosis
A1	Meta-analysis of at least 2 independently conducted studies at the A2 level	
A2	Research compared to a reference test (gold standard) with previously defined cutoff values and independent evaluation of results, with a sufficiently large series of consecutive patients who have only had the index and reference test.	Prospective cohort study with sufficient size and follow-up and with adequate controlling for “confounding”, and where selective follow-up has been sufficiently ruled out.
B	Research compared to a reference test, but not with all the features listed under A2.	Prospective cohort study but not with all the features listed under A2, retrospective cohort study, or patient-controlled study.
C	Non-comparative study.	

et al. 2008), and to supplement the Dutch Physical Therapists Guideline for aspecific complaints of arm, neck and shoulder (KNGF 2012) and the KNGF Evidence Statement for subacromial shoulder pain (Jansen et al. 2011)—to create a guideline for the treatment of SAPS.

Methods

A working group was formed by the Netherlands Orthopedic Society (NOV), consisting of representatives from the Orthopedic Society, the Netherlands Association of Physical Therapy, the Netherlands Association of General Practitioners, the Netherlands Society of Rehabilitation Medicine, the Netherlands Association of Occupational Medicine, and the Netherlands Society of Radiology, who all have interest and expertise in clinical shoulder problems. This group formulated 8 clinical questions relevant to SAPS:

1. What is known about the prognosis of SAPS?
2. What measures are effective in preventing SAPS?
3. Which physical diagnostic tests are most accurate, sensitive, and specific for SAPS?
4. What is the added value of imaging for diagnosis of SAPS?
5. Which instruments are most suitable for measurement of outcomes in SAPS?
6. Which conservative treatment is the most effective for patients with SAPS?

7. When is surgical treatment for SAPS indicated, and which technique is preferred?
8. What advice can be given to patients with SAPS, argued from the patient’s point of view?

Literature search

The group conducted an exploratory search for existing international guidelines in Medline (OVID), the databases of the Guidelines International Network (GIN), the Quality Dome and Artsennet, and systematic reviews in Medline (OVID) and the Cochrane Library. Next, for each clinical question based on specific search terms, a search was conducted for published scientific studies in electronic databases. The searches were limited to literature in English, Dutch, French, and German. Additional studies were searched for on the basis of the reference lists of the articles selected. Search filters were used based on the filters used by the Scottish Intercollegiate Guideline Network (SIGN) to identify possible systematic reviews and randomized clinical trials.

Grading of study quality

The working group members selected articles based on criteria established in advance (Tables 1 and 2). From these data, the level of the recommendations was defined (Table 3). In general, the studies showed great heterogeneity in study populations, factors examined, duration of follow-up, and outcome measures. There were also confounders due to the definition

Table 3. Level-of-evidence strength of the conclusion, based on the literature underlying the conclusion

Level	Conclusion based on
1	For therapeutic intervention studies: high-quality studies. For diagnostic accuracy research or prognosis, etiology or side effects: A1-level study or at least 2 independently conducted A-2 level studies.
2	For therapeutic intervention studies: moderate-quality studies. For diagnostic accuracy research or prognosis, etiology or side effects: one A2-level study or at least 2 independently conducted B-level studies.
3	For therapeutic intervention studies: low-quality studies. For diagnostic accuracy research or prognosis, etiology or side effects: one B-level study or at least 2 independently conducted C-level studies.
4	For therapeutic intervention studies: very low-quality studies. For diagnostic accuracy research or prognosis, etiology or side effects: one C-level study.

of shoulder complaints, as the difference between subacromial complaints and general pain in the shoulder and/or neck was not always clear. The working group formulated recommendations on each of the questions following the highest level of evidence. When a scientific basis was not possible, consensus of the working group was obtained on the recommendation.

Results

Clinical Question 1: What is known about the prognosis of SAPS?

Scientific evidence level 1: There is an association between a longer duration of shoulder pain (> 3 months) and poorer outcome (Kuijpers et al. 2004, Bot et al. 2005, Thomas et al. 2005, Reilingh et al. 2008). There is an association between being middle-aged (45–54 years) and worse outcome (Kuijpers et al. 2004).

Level 2: Psychosocial factors appear to have a greater association with the course and prognosis of chronic shoulder pain (> 3 months) than with that of shorter-term shoulder pain (< 6 weeks) (Reilingh et al. 2008).

Level 3: There are indications that a worse outcome is associated with a worse score at the start, longer duration of symptoms, and type II or III acromion morphology (Taheriazam et al. 2005).

Considerations

There is consistent evidence that a longer duration of symptoms (> 3 months) is a poor prognostic factor. There is evidence that psychosocial factors play a role in chronic complaints.

Recommendation

The working group recommends being aware of the effect of symptom duration on prognosis (> 3 months) and distinguishing between acute symptoms and chronic symptoms when deciding on interventions for SAPS.

Clinical Question 2: What measures are effective in preventing SAPS?

Scientific evidence level 1: There are associations between the occurrence of SAPS and (1) repetitive movements of the shoulder or hand/wrist during work, (2) work that requires much or prolonged strength of the upper arms, (3) hand-arm vibration (high vibration and/or prolonged exposure) at work, (4) working with a poor ergonomic shoulder posture, and (5) a high psychosocial workload. Psychosocial factors associated with prolonged shoulder complaints are high psychological demands, low control, low social support, low job satisfaction, and high pressure to perform (van Rijn et al. 2010).

Level 2: There is evidence that regular sporting activities (> 3 h per week for at least 10 months a year) have a preventive effect on the risk of neck and shoulder complaints and (long-term) illness (van den Heuvel et al. 2005).

Considerations

There were fewer modifiable factors found in studies on psychosocial risks than in studies on physical factors. In one study (Kennedy et al. 2009), influencing the entire kinematic chain is mentioned as the starting point for prevention and treatment of sports-related shoulder pain. However, there have been no studies on the effects of these interventions.

Recommendations

The working group recommends early intervention to modify repetitive movements of the shoulder or hand/wrist during work, work that demands much or prolonged power of the upper arms, hand-arm vibration (high vibration and/or prolonged exposure) during work, and work in a non-ergonomic shoulder position. An approach based on the “biopsychosocial model”, focusing on early return to work, has the best chance of success (Shanahan and Sladek 2011).

Clinical Question 3: Which physical diagnostic tests are most accurate, sensitive and specific for sub-acromial pain syndrome of the shoulder?

Scientific evidence level 1: No single test is sufficiently accurate to diagnose SAPS (Hegedus et al. 2008, Hughes et al. 2008). The inter-rater reliability of the most common tests varies greatly. Inter-rater reliability of active abduction and abduction trajectory pain is moderate (May et al. 2010).

Level 2: The combination of a number of tests increases the post-test probability of the diagnosis of SAPS. (Murrell and Walton 2001, Park et al. 2005, Michener et al. 2009).

Considerations

As one physical sign cannot sufficiently differentiate between the various shoulder disorders, or give a clear distinction regarding the status of the rotator cuff, a combination of multiple tests increases post-test probability of a diagnosis of SAPS.

Recommendations

To determine SAPS, a combination of the Hawkins-Kennedy test, the painful arc test, and the infraspinatus muscle strength test should be used; and for a rotator cuff tear, the drop-arm test and the infraspinatus and supraspinatus muscle strength tests should be used.

Clinical Question 4: What is the added value of imaging tests for diagnosis of SAPS?

Scientific evidence level 1: The sensitivity and specificity of ultrasound and conventional MRI are not significantly different in the detection of partial- or full-thickness rotator cuff tears (Dinnes et al. 2003). MR arthrography is an accurate method to rule out partial rotator cuff injuries (de Jesus et al. 2009, Ottenheijm et al. 2010).

Level 2: It is likely that ultrasound is an accurate method for the detection or exclusion of rotator cuff tendinopathy, sub-acromial bursitis, biceps tendon rupture, and tendinosis calcarea (Ottenheijm et al. 2010). The interobserver variability of ultrasound with respect to detection of rotator cuff injuries is low, as the results are very similar (Rutten et al. 2010, Sipola et al. 2010).

Level 3: There is evidence that ultrasound is not sufficiently reliable to differentiate between an intact rotator cuff and partial lesions (Sipola et al. 2010).

Considerations

Ultrasound of the shoulder is a sensitive and specific method. The diagnostic accuracy is good and comparable to that of conventional MRI for identification and quantification of complete (full-thickness) rotator cuff injuries. There are conflicting results about the value of ultrasonography in partial rotator cuff tears and tendinopathies. For optimal sonographic analysis of the shoulder, standardized examination and expertise as well as high-quality equipment (7.5- to 20-MHz linear trans-

ducers) should be available. When repair of a rotator cuff tear is intended, MRI provides useful information on size, retraction, and matching atrophy and fatty infiltration. For the detection of partial articular side cuff injuries (PASTA lesions), MR arthrography may be considered because of its high sensitivity and specificity. It is preferable to perform a series in abduction/external rotation position (ABER). Although a correlation has been described between the shape of the acromion (type III, angled) and the presence of rotator cuff injuries (Toivonen et al. 1995), this association is not significant in patients over 50 (Gill et al. 2002, Oh et al. 2010).

Recommendations

Ultrasound is advised as the most valuable and cost-effective diagnostic imaging if a first period of non-operative treatment fails. This can be combined with conventional radiography of the shoulder to determine osteoarthritis, osseous abnormalities, and presence/absence of calcium deposits. MRI of the shoulder is indicated when reliable ultrasound is not at hand or inconclusive, and should be used in patients who are eligible for surgical repair of a cuff tear to assess the degree of retraction and atrophied fatty infiltration. An MRI study with intra-articular contrast can be considered if any intra-articular abnormality or a partial rotator cuff injury have to be ruled out. It is preferable for a study in abduction and external rotation (ABER) to be part of an MR arthrography protocol.

Clinical Question 5: Which instruments are most suitable for measuring the outcome of treatment of SAPS?

Scientific evidence level 2: Measurements of ROM using instruments (in goniometry and inclinometry) are more reliable than those based on visual assessment (van de Pol et al. 2010). The Dutch Shoulder Disability Questionnaire seems to be responsive (van der Windt et al. 1998, van der Heijden et al. 2000).

Levels 2/3: The internal consistency and test-retest reliability of the Dutch Simple Shoulder Test seem high and the construct validity moderate to good (van Kampen et al. 2012).

Level 3: There is insufficient inter-rater reliability of visual estimation of ROM (Terwee et al. 2011). There are indications that the inter-rater reliability of ROM measured using a digital inclinometer for individual patients is poor, with differences in ROM of less than 20–25 degrees being indistinguishable from measurement error (de Winter et al. 2004). The DASH-DLV has excellent internal consistency, reasonable test-retest reliability, and reasonable criterion validity (Veehof et al. 2002). The English Oxford Shoulder Score has a high test-retest reliability, high internal consistency, and a weak-to-moderate criterion validity (Berendes et al. 2010). The Dutch Shoulder Rating Questionnaire has high internal consistency, high test-retest reliability, moderate-to-good criterion validity, and is an appropriate instrument to demonstrate clinical differences (Vermeulen et al. 2005).

Level 4: It is possible that isokinetic muscle strength measurements using a dynamometer have good reliability at group level and poor reliability at individual level (Meeteren et al. 2002).

Considerations

Visual assessment of the ROM is appropriate only for distinguishing between the affected and the contralateral side. Even when using a goniometer, which can increase the reliability of the measurements, the measurement error remains high. In selecting an outcome instrument, it is important for the instrument to have been validated in the Dutch language. The Simple Shoulder Test and the Oxford Shoulder Score are instruments with relatively few questions and are easy to use. The Dutch Shoulder Disability Questionnaire with 16 questions is a medium-length questionnaire and is also easy to use. The Shoulder Rating Questionnaire is more detailed, has a more complex calculation of the sum score, and for certain items it misses answers quite often.

Recommendations

Visual estimates of the range of motion can only serve to distinguish between the affected and the contralateral shoulder. Instruments to assess the effects of treatment of SAPS, validated in the Dutch language, are: Disabilities of the Arm, Shoulder and Hand (DASH), English Oxford Shoulder Score (DOSS), Dutch Simple Shoulder Test (DSST), and Shoulder Disability Questionnaire (SDQ-NL).

Clinical Question 6: Which non-operative treatment is most effective for patients with SAPS?

• Corticosteroid injections

Scientific evidence level 1: In the first 8 weeks, corticosteroid injections are more effective than placebo injections, physiotherapy, or no treatment in reducing pain and improving shoulder function. Corticosteroid injections in the short term are no more effective than NSAIDs in reducing pain. The effect of corticosteroids in the long term (≥ 3 months) is unclear (Buchbinder et al. 2003, Arroll and Goodyear-Smith 2005, Gaujoux-Viala et al. 2009).

• Extracorporeal shockwave therapy (ESWT)

Level 1: High-energy extracorporeal shockwave therapy (ESWT) is more effective than low-energy ESWT or placebo in reducing pain and improving shoulder function in patients with tendinosis calcarea. ESWT (all forms) is no more effective than placebo or other treatments in reducing pain or in improving shoulder function of patients without calcium deposition in the tendons (Huisstede et al. 2011).

• Exercise therapy

Levels 1–2: Exercise therapy is more effective than no treatment in reducing pain and improving function of the shoulder (Dickens and Williams 2005, Lombardi et al. 2008). There appears to be no difference in effectiveness between exercise therapy and home exercises (Werner et al. 2002,

Walther et al. 2004). Exercises specifically focused on rotator cuff and scapular stabilizers appear to be more effective than general exercise therapy (Holmgren et al. 2012). Manual joint mobilizations have no added benefit to a program of active exercises in reducing pain and improving shoulder function (Brudvig et al. 2011).

Level 2: Massage (myofascial trigger points in the shoulder muscles, or soft tissue) appears to be more effective than placebo or no treatment in reducing pain and improving shoulder function in patients with shoulder pain (van den Dolder and Roberts 2003, Hains et al. 2010, Bron et al. 2011, Yang et al. 2012)

• Other interventions

Level 3: Oral NSAIDs appear to be more effective than placebo in reducing pain in the first 1–2 weeks (Mena et al. 1986, Petri et al. 2004). Laser treatment (of all types) appears to be more effective than placebo or ultrasound treatment in reducing pain after 2–4 weeks (England et al. 1989, Taverna et al. 1990, Saunders 1995, Vecchio et al. 1993, Santamato et al. 2009). Ultrasound treatment is no more effective than placebo, no treatment, physiotherapy, or exercise therapy (Berry et al. 1980, Ebenbichler et al. 1999, Gam et al. 1998, Kurtais Gursel et al. 2004, Nykanen 1995). Electrical stimulation has not been shown to be more effective than placebo (Binder et al. 1984, Dal Conte et al. 1990, Aktas et al. 2007). Acupuncture treatment appears to be no more effective than placebo and exercise therapy (Green et al. 2005).

Considerations

Much research has been done on the effect of non-operative therapies for various subacromial and shoulder pain syndromes. There is a great diversity of interventions and methods, and many studies use the terms shoulder pain and SAPS interchangeably. Also, any co-interventions and complications often remain unnamed. There is no literature on the effectiveness of behavioral counseling, but it is unlikely that therapy is given without behavioral counseling. The effectiveness of such advice (ranging from absolute rest to passive mobilization beyond the pain threshold) is unclear.

Recommendations

A non-operative treatment algorithm for SAPS starts with a recommendation of relative rest in the acute phase, if necessary combined with a prescription of NSAIDs for 1 or 2 weeks. This should be followed by gradually expanding activities. Corticosteroid injections may be used for severe pain, if possible under ultrasound guidance, in the first 8 weeks. The use of corticosteroid injections as single long-term therapy is not recommended. Use of high-energy ESWT can be considered for proven subacromial calcium deposits. ESWT is not recommended in the acute phase. Movement within the pain threshold is desirable. Neither strict immobilization nor passive joint mobilization in SAPS is recommended. Exercise

should preferably be performed at low intensity and high frequency, within the pain threshold, and focusing on eccentric training. Scapular stabilization training and relaxation with proper posture should be part of the regime. Treatment of myofascial trigger points (including stretching of the muscles) may be considered. Rehabilitation can be considered for chronic, treatment-resistant SAPS, where pain-perpetuating behavior plays a role.

Clinical Question 7: When is surgical treatment for SAPS indicated, and which technique is preferred?

Interventions with an intact rotator cuff

Scientific evidence level 2: It has not been shown that surgical treatment of SAPS is more effective than non-operative management to improve shoulder function or reduce pain (Coghlan et al. 2008, Dorrestijn et al. 2009, Gebremariam et al. 2011). No difference in outcome (shoulder function, complications) has been shown between an arthroscopic approach and an open approach. A bursectomy is likely to give the same clinical outcome as a bursectomy with acromioplasty (Faber et al. 2006, Barfield and Kuhn 2007, Coghlan et al. 2008, Davis et al. 2010, Donigan and Wolf 2011).

Level 3: An open decompression may lead to longer hospital stay and a delayed return to work compared to arthroscopic surgery for SAPS (Davis et al. 2010).

Interventions to repair a torn rotator cuff

Level 3: There are indications that there is no difference between single-row and double-row fixation technique in terms of the final clinical outcome (shoulder function, re-ruptures) in surgical treatment of rotator cuff tears (Nho et al. 2009b). There are indications that there is a greater chance of anatomical recovery (tendon adhesion to the footprint) in the double-row fixation technique than in the single-row fixation technique (Saridakis and Jones 2010). There are indications that the chance of re-ruptures is smaller in the double-row fixation technique in tears larger than 1 cm (Duquin et al. 2010). There are indications that there is no difference between an open, mini-open, or arthroscopic approach with regard to final clinical outcome in the surgical treatment of rotator cuff tears (Morse et al. 2008, Seida et al. 2010). There are indications of worse outcome after arthroscopic rotator cuff repair measured after 1–2 years of follow-up associated with simultaneous procedures on the biceps, simultaneous procedures on the acromioclavicular joint, preoperative fatty degeneration of the m. supraspinatus, sex (women have worse outcomes than men), and age (the risk of poorer outcome increases with age) (Nho et al. 2009a, Oh et al. 2009, Grasso et al. 2009, Park et al. 2010).

Biceps tendon tenotomy or tenodesis

Level 3: A biceps tenotomy leaves more cosmetic defects; a biceps tenodesis gives more pain (Hsu et al. 2011).

Considerations

There is no convincing evidence that surgical treatment is more effective than non-operative treatment. No clear preference for surgical technique can be indicated either. There is no indication for surgical treatment of asymptomatic rotator cuff tears (AAOS. 2010). If rotator cuff repair is indicated, performing an open, a mini-open, or an arthroscopic approach makes no difference in end-results. There is moderate evidence for fewer re-ruptures in tears larger than 1 cm (measured backward) with a double-row fixation, but any effect on clinical outcome has not been demonstrated. Comparison between ESWT, barbotage (needling of the calcium deposit guided by fluoroscopy or ultrasound), and surgical removal shows no obvious preference for one of these interventions (Diehl et al. 2011) in the treatment of tendinosis calcarea. The only difference between a biceps tendon tenotomy and biceps tenodesis is cosmetic (Hsu et al. 2011).

Recommendations

SAPS should preferably be treated non-operatively. If the patient does not respond to exhaustive non-operative treatment and does not qualify for a rehabilitation treatment, bursectomy can be considered. A mini, mini-open, or arthroscopic approach is associated with shorter hospital stay and faster return to work. When surgical repair of symptomatic rotator cuff tears is indicated, the condition of the muscles as well as age and activity level of the patient play a role in the decision. Surgical treatment of tendinosis calcarea is not recommended, given the availability of equivalent alternatives.

Clinical Question 8: What advice can be given to patients with SAPS, argued from the patient's point of view?

Considerations

There is little research on the patient's point of view. From the few existing studies, it can be tentatively concluded that dissatisfaction with the outcome of treatment is more common in women than in men. There are indications that after a course of treatment, two-thirds of patients are still looking for one or more subsequent treatments, either in the medical sector or in alternative sectors.

Conclusion

Patients with shoulder pain who are often part of the working population come into contact with various healthcare providers. The collected recommendations from all disciplines in this guideline provide treatment advice based on the best-available evidence.

The "do's" in this treatment algorithm are:

1. A diagnosis of SAPS can only be made after a combination of tests; the Hawkins-Kennedy test, the painful arc test, and the infraspinatus muscle strength test are advisable.
2. It is preferable to treat SAPS non-operatively.

3. Treat acute pain with advice, explanation, and possibly analgesics (NSAIDs) for a maximum of 2 weeks.
4. If symptoms persist longer than 6 weeks, take steps in the workplace to prevent development of a chronic syndrome.
5. Prescribe therapy or home exercises of low intensity and high frequency, combining eccentric training with stabilization training of the scapula and focusing on relaxation and proper posture.
6. Treatment of myofascial trigger points (including stretching of the muscles) can support exercise therapy.
7. For persistent symptoms, subacromial injection with corticosteroids is an effective treatment.
8. If symptoms persist longer than 6 weeks, ultrasound can be performed to rule out cuff rupture—if indicated, supplemented by conventional radiographic examination.
9. MRI is indicated when ultrasound examination is inconclusive, or to measure the size of the tear and the condition of the muscles when rotator cuff repair is being considered.
10. For tendinosis calcarea, ESWT or barbotage can be used.
11. Rehabilitation in a specialized center can be considered for chronic, treatment-resistant SAPS, in which pain-perpetuating behavior plays a role.
12. The indication for surgical repair of a symptomatic rotator cuff tear depends on the size of the tear, the condition of the muscles, and the age and activity level of the patient.

The “don’ts” in this algorithm are:

1. Strict immobilization.
2. No active intervention to prevent overload in work or sports and to address psychosocial factors.
3. Limiting imaging to conventional radiographic examination.
4. Ultrasound examination with suboptimal technique and experience.
5. ESWT in the acute phase, and in absence of tendinosis or bursitis calcarea.
6. Surgical treatment without exhaustive non-operative treatment.

The production of this guideline was supported by Ms S. B. Muller-Ploeger and Ms N. van Veen of the Knowledge Institute of the Netherlands Medical Specialists Association.

AAOS. Clinical practice guideline on optimizing the management of rotator cuff problems. American Academy of Orthopaedic Surgeons, Rosemont, IL 2010.

Aktas I, Akgun K, Cakmak B. Therapeutic effect of pulsed electromagnetic field in conservative treatment of subacromial impingement syndrome. *Clin Rheumatol* 2007; 26 (8): 1234-9.

Arroll B, Goodyear-Smith F. Corticosteroid injections for painful shoulder: A meta-analysis. *Br J Gen Pract* 2005; 55 (512): 224-8.

Barfield L C, Kuhn J E. Arthroscopic versus open acromioplasty: A systematic review. *Clin Orthop* 2007; (455): 64-71.

Berendes T, Pilot P, Willems J, Verburg H, te S R. Validation of the dutch version of the oxford shoulder score. *J Shoulder Elbow Surg* 2010; 19 (6): 829-36.

Berry H, Fernandes L, Bloom B, Clark R J, Hamilton E B. Clinical study comparing acupuncture, physiotherapy, injection and oral anti-inflammatory therapy in shoulder-cuff lesions. *Curr Med Res Opin* 1980; 7 (2): 121-6.

Binder A, Parr G, Hazleman B, Fitton-Jackson S. Pulsed electromagnetic field therapy of persistent rotator cuff tendinitis. A double-blind controlled assessment. *Lancet* 1984; 1 (8379): 695-8.

Bot S D, van der Waal J M, Terwee C B, van der Windt D A, Scholten R J, Bouter L M, Dekker J. Predictors of outcome in neck and shoulder symptoms: A cohort study in general practice. *Spine* 2005; 30 (16): E459-70.

Bron C, de Gast A, Dommerholt J, Stegenga B, Wensing M, Oostendorp R A. Treatment of myofascial trigger points in patients with chronic shoulder pain: A randomized, controlled trial. *BMC Medicine* 2011; 9: 8.

Brudvig T J, Kulkarni H, Shah S. The effect of therapeutic exercise and mobilization on patients with shoulder dysfunction: A systematic review with meta-analysis. *J Orthop Sports Phys Ther* 2011; 41 (10): 734-48.

Buchbinder R, Green S, Youd J M. Corticosteroid injections for shoulder pain. *Cochrane Database Syst Rev* 2003; (1): CD004016.

Coghlan J A, Buchbinder R, Green S, Johnston R V, Bell S N. Surgery for rotator cuff disease. *Cochrane Database Syst Rev* 2008; (1): CD005619.

Dal Conte G, Rivoltini P, Combi F. Trattamento della periartrite calcarea di spalla con campi magnetici pulsanti: Studio controllato. *La Riabilitazione* 1990; 23 (1): 27-33.

Davis A D, Kakar S, Moros C, Kaye E K, Schepsis A A, Voloshin I. Arthroscopic versus open acromioplasty: A meta-analysis. *Am J Sports Med* 2010; 38 (3): 613-8.

de Jesus J O, Parker L, Frangos A J, Nazarian L N. Accuracy of MRI, MR arthrography, and ultrasound in the diagnosis of rotator cuff tears: A meta-analysis. *AJR Am J Roentgenol* 2009; 192 (6): 1701-7.

de Winter A F, Heemskerk M A, Terwee C B, Jans M P, Deville W, van Schaardenburg D J, Scholten R J, Bouter L M. Inter-observer reproducibility of measurements of range of motion in patients with shoulder pain using a digital inclinometer. *BMC Musculoskeletal Disord* 2004; 5: 18.

Dickens V, Williams J A B. Role of physiotherapy in the treatment of subacromial impingement syndrome: A prospective study. *Physiotherapy* 2005; 91 (3): 159-64.

Diehl P, Gerdesmeyer L, Gollwitzer H, Sauer W, Tischer T. Calcific tendinitis of the shoulder. *Orthopade* 2011; 40 (8): 733-46.

Dinnes J, Loveman E, McIntyre L, Waugh N. The effectiveness of diagnostic tests for the assessment of shoulder pain due to soft tissue disorders: A systematic review. *Health Technol Assess* 2003; 7 (29): 1-166.

Donigan J A, Wolf B R. Arthroscopic subacromial decompression: Acromioplasty versus bursectomy alone--does it really matter? A systematic review. *Iowa Orthop J* 2011; 31: 121-6.

Dorrestijn O, Stevens M, Winters J C, van der Meer K, Diercks R L. Conservative or surgical treatment for subacromial impingement syndrome? A systematic review. *J Shoulder Elbow Surg* 2009; 18 (4): 652-60.

Duquin T R, Buyea C, Bisson L J. Which method of rotator cuff repair leads to the highest rate of structural healing? A systematic review. *Am J Sports Med* 2010; 38 (4): 835-41.

Ebenbichler G R, Erdogmus C B, Resch K L, Funovics M A, Kainberger F, Barisani G, Aringer M, Nicolakis P, Wiesinger G F, Baghestanian M, Pressinger E, Fialka-Moser V. Ultrasound therapy for calcific tendinitis of the shoulder. *N Engl J Med* 1999; 340 (20): 1533-8.

England S, Farrell A J, Coppock J S, Struthers G, Bacon P A. Low power laser therapy of shoulder tendonitis. *Scand J Rheumatol* 1989; 18 (6): 427-31.

Faber E, Kuiper J I, Burdorf A, Miedema H S, Verhaar J A. Treatment of impingement syndrome: A systematic review of the effects on functional limitations and return to work. *J Occup Rehabil* 2006; 16 (1): 7-25.

Gam A N, Warming S, Larsen L H, Jensen B, Hoydalsmo O, Allon I, Andersen B, Gotzsche N E, Petersen M, Mathiesen B. Treatment of myofascial trigger-points with ultrasound combined with massage and exercise--a randomised controlled trial. *Pain* 1998; 77 (1): 73-9.

- Gaujoux-Viala C, Dougados M, Gossec L. Efficacy and safety of steroid injections for shoulder and elbow tendonitis: A meta-analysis of randomised controlled trials. *An Rheum Dis* 2009; 68 (12): 1843-9.
- Gebremariam L, Hay E M, Koes B W, Huisstede B M. Effectiveness of surgical and postsurgical interventions for the subacromial impingement syndrome: A systematic review. *Arch Phys Med Rehabil* 2011; 92 (11): 1900-13.
- Gill T J, McIrvin E, Kocher M S, Homa K, Mair S D, Hawkins R J. The relative importance of acromial morphology and age with respect to rotator cuff pathology. *J Shoulder Elbow Surg* 2002; 11 (4): 327-30.
- Grasso A, Milano G, Salvatore M, Falcone G, Deriu L, Fabbriani C. Single-row versus double-row arthroscopic rotator cuff repair: A prospective randomized clinical study. *Arthroscopy* 2009; 25 (1): 4-12.
- Green S, Buchbinder R, Hetrick S. Acupuncture for shoulder pain. *Cochrane Database Syst Rev* 2005; (2): CD005319.
- Greving K, Dorrestijn O, Winters J C, Groenhouf F, van der Meer K, Stevens M, Diercks R L. Incidence, prevalence, and consultation rates of shoulder complaints in general practice. *Scand J Rheumatol* 2012; 41 (2): 150-5.
- Hains G, Descarreaux M, Hains F. Chronic shoulder pain of myofascial origin: A randomized clinical trial using ischemic compression therapy. *J Manipulative Physiol Ther* 2010; 33 (5): 362-9.
- Hegedus E J, Goode A, Campbell S, Morin A, Tamaddoni M, Moorman C T, 3rd, Cook C. Physical examination tests of the shoulder: A systematic review with meta-analysis of individual tests. *Br J Sports Med* 2008; 42 (2): 80-92.
- Holmgren T, Bjornsson Hallgren H, Oberg B, Adolfsson L, Johansson K. Effect of specific exercise strategy on need for surgery in patients with subacromial impingement syndrome: Randomised controlled study. *BMJ* 2012; 344: e787.
- Hsu A R, Ghodadra N S, Provencher M T, Lewis P B, Bach B R. Biceps tenotomy versus tenodesis: A review of clinical outcomes and biomechanical results. [review]. *J Shoulder Elbow Surg* 2011; 20 (2): 326-32.
- Hughes P C, Taylor N F, Green R A. Most clinical tests cannot accurately diagnose rotator cuff pathology: A systematic review. *Aust J Physiother* 2008; 54 (3): 159-70.
- Huisstede B M A, Gebremariam L, van der Sande R, Hay E M, Koes B W. Evidence for effectiveness of extracorporeal shock-wave therapy (ESWT) to treat calcific and non-calcific rotator cuff tendinosis – A systematic review. *Man Ther* 2011; 16 (5): 419-33.
- Jansen M J, Brooijmans F, Geraets J J X R, Lenssen A F, Ottenheijm R P G, Penning L I F, de Bie R A. KNGF evidence statement subacromiale klachten. *Ned Tijdschr Fysiother (Supplement)* 2011; 121 (1).
- K.N.G.F. Richtlijn specifieke klachten arm, nek en/of schouders. 2012.
- Kennedy D J, Visco C J, Press J. Current concepts for shoulder training in the overhead athlete. *Curr Sports Med Rep* 2009; 8 (3): 154-60.
- Kuijpers T, van der Windt D A, van der Heijden G J, Bouter L M. Systematic review of prognostic cohort studies on shoulder disorders. *Pain* 2004; 109 (3): 420-31.
- Kurtais Gursel Y, Ulus Y, Bilgic A, Dincer G, van der Heijden G J. Adding ultrasound in the management of soft tissue disorders of the shoulder: A randomized placebo-controlled trial. *Phys Ther* 2004; 84 (4): 336-43.
- Lombardi I Jr, Magri A G, Fleury A M, Da Silva A C, Natour J. Progressive resistance training in patients with shoulder impingement syndrome: A randomized controlled trial. *Arthritis Rheum* 2008; 59 (5): 615-22.
- May S, Chance-Larsen K, Littlewood C, Lomas D, Saad M. Reliability of physical examination tests used in the assessment of patients with shoulder problems: A systematic review. *Physiotherapy* 2010; 96 (3): 179-90.
- Meeteren J, Roebroek M E, Stam H J. Test-retest reliability in isokinetic muscle strength measurements of the shoulder. *J Rehabil Med* 2002; 34 (2): 91-5.
- Mena H R, Lomen P L, Turner L F, Lamborn K R, Brinn E L. Treatment of acute shoulder syndrome with flurbiprofen. *Am J Med* 1986; 80 (3A): 141-4.
- Michener L A, Walsworth M K, Doukas W C, Murphy K P. Reliability and diagnostic accuracy of 5 physical examination tests and combination of tests for subacromial impingement. *Arch Phys Med Rehabil* 2009; 90 (11): 1898-903.
- Morse K, Davis A D, Afra R, Kaye E K, Schepsis A, Voloshin I. Arthroscopic versus mini-open rotator cuff repair: A comprehensive review and meta-analysis. *Am J Sports Med* 2008; 36 (9): 1824-8.
- Murrell G A, Walton J R. Diagnosis of rotator cuff tears. *Lancet* 2001; 357 (9258): 769-70.
- Neer C S. Impingement lesions. *Clin Orthop* 1983; (173): 70-7.
- Nho S J, Brown B S, Lyman S, Adler R S, Altchek D W, MacGillivray J D. Prospective analysis of arthroscopic rotator cuff repair: Prognostic factors affecting clinical and ultrasound outcome. *J Shoulder Elbow Surg* 2009a; 18 (1): 13-20.
- Nho S J, Slabaugh M A, Seroyer S T, Grumet R C, Wilson J B, Verma N N, Romeo A A, R. B B, Jr. Does the literature support double-row suture anchor fixation for arthroscopic rotator cuff repair? A systematic review comparing double-row and single-row suture anchor configuration. *Arthroscopy* 2009b; 25 (11): 1319-28.
- Nykanen M. Pulsed ultrasound treatment of the painful shoulder a randomized, double-blind, placebo-controlled study. *Scand J Rehabil Med* 1995; 27 (2): 105-8.
- Oh J H, Kim S H, Ji H M, Jo K H, Bin S W, Gong H S. Prognostic factors affecting anatomic outcome of rotator cuff repair and correlation with functional outcome. *Arthroscopy* 2009; 25 (1): 30-9.
- Oh J H, Kim J Y, Lee H K, Choi J A. Classification and clinical significance of acromial spur in rotator cuff tear: Heel-type spur and rotator cuff tear. *Clin Orthop* 2010; (468) (6): 1542-50.
- Ottenheijm R P, Jansen M J, Staal J B, van den Bruel A, Weijers R E, de Bie R A, Dinant G J. Accuracy of diagnostic ultrasound in patients with suspected subacromial disorders: A systematic review and meta-analysis. [review]. *Arch Phys Med Rehabil* 2010; 91 (10): 1616-25.
- Papadonikolakis A, McKenna M, Warme W, Martin B I, Matsen F A, 3rd. Published evidence relevant to the diagnosis of impingement syndrome of the shoulder. *J Bone Joint Surg (Am)* 2011; 93 (19): 1827-32.
- Park H B, Yokota A, Gill H S, El Rassi G, McFarland E G. Diagnostic accuracy of clinical tests for the different degrees of subacromial impingement syndrome. *J Bone Joint Surg (Am)* 2005; 87 (7): 1446-55.
- Park J Y, Siti H T, Keum J S, Moon S G, Oh K S. Does an arthroscopic suture bridge technique maintain repair integrity?: A serial evaluation by ultrasonography. *Clin Orthop* 2010; (468) (6): 1578-87.
- Petri M, Hufman S L, Waser G, Cui H, Snabes M C, Verburg K M. Celecoxib effectively treats patients with acute shoulder tendinitis/bursitis. *J Rheumatol* 2004; 31 (8): 1614-20.
- Reiling M L, Kuijpers T, Tanja-Harfterkamp A M, van der Windt D A. Course and prognosis of shoulder symptoms in general practice. *Rheumatology* 2008; 47 (5): 724-30.
- Rutten M J, Jager G J, Kiemeny L A. Ultrasound detection of rotator cuff tears: Observer agreement related to increasing experience. *AJR Am J Roentgenol* 2010; 195 (6): W440-6.
- Santamato A, Solfrizzi V, Panza F, Tondi G, Frisardi V, Leggin B G, Ranieri M, Fiore P. Short-term effects of high-intensity laser therapy versus ultrasound therapy in the treatment of people with subacromial impingement syndrome: A randomized clinical trial. *Phys Ther* 2009; 89 (7): 643-52.
- Saridakis P, Jones G. Outcomes of single-row and double-row arthroscopic rotator cuff repair: A systematic review. *J Bone Joint Surg (Am)* 2010; 92 (3): 732-42.
- Saunders L. The efficacy of low level laser therapy in supraspinatus tendinitis. *Clin Rehabil* 1995; 9: 126-34.
- Seida J C, LeBlanc C, Schouten J R, Mousavi S S, Hartling L, Vandermeer B, Tjosvold L, Sheps D M. Systematic review: Nonoperative and operative treatments for rotator cuff tears. *Ann Intern Med* 2010; 153 (4): 246-55.
- Shanahan E M, Sladek R. Shoulder pain at the workplace. *Best Prac Res Clin Rheumatol* 2011; 25 (1): 59-68.

- Sipola P, Niemitukia L, Kroger H, Hoffing I, Vaatainen U. Detection and quantification of rotator cuff tears with ultrasonography and magnetic resonance imaging – a prospective study in 77 consecutive patients with a surgical reference. *Ultrasound Med Biol* 2010; 36 (12): 1981-9.
- Taheriazam A, Sadatsafavi M, Moayyeri A. Outcome predictors in nonoperative management of newly diagnosed subacromial impingement syndrome: A longitudinal study. *MedGenMed* 2005; 7 (1): 63.
- Taverna E, Parrini M, Cabitza P. Laser therapy in the treatment of some bone and joint pathology. *Minerva Ortop Traumatol* 1990; 41: 631-6.
- Terwee C B, Mokkink L B, Knol D L, Ostelo R W, Bouter L M, de Vet H C. Rating the methodological quality in systematic reviews of studies on measurement properties: A scoring system for the COSMIN checklist. *Qual Life Res* 2011; 21 (4): 651-7.
- Thomas E, van der Windt D A, Hay E M, Smidt N, Dziedzic K, Bouter L M, Croft P R. Two pragmatic trials of treatment for shoulder disorders in primary care: Generalisability, course, and prognostic indicators. *Ann Rheum Dis* 2005; 64 (7): 1056-61.
- Toivonen D A, Tuite M J, Orwin J F. Acromial structure and tears of the rotator cuff. *J Shoulder Elbow Surg* 1995; 4 (5): 376-83.
- van de Pol R J, van Trijffel E, Lucas C. Inter-rater reliability for measurement of passive physiological range of motion of upper extremity joints is better if instruments are used: A systematic review. *J Physiother* 2010; 56 (1): 7-17.
- van den Dolder P A, Roberts D L. A trial into the effectiveness of soft tissue massage in the treatment of shoulder pain. *Aust J Physiother* 2003; 49 (3): 183-8.
- van den Heuvel S G, Heinrich J, Jans M P, van der Beek A J, Bongers P M. The effect of physical activity in leisure time on neck and upper limb symptoms. *Prev Med* 2005; 41 (1): 260-7.
- van der Heijden G J, Leffers P, Bouter L M. Shoulder disability questionnaire design and responsiveness of a functional status measure. *J Clin Epidemiol* 2000; 53 (1): 29-38.
- van der Windt D A, van der Heijden G J, de Winter A F, Koes B W, Deville W, Bouter L M. The responsiveness of the shoulder disability questionnaire. *Ann Rheum Dis* 1998; 57 (2): 82-7.
- van Kampen D A, van Beers L W, Scholtes V A, Terwee C B, Willems W J. Validation of the dutch version of the simple shoulder test. *J Shoulder Elbow Surg* 2012; 21 (6): 808-14.
- van Rijn R M, Huisstede B M, Koes B W, Burdorf A. Associations between work-related factors and specific disorders of the shoulder—a systematic review of the literature. *Scand J Work Environ Health* 2010; 36 (3): 189-201.
- Vecchio P, Cave M, King V, Adebajo A O, Smith M, Hazleman B L. A double-blind study of the effectiveness of low level laser treatment of rotator cuff tendinitis. *Br J Rheumatol* 1993; 32 (8): 740-2.
- Veehof M M, Slegers E J, van Veldhoven N H, Schuurman A H, van Meeteren N L. Psychometric qualities of the dutch language version of the disabilities of the arm, shoulder, and hand questionnaire (DASH-DLV). *J Hand Ther* 2002; 15 (4): 347-54.
- Vermeulen H M, Boonman D C, Schuller H M, Obermann W R, van Houwelingen H C, Rozing P M, Vliet Vlieland T P. Translation, adaptation and validation of the shoulder rating questionnaire (SRQ) into the dutch language. *Clin Rehabil* 2005; 19 (3): 300-11.
- Walther M, Werner A, Stahlschmidt T, Woelfel R, Gohlke F. The subacromial impingement syndrome of the shoulder treated by conventional physiotherapy, self-training, and a shoulder brace: Results of a prospective, randomized study. *J Shoulder Elbow Surg* 2004; 13 (4): 417-23.
- Werner A, Walther M, Ilg A, Stahlschmidt T, Gohlke F. Self-training versus conventional physiotherapy in subacromial impingement syndrome. *Z Orthop Ihre Grenzgeb* 2002; 140 (4): 375-80.
- Winters J C, van der Windt D A W M, Spinnewijn W E M, de Jong A C, van der Heijden G J M G, Buis P A J, Boeke A J P, Feleus A, Geraets J J X R. NHG-standaard schouderklachten. *Huisarts Wet* 2008; 51 (11): 555-65.
- Yang J L, Chen S, Hsieh C L, Lin J J. Effects and predictors of shoulder muscle massage for patients with posterior shoulder tightness. *BMC Musculoskelet Disord* 2012; 13 (1): 46.