

©Borgis

Krzysztof Kura, Jacek Osuchowski, Radosław Rola, *Tomasz Trojanowski

Steerable epiduroscope in syringomyelia operations. Preliminary experience

Sterowalny endoskop nadtwardówkowy w leczeniu jamistości rdzenia. Doświadczenie wstępne

Chair and Department of Neurosurgery and Paediatric Neurosurgery, Medical University in Lublin
Head of Department: Professor Tomasz Trojanowski, MD, PhD

Keywords

syringomyelia, endoscopic operation, epiduroscope

Słowa kluczowe

jamistość rdzenia, operacja endoskopowa

Conflict of interest

Konflikt interesów

None

Brak konfliktu interesów

Address/adres:

*Tomasz Trojanowski
Katedra i Klinika Neurochirurgii
i Neurochirurgii Dziecięcej
Uniwersytet Medyczny w Lublinie
ul. Jaczewskiego 8, 20-954 Lublin
tel. +48 (81) 724-41-75
t.trojanowski@umlub.pl

Summary

Introduction. A cyst formed within the spinal cord is called syringomyelia or syrinx. Damage to the nerve fibers results in progressive weakness in the arms and legs, loss of sensation particularly of temperature, stiffness and pain. Even though there are known causes of the disease the exact pathological mechanism remains disputable. Management of syringomyelia is based on surgical procedures. In patients with Chiari malformation suboccipital decompression is commonly used. Drainage of the syrinx remains to be an option. When syrinx is separated into cavities by septa they need to be interrupted. This maneuver is commonly done blind with a catheter, but endoscopic vision should increase the safety and effectiveness of the procedure.

Aim. The aim of this paper is evaluation of the use of steerable epiduroscope in draining syringomyelia cavities.

Material and methods. Multiple cavities of syrinx in three patients were connected and drained utilizing a steerable, disposable 1.4 mm diameter Prisma SRL epiduroscope to perforate the septa.

Results. Epiduroscope Prisma SRL proved to be a useful instrument providing adequate vision within the syrinx cavity and an inflatable balloon an effective tool to extend the perforation of the septa. The method provided adequate vision within the syrinx cavity and an inflatable balloon was effective in extending the septa fenestration. All procedures achieved the goal. There were no early or late complications encountered.

Conclusions. Disposable epiduroscope Prisma SRL of 1.4 mm diameter is a useful and safe tool enhancing the safety and effectiveness of syrinx septotomy in syrinx drainage operations.

Streszczenie

Wstęp. Jamistość rdzenia kręgowego polega na wytworzeniu w obrębie rdzenia jamy, która z czasem stopniowo powiększa swoją objętość. Dokładny mechanizm choroby nie jest poznany, chociaż istnieje kilka teorii w tym zakresie. Leczenie polega na operacji odbarczenia podpotylicznego u chorych z zespołem Chiari albo drenażu jamy śródrdzeniowej do przestrzeni podpajęczynówkowej, jamy oponowej lub otrzewnowej. Gdy jamy są poprzedzielane przegrodami, tworząc szereg oddzielnych jam przegrody, powinny być przerwane. Skuteczność zabiegu można zwiększyć, łącząc jamy pod kontrolą wzroku.

Cel pracy. Celem pracy jest przedstawienie wstępnych doświadczeń z zastosowania jednorazowego, sterowalnego neurofibroskopu w operacjach drenażu jam śródrdzeniowych.

Materiał i metody. Drenaż wielokomorowych jam śródrdzeniowych został przeprowadzony u 3 chorych z wykorzystaniem fibroskopu o średnicy 1,4 mm (Prisma SRL Epiduroscope), narzędzia do operacji w obrębie przestrzeni nadtwardówkowej.

Wyniki. Wszystkie zabiegi przebiegły bez powikłań, uzyskano skuteczne zapadnięcie się jam śródrdzeniowych, a przebieg operacji został oceniony jako pewniejszy i bezpieczniejszy w porównaniu ze stosowanym dotychczas przerywaniem przegród bez kontroli wzrokowej.

Wnioski. Epiduroscope Prisma SRL okazał się narzędziem przydatnym w operacji drenażu wielokomorowych jam śródrdzeniowych zarówno w przypadku jamistości pierwotnej, jak i nieskutecznego odbarczenia podpotylicznego.

Łączenie mnogich jam śródrdzeniowych pod kontrolą neuroendoskopu jest metodą skuteczną i bezpieczną. Wyniki wymagają potwierdzenia po przeprowadzeniu większej liczby zabiegów.

INTRODUCTION

Syringomyelia is a cystic extension of the central medullary canal, most commonly associated with Chiari type I malformation. It can also accompany an intramedullary tumor, follow traumatic injury or infection. With the improved imaging more incidental/idiopathic syrinxes are diagnosed (1).

Syringomyelia can occur in any segment of the spinal cord and usually expands over time. Damage to the spinal cord develop predominantly around the medullary central canal and affects the fibers that carry information between the brain and the extremities. It results in progressive weakness in the arms and legs, loss of the ability to feel extremes of hot or cold, produce stiffness and pain. The symptoms tend to develop slowly.

A variety of surgical operations have been proposed for symptomatic syringomyelia. It results from ambiguity in the explanations proposed to explain the mechanism leading to this disease (1). Presently in cases with Arnold-Chiari syndrome the most common treatment is suboccipital decompression sometimes extended to cervical decompression. This involves suboccipital craniectomy with removal of the posterior border of the foramen magnum, and sometimes a laminectomy of the upper cervical vertebrae. Duraplasty of the exposed region of cerebellar tonsils and spinal cord completes the procedure. Some centers advocate microsurgical dissection of any adhesions, opening of the fourth ventricle outlet and plugging of the obex. An alternative treatment involves dorsolateral myelotomy/syringotomy after exposure of the extended spinal cord. This is regarded to be the principal indication in idiopathic syringomyelia. This procedure involves exposing of the spinal cord through a laminectomy. The syrinx is drained into the subarachnoid space either by a direct incision in the dorsal root entry zone, often enhanced by insertion of a drain between the cavity and subarachnoid space, pleural or peritoneal cavity. This procedure is recommended in cases of syringomyelia without Chiari or further enlargement of syrinx in patients after suboccipital decompression (2, 3).

Intramedullary cavity is often separated into a series of cavities. Myelotomy and syrinx drainage in those cases are more effective if those cavities are connected by fenestration of the septa. This can be achieved by passage of an elastic drain. Passage of the drain through the septa requires application of force which is done without control over the position of the tip of the drain. The management of septated syringomyelia is still presenting difficulties because the common methods of surgical treatment do not always secure drainage of all cavities.

This procedure can be performed with more safety under visual control provided by a fiberoscope inserted through a myelotomy. The diameter of neurosurgical fiberoscopes is large in relation to the size of the medullary central canal and medulla. A small diameter (1.4 mm) fiberoscope has been made available for treatment of the epidural adhesions in the spinal canal,

causing back pain and spinal roots dysfunction, particularly in patients after failed back surgery. The adhesions are interrupted with an inflatable balloon introduced with the fiberoscope via a Tuohy needle into the subarachnoid and epidural spaces (2-6). Primarily the epiduroscope has been designed for the diagnosis in patients with spinal neurological deficits impossible to be diagnosed with imaging. Fiberscopes with an external diameter of 0.5, 0.9, or 1.4 mm were developed (4). They enabled diagnosis of proliferation of fibrous tissue in the subarachnoid space and be followed by open surgery interrupting the adhesions and relieving the patients from the symptoms. The idea has been further developed by an introduction of flexible, steerable fiberoscopes used for diagnosing and treatment of patients with subdural or epidural, mostly postoperative adhesions. This paper presents an experience in using a flexible, steerable fine fiberoscope in the shunting procedure of cervical and thoracic syringomyelia.

AIM

The aim of this paper is description of the first experience in the use of epiduroscope, a fine, disposable fiberoscope designed for exploration of the spinal epidural space for intramedullary application.

MATERIAL AND METHODS

In the years 2012-2013 there were three patients with cervico-thoracic septated syringomyelia operated using a disposable, 1.4 mm diameter flexible fiberoscope (Prisma SRL Mizar®) with AL-3000E optics. An Alcor® vascular catheter balloon has been used to extend the septa fenestrations. The patients were females in the age 32-38 years. The symptoms leading to diagnosis were gradual deterioration of sensation in the upper and lower extremities, numbness, gait disturbances and disruption in temperature sensation. All patients were subjected to magnetic resonance scanning of the head and spine. Two patients were diagnosed with an idiopathic syringomyelia based on magnetic resonance imaging, excluding Chiari malformation and one patient had a recurrence of a syringomyelia cavity with increasing numbness and loss of temperature sensation in the lower extremities as well as diminished sensation to touch and pain in the upper extremities. Recurrence occurred one year after suboccipital decompression of cisterna magna providing complete reversal of the symptoms for 6 months. Recurrence of the symptoms lead to magnetic resonance imaging showing an intramedullary septated cavity extending from the C2 segment of the cervical spine to the lower thoracic vertebrae.

The patients were operated through a cervical laminectomy over the upper extension of the syrinx. Dura was incised in the posterior aspect of the medulla. The thinnest, translucent location of the intramedullary cavity on the spine was identified and incised. The length of the incision was about 2 mm. A fiberoscope was inserted through this cervical myelotomy

allowing inspection of the intramedullary cavity and identifying the septa. Septa were in sequence fenestrated mechanically with the tip of the fiberscope. A vascular balloon catheter has been passed into the lowest cavity through the working channel of the fiberscope. The balloon was filled under visual control with saline and stepwise withdrawn thus extending the fenestrations in the septa. The extent of fenestration was adjusted by adequate filling of the balloon under visual control. A short silicone drain has been left connecting the cavity with the subarachnoid space. Dura has been sutured tightly. The patients were discharged and followed in the outpatient department for 2 years.

RESULTS

All operations were uneventfully performed. No difficulty was encountered in passing of the fiberscope through the septa. Visual control of the distortion of septa under endoscope pressure added confidence and safety to the procedure. The size of the inflatable balloon used to enlarge septa fenestration could be controlled visually, which offered optimal adjustment of the balloon diameter to the diameter of the syrinx cavity. No bleeding from the septa or walls of the cavity has been observed. The postoperative course was uneventful. The neurological symptoms in patients improved and there was no recurrence in 2 years follow-up.

DISCUSSION

The precise etiology for idiopathic syringomyelia remains unclear despite a variety of theories proposed. They include a cerebellar piston, intramedullary pulse pressure and elevated spinal subarachnoid pressure theories (1).

The management of septated syringomyelia is presenting difficulties because the common methods of surgical treatment do not always secure drainage of all cavities (6).

The development of a flexible neuroendoscope enables perforation of the septa under visual control.

The fine flexible fiberscope was developed in 1988 to inspect cisterna magna and cerebral ventricles through a lumbar spinal tap. Afterwards there were no further developments reported, particularly in the treatment of syringomyelia. The literature comprehensive review yielded below 50 cases of idiopathic syringomyelia cases described (2).

Persistence or recurrence of the syringomyelia symptoms after suboccipital decompression is rare, but can occur in 1-40% of cases (7). It has been proposed that failure in suboccipital decompression can result from inadequate extension of the paratonsillar space, persistent blockage of the CSF pathways at the foramen magnum and increased pulsation of the cerebellar tonsils. In those cases surgical enlargement of the previous craniectomy and an expansile duraplasty proved to be effective (8). In the presented case subarachnoid shunting of the cavity combined with of the multiple cavities has been also effective.

Epiduroscope, a fine endoscopic tool has been basically designed for the inspection of the epidural space and treatment of the low-back pain by interrupting epidural adhesions and deposition of steroids. There is a number of publications in this area (9, 10).

In the presented experience an epiduroscope proved to be a good tool facilitating and enhancing the effectiveness and safety of the syringomyelia operation in cases requiring direct drainage of the cavities, but this idea has not been explored adequately in the literature. To our knowledge the present report is the first on the use of a disposable flexible, steerable epiduroscope in the treatment of multi-cavity syringomyelia.

CONCLUSIONS

Disposable epiduroscope Prisma SRL of 1.4 mm diameter is a useful and safe tool enhancing the safety and effectiveness of syrinx septotomy in syrinx drainage operations.

Further studies are needed to further evaluate the feasibility of this technique.

BIBLIOGRAPHY

- Zderkiewicz E, Kaczmarczyk R: Operative treatment of syringomyelia. *Neurol Neurochir Pol* 2008; 42: 43-49.
- Roy AK, Slimack NP, Ganju A: Idiopathic syringomyelia: retrospective case series, comprehensive review, and update on management. *Neurosurg Focus* 2011; 31(6): E15. DOI: 10.3171/2011.9.
- Uchiyama S, Hasegawa K, Homma T et al.: Ultrafine flexible spinal endoscope (myeloscope) and discovery of an unreported subarachnoid lesion. *Spine* 1998; 23: 2358-2362.
- Shimoji K, Fujioka H, Onodera M et al.: Observation of spinal canals and cisternae with the newly developed small-diameter, flexible fiberscopes. *Anesthesiology* 1991; 75: 341-344.
- Shimoji K, Ogura M, Gamou S et al.: 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.
- Huewel N, Perneczky A, Urban V, Fries G: Neuroendoscopic technique for the operative treatment of septated syringomyelia. *Acta Neurochir Suppl (Wien)* 1992; 54: 59-62.
- Heiss JD, Suffredini G, Smith R et al.: Pathophysiology of persistent syringomyelia after decompressive craniocervical surgery. Clinical article. *J Neurosurg Spine* 2010; 13(6): 729-742. DOI: 10.3171/2010.6.SPINE10200.
- Heiss JD, Snyder K, Peterson MM et al.: Pathophysiology of primary spinal syringomyelia. *Neurosurg Spine* 2012; 17(5): 367-380. DOI: 10.3171/2012.8.SPINE111059.
- Donato AD, Fontana C, Pinto R et al.: The effectiveness of endoscopic epidurolysis in treatment of degenerative chronic low back pain: a prospective analysis and follow-up at 48 months. *Acta Neurochir Suppl* 2011; 108: 67-73. DOI: 10.1007/978-3-211-99370-5_11.
- Igarashi T, Hirabayashi Y, Seo N et al.: Lysis of adhesions and epidural injection of steroid/local anaesthetic during epiduroscopy potentially alleviate low back and leg pain in elderly patients with lumbar spinal stenosis. *Br J Anaesth* 2004; 93(2): 181-187.