

A New Progression Towards a Safer Anterior Percutaneous Endoscopic Cervical Discectomy: A Technical Report

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Abstract

Percutaneous Endoscopic Cervical Discectomy (PECD) has evolved as an efficient and minimally invasive procedure for both contained and non-contained cervical disc herniations in the recent years. With the advent of new working channel endoscopes and instruments design, the PECD is gaining popularity among spine surgeons and is becoming an alternative to the fusion surgery. The insertion of the working channel is the key to PECD which has to be placed very meticulously without injuring the vital structure in the neck anteriorly. We wish to present a technical report and brief discussion about the new instruments design and procedure that will enhance the safety measures in PECD.

Keywords: Cervical disc herniations; Percutaneous Endoscopic Cervical Discectomy (PECD); Meticulously; Safety

Introduction

The surgical management of cervical disc herniation has evolved considerably over the past decades; however, no surgical treatment is without associated morbidity or limitations. Minimally invasive approaches and surgical techniques are becoming increasingly popular for the treatment of a variety of cervical spine disorders [1]. With the rapid evolving of high quality endoscopes and video imaging, we have been able to reach the entire spinal column including cervical segment, with the targeting goal to achieve outcomes comparable to those of open surgery but with less bleeding, minimal tissue damage, early recovery time and hospital stay with more safe techniques.

The introduction of the anterior cervical approach, initially by Smith and Robinson [2], and later by Cloward was the foundation of the anterior cervical discectomy with or without fusion for cervical radiculopathy [3]. However, it was associated with either loss of disc height or loss of a mobile segment the possibility for long run developing fusion related complications [4] (adjacent segment disease, pseudoarthrosis and other graft related problems). Tajima et al. [5] first described percutaneous cervical discectomy (PCD) in 1989 and since then there have been several reports describing the efficacy using various instruments such as nucleotome, laser and endoscopy [6]. PECD has shown good outcomes with soft disc herniation and cervicogenic headache [7-9] associated with lower cervical spine segments and has been reported to be successful as by several authors [10-13]. However, this technique has a steeper learning curve and vigilant placement of the working channel of endoscope is the most important step of the surgery.

Although PECD is described as a safe procedure; still serious complications may occur either during the needle insertion that can entail vascular, neurological and visceral injury or can happen during the procedure [14]. Postoperatively hematoma formation and transient hoarseness have been reported [15].

All these complication can be avoided with meticulous placement of instruments, patient selection and following a strict procedure protocol. In this technical report we wish to discuss about patient criteria, some important technical aspects of PECD and a new modification in the obturator and cannula designs for their safe insertion.

Selection of the Patient

Indications

Radiological:

- Soft cervical disc herniations involving C4-C5, C5-C6, C6-C7.

- Annular tears.
- Preserved disc space of at least 4 mm.
- Uncommonly for C3-C4 & C7-T1.

Clinical:

- Unilateral radicular pain
 - Axial neck pain
 - Cervicogenic headache.
- concordant symptoms with provocative discography.

Contraindications:

- High grade migrated disc herniation.
- Calcified disc and ossification of posterior longitudinal ligament.
- Collapsed intervertebral disc space less than 4 mm.
- Past history of anterior cervical surgery (a relative contraindication).
- Infections.
- Instability.

Technical Aspects

Approach - Anterior cervical

Armamentarium: (Figures 1A and 1B).

- Endoscope – New cervical endoscopic spine system (Spine doctors, South Korea) (Table 1).
- Spinal Needle 18 Gauge.
- Guide wire 0.8 mm.
- Dilator 2 mm and working length 160 mm.
- Obturator 4 mm (threaded) working length 140 mm.

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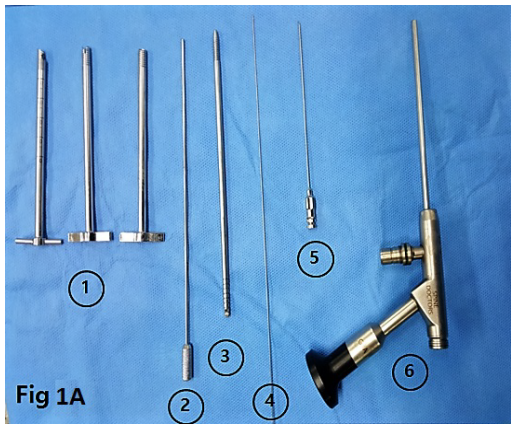


Figure 1a: Cervical endoscopy set: 1-partially threaded cannula (circular & oblique), 2-dilator, 3-partially threaded obturator, 4-guide wire, 5-18 G spinal needle and 6-cervical endoscope.

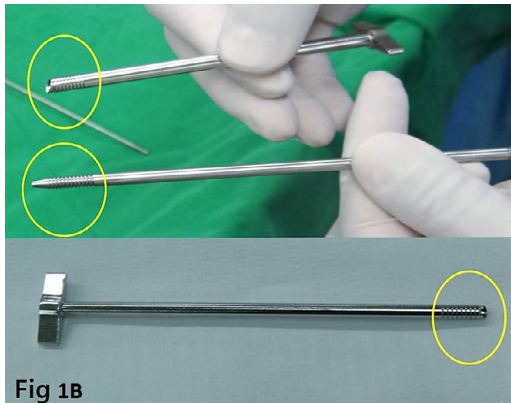


Figure 1b: Partially threaded cannula and obturator.

Angle	Length	Working channel	Outer diameter
5 degrees	100 mm	2.1 mm	4 mm

Table 1: New cervical endoscopic spine system.

- Cannula 5 mm (threaded) working length 95 mm.
- Endoscopic grasper forceps- working length 220 mm and outer diameter 1.6 mm.
- Radiofrequency cautery (trigger flex elliquance,USA) settings 40/40.
- Ho-YAG laser with side firing probe (lumenis 100 W) settings 1 Joules and 15 pulse/sec (Hz).

Surgical Technique

Anaesthesia

Performed under local anaesthesia with 1% lidocaine in conscious sedation (initially intravenous Midazolam 0.05 mg/kg and 0.8 mg/kg Fentanyl and repeated if required).

Position

- Supine on a radiolucent table.
- The neck is slightly extended by placement of a towel roll under the shoulder blade.

- The head can be stabilized by applying a plaster tape across the forehead.
- A plastic tent is placed over the patient’s face to prevent a feeling of suffocation and for ease of communication during the procedure.
- The shoulders are pulled down by an adhesive strap and arms are fixed on the sides of the table for the better C-Arm lateral view.

Procedure

- The level and midline are marked with the help of a C-arm fluoroscopy.
- The anterior neck is painted and draped.
- Skin is infiltrated with 1% lidocaine at the entry site.
- For paracentral and foraminal disc herniations approach is from the contralateral side, whereas for a midline disc herniation entry from the right side is preferred for a right handed surgeon.
- The carotid pulse is palpated by the left hand and the tracheoesophageal complex is then pushed by the finger nail while the anterior part of the cervical vertebrae is felt by the finger tip. A safe interval is created between the fingers of the left hand and maintained till the insertion of the working cannula (Figure 2).
- The shift of the complex is confirmed under fluoroscopy by the tracheal shadow.
- An 18 gauge needle is inserted through the skin into safe interval and further advanced into the subcutaneous tissue, and upto the anterior margin of the disc space under fluoroscopic guidance (Figure 3).
- The disc space is entered by advancing the needle as close as possible to the midline between the longus colli. This helps in preventing bleeding or any injury to the cervical sympathetic chain.
- After entering to the centre of the disc the inner stylet of the needle is removed and discography is performed with 0.2 ml of a mixture of radiopaque dye, normal saline, and indigo carmine dye in the ratio 2:2:1

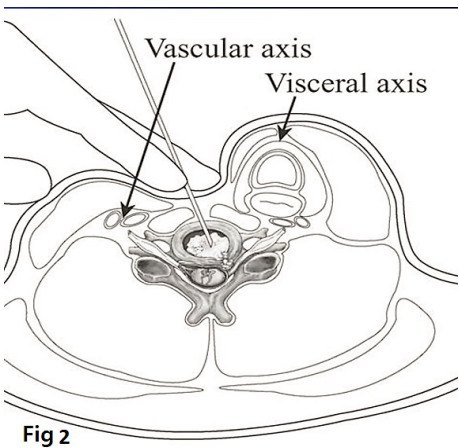


Figure 2: A safe interval is created between the fingers of the left hand.

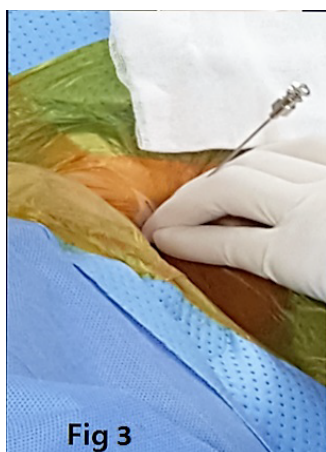


Figure 3: Insertion of 18 gauge needle through the safe interval.

- Discography helps to confirm the disc space and helps to identify the stained nucleus pulposus during discectomy.
- The needle is exchanged with a guide wire.
- A 5 mm transverse incision is made over the skin and underlying subcutaneous tissue.
- Initially a 2 mm dilator is passed over the guide wire to the anterior margin of the annulus followed by an obturator. This is a new modified obturator with partial threads at its tapered end. It is passed over the guide wire in a clockwise rotating manner upto the posterior annulus (Figures 4A and 4B).
- Finally, a 5 mm partially threaded circular cannula is passed over the obturator gently in the same clockwise rotating manner. This maneuver allows a meticulous insertion of both obturator and cannula, thus avoiding the use of hammer while inserting them which puts the patient on risks due to sudden uncontrolled advancement of the obturator/cannula into the disc space and can penetrate the spinal cord leading to devastating consequences (Figure 5A).
- Cannula should be placed upto posterior vertebral line ideally on lateral view of C-arm and in the midline on AP view for central disc herniations (Figures 5B and 5C).
- For paracentral and foraminal disc herniation the tip should be directed towards the respective foramen in AP view.
- A 4 mm 5 degree endoscope with a working channel of 2.1 mm is passed into the cannula.
- The disc fragments are identified and removed with an endoscopic forceps.
- If the disc fragments are entrapped into the annulus, the fissure or the annular mouth is widened with a side firing holmium-aluminum-garnet (Ho:YAG) laser, which gradually vapourises the blue stained disc material and facilitates the removal by the endoscopic forceps. The side-firing laser could also ablate the fragile osteophyte at the foraminal area, thereby accomplishing the foraminoplasty decompression. Bipolar RF can be used to achieve hemostasis and better visualization.
- Once the dural sac or exiting root is visualised the decompression is complete.

- The cannula is retrieved carefully and the entry point is closed with one subcuticular stitch and steri-strips.
- A preoperative and postoperative MRI of PECD case is illustrated in Figures 6A and 6B.

Discussion

Percutaneous Endoscopic Cervical Discectomy (PECD) minimizes the risk of complications that were seen with open conventional anterior cervical discectomy and fusion which includes hoarseness, dysphasia, hematoma/edema causing airway obstruction and esophageal injury. Post cervical fusion surgeries patient may develop graft failure, pseudoarthrosis and adjacent segment disease (ASD) which is as high as upto 25% and within ten years patients may require a second surgery [16]. With PECD a targeted discectomy is performed which preserves the segmental stability and function of musculoskeletal system, hence reduces the chances of ASD. Nevertheless, PECD carries the risk of major complications as well. There are only few studies on safety measures and complications associated with PECD [15,17].

Complications in PECD can be minimised with general measures like proper patient selection, patient positioning, and neuroleptanalgesia as intraoperatively patient's feedback is the best monitor during awake surgery. In our institution, we have established the standard operative protocol to minimise possible complications encountered during the procedure. We focus on midline entry of the percutaneous spinal needle to avoid any injury to the longus colli muscle and cervical sympathetic chain. With the introduction of new threaded obturator and cannula it is possible to insert them without tapping, by threading in a clockwise manner into the disc space. This maneuver allows a meticulous insertion without the use of hammer, which can sometimes lead to sudden uncontrolled advancement of the obturator/cannula into the disc space posteriorly and can cause injury

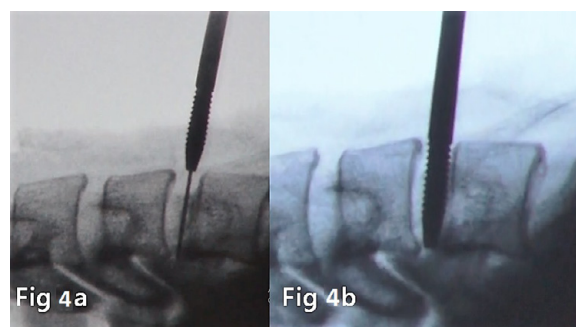


Figure 4: Obturator insertion (4a- insertion of the partially threaded obturator, 4b-advancement of the obturator to the posterior annulus).

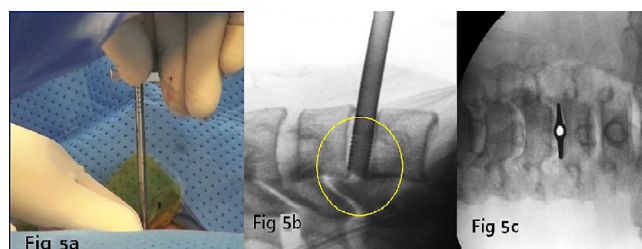


Figure 5: Placement of threaded working cannula. (5a-insertion of cannula by rotating in clockwise direction 5b-gradual advancement of the cannula upto the posterior vertebral line 5c- a proper midline placement of the cannula).

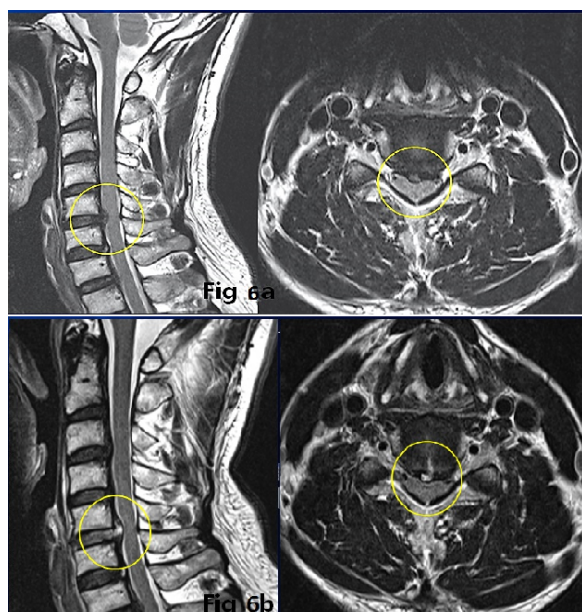


Figure 6: Case illustration PECD a-Preoperative MRI showing large C5. (6a-central disc herniation, 6b-Post-operative MRI showing removal of the herniated disc fragment with empty annular shell).

to the dural sac leading to devastating consequences. With a safer approach, PECD procedure can be performed under local anaesthesia with minimal complication as an outpatient procedure, and the patient can be discharged on the same day from the hospital.

Conclusion

Authors found these new instruments very efficient in the safe insertion of the working channel in anterior cervical endoscopy and together with standard operative protocols, making PECD a more feasible and safe procedure for the spine surgeons.

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