Our experience in surgical treatment of spinal disc herniation

Abstract. Background. The purpose of the study was to evaluate the effectiveness of the transforaminal endoscopic microdiscectomy, to highlight the disadvantages and advantages of this method in comparison with traditional methods, based on the data obtained to determine the main indications and contraindications to this procedure. Materials and methods. One-hundred and ninety clinical records of the patients with lumbar spinal cord injuries were analyzed, which were treated at the Regional Centre of Orthopedics, Traumatology and Vertebrology “Rivne Regional Clinical Hospital” from April 2016 to April 2018. We performed a quantitative and qualitative assessment of pain syndrome by the Visual Analogue Scale of Pain (VAS); assessment of the quality of life by Oswestry Disability Index. Results. The use of transforaminal endoscopic microdiscectomy for the treatment of patients with spinal disc herniation confirmed the high efficiency of this technique. So, the international Oswestry Disability Index demonstrated in average 21.1 % for the group in operated patients, which corresponds to a good result. The dynamics of the pain syndrome was estimated by VAS and its preoperative level was 8.5 scores, and in 6 months after the operation — 1.5 with the predominance of lumbalgia, and with the almost complete absence of root pain. This technique makes it possible to enter the endoscope into the vertebral canal under the local anaesthesia minimally invasive and under visual control to decompress the nerve root by removing the hernial bulging. However, the technique is not universal and cannot be applied to all patients. Conclusions. Considerable practical experience has shown that the surgeon can meet certain technical difficulties in cases of cranial or caudal migration of sequestration, in some cases access to the level of L₁-S₁ is difficult due to the high position of the iliac crest. However, with the correct indications, this technique allows solving the problem of the radicular syndrome in a short time.

Keywords: herniated disc; endoscopic microdiscectomy; lumbar osteochondrosis

Introduction

Surgical methods of treating intervertebral disk herniation at the lumbar spine change one another in a rapid succession. Although an open microdiscectomy is considered a ‘gold standard’ in surgery, recently there are many new methods whose inventors are trying to minimize the traumatic effect of surgery retaining its radical character. In early 1990s, an alternative method of transforaminal endoscopic microdiscectomy (ETM) was suggested [1-6]. Surgeons started to use two principal accesses — lateral (Richard Wolf) and posterolateral (JoyMax, Thesyss, MaxMore).

Most authors [4-6], along with us, prefer the posterolateral access due to a range of advantages: possibility of a partial facet resection enables the surgeon to enlarge the endoscopic space and reduce the extent of lateral stenosis, as well as to perform a partial revision of an interbody space; while the purely lateral approach allows resecting but the free sequestrers from a canal. If the surgeons have been treating this method skeptically for a long time, nowadays the adherents of transforaminal endoscopic microdiscectomy are numerous, and their opinion is supported by many reports on the significant advantages of this method over an open surgery [7-10].

Furthermore, a number of surgeons do not restrict themselves to a proper microdiscectomy; instead they opt for an endoscopic surgery to remove facet joint cysts [11] and to treat various stenosis forms [12-15].

The purpose of the study was to evaluate the effectiveness of the transforaminal endoscopic microdiscectomy, to highlight the disadvantages and advantages of this method in comparison with the traditional methods, to determine the main indications and contraindications for this procedure, taking into account the data obtained.

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**Materials and methods**

190 medical records of patients with lumbar intervertebral disk herniation were analyzed. The patients were treated at the "Rivne Regional Clinical Hospital", the Regional Center of Orthopedics, Traumatology and Vertebrology, from 04.2016 to 04.2018. Prior to the surgery, all the patients underwent MRI or CT of lumbar spine, functional X-rays and general clinical examinations.

Among the indications for surgery there were: ineffective conservative treatment of spinal compression syndrome during 6-8 weeks, cauda equina syndrome, acute foot drop (paresis), and progressive neurological symptoms attending the conservative treatment.

The Table presents distribution of patients according to the hernia localization (by the MRI data). For instance, 120 (63.1%) patients had a hernia at the level of L$_1$-L$_5$, 50 (26.2%) patients had it at the level of L$_4$-S$_1$, 3 (1.6%) patients - at the level of L$_1$-L$_6$, 10 (5.3%) patients at all 3 levels: L$_1$-L$_6$ and L$_4$-S$_1$. 2 (1.1%) patients - at the level of L$_1$-L$_2$ and 5 (2.7%) patients - at the level of L$_4$-L$_5$. Distribution of patients according to the hernia localization within the spinal canal is given in Table 1.

**Surgery technique**

Surgery was performed with MaxMore surgical instruments by T. Hoogland. The ‘outside in’ technique was applied [4-6] (Fig.1).

With patient lying prone, the surgeon marks out the dilators’ access trajectory on his/her stomach. At L$_1$-S$_1$, the surgeon retreated 12-14 cm from the median, at L$_4$-L$_6$, 10-12 cm, and at L$_1$-L$_4$, and L$_4$-L$_5$ - 8-10 cm. to determine the angle, trajectory was drawn through the tip of lateral facet and hornia base. After a local anesthesia with a 2 % lidocaine solution, spinal needle was put at the tip of lateral facet (Fig. 2a). Conduit pin was passed along the needle (Fig. 2b), softly along with tissue dilatators, Tom- Shidi needle and bone expanders from 4.5 to 9 mm in succession (Fig. 2c). All the steps were monitored by electronic-optical transformer in 2 projections (Fig. 2d).

After a partial resection of lateral facet, the cannula was inserted in a transforaminal projection (Fig. 3a); later along this cannula an endoscope was put inside the patient’s body (Fig. 3b). A continuous flow of sterile saline fluid, previously warmed to the normal body’s temperature, was provided under the 80 mm pressure of water gauge. On identifying the protrusion, the surgeons removed it with a microronger (Fig. 3c), while the larger sequesters not fitting the endoscope’s canal were evacuated together with an optical tool (Fig. 3d).

In order to achieve a complete removal of minor disc particles, epidural compounds and dissociated posterior longitudinal ligament, we’ve been using Triger-Flex, radio-frequency electrode connected to a radio-frequency generator with an operative temperature of up to 42 degrees Centigrade at its tip. Low-temperature coagulation resulted in a dura mater and root pulsation, considered a positive sign (Fig.4).

In a follow-up period, we’ve performed a control MRI examination to verify the complete hernia removal (Fig.5).

**Results and discussion**

According to the international Oswestry life quality questionnaire, mean value for the operated-on patients was 21.1 %, corresponding to a good result. Vertebral pain syndrome and its dynamics were evaluated by means of VAS: in the post-op period it amounted to 8,5 points, while in the 6-month follow-up period - 1.5 points. Lumbar pain predominated; root pain was almost completely absent.

An average ‘bed-day’ index was 3 days; verticalization took place 2-3 hours after surgery. In the post-op period, patients were recommended to take the non-steroid anti-inflammatory drugs (NSAIDs), Gabapентин and peripheral muscle relaxant drugs for up to 7 days. Neurotropic therapy was recommended for 1 month.

We should mention the following technical difficulties and complications we were facing:

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![Fig. 1. MaxMore transforaminal endoscopic kit](image)

**Table 1. Distribution of patients according to the hernia localization**

<table>
<thead>
<tr>
<th>Localization</th>
<th>Level</th>
<th>L$_1$-L$_2$</th>
<th>L$_1$-L$_5$</th>
<th>L$_2$-L$_4$</th>
<th>L$_4$-L$_5$</th>
<th>L$_4$-S$_1$</th>
<th>L$_5$-L$_5$-S$_1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td></td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>18</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Paramedian</td>
<td></td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>90</td>
<td>40</td>
<td>7</td>
</tr>
<tr>
<td>Foraminal</td>
<td></td>
<td></td>
<td>10</td>
<td>5</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extraforaminal</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>2 (1.1 %)</td>
<td>5 (2.7 %)</td>
<td>3 (1.6 %)</td>
<td>120 (63.1 %)</td>
<td>50 (26.2 %)</td>
<td>10 (5.3 %)</td>
</tr>
</tbody>
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Vol. 9, No. 3, 2019

Bol’, sustavy, pozvonočnik, ISSN 2224-1507 (print), ISSN 2307-1133 (online)
Fig. 2. Steps of the transforaminal access.

Note: a – marking out the entry trajectory and local anesthesia; b – insertion of conduit pin; c – insertion of bone expanders; d – monitoring by electronic-optical transformer

Fig. 3. Steps of transforaminal endoscopic microdiscectomy (ETM)

Note: a – insertion of a cannula; b – insertion of endoscope with a continuous flow of saline fluid; c – identifying and removing the protrusion; d – evacuation of a larger sequester
1. At the initial stages of acquiring the technique, 6 (3.1%) patients did not get a complete protrusion evacuation due to the performers’ lack of experience and major sequesters’ migration along the canal. It prompted a repeat intervention.

2. In 5 (2.6%) asthenic patients at the level of L5-S1, transforaminal and peripheral intervention was impossible due to an elevated position of ilium ridge. In those cases open surgery was performed.

3. In 11 (5.8%) patients, the hernia recurred after 6 months. We attribute this recurrence to the fact that the transforaminal endoscopic microdiscectomy does not involve a radical revision and curettage of disc cavity, potentially leading to a migration of loose interbody elements into the spinal canal. According to various reports [2, 3], disc hernia recurrence happens in 8 to 9% of cases, following the open microdiscectomy. This number is significantly lower than our findings - 9,9% (6,5% – recurrence and 3,4% – incomplete evacuation of protrusion). The remaining 168 (88.4%) patients had a positive dynamic of neurological deficit recovery.

4. In 2 (1.1%) patients with signs of initial instability, after 6 to 8 months after surgery instability increased, marked by the back pain intensification, even without a neurological deficit. It required a transpedicular fixation.

5. Aseptic spondilodiscitis developed in 3 (1.57%) patients. Its progression was arrested by the traditional medication.

6. In 2 (1.1%) patients, intrasurgical damage of dura mater occurred, presumably due to present epidural adhesive process caused by a long disease and pronounced central spinal stenosis. To prevent the liquor-rhea, we used the TachoComb sponge and put a deep suture on the wound. This complication did not reflect on the surgery outcomes in any noticeable way; its percentage being as low as with a traditional microdiscectomy.

In light of the above mentioned facts, we may outline the principal indications for the transforaminal endoscopic microdiscectomy (ETM):

— intervertebral disk herniation at any lumbar spine segment, root compression syndrome not responding to the conservative treatment during 6-8 weeks;
— acute foot drop (paresis);
— cauda equina syndrome.

Among the contraindication we find:
— elevated position of ilium ridge, ruling out the transforaminal access at the level of L5–S1;
— instability of spinal and locomotor segment at the operated level;
— pronounced central spinal stenosis;
— remote cranial or caudal migration of loose sequestrs.

Conclusions
Transformaminal endoscopic microdiscectomy (ETM) was proved highly effective in treatment of intervertebral disk herniations. According to the international Oswestry life quality questionnaire, mean value for the operated-on patients was 21.1 %, corresponding to a good result. Vertebral pain syndrome and its dynamics were evaluated by means of VAS: in the post-op period it amounted to 8.5 points, while in the 6-month follow-up period − 1.5 points. Lumbar pain predominated; root pain was almost completely absent.

Performing this intervention on patients with intervertebral disk herniae revealed the following advantages: minimal damage of soft tissues and minimal contact with nerve structures; quick post-intervention recovery reduces the work incapacitation term; unlike the traditional electrocoagulation, coagulation of epidural vessels with a radio-frequency electrode of a 42 °C operative temperature reduced epidural fibrosis risk; optimal visualization of intracranial structures with an optic enlargement reduces the nerve root damage risk; direct access to the extrusion via the natural foraminal opening; minimal infection-related complication risk.

Conflicts of interests. Authors declare the absence of any conflicts of interests and their own financial interest that might be construed to influence the results or interpretation of their manuscript.

References
Ціль дослідження: оцінити ефективність трансфорамінальної ендоскопічної мікродискектомії, виділити недоліки та переваги даного методу порівняно з традиційними методиками, на підставі отриманих даних визначити основні показники та противопоказання до проведення даної процедури. Матеріали та методи. Проаналізовано 190 історій хворих на грижі поперекового відділу хребта, які лікувалися в Областному центрі ортопедії, травматології та вертебрології «Рівненська обласна клінічна лікарня» з 04.2016 по 04.2018. Проводилася кількісна та якісна оцінка хворого синдрому за візуальною аналоговою шкалою болю (ВАШ), оцінка якості життя через анкету Oswestry. Результати. За рахунок трансфорамінальної ендоскопічної мікродискектомії у лікуваних пацієнтів з грижами міжхребцевих дисків (МХД) підтвердило досягнення ефективності даної методики. Так, за даними міжнародного опитувальника якості життя Oswestry, середній показник у групі прооперованих становив 21,1 %, що відповідає добробуту результату. Відмічено позитивну динаміку хворого синдрому. Висновки. Значний практичний досвід показав, що хірург може зустрітися з навколишніми технічними труднощами у випадках краніальної або каудальної міграції секвестру гриж міжхребців, але при наявності правильних показань методика мікродискектомії дозволяє в короткий термін ефективно лікувати пацієнтів з компресійним кірневим синдромом.

Ключові слова: грижа диска; ендоскопічна мікродискектомія; поперековий остеохондроз

Цель исследования: оценить эффективность трансформаминальной эндоскопической микродискэктомии, выделить недостатки и преимущества данного метода на фоне традиционных методик, на основе полученных данных определить основные показания и противопоказания к данной процедуре. Материалы и методы. Проанализировано 190 историй болезни пациентов с грыжами поясничного отдела позвоночника, которые лечились в Областном центре ортопедии, травматологии и вертебрологии «Ровенская областная клиническая больница» с 04.2016 по 04.2018. Проводилась количественная и качественная оценка болевого синдрома за визуальной аналого-шкалой боли, оценка качества жизни с помощью анкеты Oswestry. Результаты. За счет применения трансформаминальной эндоскопической микродискэктомии в лечении пациентов с грыжами поясничных дисков подтверждено достаточно высокую эффективность данной методики. Так, в соответствии с международным опросником качества жизни Oswestry, средний показатель по группе среди прооперированных составил 21,1 %, что соответствует хорошему результату. Динамика болевого синдрома оценивалась по ВАШ и в предоперационном периоде составляла 8,5 балла, а через 6 месяцев после операции — 1,5 балла с преблажанием люмбалгии и с почти полным отсутствием корешковой боли. Данная методика позволяет улыбчиво под местной анестезией ввести эндоскоп в позвоночный канал и под визуальным контролем провести декомпресию нервного корешка путем удаления грыжевого выпячивания. Однако методика не является универсальной и не может быть применена у всех пациентов. Выводы. Значительный практический опыт показал, что хирург может встретиться с определенными техническими трудностями в случаях краиальной или каудальной миграции ввести эндоскоп в позвоночный канал и под визуальным контролем провести декомпресию нервного корешка путем удаления грыжевого выпячивания. Однако методика не является универсальной и не может быть применена у всех пациентов.

Ключевые слова: грыжа диска; эндоскопическая микродискэктомия; поперековый остеохондроз