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Physical Therapy and Surgery

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Abstract

Physical therapy and orthopedic surgery are important components in the treatment of ankylosing spondylitis (AS). Supervised physical therapy is more effective than individual or unsupervised exercise in improving symptoms, but controlled trials suggest that combined inpatient and outpatient therapy provides the greatest improvement. Recommendations for exercise are universal, but the best types and sequence of therapies are not known. Total hip replacement is the surgery most commonly performed for AS, with good long-term implant survival. Heterotopic ossification may occur no more frequently after hip replacement in patients with AS than in patients with other diseases. Corrective spinal surgery is rarely performed and requires specialized centers and experienced surgeons.

There are two main types of treatment of ankylosing spondylitis (AS): pharmacologic and non-pharmacologic. While pharmacologic therapy has improved dramatically in recent years with the advent of anti-tumor necrosis factor therapy, non-pharmacologic treatments remain an important component of comprehensive care throughout the course of AS¹. Physical therapy and orthopedic surgery are the main non-pharmacologic treatments available for AS.

Physical Therapy

A principle symptom of AS is loss of flexibility. This often causes abnormal body posture and affects spine biomechanics. Early limitation of spinal mobility has been identified as one of the most important prognostic factors in AS². Physical therapy is directed mainly at patient education and regular exercise, with the goals of preserving spinal flexibility and fitness, preventing postural deformities, and improving muscle strength, thereby, reducing pain². Rather than removing the motivation to exercise, patients treated with anti-TNF agents appear to exercise more than they did before using this medication, and feel that physical therapy is even more helpful in improving their stiffness, function, and motivation after starting treatment³.

Various types of exercise programs have been developed worldwide: individualized physical therapy, supervised group physical therapy, and unsupervised self-administered exercise⁴. A meta-analysis of 11 clinical trials indicated that a home exercise program is better than no program at all; at the same time, supervised group physical therapy is better than home exercise, and finally that combined inpatient spa-exercise therapy followed by supervised weekly group physical therapy is the most effective program available today⁵. Intensive inpatient courses have shown to be effective, but the results of outpatient programs have

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been more varied in therapeutic and educational effect⁶. Although inpatient treatment courses are common in Western Europe, they are not in other regions.

In practice, many patients often find it difficult to perform daily exercises on their own. Supervised group physical therapy is offered mainly to stimulate and motivate, as well as provide social contact with fellow patients. Also, the supervising physiotherapist can closely monitor the intensity of the exercises in order to achieve improvement. Group physical therapy usually consists of one hour of physical exercise, one hour of sport, and one hour of inpatient spa therapy⁴. Therapy in a spa provides complementary effects over self-exercise and group-exercise alone, and these effects may persist for several months. Furthermore, some evidence suggests that the cost-utility and cost-effectiveness of inpatient spa therapy are favorable compared to those of self-exercise and group-exercise alone⁶.

Although studies have tested several different physical therapy programs, the optimal exercise program for patients with AS is still not known, primarily because interventions are often poorly or incompletely described, different types of exercises and training doses are used, and the expected physiologic responses to the exercises are not defined⁵.

When recommending sports, it is advisable for patients to engage in non-contact rather than contact sports. There are no uniform exercises for all patients, and therapists can serve an important role in examining each patient individually and developing a personalized protocol⁷. The therapist can teach the patient how to move, how to rest, and which sports are appropriate (badminton, volleyball, swimming, cross-country skiing, for example) and which are not (horseback riding, football)⁴.

Individual variation in the course of AS is considerable, and an understanding of the pathophysiologic process and biomechanical principles are important factors in planning individual programs; therefore, studies that include these aspects must be evaluated². Additionally, controlled studies that compare different treatment programs would be of great value⁶. Research on physical therapy interventions in AS can be improved, including better measurement techniques, more detailed analysis of treatment programs, and better understanding of the relationships between dose and effect.

Notwithstanding the need for better knowledge of what constitutes the most effective exercise and physical therapy programs, a clinical prediction rule has been developed to identify patients with AS who are more likely to respond to an exercise program⁸. The study suggests that pain and function can be better indicators of the response to exercise than some traditionally used impairment measures such as spinal range of motion. Other clinical prediction rules have been used in the classification of patients with low-back pain, neck pain, or tension headache, and are useful in selecting a treatment protocol for each individual. Future studies are necessary to validate these prediction rules.

Although much is known regarding physical therapy and exercise, important advances are yet to be made in how best to apply these in the treatment of patients with AS. Such studies of physical therapy are urgently needed because physical therapy represents an important complement to pharmacologic treatments and helps to improve patients' physical function and emotional well-being.

Surgical Considerations

With regards to surgical intervention in AS, current Assessment of SpondyloArthritis International Society (ASAS) guidelines are based on level III evidence and expert opinion⁹. The low hierarchy of evidence for surgical intervention is attributed to the technical and ethical constraints of performing randomized, controlled trials for these procedures.

Evidence-based cross-sectional and retrospective studies are of small patient numbers, short duration, and have not included placebo arms nor stratified for disease-modifying antirheumatic or biologic therapy. Limitations of data, study design, and level of evidence persist in studies published after these guidelines.

The first component of current ASAS surgical guidelines states: “Total hip arthroplasty should be considered in patients with refractory pain or disability and radiographic evidence of structural damage, independent of age⁹.” Recent data confirm that inflammatory hip disease occurs in 25% to 50% of patients with AS, and when present, is bilateral in as many as 47% to 90%^{10, 11}. Juvenile AS patients are more likely affected (~ 2:1), as are males and those with axial disease and enthesitis^{12, 13}. A cross-sectional analysis of 2,718 AS patients from multinational registries found hip involvement to account for a differential in BASFI (Bath Ankylosing Spondylitis Functional Index) of 1.6, and was associated with cervical, shoulder and spine immobility¹⁰. Several studies continue to support improvement in function and pain relief after total hip replacement (THR)^{11, 14–18}. Survival of prostheses remains favorable with 90% at 10 years, and remains at 65% and 71% after 20 and 27 years, respectively. The failure rate of hip prostheses is approximately 1% per year, and revisions within 7 years result from aseptic loosening. Revised THR have a 20-year survival of 60%. Comparisons of cemented versus non-cemented prosthesis report failure rates of 5% and 28%, respectively¹⁶. However, non-cemented prostheses are preferred, as patients are usually young, and hence potential revisions are technically less problematic^{16, 17}.

Most studies report hip flexion contracture or complete ankylosis as indications for THR in AS. Details regarding an anti-inflammatory or degenerative etiology are lacking, and histological evaluations of specimens are not performed routinely. One retrospective study of 181 hips undergoing THR in 103 AS patients alluded to the etiology of hip disease by describing radiographic changes of protrusio acetabuli 6 in 20.4%, bony ankylosis in 23.2%, and either upper pole or concentric osteoarthritis in 42.5%¹⁸. The distinction is indeed important, as AS of the hip, unlike the osteoproliferative changes of the spine, involves erosive lesions with inflammation of subchondral bone marrow¹⁹. Further, unlike the reported, though short term, lack of efficacy of biologic therapy in disease modification of the spine in AS, there are reports of efficacy with anti-TNF agents, not only with symptoms and composite disease scores, but also of joint space narrowing of the hip in AS patients^{20, 21}. Since the approval of anti-TNF agents in AS, preliminary cohort data indicate a decrease in frequency of THR for AS²². A more precise definition of hip disease, and distinction of inflammatory vs. noninflammatory hip arthritis by improved biomarkers, particularly in those with high BASFI scores, are needed to better assess the outcomes of THR in AS patients, as well as to determine the appropriate use and efficacy of biologic agents.

A potential complication of THR in AS patients is heterotopic ossification (HO), but for which there are no ASAS guidelines. HO is reported to occur in as many as 40% of AS patients, often asymptomatic, and when moderate to severe, results in limited range of motion [Brooker class III-IV]^{11, 23}. HO consists of both cancellous and cortical bone with areas of fibrocartilage, and remodeling may continue for as long as 3 years²⁴. Contrary to older literature, AS patients appear not to be at greater risk of HO, and have similar rates as patients with diffuse idiopathic skeletal hyperostosis, Paget’s disease, unilateral hypertrophic osteoarthritis, or who have reduced preoperative limitation in hip external rotation^{25, 26}. Patients with AS considered at risk are those who need repeat surgery, develop postoperative infection, undergo a trans-trochanteric approach, or have concurrent active disease^{11, 15}. One study of 20 AS patients found HO to occur in 30%, and correlated with C-reactive protein levels²⁷. Randomized, controlled studies support nonsteroidal anti-inflammatory agents (NSAID), most often indomethacin, and radiation as efficacious for

prophylaxis, but yield inconsistent results^{28, 29}. Both options are advised perioperatively, optimally 24 to 48 hours after surgery, and at least within 5 days^{25, 29}. Cyclo-oxygenase-2-inhibitors are reportedly as effective as NSAIDs, with fewer adverse effects, though more costly^{30, 31}. A cost comparison of NSAIDs and radiation found radiation to be about 45 times more expensive, and a meta-analysis reported an incremental-cost-effectiveness ratio of approximately \$6,000 per additional case of HO prevented^{30, 32}. Although no difference in short-term side effects were reported, the rate of NSAID complications requiring treatment, as well as long-term effects, still need to be considered. Despite the evidence, it is debatable if prophylaxis of HO is cost-effective and without long-term sequelae, and whether it is indicated for all AS patients.

The second component of the 2005 ASAS surgical guidelines state “spinal surgery—for example, corrective osteotomy and stabilization—may be of value in selected patients⁹. Indications for corrective osteotomy include functional (the inability to eat or swallow), clinical (loss of horizontal gaze, abnormal chin-brow angles), or radiographic (rigid deformities). Three surgical options have been reported: open, closed, and poly-segmental osteotomy. A large series of 856 patients that utilized all 3 techniques concluded that the closed method had the fewest complications although mortality was 4%³³. Specialized support is often needed, including fiberoptic intubation, an intraoperative “wake up test,” and, when performed in the cervical region, continuous neurological monitoring, which often requires the patient to remain awake. A retrospective study of 148 patients who underwent corrective spinal surgery and survived found 88% satisfied and 60% able to return to work³⁴.

Despite improved therapies and sensitivity to the need to treat osteoporosis associated with inflammatory rheumatic disease, vertebral fractures still occur more commonly in patients with AS than in patients without AS, and are often misdiagnosed. In a case-control study of 53,108 patients with inflammatory rheumatic disease, vertebral fractures were 7.1 times more likely among those with AS³⁵. In a 7-year retrospective study of hypertrophic spine disease inclusive of DISH (diffuse idiopathic skeletal hyperostosis), vertebral fractures were most common in the cervical spine (C6–C7), neurological 8 complications occurred in 58%, and mortality in 32%³⁶. In the AS group, there was a delay in diagnosis of vertebral fractures, and patients were younger. In another retrospective study of 119 patients, more than a quarter of vertebral fractures were assessed incorrectly, one-half were preceded by trivial trauma, and spinal cord injury ensued in 60%³⁷. Mortality was 32% and correlated with age, number of comorbidities, and low-energy mechanism of injury. Controversy persists regarding the sequence of intervention when more than one kyphotic lesion exists, or where there is coexistent hip disease¹¹. Careful positioning, appropriate imaging, interpretation and referral are required for early detection and optimum outcomes of vertebral fractures.

Case series and meta-analyses confirm cauda equina to be a rare complication of AS, in which dural sac enlargement and arachnoid diverticulae lead to progressive neurological impairment^{38, 39}. Lumbo--peritoneal decompression and infliximab have both been reported to be effective treatments^{40, 41}.

References

1. Elyan M, Khan MA. Does physical therapy still have a place in the treatment of ankylosing spondylitis? *Curr Opin Rheumatol*. 2008; 20(3):282–86. [PubMed: 18388519]
2. Nghiem FT, Donohue JP. Rehabilitation in ankylosing spondylitis. *Curr Opin Rheumatol*. 2008; 20(2):203–07. [PubMed: 18349752]

3. Masiero S, Bonaldo L, Pigatto M, Lo Nigro A, Ramonda A, Punzi L. Rehabilitation treatment in patients with ankylosing spondylitis stabilized with tumor necrosis factor inhibitor therapy. A randomized controlled trial. *J Rheumatol*. 2011; 38(7):1335–42. [PubMed: 21459942]
4. van der Linden S, van Tubergen A, Hidding A. Physiotherapy interventions for ankylosing spondylitis: what is the evidence? *Clin Exp Rheumatol*. 2002; 20(Suppl28):S60–64. [PubMed: 12463449]
5. Dagfinrud H, Hagen KB, Kvien TK. Physiotherapy interventions for ankylosing spondylitis. *Cochrane Database Syst Rev*. 2008; 23(1):CD002822. [PubMed: 18254008]
6. van Tubergen A, Hidding A. Spa and exercise treatment in ankylosing spondylitis: fact or fancy? *Best Pract Res Clin Rheumatol*. 2002; 16(4):653–66. [PubMed: 12406432]
7. Viitanen JV, Suni J. Management principles of physiotherapy in ankylosing spondylitis – which treatments are effective? *Physiotherapy*. 1995; 81(6):322–29.
8. Alonso-Blanco C, Fernandez-de-las-Peñas C, Cleland JA. Preliminary clinical prediction rule for identifying patients with ankylosing spondylitis who are likely to respond to an exercise program: a pilot study. *Am J Phys Med Rehabil*. 2009; 88(6):445–54. [PubMed: 19325453]
9. Zochling J, van der Heijde D, Burgos-Vargas R, Collantes E, Davis JC Jr, et al. ASAS/EULAR recommendations for the management of ankylosing spondylitis. *Ann Rheum Dis*. 2006; 65(4):442–52. [PubMed: 16126791]
10. Vander Cruyssen B, Muñoz-Gomariz E, Font P, Mulero J, de Vlam K, Boonen A, Vazquez-Mellado J, Flores D, Vastesaeger N, Collantes E. ASPECT-REGISPONSER-RESPONDIA working group. Hip involvement in ankylosing spondylitis: epidemiology and risk factors associated with hip replacement surgery. *Rheumatology (Oxford)*. 2010; 49(1):73–81. [PubMed: 19605374]
11. Kubiak E, Moskovich R, Errico T, Di Cesare P. Orthopaedic management of ankylosing spondylitis. *J Am Acad Orthop Surg*. 2005; 13(4):267–78. [PubMed: 16112983]
12. Ibn YY, Amine B, Laatiris A, Hajjaj-Hassouni N. Gender and disease features in Moroccan patients with ankylosing spondylitis. *Clin Rheumatol*. 2011 Jul 28. [Epub ahead of print].
13. Jang JH, Ward MM, Rucker AN, Reveille JD, Davis JC Jr, Weisman MH, Leach TJ. Ankylosing spondylitis: patterns of radiographic involvement--a re-examination of accepted principles in a cohort of 769 patients. *Radiology*. 2011; 258(1):192–98. [PubMed: 20971774]
14. Sweeney S, Gupta R, Taylor G, Calin A. Total hip arthroplasty in ankylosing spondylitis: outcome in 340 patients. *J Rheumatol*. 2001; 28(8):1862–66. [PubMed: 11508591]
15. Brinker MR, Rosenberg AG, Kull L, Cox DD. Primary noncemented total hip arthroplasty in patients with ankylosing spondylitis: clinical and radiographic results at an average follow-up period of 6 years. *J Arthroplasty*. 1996; 11(7):802–812. [PubMed: 8934320]
16. Tang WM, Chiu KY. Primary total hip arthroplasty in patients with ankylosing spondylitis. *J Arthroplasty*. 2000; 15(1):52–58. [PubMed: 10654462]
17. Sochart DH, Porter ML. Long-term results of total hip replacement in young patients who had ankylosing spondylitis: eighteen to thirty-year results with survivorship analysis. *J Bone Joint Surg Am*. 1997; 79(8):1181–89. [PubMed: 9278078]
18. Joshi AB, Markovic I, Hardinge K, Murphy JC. Total hip arthroplasty in ankylosing spondylitis: an analysis of 1. 81 hips. *J Arthroplasty*. 2002; 17(4):427–33. [PubMed: 12066271]
19. Appel H, Kuhne M, Spiekermann S, et al. Immunohistochemical analysis of hip arthritis in ankylosing spondylitis: evaluation of the bone-cartilage interface and subchondral bone marrow. *Arthritis Rheum*. 2006; 54(6):1805–13. [PubMed: 16736521]
20. Verbruggen G. Chondroprotective drugs in degenerative joint diseases. *Rheumatology*. 2006; 45(2):129–38. [PubMed: 16278282]
21. Lian F, Yang X, Liang L, Xu H, Zhan Z, Qiu Q, Ye Y. Treatment efficacy of etanercept and MTX combination therapy for ankylosing spondylitis hip joint lesion in Chinese population. *Rheumatol Int*. 2011 Mar 9. [Epub ahead of print].
22. Baraliakos X, Braun J. Hip involvement in ankylosing spondylitis: What is the verdict? *Rheumatology (Oxford)*. 2010; 49(1):3–4. [PubMed: 19755506]

23. Brooker, Al; Bowerman, JW.; Robinson, RA.; Riley, LH, Jr. Ectopic ossification following total hip replacement: incidence and a method of classification. *J Bone Joint Surg Am.* 1973; 55(8): 1629–32. [PubMed: 4217797]
24. Isaacson BM, Brown AA, Brunner LB, Higgins TF, Bloebaum RD. Clarifying the structure and bone mineral content of heterotopic ossification. *J Surg Res.* 2011; 167(2):e163–70. [PubMed: 21392799]
25. Iorio R, Healy W. Heterotopic ossification after hip and knee arthroplasty: risk factors, prevention, and treatment. *J Am Acad Orthop Surg.* 2002; 10(6):409–16. [PubMed: 12470043]
26. Schwarzkopf R, Cohn RM, Skoda EC, Walsh M, Jaffe F. The predictive power of preoperative hip range of motion for the development of heterotopic ossification. *Orthopedics.* 2011; 34(3):169. [PubMed: 21410126]
27. Tani Y, Nishioka J, Inoue K, Hukuda S, Tsujimoto M. Relation between ectopic ossification after total hip arthroplasty and activity of general inflammation in patients with ankylosing spondylitis. *Ann Rheum Dis.* 1998; 57(10):634. [PubMed: 9893577]
28. Pakos E, Ioannidis J. Radiotherapy vs. nonsteroidal anti-inflammatory drugs for the prevention of heterotopic ossification after major hip procedures: a meta-analysis of randomized trials. *Int J Radiat Oncol Biol Phys.* 2004; 60(3):888–95. [PubMed: 15465207]
29. Hashem R, Tanzer M, Rene N, Evans M, Souhami L. Postoperative radiation therapy after hip replacement in high-risk patients for development of heterotopic bone formation. *Cancer Radiother.* 2011; 15(4):261–4. [PubMed: 21292525]
30. Vavken P, Castellani L, Sculco T. Prophylaxis of heterotopic ossification of the hip: systematic review and meta-analysis. *Clin Orthop Relat Res.* 2009; 467(12):3283–89. [PubMed: 19517202]
31. Vasileiadis GI, Sioutis IC, Mavrogenis AF, Vlasik K, Babis GC, Papagelopoulos PJ. COX-2 inhibitors for the prevention of heterotopic ossification after THA. *Orthopedics.* 2011; 34(6):467–72. [PubMed: 21661680]
32. Strauss JB, Chen S, Shah AP, Coon AB, Dickler A. Cost of radiotherapy versus NSAID administration for prevention of heterotopic ossification after total hip arthroplasty. *Int J Radiat Oncol Biol Phys.* 2008; 71(5):1460–64. [PubMed: 18234435]
33. Van Royen BJ, De Gast A. Lumbar osteotomy for correction of thoracolumbar kyphotic deformity in ankylosing spondylitis: a structured review of three methods of treatment. *Ann Rheum Dis.* 1999; 58(7):399–406. [PubMed: 10381482]
34. Halm H, Metz-Stavenhagen P, Zielke K. Results of surgical correction of kyphotic deformities of the spine in ankylosing spondylitis on the basis of the modified arthritis impact measurement scales. *Spine.* 1995; 20(14):1612–19. [PubMed: 7570177]
35. Weiss RJ, Wick MS, Ackermann PW, Montgomery SM. Increased fracture risk in patients with rheumatic disorders and other inflammatory diseases — a case-control study with 53,108 patients with fracture. *J Rheumatol.* 2010; 37(11):2247–50. [PubMed: 20889599]
36. Caron T, Bransford R, Nguyen Q, Agel J, Chapman J, Bellabarba C. Spine fractures in patients with ankylosing spinal disorders. *Spine.* 2010; 35(11):e458–64. [PubMed: 20421858]
37. Backhaus M, Citak M, Källicke T, Sobottke R, Russe O, Meindl R, Muhr G, Frangen TM. Spine fractures in patients with ankylosing spondylitis: an analysis of 129 fractures after surgical treatment. *Orthopade.* 2011; 49(10):917–20. 922–24. [PubMed: 21688056]
38. Ahn NA, Ahn MU, Nallamshetty L, Springer BD, Buchowski JM, Funches L, Garrett JP, Kostuik ES, Kebaish KM, Sponseller PD. Cauda equina syndrome in ankylosing spondylitis (the CES-AS Syndrome): meta-analysis of outcomes after medical and surgical treatments. *J Spinal Disord.* 2001; 14(5):427–43. [PubMed: 11586143]
39. Liu CC, Lin YC, Lo CP, Chang TP. Cauda equina syndrome and dural ectasia: rare manifestations in chronic ankylosing spondylitis. *Br J Radiol.* 2011; 84(1002):e123–5. [PubMed: 21606066]
40. Ea HK, Lioté F, Lot G, Bardin T. Cauda equina syndrome in ankylosing spondylitis: successful treatment with lumboperitoneal shunting. *Spine.* 2010; 35(24):e1423–9. [PubMed: 21030893]
41. Cornec D, Devauchelle Pensec V, Joulin SJ, Saraux A. Dramatic efficacy of infliximab in cauda equina syndrome complicating ankylosing spondylitis. *Arthritis Rheum.* 2009; 60(6):1657–60. [PubMed: 19479855]