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The Bright and Dark Faces of Percutaneous Endoscopic Lumber Discectomy under Local Anesthesia

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Abstract: ***Background**: Lumbar disc herniation is one of the most common problems in orthopedics and neurosurgery and can be presented as low back pain, leg pain (radicular pain) or both. Intervertebral discs consist of an outer fibrous ring, the anulus fibrosus disci intervertebralis, which surrounds an inner gel - like center, the nucleus pulposus. The fibrous ring of an intervertebral disk can be damaged and allows the soft central portion, the nucleus pulposus, to bulge out beyond the affected fibrous rings. [1] Minimal invasive techniques for lumbar disc herniation should give the same gools of standard techniques but with minimal soft tissue damage, less blood loss and early recovery of the patient. These minimal invasive techniques for surgical treatment of lumbar disc herniation involved using microscope or endoscopy with many modifications aiming to minimize soft tissue damage and improve the early patient recovery with optimum results [2, 3, 4]. **Patients and method**: During the period between January 2019 to December 2020, 45 patients were included in this study according to inclusion and exclusion criteria, where it involves patients presented with single level disc prolapse or herniation, not responding to conservative treatment. The procedure takes an average of 110 min, under local anaesthesia, the proper procedure is done while communication with the patient is still throughout the operation, the wounds are small and the patient is allowed postoperatively to walk and use the bathroom 2 hours later. **Results**: The ages of the patients was between 19 - 69 years old (average 41.16), including 11 females and 34 males. The levels operated upon was vary from 3 cases in L3 - 4, 22 cases at L4 - 5 level and 20 cases in L5 - S1 levels. This includes 16 discs with left radiculopathy and 30 discs with Right one. **Discussion**: The benefits of this approach include less damage to the paraspinal musculature and less bruises. To decompress the exiting nerve root, bone removal is not necessary and this prevents the possibility of causing spinal instability [12, 13, 14] There is still no breach of the spinal canal, meaning there is less epidural bleeding and epidural scarring. Percutaneous endoscopic discectomy allows removal of not only fragments located in the center of the nucleus, but also fragments that have migrated posteriorly and posteroaterally. Since percutaneous endoscopic discectomy, several studies have demonstrated good to excellent clinical outcomes based on change of illness - related conditions and physical signs. [12, 13, 15, 16] In our study the average operative time was 110 minutes which is comparable with other studies (15 min. - 3 hours) [17, 18] Using local anesthesia which is safe, simple, effective and fast way of anaesthesia. Surgeons can maintain effective communication with patients. This surgical procedure also lessens chances of nerve root injury. Also, the patient is allowed to walk after 2 hours from the operation and go to the bathroom (allowance to walk). The complications are more or less than that mentioned in other studies and it seems similar to that in conventional surgery however there is less chance of instability and early degrative changes that is usual after the open procedure, the complications are started to be less with the upgrading surgical skill's curve. **Recommendations**: We recommend the percutaneous lumbar discectomy procedure since it is characterized by small incisions, less soft tissue distraction, and maintenance of spinal structural stability, good operative field visualization, continuous communication with the patient during the operation, less blood loss, early recovery, short hospital stay in comparison to the traditional open procedure.***

Keywords: disc herniation, sciatica, endoscopic discectomy, low back pain, minimal - invasive discectomy

1. Introduction

Low back pain [LBP] is the leading cause of disability internationally according to the latest Global Burden of Disease study [1].

Lumbar disc herniation, one of the most important causes of low back pain which is one of the most common problems in orthopedics and neurosurgery, can be presented with low back pain, leg pain (radicular pain) or both. Intervertebral discs consist of an outer fibrous ring, the anulus fibrosus disci intervertebralis, which surrounds an inner gel - like center, the nucleus pulposus. The fibrous ring of an intervertebral disk can be damaged and allows the soft central portion, the nucleus pulposus, to bulge out beyond the affected fibrous rings.

Treatment of lumbar disc herniation varies from conservative treatment, with different modalities, to surgical treatment which involved several surgical procedures starting from most invasive techniques to minimal invasive techniques.

Minimal invasive techniques for lumbar disc herniation should give the same gools of standard techniques but with minimal soft tissue damage, less blood loss and early recovery of the patient. These minimal invasive techniques for surgical treatment of lumbar disc herniation involved using microscope or endoscopy with many modifications aiming to minimize soft tissue damage and improve the early patient recovery with optimum results [2, 3, 4].

The concept of minimally invasive spine surgery is less tissue damage, while achieving good clinical outcome comparable with conventional open surgery. Patients are expected to have less back pain, shorter hospitalization and quicker resumption of daily activities. Moreover, the cost - effectiveness is expected to be superior. The primary goal of surgery is retrieval of herniated disc fragments and decompression of the nerve root. Since the first report of lumbar disc surgery in 1934 by Mixter and Barr [5], who performed a laminectomy with transdural disc removal, various less invasive techniques have been developed. With the introduction of the microscope, Yasargil and Caspar refined the original laminectomy into the open microdiscectomy [6, 7]. This technique has become the most common procedure worldwide. In 1997 Foley and Smith introduced the transmuscular approach of microendoscopic discectomy (MED) with advanced optics and instruments applicated in laparoscopic surgery [8].

Later, the original endoscopic procedure was modified with the operative microscope which has led to the development of the Microscopic Endoscopic Tubular Retractor System Lumbar microdiscectomy is the most commonly performed spinal surgical procedure [9]. Lumbar microdiscectomy is indicated for radicular pain unresponsive to conservative management (e. g. analgesia and physiotherapy), neurological deficit (e. g. weakness) or for cauda equina syndrome.

2. Materials and Method

During the period between January 2019 to December 2020, 45 patients were included in this study according to inclusion and exclusion criteria, where it involves patients presented with single level disc prolapse or herniation, not responding to conservative treatment.

- The procedure name Percutaneous Endoscopic Lumber Discectomy (PELD)
- Average operative time: 110 min. (operative time)
- Smooth operative period
- The patient is allowed to walk after 2 hours from the operation and go to the bathroom (allowance to walk)
- The patient is discharged from the hospital at the same day or after one day (hospital stay)
- The stitch is removed after 2 weeks
- After the operation usually the patient gains complete pain relief, if paresthesia is present 80 - 90% will be relieved immediately after the operation 10 – 20% of paresthesia will take up to 3 months to resolve (pain and parasthesia reliefing period)
- 7 cases with negative planter reflex preop. Regain the reflex immediately after the operation. (neurological improvement)
- 3 cases with foot drop one of them regain normal power after 4 weeks the 2 other remain with no motor improvement

Indications

- Severe pain for more than 6 weeks not responding to conservative treatment
- Single disc herniation on MRI, if more than one level herniation is present, selective nerve block is done to choose the painful disc.

Preoperative investigations include

- CBC
- GUE
- MRI
- LUMBER X - RAY = A/P.
- DYNAMIC LUMBER X - RAY
- B. SUGAR
- RENAL FUNCTION TEST Procedure:
- The patient is fasting for at least 6 hours preop.
- i.v. access is established and the patient is connected to non - invasive monitoring SpO2& NIBP
- O2 is delivered to the patient via a nasal cannula
- Intravenous antibiotics is commenced before the operation (ceftriaxone) unless the patient reported sensitivity to this drug.
- The patient is place in prone position with the affected side towards the operator
- We usually mark the skin before antiseptic preparation using fluoroscope and metal ruler. A vertical line is drawn over the spinous processes of the lumber vertebrae, another transvers line is drawn crossing the targeted disc in the middle of the space, in cases of L5/S1 disc herniation this line will be oblique and passing above the iliac crest.
- The entry point will be 12 cm from the midline for L5/S1 level, 10 cm for L4/5 level and 8 cm for L3/4 level
- After antiseptic preparation, 5 ml of 1% lidocaine is infiltrated in the skin and subcutaneous tissue of the entry point.
- A 18 G.20 cm needle is advanced under x - ray control towards the targeted disc until the bone of superior articular process (SAP) is encountered, then the needle is moved under the bone of the SAP until it reaches the disc, at this point the tip of the needle should be at the level of medial pedicular line on A/P view and at the level of posterior vertebral body line on lateral view.
- Before advancing the needle in the disc a 2 - 3 ml of 1% lidocaine is injected through the needle to anesthetize the annulus, after that the needle in the disc until the tip of the needle reaches the midline in A/P view and the posterior ¼ of the targeted disc.
- The needle is replaced with a guide wire
- An 8 mm incision is made in the skin
- A 6.3 mm diameter dilator is passed over the dilator, care should be taken not to bend the guide wire
- A 7.5 mm cannula is passed over the dilator, the bevel of the cannula should be facing up in order to avoid trauma to the traversing nerve with the tip of the cannula. Once the cannula reaches the disc, it will need to be tapped with a mallet hummer in order to enter the annulus.

- The dilator is removed and a 6.3 mm diameter spinal endoscope is passed through the cannula.
- A various type of forcepses are used to remove disc fragments, we prefer 2.7 mm diameter flexible forceps.
- A bipolar radiofrequency probe is used for hemostasis and annular modulation
- The cannula is withdrawn gradually during that any loose disc fragment should be removed
- After completing the removal of the disc herniation the cannula is withdrawn and the skin incision is closed with single stitch.

3. Results and Discussion

The ages of the patients was between 19 - 69 yrs old (average 41.16), including 11 females and 34 males (fig.1)

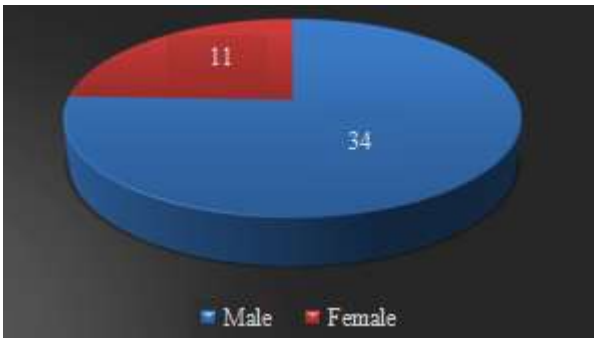

Figure 1: No. of males and females included in the study

The levels operated upon was vary from 3 cases in L3 - 4, 22 cases at L4 - 5 level and 20 cases in L5 - S1 levels (fig.2)

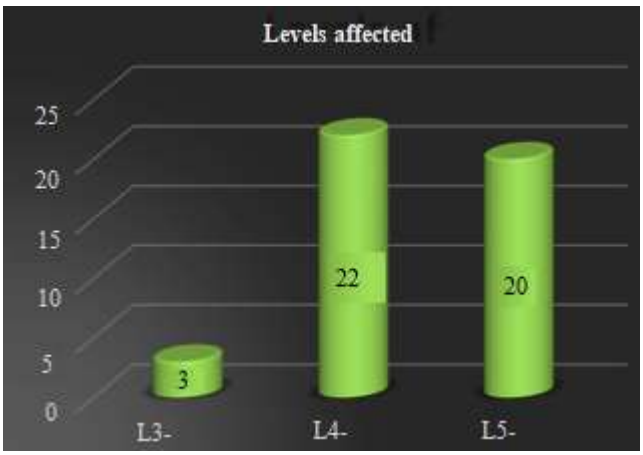

Figure 2: The no. of disc levels affected

This includes 16 discs with left radiculopathy and 30 discs with Right one. As shown in (fig.3)

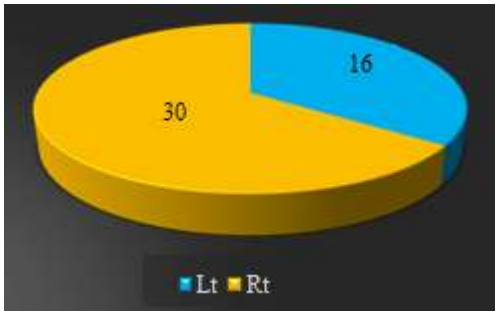

Figure 3: The direction of operative approach and radiculopathy

Conventional open surgery is the 'gold standard' for the treatment of herniated intervertebral discs. However, the disadvantages of open surgery include extensive retraction and dissecting of the paraspinal muscles, longer operating time, larger wounds and bone resection. [10, 11]

An alternative procedure for the treatment of lumbar disc herniation is endoscopic discectomy using a percutaneous transforaminal posterolateral approach. Advances in instrumentation now making the ways from which different instruments can be transmitted under direct endoscopic visualization for the secure removal of disk content. The benefits of this approach include less damage to the paraspinal musculature and less bruises. To decompress the exiting nerve root, bone removal is not necessary and this prevents the possibility of causing spinal instability. [12, 13, 14] There is still no breach of the spinal canal, meaning there is less epidural bleeding and epidural scarring.

Percutaneous endoscopic discectomy allows removal of not only fragments located in the center of the nucleus, but also fragments that have migrated posteriorly and posteroaterally.

Since percutaneous endoscopic discectomy, several studies have demonstrated good to excellent clinical outcomes based on change of illness - related conditions and physical signs. [12, 13, 15, 16]

In our study the average operative time was 110 minutes which is comparable with other studies (15 min. - 3 hours) [17, 18]

Using local anesthesia which is safe, simple, effective and fast way of anasthesia. Surgeons can maintain effective communication with patients. This surgical procedure also lessens chances of nerve root injury. This technique uses the lumbar posterolateral puncture approach, the surgical incision may be just 0.8 cm long, and this procedure does not damage the lumbar musculature, as well as the bones and joint ligament structures. Therefore, this technique will decrease lumbosacral pain and will not disturb lumbar stability. There is no need to isolate and retract the nerve root and the dural sac throughout the process. Therefore, in the vertebral canal, there is no reason to disrupt the neural tissues and it does not induce excessive bleeding and adhesions in the vertebral canal. It also has the characteristics of minor surgical pain and rapid recovery following surgery.

Also, the patient is allowed to walk after 2 hours from the operation and go to the bathroom (allowance to walk) and the patient is discharged from the hospital at the same day or after one day (hospital stay) and it seems good time to regain movement. Other studies have also shown that the hospital stay was one day in average [14, 19, 20], while the median hospital stay for patients treated with conventional open discectomy range from 3 to 4 days. [21]

Regarding clinical improvement after the operation in our study the patient gains complete pain relief, if paresthesia is present 80 - 90% will be relieved immediately after the

operation 10 – 20% of paresthesia will take up to 3 months to resolve. Schube et al. [21] reported that a total of 558 patients with lumbar disc herniation underwent percutaneous lumbar endoscopic discectomy, all patients were followed up for 2 years. The percentage of patients with excellent and good postoperative nerve root VAS (visual analog score) scores was 95.3%. In Zhou, YL, Chen, G., Bi, DC. *et al.* [22] who followed 72 at 2 days, 6 months, and 12 months postoperatively, suggest that the short - term curative effect of this surgical procedure is significant, and its postoperative recovery is rapid.

In our study the levels operated upon was vary from 3 cases in L3 - 4, 22 cases at L4 - 5 level and 20 cases in L5 - S1 levels, which looks like same distribution as other studies [21.22]

4. Complications

We discovered recurrence in 8.9%, remanent paresthesia in 2.2%, and infection in 2.2%.

Many studies reported that the overall complication rate for this kind of surgical procedure averages 2.6%. [20, 23, 24] The complications reported include dysthesia, nerve root or vascular injury, postoperative infections and dural tear.

Hirano et al. [25] reported that recurrence rate after percutaneous lumbar endoscopic discectomy was 2.4– 8.5%. they considered that the residual intervertebral disc underwent degeneration. When intervertebral stress increased, it extruded at the weakest point of the fibrous rings and posterior longitudinal ligaments, which is the main mechanism of the postoperative recurrence of lumbar disc herniation.

The complications are more or less than that mentioned in other studies and it seems similar to that in conventional surgery however there is less chance of instability and early degrative changes that is usual after the open procedure, the complications are started to be less with the upgrading surgical skill's curve.

5. Conclusion

We recommend the percutaneous lumbar discectomy procedure since it is characterized by small incisions, less soft tissue distraction, and maintenance of spinal structural stability, good operative field visualization, continuous communication with the patient during the operation, less blood loss, early recovery, short hospital stay in comparison to the traditional open procedure.

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