Surgical Interventions for Ankylosing Spondylitis

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Introduction

Ankylosing spondylitis is an inflammatory condition of the spine usually starting in young adulthood. The predominant symptom is pain, later followed by stiffness. The sacro-iliac joints and the spine are most commonly affected but the peripheral joints may also be involved. In the study of 100 patients, Ho et al found peripheral joint involvement in 58 patients, the most common being the hips and knees.1

As the spine is concerned, there are three aspects in ankylosing spondylitis that are of particular surgical interest. They are severe kyphosis deformity, pseudarthrosis and spinal fractures. For the peripheral joints, total hip arthroplasty has become a well established treatment for patients with significant hip involvements.

Kyphosis in Ankylosing Spondylitis

Kyphosis may affect the cervical and thoracic spine. The kyphotic posture put the spine in mechanical disadvantage. Owing to the increased level arm, more force is required to maintain the up-right posture which makes patients tiring in walking and standing (Fig 1). Sagittal mal-alignment together with the stiff spine also impairs the visual angles of the patients; making them difficult to look forward on standing and walking. In order to maintain a good forward visual arc, patients need to flex their knees, thus resulting in a very tiring posture (Fig 2) the severe kyphosis may also cause difficulty in sitting, feeding, sleeping, impair diaphragmatic breathing, and psycho-social function. Surgical interventions should be considered in patients with severe fixed kyphosis that causes significant symptoms or disabilities.

Three types of extension osteotomies have been described to correct kyphosis in ankylosing spondylitis, namely Smith Peterson opening wedge osteotomy (Fig 3), Thomason closing wedge osteotomy (Fig 4) and poly-segmental dorsal wedge osteotomy (Fig 5). For thoraco-lumbar kyphosis, the osteotomy is usually at the lumbar spine for lesser chance of neurological complications and more effective in correcting the sagittal mal-alignment compared with osteotomy at thoracic levels2 (Fig 6). For cervical or cervico-thoracic kyphosis, the osteotomy is usually at cervico-thoracic junction to correct the gaze angle and maintain the sagittal alignment of the spine 3 (Fig 7) Kim et al prospectively studied 45 patients having received extension osteotomies for kyphosis in ankylosing spondylitis, there were significant improvements in sagittal balance of the spine, gaze angle, overall function, indoor activities levels, outdoor activities levels and back pain after the operation. 4 Van Royen et al reviewed 856 patients underwent extension osteotomy for kyphosis and ankylosing spondylitis in 41 published articles. The overall neurological complication was two to three percents. Four patients had aortic rupture and ended up with mortality. All aortic ruptures happened in the Smith-Peterson opening wedge osteotomy group and the ruptures were attributed to the opening up of the anterior column as the aorta is just lying in front of the thoraco-lumbar spine, suggesting this method is less safe compared with the other two methods.5

Spinal Pseudarthrosis in Ankylosing Spondylitis

This condition was first described by Romanus and Yden in 1953. It appears as disco-vertebral destructive lesions commonly in thoraco-lumbar junction in patients with ankylosing spondylitis (Fig 8). Initially it was thought to be caused by inflammation or infection of the spine. Fang et al did en-block excision of the lesions in 35 patients for histopathological analysis. They showed that the lesions were fibrous tissue and/or fibrocartilage showing fibrinoid necrosis and cystic degeneration characteristic of pseudarthrosis.6 there are three possible causes for formation of the pseudarthrosis. Firstly, the segment in question may have escaped fusion while other levels became ossified. The process of spinal ossification in ankylosing spondylitis is multifocal and not contiguous, so this process may leave short mobile segments between long ankylosed segments. This set the scene for high stress and mechanical failure. Secondly, there is a distinct possibility of an acute fracture through an already fused segment which ended up with non-union. Thirdly, the mechanics of a stiff kyphotic spine result in high stresses, especially near the thoraco-lumbar junction. Repeated stress may lead to fatigue fracture as in stress fractures of long bones. Both acute or stress fractures are predisposed to non-union by the long level arm of the kyphotic ankylosed spine.

Not all pseudarthrosis are symptomatic. In patients whose lesions are painful, the pattern of pain may vary. A patient with ankylosing spondylitis may present initially with increasing pain and stiffness for a number of years, and subsequently there is gradual decrease of the amount of pain. A recent increase in pain or the pain
becomes more acute and perhaps more localised, may suggest the development of pseudarthrosis. The second pattern is noted in patients whose disease has already burnt out so that there is no pain, but with residual stiffness and deformity associated with a tiring posture. The pain, which can recur, may be localised or more acute. This also suggests development of pseudarthrosis. Healing of the pseudarthrosis may rarely occur with plaster cast or spinal brace immobilisation or without any treatment. The indication for surgical treatment is persistent and significant pain not responding to conservative treatment. Another indication although uncommon, is the presence of neurological symptoms. Fang et al reported 18 lesions in 16 patients who underwent anterior spinal fusion. Solid fusion was achieved in 16 lesions. 15 patients had well to complete relief of the back pain.7

Spinal fracture in ankylosing spondylitis.

Advanced ankylosing spondylitis creates a kyphotic, stiff and brittle spine that is prompt to fracture. Most of the spinal fractures involve three spinal columns predisposing them to displacement and neurological complications. Surgical stabilisation is usually indicated to prevent neurological complications and allow early mobilisation and rehabilitation. (Fig 9)

Hairline fractures can result in a patient with extensive ossification of the spine. The fracture may occur as a result of a fall or with very minor injury. In the process of trying to break the fall, there is sudden and strong contraction of paraspinal muscles resulting in a fracture. Hairline fractures commonly occur at the cervicothoracic junction. Plain x-ray may not reveal the fracture line. Clinical suspicion together with marked tenderness may alert the physician to such a problem. MRI and CT scan are more sensitive in diagnosing the condition (Fig 10). Despite the fracture is undisplaced, it is unstable and may result in neurological injury if left untreated. Surgical fixation is generally recommended in this condition.8

Ankylosing spondylitis with hip involvement.

Apart from the spine, ankylosing may also involve the hips. Total hip replacement is a well established treatment for ankylosing spondylitis patients with severe hip involvements. (Fig 11) The indications for surgery include significant hip pain, stiffness and flexion deformity that cause limitations in functions. Tang et al reported 96 total hip replacements in 56 ankylosing spondylitis patients, majority patients had good to excellent results.9 Joshi et al reported 181 total hip arthroplasty in 103 patients with ankylosing spondylitis. Ninety-six percent patients had minimal or no hip pain and seventy percent of patient had well to excellent function after surgery.10

Conclusion

Surgical interventions are indicated in some patients suffering from ankylosing spondylitis. The indications for surgery include: Firstly, severe kyphotic deformity, which corrective spinal osteotomy can improve function and decrease back pain. Secondly, patients with spinal pseudarthrosis and back pain which failed conservative treatment, spinal fusion can achieve bone union and decrease back pain in majority of patients with this condition. Thirdly, patients with spinal fractures, surgical stabilisation can prevent neurological injury and allow early mobilisation and rehabilitation. Fourthly, for patients with severe hip involvements, total hip arthroplasty can decrease hip pain and improve function.
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