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OPEN OPERATING THEATRE (OOT)

Correction of kyphoscoliosis

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Keywords Post irradiation spinal deformity · Kyphoscoliosis · Post actinic paravertebral and abdominal muscle atrophy · Secondary lipomatosis · Adult secondary deformity · Adult scoliosis due to poor muscle resources

Learning targets

- To understand a complex secondary deformity in a patient post irradiation due to Hodgkin lymphoma with destruction of the paravertebral and abdominal muscles and replacement with scar tissue and lipomatosis.
- To understand the character of a progressive adult degenerative scoliosis and its indication for surgery. Progressive kyphosis in flexion between spine and pelvis on one side and legs on the other side, evaluation of the hip extensors as the counterforce to maintain a straight spine when the spine is corrected and aligned with the pelvis.
- Learning how to use instrumentation in a combination of severe deformity and osteoporosis.

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Introduction

This patient was presented to us with a severe deformity, following massive irradiation because of a Morbus Hodgkin in the years 1981 and 1982. This is an exceptional case of a patient, which is walking mainly flexed and looking down at the floor because the scar formation of the abdominal wall basically pulls the patient forward in a flexed position between trunk and pelvis. This patient has significant risk factors, locally due to osteoporosis and generally due to a status after thromboembolic disease and lung embolism in 1986 and 1988 and therefore anticoagulation since then. This case should demonstrate the careful preparation to avoid any possibly unforeseen complications during surgery.

Case description

The patient is a 58-year-old lady who suffered from a severe Morbus Hodgkin in 1981 and 1982, at this time chemotherapy as well as severe irradiation of the pelvis and the trunk to basically destroy all the lymph nodules paravertebral and in the inguina. Following this treatment, the patient also developed a severe thromboembolic disease with embolism to the lungs in 1986 and again in 1988. For this reason, the patient is under permanent anticoagulation.

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When the patient presented herself, she could walk with canes to support her trunk, which is completely flexed in relation to the pelvis. The patient needs to have a massive hyperextension of the neck to see forward. If not hyperextended in the neck, the patient looks at the ground. This patient can be straightened out by lying on a bed and in hyperextension, so it seems that the problem is between the pelvis and the trunk respectively the lumbar and thoracic spine. The patient is able to extend the hips due to strong gluteal muscles. The kyphosis with bending forward is about 80° and the patient can only erect herself with support. Following chemotherapy, the patient also developed a significant osteoporosis.

In this context, the patient has been treated with kyphoplasties from T12 to L5 to avoid further collapse of these vertebrae and further progression of the curve. This treatment has been done in another hospital. This quite significant cement augmentation of the vertebrae prevents us to consider a trans-pedicular subtraction osteotomy. This patient would need an osteotomy of about 30° to correct the lumbar spine and to help her to erect herself over the pelvis. Considering this situation, the patient is planned to get three Smith–Petersen osteotomies to correct the 30°. Concerning the thromboembolic disease, it has been evaluated with the vascular surgeons and vascular specialists whether we should set a cava to prevent spreading of thromboembolic material, which they did not recommend to do. To get a reasonable correction, a fixation from T10 to the pelvis is necessary and it will most probably be necessary to augment the adjacent vertebra at the cranial end to prevent secondary fracture due to osteoporosis.

This is a high-risk intervention, which has been extensively discussed with the patient, who finally decided to take this risk.

Surgical procedure

The patient is in prone position under neuro-monitoring control. Cell saving, step-by-step preparation of the spine, starting at T10. Exposure of T10, T11, T12 and L1 and positioning of screws. The screws have to be directed in a way that they can get bypassed to the cement in the vertebral bodies. All the screws have good bony purchase. The screws are checked with the image intensifier. Then this part of the spine is packed and the incision is continued caudally with exposure of the vertebrae L2, L3 and L4. Also here careful opening of the pedicles, partially under image intensifier, and insertion of the screws, which all have good purchase. In the lower part, i.e. from L2 to L3 downwards, the muscles are basically replaced by fat tissue. The skin incision is now extended into the sacrum and L5 is exposed as well as the iliac crests. Screws are inserted into the iliac crests and in L5 and augmented with cement.

Secondary, also the screws in T11 and T12 are augmented with cement. Finally, the Smith-Petersen osteotomies are performed at the level T12/L1, L1/L2 as well as L4/L5, partially at the level L3/L4. Partially, after prebending the rods, insertion of them into the screws and now step-by-step reduction by pulling the screws to the preformed rods. The screws are then compressed against each other by creating a tension banding posteriorly and therefore closing the wedges of the Smith–Petersen osteotomies and aligning the spine in lordosis.

At the end, there is a significant fusion combined with autologous bone taken locally from the spine as well as allogenic bone from femoral heads. The fusion is performed from T10 to the sacrum.

At the end of the surgery, a vertebroplasty is performed through a separate percutaneous insertion of the working tubes into T9. The cement injection is a prophylactic enhancement of the vertebral body to avoid a fatigue fracture of the adjacent vertebrae above the rigid fixation.

Postoperative information

The patient is postoperatively neurologically intact. No adverse events during neuro-monitoring. The patient is mobilized on the first day after the surgery into sitting position on the boarder of the bed, then gradual mobilized with the Eulenburg support and then with crutches. The patient has been set under coagulation again.

She has been instructed for isometric exercises for the abdominal and paravertebral muscles (little left due to the scar formation and lipomatosis). The rehabilitation starts after 10 days and is done in a specialized rehab centre in our hospital for spine patients with mobilization in the water. She made significant progress and after discharge, the patient can walk without crutches.

Discussion and conclusion

This patient demonstrates a rare complication of intensive irradiation of the lymph nodules along the lumbar spine and in the pelvis in the context of a Hodgkin lymphoma. Since this irradiation was many years ago, the focusing of the irradiation power was not just on the lymph nodules, but it created a lot of collateral damage, like destruction of the abdominal muscles as well as partially of the paravertebral muscles. The destruction of the abdominal muscles leads to scar formation and over the years, this scar formation with the lack of paravertebral muscles, due to replacement with fat tissue, results in an increasing

kyphosis respectively leaning forward of the patient with a significantly disturbed sagittal balance [1], since there are no muscles to maintain the balance. Through preoperative evaluation of the possible correction of this curve respectively kyphosis, which is combined with scoliosis, it became obvious that through correction of the lumbar spine and the thoracolumbar junction and the fixation to the pelvis, the patient could with a high probability be straightened out.

There were several additional problems which made the whole surgery complicated:

1. The fact that this patient had kyphoplasties or vertebroplasties in all lumbar vertebrae, which blocked the vertebral body to do reduction osteotomies and making the placement of screws through the pedicles difficult.
2. Significant osteoporosis.
3. A history of severe thromboembolism with permanent anticoagulation. Instead of doing a subtraction osteotomy trans-pedicular, which is very difficult with the cement in the vertebral body, three Smith–Petersen osteotomies have been done which led to about 35° correction of the lumbar kyphosis.

After surgery the patient is much better balanced. Clinically and radiologically the balance is marginal, i.e. more lordosis would probably have been beneficial. This patient needs a good training of the remaining muscle strength and specifically of the hip extensors to maintain her position. From the curve structure, the only fixation, which makes sense, is from the lower thoracic spine into the pelvis. There is of course a certain risk that the vertebrae above may fracture due to the osteoporosis. At least the transition from the rigid fixation to the non-instrumented spine has been addressed with an augmentation of this adjacent vertebra T9.

Conflict of interest None.

Reference

1. Le Huec JC, Roussouly P (2011) Sagittal balance of the spine: consequences for the treatment of the degenerative spine. Eur Spine J, 20 Suppl 5