Flexible Endoscopy in Surgical Treatment of Spinal Adhesive Arachnoiditis and Arachnoid Cysts

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Thecaloscopy is less-invasive exploration of spinal subarachnoid space with an ultra-thin flexible endoscope and endoscopic fenestration of scars and adhesions. Thecaloscopy was used in Russian neurosurgery for the first time. Since 2009, 32 patients with following diagnosis have been operated on: 17 – spinal adhesive arachnoiditis (8 – local forms, 9 – diffuse forms), 12 – spinal arachnoid cysts (7 – post-traumatic cysts, 5 – idiopathic cysts), 3 – extramedullary tumors (thecaloscopic videoassistance and biopsy). In all cases, the subarachnoid space was explored and pathologic lesions were treated by endoscopic perforation of cyst or dissection of adhesions using special instrumentation. The mean follow-up period in our group was 11.4 months. Neurological improvement (estimated as 1.4 by modified Frankel scale, 1.8 by Ashworth spasticity scale) was seen in 87% of patients operated on for spinal arachnopathies. Transient neurological deterioration (mild disturbances of deep sensitivity) was found in 9% of patients and was managed successfully with conservative treatment. One (3.1%) patient was operated on three times because of recurrence of adhesions. There were no serious intraoperative complications (e.g., severe bleeding, dura mater perforation, etc.). Postoperative complications included one case of wound leakage and one case of postoperative intercostal neuralgic pain. The mean hospitalization time was 7.6 days. According to our data, thecaloscopy is an efficient and safe method, and could be widely used for treatment of spinal arachnopaties, adhesive arachnoiditis, and arachnoid cysts. Taking into account that adhesive spinal arachnoiditis is a systemic process and spinal arachnoid cysts can be extended as well, thecaloscopy can be regarded as the most radical and less-invasive way of surgical treatment existing in neurosurgery.

Keywords: *thecaloscopy, epiduroscopy, spinal arachnoiditis, arachnoid cysts, subarachnoid space, flexible endoscopy, neuroendoscopy, syringomyelia.*

Thecaloscopy is less-invasive surgical technique performed by insertion of a flexible endoscope into the dural sac with diagnostic or treatment purposes.

In 2001, J. Warnke, M. Tschabitscher, A. Nobles, N. Gheel (Paracelsus Hospital, Zwickau, Germany) proposed “thecaloscopy” as a new term for flexible endoscopy of the subdural space [5, 6]. This term was chosen due to the initial purpose of pointwise intrathecal injection of drugs in patients with intractable pain syndromes caused by oncologic diseases.

Thecaloscopy is a new method of surgical endoscopy of the spinal cord. The world experience of using it is limited; there are few references that mostly describe clinical cases. There is no evidence for using this method in Russia. Nevertheless, foreign articles on the subject have reported the advantages of using thecaloscopy, especially in treating spinal arachnoiditis and spinal arachnoid cysts. Hence, further research into thecaloscopy is rather relevant.

Indications for using thecaloscopy

As mentioned above, thecaloscopy can be used as a separate surgical technique, as well as video assistance for microsurgeries.

Indications for using thecaloscopy are as follows:

— true and pseudo-arachnoid cysts of the spinal cord of different length and genesis (including post-traumatic);

— pseudomeningocele;

— adhesive spinal arachnoiditis causing conductive or radicular symptoms that influence quality of life of a patient and are resistant to rehabilitation treatment and conservative therapy;

— syringomyelia associated with the adhesion processes in the subarachnoid space of the spinal cord;

— extramedullary tumors (thecaloscopic video assistance and biopsy);

— tethered spinal cord syndrome.

Contraindications include

— decompensated severe somatic diseases;

— active inflammation in the spinal cord membranes or spine (acute exudative arachnoiditis, pyogenic epiduritis; spondylodiscitis, etc.) confirmed by clinical-laboratory examination;

— severe immunodeficiency, including HIV.

Features of the clinical picture of adhesive spinal arachnoiditis and arachnoid cysts

E.I. Gusev, V.E. Grechko and G.S. Burd (1988) described 4 clinical forms of spinal arachnoiditis according

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to the prevalent symptoms: 1) conductive; 2) radicular; 3) mixed; and 4) dorsal columnar [1].

Spinal arachnoiditis can be characterized by acute, sub-acute, or chronic disease progression. Acute spinal arachnoiditis is mostly found in patients with severe systemic infections, such as sepsis and bacterial meningitis. It is often accompanied with hyperthermia, fever, acute phase symptoms. In the most severe cases it is complicated by hemorheological disorders, multiorgan failure, etc. Neurologic symptoms develop quickly over only a few days or even hours; in particular, acute progression of severe conductive symptoms emerges. Sub-acute spinal arachnoiditis also accompanies infections, but in a more latent form, developing over months; it is characterized by normal or subferile temperature. In the neurologic status, radicular symptoms come to forefront, while conductive symptoms emerge later. In patients with chronic spinal arachnoiditis, it is often impossible to determine an exact infectious agent; disease progresses very slowly; spastic and afferent paresis, as well as pelvic disorders, is prevalent [3].

It should be mentioned that arachnoid spinal cysts often clinically resemble an extramedullar tumor; this fact used to cause diagnostic errors before neuroimaging started to be widely used. An arachnoid cyst causes slow-progressing conductive disorders, cerebrospinal fluid circulation disorders, rarely – radicular symptoms localizing at one of the adhesions on the cyst wall. Numerous studies have been devoted to experimental methods for modeling arachnoid cysts and their role in syringomyelia development. Thus, the presence of compression of the subarachnoid space has been proved to cause widening of the central canal and formation of a syringomyelitic cyst [7].

Planning of pre-operative examination

As mentioned above, the clinical picture of cysto-adhesive spinal arachnoiditis may be different; patient's condition may vary from subclinical health complaints to severe disability. In a few cases, especially after bacterial meningitis, spinal symptoms can be overlaid with the clinical presentation of intracranial pathology. Moreover, many arachnoid cysts (especially the idiopathic ones) are asymptomatic; they may be detected incidentally during MRI examination.

Therefore, the main objective of pre-operative examination is to determine whether the neurologic symptoms are caused by spinal arachnoiditis or arachnoid cyst and to eliminate the possibility of intercurrent pathology. A precise algorithm of the examination may differ depending on a certain patient; but the mandatory plan of pre-operative examination includes the following items:

— neurological examination (both by a neurosurgeon and a neurologist);

— MRI of all possibly involved sections of the spine and spinal cord (magnetic field intensity more than 1.5 T) with MR myelography and quantitative dynamics of the cerebrospinal fluid if necessary;

— routine laboratory studies (measuring the level of C-reactive protein in blood) and analyses for highly infectious diseases.

If necessary, the following methods are also can be used:

— neurophysiological methods (electroneuromyography, somatosensory-evoked potentials, transcranial magnetic stimulation);

— lumbar puncture (to measure pressure in the cerebrospinal fluid; total, biochemical and microbiological analyses of CSF);

— MRI of the adjacent spine sections;

— CT scanning of the spine;

— Consulting neurologists specializing in neurodegenerative and demyelinating diseases.

Description of the procedure

Technical equipment for the method

The use of a flexible endoscope (fiberscope) manufactured by Karl Storz (Germany) is described in this study **(Fig. 1)**. The endoscope can be either 40 or 70 cm long. The latter version is sufficient for complete revision of the entire subarachnoid space from the *cauda equina* roots to the craniovertebral transition in an adult patient. The fiberscope is compatible with a standard endoscope stand.

A manipulator on the base of the fiberscope allows bending of its distal part up to 270° in two directions **(Fig. 2)**. This function allows one to perform complete visualization and revision of the ventral and dorsal subarachnoid spaces.

The working surface is 2.8 mm in diameter; has a light source, camera, and working channel 1.2 mm in diameter (**Fig. 3, 4**). This channel can be used for irrigation during the surgery and to insert manipulators for biopsy and adhesion detachment under visual control.

The recent technology has allowed placing the camera at the distal part of the endoscope; this technology was registered by Karl Storz under the "chip-on-tip" trade name. Optical resolution of the "chip-on-tip" devices is superior to standard fiberscopes with the same diameter of the working surface. The preliminary results of clinical use of digital endoscopes show that they can be useful for interventions in the brain, as well as in the spinal cord: for perforation of the floor of III cerebral sinus, biopsy of tumors of the cerebral sinus system, endoscopic drainage and fibrinolysis of hypertensive intracerebral hemorrhages. Visualization of intracranial structures is of high quality when this technology is used.

Surgery technique

The intervention is performed on patients in the prone position. Both endotracheal and local infiltration with anesthesia ensured through the puncture approach is possible due to the low invasiveness of the method. In surgeries on the superior cervical spine, patient's head is

Fig. 1. **Thecaloscope: general view.**

Fig. 2. **Control over the distal part of the thecaloscope using a manipulator.**

Fig. 3. **Manipulation channels of the thecaloscope (1.2 mm in diameter).**

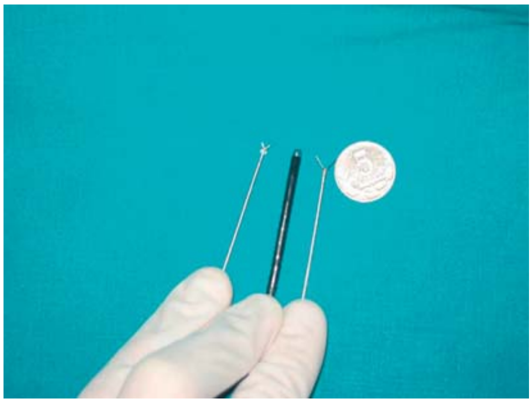

Fig. 4. **Size of the distal part of thecaloscope and manipulators, comparative view.**

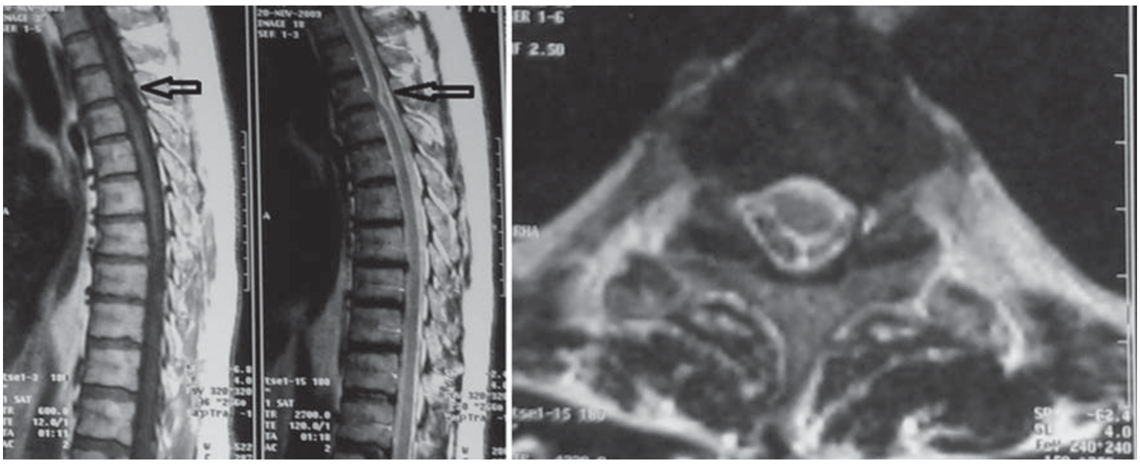

Fig. 5. **Local spinal adhesive arachnoiditis at the T3 level (shown with arrows).**

rigidly fixed with a Mayfield head holder. The endoscopic stand is placed facing the working surgeon. Intraoperative radiography is used.

According to the principles of the minimally invasive surgery, the approach should be as small as possible, but it should entirely conform to intervention objectives. Therefore, it is possible to choose different approach localizations.

The approach is performed strictly above the compression site in the cases of local spinal cysts or single adhesions **(Fig. 5)**, making it possible to conduct microsurgical dissection of the adhesions **(Fig. 6)**.

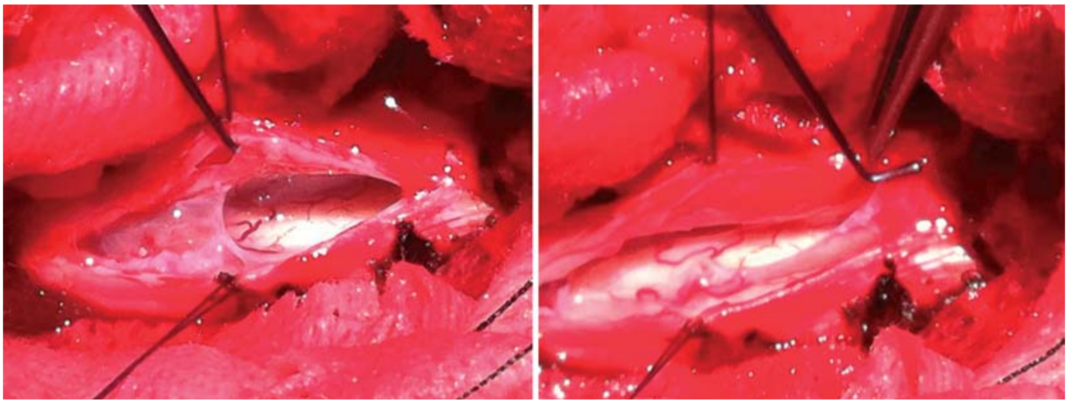

***Fig. 6*. Microsurgical separation of adhesions before thecaloscopic surgery.**

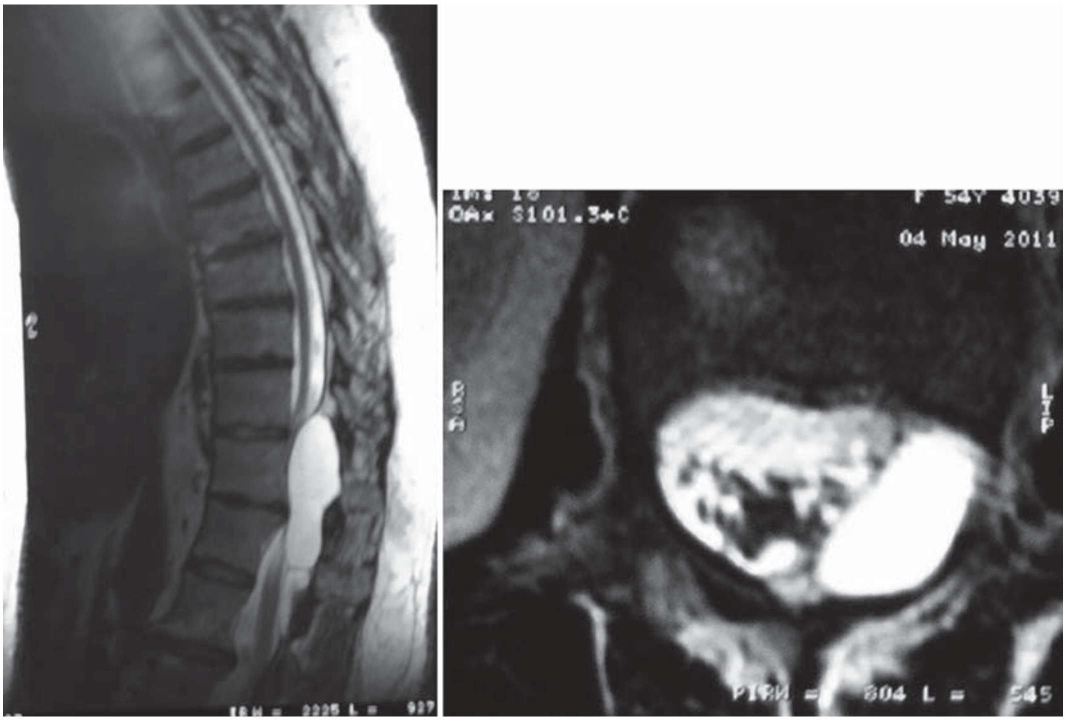

***Fig. 7*. Extended arachnoid post-traumatic cyst at the T9–T11 level.**

In the cases of extended arachnoid cysts, it is reasonable to use the approach in the middle of the cyst **(Fig. 7)**. This allows one to perform convenient manipulations with the endoscope both in the cranial and caudal directions.

In the cases of severe adhesions, extended adhesive arachnoiditis, and presence of a wide range of symptoms caused by damage to various sections of the spinal cord and its roots **(Fig. 8)** and when adhesions are localized in a dangerous area (conus, epi-conus), it is the safest to use the approach caudally from the conus. This makes it possible to perform manipulations under conditions of larger vertical dimensions of the subarachnoid space and reduces the risk of aggravation of the neurologic symptoms.

When using an open approach, skin and soft tissues are incised in the projection of the target spine section under the control of the intraoperative radiography according to the tactics selected. Spinous processes and vertebral arches are skeletonized at the target level. Then, laminectomy is performed, typically at the arch of a single vertebra (corresponding to the 5–7 cm long skin incision). The lngth of the dura mater incision is usually less than 2 cm. Effective hemostasis (using modern hemostatic materials) is of high importance, since even the minimal bleeding hinders endoscopic imaging.

The main stage (thecaloscopy) begins after the microsurgical dissection of visible adhesions and cyst walls. The fiberscope is inserted into the dorsal subrachnoid space and, if necessary, into the ventral space by bending the distal end of the instrument with the manipulator

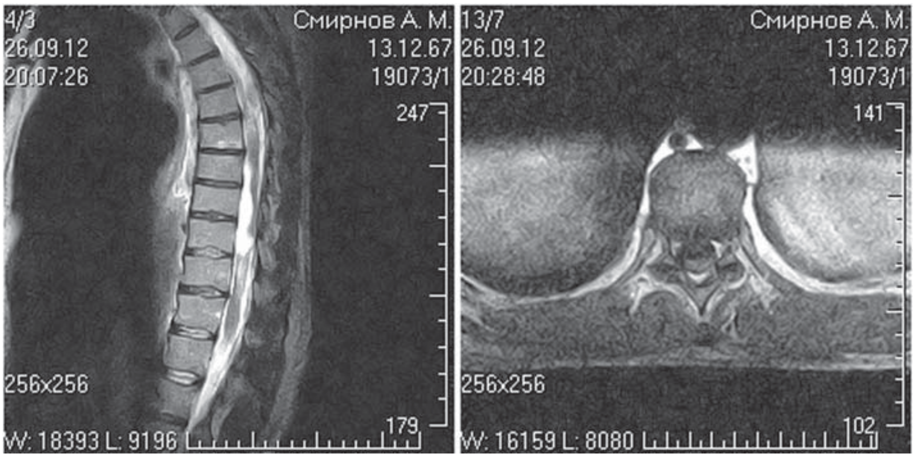

***Fig. 8*. Extensive post-infectious arachnoiditis of the middle thoracic spine.**

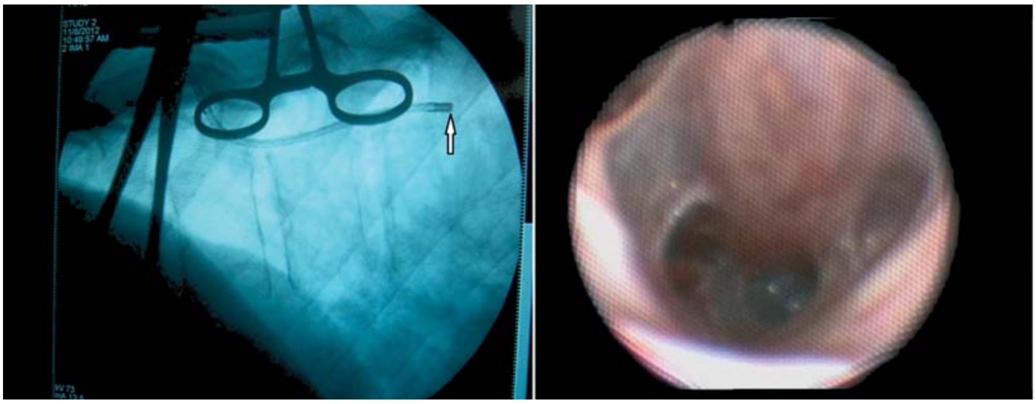

***Fig. 9*. Thecaloscopy of the ventral subarachnoid space. An arrow shows the distal end of thecaloscope.**

(Fig. 9). If necessary, endoscope position is controlled using an electro-optical converter.

This method allows precise visualization of adhesions and cyst walls **(Fig. 10)**, as well as different anatomic **(Fig. 11)** or pathologic **(Fig. 12)** formations.

Adhesion separation and cyst fenestration manipulations can be performed either using the working area or using manipulators **(Fig. 13)**. All thecaloscopic manipulations should be smooth, without applying the force, in order to prevent traction of the spinal cord and aggravation of the neurologic symptoms. It is to be noted that the technical features of the method require a surgeon to have certain experience in image interpretation; in particular, it is important to get used to its "mesh-like" appearance, which is typical of all ultrathin flexible endoscopes; to the better image quality when the fiberscope moves backwards, and to the need for proper orientation in the two-dimensional space.

Thecaloscopy can be used to separate intramedullary adhesions in surgeries for severe syringomyelia with myelotomy **(Fig. 14)**.

Prolonged irrigation with physiological saline is used to stop bleeding from arachnoid envelope vessels **(Fig. 15)**, which are often pathologically changed. No hemorrhage of significant volume and duration has been observed in our practice. Semiconductor diode laser also can be used for vessel coagulation.

Much attention is paid for prevention of wound liquorrhea, which is relatively probable in patients with arachnoiditis due to morphological changes in thr dura mater. Hermetic suturing is insufficient in some cases and plastic repair of the dura mater is required.

Postoperative management of the patients

Patients were typically activated as early as possible, preferably the next day after the surgery. Early beginning of rehabilitation under the control of neurorehabilitation specialists is very important. Antibiotic prophylaxis, glucocorticosteroid therapy, and symptomatic treatment are employed. Lumbar puncture is performed the next day after surgery with estimation of the pressure in CSF and washing with doxycycline solution to sanitize the subarachnoid space. The mean hospital stay in the case of microsurgical approach is 7–10 days. It should be noted that puncture thecaloscopy can be performed at one-day inpatient hospital stay.

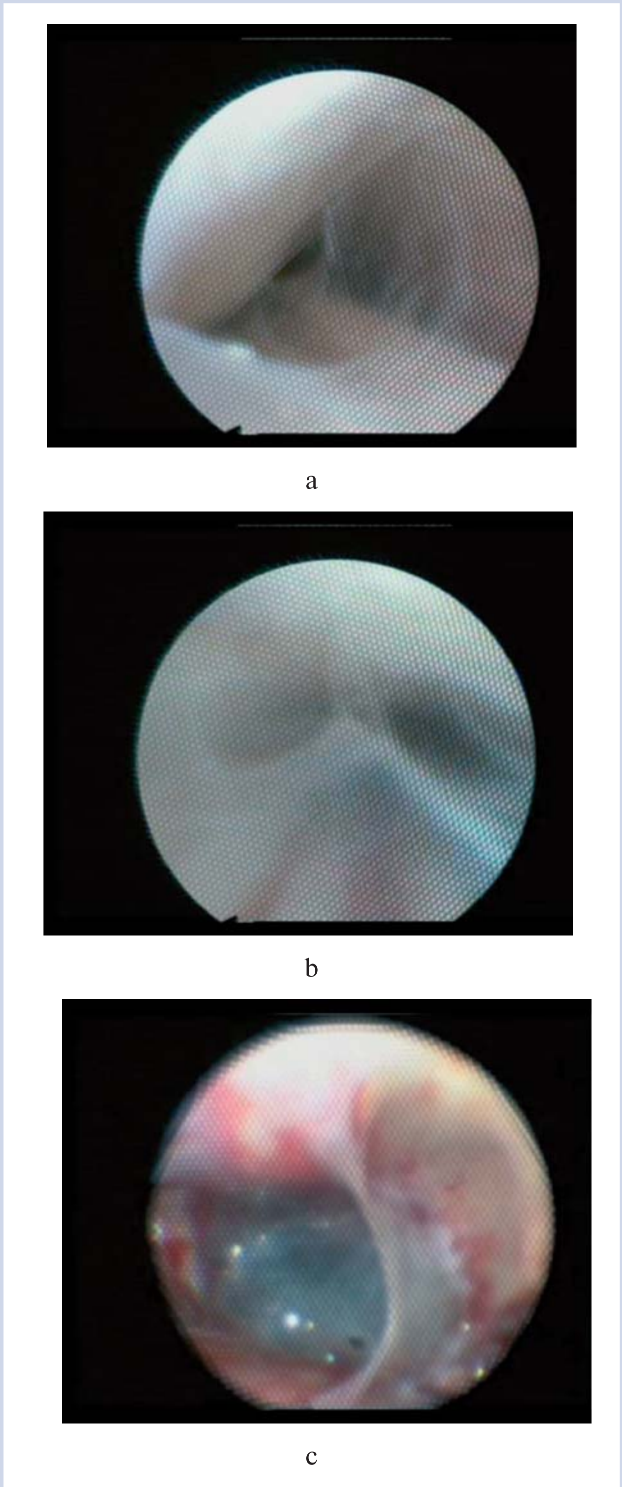

Fig. 10. **Arachnoid adhesions (a, b) and arachnoid cyst wall (c), thecaloscopic view.**

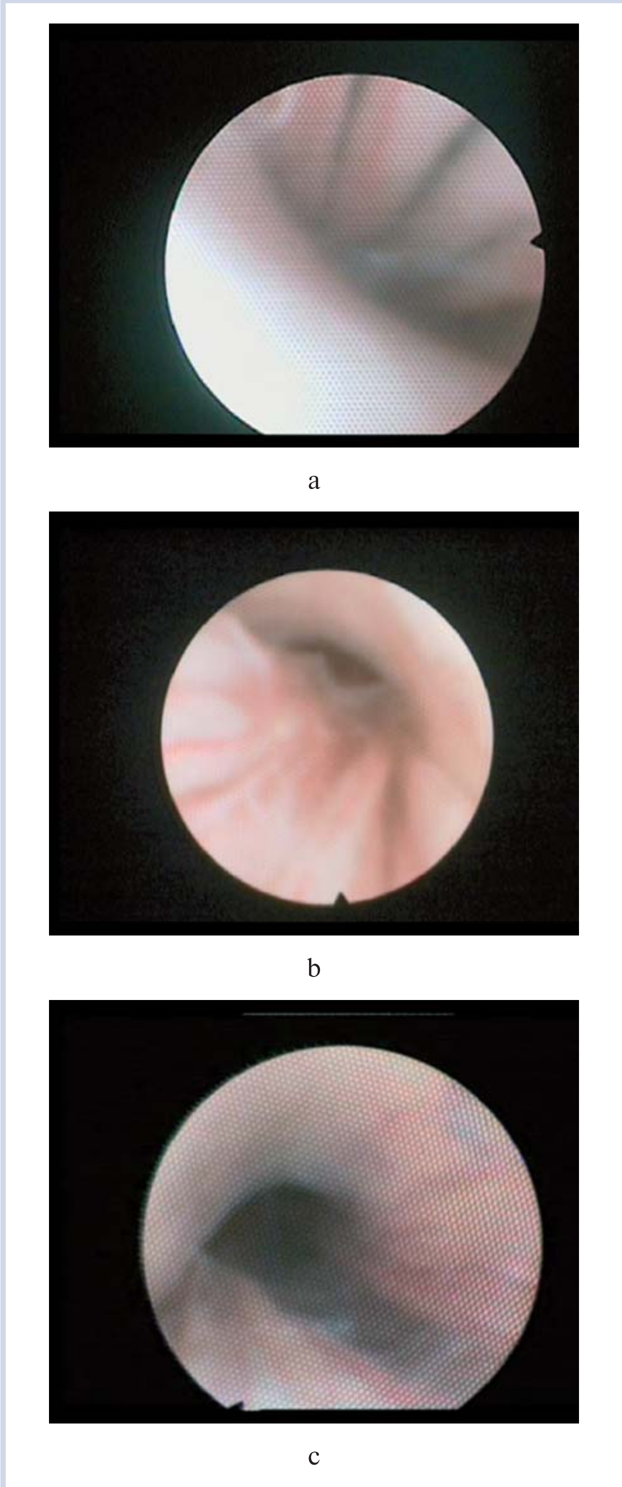

Fig. 11. **View of the cauda equina roots in the spinal cord for ventral (a) and dorsal (b) endoscope insertion. The site where the spinal cord roots originates from the cauda equina (c).**

Evaluation of surgery results

It is reasonable to evaluate the treatment results on the day when a patient was activated, at hospital discharge, 6 months after the surgery, and then annually. The following methods are typically used for evaluation:

— neurological examination in the dynamics;
— modified Frankel scale;
— neuroimaging results (MRI including MR myelography);
— record of complications.

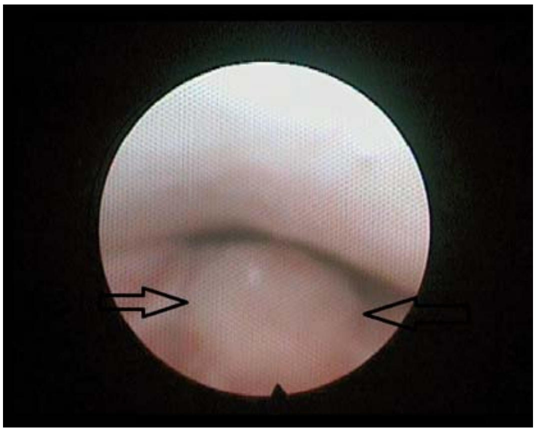

Fig. 12. **Extramedullary tumor (neurofibroma) at the L3 level (arrows).**

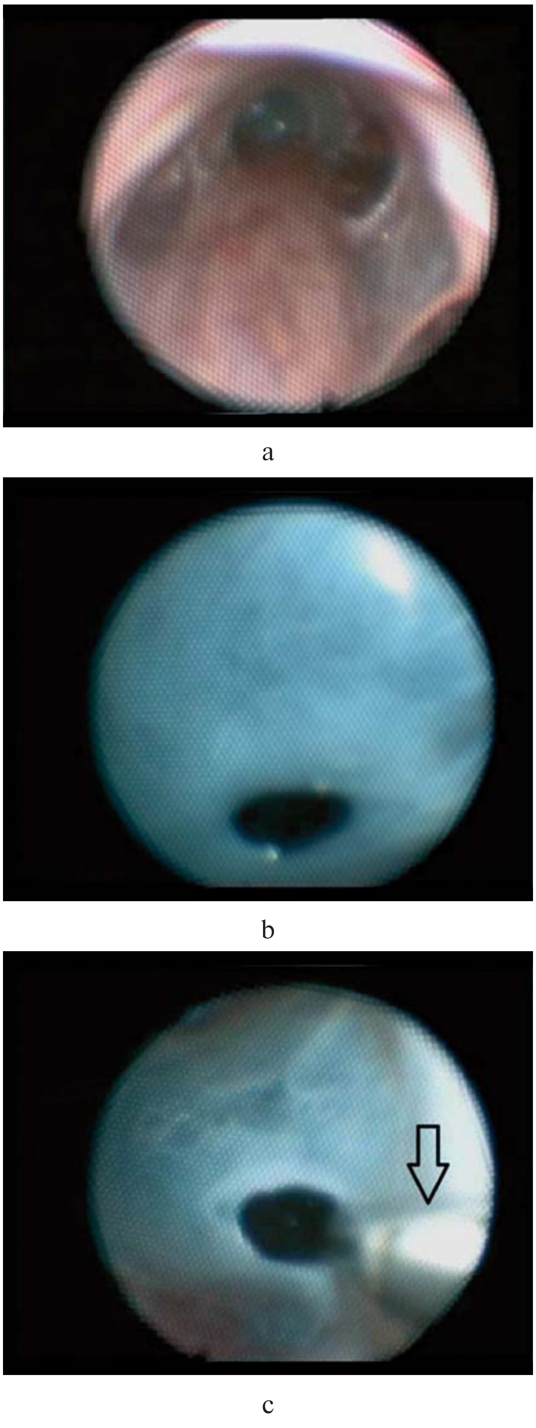

Fig. 13. **Fenestration of arachnoid adhesions in thecaloscopic surgery.**
a — adhesions in the dorsal subarachnoid space; b — fenestrated arachnoid cyst wall; c — fenestration of the cyst with a manipulator (arrow).

Complications and unsatisfactory results

Our data suggest that thecaloscopy rarely causes complications; their frequency is no higher than in other spinal neurosurgeries. No serious intraoperative complications were observed. Besides general surgical and anesthetic complications, development of liquorrhea or a liquor cyst of soft tissues, as well as reactive aseptic meningitis, is possible.

A possible unsatisfactory result of the surgery can be recurrent adhesion, which can develop over different periods and cause aggravation of neurologic symptoms (3.1% patients in our group). These cases are rare according to our data [5]; predictors of such results are likely to be as follows: prevalence of arachnopathies, general inflammation processes, immunoreactive disorders, and proneness to develop adhesions **(Fig. 16)**. A patient should be warned about the possibility of such result.

Results of using thecaloscopy

We used this method for the first time in November 2009. Since 2009, 32 patients have been operated on: 17 — for spinal adhesive arachnoiditis (8 — local forms, 9 — diffuse forms), 12 — spinal arachnoid cysts (7 — post-traumatic cysts, 5 — idiopathic cysts), 3 — extramedullary tumors (thecaloscopic video assistance, and biopsy). In all cases, the subarachnoid space was examined in both the dorsal and ventral sections. Surgery for cysts and adhesions included thecaloscopic separation of adhesions and exploration of the subarachnoid space caudally and cranially from the surgical approach site. The modified Frankel scale, the Ashworth scale, and the MRI data were used to evaluate the results.

The mean follow-up period in our group was 11.4 months. Neurological improvement (estimated as 1.4 according to the modified Frankel scale, 1.8 according to the Ashworth scale) was observed in 87% of patients operated on for spinal arachnopathies **(Fig. 17)**.

Transient neurological deterioration (mild disturbances of deep sensitivity) was found in 9% of patients and were managed successfully with conservative treatment. One (3.1%) patient with severe widespread adhesive arachnoiditis was operated on 3 times with 6- or 8-month intervals due to recurrent adhesions detected by MRI. After each thecaloscopy, patient's condition improved; however, it deteriorated back to the initial level after the mentioned intervals. No serious intraoperative

Fig. 14. **Intramedullary thecaloscopy. Adhesions in the central canal of the spinal cord.**

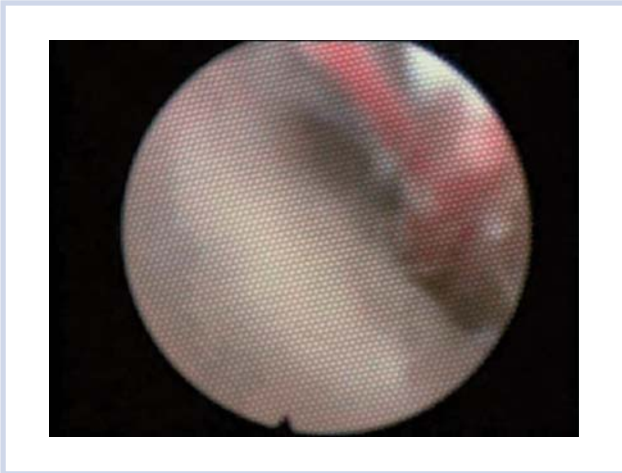

Fig. 15. **Vessels of the arachnoid envelope of the spinal cord.**

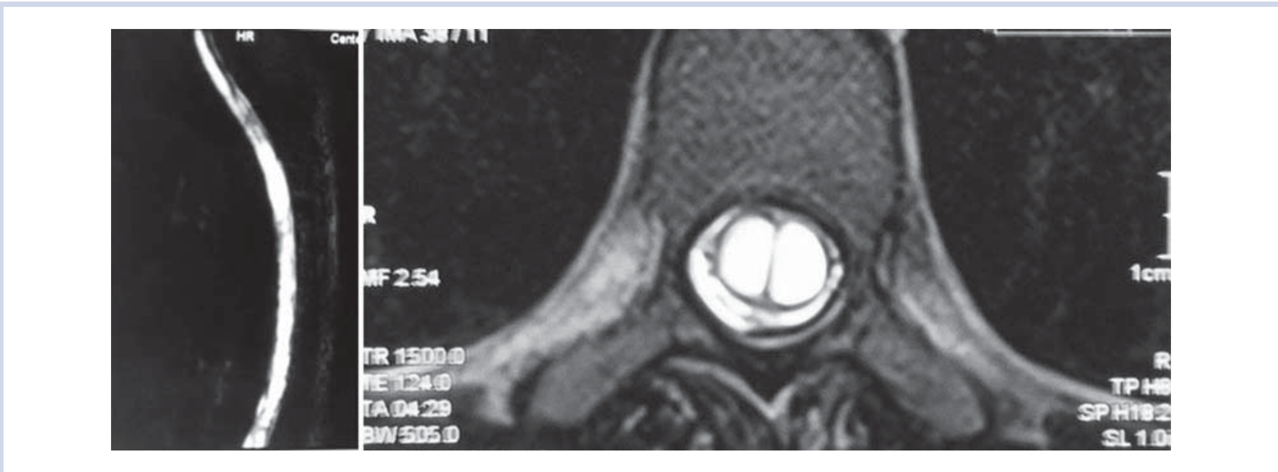

Fig. 16. **Severe infectious adhesive arachnoiditis with development of syringomyelia.**

complications (e.g., severe bleeding, dura mater perforation etc.) were observed. Postoperative complications included one case of wound leakage and one case of postoperative intercostal neuralgic pain. The mean hospital stay was 7.6 days. According to the MRI data acquired after the surgery, recurrent adhesions were found in one (3.1%) patient; thus, reoperation was performed 7 months after the primary intervention.

Clinical case

A 29-year-old female patient *S.* belonging to the disability group I. At the moment of hospitalization to the Neurosurgical Department of the Research Center of Neurology, she had complaints for movement problems, spastic feeling in legs, reduced sensitivity in limbs, and episodic involuntary urination and defecation. She could walk for short distances with assistance. At the age of 17 years, the patient acquired complicated traumas in a criminal accident: closed cerebrocranial injury, brain concussion, injury of the spine and spinal cord at the cervical thoracic transition. The patient had multiple knife wounds of the neck, abdominal, thoracic cavities, pneumothorax on the left side, and spleen rupture. Immediately after the wounding, movements in limbs were completely absent, as well as sensitivity and self-contained urination and defecation. A significant improvement was achieved after the long-term rehabilitation: the patient began walking; pelvic organ functions partially restored. Approximately 1.5 years prior to the hospitalization she noticed slow aggravation of neurologic symptoms, difficulty in limb movements, and aggravation of numbness. Conservative therapy and rehabilitation were ineffective; a neurosurgeon recommended surgical treatment.

Diagnosis: post-traumatic arachnopathy at the C7—T1 level. Myelopathy at the C7—T1 level.

Neurological status: spastic tetraparesis up to 3 points in legs, up to 4 points in arms; reduced surface sensitivity starting from the T2 level; severe disturbances of deep sensitivity in legs; dysfunction pelvic organs (neurogenic urocyst). MRI revealed myelopathy at the C7—T1 level together with archnopathy, disorders in CSF dynamics (in the MR myelography mode) **(Fig. 18)**.

Laminectomy was performed at the T1 level along with adhesiolysis and thecaloscopic separation of adhesions. A rigid adhesion fixing the spinal cord at the C7–T1 level was detected intrasurgically; the adhesion was dissected. Thecaloscopy in caudal direction from the approach site (T4–T5) detected a rigid ventral and dorsal adhesion fixing the spinal cord and belonging to the arachnoid cyst wall **(Fig. 11)**. They were endoscopically dissected, which resulted in the normalization of spinal cord pulsation and CSF passage **(Fig. 15)**.

The patient was activated the next day after the surgery. Neurological improvement was seen as reduced spasticity (score 1 according to the Ashworth scale); no pelvic disorders were observed; surface and deep sensitivities improved. The wound was healed by primary intention. The patient was discharged on the 6th day after the surgery. Control examination after 6 months detected stabilization in the neurological status with no signs of relapse. The patient was able to walk and continued her high education.

Thus, the aggravation of the symptoms 11 years after the injury was most likely caused by decompensation of spinal blood circulation and progression of the adhesive process in the damaged area, compression of the spinal cord and disorders in CSF dynamics. Some authors [6] believe that autoimmune reactions cause there delayed adhesions (similar to the delayed period of severe cerebrocranial injury). Thecaloscopy made it possible to perform fenestration of adhesions and decompression of the spinal cord, including more caudally from the approach site where the adhesions were not verified by preoperative MRI. This method allowed one to achieve stable improvement in neurologic symptoms, significant improvement of patient's quality of life, and promoted early medical and social rehabilitation.

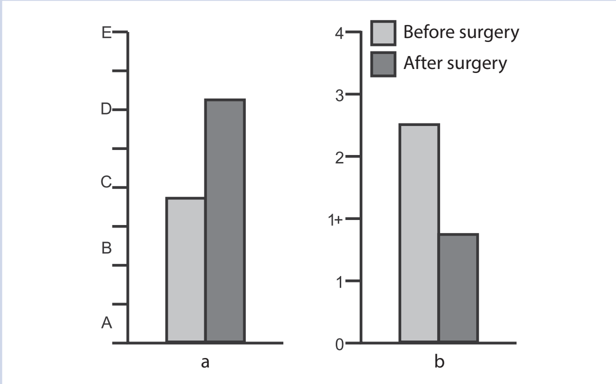

***Fig. 17*. Results of the control examination of patients (the mean follow-up 11.4 months).**

a – the modified Frankel scale (the average neurological improvement was estimated as 1.4 points): A (total damage) – motor functions and sensitivity are absent below the damaged level; B (only sensitivity preserved) – sensitivity is partially retained, voluntary movements are absent; C (minimal motor functions) – movements are retained; strength is reduced to 2 points; D (motor functions are retained) – motor functions are preserved; strength is more then 3 points; the patient is able to move with or without assistance; E (normal functioning) – normal motor functions and sensitivity; b – the modified Ashworth scale (an average decrease in spasticity in limbs by 1.8 points): 0 – no increase in muscle tonus; 1 – a slight increase in muscle tonus experienced when flexing and extending the limb segment as low resistance in the end of the movement; 1+ – slight increase in muscle tonus experienced when flexing and extending the limb segment as low resistance in the second part of the movement phase; 2 – moderate increase in muscle tonus experienced during the entire movement, without hindering passive movements; 3 – a significant increase in muscle tonus, hindering passive movements; 4 – the damaged limb segment is fixed in the flexed or extended position (flexion or extension contracture).

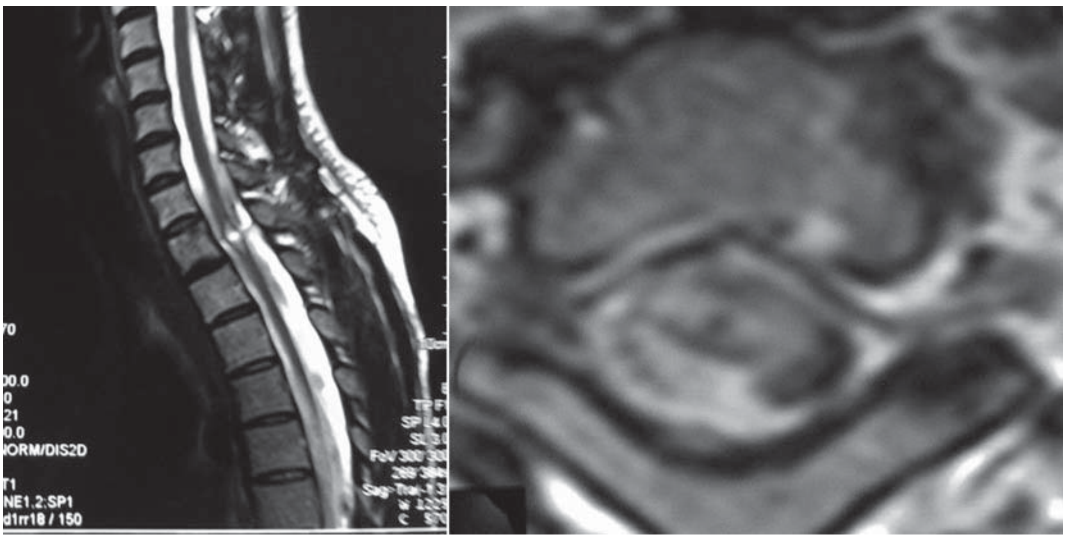

***Fig. 18*. Post-traumatic arachnopathy at the C7–T1 level.**

Myelopathy at the C7–T1 level.

Conclusions

Thecaloscopy was used in Russian neurosurgery for the first time. According to our data, thecaloscopy is an efficient and safe method; it can be widely used for spinal arachnopaties, adhesive arachnoiditis, and arachnoid cysts. Preliminary results of our study reveal the advantages of this method over open microsurgical intervention; better clinical results were achieved with shorter length of stay and faster rehabilitation of the patient. In addition, thecaloscopy can be used for biopsy of extramedullar formations, and for video assistance in patients with the tethered spinal cord syndrome. Further studies will allow us to assess the long-term treatment results; they give grounds for broadening the range of indications for thecaloscopy.

REFERENCES

1. *Polishchuk N.E., Korzh N.A., et al.* Infectious and inflammatory diseases of the spine and spinal cord. Moscow: Meditsina 2001. In Russian.
2. *Alvisi C., Cerisoli M., Giulioni M., Guerra L.* Long-term results of surgically treated congenital intradural spinal arachnoid cysts. J Neurosurg 1987; 67: 333—335.
3. *Di Ieva A., Barolat G., Tschabitscher M., Rognone E., Aimar E., Gaetani P., Tancioni F., Lorenzetti M., Crotti F.M., Rodriguez Baena R., Warnke J.P.* Lumbar arachnoiditis and thecaloscopy: brief review and proposed treatment algorithm. Cent Eur Neurosurg 2010; 71: 4: 207—212. doi: 10.1055/s-0029-1243201.
4. *Koki Shimoji M.D., Mai Ogura, Sanae Gamou, Seki Yunokawa, Hidetoshi Saka moto, Satoru Fukuda.* A new approach for observing cerebral cisterns and ventricles via a percutaneous lumbosacral route by using fine, flexible fiberscopes. J Neurosurg 2009; 110: 376—381.
5. *Kumar K., Malik S., Schulte P.A.* Symptomatic spinal arachnoid cysts: report of two cases with review of the literature. Spine 2003; 28: E25—E29.
6. *Warnke J.P., Tschabitscher M., Nobles A.* Thecaloscopy: the endoscopy of the lumbar subarachnoid space, part I: historical review and own cadaver studies. Min Inv Neurosurg 2001; 44: 2: 61—64.
7. *Warnke J.P., Mourgela S.* Endoscopic treatment of lumbar arachnoiditis. Min Inv Neurosurg 2007; 50: 1: 1—6.

Commentary

The study is devoted to flexible endoscopy, a novel technology in spine surgery, which was used in Russia for the first time only several years ago. The authors of the article are the leading team of surgeons who use the flexible endoscope in surgical treatment of spinal adhesive arachnoiditis and arachnoid cysts. Thecaloscopy is a less-invasive surgical technique performed via insertion of the flexible endoscope into the dural sac with diagnosis or treatment purposes. Over the long-term period of studies, the authors have accumulated a large body of observations on using this technique. A total of 32 patients have been operated on: 17 – for spinal adhesive arachnoiditis (8 – local forms, 9 – diffuse forms), 12 – spinal arachnoid cysts (7 – posttraumatic cysts, 5 – idiopathic cysts), 3 – extramedullary tumors (thecaloscopic video assistance and biopsy). Surgery for cysts and adhesions included thecaloscopic separation of adhesions and exploration of the subarachnoid space caudally and cranially from the approach site. It should be mentioned that the authors managed to define indications for surgery. These are: true and pseudo-arachnoid cysts of the spinal cord of different length and genesis (including post-traumatic); adhesive spinal arachnoiditis, causing conductive or radicular symptoms, influencing life quality of the patient and resistant for rehabilitation treatment and conservative therapy; syringomyelia, connected with adhesion processes in subarachnoid space of spinal cord; extramedullary tumors (thecaloscopic video assistance and biopsy); and the tethered spinal cord syndrome. The authors have drawn a conclusion that thecaloscopy is an efficient and safe method and can be widely used for spinal arachnopaties, adhesive arachnoiditis and arachnoid cysts. Thecaloscopy can also be used for biopsy of extramedullar formations and for video assistance in patients with the tethered spinal cord syndrome.

However, the amount of manipulations that can be performed in the dural space is limited because of the use of single instrument and low image quality caused by small endoscope diameter. But technologies are being constantly mastered. Small-diameter endoscopes have recently started to be used in neurosurgery. They are equipped with a camera at the distal end, producing high-quality image, while the endoscope diameter is minimal. Advances in instrumentation and combining the instruments with manipulators will make it possible to perform more sophisticated surgeries with the minimal damage to the adjacent tissues. These facts argue in favor of the potential of using and improving this technique in the near future.

This article presents valuable scientific information; it is well-illustrated and provides a complete insight into using the technology.

N.A. Konovalov (Moscow)