CASE REPORT

Multilevel spinal osteotomy in ankylosing spondylitis – case report

Wielopoziomowa osteotomia kręgosłupa u pacjenta z ZZSK – opis przypadku

Marcin Niedźwiecki¹, Artur Makowski¹, Tomasz Niedźwiecki¹, Damian Deresiewicz¹, Roman Grzybowski¹, Kajetan Łątka²
¹ Clinical Department of Trauma, Orthopaedic and Spine Surgery, Provincial Specialist Hospital in Olsztyn, Poland
² Department of Neurosurgery, University Hospital in Opole, Poland

Abstract

Ankylosing spondylitis (AS, Bechterew’s Disease) is a chronic inflammatory disease of the spine of unknown etiology. One of its consequences is the progressive deformity of the spine. The resulting spinal imbalance results in falls and fractures. Surgical treatment of fixed deformities consists in reconstructing the spine balance through osteotomies of the spine with its stiffening in a corrective position. The following paper presents the case of a patient with total hyperkyphosis in the course of AS, traumatic PTK, and global sagittal imbalance, subjected to two-stage surgical treatment of spinal deformities with the use of three-column osteotomies in the cervical and lumbar spine sections.

Key words: spinal osteotomy, ankylosing spondylitis, sagittal balance

Streszczenie

Zesztywniające zapalenie stawów kręgosłupa (ZZSK, Choroba Bechterewa) to przewlekła zapalna choroba kręgosłupa o nieznanej etiologii. Jednym z jej następstw jest postępująca deformacja kifotyczna kręgosłupa. Tak powstałe zaburzenia balansu strzałkowego kręgosłupa prowadzą w do upadków pacjenta i złamań. Leczenie operacyjne utworzonych deformacji polega na odtworzeniu balansu kręgosłupa poprzez osteotomie kręgosłupa z jego usztywnieniem w korekcyjnym ustawieniu. W poniższej pracy przedstawiamy przypadek pacjenta z totalną hiperkifozą w przebiegu ZZSK, urazową PTK (post-traumatic kyphosis), oraz globalnym zaburzeniem balansu strzałkowego, poddanego dwuetapowemu leczeniu operacyjnemu deformacji kręgosłupa z użyciem osteotomii trójkolumnowych w odcinku szyjnym i lędźwiowym.

Słowa kluczowe: osteotomie kręgosłupa, ZZSK, balans kręgosłupa

Author’s address: Marcin Niedźwiecki, 1 Maja 5a/59, 10-117 Olsztyn, Poland, phone: +48 606330407, e-mail: marcintytus@gmail.com
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Introduction

Ankylosing spondylitis (AS, Bechterew’s Disease) is a chronic inflammatory disease of the spine of unknown etiology. The first symptoms usually begin before the age of 40, with male domination [1]. The disease progresses slowly, creating bone connections between the vertebrae called “syndesophophites”. This reduces the mobility of the spine movement segments [2], resulting in complete spine stiffening (“bamboo stick”) limiting its support and movement function [3]. This results in chronic pain and disability [4]. Due to the slow progression of the disease and nonspecific symptoms, the time between the onset of the disease and the diagnosis is on average about 8-10 years [5].

Currently, the best treatment results are early diagnosis and pharmacological treatment with a group of biological drugs blocking TNF-alpha [6] and preventing the permanent deformation of the axial skeleton.

Disorders of spinal sagittal balance, through the stiffening of the spine in hyperkyphotic position, lead to difficulties in walking, hindering professional work, withdrawal from social life, body balance disorders, loss of horizon vision, and, as a result, causing fractures [7]. Spine fractures in ZZSK have a characteristic pattern – a “piece of chalk” fracture [8]. The surgical treatment of spine fractures in Bechterew’s disease is the treatment of choice.

Surgical treatment of fixed deformities consists in reconstructing sagittal and frontal balance of the spine through osteotomies of the spine and stiffening in corrective position [9,10].

Aim

The aim of the work is to present a clinical case of a patient with AS with typical for advanced disease changes, with traumatic deformity of the cervical spine [11], preventing daily functioning and professional work.

Materials and methods

A 55-year-old patient was admitted to the Department in June 2016. At the age of 16, the patient was diagnosed with AS, with the progression of spinal deformities from 25 years of age. In July 2015, he underwent a traumatic “chalk” fracture of the C7 / Th1. At that time, he was treated in another department with C6-Th1 in-situ stabilization in lateral masses, unfortunately, in the hyperkyphotic alignment at the fracture level. This has worsened the already much positive global balance of the spine.

The main symptoms of the patient are: lack of vision of the horizon in a standing position, limitation of locomotion (total hyperkyphosis, chin in constant contact with the sternum), neck and low back pain, impossibility of continuing work (lawyer), suicidal thoughts (figure 1 patient at admission.) paresis of the right upper limb from the C6 and C7 roots.

During the diagnostic process and surgical qualification, X-ray pictures were taken in both projections of the spine segments: cervical, thoracic, lumbar, whole body images [12], CT scan of the entire spine and MRI. (Fig. 2-6) Radiological measurements were made [13] (Fig. 7 and 8).

The tactics of surgical treatment [14] was planned: in the first stage L3 PSO [15] (Pedicle Subtraction Osteotomy) with the maximum possible correction. The multi-level Smith-Petersen osteotomy was considered impossible [16] due to the complete ossification of both columns of the spine. In the second stage, the C7 PSO type “open-wedge” is planned with the maximum possible correction [17].
The first stage and its potential problems: difficult intubation, placing the patient on the table. Success was achieved with the third fiberoptic intubation approach. Placing the patient on shafts on the operating table (Figs 9 and 10). During the operation, neuromonitoring (SEP, MEP), control of osteotomy under the C-arm, screws placement using the “free-hand” technique were used.
The treatment was carried out with the Redux Medtronic system (Figure 11 – state after the PSO osteotomy has been closed). A three-column wedge L3 osteotomy with L1-L5 stiffening was performed. Intraoperatively, there were no complications – proper implant placement, stable immobilization, and PSO correction of 40 degrees were obtained (Fig. 12). Due to the deformation of the cervical spine, tracheotomy could not be performed post-operatively. For this reason, the patient was not extubated after surgery, and he went to the ICU in anticipation of the second stage of surgical treatment.

The second stage of treatment was performed after 2 weeks for life indications. According to the plan, the C7 PSO "open-wedge" was to be performed at the level of PTK (post-traumatic kyphosis) [18].

Potential problems of the second stage: laying the patient on the operating table (Fig. 13 and 14), location of the osteotomy site (due to the shadow of the shoulders in the lateral picture, correct visualization of the C6-Th2 level were impossible), high risk of vascular complications (vertebral arteries). Intraoperatively, massive bleeding occurred – suspected right-sided damage to the vertebral artery. After fast control of bleeding with Flossil, the operation was continued without any other complications. (Fig. 15 after closing osteotomy). After the osteotomy, the spine was stiffened in the C0-Th4 range using Vertex and Legacy Medtronic systems. The SEPs and MEPs were normal during and after the procedure.
A correction of 27 degrees was achieved with 4 mm translation at the level of osteotomy (Fig. 16 and 17). Intraoperatively, the osteotomy level was incorrectly determined: it was done at C6 level. The patient returned to the ICU without awakening. In the postoperative study: anisocoria, tetraparesis (Frankel B). He remained in ICU.

![Fig. 15. Closed cervical "open-wedge" PSO.](image)

**Fig. 15. Closed cervical "open-wedge" PSO.**

**Fig. 16. and 17. Post-op cervical measurements.**

**Results**

The sagittal balance has been completely corrected by 67 degrees [19]. In angio-CT control: no inflow in both vertebral arteries at the osteotomy level, good retrograde influx, Willis’ arterial circle completely efficient. In MRI control: large artifacts due to the presence of titanium implants, suspicion of ischemic changes in the spinal cord from C4 to C7 / Th1 (Fig. 18).

During hospitalization in the ICU, the patient developed pneumonia, sepsis, multi-organ failure, surgical site infection, and cachexia. During his stay he was repeatedly examined neurologically. After a month of ICU stay, the patient was in good condition and was transferred to the Department of Trauma and Orthopedic Surgery. The patient was circulatory and respiratory stable. He had a tetraparesis from C5 level, massive paresis of the right upper limb, in the remaining limbs of Lovett 2 grade. The logical contact was normal, speech disorders occurred. He was not walking. Decubitus II degree on heels and sacrum. After the education of the family and the patient regarding post-operative rehabilitation, management and nutrition, he was transferred to the Department of Neurological Rehabilitation at the Hospital in Bartoszyce.

After 3 months of stay, a significant frame of the patient's condition was obtained and he was discharged home. In the follow-up examination after 9 months the picture was as

**Fig. 18. Cervical MRI: suspicion of ischemic changes in the spinal cord from C4 to C7 / Th1.**

**Fig. 19. Lumbar osteotomy fusion.**
follows: a significant degree of patient satisfaction with the treatment performed. Independent functioning and walking without crutches and orthosis. Independent car driving. He returned to active work as a lawyer. Fusion at the level of both osteotomies without loss of correction. The paresis of the right upper limb is maintained in the same way as before the operation. He reports minor pain of the spine (Fig. 19-22).

Fig. 20. Cervical osteotomy fusion.
Fig. 21. Patient walking.
Fig. 22. Follow-up after 9 months: standing pictures.

Discussion and Conclusions

The surgical treatment of advanced, complicated deformities in the course of AS is difficult, multistage and long-lasting. The above case shows the difficulties and potential risks associated with surgical treatment of advanced deformities in patients with AS. Surgical treatment is the only way to treat this type of spinal deformities [20]. Three-column spinal osteotomies, PSO [21], and especially the open-wedge PSO of the cervical spine, require a lot of both experience and skills of the surgeon and the surgical team. Another possible method of surgical treatment, as an alternative to the subtraction osteotomy in the lumbar region [22], is Corner Osteotomy technique according to Berjano [23].

Patient qualification should be precise and meticulous, preceded by an exhaustive conversation about the risk of such treatment. Such operations, as a planned multi-stage treatment [24] should take place in centers with the highest referentiality and experience in advanced spinal surgery. To avoid and minimize complications, it should be used for this type of intraoperative CT procedures with navigation and neuromonitoring. With the success of treatment, as in this case, the quality of life of patients is significantly improved [25].

References