30 EPIDUROSCOPY (EPIDURAL ENDOSCOPY)

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Definition

Epidural endoscopy (Epiduroscopy) is a minimal invasive technique that ensures the examination of the normal or pathologic structures in the epidural space with direct endoscopic imaging and helps the pain management.

History

Studies on epiduroscopy were first started by Burman on cadaver vertebras using rigid arthroscopic systems in 1931, and were developed by Poole in 1942. With this system structured as myeloscopy, 400 patients were examined in the preoperative period; however, due to the lack of recording and imaging system, pathologies were shown with medical drawings.[9,11] Ooi developed endoscopy for intradural and extradural use between 1960 and 1970 and added the fiber optic light source to the system to facilitate taking photographs. Blumbarg reported in 1980 his epiduroscopy method also including the needle catheters required for epidural anesthetics but still used with a rigid scope.[1] In 1991, Saberski and Kitahata started to use the flexible fiberoptik endoscope and light systems and video-guided catheter in epiduroscopy, and achieved the contemporary technology by imaging the epidural space directly.[10,11]

Indications

The basic aims of epiduroscopy used in the diagnosis and treatment of pain are as follows:

1) To ensure imaging of the epidural space and diagnosing the pathology visually,
2) To perform percutaneous lysis of the epidural adhesions (adhesiolysis),
3) Administering medications directly to the epidural space.

As seen in the basic purposes given above, epiduroscopy is a minimal invasive method that can be used for the diagnosis and treatment of causes of chronic pain originating from the lumbar spine.

Chronic low back pain is in the second place after the respiratory track diseases among the causes of labor loss. Eight million new chronic low back pain patients are diagnosed annually in the USA, caused by lumbar spondylosis in the first place, and 250,000 lumbosacral procedures are performed with this reason. Re-operation is performed in 20% of these patients after surgery.[11]

Patients with pain related to failed back surgery (FBS) constitute a significant portion of patients with chronic low back pain, and approximately 37,500 patients are added to this group each year.[11] The most frequent causes of FBS include the scar formations and adhesion in the epidural space. Manchikanti and colleagues found scar and adhesion formations in the epiduroscopic examination in 73-84% of 82 patients with FBS.[6] Significant improvements in the chronic low back pain and radicular pain in 80% of these patients were reported after epiduroscopy and adhesiolysis at month 3. Of these patients, 56% and 48% were still improving during the control at month 6 and year 1, respectively. Geurts and

colleagues, Richardson and colleagues and Igarashi and colleagues also published their follow-up results for 3 and 6 months and reported results similar to that of Manchikanti.[4,5,7,8]

Di Donato performed epiduroscopic adhesiolysis together with medication on a series of 350 patients consisting of FBS, lumbar spondylosis and lumbar narrow channel groups that had not responded to conservative treatment of at least 6 months or refused surgery[3]. In the evaluation of patients with VAS score and Oswestry index, long term pain improvement 66% in months 36 and 48%, respectively and 65% in month 60 were found. In addition, significant improvements in the insufficiencies of the patients related to pain have been reported. Furthermore, repeatability in patients that had had limited benefit, possibility of application under local anesthesia and mild sedation with providing comfort for the patient, possibility of application on ASA 3-4 patients, very rapid return to normal daily life with very little loss of work and providing the patient with a minimal invasive option have been reported as the important advantages.[2,3]

Patient groups with chronic low back pain that application is possible

A) Not responding to conservative treatment of at least 6 months,
B) Patients unable to receive general anesthesia because of systemic problems,
C) Patients that surgery is not possible because of age or general medical status,
D) Patients who had refused the offered surgery,
E) Patients who had not benefited from the previous epidural steroid injections,
   a. FBS
   b. Lumbar spondilosis
   c. Spondylolisthesis based on lumbar spondilosis
   d. Lumbar disc herniation

Contra-indications

1) Koagülopati
2) Infection
3) Cutaneous infection around the sacral hiatus
4) Anatomical abnormalities of sacrum
5) Advanced systemic diseases
   a. Renal insufficiency
   b. Chronic liver dysfunction
6) Lumbosacral surgery within the last 6 months
7) Progressive neurologic deficit
8) Causes of intracranial pressure increase
9) Closed sacral hiatus

Technique

The patient is taken to the operation table and given prone and neutral position. The pressure points are relieved using footpad, head pad and arm supports and the most comfortable lying is provided for the patient. All the procedures performed will be under local anesthesia and mild sedation. Following the sterile painting and draping without using metal clamps to avoid spoiling the images localization of the sakral hiatus will be determined. In the manual sacral hiatus-coccyx technique, hand is placed on the sacrum so that the middle finger will be on the tip of the patient's coccyx. The access point is generally located in the 7cm proximal of the tip of the coccyx. Again, this point also will be determined with the help of a metal tool under the guidance for fluoroscopy. (figure 1) Then, skin of this area, subcutaneous layer and the sacrococcygeal ligament closing the hiatus will be infiltrated with a local anesthetic.

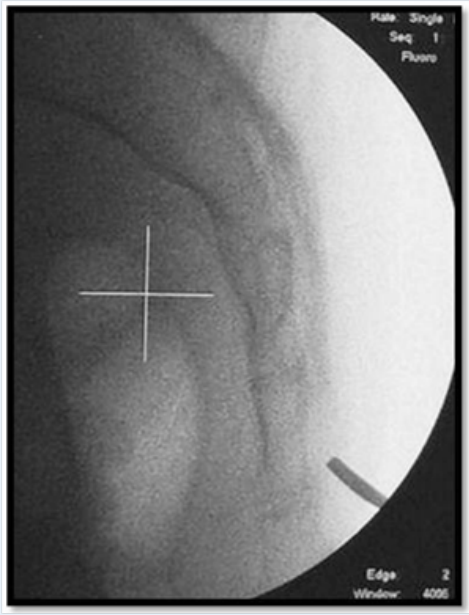

Figure 1: *Determining the sacral hiatus with fluoroscopy.*

Following this, the Tuohy needle no. 16 is used to pass the sacrococcygeal ligament under lateral fluoroscopy and the caudal side of the sacral canal is reached. (figure 2) The issue that must be taken care of at this stage is that the access point must not be located at immediately over the hiatus, but must be located at a few centimeters distal. In case the entry angle is too vertical instead of the correct angle, the video-guided catheter to be used in the following stages will be bent and manipulation will be difficult. After confirmation of the location of the Tuohy needle, the guide wire is sent through the guide wire. (figure 3) The wire can fold inside when being forwarded, can turn in ring fashion, or simply does not go further because of the anatomic variations in the sacrum or adhesions. Therefore all these stages must be controlled with lateral fluoroscopy images during all these stages. (figure 4) After this, the needle will be carefully removed leaving the guide wire in place, and a deep incision 0.5cm long will be made at the entry point of the wire using a blade no. 11 following the course of the guide wire. The dilator tubes found in the transport kits of the materials used will be passed through the guide wire, and the sacrococcygeal ligament will be dilated. (figure 5) Length of the dilator tube must be considered carefully, and unnecessary force must not be applied forwards and must not be pushed. In this stage, sudden and pressurized CSF can come from the tube in relation with dural tear. After removing

Figure 2: *Caudal-sacral channel is reached by passing through the sacrococcygeal ligament with the Tuohy needle no. 18 under the guidance of lateral fluoroscopy.*

Figure 3: *After confirming the location of the Tuohy needle, guide wire is sent through the needle (MyeloTec Epidural Access Kit).*

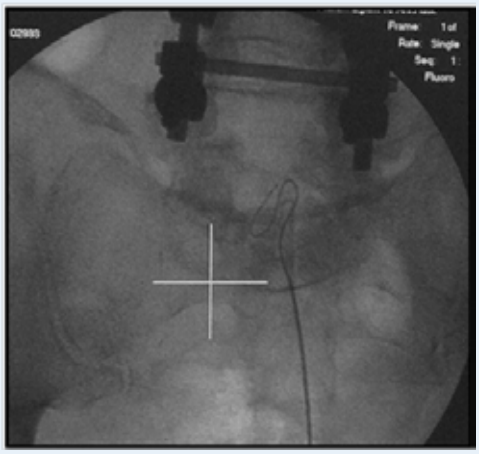

Figure 4: *Image of the guide wire under the fluoroscopy*

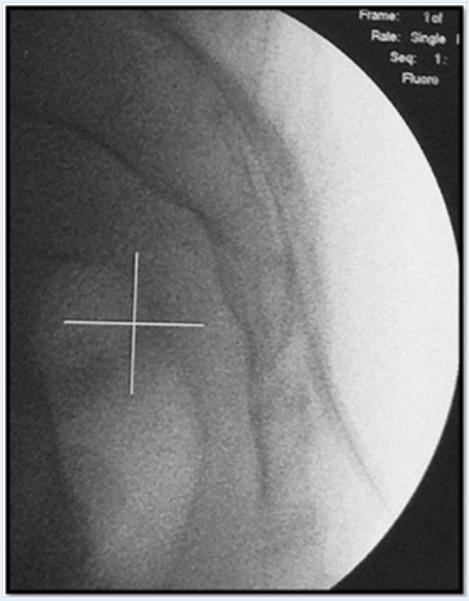

Figure 5: *The dilator tubes are passed through the guide wire and then the sacrococcygeal ligament is dilated.*

the dilator tube, the tube containing the working cannula is passed again over the guide wire. Attempting to dilate the subcutaneous layer and sacrococcygeal ligament with clamps or thick dilators to provide a more convenient working channel can cause postoperative pain or subcutaneous hematoma. Following this, the guide wire and the tube will be carefully pulled back and the working cannula will be thus placed. The video-guided catheter is passed through the working cannula to reach the epidural area. It is mow possible to take images with flexible fiber optic endoscope with the help of this catheter to evaluate the pathologies in the epidural area. (figure 6)

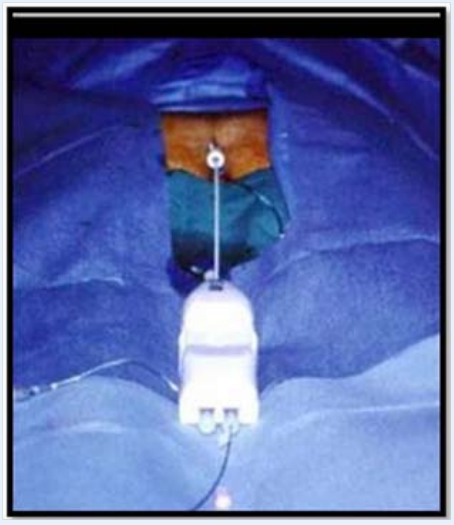

Figure 6: *The video-guided catheter placed in the working channel (MyeloTech video-guided catheter).*

Mechanisms of Treatment with Epiduroscopy and Mechanisms

Mechanic Adhesiolysis: Maneuvers are possible with video-guided catheter especially in FBS patients with intense scar and adhesion formations. Determination of space must only be made with fluoroscopy. Areas with intense adhesions can be seen as filling defects after administration of nonionic contrast substance with the help of the catheter. (figure 7) These areas can be visually confirmed with the help of endoscope to dissect the adhesions and scar bands and open tissue planes through freeing. (figure 8) Dura tears can occur during these maneuvers and catheter and enter the intradural space and cause unwanted results. It must be kept in mind that it is not possible

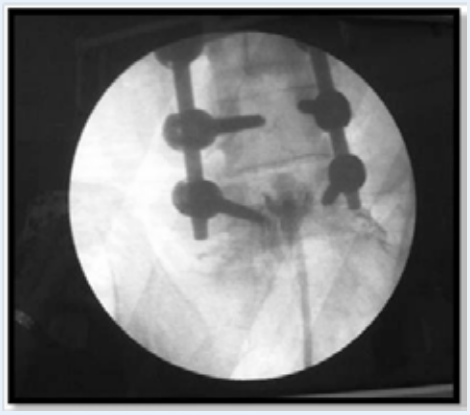

Figure 7: *The filling defect upwards and block following the injection of contrast substance in the patient that total laminectomy and stabilization had been performed previously.*

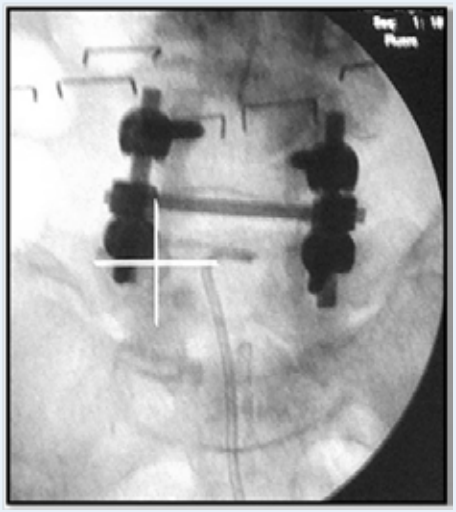

Figure 8: *Adhesions and scar bands can be dilated with the video-guided catheter and tissue planes can be opened by freeing (MyeloTech video-guided catheter)*

to see the entry of the catheter into the intradural space in maneuvers made based only on fluoroscopy without using the endoscope images. Therefore, it is very important to avoid overstrain during dissections, and to follow the endoscopic images at each stage.[2,3,11]

Volumetric Distension of the Epidural Space: It is possible to dissect the space by administering solely saline or steroid and local anesthetic together with saline. Although saline up to 200 cc can be given to the epidural space, giving it 110 cc in the average will be safe. Saline is administered to the space through the 3-way cocks on the catheter. Care must be given to the patency and operational status of the discharging channel in the catheter. Saline can be administered continuously or interruptedly with an injector to ensure distension and opening of the tissue planes. Washing out the inflammatory agents within the epidural space particularly around nerve root through the irrigation made with saline is also considered as one of the mechanisms of action.[3]

***Administration of Local Anesthetics*:** This provides acute pain relief. Particularly, use of Bupivacaine helps the short-long term improvement. It is thought that Bupivacaine shows these effects by preventing the nociceptive discharge and axonal transport, blocking sensitization and sympathetic reflex arc and through the anti-inflammatory effect [6, 7].

Steroid Application: It has been reported that steroids prevent inflammation by inhibiting the release and synthesis of pro-inflammatory mediators.[3,6,7]

***Hyaluronidase Application*:** 150 IU Hyaluronidase within saline helps to the dissection of the inflammatory tissue and adhesions.[3,6]

Ozone Application: It was shown in the recent studies that ozone treatment administered under direct endoscopic imaging to the pathologic areas is also effective. It has been shown that ozone dramatically reduces the free radical formation and normalizes the cytokine and prostaglandin levels.[3]

Terminating the Procedure

After the video-guided catheter is removed, the working cannula will also be removed, and will be closed with one suture using prolene. Following the bed rest for the first 4 hours and 24-hour observation in the hospital, the patient can be discharged with a prescription of antibiotics and analgesics for 5 days. The patient can rapidly return to normal daily life.

Complications

1) Wound infection
2) Dura tear
3) Neurologic damage
4) Temporary paresthesia
5) Position-related retinal hemorrhage
6) Headache related to dural tear
7) Meningitis,
8) Arachnoiditis
9) Epidural abscess

Conclusion

In patients with chronic low back pain and lumbar spondylosis who had undergone failed back surgery, adhesiolysis and medical treatment with epiduroscopy is a method that can be preferred as a minimal invasive intervention. The small complication risk, easy tolerability by the patient, obtaining the results quickly, early return to the normal daily life after the procedure and the option of a nonsurgical pain treatment offered by this method are the important advantages of this method.

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