Mediastinal migration of distal occipito-thoracic instrumentation

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Abstract We present the occurrence and management of mediastinal migration of the distal aspect of a posterior occipito-thoracic screw–rod construct. No similar occurrence was found in the literature. This event occurred following an emergency tracheotomy (requiring neck hyperextension) in a patient with severe rheumatoid arthritis, who had previously undergone decompression and an Occiput-T2 instrumented fusion for cranio-cervical and sub-axial cervical spine instability. Imaging showed fracture-subluxation of T1/2 and T2/3 with the bilateral C7, T1 and T2 screws in the mediastinum causing tracheal and esophageal compression. Removal of the instrumentation, decompression (T2 corpectomy) and construct revision down to T10 was safely performed from a posterior approach. Severe osteoporosis, some pre-existing screw loosening and hyperextension of the neck were the predisposing factors of this near catastrophic event. By staying directly posterior to the rod and following the fibrous tract already created, the instrumentation was safely removed from the mediastinum.

Keywords Cervical spine · Complication · Spinal instrumentation · Rheumatoid arthritis

Introduction

Occipital to upper thoracic fusion (OTF) is a well-described and accepted procedure for stabilizing the craniocervical junction and cervical spine in patients with rheumatoid arthritis (RA) [1–3, 6–8, 11]. We report a case where the lower end of the OTF migrated into the mediastinum. The predisposing factors, imaging findings and management are discussed. This occurrence has not been previously reported in the english literature.

Case report

Presentation

A 50-year-old female with severe RA, initially presented to our institution 2 years previously with gross cranio-cervical and sub-axial instability causing myelopathy-quadruparesis (Ranawat IIIB). Decompression and an Occiput-T2 instrumented fusion was performed. The patient previously had numerous operations secondary to destructive arthropathy of the upper and lower extremity. Post-operatively, the patient regained the ability to independently transfer and stand, but remained non-ambulatory. However, despite of repeated counseling not to do so, the patient predominantly used her truncal muscles to move the torso and/or head and neck, which resulted in jerking movements of the cervico-thoracic junction. Post-operative imaging at 1 year demonstrated asymptomatic screw loosening at C7, T1 and T2. Eighteen months following OTF, the patient developed acute airway obstruction (due to destructive changes in the upper airway) for which an emergency tracheotomy was performed. This was followed by bilateral hand

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weakness, dysphagia, upper thoracic pain and lateral tilt of the head and neck. After 2 months of progressive symptoms, the patient was sent to our institution for evaluation.

Investigations (Figs. 1, 2, 3, 4, 5)

Investigations showed a kyphotic deformity (62° from T1–T3) at the cervicothoracic junction with cord compression and fracture-subluxation at C7/T1, T1/T2, and T2/T3, with maximal collapse of T2 vertebral body. There was anterior cut-out of the C7–T2 screws and rods into the mediastinum. A screw on the left side compressed the trachea. A barium swallow study suggested the left C7 screw was indenting, but not perforating the esophagus. Bronchoscopy confirmed non-occlusive compression of the posterior tracheal wall. CT angiography ruled out great vessels involvement.

Management

Thoracic surgery and Otolaryngology were consulted to review the case and provide assistance if required. Halo-traction applied for 3 days (due to increased pain only 25 pounds was tolerated) corrected her coronal plane deformity, but did not change the sagittal spinal and instrumentation alignment.

Operative management was performed with the patient in traction from a posterior approach as follows:

- To maximize fixation into osteoporotic bone and to avoid ending the construct at the apex of the normal thoracic kyphosis pedicle screws were placed from T4–T10. Placement of the fixation at the beginning of the procedure enables rapid definitive stabilization in the event that the procedure had to be abandoned due to mediastinal airway or bleeding difficulties.
- Safe dissection into the mediastinum was facilitated by staying on the posterior aspect of the instrumentation within the tract created by the anterior migration of the construct (Fig. 6).
- Once the distal screw heads were completely accessible, the screw heads were firmly held to prevent toggling and possible injury to adjacent soft tissue or screw migration and the locking nuts were sequentially removed. The rods and screws were then easily delivered. Assessment for an air leak was performed by filling the wound with saline and performing a Valsalva maneuver.
- Circumferential spinal cord decompression was then performed by multilevel laminectomies and a complete T2 corpectomy from a bilateral posterolateral approach. The T2 defect was reconstructed with a tri-corticated iliac crest allograft (Fig. 7).
- The C2 pars and C3–C5 lateral mass screws were revised to larger screws. Contoured rods were fitted from occipito-cervical (3.0 mm rod) and thoracic (5.5 mm rod) regions and connected with an end-to-end connector (Summit Occipito-Cervical System and ExpEDIUM Thoracolumbar System, Depuy Spine Inc., Raynham, MA, USA) (Fig. 8).

Fig. 1 **a** Right parasagittal CT reconstructions show the right lower screw related to the apical lung pleura. **b** Sagittal CT reconstruction shows the left lower screw indenting the trachea, near the

tracheotomy tube. Anterolisthesis is demonstrated at C7/T1 and T1/T2, and retrolisthesis of T2/T3. The loss of T2 body height and kyphosis are clearly seen

Fig. 2 **a** Coronal CT reconstruction shows the lower three screws on either side with rods in the superior mediastinum. The lower screw on the right is closely related to the apical lung pleura. **b** Coronal CT reconstruction shows the track of the implant traversing through and destroying the superior part of T2 and left lateral T1 vertebral bodies, and left C7 lateral mass

Fig. 3 Axial CT at T3 level showing the location of reconstruction planes for 1a, 1b, 2a and 2b

- Allograft and local decompression autograft was used to facilitate fusion from C7 to T10 (O–C7 was already fused).
- Blood loss was approximately 1,500 ml. Post-operatively a Halo-Vest was applied and no complications have occurred.
- Repeat bronchoscopy and barium swallow, on post-operative day 3, did not demonstrate any abnormalities. Post-operatively the patient has continued to make a

Fig. 4 Mid-sagittal T2 weighted image demonstrates significant spinal cord compression at the level of the kyphosis

good recovery from surgery with improved hand movement, dysphagia and pain. The Halo was removed at 1 year following surgery. At last follow up at

Fig. 5 Anterior–posterior barium swallow study showing the close relation of the left C7 screw to the esophagus

Fig. 6 Intraoperative picture demonstrating the left screw–rod tract into the mediastinum. Note the anterior depth of the T2 screw relative to the T4 screw

18 months post-operatively, she remained stable and required one assistant for transfers.

Discussion

In this unusual case, spinal problems associated with severe RA are brought to light. Decompression and fusion (including OFT) surgery in this type of rheumatoid patient has been shown to be beneficial in maintaining or improving the quality of life [1, 2, 7, 8, 10, 11].

One of the technical advantages for the use of contemporary occipito-cervical rod–screw instrumentation is that an additional external brace such as a Halo-Vest is not

Fig. 7 A 18 month post-operative sagittal CT reconstruction demonstrates good reconstruction of the cervico-thoracic sagittal balance. The iliac crest allograft at T2 corpectomy defect is noted with fusion across T1–T3 levels

necessary [3, 6–8, 11]. However, following the initial surgery, lack of compliance to limit her mobility and poor bone quality led to loosening of the lower screws of the occipito-cervico-thoracic fusion. The use of a Halo-Vest was recommended post-operatively, however, was refused by the patient.

The airway obstruction was due to cricoarytenoid arthritis, a rare but known complication of RA [5]. The life saving emergency tracheotomy required hyperextension of the head and neck. With previous loosening of the lower screws and solid fixation up into the occiput, the extension maneuver essentially levered the distal fixation anteriorly through the vertebrae. The latter is a reflection of the severe osteoporosis associated with her RA. Osteoporosis leading to spinal deformities or instrumentation failure is well recognized in RA [3, 4, 6, 7, 9, 11].

Given this patient's pre-existing overall poor quality of life, the option of non-operative (i.e., palliative) management and the possible terminal consequences (erosion of the screws through the trachea or esophagus) were fully discussed.

The principles brought out by this case are (1) in osteoporotic patients who are dependent on the use of truncal muscles for transfer and mobility a halo-vest following OFT is recommended (regardless of contemporary fixation methods). (2) In the sub-acute phase (2 months), the pathway created by the migrated instrumentation provided a safe corridor from which the mediastinal instrumentation could be removed without an anterior approach.

Fig. 8 A 1 year postoperative anterior–posterior and lateral X-rays demonstrates the final reconstruction

Conclusions

1. A rare event of migration of lower end of occipito-cervical fusion instrumentation into the mediastinum is presented.
2. Forcible hyperextension of the neck, severe osteoporosis, and pre-existing C7, T1, and T2 screw loosening were the predisposing factors.
3. By staying posterior to the instrumentation and following the rods and screw heads through the fibrous tract created by their anterior movement, the instrumentation was removed safely.

Conflict of interest statement None of the authors has any potential conflict of interest.

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