



## Usage of Bone Wax to Facilitate Percutaneous Endoscopic Cervical Discectomy Via Anterior Transcorporeal Approach for Cervical Intervertebral Disc Herniation

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**BACKGROUND:** Currently, anterior transdiscal access and posterior interlaminar approach are the main approaches for percutaneous endoscopic cervical discectomy (PECD). To overcome access shortcomings, we previously described a novel anterior endoscopic transcorporeal approach on a migrated cervical disc. We innovatively introduced bone wax into endoscopic surgery to aid hemostasis and facilitate the process of drilling an intracorporeal tunnel.

**METHODS:** Five patients with cervical intervertebral disc herniation (CIDH) were treated by PECD via the anterior transcorporeal approach. During the operation, we marked the punctured tunnel with bone wax containing indigo carmine as a guide and smeared bone wax on the endoscopic burr to aid hemostasis.

**RESULTS:** A satisfactory clinical outcome was observed in all 5 patients postoperatively; pain and neurologic condition were dramatically improved. Surgery-related complications, such as esophageal injury, vascular rupture, hematoma, intervertebral disc infection, or postoperative headache, were not encountered. A computed tomography scan was used to observe the process of bone healing. At 3-month postoperative follow-up, the bone defect within the drilling tunnel had partially shrank and was completely healed at 6 months postoperatively.

**CONCLUSIONS:** The anterior endoscopic transcorporeal approach for PECD is a novel, valuable alternative for the treatment of CIDH. Bone wax could indeed facilitate the

operation by guiding the drilling process and instantly controlling the bleeding without obvious interference with bone healing. Long-term follow-up is warranted in further clinical studies.

The current gold standard for cervical intervertebral disc herniation (CIDH) is anterior cervical discectomy and fusion (ACDF). However, fusion complications, approach-related complications, and extensive tissue damage remain worrisome.<sup>1-6</sup> Since Hijikata and Kambind first introduced percutaneous lumbar nucleotomy, with the continuous development of endoscopy, percutaneous endoscopic cervical discectomy (PECD) has become a practical, relevant technique to specifically address CIDH through anterior transdiscal or posterior interlaminar approaches.<sup>7-10</sup> PECD is a safe, sufficient alternative to conventional procedures and achieves comparable satisfactory outcomes when the indication criteria are fulfilled; it also has the advantage of reducing iatrogenic injury. Because of the relatively more substantial injury to the anterior nucleus pulposus, anterior PECD is prone to further decreases in the intervertebral disc space (IVS) and is sometimes inapplicable for patients with IVS less than 4 mm.<sup>10-12</sup> In our preliminary study, we also observed a greater decrease in IVS via an anterior transdiscal approach.<sup>13</sup> In addition, when the herniated lesion migrates upward or downward behind the vertebral body (VB), anterior or posterior PECD and ACDF are impractical, and corpectomy is commonly considered the only efficacious treatment. To decrease the incidence of iatrogenic injury to the anterior discal tissue and overcome the shortcomings of the current approach, we first used a transcorporeal approach to

### Key words

- Bone wax
- Cervical discectomy
- Disc decompression
- Endoscopes
- Minimally invasive surgery
- Percutaneous
- Transcorporeal approach

### Abbreviations and Acronyms

- ACDF:** Anterior cervical discectomy and fusion  
**CIDH:** Cervical intervertebral disc herniation  
**IVS:** Intervertebral disc space  
**PECD:** Percutaneous endoscopic cervical discectomy  
**VAS:** Visual analog scale  
**VB:** Vertebral body

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Citation: *World Neurosurg.* (2018)118:102-108.

<https://doi.org/10.1016/j.wneu.2018.07.070>

Journal homepage: [www.WORLDNEUROSURGERY.org](http://www.WORLDNEUROSURGERY.org)

Available online: [www.sciencedirect.com](http://www.sciencedirect.com)

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remove a herniated disc at the C4-5 level under endoscopy, which was previously used by George et al.<sup>14,15</sup> to address anteriorly located lesions during open cervical surgery.<sup>16</sup> Based on our preliminary experience, how to create a drilling tunnel with a precise trajectory and how to control intraoperative bleeding during the drilling process are the key points for the entire surgery. We innovatively introduced bone wax into endoscopic surgery to aid hemostasis and facilitate the process of drilling tunnels with a satisfactory trajectory. In this case series, we will share our preliminary experience and explore the efficacy and safety of this approach.

**METHODS**

**Patients**

From October 2014 to March 2015, 5 consecutive patients with CIDH who underwent PECD via the anterior transcorporeal tunnel approach were included in this study. **Table 1** presents patient demographic data, treatment outcomes, and complications. The neurologic status of patients was evaluated with American Spinal Injury Association scores. Neck and arm pain were measured using a visual analog scale (VAS) ranging from 0 (no pain) to 10 (extremely severe pain). During follow-up at 1, 3, 6, and 12 months postoperatively, plain radiograph, computed tomography scan, and magnetic resonance imaging examinations were recommended for all patients. The study was approved by the Ethics Committee of the Second Affiliated Hospital of Chongqing Medical University and Honghui Hospital of Xi'an Jiaotong University. Patient inclusion and exclusion criteria are described in **Table 2**.

**Surgical Technique**

Under general anesthesia, the patient was placed in a supine position with the neck mildly extended. The entire surgical process was controlled with electroneurophysiologic monitoring. When the targeted VB below the pathologic disc was demarcated by fluoroscopy, an 8-mm transverse skin incision was made medial to the sternocleidomastoid muscle above the targeted VB. Because of compartmentalization of the neck by the deep fascia, the visceral sheath containing the thyroid, trachea, esophagus, and carotid sheath could easily

be displaced to the opposite side with 2 fingers. After blunt dissection, a self-designed puncture needle complex incorporating a nonbeveled sheath of a vertebroplasty needle on the outside and a blunted K-wire on the inside was inserted cranially and medially through the small safe window between the lateral carotid sheath and the medial visceral sheath and ultimately placed on the anterior surface of the targeted VB (**Figure 1**, left). After fluoroscopic confirmation, the blunted inner K-wire was retrieved and replaced with a sharp stylet (**Figure 1**, middle). The puncture needle complex with a sharp tip could anchor on the anterior surface of the targeted VB along with the outer sheath and then advance toward the posterosuperior edge of the targeted VB (**Figure 1**, right). The trajectory and depth were controlled with intraoperative anteroposterior and lateral fluoroscopy. Subsequently, the inner sharp stylet was extracted. A blunted guidewire could be used to verify that the posterior wall of the VB was intact. First, we mixed bone wax with indigo carmine and injected it through an outside sheath into the VB with a pushrod. As the tunnel was filled with bone wax containing indigo carmine, the outside sheath retreated backward. When the outside sheath arrived at the anterior portion of the VB, we inserted the guidewire and then removed the outside sheath. Along with the guidewire, the dilator sheath and the outer working sheath were inserted sequentially via the created intracorporeal hole into the targeted VB (**Figure 2**). When both the dilator sheath and inner guidewire were removed together, the working sheath was punched slightly forward along the previous trajectory into the anterior portion of the VB. The previously punctured hole was reconfirmed under endoscopy and enlarged using a diamond high-speed burr (SPINENDOS Drill System [SPINENDOS GmbH, Munich, Germany]). Under the guidance of blue bone wax, the former satisfactory trajectory was easily recognized under endoscopy (**Figure 3**). During the drilling process, although a low-energy bipolar flexible radiofrequency probe (Ellman Trigger-Flex Probe [Ellman International, Hewitt, New York, USA]) was typically used to control intractable bleeding from cancellous bone, we smeared bone wax on the endoscopic burr, which created an intracorporeal tunnel and aided hemostasis (**Figure 4**). When the opening of the posterior wall of

**Table 1.** Demographic Characteristics of Patients Before and After Percutaneous Endoscopic Cervical Discectomy

Case Number	Age (Years)	Sex	Indications for Surgery	Surgical Level	Preoperative VAS Score for Neck and Arm Pain	Preoperative JOA Score	VAS for Neck and Arm Pain at 6 Months Postoperative	JOA Score at 6 Months Postoperative
1	37	F	Myelopathy	C4-5	7	10	2	14
2	40	M	Radiculopathy	C5-6	8	14	1	15
3	45	F	Radiculopathy	C4-5	7	13	2	15
4	42	F	Radiculopathy	C5-6	8	14	1	16
5	50	M	Myelopathy	C5-6	6	11	2	15

VAS, visual analog scale; JOA, Japanese Orthopaedic Association; F, female; M, male.

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