

Review of the literature on laparoscopic supracervical hysterectomy and related complications with single institution experience

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Videosurgery Miniinv

DOI: <https://doi.org/10.5114/witm.2017.67469>

Abstract

Hysterectomy is the second most common gynecologic operation after cesarean section. In the USA, the incidence rate for various types of hysterectomies has been estimated at 600 000 annually. At present, the laparoscopic route is becoming a more popular type of hysterectomy, from 0.3% in 1990 to 12% in 2003, with steadily growing rates. Laparoscopy is slowly replacing traditional, abdominal hysterectomies. It is recommended in patients with benign gynecologic conditions, e.g. dysfunctional and excessive uterine bleeding, uterine myomas, adenomyosis, or endometriosis. The operation time is comparable with other hysterectomy types. In Europe and in our center the risk of severe complications associated with laparoscopic supracervical hysterectomy is about 1%. This is not a high risk of complication during hysterectomy. Despite the undeniable advantages, it also has some disadvantages: cervical stump bleeding, risk of cervical stump malignancy, urinary tract occlusions, intestinal injuries and others.

Key words: laparoscopy, endoscopy, supracervical hysterectomy, laparoscopic supracervical hysterectomy, complication.

Introduction

Laparoscopic supracervical hysterectomy (LSH) is an example of a partial hysterectomy, performed due to uterine fibroids, profuse bleeding, and other gynecological complaints. The corpus is detached above the uterine cervix, without compromising its integrity, and extracted with a power morcellator through one of the surgical trocars. The cervix remains in place, which has a beneficial effect on the anatomy of the vagina. In light of the accumulating body of data about development of ovarian cancer (OC) from Fallopian tube cells, additional preventive bilateral salpingectomy is frequently performed. The ovaries are usually left intact in order to maintain hormonal balance and to prevent iatrogenic meno-

pause. A growing number of authors claim that preventive oophorectomy during hysterectomy is a less favorable way of management due to lower risk for developing OC than complications due to impaired homeostasis of the entire system. The LSH is a relatively uncomplicated procedure when the operator has adequate experience. Proponents of LSH suggest possible advantages including reduced hospitalization time, decreased risk of pelvic organ prolapse, and decreased risk of organ damage, in particular to the urinary tract. Opponents of LSH have suggested that this method increases the risk of cervical malignancy and cyclical bleeding. Regardless of the advantages, a number of complications may occur, including damage to the urinary system, hemorrhage, metastatic disease (in the case of unrecognized

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sarcoma, leiomyomatosis), or postoperative adnexal torsion. In 2014 the FDA raised the alarm concerning power morcellation and related consequences. In this paper we present our own observations about LSH complications.

Aim

The aim of this manuscript was to assess the intraoperative and perioperative complications of LSH in a teaching hospital.

Material and methods

Our manuscript is based on retrospective analysis of 481 laparoscopic supracervical hysterectomies with bilateral salpingectomy performed between January 2012 and December 2015 in our center. The operations were performed by the specialists as well as by the residents with the assist of specialists.

After admission to the clinic every patient had a gynecological examination including transvaginal sonography prior to surgery. Indications for LSH were as follows: uterine fibroids with pain or enlargement of the uterus, dysfunctional uterine bleeding, dysmenorrhea, adenomyosis, descensus of the uterus and benign hyperplasia of the endometrium. Patients with suspected or proven malignancy were excluded from this procedure and referred to an oncologist.

Almost all patients were operated on with a similar technique. Differences of the described technique occurred rarely and were caused by previous procedures or adhesions. The patient was placed in a supine position with outstretched legs. Disinfection of the vagina and abdomen and catheterization of the bladder were performed. A sterile curette was inserted into the uterine cavity as a manipulator. An umbilical incision was made. Insertion of a 10-mm trocar (optic) was followed by carbon dioxide insufflation to a pressure of 12 mm Hg. We do not use a Veress needle in our center. After that the patient was placed in a Trendelenburg position. One 5-mm trocar on the right side and one 10-mm trocar on the left side were placed in a typical position under optic visualization. The uterus was mobilized bilaterally by bipolar coagulation of the round ligament, the fallopian tube and the ovarian ligament followed by dissection using laparoscopic scissors. Bladder peritoneum opening and caudation of the bladder were performed using bipolar coagulation and scissors dissection. Uterine vessels were coagulated and dis-

sected on both sides. The uterus was separated from the cervix by laparoscopic scissors. Before the separation, the curette was removed from the uterine cavity. After hemostasis of the cervical stump using coagulation, the cervical canal was also coagulated bipolarly. The uterus was removed by electric morcellation through an incision (previously enlarged) on the left side. The Fallopian tubes were removed typically on both sides. The fascia and the skin were closed with sutures.

Results

A total of 481 patients who underwent LSH in our gynecological department between January 2012 and December 2015 were analyzed. All LSH were performed with salpingectomy. We found 6 cases ($n = 6$, 1,2%) of severe operative complications: excessive bleeding ($n = 2$, 0,4%), bladder injury ($n = 2$, 0,4%), peritoneal disseminate leiomyomatosis ($n = 1$, 0,2%) and adnexal torsion ($n = 1$, 0,2%).

One of the cases of postoperative hemorrhage occurred as a result of vascular damage after cutting off the uterine corpus from the cervix. The second case of increased blood loss was not recognized during the operation. Postoperative blood examination revealed a drop of hemoglobin and red blood count. An increased amount of fluid in the peritoneum was also found. The patient did not present any negative symptoms. The team decided to observe the patient and perform blood transfusion. The red blood count rose and the fluid disappeared spontaneously without an operation.

In our data there were also two cases of bladder injury during LSH. The injuries were managed with laparoscopic suturing of the bladder. Both patients stayed with a Foley catheter for 2 weeks. The patients are still in our outpatient clinic follow-up; they do not have any additional symptoms.

During those 4 years we had one case of peritoneal disseminate leiomyomatosis. The patient had two laparoscopies before (myomectomy and LSH), then she was diagnosed with peritoneal disseminate leiomyomatosis. The patient was operated on (laparotomy) and all suspicious changes were removed. The patient does not present any symptoms now.

One of our patients presented an atypical complication. The patient was diagnosed with a tumor with the suspicion of ovarian cancer. The patient was operated on, but the lesion was found to be an old

ovarian torsion. The change was removed without any complications. The patient is well at the moment.

Discussion

Hysterectomy, or surgical removal of the uterus, is the second most common gynecologic operation after cesarean section, which is the most popular surgical procedure in general. In the USA, the incidence rate for various types of hysterectomies has been estimated at 600 000 annually [1]. Types of hysterectomy include partial, complete, with or without salpingectomy and oophorectomy, and radical. The most common surgical methods are classic (abdominal and vaginal approach) and laparoscopic hysterectomies. The latter includes laparoscopic-assisted supracervical hysterectomy (LSH), laparoscopic-assisted vaginal hysterectomy (LAVH), total laparoscopic hysterectomy (TLH), and total laparoscopic radical hysterectomy (TLRH). Modern hysterectomy using laparoscopy (LAVH) dates back to the 1980s. To date, numerous modifications of surgical methods of removing the uterus have been proposed, but the essentials remain unchanged.

The American College of Obstetricians and Gynecologists (ACOG) recommends taking into account patient anatomy and surgeon experience when selecting the best surgical method. The decisive factors include size and shape of the vagina and the uterus, access to the uterus, concomitant diseases and complaints, medical history, available surgical equipment, and patient wishes [2].

Ovarian cancer is associated with the highest mortality rates among patients with cancer of the genital organs [3, 4]. Gynecologic societies from various parts of the globe emphasize the need to find effective preventive measures in order to lower OC incidence rates. OC tumors may be divided into two types. Type I includes low-grade serous, low-grade endometrioid, clear cell and mucinous carcinomas, as well as Brenner tumors. Their growth is slow and they are usually detected in the early stages, when the tumor is confined to the ovary. Neoplastic spread requires a lengthy period of time [5]. Type II tumors are more common and typically include serous tumors. They are usually detected in more advanced stages of the disease. They originate from the ovarian epithelium (60–70% of type II tumors) [6, 7].

Current theories about the development of clinically advanced high-grade tumors (serous, endome-

trioid, and clear-cell carcinoma) claim that OC originates from the Fallopian tube and the endometrium, in contrast to the earlier claim that OC originated from the ovarian cells [8–12]. In light of the above, recent years have brought the concept that preventive bilateral salpingo-oophorectomy during hysterectomy might in fact be a form of OC prophylaxis in the affected women [13]. The most recent reports have confirmed the effectiveness of salpingectomy as a preventive measure against OC in women with benign conditions of the genital tract undergoing hysterectomy or salpingectomy, thus proving that the vast majority of ovarian neoplastic tumors originate in Fallopian tube epithelium [14]. Other authors also support this theory and suggest that it affects patients both at high and low risk for ovarian malignancy [15]. Regardless, in the absence of data from randomized clinical trials, the theory remains to be validated. Consequently, it is vital for surgeons to inform the patients about the benefits and drawbacks of salpingectomy during hysterectomy before surgery [13, 16, 17].

According to ACOG and the Society of Obstetricians and Gynaecologists of Canada (SOGC), vaginal hysterectomy is the approach of choice whenever feasible, based on its well-documented advantages and lower complication rates, and should be considered as a first choice for all benign indications. Laparoscopic hysterectomy is an alternative to abdominal hysterectomy for those patients in whom a vaginal hysterectomy is not indicated or feasible. The laparoscopic approach should be considered when it can reduce the need for a laparotomy [2, 18]. According to the German Society of Gynecology and Obstetrics (DGOG), the Austrian Society of Gynecology and Obstetrics (OEGOG) and the Swiss Society of Gynecology and Obstetrics (SGOG), patients should be allowed to choose the therapeutic intervention for their benign disease of the uterus that best suits them and their personal life situation [19]. Recent international trends to abandon abdominal hysterectomy in favor of more harmless procedures such as LSH have been discussed in several gynecological congresses. In those procedures the final decision is made by the surgeon and is based on patient condition and wishes. The choice of hysterectomy route should be based on patient wishes and clinical presentation, as well as surgeon experience and evidence-based practice. The surgery method should be as harmless as possible, but it should also

provide adequate treatment. All surgical approaches should be discussed with patients. While LSH continues to gain acceptance among physicians and patients as an attractive surgical option, each gynecologic surgeon must honestly assess his or her skills in endoscopic, vaginal, and abdominal surgery.

At present, the laparoscopic route is becoming a more popular type of hysterectomy, from 0.3% in 1990 to 12% in 2003, with steadily growing rates. Laparoscopy is slowly replacing traditional, abdominal hysterectomies. Even in oncological indications it may become the method of choice, e.g. in endometrial cancer stage I [20, 21]. It is especially recommended in patients with benign gynecologic conditions, e.g. dysfunctional and excessive uterine bleeding, uterine myomas, adenomyosis, or endometriosis. All of these are also the main indications for LSH in our center. We are a minimally invasive gynecology center, specialized in endoscopy. Vaginal and transabdominal hysterectomies are performed rarely here. Our surgeons are mainly trained in LSH and TLH hysterectomy methods. It is known that laparoscopic hysterectomy results in a quicker return to normal activities than abdominal hysterectomy. In our experience, LSH with power morcellation offers significant direct benefits to patients. This minimally invasive approach results in less perioperative morbidity, better cosmetic results and a short recovery time, not only in gynecology [22]. The LSH has a longer operation time than vaginal hysterectomy [23, 24], but when performed by a skilled surgeon the LSH operation time might be comparable or even shorter than in other hysterectomy types. In our center the mean operating time is approximately 83 min (depending on clinical presentation) from initial trocar placement until closure of all skin incisions. In our opinion the use of a power morcellator contributes significantly to the relatively short operative times. Most patients have reported the ability to return to work or normal daily activities within 2 to 4 weeks after the operation.

The LSH is associated with a relatively small number of complications, especially if performed by a trained endoscopic surgeon. This technique is not well suited for the inexperienced laparoscopist. There are some data about greater risk of damaging the bladder or ureter associated with LSH [24]. Skorupska *et al.* in 2016 compared different types of hysterectomy; the conclusion was that LSH with bilateral salpingectomy should be the procedure of choice for middle-aged women operated on for benign conditions [25].

Grosse-Drieling *et al.* analyzed approximately 1600 laparoscopic hysterectomies performed in their center and found 17 cases (approximately 1%) of severe operative complications, including excessive bleeding (6), bladder injury (4), intestinal injury (3), omental incarceration (2), ureter injury (1), and epigastric vein injury (1) [26]. In our center over the last four years 481 LSH were performed, all with salpingectomy. We found 6 cases (1.2%) of severe operative complications: excessive bleeding (2), bladder injury (2), peritoneal disseminate leiomyomatosis (1) and adnexal torsion (1). Presented numbers are almost equal.

Cervical stump cyclical bleeding is the main complaint among all women after LSH, reported by 1–25% of patients. Its intensity may vary and typically it requires no additional treatment. However, occasionally cervical stump bleeding is so profuse and persistent that timely intervention is necessary [27]. The cervix requires regular check-up and screening. The LSH women should undergo regular cytology examination. The risk for cervical cancer after surgical removal of the uterine corpus is estimated at 0.1–0.2% [28]. Grosse-Drieling *et al.*, in their abovementioned study, report a few cases of bleeding after LSH. Detachment of the uterus from uterine arteries is the critical point of surgery and may lead to profuse, uncontrollable perioperative bleeding. Bilateral coagulation of the uterine artery is advisable before detachment [26]. In our center there were 2 cases of hemorrhage. One of them occurred as a result of vascular damage after cutting off the uterine corpus from the cervix – there was sudden bleeding from the stump. That hemorrhage was managed laparoscopically. One case of increased blood loss was not recognized. The patient post-operatively was found with an increased amount of fluid in the peritoneum and a decrease in blood morphology. Symptoms resolved spontaneously after blood transfusion.

The LSH may also be associated with complications related to the urinary tract. They are fairly sporadic; most common problems are bladder and ureter injuries, or formation of a postoperative vesicovaginal fistula. An analysis of over 4000 cases of laparoscopic hysterectomies revealed a 0.23% rate of injury to the urinary tract with approximately half of them occurring during LSH (ureter injury was more common than bladder injury) [29]. According to another source, perioperative injury to the urinary tract is found in 1% of hysterectomies. Impor-

tantly, these authors reported that a normal result of perioperative cystoscopy does not exclude the possibility of ureter injury during hysterectomy [30]. In our center there were two cases of bladder injury during LSH. All cases occurred in patients with peritoneal adhesions and a history of peritonitis. After the injury bladder perforation was managed with laparoscopy and the Foley catheter was retained for 2 weeks. Currently, each of those patients is under outpatient clinic observation. Patients are satisfied with the operation. They do not present any urinary associated symptoms.

Methods of removing uterine tissues from the abdominal cavity are the subject of much dispute on modern hysterectomy and laparoscopic myomectomy. Some centers perform minilaparotomy as well [31]. Recently, the most renowned experts in the field of gynecology have engaged in a heated debate, originally initiated by the US Food and Drug Administration, on the dangers of morcellation, particularly the possibility of spreading abnormal myomatous or endometrial cells within the abdominal cavity, formation of tumor implants and the consequent tumor growth [32, 33]. A study by Van Der Meulen *et al.* identified 69 patients who developed new, parasitic myomas resulting from morcellation. The risk for such complication has been estimated at 0.1–0.9% [34]. Other authors emphasize the possibility of spreading previously undiagnosed sarcoma or endometrial cancer. The probability of such pathology is relatively low (0.06%). However, before informed consent is obtained, each patient should be made aware of the possibility of that morcellation-related complication [35, 36]. Retrieval systems (Endobag) have been suggested as the solution to prevent cell spread during morcellation. Morcellation takes place within such systems, thus lowering the risk for tumor spread and consequent diffuse leiomyomatosis, parasitic myomas, and malignant tumor implants [37]. In our center there has been 1 case of peritoneal disseminate leiomyomatosis. We cannot specify whether it was a result of previous operations. The patient had had two laparoscopies before (myomectomy and LSH), then she was diagnosed with peritoneal disseminate leiomyomatosis. The patient underwent an operation, and the surgeon removed all suspicious changes. A year after the surgery the patient does not report any symptoms.

Adnexal torsion constitutes yet another complication after hysterectomy. It is defined as at least

one complete twist of the adnexa around their axis, less frequently as Fallopian tube twist around the uterine pedicle, with subsequent infarction of the adnexal vessels [38]. As a result, blood flow is restricted but the twisted structure continues to receive blood, which leads to distension and complete obstruction of blood flow [38, 39]. The diagnosis is challenging due to non-specific symptoms. Differentiation includes urinary tract (renal calculi, acute pyelonephritis, and other conditions) and gastrointestinal tract complaints (appendicitis, diverticulitis, bowel obstruction, etc.). Clinical presentation of adnexal torsion is predominantly manifested by sudden, acute pain within the lesser pelvis, often limited to one side only, nausea, vomiting, and diarrhea. Approximately 10% of the affected women are febrile. Adnexal torsion is responsible for about 3% of acute pain episodes in the lesser pelvis that are an indication for emergency surgical intervention in gynecology units [38–40]. The abovementioned guidelines recommend Fallopian tube removal during hysterectomy. At that stage, the effect of salpingectomy on the incidence of adnexal torsion remains unclear. The literature offers no comparative studies on the risk for adnexal torsion after hysterectomy with and without salpingectomy. In the future, an analysis of all cases might generate reliable conclusions on how salpingectomy affects the risk for adnexal torsion. The amount of data on adnexal torsion shortly after hysterectomy, typically with severe pain and symptoms of acute abdomen, is considerable [38, 39]. In our center we have experienced one case of atypical adnexal torsion. Adnexal torsion in this patient was mimicking ovarian cancer. A large tumor of unknown origin was discovered. Because of the pain symptoms, elevated ROMA risk (31.5%), and because of suspected positive IOTA algorithms, the team performed laparotomy and found old adnexal torsion. The lesion was removed and the patient is well at the moment.

Conclusions

The LSH is a very good laparoscopic technique in the hands of an experienced operator. The LSH operation time is comparable with the duration of vaginal hysterectomy. The patient is able to leave the hospital early after the operation. In Europe and in our center the risk of severe complications associated with LSH is about 1%. This is not a high risk of

complications during hysterectomy. During LSH the reproductive organ undergoes slight changes and patients rarely complain about additional ailments. Therefore, this technique is gaining a large group of supporters. In our opinion, this technique has the full right to be recommended as a gold standard in benign gynecological indications. Despite the undeniable advantages, this technique also has some disadvantages. These are as follows: cervical stump bleeding, risk of cervical stump malignancy, urinary tract occlusions, intestinal injuries and others. The risk associated with morcellation is not certain, but currently it is recommended to proceed most cautiously using this technique. There are suitable special morcellation bags which can provide a safe alternative.

Conflict of interest

The authors declare no conflict of interest.

References

1. Wu JM, Wechter ME, Geller EJ, et al. Hysterectomy rates in the United States, 2003. *Obstet Gynecol* 2007; 110: 1091-5.
2. American College of Obstetricians and Gynecologists. Committee Opinion No. 444: Choosing the route of hysterectomy for benign disease. *Obstet Gynecol* 2009 (Reaffirmed 2011); 114: 1156-8.
3. Siegel R, Ma J, Zou Z, et al. Cancer statistics, 2014. *CA Cancer J Clin* 2014; 64: 9-29.
4. McAlpine JN, Hanley GE, Woo MM, et al. Opportunistic salpingectomy: uptake, risks, and complications of a regional initiative for ovarian cancer prevention. *Ovarian Cancer Research Program of British Columbia. Am J Obstet Gynecol* 2014; 210: 471.e1-11.
5. Kurman RJ, Shih IM. Molecular pathogenesis and extraovarian origin of epithelial ovarian cancer. Shifting the paradigm. *Hum Pathol* 2011; 42: 918-31.
6. Kurman RJ. Origin and molecular pathogenesis of ovarian high-grade serous carcinoma. *Ann Oncol* 2013; 24 (Suppl. 10): 16-21.
7. Przybycin CG, Kurman RJ, Ronnett BM, et al. Are all pelvic (non-uterine) serous carcinomas of tubal origin? *Am J Surg Pathol* 2010; 34: 1407-16.
8. Kurman RJ, Shih IM. The origin and pathogenesis of epithelial ovarian cancer: a proposed unifying theory. *Am J Surg Pathol* 2010; 34: 433-43.
9. Erickson BK, Conner MG, Landen CN Jr. The role of the fallopian tube in the origin of ovarian cancer. *Am J Obstet Gynecol* 2013; 209: 409-14.
10. Crum CP. Intercepting pelvic cancer in the distal fallopian tube: theories and realities. *Mol Oncol* 2009; 3: 165-70.
11. Kindelberger DW, Lee Y, Miron A, et al. Intraepithelial carcinoma of the fimbria and pelvic serous carcinoma: evidence for a causal relationship. *Am J Surg Pathol* 2007; 31: 161-9.
12. Kamran MW, Vaughan D, Crosby D, et al. Opportunistic and interventional salpingectomy in women at risk: a strategy for preventing pelvic serous cancer (PSC). *Eur J Obstet Gynecol Reprod Biol* 2013; 170: 251-4.
13. Committee on Gynecologic Practice. Committee opinion no. 620. Salpingectomy for ovarian cancer prevention. *Obstet Gynecol* 2015; 125: 279-81.
14. Falconer H, Yin L, Grönberg H, et al. Ovarian cancer risk after salpingectomy: a nationwide population-based study. *J Natl Cancer Inst* 2015; 107. pii: dju410.
15. Oliver Perez MR, Magriñá J, García AT, et al. Prophylactic salpingectomy and prophylactic salpingo-oophorectomy for adnexal high-grade serous epithelial carcinoma: a reappraisal. *Surg Oncol* 2015; 24: 335-44.
16. Berek JS, Chalas E, Edelson M, et al. Prophylactic and risk-reducing bilateral salpingo-oophorectomy: recommendations based on risk of ovarian cancer. *Obstet Gynecol* 2010; 116: 733-43.
17. Salvador S, Gilks B, Kobel M, et al. The fallopian tube: primary site of most pelvic high-grade serous carcinomas. *Int J Gynecol Cancer* 2009; 19: 58-64.
18. Lefebvre G, Allaire C, Jeffrey J, et al. SOGC clinical guidelines. Hysterectomy. *J Obstet Gynaecol Can* 2002; 24: 37-61.
19. Neis KJ, Zubke W, Römer T, et al. Indications and Route of Hysterectomy for Benign Diseases. Guideline of the DGGG, OEGGG and SGGG (S3 Level, AWMF Registry No.015/070, April 2015). *Geburtshilfe Frauenheilkd* 2016; 76: 350-64.
20. Pawłowicz P, Ajdacka U. The role of laparoscopy in the surgical treatment of endometrial cancer. *Videosurgery Miniinv* 2015; 10: 44-8.
21. Surynt E, Reinholz-Jaskólska M, Bidziński M. Laparoscopic sentinel lymph node mapping after cervical injection of indocyanine green for endometrial cancer – preliminary report. *Videosurgery Miniinv* 2015; 10: 406-12.
22. Śmigielski JA, Piskorz Ł, Koptas W. Comparison of treatment costs of laparoscopic and open surgery. *Videosurgery Miniinv* 2015; 10: 437-41.
23. Malinowski A, Maciutek-Blewniewska G. Why vaginal hysterectomy? *Ginekol Pol* 2007; 78: 434-42.
24. Aarts JWM, Nieboer TE, Johnson N, et al. Surgical approach to hysterectomy for benign gynaecological disease. *Cochrane Database Syst Rev* 2015; 8: CD003677.
25. Skorupska K, Miotła P, Kubik-Komar A, et al. Are there any differences in quality of life and sexual functions after various types of hysterectomy – does prophylactic salpingectomy matter? *Ginekol Pol* 2016; 87: 26-31.
26. Grosse-Drieling D, Schlutius JC, Altgassen C, et al. Laparoscopic supracervical hysterectomy (LASH), a retrospective study of 1,584 cases regarding intra and perioperative complications. *Arch Gynecol Obstet* 2012; 285: 1391-6.
27. Learman LA, Summitt RL Jr, Varner RE, et al. A randomized comparison of total or supracervical hysterectomy: surgical complications and clinical outcomes. *Obstet Gynecol* 2003; 102: 453-62.
28. Gimbel H. Total or subtotal hysterectomy for benign uterine diseases? A meta-analysis. *Acta Obstet Gynecol Scand* 2007; 86: 133-44.

29. Adelman MR, Bardsley TR, Sharp HT. Urinary tract injuries in laparoscopic hysterectomy: a systematic review. *J Minim Invasive Gynecol* 2014; 21: 558-66.
30. Tan-Kim J, Menefee SA, Reinsch CS, et al. Laparoscopic hysterectomy and urinary tract injury: experience in a Health Maintenance Organization. *J Minim Invasive Gynecol* 2015; 22: 1278-86.
31. Książakowska-Łakoma K, Żyła M, Wilczyński J. Removal of uterine fibroids by mini-laparotomy technique in women who wish to preserve their uterus and fertility. *Videosurgery Miniinv* 2015; 10: 561-6.
32. Krentel H, De Wilde RL. Complications in laparoscopic supracervical hysterectomy (LASH), especially the morcellation related. *Best Pract Res Clin Obstet Gynaecol* 2016; 35: 44-50.
33. McCarthy M. US agency warns against morcellation in hysterectomies and myomectomies. *BMJ* 2014; 348: g2872.
34. Van der Meulen JF, Pijnenborg J, Boomsma CM, et al. Parasitic myoma after laparoscopic morcellation: a systematic review of the literature. *BJOG* 2016; 123: 69-75.
35. Lieng M, Berner E, Busund B. Risk of morcellation of uterine leiomyosarcomas in laparoscopic supracervical hysterectomy and laparoscopic myomectomy, a retrospective trail including 4791 women. *J Minim Invasive Gynecol* 2015; 22: 410-4.
36. Bojahr B, De Wilde RL, Tchartchian G. Malignancy rate of 10,731 uteri morcellated during laparoscopic supracervical hysterectomy (LASH). *Arch Gynecol Obstet* 2015; 292: 665-72.
37. Rimbach S, Holzknrecht A, Nemes C, et al. A new in-bag system to reduce the risk of tissue morcellation: development and experimental evaluation during laparoscopic hysterectomy. *Arch Gynecol Obstet* 2015; 292: 1311-20.
38. Chang HC, Bhatt S, Dogra VS. Pearls and pitfalls in diagnosis of ovarian torsion. *Radiographics* 2008; 28: 1355-68.
39. Oelsner G. Adnexal torsion. *Clin Obstet Gynecol* 2006; 49: 459-63.
40. Grabowski A, Korlacki W, Pasierbek M. Laparoscopy in elective and emergency management of ovarian pathology in children and adolescents. *Videosurgery Miniinv* 2014; 9: 164-9.

Received: 23.08.2016, **accepted:** 26.03.2017.