www.jkns.or.kr 10.3340/jkns.2011.49.1.61 Print ISSN 2005-3711 On-line ISSN 1598-7876
J Korean Neurosurg Soc 49 : 61-64, 2011

Case Report

Inferiorly Migrated Disc Fragment at T1 Body Treated by T1 Transcorporeal Approach

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Upper thoracic vertebral bodies are difficult to access using standard anterior approaches. It may require sternotomy and claviculectomy, which carries significant possibility of morbidities. We report a case of inferiorly migrated cervicothoracic junction disc treated successfully by anterior upper-vertebral transcorporeal approach. This specific technique obviated the need of sternotomy, created favorable working space and saved the motion segment at cervicothoracic junction. This report is the first transcorporeal approach to a disc fragment at T1-2 space without fusion.

Key Words : Intervertebral disc · Transcorporeal approach · Upper thoracic vertebral disc.

INTRODUCTION

Anterior approach to the T1-2 space has been challenging due to the narrow operative space[19]. It still remains an utmost issue whether a surgeon can access to this level without manubriectomy or sternotomy[25]. Karikari et al.[18] proposed the lowest accessible disc space can be determined by computed tomographic sagittal reconstruction of the cervical and upper thoracic spine. They figured out whether a straight line passing through the disc space above the manubrium. Fraser et al.[8] proposed Instrument Manubrial Thoracic Distance as a reliable method to choose surgical approach.

They adopted geometric variables to calculate equations with standardized heights of intervertebral discs above and below the superior tip of the manubrium. There has also been a controversy whether anterior or posterior approach should be adopted to yield better results[26].

We report an inferiorly migrated cervicothoracic junction disc which was treated by T1 transcorporeal approach. This is the first anterior foraminotomy without fusion at T1-2 disc space. We reviewed how this specific approach is advantageous in terms of creating working space at the T1-2 disc space.

• Received : December 17, 2010 • Revised : August 26, 2010
• Accepted : December 31, 2010
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CASE REPORT

History and examination

A 50-year-old woman presented with a two-month history of cervico-thoracic back pain and developed progressive motor weakness of her right hand beginning one week prior to presentation. Neurologic examination revealed diminished sensation of the right arm and mild weakness of the right hand intrinsic muscles. She showed positive Spurling's sign, but the tendon reflexes were normal. Magnetic resonance imaging (MRI) demonstrated a C7-T1 disc extrusion which migrated caudally to T1-T2 disc space (Fig. 1A).

A small disc fragment at C7-T1 did not cause nerve root or spinal cord compression. The most prominent fragment responsible for the patient's radiculopathic symptoms was found to be compressing the right T1 nerve root at the neural foramen (Fig. 1B). To evaluate accessibility without sternotomy, we extended T1-2 intervertebral disc line anteriorly in the current case, which exactly met the suprasternal notch (Fig. 1A). Electromyography revealed both C8 and T1 root lesions, more severe on the right side.

Operation

Before surgery, measurements were made on 3-dimensional Computed tomography (CT) reconstruction scan. The distance from midline to the migrated disc fragment was around 6 mm. The main fragment of the disc was located in the T1-2 neural foramen. Therefore, this neural foramen on oblique x-ray served as the target point during the drilling procedure. The patient was placed supine position where an oblique skin incision was made along the left sternocleidomastoid muscle to the sternal notch.

After exposure of the prevertebral fascia, a mark on the anteromedial side of the T1 vertebral body was made in relation to the two longus colli muscles. We confirmed this level using the C-arm anterior-posterior image with relationship to the 1st rib. Self-retaining Caspar retractors were applied beneath the longus colli muscles at C7-T1. Exposure below T1 body was not necessary because designed trajectory was achieved. Subperiosteal dissection around the manubrium was not performed either. A 6 mm-diameter transcorporeal tunnel was made through the T1 body (Fig. 2). It started just below C7-T1 disc space. An 18 gauge needle was then inserted into the hole. The C-arm was angled to visualize the right T1-2 neural foramen maximally[7] and we made a hole directed towards the T1-2 neural foramen with serial C-arm imaging. When the posterior vertebral wall (cortical wall) was exposed, meticulous thinning of the cortical wall was done until we encountered the disc material. With the pressure of the disc material, the soft fragment was felt by palpating with a microdissector. The disc fragments continued to bulge out as the tunnel was widened. These fragments were removed with forceps. Additional fragments were removed using probes and forceps. Final decompression was checked by palpation along the nerve root with a blunt dura hook. Dural pulsations were noted around the nerve root as well.

Post-operative course

In the early postoperative period, back pain and right hand weakness had improved significantly. The patient was discharged 5 days after surgery. MRI scans demonstrated complete removal of the disc fragment (Fig. 3).

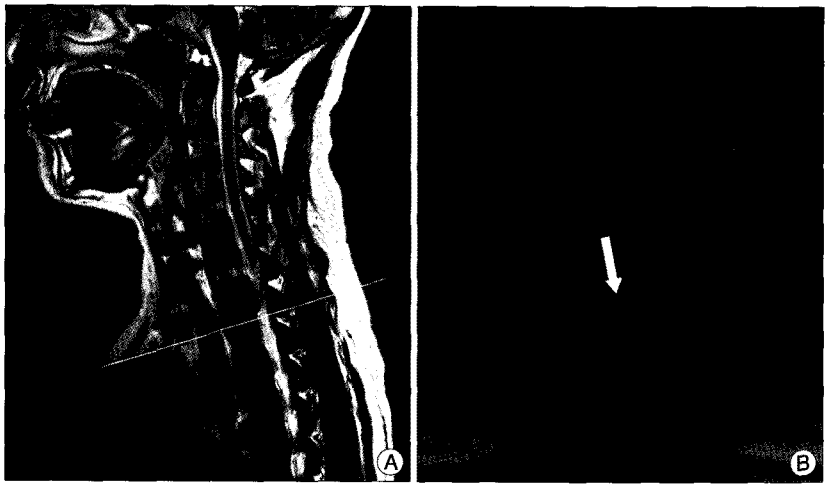

Fig. 1. Preoperaive MRI finding. A : Sagittal image showing a C7-T1 disc fragment herniated and migrated inferiorly to T1-2 disc space. The T1-2 intervertebral disc line meets suprasternal notch tangentially (white line). B : T2 axial image showing a high signal fragment compressing right T1 nerve root (white arrow).

Follow-up

At two years following operation, the patient showed normal flexion and extension range of neck movement. She did not complain neck pain and her motor function of the right hand was recovered completely.

DISCUSSION

In 1954 Svien and Karavitis[31] described the first successful removal of a T1-2 and T2-3 thoracic herniated disc by cervicothoracic hemilaminectomy. Until 1990s, T1-2 herniation was treated exclusively by posterior approach[1,2,9,10]. Anterior approach was not used for such disc

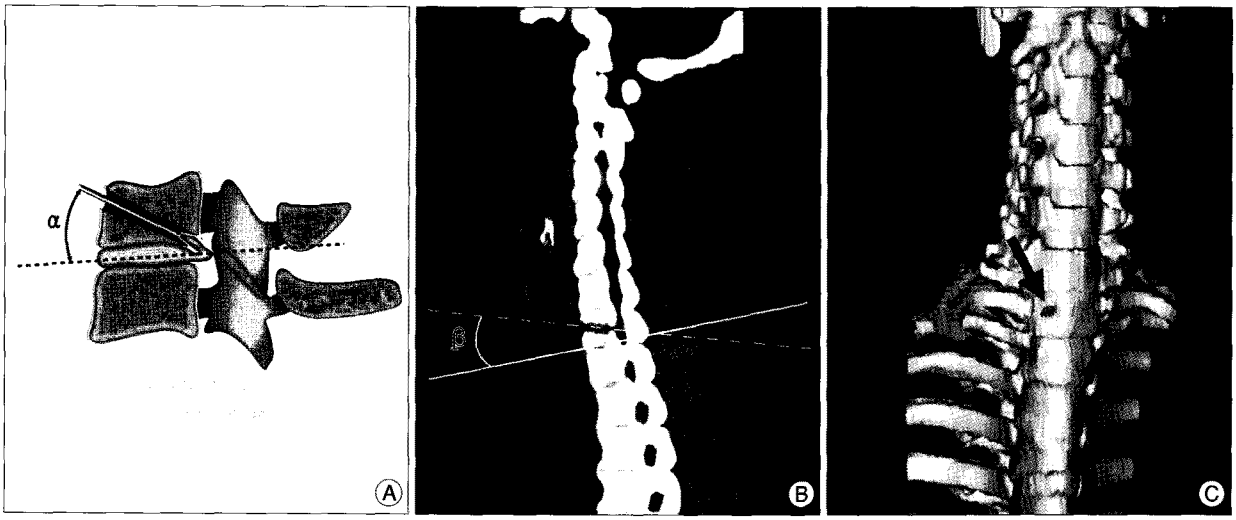

Fig. 2. The treatment design and postoperative CT images. A and B are treatment design in the current case. The angle between the T1-2 disc plane and the drill hole trajectory are shown as an artist's illustration (α) and postoperative CT (β). B shows a tunnel through T1 body. β is the actual angle between the T1-2 disc plane and the drill hole. Note that the T1-2 disc space is below the first rib. C shows the T1 body fenestrated by a tunnel. It illustrates the tunnel is at upper half of T1 body.

disorder because anterior exposure was believed to be challenging[6,29,30]. Conventional posterior approach for a thoracic herniated disc may cause spinal cord retraction and CSF leak[22,23]. Also, it is difficult to manage medially-located pathology without cord mobilization[22,23,28]. The first anterior T1-2 discectomy was reported by Rossitti et al.[27] in 1993. They thought anterior T1-2 surgery could be familiar to surgeons who are accustomed to anterior cervical surgery. They could remove the T1-2 disc and bone block was inserted as usual anterior cervical surgery without manubriectomy or claviculectomy. However, this was not always possible when a patient's neck was short[5]. It is obvious that the sternum, thoracic kyphosis and clavicle restrict access to the pathology[3,20,28]. Sternotomy, manubriectomy and claviculectomy have been proposed as alternative measures to overcome this obstable[6,21,23,30]. However, these measures may increase the risk of pleural injury, pneumothorax, hemothrax, subclavian vein injury and laryngeal nerve dysfunction[4,21]. Also, when we consider the degree of morbidity caused by the radiculopathy, aggressive approaches like sternotomy and claviculectomy are a skeptical options for common disc disorder as T1-2 disc disease rarely presents with myelopathic symptoms[27]. This is especially true with the emergence of newer minimally-invasive techniques being devised in efforts to reduce post-operative morbidity and facet joint violation.

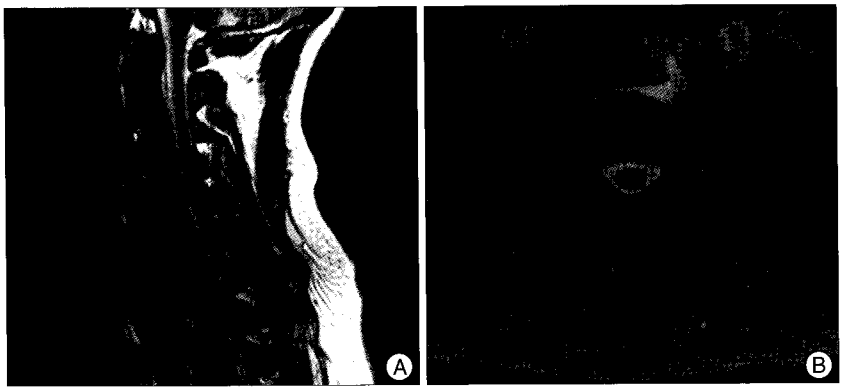

Fig. 3. Postoperative MRI findings. A demonstrates complete removal of disc fragment in sagittal plane. B shows both T1 nerve roots without compression.

Previous reports on T1-2 disc disease did not provide clues on how surgeon can measure surgical accessibility through anterior approach. Rossitti et al.[27] chose anterior approach based on their surgical experience. They concluded that anterior approach is applicable in selected T1-2 disc cases. However, they did not address how those selections could be made. Caner et al.[5] reported T1-2 disc cases treated by splitting the manubrium because of short neck. The details were missing on how such approach was done without manubriectomy. In 2000, this issue was formulated by Sharan et al.[28] They determined the surgical accessibility by the vertebral level tangential to the suprasternal notch[28]. This method was also further supported by Karkari et al.[18] with similar method using CT sagittal images. When we extended T1-2 intervertebral disc line anteriorly in the current case, it exactly met the suprasternal notch (Fig. 1A). We were not sure whether we could access T1-2 disc space without manubriectomy. Even if we could access T1-2 space, it would have not been convenient anterior cervical approach using Caspar retractors and body distracters to insert cages into disc space. It is because Sharan's verification method was based on extensive subperiosteal exposure including rostral posterior surface of the manubrium to the medial clavicular attachment[28]. Also, retractor blade should be applied against the superior surface of the suprasternal notch removing medial portions of sternomastoid, sternohyoid and sternothyroid muscles. We might have had difficulty applying Caspar retractors creating working space. Moreover, the placement of a distractor screw did not seem feasible at T2 body.

We chose transcorporeal approach to the T1-2 disc space to overcome these spatial restrictions. It provided several advantages accessing the pathology at the T1-2 space. The caudad trajectory was far more favorable than the one through the T1-2 intervertebral disc space. The angle between the transcorporeal and conventional approach was 18.6 degrees, which means the trajectory and working space could be kept far above the manubrium (Fig. 2B). The bone drilling point was also favorable dealing with narrow working space. It was started near the C7-T1 disc space which could keep the surgical field above upper T1 body. We used usual Caspar retracotors and the retractors were applied like usual C7-T1 disc space. Extensive subperiosteal dissection of the rostral posterior surface of the manubrium by Sharan et al.[28] was not required. Since we did not need to apply body distractor, we did not need to explore inferiorly to mid T2 body. Upper vertebral transcorporeal approach made the surgical field one level above the pathology.

Upper vertebral transcorporeal approach is a modification of anterior cervical foraminotomy[11]. Jho[12] introduced a method of removing cervical disc fragment by removing the uncinate process under the name of "anterior cervical foraminotomy". With this approach, he intended to preserve as much disc as possible while removing disc fragment compressing nerve roots. Later this technique was termed as "transuncal approach". Transcorporeal approach was also proposed by him in 2002[17]. It was one of his modifications in several ways[13-16]. In upper vertebral transcorporeal approach, the drill hole entry was moved much more cephalad than uncovertebral juncture on the anterior aspect of the cervical spine because of the cephalad inclination of intervertebral disc in the sagittal plane[17]. To compensate this inclination, the drill hole should be moved upward in the upper level vertebral body[17]. This cephalad location of drill hole actually brings the drilling point just below C7-T1 disc space (Fig. 2A). Also, the resultant trajectory became more favorable caudad inclination in the vertebral body in the current case (Fig. 2B).

Transcorporeal approach was also beneficial to preserve mother disc and motion segement in the cervicothoracic junction. In 2009, anterior foraminotomy was reported on one case of T1-2 disc by Ozer et al.[24] However, their method is very different from anterior foraminotomy proposed by Jho[12]. They did not preserve the disc and PEEK cage was inserted into the disc space[24]. Besides, their trajectory did not create working space at cervicothoracic junction because it was almost parallel to the T1-2 disc space. As far as we know, this report is the first case of T1 transcorporeal foraminotomy to access T1-2 disc space without fusion.

CONCLUSION

Upper vertebral transcorporeal approach is an excellent treatment method to access T1-T2 disc space. By moving the surgical field almost one level above the pathology, it provides favorable access angle and creates more working space. It also decreases the possibility of manubriectomy and preserves the motion segement at the cervicothoracic junction.

Acknowledgements

Byung Kwan Choi was supported for 2 years by Pusan National University Research Grant.

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