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Endoscopic surgery for managing sciatic nerve pathology: first results, possibilities, complications: a case series

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Abstract

Introduction Sciatic nerve neuropathy is common pathology. Development of endoscopic method of decompression and neurolysis is extremely prospective. **Objective** Analyze the results of endoscopic decompression of sciatic nerve at a 1-year follow-up. **Material and methods** 15 patients (11 females – 79 %, 4 males – 21 %) were included into the study and were treated in the period from 2018 to 2022. Endoscopic sciatic nerve neurolysis and decompression were performed. Mean age of the patients was 47 ± 16 years. The severity of pain according to VAS was 8 ± 1. Motor dysfunction according to the BMRC scale was 2.6 ± 1.7 points. Degree of sensitive dysfunction according to Seddon scale was 2.9 ± 0.9 points. Functional activity of the lower limb according to LEFS scale was 49 ± 7 points. **Results** The severity of pain one year after surgery according to VAS scale decreased to 2.8 ± 2.6 cm. Degree of motor dysfunction according to BMRC scale became 4.4 ± 0.8 points. Degree of sensitive dysfunction according to Seddon scale became 3.7 ± 0.4 points. Functional activity of the lower limb according to LEFS scale increased to 68 ± 8.7 points. Efficacy of surgery in our study was 80 % (12 patients), there was one complication after surgery (6.7 %). **Discussion** Our study obtained clinical results that are comparable with the data of domestic and world literature. **Conclusion** Endoscopic decompression of sciatic nerve is an effective and low-traumatic method with a low rate of complications, which allows for pain relief, promotes restoration of function of the sciatic nerve and lower extremity.

Keywords: sciatic nerve, endoscopic decompression, neuropathy, neuropathic pain syndrome

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INTRODUCTION

Neuropathy of the sciatic nerve ranks second among the neuropathies of the peripheral nerves of the lower extremities, second only to neuropathy of the peroneal nerve. The main cause of neuropathy is nerve compression in the region of the subpiriform foramen [1, 2]. Compression develops due to pressure from the hip rotator muscles (subpiriformis, obturator internus, superior and inferior gemelli muscles), as well as due to the development of cicatricial and adhesive processes in this area after injury [3]. Injury to the sciatic nerve can occur due to a fall on the buttocks in everyday life, a fracture of the pelvis and femur. Unfortunately, an iatrogenic nerve injury occurs frequently during osteosynthesis of the femur and pelvis, or hip arthroplasty. Treatment of neuropathy of the sciatic nerve is conservative at the first stage if its anatomical integrity is preserved. It includes neurotropic and anti-inflammatory therapy, physiotherapy, a set of exercise therapy, electrical myostimulation. If there is no effect, surgical treatment is resorted to neurolysis and decompression of the sciatic nerve in the region of the subpiriform foramen [4]. This intervention is performed through an open approach by cutting off the gluteus maximus muscle from the greater trochanter of the femur. However, over the past decade, a number of publications have appeared that describe the surgical technique of endoscopic sciatic nerve neurolysis with immediate and long-term results [5]. The benefits of the endoscopic method are obvious: less trauma and blood loss, better aesthetics, faster and painless rehabilitation, lower risk of complications and relapses [6]. In our work, we analyzed our experience of endoscopic decompression of the sciatic nerve performed in the period from 2018 to 2022, its long-term results, the first failures and complications.

Purpose: to analyze the results of endoscopic decompression of the sciatic nerve at a follow-up period of up to a year after surgery.

MATERIALS AND METHODS

The study included 15 patients who underwent endoscopic neurolysis and decompression of the sciatic nerve in the period from 2018 to 2022 performed with a previously published technique [7]. All operations were performed at the Departments of Traumatology and Orthopedics and Neurosurgery of the Buyanov Municipal Hospital by one team of surgeons, which included an orthopedic trauma surgeon (author 1) and a neurosurgeon (author 2). The mean age of the patients was 47 ± 16 years. Most of the patients were women, 11 (70 %), there were 4 (30 %) males. In 12 patients (80 %), the onset of neuropathy was preceded by trauma; there was no history of trauma in 3 patients (20 %). The development of neuropathy and the formation of an intraneural cyst occurred without injury after long-term cycling activities in one patient (6.7 %). According to the mechanism of injury, a fall on the buttocks prevailed (3 patients (20 %); neuropathy developed after osteosynthesis of the pelvic bones in 2 patients (13 %). Iatrogenic nerve damage during hip arthroplasty occurred in 6 patients (40 %). One patient (6.7 %) sustained injury during wrestling.

Examination of the patients included clarification of the anamnesis and complaints, a thorough orthopedic and neurological examination, and an instrumental study. Pain was revealed by palpation in the region of the subpiriform space. The range of motion in the hip joint was measured and compared with the healthy side. All patients underwent a "piriformis test". The patient was in a position on a healthy side, the test leg was bent at the hip joint up to 60°, the knee joint was given a 90° flexion position, then the hip was brought to the midline of the body and then down until tension appeared. The test was considered positive when pain appeared in the buttocks and on the posterior surface of the thigh, numbness and paresthesis appeared on the posterior surface of the thigh [8]. The severity of the pain, measured with VAS [9], averaged 8 ± 1 cm. Motor impairment was determined on the BMRC scale [10], the average value was 2.6 ± 1.7 points. Sensory deficit was determined with the Seddon scale [11], and averaged 2.9 ± 0.9 points. The functional activity of the lower limb was checked with the LEFS scale [12], the average value was 49 ± 7 points.

Statistical data processing was carried out using the Microsoft Excel (Microsoft Office 365) and Stattech 2.0 software package. For quantitative signs, the arithmetic mean (M) and standard deviation (SEM) were calculated. To assess the statistical significance of the results obtained, the nonparametric Mann-Whitney test was used. Differences were considered significant at $p < 0.05$.

Instrumental study included radiography of the pelvis, MRI of the hip joint on the affected side, ultrasound of the sciatic nerve, ENMG of the nerves of the lower limb [13, 14]. Radiography of the pelvis was performed to identify the pathology of the hip joint, the presence and stability of metal fixators/ endoprosthesis components, and bone anomalies (Fig. 1).

Fig. 1 X-ray of the pelvis in a direct projection of a patient with neuropathy of the sciatic nerve after complex arthroplasty of the right hip joint

Magnetic resonance imaging was performed to identify the pathology and damage to the rotator cuff of the thigh (piriform, obturator internus, gemini muscles), to assess the topographic anatomy of the sciatic nerve in the region of the subpiriform foramen. An ultrasound examination of the sciatic nerve was performed to assess its structure, confirm the anatomical integrity, the presence of scar and adhesive tissues around the nerve and areas of its compression. Electroneuromyography was performed to confirm and grade functional nerve damage.

Ethical approval: The study protocol was approved by the Ethics Committee of the Medical Institute of the Federal State Autonomous Institution of Higher Education "Peoples' Friendship University of Russia" (No. 7 dated April 21, 2022).

Surgical technique

Surgical intervention was performed under general anesthesia according to the previously described technique [7, 15]. The patient was in prone position. Anatomical landmarks and approaches were marked in the area of intervention (Fig. 2).

Fig. 2 Intraoperative marks of anatomical orientation points and endoscopic portals

Endoscopic ports were formed and the arthroscope and the working instrument were inserted in the projection of the sciatic nerve passage in the region of the subpiriform foramen. A schematic arrangement of endoscopic instruments is shown in Figure 3.

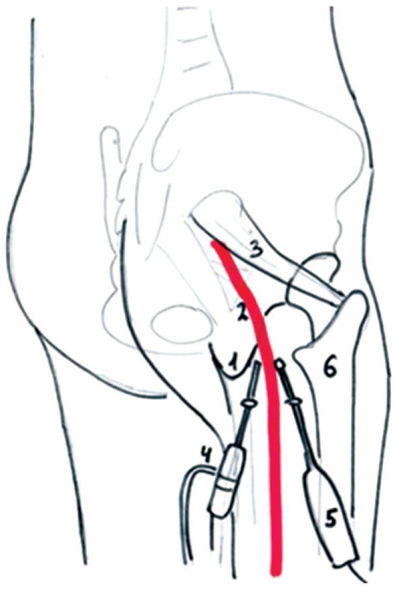

Fig. 3 Diagram of the relative position of anatomical landmarks and endoscopic instruments: 1 – sciatic tubercle, 2 – sciatic nerve, 3 – piriformis muscle, 4 – arthroscope, 5 – working instrument

During the operation, the operating surgeon stood between the patient's legs, the assistant was on patient's healthy limb side (Fig. 4).

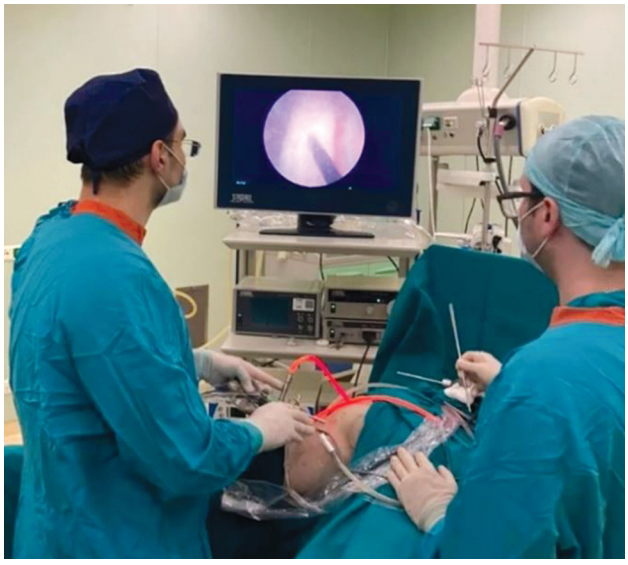

Fig. 4 Position of the patient, the surgical team, the arthroscopic stand and the working instrument during the operation of endoscopic sciatic nerve neurolysis

RESULTS

An endoscopic tissue dissection was performed in the area of the subpiriform foramen, the sciatic nerve was visualized, its neurolysis and decompression were performed. One patient (A., 40 years old) had an intraneural ganglion of the sciatic nerve (Fig. 5).

The ganglion wall was opened and the gel-like contents of the cyst were removed (Fig. 6).

Two patients had an anatomical feature of the passage of the sciatic nerve through the fibers of the piriformis muscle, which was the cause of its compression. A partial piriformis myotomy was performed (Fig. 7).

The screw fixing the pelvic plate was removed due to its excessive length in one patient during the operation of sciatic nerve neurolysis. An additional approach was formed for the insertion of a screwdriver and subsequent removal of the screw (Fig. 8).

The criterion for the completion of neurolysis and decompression was the complete release of the sciatic nerve from the surrounding cicatricial adhesive tissues, which created optimal conditions for its regeneration (Fig. 9).

Endoscopic placement of a temporary stimulation electrode for postoperative nerve stimulation was performed in 3 cases; the electrode was fixed to the skin with a purse-string suture (Fig. 10).

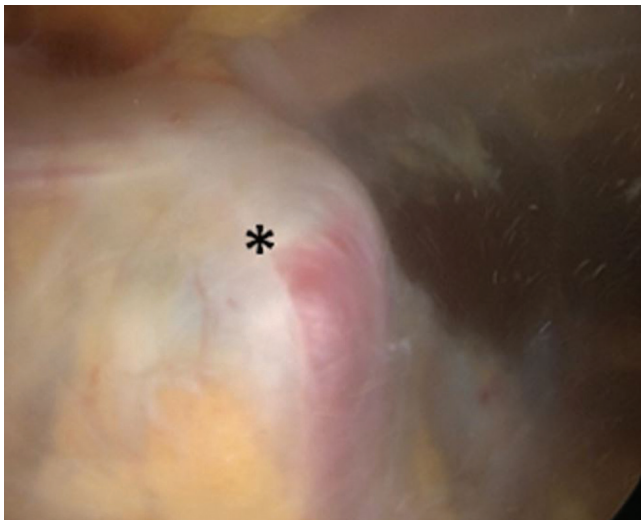

Fig. 5 Endoscopic photo of the sciatic nerve (*)

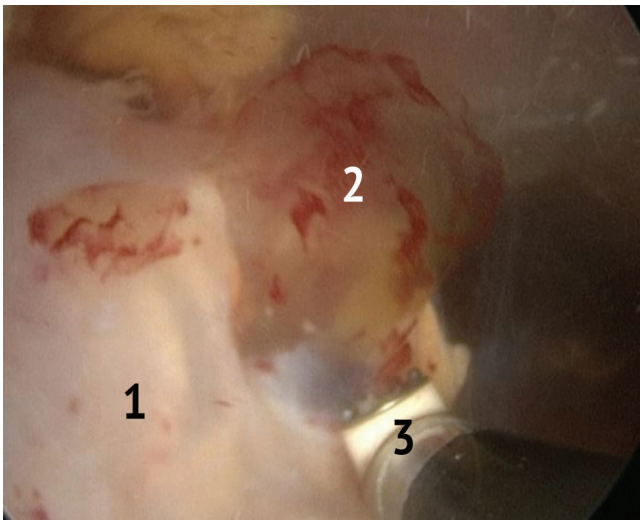

Fig. 6 Exposure and evacuation of the intraneural ganglion: 1 – sciatic nerve, 2 – gel-like contents of the ganglion, 3 – working tool (ablator)

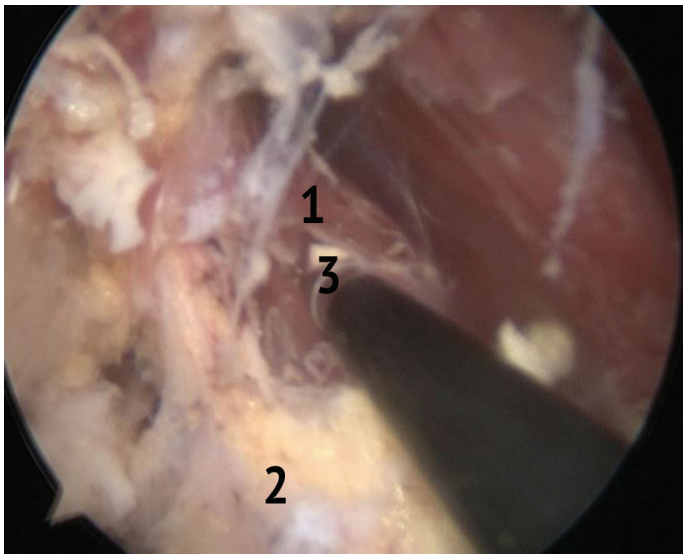

Fig. 7 Myotomy of the piriformis muscle in the area of the passage of the sciatic nerve: 1 – dissected fibers of the piriformis muscle, 2 – sciatic nerve, 3 – working tool (ablator)

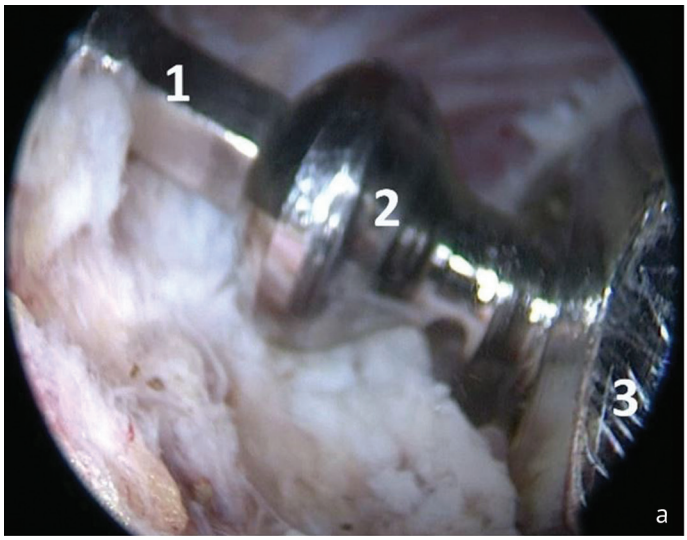

Fig. 8 Endoscopic screw removal (a): 1 – screwdriver tip, 2 – screw head, 3 – pelvic plate; b – appearance of the screw after removal

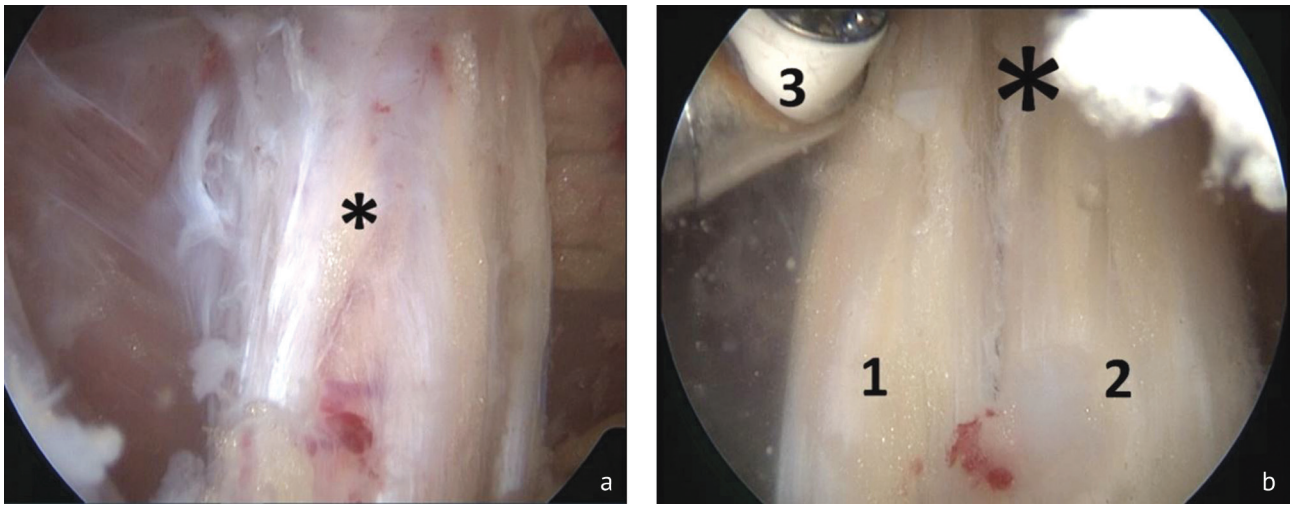

Fig. 9 Sciatic nerve (*) after neurolysis: 1 – peroneal portion of the sciatic nerve, 2 – tibial portion of the sciatic nerve, 3 – ablator head

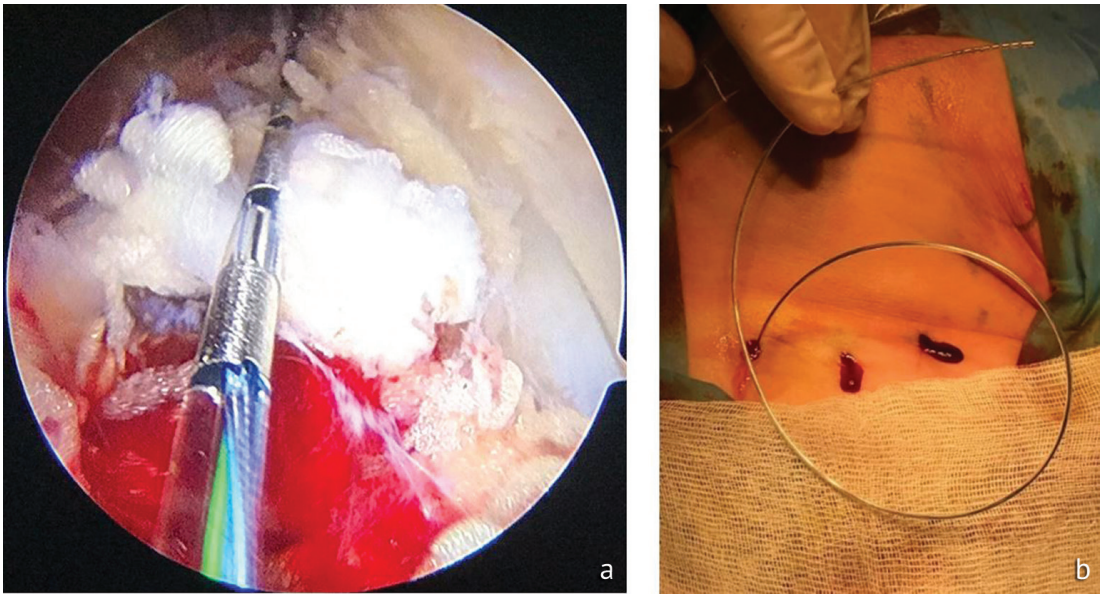

Fig. 10 Placement of an electrode for postoperative stimulation: a – the electrode is approached to the sciatic nerve; b – external position of the electrode inserted through the endoscopic port

At the final stage of the operation, an excessive saline was evacuated from the working area, and sutures were placed on the endoscopic ports. By the end of the operation, soft tissue edema in the buttocks and thighs was noted, which resolved on its own the following day by the time of dressing. Already on the following day after the operation, the patient started physical therapy exercises independently and under the supervision of an exercise therapy instructor. After discharge from the hospital and once the postoperative wound healed, patients began a course of rehabilitation therapy at rehabilitation centers, which included exercise therapy, physiotherapy, massage, myostimulation. Also, the patients were prescribed drug therapy, which included anti-inflammatory and anticholinesterase drugs, thioctic acid preparations.

Postoperative wounds in all patients healed by primary intention. All patients were allowed early activation after surgery with full weight bearing on the operated leg. Most patients did not require additional support, and by the time the sutures were removed, they were able to move independently without any discomfort (Fig. 11).

Good esthetics results after endoscopic intervention were noted, postoperative scars in the area of the gluteal fold were hardly noticeable (Fig. 12).

The patient, who underwent endoscopic removal of the screw from the pelvic plate during neurolysis, underwent a follow-up radiography after the operation, which confirmed the removal of the screw (Fig. 13).

Fig. 11 Functional result 1 week after sciatic nerve neurolysis and removal of the intraneural cyst (ganglion)

Fig. 12 Esthetic outcome half a year after the surgery

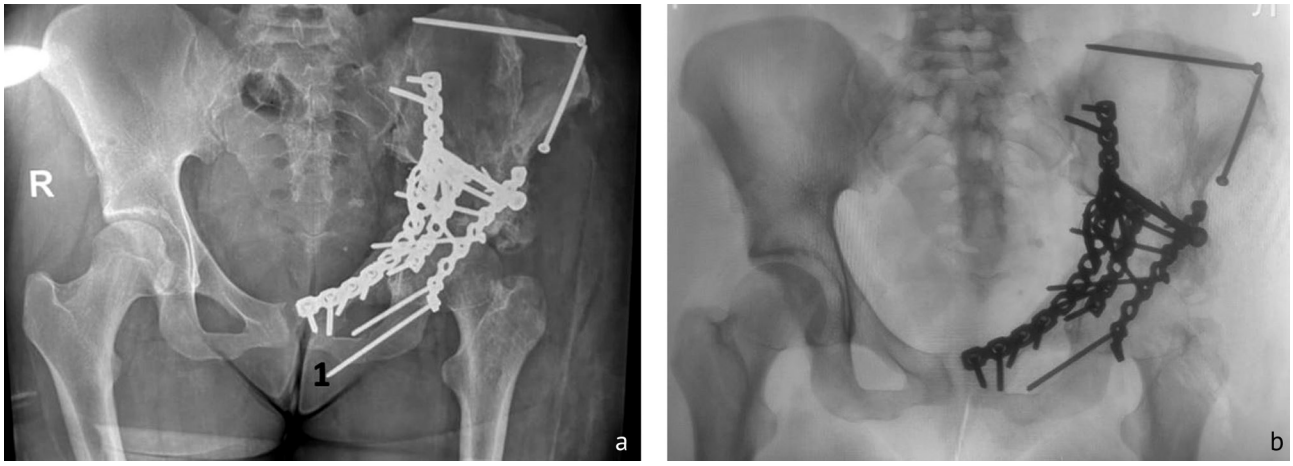

Fig. 13 X-ray of the pelvis in direct projection: a - before surgery, where 1 is the screw is of excessive length, requiring removal; b - after surgery

The final follow-up examination was carried out 12 months after the operation. The severity of the pain syndrome was measured on the VAS scale and averaged 2.8 ± 2.6 cm. Motion disorders on the BMRC scale averaged 4.4 ± 0.8 points. The degree of sensitive deficit on the Seddon scale averaged 3.7 ± 0.4 points. The functional activity of the lower limb according to the LEFS scale averaged 68 ± 8.7 points. The results for all parameters were statistically significantly different from preoperative values ($p < 0.05$). Good and excellent results after surgery were noted in 12 patients (80 %); pain and neurological disorders persisted in 3 patients (20 %), their results of surgical intervention were rated as "poor".

Complication after endoscopic neurolysis of the sciatic nerve

In our series, we encountered one complication (6.7 %): edema of the retroperitoneal space, damage to the parietal peritoneum, ingress of saline into the abdominal cavity (Fig. 14).

Damage to the peritoneum in patient A., 70 years old, occurred due to excessive pressure and edema in the retroperitoneal space, which was caused by excessive pressure in the arthroscopic pump, the duration of the operation, and the performance of neurolysis too proximally in the immediate vicinity of the parietal peritoneum. The patient underwent therapeutic and diagnostic laparoscopy and evacuation of saline from the abdominal cavity in a volume of 400 ml; no damage to the abdominal organs was detected. Once postoperative wounds healed and sutures were removed on the 10th day after the operation, the patient was discharged for outpatient care. At 6-months follow-up, pain persisted, which indicated the ineffectiveness of the surgical intervention.

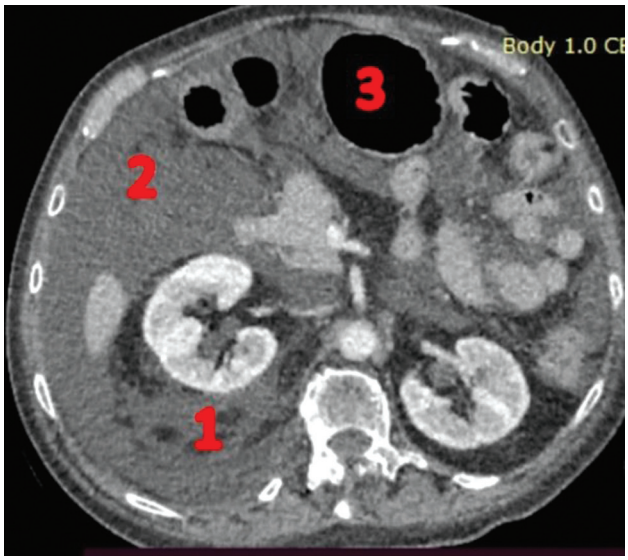

Fig. 14 CT scan of the abdominal organs after surgery: 1 - edema of the retroperitoneal perirenal tissue on the right, 2 - free fluid in the abdominal cavity, 3 - stomach swollen with gas

DISCUSSION

In the domestic literature, one report was published by our team of authors, dedicated to fully endoscopic decompression of the sciatic nerve [15]. The study at that time included 6 patients, of whom 5 (83 %) reported a significant clinical improvement; according to the VAS scale, the intensity of the pain decreased from 7.8 cm before surgery to 1.5 cm three months after surgery. The team of authors led by A.V. Dekopov published a case series of 4 patients in 2020 who underwent minimally invasive endoscopically-assisted decompression and sciatic nerve neurolysis with the installation of an electrode for neurostimulation. All patients reported a persistent positive clinical effect. Pain decreased up to 50 %. Within 2-3 months after the operation, there was an increase in muscle strength and an increase in the range of motion [16].

In the foreign literature, there are a number of reports on endoscopic neurolysis of the sciatic nerve, including meta-analyses. Myung-Sik Park et al. conducted an analysis of endoscopic neurolysis of the sciatic nerve in 70 patients, of which 25 patients (group 1) had previously undergone reconstructive surgery on the acetabulum, and 45 patients (group 2) had idiopathic onset of pain [6].

Both in the first and second groups, there was a significant decrease in pain, regression of neurological disorders, improvement in the function of the lower limb according to the Harris scale (from 61.5 ± 13.4 to 84.1 ± 8.1 points and from 73.8 ± 10.3 to 94.4 ± 5.3 points in groups 1 and 2, respectively), which is comparable with our results. Ham et al. published the results of endoscopic decompression of the sciatic nerve in 24 patients, with a mean follow-up of 32 months [17]. Pain measured with VAS decreased from 7.1 ± 0.9 to 2.5 ± 1.5 cm, the function of the hip joint measured with Harris hip score increased from 59.4 ± 6.5 to 85.0 ± 8.3 points [17].

In our study, similar results were obtained in pain relief, from 8 ± 1 to 2.8 ± 2.6 cm on the VAS scale. Aguilera-Bohorquez et al. in 2018 published their results of endoscopic neurolysis of the sciatic nerve in 41 patients with a follow-up period of up to 12 months after surgery [18].

According to the WOMAC, there was a decrease in this parameter from 63 to 26 points. Five patients (12 %), had poor results: one patient had pain in the projection of the posterior femoral cutaneous nerve, and 4 patients had a recurrence of the cicatricial adhesive process, which required revision. In our study, the number of unsatisfactory results was slightly higher (20 %). Park et al. reported the results of endoscopic neurolysis of the sciatic nerve; the study group included 60 patients and the follow-up period was 2 years [19]. According to the VAS scale, pain decreased from 7.4 ± 1.5 to 2.6 ± 1.5 cm, and the function of the hip joint according to the HHS increased from 81.7 ± 9.6 to 91.8 ± 7.6 points, which is also comparable to our results. The meta-analysis, which was conducted by Metikala et al. analyzed the results of treatment of 144 patients after neurolysis of the sciatic nerve with an average follow-up period of 26.3 months. Good clinical outcomes and regression of neurological deficit as well as a low risk of complications were reported [20]. Summarizing the above, we can conclude that the clinical results obtained in the course of our study are comparable with the results published in domestic and foreign literature.

CONCLUSION

Endoscopic decompression and neurolysis of the sciatic nerve is an effective and low-traumatic technique that allows patients to get rid of neuropathic pain, creates conditions for restoring the function of the sciatic nerve and the lower limb. Endoscopic technique, among other things, allows visualization and removal of intraneural cysts (ganglions). The efficiency of the operation in our series of observations was 80 %, a complication happened in one case (6.7 %).

Competing interests. *The authors declare that they have no competing interests.*

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Informed consent *All patients signed an informed consent form.*

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Belyak E.A., Pashin D.L., Loginov M.A., Makhuova G.B. – concept and design of the study, forming data, writing the text, editing.
Lazko F.L. – conception and design of the study.
Prizov A.P. – statistical analysis.
Lazko M.F. – writing text.
Yusufov M.P. – forming data and analysis.
Asratyan S.A. – editing.