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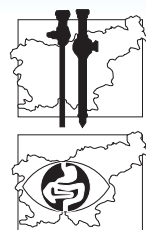
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**Uredništvo**

*The articles have not been edited and have been printed as submitted.*

***Editors***



## Uvodnik

### *Editorial*



Moderna laparoskopija, ki se je začela s prvimi insuflatorji Kurta Semma in prvimi uspešnimi apendektomijami, je stara dobrih 30 let. Od teh zgodnjih tehničnih izumov je tehnologija skokovito napredovala, od bazične laparoskopije do napredne laparoskopske kirurgije in endoskopske kirurgije skozi naravne odprtine. Razvoj se nadaljuje v smeri računalniško podprte in robotske kirurgije. Brez dvoma je laparoskopija korenito spremenila kirurške pristope, ki so veljali stoletja za nespremenljive. Verjetno bodo prihodnje generacije tudi današnjo kirurgijo videle kot zastarelo. Mnoge bolezni, ki jih danes zdravimo kirurško, bodo ozdravljive brez operativnega posega, tako kot smo kirurško zdravljenje peptične razjede nadomestili z zdravljenjem z antibiotiki.

Sodobne mobilne tehnologije so že močno spremenile naše vsakdanje ravnanje in brez dvoma bodo te tehnologije tudi v prihodnosti imele velik vpliv na zdravljenje bolezni, tudi na kirurgijo. Z napredovalimi, miniaturiziranimi robotskimi sistemi, ki jih bodo izdelovali različni proizvajalci, bodo kirurški roboti postali širše dostopni, cena pa bo padla. Tako bodo postali dostopni tako kirurgom kot bolnikom. To bo pripomoglo k razvoju kirurške tehnike in znižalo ceno zdravljenja. Ekonomski razlogi bodo vedno pomembni, saj nobena inovacija ne bo uspela, če ne bo ekonomsko sprejemljiva.

*Modern laparoscopy, starting with Kurt Semm's insufflators and the first successful appendectomies, was introduced approximately 30 years ago. Since those early successes, the technology has grown from the inception of basic laparoscopy to endoscopic surgery through natural orifices, and it continues to evolve by leaps and bounds with computer-assisted surgery and improved robotics in surgery. Without question, laparoscopy has revolutionized the way we perform standard surgery, especially relative to the techniques that had been used for hundreds of years.*

*Future generations will undoubtedly view the way we currently perform surgery as antiquated. Many diseases that currently require surgical treatments may no longer need them. For example, surgical treatment of peptic ulcer disease has now been mostly replaced by antibiotic treatment. Mobile technologies have already affected our daily lives, and without any doubt they will be implemented in digital or mobile health care, which includes surgery. Moreover, with more advanced, diverse and miniaturized robotic technologies being produced by multiple companies, surgical robotics will become more widely available, and as competition increases, the price will decrease. This will make robotic platforms accessible to more surgeons and patients, and by*



Do takrat pa bosta napredna endoskopija in laparoskopija v ospredju v vsakodnevni kirurški praksi.

Glavni in odgovorni urednik  
Endoskopske revije

**Mirko Omejc**

*default improve surgical technique, as the economies of scale and scope dictate results. Ultimately, economic factors will always play a role, as no innovation will succeed unless it makes economic sense. Until then, the combination of advanced flexible endoscopy and laparoscopy will continue to be at the forefront of everyday surgeries.*

*Editor-in-Chief  
of the Endoscopic Review*

**Mirko Omejc**



## Članki

### *Articles*

## ***Expandable tubular retractor used as an endoport for endoscope-assisted removal of intraventricular tumor.***

## **Razširljivi cevasti razpirač kot endoport za endoskopsko-asistirano odstranitev intraventrikelnega tumorja**

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VIDEOLINK:

<https://dl.dropbox.com/u/19035251/VIDEO%20Endoport%20Endoscopic%20Neurosurgery.wmv>

### **Abstract**

**Introduction.** Brain retraction is necessary to approach deep-seated intra-axial lesions. The incidence of brain retraction injury remains high. We describe a transparent PVC tubular retractor technique for intraventricular lesion.

**Patients and methods.** The technique was used in a 75-yr old patient with a 3x3 cm tumor in the frontal horn of the left lateral ventricle. A 1.5 cm skin incision was made inside the forehead wrinkle supraciliary followed by 1 cm trephination.

The polyvinyl sheet was cut in 7x 7 cm square piece and rolled into a tubular shape. We inserted the roll wrapped around neuronavigational probe via minimal brain incision, expanded the inserted roll with a balloon dilatation to 7 mm of diameter and kept this surgical corridor without usual spatulas during bimanual microsurgical lesionectomy under endoscopic visualization.





**Results.** Subependimoma was completely removed from the frontal horn, foramen of Monroe was released, septum was perforated. There was no hematoma. The patient was without neurological problems. The cosmetic effect was excellent. T2/FLAIR MRI scan revealed only a minimal white matter injury along the surgical corridor.

**Conclusions.** The expandable tubular retractor in conjunction with frameless neuronavigation provided a safe access and an excellent visualization of the underlying lesion. The tubular shape of the retractor permitted the use of standard microsurgical techniques through minimally invasive craniotomies without putting extra pressure on the brain tissue.

**Key words.** Endoport, neuroendoscopy, intraventricular, subependymoma.

## Povzetek

**Uvod.** Pri kirurških pristopih do globoko-možganskih sprememb je potrebno razmikanje možganovine. Okvare možganovine zaradi razmikanja so še vedno razmeroma pogoste. Predstavljamo tehniko uporabe cevastega razpiralca iz prozornega polivinila za pristop do znotrajventrikelnega tumorja.

**Bolniki in metode.** Pri 75-letnem bolniku s 3x3 cm velikim tumorjem v frontalnem rogu levega stranskega ventrikla smo najprej napravili 1,5 cm dolg rez kože v gubi na čelu nad obrvjo in nato pod njim še 1 cm široko trepanacijsko luknjico. 7x7 cm velik listič tankega polivinila smo zvili okrog nevronavigacijskega vodila debeline 4 mm in jo skozi minimalni vrez v možganski površini stereotaktično uvedli do spremembe v globini. Po odstranitvi vodila smo v cevko zvit polivinil razprli z napihanjem balončka do premera 7 mm. Cevka je zagotavljala stalno odprto kirurško pot skozi možganovino brez uporabe klasičnih špatul med dvoročnim mikrokirurškim odstranjevanjem tumorja pod vidno kontrolo z endoskopom.

**Rezultati.** Subependimom smo v celoti odstranili, sprostili foramen Monroe in s predrtjem ventrikelnega septuma dodatno povezali oba ventrikla. Krvavitve ni bilo. Bolnik ni imel nevroloških izpadov. Kozmetični izgled kirurške brazgotine, skrite v čelni gubi, je bil odličen. Magnetno-resonančno slikanje (T2/FLAIR) je pokazalo minimalno poškodbo neposredno vzdolž kirurške poti.

**Zaključki.** Razširljivi cevasti razpiralci v souporabi s prostoročno nevronavigacijo zagotavljajo varno kirurško pot in odličen endoskopski pogled nad spremembo pod njim. Cevasta oblika razpiralca omogoča uporabo klasične mikrokirurške tehnike skozi minimalno trepanacijo, vendar brez dodatnega in ponavljajočega pritiskanja možganovine.

**Ključne besede.** Endoport, neuroendoskopija, intraventrikelni, subependimom.

## Introduction

Brain retraction is necessary to remove deep-seated intra-axial and intraventricular lesions.

Conventional microsurgical retractor systems of Greenberg (1) or Leyla, which are using one or a pair of spatula, produce a significant disruptive forces to the surrounding brain, ongoing laceration the brain and may produce critically decreased

regional blood flow, pH and ischemia in an unequally distribution pattern (2-6). Additionally, the retracted brain tissue herniates back between the blades, obstructing the operative corridor and colliding with instruments and microscopic illumination.



The incidence of retraction injury of cerebral cortex, white matter and vasculature remains high. The consequences are seizures, focal neurological deficits, cerebral swelling and cognitive impairment. Apart from mechanical trauma from overuse of traction or prolonged traction, venous infarction may also appear in delayed fashion.

Modern endoscopic techniques, endoscopy-customized instruments and neuronavigation have enabled approach to the deep-seated brain lesions under direct vision through a burr hole or a minimal craniotomy. Although the full-endoscopic approach is the least traumatic, it doesn't enable bimanual microsurgical technique and total removal.

The introduction of cylindrical retractors with microscopic (7-9) and lately with endoscopic visualization followed the idea of a more symmetrical and less harmful distribution of pressure along the tube (10-20). Neuronavigational systems, fMRI and DTI have greatly improved precise targeting of the lesion and safety of trajectory. The portal endoscopic microsurgery evolved from intraventricular to intraparenchymal lesions (7,13,16,18,19,21,22). The deep-seated brain lesions, that were previously accessible for stereotactic biopsy only, can now be removed through cylindrical retractor under endoscopic visualization. The term endoport defines a cylinder or tube retractor system, either fixed or variable, used as a corridor during endoscope-assisted removal of a deep-seated brain lesion using microsurgical technique. The dimensional ratio between the diameter of cylinder and size of the lesion have been recently established (11,13,14,22,23).

These deep locations in the brain include: lateral ventricle, basal ganglia, pulvinar/posterior thalamus and insular cortex. The endoport technique has been reported for removal of astrocytomas (24), gangliogliomas, cavernous angiomas, gliomas, ependymomas, papilomas, brain abscess, intraparenchymal hematomas, massive hematocephalus, intraventricular meningiomas, metastasis, colloid cyst, subependymoma, neurocytomas, choroidal AVM, etc (10-23,25).

We present our experience with a soft recoiling PVC roll with a working diameter of 7-10 mm

used as an endoport in endoscopic-assisted removal of intraventricular tumor.

## *Case*

We present a case of a 75-year old right handed male who presented in July 2012 with occasional vertigo and insecurity while walking causing frequent falls. His wife noticed a certain emotional numbness. He was also less talkative. During one of the falls he hit his head. A head CT revealed an expansive lesion in the left lateral ventricle. A head MRI was done a few weeks later in September 2012 and it showed a tumor inside the frontal horn of the left lateral ventricle, measuring 3,5 x 3 x 1,5 cm (Fig. 1, 2). Postero-medially the tumor obstructed the left foramen of Monroe, but the ventricles were not enlarged. The tumor had a benign appearance. The MRI also revealed a 3 cm thick subacute-chronic subdural hematoma fronto-temporo-parietally on the left and a smaller one frontally on the right. The patient presented with a discrete right sided hemiparesis and dysphasia. The hematoma on the left was evacuated with open surgery in October 2012, but a small residuum of the hematoma remained (Fig. 2).

The patient was then operated on in December 2012 using an endoport endoscopic approach through a burr hole in the left forehead. A 1.5 cm skin incision was made inside the forehead wrinkle supraciliary and the tumor was completely removed through 1,5 cm oval burr hole. The residual hematoma cavity was also explored and the thick capsule of hematoma was fenestrated into subarachnoidal space. After the surgery the patient became more talkative and lively, his wife claimed he got his true personality back. The postoperative course was uneventful. The pathological exam revealed subependymoma.

## *Surgical technique*

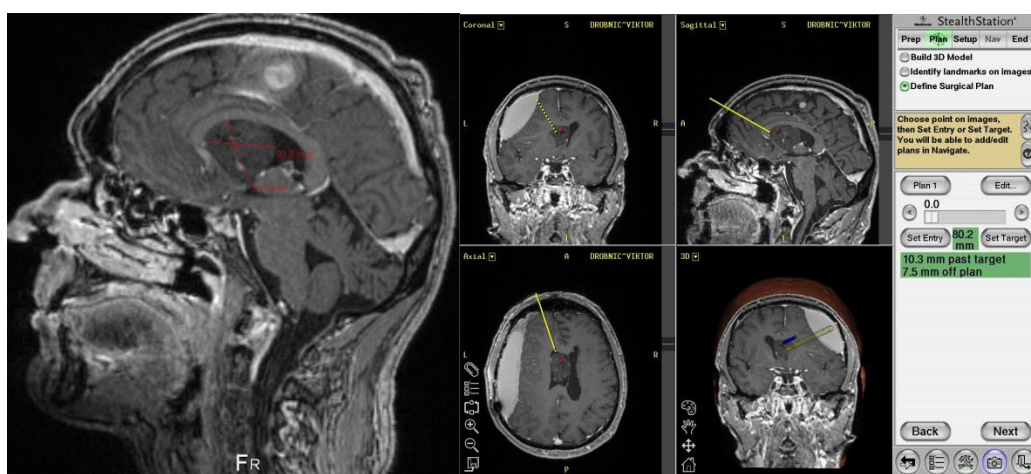
The microroll retractor was made of polyvinyl sheet. The sheet was cut in 10 x 7 cm square piece and rolled into a tubular shape. The roll was wrapped around neuronavigational probe



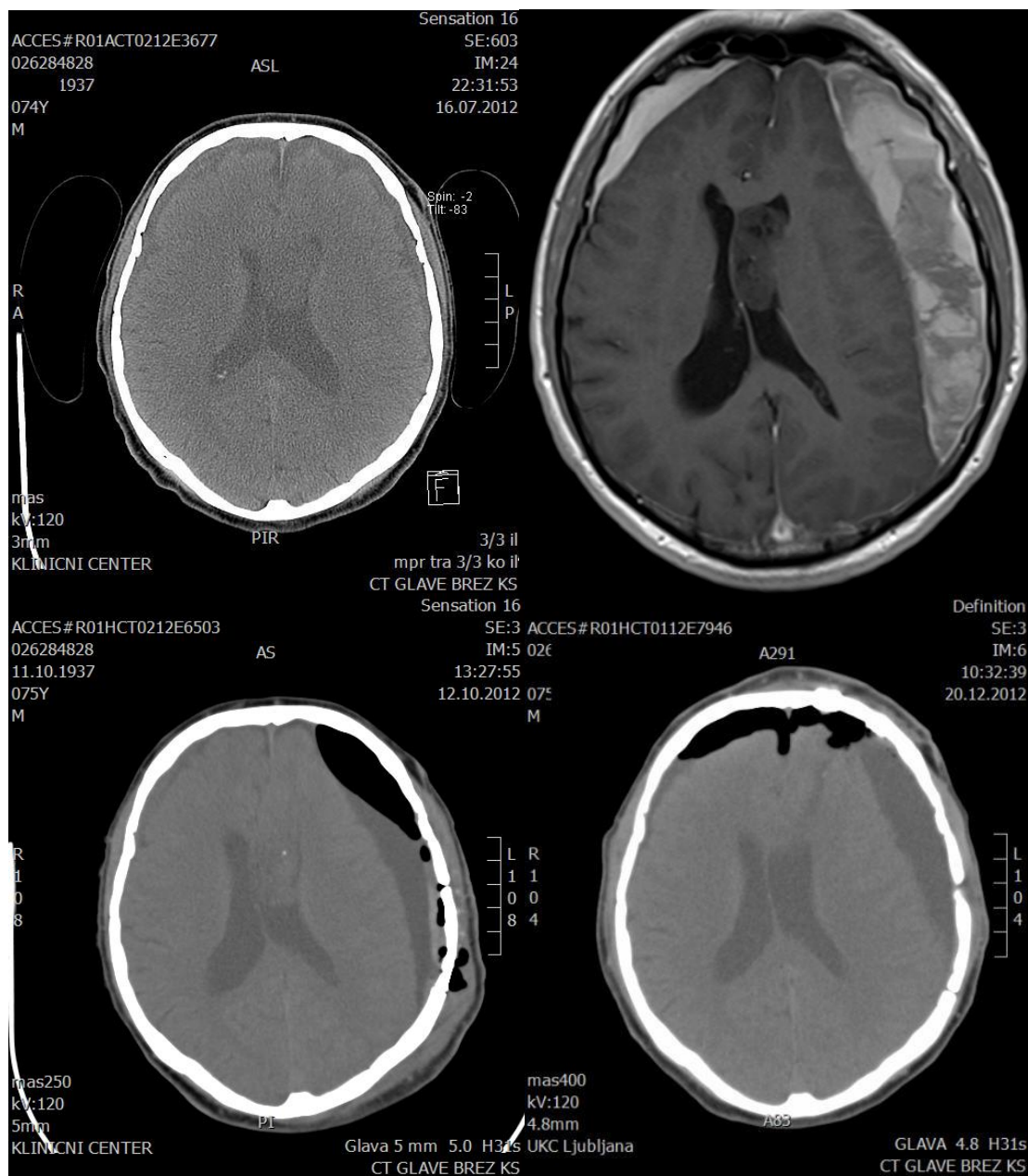
(diameter of 4 mm) and fixed to it with two stitch threads on poles with releasable notches (Fig. 3). When inserted stereotactically via minimal brain incision and released from the probe, the roll was 7 mm in diameter. With the inflation of Fogarty catheter 14 French, the roll uncoiled to 1 cm diameter. We introduced a 4 mm endoscope (Hopkins 0 degrees, Karl Storz, Tuttlingen, Germany). The roll was held with two fingers to the endoscope walls (Fig. 3). The roll acquired an ovoid shape, which was half occupied with endoscope and the other half was free for introducing instruments. Two pituitary bayonete instruments were introduced into the endoport. The grayish tumor was aspirated until frontal horn was completely free of tumor. Foramen of Monroe was released. Septum pellucidum was perforated (Fig. 4; see also supplementary video material 1).

## Discussion

Minimally invasive neurosurgery of deep seated lesions has evolved significantly in the last decade. The intraventricular lesions have been approached transcortically in 80's using 20 to 30 mm tubular cylinders which enabled binocular vision and bimanual microsurgical technique under microscopic magnification. Endoscope-assisted microsurgery has been introduced by Perneczky fifteen years ago. Endoscope was used as an adjuvant tool for angled visualization of the operative field. Fiber optic based ventriculscopy has significantly reduced the size of the cortical and white matter disruption. In ventriculscopy, the tumors are biopsied or removed through a working channel. However, the feasibility of definitive removal in full-endoscopic procedures is limited by monomanual operating the instrument fort and back and by maneuvering the shaft side-wise or up and down. High vascularized and firm tumors present unacceptably high risk of complications. The endoport technique introduces the possibility of endoscopic visualization and bimanual microscopic technique and minimizes trauma to surrounding brain parenchyma.



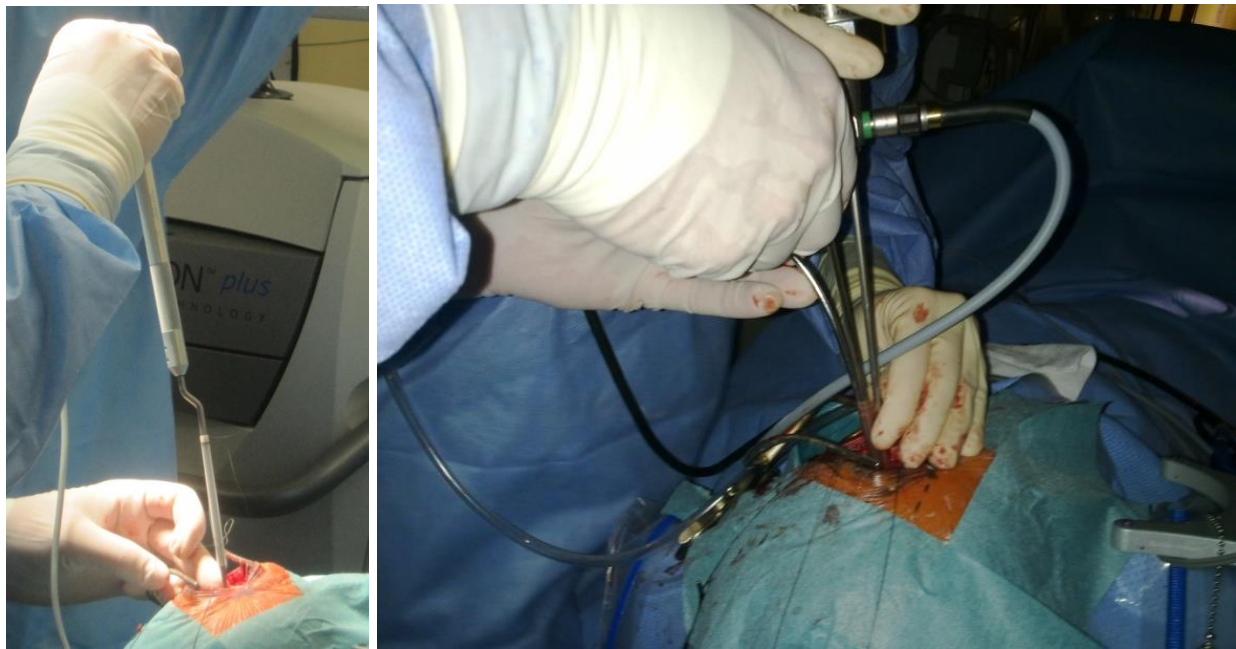
**Figure 1**  
Surgical planning for image-guided endoport-assisted removal of intraventricular tumor. A chronic subdural hematoma and a small falx meningioma are also presented.



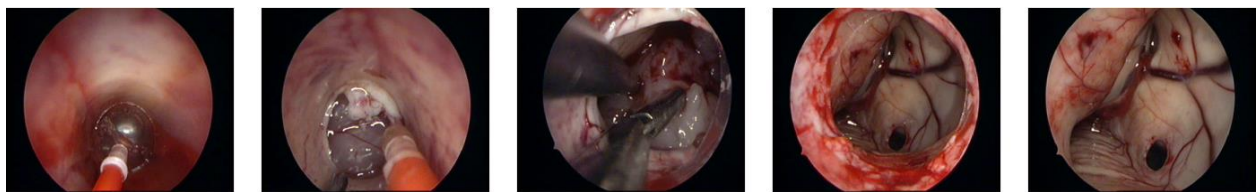
**Figure 2**

An initial CT revealed an accidental tumor in the left horn of the lateral ventricle. A MRI 2 months after revealed chronic subdural hematomas bilaterally. The left hematoma has been evacuated, but didn't resolved in two months later when endoscopic surgery was performed. The last CT shows the situation 24 hours after endoport removal of the tumor. The trace of endoport is barely visible.





**Figure 3**  
The soft PVC sheath was rolled three times around the probe of neuronavigational system (diameter 4 mm), secured with releasable stitches at both ends and introduced into the brain to the target. After releasing the stitches and deployment, the tube was uncoiled with Fogarty catheter to 10 mm of diameter and held by fingers to the endoscope. During bimanual work, the tube assumed more ovoid and funnel shaped configuration (more sac than tube), which facilitated introduction of curved Fugita aspirator and grasping forceps.



**Figure 4**  
After insertion, the tube was uncoiled with Fogarty catheter up to 10 mm of diameter. The tumor was grayish and avascular, and was removed by aspiration and by pieces. The septum was perforated to achieve communication between the ventricles. The foramen of Monroe and the thalamostriatal and septal veins are visible after complete tumor removal (note up-side down position of the ventricle; see also supplementary video material 1).



Prolonged or excessive brain retraction causes damage to the brain tissue and its vasculature (2, 4-6). The use of self-retaining retractor blades, a revolutionary assistant instrument for achieving corridor through the brain parenchyma or for lobar retraction, has soon been recognized hazardous and was replaced by intermittent retraction technique where retraction is performed with working instruments only. Transfissural and transsulcal approaches are further innovations for minimizing surgical trauma to the brain.

Anterior, posterior and lateral approaches are used for entering supratentorial ventricles in open surgery (26). The interhemispheric anterior transcallosal is the most often used approach to the lateral ventricle and foramen of Monro. Anterior transcortical, anterior frontal, posterior transcortical, posterior transcallosal, occipital or infratentorial supracellebellar (to pineal region and posterior third ventricle), transtemporal and subtemporal and pterional are selected according to the localization of the intraventricular or periventricular lesion (26). The surgery of intraventricular lesions is considered a high risk procedure (27).

However, intermittent retraction with a bipolar forces and aspirator is not suitable for repeatable entering soft brain parenchyma several centimeters deep. The idea of tubular retractor includes evenly distributed forces around the retractor. A significant reduction in regional cerebral blood flow with a retraction pressure of 30 mm Hg has been studied in rat (4). However, the retracting pressure around a cylindrical endoport up to 2 cm of diameter never exceeded 10 mm Hg (18). Post-operative MR imaging based on T (2)/FLAIR and diffusion restriction/ADC signal is best to determine extent of resection and extent of white matter injury along the surgical trajectory (11, 13).

The tubular retractors can be fixed-size or recoiled. Some fixed-size models are funnel-shaped for additional freedom, in other bayonet pituitary instruments are preferable. Funnel shape or inserting dilators successively are further improvements in producing unavoidable local minimal brain trauma in a more controlled way. Image-guided

tubular retractors have enabled many deep seated lesions being removed, not only stereotactically biopsied. The series report decreased morbidity and no mortality with endoport technique (11, 13, 14, 19, 21-23, 25). In the recent series of Engh et al, in which resection of 32 colloid cysts and 15 intraventricular tumors was performed via an 11.5 mm transparent conduit, gross or near total resection was achieved in 31 (96.9%) of the 32 colloid cysts and in 80% of intraventricular tumors respectively. No permanent neurological morbidity occurred (11). The endoport technique has been recently applied in posterior fossa surgery via lateral transcerebellar route (28).

Despite rare commercially available models (13, 15, 19, 22), tubular retractors can be assembled with equipment and material already available at many institutions.

Jho reported in 2002 the first endoscopic removal of third ventricular tumor using a vinyl sheath, rolled like a cigarette and inserted with image-guided stereotactic assistance in to the lateral ventricle and foramen Monro (17). The vinyl tube expanded to its original 10-mm-diameter tube by recoil assisted with a balloon dilatation technique. A rigid polypropylene tube 7 mm was used for removal of neurocytoma by aspiration, unipolar coagulating aspirator and visualization with a 2,7 mm 0 degree optics (10). A longitudinally cut silicone tube has been reported as a low cost endoport (29).

However, selected tumors can be removed by full endoscopic approach to the third ventricle using diode laser for vaporization of the tumor (20). To avoid thermal injury to the brain stem, several authors prefer mechanical removal of the tumor, which is possible with microsurgical bimanual technique. Endoscopic single-port or dual-port approaches offer this possibility. A side-cutting instrument, combining variable aspiration and cutting function from lateral aperture, has been successfully used in keyhole craniotomies, endoscopic endonasal approaches, and more recently transcranial port surgery. The instrument has up to 3 mm of outer diameter and affords controlled tissue shaving, gross tissue debulking, and blunt dissection in narrow corridors without any thermal



effect. The bladed inner cannula transects the tissue that is drawn into the cannula (30). Tubular retractor system used in spinal surgery (METRx; Medtronic, Minneapolis, MN) has been used to microscopically remove deep-seated parenchymal lesion in ten patients (12,13,31). This system includes progressive dilatation of the corridor using a set of dilating tubes.

Our vinyl roll was a low cost modification of the rollable transparent vinyl tube introduced by Jho in 2002 (17). Our tube was rolled from 10 x 7 cm vinyl sheath and very soft (like cigarette paper). The tube was uncoiled with Fogarty catheter from initial 4 mm to final 10 mm of diameter and held by fingers to the endoscope (diameter 4 mm). During bimanual work, the tube assumed more ovoid and funnel shaped configuration (more sac than tube), which facilitated introduction of curved Fugita aspirator and grasping forceps. Because the roll had several turns, it was never unrolled totally and coiled back a little with each retrieval of instruments and unrolled with each introduction of instruments, but never exceeded 1 cm. This dynamic effect further minimized total pressure burden to the surrounding parenchyma. We report no morbidity with this technique.

## Conclusion

A frameless stereotactic tubular retractor system minimizes skin incision, size of craniotomy, and retractor-induced trauma to cortex and to underlying white matter and permitted the use of standard microsurgical techniques.

The vinyl roll retractor is extremely simple, low cost and provides enough surgical corridor for safe and total resection of intraventricular lesions under endoscopic visualization. The endoport technique has a potential for improving patient outcomes and lowering complications in endoscopic neurosurgery of intraventricular and deep-seated brain parenchymal lesions.

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## *Successful treatment of pancreatic pseudocysts with percutaneous pseudocystogastric drainage – a case report*

### **Uspešno zdravljenje pankreatične psevdociste s perkutano psevdocistogastrično drenažo – prikaz primera**

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#### ***Abstract***

**Background.** *Nonoperative management of the pancreatic pseudocyst has become an accepted treatment in past years. We present a case of the pancreatic pseudocyst successfully treated with percutaneous pseudocystogastric drainage after resolution of its complication.*

**Case report.** *A 60 - year - old man with a history of acute necrotizing pancreatitis was diagnosed a 10 cm large pancreatic pseudocyst, which was treated with percutaneous pseudocystogastric drainage. This routine procedure has been sucesfully performed in our institution since 1995, but in the presented case the pseudocyst actually increased in size after insertion of the pigtail catheter. An additional external percutaneous drainage was placed and in course of few days pseudocyst decreased in size. The external catheter was therefore removed and the residue of the pseudocyst was drained by the pigtail catheter, that was left in place and finally removed 12 months afterwards. The patient was free of any subjective complaints from the moment of its insertion and till its removal.*

**Conclusion.** *Percutaneous pseudocystogastric drainage remains a leading method in pancreatic pseudocyst treatment, provided a proper selection of patients. In case of apparent inefficiency of the method, the complication can be resolved with additional temporary external percutaneous drainage as an alternative to a more invasive surgical approach.*

**Key words.** *Pancreatic pseudocyst, treatment, pigtail catheter.*



## Povzetek

**Uvod.** Pseudocista pankreasa je najpogostejša cistična lezija pankreasa in predstavlja eno izmed komplikacij akutnega ali še pogosteje kroničnega pankreatitisa. Pri večini pseudocist pride do spontanega regresa. Zdravljenje je indicirano, ko postane simptomatska, povzroča komplikacije ali dosega velikost 5cm in ne kaže znakov regresa po šestih tednih opazovanja. Ob ustrezni izbiri bolnikov je zdravljenje možno kirurško ali konzervativno z zunanjo ali notranjo perkutano drenažo pseudociste v želodec. Slednja metoda se na KIR – u v UKC Ljubljana z manjšimi časovnimi prekinitvami uspešno izvaja vse od leta 1995.

**Predstavitev primera.** Prispevek obravnava bolnika z deset cm veliko pankreatično pseudocisto, nastalo po akutnem nekrozantnem pankreatitisu, ki je bila zdravljena s perkutano drenažo vsebine pseudociste v lumen želodca. Kontrolne UZ preiskave trebuha po posegu so pokazale pseudocisto, ki je bila naslednji dan po posegu manjša, nato pa se je kljub notranji drenaži povečevala. Ob tem je bil bolnik klinično asimptomatski, brez laboratorijskih kazalcev okužbe ali krvavitve. Na osnovi UZ izvidov je bila sprejeta odločitev za vstavev dodatne zunanje perkutane drenaže. Nadaljnje UZ kontrole so potrdile ustrezno lego obeh katetrov ter progresivno manjšanje pankreatične pseudociste, čemur je končno sledila odstranitev zunanjega katetra. Ob funkcionalni notranji pseudocistogastrični drenaži je bil bolnik odpuščen v domačo oskrbo. Sledile so mesečne UZ kontrole ter dokončna endoskopska odstranitev dvojnega »pig tail« katetra eno leto po njegovi vstavitvi.

**Zaključek.** Notranja pseudocistogastrična drenaža je varna in minimalno invazivna metoda za zdravljenje izbranih bolnikov s pankreatično pseudocisto. Kot uspešna se je pokazala tudi v našem primeru, pri katerem je prišlo do nepojasnjene zapleta pri drenaži, ki pa je bil učinkovito premoščen z uvedbo začasne zunanje drenaže. Predpogoj za uspešno zdravljenje pa je dobro sodelovanje med interventnim radiologom, ultrazvočistom ter klinikom endoskopistom.

**Ključne besede.** Pseudocista pankreasa, zdravljenje, »pig tail« kateter.

## Introduction

Pancreatic pseudocyst is a common complication of both acute and chronic pancreatitis, with a higher prevalence of 20-40% in chronic pancreatitis (1,2). Patients present with abdominal pain, nausea and vomiting, or they are asymptomatic. The diagnosis of a pancreatic pseudocyst is usually established by imaging studies, among which transabdominal ultrasonography is important as an initial investigation.

An important question in everyday clinical practice is whether and when an acute or chronic pancreatic pseudocyst ought to be treated, because most pseudocysts resolve spontaneously with supportive care.

The main two indications for some type of invasive drainage procedure are persistent patient symptoms or the presence of complications (infection, gastric outlet or biliary obstruction, bleeding). Pancreatic pseudocysts can be treated successfully with a variety of methods: endoscopic (transpapillary or transmural) drainage, percutaneous internal catheter drainage, laparoscopic surgery or open pseudo-cystoenterostomy. To date, no prospective control-led studies have compared directly these approaches (3). As a result, the management varies on local expertise, but in general, endoscopic drainage is becoming the preferred approach because it is less invasive



than surgery, avoids the need for external drain, and has a high long-term success rate (1,2,3). In our institution, we perform percutaneous double pigtail catheter internal drainage of pancreatic pseudocyst to stomach with ultrasonographic and gastroscopic guidance. In this case report we describe a patient who was successfully treated with this procedure after resolution of its complication.

## Case report

A 60-year-old man with a history of acute necrotizing pancreatitis of biliary etiology eight months ago was referred for follow-up US of the abdomen. Previous US examination a month ago revealed 5 cm large collection of fluid behind the corpus of the stomach. Current US confirmed 10 cm large pseudocyst with thin wall and clear contents (Fig.1). A decision for the minimally invasive treatment – percutaneously US guided internal cystogastric drainage with double pigtail catheter and endoscopic assistance was reached. The patient who complained only of pain in epigastrium after ingesting food was admitted to hospital. Following written patient consent, the procedure was performed in an intervention-radiology room. The patient was lying supine on an X-ray table. Prior to the procedure, the patient was re-examined using ultrasound in order to determine the location and direction of access. The patient was then given 5ml of noramino-phenazone and 5mg of diazepam i.v. A flexible gastroscope was introduced into the patient's stomach. The chosen area in the epigastric region was washed sterile and lined with sterile surgical sheets. The location and direction of puncturing were finally determined with a sterile – enclosed 3.5MHz probe with an attachment for puncturing. The skin on the anterior abdominal wall was infiltrated with 10ml of 2% Xilocaine and a small incision was made. Puncturing was performed with a 20cm long 18-gauge needle with mandrel. The penetration of the needle into the pseudocyst through the anterior and posterior stomach walls was observed on an ultrasound monitor and through a gastroscope (Fig.2). Gastric access was needed to attain the connection of the pseudocyst with the stomach through a double-pigtail

catheter in order to allow drainage. The success of puncturing was checked by aspiration of cystic contents and assured fluoroscopic control after the administration of the contrast medium, while its passage through the stomach was checked by a gastroscope. A J-type 0.035" teflon guide wire was introduced through the needle cannula. The cannula was removed and dilatation of the channel was performed with 7F plastic dilator. A double pigtail catheter ( 7F thick and 8 cm long) with side openings at both ends was introduced ( Fig. 3). Behind the pigtail is a pusher with which the tip of the pigtail catheter was pushed from the cannula into the pseudocyst, while its base remained in the stomach. The position of the pigtail catheter was adjusted by pusher and endoscope clamp. The following day another US was performed which showed that the pseudocyst had not been completely drained, although it had decreased in size (measuring 5cm in diameter) (Fig. 4,5). Daily follow-up US were continued and four days after the insertion of internal catheter pseudocyst was noted to increase in size (measuring 11cm in diameter) (Fig.6). The patient complained of no symptoms, there was no laboratory evidence of bleeding or infection. The therapeutic team was thus faced with a dilemma whether to proceed the treatment of pancreatic pseudocyst with open surgery. After consultation with the surgeon our radiologist decided to keep the internal pseudocystogastric drainage »in situ« and complement it with percutaneous external drainage, which was achieved using US guidance. A drainage pigtail catheter was placed percutaneously into the fluid cavity and fluid was drained over a course of few days into an external collection system. Abdominal US (performed three days after the insertion of external catheter) showed a small residue of the pseudocyst ( 4 x 2.5cm) (Fig. 7). The external drainage was then closed, and the pseudocyst was no longer visible on US three days afterwards.

The internal pseudocystogastric drainage was thus confirmed to be functional and the external catheter was removed. The patient was well and after the successful resolution of the unexplained complication of pseudocysts internal drainage he



was discharged from hospital. He was prescribed postprocedural monthly follow-up ultrasound which showed optimal postprocedural course.

One year after the insertion the pigtail catheter was endoscopically removed (Fig.8). The patient was free of any subjective complaints (Fig.9).

## **Discussion**

Pancreatic pseudocysts are complications of acute or chronic pancreatitis. In making treatment decisions, it is important to recall that 50% of pancreatic pseudocysts do not require any intervention and can be successfully managed by a wait-and-watch approach. Pancreatic pseudocysts should be treated when they cause symptoms, produce complications, or reach a size exceeding 5 cm and do not regress after 6 weeks of observation. In the last-named situation, treatment is indicated because complications can otherwise be expected.

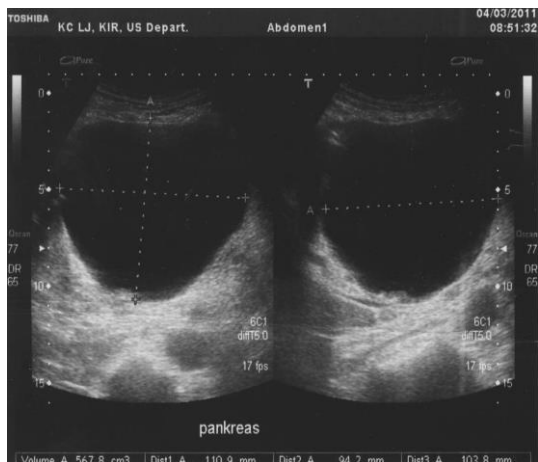
If treatment is indicated, endoscopic and laparoscopic therapeutic procedures have comparable results, while open surgery carries a somewhat higher morbidity and mortality (1-4). Endoscopic pseudocyst drainage with the aid of pigtail catheters by way of the pancreatic duct or the gastric wall (less commonly, the duodenal wall) is currently the safest and most frequently used technique (3). However, there are no randomized studies directly comparing the therapeutic techniques. The choice of technique depends very heavily on the experience of the treatment center. As an alternative to endoscopic treatment percutaneous double pigtail catheter internal drainage of pancreatic pseudocyst to stomach with ultrasonographic and gastroscopic guidance described first by Hancke in 1985 (5) has been performed in our institution since 1995. This method requires a proper selection of patients: the cyst must be

mature (6-8 weeks old to get a thick wall) and in close contact with duodenum or stomach. Too small residual of stomach following surgery, bleeding into pseudocyst or infection of its content does not permit double pigtail drainage. The diameter of pseudocyst must be at least 5cm (6).

The pancreatic pseudocyst of the presented patient met all the criteria needed for percutaneous pseudocystic drainage into the stomach (10 cm large pseudocyst that doubled in size in one month, lying behind the stomach and with a wall thickness of 5-10 mm and clear content). The successful performance of the specific procedure was possible with a good cooperation of the intervention radiologist, endoscopist and ultrasound examiner. Usually the follow-up US performed one day after the procedure reveals no residues of the pseudocyst (6). In our patient the pseudocyst began to actually increase in size the following days after the procedure. This condition was not completely understood with regard to no clinical and laboratory evidence of infection or bleeding. However, the complication was resolved with a placement of additional external drainage. The true reason for the increase in size of the pseudocyst remains unexplained. Our assumption is that there was a temporary blockage of the pigtail catheter that was resolved spontaneously during the external drainage.

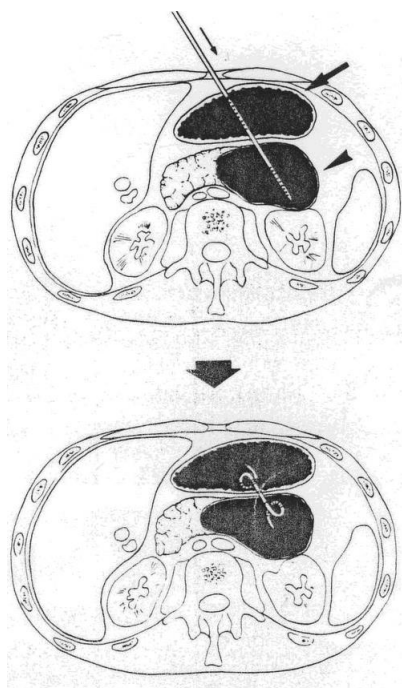
## **Conclusion**

Percutaneous pseudocystogastric drainage remains a leading method in pancreatic pseudocyst treatment, provided a proper selection of patients. In case of apparent inefficiency of the method, the complication can be resolved with additional temporary external percutaneous drainage as an alternative to a more invasive surgical approach.



**Figure 1**

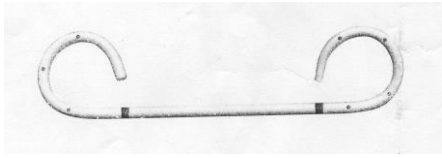
Abdominal US of the presented patient on admission. 10cm large pancreatic pseudocyst behind the corpus of the stomach. The pseudocyst met all the criteria needed for percutaneous pseudocystogastrostomy (10 cm large pseudocyst that doubled in size in one month, lying behind the stomach, with a wall thickness of 5-10 mm and clear content).



**Figure 2**

Procedure of percutaneous pseudocystogastrostomy. The double pigtail catheter is mounted on the puncture needle and introduced under ultrasound guidance, through the anterior and posterior wall of the stomach into the cyst. The double pigtail catheter is placed in position with its curled proximal end in the lumen of the stomach and its distal end in the pseudocyst respectively.





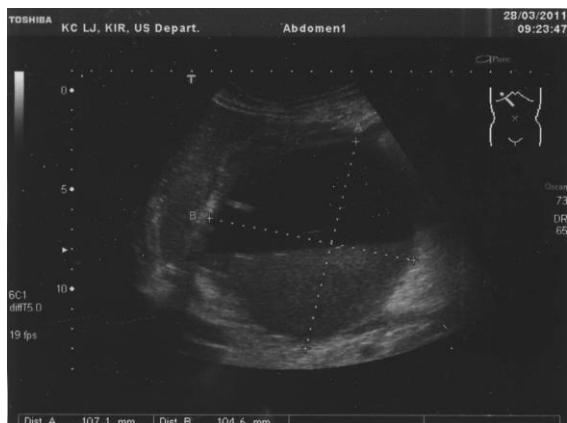
**Figure 3**  
Double pigtail catheter



**Figure 4**  
Control US first day after the procedure (pseudocystogastrostomy). Small residue of pancreatic pseudocyst. Correctly positioned distal end of double pigtail catheter in the pseudocyst.



**Figure 5**  
Control US first day after the procedure. Correctly positioned proximal end of the double pigtail catheter in the lumen of the stomach.



**Figure 6**

US control four days after the insertion of the double pigtail catheter. The pseudocyst was noted to increase in size (measuring 11cm in diameter), the content was more dense.



**Figure 7**

US control one day after placement of additional percutaneous external drainage. Pseudocyst decreased in size. In the following days the external catheter was therefore removed and the residue of the pseudocyst was drained by the pigtail catheter.



**Figure 8**

Endoscopic removal of double pigtail catheter 12 months after its insertion.





**Figure 9**  
Endoscopically removed double pigtail catheter. The patient was free of any subjective complaints from the moment of its insertion and till its removal.

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# *Diagnostic value of ultrasound-guided fine-needle aspiration cytology in diagnostics of solid renal lesions*

## **Zanesljivost UZ vodene tankoigelne aspiracijske biopsije v diagnostiki solidnih lezij v ledvicah**

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### ***Povzetek***

**Izhodišča.** UZ vodena aspiracijska biopsija ledvičnih tumorjev je diagnostično zanesljiva in varna metoda, ki je bila sprva namenjena diagnostiki neresektabilnih ledvičnih karcinomov, metastaz, limfomov ter infekcij. Omejitve slikovnih diagnostičnih metod pri etiološki opredelitvi manjših ledvičnih tumorjev ter uvedba nekiruskih oblik zdravljenja ledvičnih karcinomov pa so dodatno razširile njeno vlogo. Tankoigelna aspiracijska biopsija z napredkom citoloških tehnik (imunocitokemija, citogenetika) omogoča zanesljivo etiološko opredelitev ledvičnih tumorjev. Debeloigelna biopsija je indicirana le v primerih, kadar je vzorec odvzet s tankoigelno biopsijo nereprezentativen. Z retrospektivno analizo smo želeli ugotoviti diagnostično zanesljivost UZ vodene tankoigelne aspiracijske biopsije solidnih lezij v ledvicah pri naših bolnikih.

**Metode, bolniki.** Analizirali smo citopatološke izvide pri 60 bolnikih, ki so v letih 2010 in 2011 na Kliničnem inštitutu za radiologijo UKC Ljubljana imeli opravljeno UZ vodeno tankoigelno (20G ali 21G) aspiracijsko biopsijo solidnih lezij v ledvicah.

**Rezultati.** Vzorci odvzeti s tankoigelno aspiracijsko biopsijo pri 60 bolnikih so bili v 50 primerih (83%) diagnostični. Preostalih 10 vzorcev (17%) je bilo neuporabnih ali nereprezentativnih za citopatološko preiskavo. Pri 30 bolnikih je bila postavljena diagnoza maligne bolezni. Od teh je bilo 17 bolnikov operiranih in histopatološka preiskava je pri vseh potrdila citopatološko diagnozo. Preostalih 13 bolnikov ni bilo operiranih ali pa histopatološki izvid ni bil na voljo. Naši rezultati se ujemajo z v literaturi objavljenimi rezultati.

**Zaključek.** Z našimi izkušnjami smo potrdili, da je UZ vodena tankoigelna aspiracijska biopsija diagnostično zanesljiva in varna metoda za opredelitev solidnih lezij v ledvicah.

**Ključne besede.** Tankoigelna aspiracijska biopsija, ledvični tumor.



## Introduction

Percutaneous ultrasound-guided biopsy of renal masses is a safe and accurate procedure, once reserved for the diagnosis of unresectable renal cell carcinoma, metastases, lymphoma, and infection (1-3). Today percutaneous ultrasound-guided biopsy has an expanded role. A substantial proportion of small, solid renal masses are benign neoplasms. Although imaging can be used to diagnose most of them, some are incorrectly believed to represent renal cell carcinomas and result in unnecessary surgeries. Percutaneous biopsy can now be used to diagnose these benign neoplasms and thus prevent them from being treated unnecessarily (1). Results from percutaneous biopsy can provide added value by directly affecting therapy choices for patients with presumed malignant lesions who may not be candidates for resection and also in patients for whom partial nephrectomy rather than radical nephrectomy may be a preferred alternative treatment (4).

the diagnosis of renal masses. This is largely due to enhancements in cytologic techniques (immunocytochemistry and cytogenetics) that have allowed for the accurate diagnosis of benign and malignant neoplasms and in some cases the determination of renal cell carcinoma subtype and Fuhrman nuclear grade. Given the lack of conclusive evidence that large needles confer a greater diagnostic effectiveness, fine-needle specimens are initially obtained and if the specimens are not adequate, a large needle biopsy is then performed (1).

In recent years, urologists at the Clinical Centre of Ljubljana have begun skipping fine-needle aspiration biopsy of solid renal lesions in favour of large-needle biopsy or direct surgical procedures. The purpose of our study was to evaluate the performance of fine-needle aspiration cytology and to determine its place in diagnostic procedures of solid renal lesions.

## Methods and materials

### Patients

A retrospective review of Clinical Centre of Ljubljana Department of Radiology database identified 60 patients who underwent ultrasound-guided percutaneous fine-needle biopsy of solid renal masses between years 2010 and 2011.

There were 27 women and 33 men; mean age of 66 years (ranging from 38 to 88 years). The patients were referred for biopsy after the masses had been identified on previous imaging.

### Procedure

All biopsies were performed using Toshiba Aplio XV ultrasound machine with a curved array multi-frequency transducer (3-6 MHz) and a detachable biopsy guide.

Each biopsy was performed by two radiologists or an attending radiologist, with the assistance of a resident. Initial diagnostic sonography was performed to localize the mass via a trajectory free of overlying bowel, and color Doppler sonography was used to avoid major blood vessels.



**Figure 1**

Uncharacterized small solid renal lesion suitable for characterization with fine-needle aspiration cytology.

Biopsy using fine needles (fine-needle aspiration biopsy - FNAB, FNA or NAB, or fine-needle aspiration cytology - FNAC), using 20 gauge or thinner needles, has been shown to be accurate in



**Figure 2**  
Curved array multifrequency transducer with a detachable biopsy guide.



**Figure 3**  
21 gauge spinal needle used to perform aspiration biopsy.



**Figure 4**  
Localization of the solid renal lesion with a projected trajectory for the guided biopsy free of underlying bowel or major blood vessels.

Biopsy was performed under aseptic conditions. For local anesthesia, 1% lidocaine was used. After a skin wheal was raised with a 25-gauge spinal needle, deeper injection of lidocaine was given down to the renal capsule. All aspiration biopsies were performed with 20 to 21-gauge spinal needles.



**Figure 5**  
The whole ultrasound-guided fine-needle aspiration cytology procedure as seen on the ultrasound screen. A radiologist localizes the renal lesion and fixates the transducer so that the projected trajectory of the needle is free of underlying bowel or major blood vessels. Once fixated in place, the other radiologist inserts the needle through the guiding system attached to the transducer, through the soft tissue into the solid renal lesion and aspirates cytologic material.



**Figure 6**  
Insertion of the spinal needle. One radiologist inserts the needle through the guiding system, while the other is fixating the transducer with the

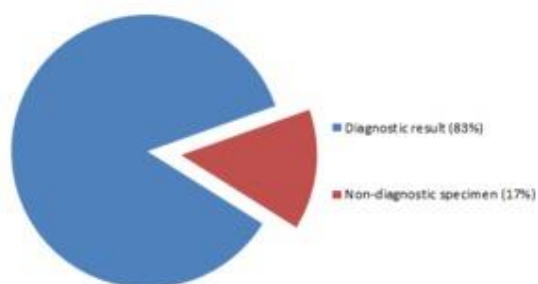


guiding system in a fixed position. Both radiologists observe the passing of the needle through the projected trajectory towards the renal lesion on the screen. Adjustments are made if the needle goes off projected course.

Two specimens were obtained from each patient. All biopsies were performed without a cytologist present. Aspirated specimens were sent to a cytologist for an official review. A specimen was considered diagnostic if there was sufficient tissue to answer the clinical question.

## Results

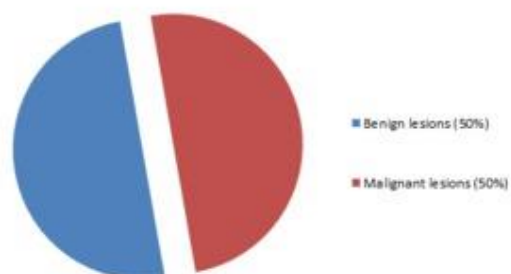
Of the 60 patients who had a fine-needle biopsy procedure performed, the biopsy yielded a diagnostic result in 50 of the procedures (83,3%).



**Figure 7**

Success rate of fine-needle aspiration cytology resulting in a diagnostic specimen.

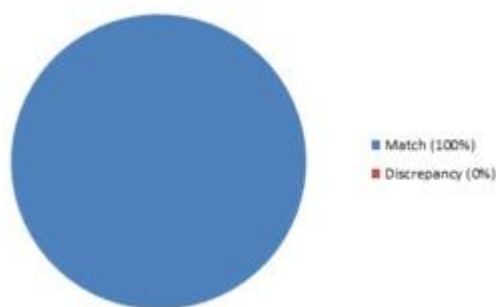
30 patients were diagnosed with a malignant disease.



**Figure 8**

In our study results confirmed malignancy in 50% of patients who underwent fine-needle aspiration cytology procedure.

Definite hystology data was available for 17 of these cases, in 13 patients no definite hystology could be gathered. For some patients the surgical procedure was contraindicated, some decided against the surgical procedure and some chose a different institution for the surgical procedure and thus pathology result was not accessible. The comparisment between the fine-needle aspiration cytology results and definite hystology reports of the 17 cases showed a perfect, 100% match in confirming malignancy.



**Figure 9**

Comparing the results of ultrasound-guided fine-needle aspiration cytology with the definite hystology reports in patients with malignant lesions who underwent surgical procedures showed a perfect match.

## Conclusion

The success rate of fine-needle aspiration cytology resulting in a diagnostic specimen in our study was 83,3%. Accuracy of our study correlates with the reports in literature (>70%) (3, 5-7).

US guided fine-needle aspiration cytology is a safe, minimally invasive diagnostic procedure. None of our 60 patients had any reported complications. In published literature, reported complications of fine-needle biopsy procedures are rare, but include perirenal hemorrhage, pneumothorax, infection, arteriovenous fistula and urinoma. Death and needle track seeding are extremely uncommon (2, 4).

The comparisment between the fine-needle aspiration cytology results and definite hystology





reports of our 17 cases shows a perfect, 100% match in confirming malignancy. This correlates with some reports in published literature (2) while other reports suggest slightly lower, 73-94% accuracy (3, 5-11).

In conclusion, our study confirmed our hypothesis that ultrasound-guided fine-needle aspiration cytology is a safe diagnostic procedure that provides valuable results completely comparable to definite histological pathology reports and as such it should have a place in the diagnostics of solid renal lesions.

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# Primerjava učinkovitosti analgezije s piritramidom po PCA in incidenca pooperativne nevropatske bolečine pri laparoskopskih in klasičnih črevesnih operacijah

## *Comparison of piritramid PCA analgesia efficiency and postoperative neurophatic pain occurrence in laparoscopic and classical colorectal surgery*

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### **Povzetek**

**Uvod.** Med operacijo lahko pride do poškodbe perifernih živcev, kar lahko vodi v razvoj nevropatske bolečine v obdobju okrevanja. Pooperativno bolečino lahko po laparoskopskih in klasičnih črevesnih operacijah lajšamo z infuzijo opioidov. V naši raziskavi smo primerjali razliko v pogostosti pojava pooperativne nevropatske bolečine, porabi opioidov in številu zapletov med skupinama bolnikov, ki so imeli laparoskopsko ali klasično črevesno operacijo.

**Metode.** V prospektivno raziskavo smo vključili 40 odraslih bolnikov, starejših od 18 let, razvrščenih po klasifikaciji ameriškega združenja anesteziologov (American Society of Anesthesiologists, ASA) v skupine I-III, pri katerih je bila načrtovana laparoskopska (skupina 1) ali klasična (skupina 2) resekcija črevesa. V skupino 2 smo vključili bolnike, pri katerih ni bila indicirana vstavev epiduralnega katetra. V obe skupini smo vključili po 20 bolnikov. Za pooperativno analgezijo so bolniki prejeli infuzijo piritramida s pomočjo črpalk, ki so jih bolniki urejali sami (patient controlled analgesia, PCA), z možnostjo dodatnih odmerkov piritramida, paracetamola in metamizola, glede na oceno vizualne analogne skale (VAS). Pooperativno analgezijo smo spremljali z VAS na 6 ur. Porabo piritramida smo spremljali v zbujevalnici in na oddelku za intenzivno nego na dan operacije ter še naslednja dva dni. Za oceno pojava pooperativne nevropatske bolečine smo uporabili vprašalnike za nevropatsko bolečino (douleur neuropathique, DN4in Pain detect).





**Rezultati.** Bolniki v skupini 1 so imeli statistično pomembno manjšo dolžino rane ( $p < 0.01$ ), krajši čas hospitalizacije ( $p < 0.01$ ) in daljši čas operacije ( $p < 0.03$ ) glede na skupino 2. Med skupinama ni bilo razlik v oceni VAS in porabi piritramida na dan operacije in v naslednjih dveh dneh. Vprašalnike za ocenjevanje nevropatske bolečine je izpolnilo 12 pacientov v skupini 1 in 10 pacientov v skupini 2. Skladno s Pain detect vprašalnikom, je nevropatsko bolečino izkusil 1 bolnik v 2. skupini (10%) in nihče v 1. skupini ( $p = 0.01$ ). Glede na DN4 vprašalnik sta 2 bolnika v 2. skupini izkusila nevropatsko bolečino, v 1. skupini pa nihče ( $p = 0.06$ ).

**Zaključek.** V skupini laparoskopsko operiranih bolnikov, kjer smo glede na manjšo dolžino operativne rane pričakovali manjšo porabo piritramida, ta ni bila statistično značilna. Čeprav smo v skupini klasično operiranih bolnikov opazili večji pojav nevropatske bolečine, pomembnosti te razlike nismo mogli statistično potrditi zaradi majhnega vzorca bolnikov.

**Ključne besede.** Črevesne operacije, neuropatska bolečina, analgezija s PCA.

## Abstract

**Background.** Surgery can be seen as an injury to the peripheral nervous system and may cause neuropathic pain in the course of the recovery. In laparoscopic and classical colorectal surgery postoperative pain could be relieved by opioid infusion. The aim of our study was to find out whether the postoperative neuropathic pain incidence, opioid consumption and complication rate differ between laparoscopic and more invasive classical colo-rectal procedures.

**Methods.** In prospective study 40 adult patients, ASA (American Society of Anaesthesiologists, ASA) I-III, scheduled for elective laparoscopic and classical colorectal surgery and to whom epidural catheter insertion was not indicated, were included. Patients were randomly divided into two groups: 20 patients in group 1 underwent laparoscopic procedure and 20 patients in group 2 were operated classically. Postoperative analgesia was provided in a patient controlled mode (patient controlled analgesia, PCA) with piritramide and additional piritramide, paracetamol or metamisol boluses as needed, according to the visual analogue scale (VAS). VAS values were recorded every 6 hours. On the day of the operation and in next two postoperative days the amount of piritramide used was recorded in the recovery room and on intensive care ward. Questionnaires for neuropathic pain (DN4- "douleur neuropathique" and Pain detect) were used to assess neuropathic pain appearance after surgery.

**Results.** In the group 1 there was statistically significant smaller wound length ( $p < 0.01$ ), shorter hospital stay ( $p < 0.01$ ) and longer duration of the operation time ( $p < 0.03$ ). No statistically significant differences in VAS values and in piritramide consumption were found between groups on the day of the operation and in the next two following days. In neuropathic pain assessment, 12 patients in the group 1 and 10 patients in the group 2 participated. According to Pain detect questionnaire, 1 patient (10%) in group 2 and none in group 1 experienced neuropathic pain ( $p = 0.01$ ). According to DN4 questionnaire, 2 patients (20%) in group 2 and none in group 1 experienced neuropathic pain ( $p = 0.06$ ).

**Conclusions.** In the group of patients who underwent laparoscopic procedure, where less piritramide consumptions was expected regarding to shorter wound length, this difference was not statistically significant. Although neuropathic pain was more frequent in the group of patients operated classically, significance of this difference could not be confirmed statistically due to small patient number.



**Key words.** *Colorectal procedures, neuropathic pain, PCA analgesia.*

## Uvod

Bolečino po laparoskopskih in klasičnih črevesnih operacijah lahko lajšamo s torakalno epiduralno analgezijo (TEA) (1). Ker so laparoskopski posegi manj invazivni, lahko bolečino lajšamo tudi z manj invazivnimi načini, npr. z opioidi intravensko. Opioide lahko uporabimo za lajšanje bolečine tudi pri klasičnih črevesnih operacijah, kadar vstavev epiduralnega katetra ni možna ali ga bolniki zavračajo (2-4). Pri zdravljenju z opioidi se lahko pojavijo stranski učinki (ileus, slabost, zavora dihanja, zadrževanje urina).

Tipična kronična pooperativna bolečina se razvije po operaciji, traja najmanj 2 meseca, izključiti je potrebni ostale možne vzroke bolečine. Med operacijo lahko pride do poškodbe perifernih živcev, kar vodi v razvoj nevropatske bolečine v obdobju okrevanja. Tipični simptomi za nevropatsko bolečino so lahko pozitivni (dizestezijska, parestezijska, alodinija, hiperalgezija, spontana bolečina) ali negativni (delna ali popolna izguba občutljivosti).

Največja incidenca nastanka kronične pooperativne bolečine je po amputacijah, srčnih operacijah, po torakotomiji, mastektomiji, holecistektomiji in hernioplastiki; nanjo vplivajo dejavniki tveganja s strani bolnika (genotip, anamneza, predhodne bolečinske težave, prepričanja, psihosocialne okoliščine) in medicinski dejavniki (vrsta operacije in anestezije, perioperativna analgezija ter ostalo zdravljenje). Za nevropatsko bolečino so značilni številni različni kompleksni mehanizmi in z njimi povezani simptomi.

Eden pomembnejših mehanizmov za razvoj nevropatske bolečine je centralna senzitivizacija, pri kateri postanejo nevroni v hrbtenjači preveč odzivni, kar vodi do povečane občutljivosti (na dotik in temperaturo) in bolečine, ki zajema širšo površino, kot je obseg poškodbe. Jakost aferentnih signalov uravnava descendenta inhibitorna pot, ki jo lahko stimuliramo z opioidi. Opioidi se

vežejo na receptorje v možganih in povečajo descendento inhibicijo, kar zmanjša aferentni bolečinski signal (5-8).

V naši raziskavi smo primerjali učinkovitost lajšanja bolečine z infuzijo piritramida s pomočjo črpalke, ki so jih bolniki urejali sami (patient controlled analgesia, PCA), porabo opiatov, število komplikacij in pogostnost pojava pooperativne nevropatske bolečine med skupinama bolnikov, ki so imeli laparoskopsko ali klasično črevesno operacijo.

## Metode

V prospektivno raziskavo smo vključili 40 odraslih bolnikov, starejših od 18 let, razvrščenih po klasifikaciji ameriškega združenja anesteziologov (American Society of Anesthesiologists, ASA) v skupine I-III, pri katerih je bila načrtovana laparoskopska (skupina 1) ali klasična (skupina 2) črevesna operacija. V skupino 2 smo vključili bolnike, pri katerih ni bila indicirana vstavitev epiduralnega katetra. V obe skupini smo vključili po 20 bolnikov.

Neposredno pred operacijo, po vzpostavitvi intravenske poti, smo bolnike pomirili z midazolamom (1-2 mg).

Pri obeh skupinah smo za uvod v anestezijo uporabili propofol (1-2 mg/kg) ali etomidat (0,2 mg/kg), fentanil (3-5 µg/kg) in vekuronij (0,1 mg/kg) oz. rokuronij (0,6 mg/kg). Po intubaciji smo vstavili nosno-želodčno cevko in urinski kateter. Splošno anestezijo smo vzdrževali s sevofluranom (MAC 1) in z mešanico zraka/kisika (FiO<sub>2</sub> 0,40). Spremljali smo mišično relaksacijo in po potrebi dodajali vekuronij (2-4mg) oz. rokuronij (10-20 mg). Vsi bolniki so med operacijo dobili antiemetik (granisetron 1 mg).

V obeh skupinah smo bolnikom ob koncu operacije priključili PCA črpalko (piritramid 0,5 mg/ml, pretok 1,5-2 mg/h, enkratni odmerek 1,5-2mg, čas zaklepa 30 minut).



Po potrebi smo na oddelku bolnikom dodali antiemetik, paracetamol, metamizol in dodatne odmerke piritramida.

Učinkovitost pooperativne analgezije smo spremljali z oceno vizualne analogne skale (VAS) na vsakih 6 ur. Beležili smo porabo piritramida v prebujevalnici in v intenzivni enoti na dan operacije ter v naslednjih dveh dneh.

Beležili smo čas do prve defekacije in trajanje zdravljenja v bolnišnici.

Za oceno pojava pooperativne nevropatske bolečine smo uporabili vprašalnika DN4 in Pain detect.

Normalnost porazdelitve spremenljivk smo ugotavljali s testom Kolmogorov-Smirnov. Za ugotavljanje razlik med skupinami smo uporabili Mann-Whitneyev U-test pri zveznih spremenljivkah in test  $\chi^2$  pri atributivnih spremenljivkah. Pri preizkušanju hipotez smo za statistično zna-

čilne upoštevali vrednosti  $p < 0,05$ . Statistične izračune smo opravili s programskim paketom SPSS 10.0 for Windows (SPSS Inc., Chicago, Illinois) (9, 10).

## Rezultati

Demografske značilnosti bolnikov so prikazane v Razpredelnici 1. V skupini 1 so imeli bolniki statistično pomembno manjšo dolžino rane ( $p < 0,01$ ), krajši čas hospitalizacije ( $p < 0,01$ ) in daljši čas operacije ( $p < 0,03$ ) glede na skupino 2.

V opazovanem časovnem obdobju med skupinama nismo našli statistično pomembnih razlik v vrednosti VAS (Slika 1).

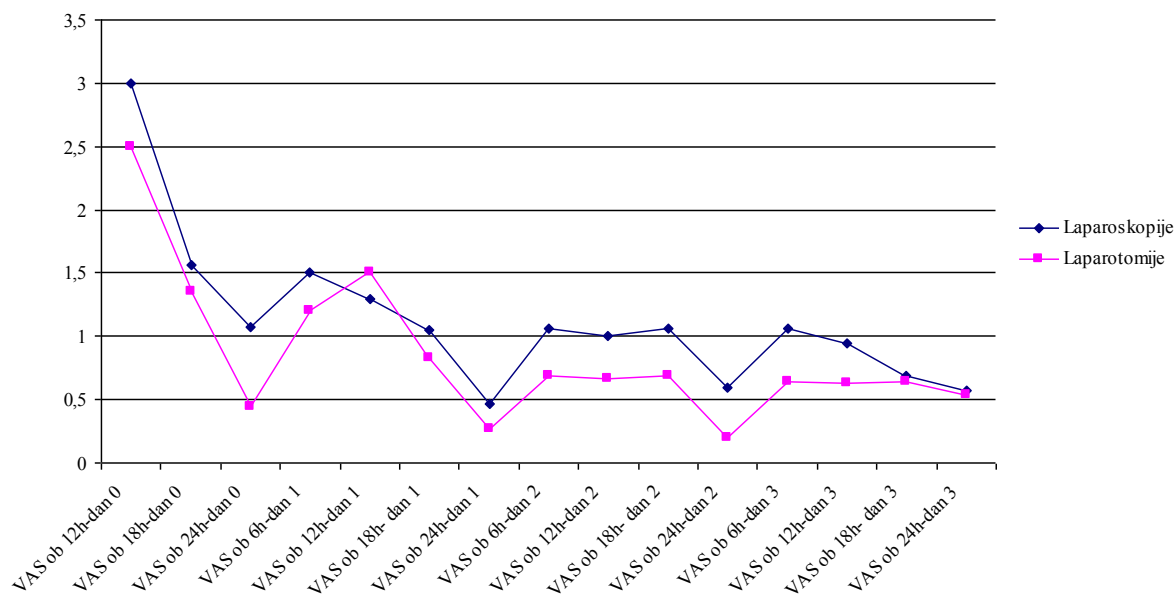
Porabo piritramida smo beležili na dan operacije in v naslednjih dveh dneh (Slika 2).

## Razpredelnica 1

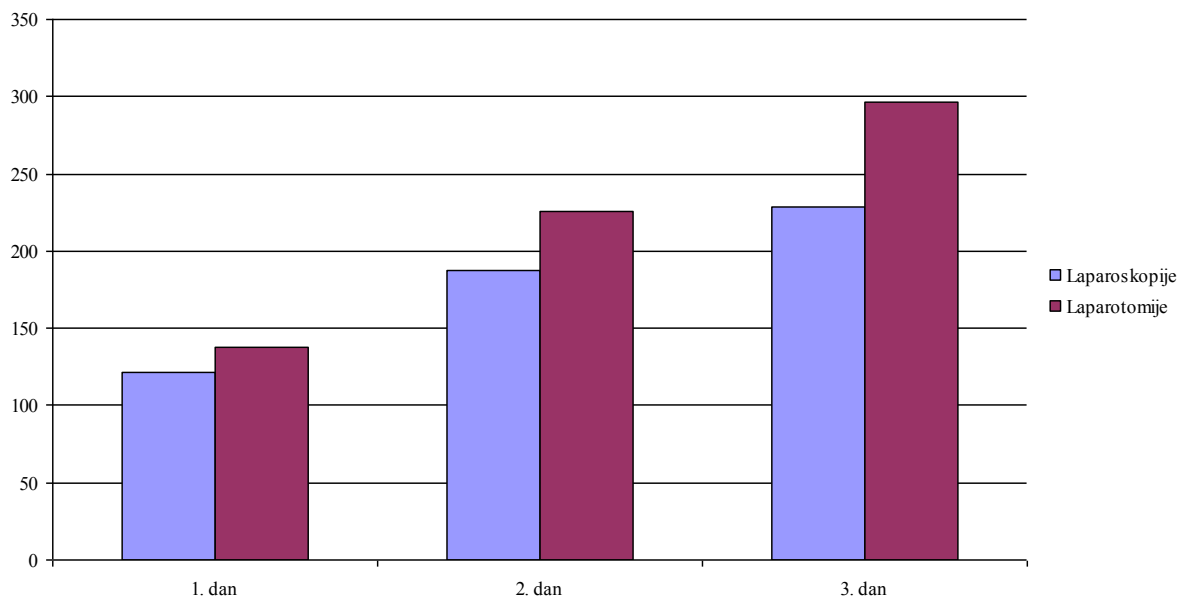
Demografske značilnosti bolnikov. Vrednosti spremenljivk so prikazane kot mediana ter 1. in 3. kvartila ali z relativno frekvenco (%). N = število bolnikov.

Spremenljivka	Skupina 1 (N = 20)	Skupina 2 (N = 20)
Starost (leta)	63 (55–69)	68 (60–78)
Spol:moški	11 (55 %)	11 (55 %)
Teža (kg)	76 (68–82)	75 (64–88)
ASA	2 (2–3)	3 (2–3)
Dolžina rane (cm)	6 (5–7) *	22 (20–25) *
Čas operacije (min)	135 (110–150) *	115 (74–130) *
Prva defekacija (dnevi)	4 (3–6)	5 (3–7)
Čas hospitalizacije (dnevi)	8 (8–9) *	11 (9–19) *

\* statistično pomembna razlika



**Slika 1**  
VAS (1-10) v pooperativnem obdobju



**Slika 2**  
Poraba piritramida (mg)



Med skupinama ni bilo statistično pomembnih razlik v porabi piritramida na dan operacije in v naslednjih dveh dneh. Prav tako med skupinama ni bilo razlik v času prve defekacije in trajanju bolnišničnega zdravljenja. 12 bolnikov v 1. Skupini in 10 bolnikov v 2. skupini je sodelovalo pri ocenjevanju nevropatske bolečine. Po Pain detect vprašalniku je 1 bolnik v 2. skupini (10%) izkusil nevropatsko bolečino, nihče pa v 1. skupini ( $p=0,01$ ). Glede na DN4 vprašalnik sta 2 bolnika v 2. skupini izkusila nevropatsko bolečino, v 1. skupini pa nihče ( $p=0,06$ ).

## Zaključek

Kljub pričakovanju, da bo v skupini laparoskopsko operiranih bolnikov, pri katerih je bila tudi dolžina operativne rane manjša, manjša poraba piritramida, tega statistično nismo mogli potrditi. Med skupinama ni bilo razlik v porabi piritramida na dan operacije in v naslednjih dveh dneh. V naši študiji je bila pooperativna analgezija enako učinkovita pri obeh skupinah bolnikov. Prav tako pri nobenem od bolnikov ni prišlo do nastanka ileusa in do depresije dihanja.

Mnoge študije so potrdile, da bolečina v perioperativnem obdobju senzitivira živčni sistem, kar vodi v nastanek kronične bolečine. Zato z zmanjšanjem nociceptivnega draženja hrbtenjače v času med in po operaciji zmanjšamo nastanek akutne in kronične pooperativne bolečine. Le v skupini klasično operiranih bolnikov smo opazili večji pojav nevropatske bolečine, pomembnosti te razlike nismo mogli statistično potrditi zaradi majhnega vzorca bolnikov. Na patogenezo nevropatske bolečine vpliva več različnih faktorjev, zato je multimodalni pristop pri zagotavljanju analgezije v perioperativnem obdobju verjetno najbolj uspešen pri preprečevanju razvoja kronične pooperativne bolečine.

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# Laparoskopska splenektomija

## *Laparoscopic splenectomy*

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### **Povzetek**

**Izhodišča.** Laparoskopska splenektomija je najustreznejša metoda odstranitve vranice pri bolnikih s hematološkimi boleznimi, kadar vranica ni močno povečana.

**Pacienti in metode.** V obdobju od 1. 1. 2006 do 31. 12. 2010 smo na Kliničnem oddelku za abdominalno kirurgijo Kirurške klinike UKC Ljubljana napravili 73 laparoskopskih splenektomij. Bolniki ležijo na operacijski mizi v desnem bočnem položaju. Večinoma smo uporabili tri troakarje, avtomatski spenjalnik ter plastično vrečko za zaščito vranice pred odstanitvijo.

**Rezultati.** Od 73 bolnikov z laparoskopsko splenektomijo je bila v 62 (84,9%) primerih indikacija za splenektomijo hematološka bolezen. Pri 11 (15,1%) bolnikih smo vranico odstranili zaradi infarkta vranice, cist in psevdociste vranice, multiplih kalcinacij, vnetnega tumorja in subkapsularnega hematoma vranice. Pri treh bolnikih smo poleg laparoskopske splenektomije napravili tudi laparaskopsko holecistektomijo zaradi žolčnih kamnov. Preklop v klasično splenektomijo je bil potreben v enem primeru. Povprečna hospitalizacija je bila 5 dni. Pri 4 (9,5%) bolnikih smo po operaciji z UZ ugotovili hematoma pod prepono. V vseh primerih je bilo konzervativno zdravljenje uspešno. Ena bolnica (1,4%) je umrla zaradi intracerebralne krvavitve.

**Zaključki.** Laparoskopska splenektomija je varna metoda odstranitve vranice pri bolnikih s hematološkimi boleznimi. Poseg običajno prinese izboljšanje ali pa daljše obdobje brez bolezni.

**Ključne besede.** Laparoskopska splenektomija, hematološke bolezni, rezultati.





## Abstract

**Background.** *The laparoscopic splenectomy is the method of choice for a safe spleen removal in patients with hematologic disorders having only slight spleen enlargement.*

**Patients and methods.** *In the period from 1. 1. 2006 till 31. 12. 2010 we performed 73 laparoscopic splenectomies. Patients were positioned on the operative table in the right lateral position. In majority of cases only three trocars, endostapler and endobag were used.*

**Results.** *The indication for laparoscopic splenectomy was in 62 (84,9%) patients hematologic disorder, 11 (15,1%) patients had spleen infarction, splenic cyst and pseudocyst, calcination, inflammatory tumor and subcapsular hematoma of spleen. In three patients we performed cholecystectomy during laparoscopic splenectomy. A conversion was necessary in one case. The average hospital stay was 5 days. Four (9,5%) patients developed postoperative subphrenic hematoma. All patients were successfully treated conservatively. One (1,4%) patient died due to intracranial hemorrhage.*

**Conclusion.** *Laparoscopic splenectomy is a safe method of spleen removal for patients with hematologic disorders. This procedure enables improvement and may prolong disease-free period.*

**Key words.** *Laparoscopic splenectomy, hematologic disorders, results.*

## Uvod

Vranico so dolgo opisovali kot skrivnosten organ. V začetku 19. stoletja so na živalih dokazali pomen vranice pri obrambi pred infekcijami. V tridesetih letih prejšnjega stoletja so poročali o sepsi s smrtnim izidom pri človeku po splenektomiji. Kljub temu so vranico ob poškodbi, brez pomisleka odstranili, kot da gre za nepomemben organ.

Prvo splenektomijon naj bi napravil Zaccardo iz Pola v Palermu leta 1549. O prvi uspešni splenektomiji pa je poročal Riegner leta 1893 (1).

V drugi polovici 20. stoletja se je število splenektomij naglo povečevalo. Čedalje pogostejše prometne nesreče s poškodbami vranice so za ohranitev življenja zahtevale urgentno splenektomijo in vse boljša kirurška tehnika je to omogočala (2). Hitro je naraščalo število radikalnih operacij zaradi tumorjev v zgornjem abdomnu, ki so vključevale tudi splenektomije (1,3). Sredi 80-ih let je začelo število splenektomij postopoma upadati. Vzrok za to so bile nove ugotovitve o pomenu vranice in uvedba različnih postopkov za njeno ohranitev (1,2,4). Indikacije za elektivno splenektomijo pri

hematoloških boleznih so se postopoma širile. Splenektomija je indicirana pri tistih stanjih, kjer z odstranitvijo vranice zdravimo anemijo, levkopenijo in trombocitopenijo in s tem zmanjšamo potrebo po pogostih transfuzijah krvi. To so maligne hematološke bolezni (limfo-, mieloproliferativne bolezni) in benigne hematološke bolezni (ITP-idiopatska trombocitopenična purpura, hemolitična anemija, kongenitalna sferocitoza) (2,3).

Druge indikacije za splenektomijo so nekatere sistemske bolezni s prizadetostjo vranice in izrazito splenomegalijo (presnovne motnje kot na primer Mb. Gaucher, Mb. Niemann-Pick, kolagenoze, infekcijske bolezni) ter ciste vranice, anevrizme vrančnih žil, tumorji in abscesi (2).

Prvo laparaskopsko splenektomijo sta napravila Delaitre in Magnien leta 1991 (5). Po prvi laparaskopski splenektomiji so številni kirurgi objavili svoje dobre rezultate s to metodo (6,7).

Sčasoma se je izkazalo, da je laparaskopska splenektomija varna in enostavna, vendar le kadar vranica ni bistveno povečana (8).



## Kirurška anatomija vranice

Vranica leži v levem hipohondriju, kjer jo ščitijo 9., 10. in 11. rebro. Normalno je velika 3x8x13 cm in je običajno ne moremo tipati preko trebušne stene. Anatomske opisujemo njen zgornji in spodnji rob, ter sprednji in zadnji pol. V trebušno votlino jo pripenjajo številni ligamenti. Gastrolienalni ligament jo pripenja na želodec, v njem pa potekajo aa. in vv. gastricae breves. Lista gastrolienalnega ligamenta se v hilusu vranice razdvoji, lateralni ovija površino vranice, medialni pa pokriva žilje v hilusu vranice, kjer se povezuje s pankreatolienalnim ligamentom in lienorenalnim ligamentom. Lateralno vranico z diafragmo povezuje frenikolienalni ligament, spodnji rob vranice pa leži na frenikokoličnem ligamentu (9,10).

Vranico prehranjuje a. lienalis, ki v 85% izhaja iz trunkus celiakusa. Poteka ob zgornjem robu trebušne slinavke. V bližini hilusa se a. lienalis razveji in odda a. gastroepiploico sinistro ter aa. gastricae breves. Končne 2-3 veje prehranjujejo vranico. Aa. gastricae breves so včasih tudi veje a. polaris superior. Glede na prekrvavitev lahko vranico delimo na dva ali tri segmente, kar je pomembno pri načrtovanju parcialnih splenektomij (10).

Vena lienalis nastane v hilusu vranice iz več manjših ven, ki zapuščajo vranico. Poteka za trebušno slinavko. Vanjo se vlivajo vv. gastricae breves, v. gastroepiploica sinistra in v. mesenterica inferior. V. lienalis se skupaj z v. mesenterico superior zliva v v. portae (11).

Limfna drenaža iz vranice poteka v lienalne bezgavke v hilusu vranice, bezgavke drugega reda so pankreatično-lienalne bezgavke vzdolž a. lienalis, bezgavke tretjega reda pa celiakalne bezgavke ob trunkus celiakusu. Od tod gre limfa po trunkus intestinalis v cisterno hili (11).

## Funkcija vranice

Vranica je filter za cirkulirajočo kri, pomembna je pri imunskem odgovoru in je rezervoar za krvne celice. Makrofagi vranice razgrajujejo hemoglobin in tako sodelujejo pri presnovi železa. Vranica verjetno omogoča uravnavanje volumna

plazme. Pri nekaterih hematoloških boleznih nastajajo v vranici krvne celice (12).

Vranični makrofagi odstranijo ostarele in poškodovane eritrocite s fagocitozo. Podobno se zgodi z eritrociti, ki imajo nepravilnosti, npr. celične membrane, pri dedni sferocitozi, hemoglobina, pri anemiji srpastih celicah in talasemijah. Iz eritrocitov se v vranici odstranijo tudi vključki, kot npr. denaturiran hemoglobin, ostanki jeter, železo, zato po splenektomiji tovrstne eritrocite najdemo v krvi (12).

Vranica je limfatični organ z imunsko funkcijo. Bakterije in virusi, prekriti z elementi komplemnega sistema, postanejo cirkulirajoči imunski kompleksi, ki jih odstranijo makrofagi vranice in jeter. Inkapsulirane bakterije, ki imajo na površini le malo komplementa in nič imunoglobulina (IgG), makrofagi težko spoznajo. Le v vranici je zaradi počasnega pretoka krvi stik med makrofagom in inkapsulirano bakterijo dovolj dolg, da jo prepoznajo in odstranijo (12-14). Vranica pri idiopatični trombocitopenični purpuri odstrani opsonizirane, z IgG prekrute, trombocite. Pomembna je tudi za specifični imunski odgovor po vdoru mikroorganizmov: v njej nastajajo IgM, plazmatke in spominske celice (12,13). V vranici nastajajo krvne celice v fetalnem obdobju, pri odraslem pa pri nekaterih hematoloških boleznih (mieloproliferativna bolezen, talasemija). Ne gre za reaktivacijo fetalnih matičnih celic, ampak za preselitev celic iz kostnega mozga v vranico (ekstramedularna hematopoeza) (12,13).

## Indikacije za splenektomijo pri hematoloških bolnikih

V preteklosti so bile splenektomije najbolj pogoste zaradi poškodbe, rakavih krvnih bolezni in citopenij. Število splenektomij se je v zadnjem desetletju zmanjšalo za 30-50% (12). Splenektomija pa ostaja za številne bolnike s krvnimi boleznimi primeren in dokončen način zdravljenja (13).

### Imunska trombocitopenična purpura (ITP)

Pri imunski trombocitopenični purpuri (ITP) se protitelesa proti glikoproteinom vežejo na trom-





bocite, fagociti pa jih odstranijo. Trombocite odstranjujeta predvsem vranica in jetra. Vranica ima pri ITP dvojno vlogo: tvori protitelesa IgG in odstranjuje trombocite. Verjetno gre za moteno celično imunost (12). Bolezen pogosto odkrijemo zaradi dolgotrajnih krvavitev po manjših poškodbah, krvavitev iz nosu in dolgotrajnejših menstruacij. Za ITP je značilna trombocitopenija. Blag upad števila trombocitov ne potrebuje zdravljenja. Hujšo trombocitopenijo s krvavitvami zdravimo s kortikosteroidi. Splenektomija je uspešna pri bolnikih, kjer zdravljenje z zdravili ni učinkovito. Pred načrtovano splenektomijo moramo izključiti akcesorno vranico (13).

### **Dedne in imunske anemije**

Dedna sferocitoza se deduje avtosomno dominantno. Zaradi nepravilne strukture membranske beljakovine spektrina, namesto bikonkavnih nastanejo sferični eritrociti, ki propadajo v vranici. Poveča se eritropoeza, oboleli pa imajo anemijo različne stopnje. Odstranitev vranice popravi anemijo, vendar lahko zaradi zvečane presnove bilirubina nastanejo žolčni kamni. Če so ti že prisotni, je potrebna sočasna holecistektomija. Dedna sferocitoza je od dednih anemij pri nas najbolj pogosta (13).

Talasemija major je avtosomna dominantna dedna bolezen. Zaradi nenormalnega hemoglobina nastanejo precipitanti v eritrocitih. Bolniki imajo zelo veliko vranico s citopenijami. Splenektomija zmanjša potrebo po rednih transfuzijah eritrocitov (13).

Pri anemiji srpastih eritrocitov, ki se deduje avtosomno recesivno, se v eritrocitih nahaja hemoglobin S. Sčasoma pride do avtosplenektomije zaradi zlepljenja eritrocitov in tromboz. Pri redkih bolnikih pa je vranica povečana. V primeru citopenije je indicirana odstranitev vranice (13).

Pri imunsko pogojenih anemijah lahko, po izčrpanem medikamentoznega zdravljenja, splenektomija izboljša potek bolezni (13).

### **Kronične levkemije**

Pri kronični limfocitni in kronični mieloični levkemiji velika vranica povzroča bolečine v trebuhu in moti hranjenje. Citopenije so hude in

so neodzivne na zdravljenje z zdravili. Odločitev za splenektomijo mora biti dobro pretehtana. Ti bolniki so imunokompromitirani, večinoma podhranjeni, tako da je tveganje za operacijo in pooperacijske zaplete zelo veliko (12).

Pri levkemiji z lasastimi celicami splenomegalija nastane zaradi infiltracije vranice. Posledica je pancitopenija. Ta onemogoča zdravljenje s citostatiki. Po splenektomiji se stopnja citopenije zmanjša na sprejemljivo raven (12,13).

Za mielofibromatozo z mieloidno metaplazijo so značilne fibrozne spremembe v kostnem mozgu z moteno hematopoezo ter povečana jetra in vranica zaradi ekstramedularne hematopoeze. Splenomegalija ima za posledico pancitopenijo, portalno hipertenzijo, moteno hranjenje in bolečine v trebuhu. Močno povečano vranico lahko odstranimo, vendar zelo redko, saj je tveganje za pooperacijske zaplete vključno s smrtjo zelo veliko (12).

### **Trombotična trombocitopenična purpura (TTP)**

Trombotična trombocitopenična purpura (TTP) je bolezen neznane etiologije. Opisani so primeri po zdravljenju s tiklopidinom in klopidogrelom, med nosečnostjo in po porodu. Obstajajo pa familiarne oblike bolezni. Značilne so trombocitopenija, mikroangiopatična hemolitična anemija, ledvična odpoved, nevrološke motnje in vročina. TTP je verjetno posledica nenormalnega von Willebrandovega faktorja, ta povzroča agregacijo trombocitov in nastanek trombov v mikrocirkulaciji različnih organov (12,13). Zdravljenje s transfuzijami sveže zmrznjene plazme in plazmofereze je pri večini bolnikov učinkovito. Splenektomija pride v poštev pri kronični in recidivantni TTP, z namenom podaljšanja obdobja brez znakov bolezni (15).

### **Maligni tumorji vranice**

Limfom je lahko razlog za povečano vranico. Vranični limfom marginalne cone se pogosto pokaže z veliko vranico. Zgodnja splenektomija je uspešen način zdravljenja (13). Drugi primarni malignomi vranice so redki. Opisani so hemangiosarkom in plazmocitom (12,13).



## Benigni tumorji vranice

Najbolj pogosta sta limfangiom in hemangiom, ki le redko povzročata pomembno zvečanje vranice (12,13).

## Indikacije in kontraindikacije za laparoskopsko splenektomijo

Indikacije za laparoskopsko splenektomijo še vedno niso natančno določene. Pri laparoskopskih posegih je krvavitev težje kontrolirati kot pri klasičnih, zato je pri bolnikih z izrazitejšo trombocitopenijo potrebna ustrezna priprava pred predvideno laparoskopsko splenektomijo. Večja možnost krvavitve je prisotna pri bolnikih s portalno hipertenzijo in pri trombozi lienalne vene. Težavno laparoskopsko splenektomijo lahko pričakujemo pri vranicah, težjih od 500 g.

Za laparoskopsko splenektomijo so idealni bolniki z ITP, kjer je vranica normalne velikosti ali pa le malo povečana in brez hujših anatomskih anomalij (16,17).

Druge indikacije za laparoskopsko splenektomijo so dedna sferocitoza, avtoimuna hemolitična anemija, TTP ter druge hematološke bolezni. Ponekod se laparoskopska splenektomija napravi za določitev stadija Hodgkinove bolezni ter malignih tumorjev vranice (18).

Kontraindikacije so lahko absolutne in relativne. Absolutne kontraindikacije so travmatska ruptura vranice in krvavitev pri cirkulatorno nestabilnemu bolniku. Relativne kontraindikacije so tromboza vranice, portalna hipertenzija, predhodne operacije v zgornjem abdomnu, preboleli difuzni peritonitis, dekompenzirana bolezen pljuč ali srca (16,19).

## Bolniki in metode

V obdobju od 1. 1. 2006 do 31. 12. 2010 smo na Kliničnem oddelku za abdominalno kirurgijo Kirurške klinike UKC Ljubljana napravili 73 laparoskopskih splenektomij, in sicer pri 34 (46,6%) moških in 39 (53,4%) ženskah. Povprečna starost je bila 53,2 (18-82) let.

Od 73 bolnikov je bila v 62 (84,9%) primerih indikacija za splenektomijo hematološka

bolezen: 32 (51,6%) bolnikov je imelo ITP, 11 (17,7%) limfom, 3 (4,8%) dedno sferocitozo, 3 (4,8%) TTP, 2 (3,2%) kronično limfocitno levkemijo, 4 (6,4%) hemolitično anemijo, 4 (6,4%) hipersplenizem in 1 (1,6%) sistemski lupus. Pri 11 (15,1%) bolnikih smo vranico odstranili zaradi infarkta vranice, cist in psevdociste vranice, multiplih kalcinacij, vnetnega tumorja in subkapsularnega hematoma vranice. Pri treh bolnikih smo poleg laparoskopske splenektomije napravili tudi laparoskopsko holecistektomijo zaradi žolčnih kamnov.

## Operacijska tehnika

Bolnika v splošni anesteziji namestimo v desni bočni položaj in ga ustrezno fiksiramo. Običajno uporabimo tri troakarje pod levim rebrom lokom. Navadno zadostujejo troakarji premera 5, 12 in 15 mm. Po insuflaciji CO<sub>2</sub> skozi Veresovo iglo do standardnega pritiska uvedemo prvi troakar in laparoskop. Po uvedbi laparaskopa je pomemben natančen pregled celotne trebušne votline. Posebno natančno pa pregledamo hilus vranice in veliki omentum zaradi morebitne dodatne vranice. Po prekinitvi splenokoličnega ligamenta sledi prikaz žil v hilusu vranice. Žile v hilusu oskrbimo z avtomatskim spenjalnikom. Kratke žile gastrospleničnega ligamenta prekinemo z ultrazvočnim skalpelom. Ko vranico popolnoma sprostimo, jo položimo v primerno plastično vrečko, ki jo delno izvlečemo na mesto največje vstopne odprtine. Na tem mestu vstavimo primeren inštrument, s katerim drobimo in postopoma odstranjujemo tkivo vranice. Po odstranitvi vrečke s preostankom vranice ponovno izperemo trebušno votlino in kontroliramo hemostazo, nato vstavimo drenažno cevko ter zašijemo fascijo in kožo (20).

## Rezultati

Operacija je v povprečju trajala 115,8 minut (55-215 minut). Povprečna teža odstranjene vranice je bila 349 g (22-1500 g). Preklop v klasično splenektomijo je bil potreben v enem primeru. Povprečna hospitalizacija je bila 5 dni. Devet bolnikov s hematološkimi boleznimi pa smo po



povprečni hospitalizaciji 3,7 dni na naši kliniki premestili na Klinični oddelek za hematologijo. Pri 4 (9,5 %) bolnikih smo po operaciji z UZ ugotovili hematoma pod prepono. V vseh primerih je bilo konzervativno zdravljenje uspešno. Ena bolnica (1,4 %) je umrla zaradi intracerebralne krvavitve.

## Razpravljanje

Pri načrtovani elektivni splenektomiji je potrebno pretehtati ali je mogoče narediti laparoskopsko splenektomijo. Prvotno so bile indikacije za laparoskopsko splenektomijo le benigne hematološke bolezni, kjer vranica ni močno povečana, kasneje so se indikacije razširile (21,22). Izrazite splenomegalije in vranice s premerom več kot 20 cm in težo nad 1000 do 1500 g pa so večinoma še vedno domena odprtega pristopa (23).

Laparoskopsko splenektomija je lahko varna in enostavna operacija. Operater pa mora upoštevati pravila, ki jih zahteva varna operacijska tehnika. Položaj bolnika omogoča dober pregled področja pod levim rebrnim lokom. Težave včasih nastopijo zaradi kratkih žil v hilusu vranice, ki jih je težko prikazati in izolirati, preden jih oskrbimo z avtomatskim spenjalnikom. Včasih je prisoten tako imenovani razpršeni vzorec žil v hilusu vranice, ko se vrančna arterija in vena delita na manjše vene že v področju repa trebušne slinavke. Mnogo ugodnejša je tako imenovana magistralna razporeditev žil v hilusu, ki pa je prisotna le malokrat (20).

Med laparoskopsko splenektomijo lahko pride do številnih zapletov. Med najbolj dramatične spada krvavitev iz velikih žil v hilusu vranice. Take masivne krvavitve običajno ne moremo laparoskopsko obvladati. Potreben je hiter preklop, učinkovita zaustavitev krvavitve in klasično dokončanje splenektomije (20). V literaturi obstajajo podatki o 0-19% incidenci krvavitve, ki zahtevajo konverzijo v odprto metodo. Isti viri navajajo, da je odstotek konverzij večji pri bolnikih z vranico težjo od 500 g (18,19).

Ostale komplikacije so povezane s poškodbami sosednjih organov med sproščanjem vranice. Tako lahko poškodujemo lienalno fleksuro ko-

lona, rep trebušne slinavke in veliko krivino želodca. Pozne pooperacijske komplikacije zajemajo hematome in abscese v levem subfreniju, pankreatično in gastrično fistulo, ter pooperacijski ileus in infekt rane. Akcesorna vranica je najpogosteje vzrok za perzistentno trombocitopenijo, kljub narejeni splenektomiji (17). Pri laparoskopski splenektomiji po podatkih iz literature odkrijemo akcesorno vranico pri 0-12% bolnikov. Poročila o dodatnih vranicah odkritih pri klasičnih splenektomijah navajajo 15-30% pojavnost (24).

Operacijski čas za laparoskopsko splenektomijo, ki ne presega dve uri je povsem sprejemljiv in tak čas smo dosegli tudi v naši seriji (20,25). Prav gotovo pa ima laparoskopsko splenektomija za bolnike tudi druge prednosti kot so manjša pooperacijska bolečina, hitrejše okrevanje in krajša hospitalizacija (20).

## Zaključki

Laparoskopsko splenektomija je najprimernejša metoda odstranitve vranice pri hematoloških boleznih in drugih patoloških spremembah, kjer vranica ni bistveno povečana. Prednosti laparoskopске operacije so manjša pooperacijska bolečina, hitrejše okrevanje in krajša hospitalizacija.

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# Laparoskopska oskrba kongenitalne pilorostenoze – naše izkušnje

## *Laparoscopic pyloromyotomy for infantile hypertrophic pyloric stenosis – our experience*

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### **Povzetek**

Piloromiotomija predstavlja zlati standard zdravljenja kongenitalne pilorostenoze novorojencev. Sodobno operativno zdravljenje vključuje tudi laparoskopski pristop, ki izboljša predvsem pooperativni izgled brazgotine. Študija predstavlja primerjavo laparoskopske in odprte metode ter primerjavo prednosti, pomanjkljivosti in zapletov po obeh metodah. Opravili smo retrospektivno analizo operiranih bolnikov v UKCLJ. Od maja 2012 do oktobra 2013 smo oskrbeli 5 novorojencev oz. dojenčkov z laparoskopsko metodo in 12 z odprto metodo. Število operativnih zapletov, čas do polnega hranjenja, incidenca bruhanja in dolžina hospitalizacije se med obema metodama statistično niso močno razlikovali. Pri enem dojenčku smo pri laparoskopski metodi naredili konverzijo v odprto metodo in pri enem dojenčku smo pri odprti metodi naredili perforacijo mukoze. Kljub temu, da pri novorojencih nismo opazovali velike statistično pomembne krajše hospitalizacije ali časa do polnega hranjenja menimo, da manjša možnost pooperativnih zapletov, vnetja pooperativne rane in lepši estetski videz ran opravičuje uvedbo nove tehnike. Laparoskopska piloromiotomija je uspešna in varna metoda operativnega zdravljenja kongenitalne pilorostenoze novorojencev.

**Ključne besede.** Piloromiotomija, pilorostenoz





## Abstract

*Ramstedt pyloromyotomy through a right upper quadrant transverse incision has been the traditional treatment for hypertrophic pyloric stenosis. Recently, laparoscopic approaches have been introduced as alternative methods to improve cosmetics. This study compares the open and laparoscopic operative techniques and examines their advantages and complication rates. We performed a retrospective review of patients undergoing pyloromyotomy at UKCLJ between May 2012 and October 2013. Seventeen patients underwent pyloromyotomy, 5 by laparoscopic and 12 by open method. Complication rate, time to ad libitum feeding, incidence of emesis, and postoperative length of stay did not differ considerably among groups. One laparoscopic patient was converted to open method. Mucosal perforation occurred in one patient in open group, but none in the laparoscopic group. Advantages of laparoscopic method include a shorter mean hospital stay without higher complications or costs and better cosmetics. Laparoscopic pyloromyotomy is a safe and effective approach to the treatment of hypertrophic pyloric stenosis.*

**Key words.** Pyloromyotomy, pyloric stenosis.

## Uvod

Pri kongenitalni pilorostenozni nastane difuzna hipertrofija in hiperplazija gladkih mišic piloričnega in antralnega dela želodca (1-3). Hipertrofična mišica sprva oži, s časom pa skoraj popolnoma zapre svetlino piloričnega kanala in onemogoči prehod hrane iz želodca v dvanajstnik, kar povzroči visoki ileus. Simptomi se pojavijo v 3. do 6. tednu starosti kot bruhanje želodčne vsebine brez primesi žolča v loku, ki se pojavi takoj po obroku in postaja vse obilnejše ter pogostejše. Bruhanje vodi v padec telesne teže, dehidracijo ter elektrolitske in kislinsko-bazne motnje (4). Vzrok nastanka bolezni je neznan, vendar poznamo tako genetske kot okoljske dejavnike, ki povečajo tveganje za nastanek bolezni (1-3,5,6). Delovno diagnozo kongenitalne pilorostenoze postavimo na osnovi tipične anamneze in kliničnega pregleda, pri katerem lahko zatipamo tumorsko maso velikosti olive v predelu duodenalne točke. Bolezen diagnostično dokažemo z UZ trebuha z visoko diagnostično občutljivostjo (7-10). V redkih primerih, če diagnoza po UZ ni zanesljiva, lahko naredimo kontrastno preiskavo zgornjih prebavil. Kongenitalno pilorostenozo zdravimo operativno. Opisi operativnega zdrav-

ljenja do leta 1912 so predlagali različne obvoje z gastroenterostomijo, piloroplastike in dilatacije skozi gastrektomijo. Leta 1912 je kirurg Conrad Ramsted opravil prvo piloromiotomijo, ki je postala zlati standard operativnega zdravljenja (11). Sodobno operativno zdravljenje vključuje tudi laparoskopski pristop.

## Bolniki in metode

Nov mejnik v otroški laparoskopski kirurgiji v Sloveniji predstavlja izgradnja nove pediatrične klinike z novimi operativnimi prostori. V njih so vse tri operativne dvorane opremljene z modernimi video laparoskopskimi stolpi ter ustreznimi operativnimi inštrumenti, ki omogočajo varne laparoskopske posege tudi pri novorojenčkih. Tako smo v letu 2012 uvedli laparoskopsko piloromiotomijo pri kongenitalnih pilorostenozah novorojencev. Pri bolnikih, ki so imeli postavljeno delovno diagnozo kongenitalna pilorostenozna, smo opravili UZ trebuha. Diagnozo kongenitalna pilorostenozna smo postavili ob upoštevanju kriterijev: debelina stene pilorusa 3-4 mm, dolžina piloričnega kanala 15-19 mm in zunanji premer pilorusa 10-14 mm. Novorojenca oz. dojenčka smo pripravili na operativni poseg s popravo elektrolitskih, kislinsko-baznih motenj in rehid-





racijo. Od staršev smo pridobili pisno dovoljenje za operativni poseg. Dojenček je predoperativno prejel antibiotično profilakso s cefazolinom, nazogastrično sondo in po sondi 50-70 ml metilenskega modrila. Za laparoskopski pristop smo uporabili 3 mm porte in inštrumente za večkratno uporabo. Optični trokar smo namestili v zgornji popkovni gubi pod kontrolo očesa, dva delovna trokarja pa pod kontrolo kamere v epigastriju in v zgornjem desnem kvadrantu pod DRL. Pneumoperitonej smo vzdrževali s tlakom do 6 mm Hg in pretokom 2 L/min. Po prikazu hipertrofičnega pilorusa in potrditvi diagnoze smo pristopili k piloromiotomiji. S prijemalko smo utrdili položaj pilorusa in z monopolarno električno iglo vzdolžno prekinili serozo in subserozo v predelu pilorusa od antruma do bulbusa dvanajstnika. S preparirnim inštrumentom smo pod kontrolo kamere v tem delu razprli hipertrofirane mišične vitre do mukoze – piloromiotomija. Metilensko modrilo nam je služilo kot varovalo pri morebitni perforaciji mukoze. Po končani piloromiotomiji smo pod kontrolo kamere odstranili delovne trokarje. Na mestu optičnega trokarja smo namestili šive fascije, drugod le šive kože. Dojenček je 6 ur po operativnem posegu pričel z uživanjem čaja in nato materinega mleka. Ob bruhanju ali večjem polivanju otroka smo hranjenje količinsko zmanjšali ali začasno ustavili. Ob zadostnem uživanju hrane in primernem pridobivanju na telesni teži smo dojenčka odpustili v domačo oskrbo.

Klasična operacija se je izvajala skozi transrektalni rez pod desnim rebrom lokom na anatomskem mestu pilorusa. Hipertrofiran pilorus smo mobilizirati nad laparotomijo in piloromiotomijo opravili pod kontrolo očesa. Pooperativni potek hranjenja je bil enak.

## Rezultati

Od maja 2012 do oktobra 2013 smo z laparoskopsko metodo oskrbeli 5 novorojencev oz. dojenčkov, od tega so bili vsi fantki. Povprečna starost otrok na dan operacije je bila 25,6 dni. Pri enem otroku smo zaradi suma perforacije ob piloromiotomiji naredili konverzijo, vendar

perforacije nismo potrdili. V pooperativnem obdobju nismo ugotavljali večjih zapletov zaradi katerih bi spremenili potek pooperativnega okrevanja. Pri štirih dojenčkih so se rane zacelile per primam, pri enem smo zaradi rdečine rane opravljali preveze z obkladki, gnojnega izcedka ni bilo, prav tako rane ni bilo potrebno razpreti. Čas do polnega hranjenja je bil povprečno 2 dni in dojenčke smo 4,8 dni po operaciji odpustili iz bolnišnice. V enakem obdobju smo zdravili 12 dojenčkov z odprto piloromiotomijo, od tega 11 fantov in 1 deklico. Povprečna starost je bila 61,5 dni, čas do polnega hranjenja enak kot pri laparoskopski metodi in čas do odpusta po operaciji 5,25 dni. En dojenček je bil zaradi nerednega dihanja po operaciji za en dan sprejet v Enoto za intenzivno terapijo, vendar je bil že naslednji dan premeščen na oddelek brez težav z dihanjem. Pri dveh bolnikih smo opravljali preveze ran zaradi rdečine.

## Razpravljanje

Bolnika v splošni anesteziji namestimo v desni bočni položaj in ga ustrezno fiksiramo. Običajno uporabimo tri trokarje pod levim rebrom lokom. Navadno zadostujejo trokarji premera 5, 12 in 15 mm. Po insuflaciji CO<sub>2</sub> skozi Veresovo iglo do standardnega pritiska uvedemo prvi trokar in laparoskop. Po uvedbi laparaskopa je pomemben natančen pregled celotne trebušne votline. Posebno natančno pa pregledamo hilus vranice in veliki omentum zaradi morebitne dodatne vranice. Po prekinitvi splenokoličnega ligamenta sledi prikaz žil v hilusu vranice. Žile v hilusu oskrbimo z avtomatskim spenjalnikom. Kratke žile gastro-spleničnega ligamenta prekinemo z ultrazvočnim skalpelom. Ko vranico popolnoma sprostimo, jo položimo v primerno plastično vrečko, ki jo delno izvlečemo na mesto največje vstopne odprtine. Na tem mestu vstavimo primeren inštrument, s katerim drobimo in postopoma odstranjujemo tkivo vranice. Po odstranitvi vrečke s preostankom vranice ponovno izperemo trebušno votlino in kontroliramo hemostazo, nato vstavimo drenažno cevko ter zašijemo fascijo in kožo (20).



## Rezultati

Operacija je v povprečju trajala 115,8 minut (55-215minut). Povprečna teža odstranjene vranice je bila 349 g (22-1500 g). Preklop v klasično splenektomijo je bil potreben v enem primeru. Povprečna hospitalizacija je bila 5 dni. Devet bolnikov s hematološkimi boleznimi pa smo po povprečni hospitalizaciji 3,7 dni na naši kliniki premestili na Klinični oddelek za hematologijo. Pri 4 (9,5 %) bolnikih smo po operaciji z UZ ugotovili hematoma pod prepono. V vseh primerih je bilo konzervativno zdravljenje uspešno. Ena bolnica (1,4 %) je umrla zaradi intracerebralne krvavitve.

## Razpravljanje

Po uspešno opravljeni piloromiotomiji s strani Conrada Ramsteda leta 1912, predstavlja vzdolžna prekinitev mišic pilorusa do mukoze zlati standard zdravljenja kongenitalne pilorostenoze novorojencev (11-13). Operativni poseg z razprtjem mišičnih viter in razširitvijo piloričnega kanala takoj sprosti stenozo pilorusa in odpravi visoki ileus. Kljub temu vzdolžna prekinitev pilorusa v poznejšem obdobju otroka oz. bolnika ne vpliva na funkcijo pilorusa. Klasičen pristop za piloromiotomijo je vključeval zgornjo laparotomijo in pozneje transrektalni rez pod DRL. Oba pristopa sta povezana z velikimi brazgotinami v poznejšem obdobju rasti otroka, ko še tako majhna brazgotina zraste z otrokom. Estetski videz se je poskušal izboljšati s pristopom nad popkom kot sta ga opisala Tan in Bianchi (14, 15). V trebušno votlino pristopimo z polkrožnim rezom vzdolž zgornje popkovne gube in s tem brazgotino delno skrijemo. Pri vseh odprtih posegih je potrebno pilorus mobilizirati nad laparotomijo in piloromiotomijo opraviti pod kontrolo očesa. Ob mobilizaciji pilorusa so možne poškodbe sosednjih organov, deserozacija želodca ali dvanajstnika in poškodba žil s krvavitvijo. S prodorom laparoskopije v otroško abdominalno kirurgijo in napredkom laparoskopskih inštrumentov ter video tehnike po letu 1990, je bila prva laparoskopska piloromiotomija opravljena leta 1991 (16). Prednosti novega pristopa so

boljši estetski videz, ni potrebe po mobilizaciji pilorusa, manjša je možnost poškodb sosednjih organov in nastanka intraabdominalnih prirastlin, krajše je pooperativno okrevanje in manjša pooperativna bolečina. Velika slabost nove metode je bila potreba po specializirani opremi, spreminjena predoperativna priprava novorojenca oz. dojenčka in spremenjen anesteziološki pristop. Potrebna je predvsem visoka specializiranost otroškega kirurga, ki mora biti večš laparoskopskega pristopa. Številne analize velikih objavljenih serij in metaanaliz kirurškega pristopa poudarjajo prednost laparoskopskega pristopa z manjšimi odstotki zapletov celjenja ran, hitrejšim okrevanjem do polnega hranjenja, krajšo hospitalizacijo in lepšim estetskim videzom (17-21).

Po uspešni uvedbi laparoskopskega pristopa pri dojenčkih smo v letu 2012 pričeli z laparoskopsko piloromiotomijo. Razen ob prvem otroku, kjer nam je manjkalo izkušenj in smo zaradi potrditve zadostne piloromiotomije naredili konverzijo, zapletov zaradi laparoskopskega pristopa nismo imeli. To dejstvo pripisujemo postopnemu uvajanju laparoskopskega pristopa zaradi druge patologije z manjšanjem starosti operiranih dojenčkov (22). S tem smo pridobili zadostne izkušnje v otroški abdominalni laparoskopski kirurgiji. Ob tem smo tesno sodelovali z anesteziologi, ki so uspešno opravili predoperativno, medoperativno in pooperativno oskrbo novorojenčka oz. dojenčka. Iz rezultatov je lepo razvidno, da je povprečna starost laparoskopsko oskrbljenih dojenčkov manjša kot pri odprti metodi, saj so bili vsi še novorojenci.

V literaturi še vedno najdemo nasprotnike laparoskopskega pristopa v otroški abdominalni kirurgiji. Kljub temu imamo vsaj šest prospektivnih študij, ki favorizirajo laparoskopski pristop (23). Velikih statističnih razlik v pooperativnim okrevanju študije sicer ne opisujejo, kljub temu pa menimo, da govorijo dolgoročen estetski videz brazgotin in manjša možnost pooperativnih zapletov v prid laparoskopskemu pristopu. To smo opazovali tudi pri naših bolnikih. Povprečna hospitalizacija je bila pri laparoskopskem pristopu krajša. Ker je metoda nova, še ne uveljavljena in je glavni pogoj za odpust iz bolnišnice normalno



pridobivanje dojenčka na telesni teži in ne popolno hranjenje, je velike razlike med obema hospitalizacijama težko pričakovati, saj je bil čas do popolnega hranjenja podoben. Velika pomanjkljivost objavljenih študij je različen pristop k pooperativni oskrbi z različnimi protokoli hranjenja, kar onemogoča direktno primerjavo (23). Število zapletov, ki jih lahko pripisujemo laparoskopskemu pristopu pa je v vseh študijah majhno, prav tako tudi pri naših bolnikih v opazovanem obdobju. Kljub temu je zelo pomembno, da se omenjen pristop uvede postopoma in v centru, kjer izvajajo tudi druge laparoskopske posege. Potrebno bo izvesti prospektivne študije z enakimi protokoli pooperativne oskrbe, ki bodo verjetno omogočile uvedbo laparoskopskega pristopa kot zlatega standarda kirurške oskrbe zdravljenja kongenitalne pilorostenoze novorojencev. Še vedno pa je najbolj pomembno, da za posameznega bolnika uvedemo najprimernejšo metodo zdravljenja glede na njegovo stanje in izkušnje kirurga. Če imamo dojenčka, ki zaradi elektrolitskih ali kislinsko-baznih motenj ni sposoben laparoskopije ali kirurg ni večš laparoskopke metode, moramo še vedno izbrati klasičen pristop. Ker v večini primerov operacija ni urgentna ampak nujna, pa takega dojenčka primerno pripravimo in tudi premestimo v ustrezn center, kjer opravljajo take posege.

## Zaključek

V letu 2012 smo uspešno uvedli laparoskopsko piloromiotomijo pri zdravljenju kongenitalne pilorostenoze novorojencev. Kljub temu, da pri novorojencih nismo opazovali velike statistično pomembne krajše hospitalizacije ali časa do polnega hranjenja menimo, da manjša možnost pooperativnih zapletov, vnetja pooperativne rane in lepši estetski videz ran opravičuje uvedbo nove tehnike. Novo tehniko je potrebno uvesti postopno v tesnem sodelovanju z anesteziologi in v specializiranem centru. V slovenskem področju je glede na številnost patologije smiselno imeti le en center.

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## Tehnične novosti

### *New techniques*

# Evolutija ali kar revolucija: uvedba 3D tehnologije za namene najzahtevnejših laparoskopskih posegov

**Sebastjan Kastelic**

Olympus Slovenija d.o.o., Hudourniška pot 2, SI-1000 Ljubljana

3D Endoeye - dve inovaciji hkrati, ki navdušujeta in postavljata nove standarde v laparoskopski kirurgiji: 3D tehnologija nudi ostrejši, preciznejši in najbolj realističen prikaz na zaslonu, kot je bil kadarkoli navoljo do sedaj. Fleksibilna konica laparoscopa omogoča maksimalno prilagodljivost in izbiro najboljšega položaja kamere tudi pri zelo zahtevnih posegih.



**Slika 1**

Olympus 3D pogled





## Prednosti

Novi EndoEYE Flex 3D je prvi laparoskop z dvema ločenima digitalnima čipoma **vgrajenima na samo konico endoskopa. Skupaj simultano zajemata in generirata** ločeno dva digitalna signala, v polni HD ločljivosti, tako za levo in desno sliko. Ti dve sliki sta nato v procesorju združeni in kreirata tri-dimenzionalno (3D) sliko, na enak način, kot sta sposobni zajemati sliko dve človeški očesi. Za kirurške posege revolucionarna tehnologija, tako postavlja Olympus na čelo proizvajalcev in inovatorjev pri kreiranju in prenosu digitalne slike iz abdominalne votline na ekran.

Prav tako je to prvi laparoskop na tržišču, ki nudi angulacijo konice v vse štiri smeri. V vsako stran do 100°, kar omogoča popolno orientacijo in podroben pogled območja posega in prinaša pomembno prednost v primerjavi s klasičnimi rigidnimi optikami ali laparoskopiji, ki imajo kot pogleda fiksni in ga ni moč spreminjati.



**Slika 2**  
Olympus 3D LTF EndoEye videolaparoskop

## Tehnologija

Človeško oko zaznava objekt z dvema očesoma, sočasno vidimo dve različni sliki, ki sta posledica pozicije naših oči. Levo in desno oko nam omogočata zaznavo objekta pod dvema rahlo različnima kotoma oziroma perspektivama. Naši možgani

združijo obe sliki in kreirajo 3D predstavo o objektu – tako zaznamo pozicijo in globino oz. oddaljenost objekta. Na enak način deluje Olympusov dvoletni oz. dvočipni sistem z dvema senzorjema na sami konici endoskopa, ki dve zajeti sliki v največji možni resoluciji v samem procesorju sinhronizira, združi in prikaže na 3D zaslonu. Kirurg za pogled na ekran uporablja, lahka, prosojna in polarizirana očala. Polarizacijska očala prepuščajo le polarizirano svetlobo, ta je različno polarizirana za levo in desno oko. Tako vsako oko dobi le njemu namenjeno sliko. Olympusov 3D efekt tako popolnoma posnema človeški očesi, kar omogoča popolnoma realističen in nenaporen prikaz na zaslonu, ki ni utrujajoč za človeške oči in možgane tudi če poseg traja več ur skupaj.

Prednosti laparoskopije so, da omogočimo skozi majhen rez, operaterjem opraviti poseg v abdominalni votlini s pomočjo inštrumentov, ki jih lahko upravljamo in nadzorujemo s pogledom na monitor. Cilj takega posega je zmanjšati invazivnost, kar je dobro za pacienta, a je hkrati tehnično zelo zahteven za kirurga. Predvsem zato, ker so premiki inštrumentov omejeni, in ker je pogled na območje posega posredovan s pomočjo kamere na zaslon. Premiki inštrumentov in preciznost pogleda sta s pomočjo 3D tehnologije močno izboljšana, lažje je zaznati razlike med tkivi in njihovo pozicijo med samo disekcijo, šivanjem ali samo opazovanjem. S 3D tehnologijo natančno reproduciramo globinsko zaznavo. To nam tudi najtežje posege poenostavi, olajša, predvsem pa poleg hitrosti omogoča večjo natančnost in varnost.

Na drugi strani fleksibilna konica endoskopa omogoča, s svojo prilagodljivostjo in obračanjem v katerokoli smer tudi za 100°, da lahko operater vidi tudi tista območja posega, ki do sedaj s klasičnimi optikami niso bili vidni. Tkivo si je možno ogledati ne le od spredaj ampak tudi s strani, omogoča nastavitve najboljšega pogleda, ki je v tistem trenutku potreben. Detajli in realistični prikaz so s tem močno izboljšani in jih s klasičnimi nefleksibilnimi laparoskopiji in 2D kamerami ni možno doseči.



### Slika 3

3D EndoEye fleksibilna konica (v vse smeri, 100°)

## V praksi

Z nastavitvijo idealnega pogleda in 3D globinsko zaznavo se olajša zaznava razlik med različnimi tkivi in tudi pozicij in prostorske oddaljenosti različnih inštrumentov. S tem se napetost in potrebna osredotočenost zmanjša in zmanjša utrujenost osebja pri daljših posegih. Količina potrebne koncentracije, ki je potrebna, da zaznamo v katero smer je obrnjena igla in kontrola nad tkivom, ki ga šivamo, je zmanjšana – s tem pa pomembno prispevamo h udobju, ki je potreben, da kirurg strokovno, natančno in brez napak opravi vrsto posegov v istem dnevu.

## Literatura

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*- Edited books*

Garnick MB, Brenner BM. Tumors of the urinary tract. In: Braunwald E, Isselbacher KJ, Petersdorf RG, Wilson JD, Martin JB, Fauci As eds. Harrison's principles of internal medicine. 11th ed. Vol 2. New York: McGraw Hill, 1987: 1218-21

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