

Application of endoscopy in pediatric and adolescent gynecology

Mariusz ZIMMER, Michał POMORSKI, Artur WIATROWSKI, Tomasz FUCHS and Grzegorz MYSZCZYSZYN

Department of Gynecology Obstetrics and Neonatology, Wrocław Medical University, Poland

Correspondence to: Assoc. Professor Mariusz Zimmer, MD, PhD
Department of Gynecology Obstetrics and Neonatology,
Wrocław Medical University, Dyrekcyjna Str. No. 5/7, 50-528 Wrocław, Poland.
PHONE: +48 717331400, +48 665866660; FAX: + 48 717331409
E-MAIL: mzimmer@op.pl

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Abstract

Early proper diagnostics and treatment of developmental age pathologies in most cases facilitate correct sex organ development, as well as reproductive functions formation.

To make the foregoing possible, it is necessary to apply minimally invasive and safest methods like vaginoscopy, hysteroscopy and laparoscopy.

The main application field of vaginoscopy and hysteroscopy in pediatric and adolescent gynecology is the diagnosis and treatment of vulvar and vaginal pathologies and developmental anomalies of sex organ.

The laparoscopy is becoming a more and more popular method in the treatment of adnexal tumors in children, due to its little invasiveness, quick recovery and less severe pain complaints after the surgery. The application of these endoscopic procedures should always be preceded by the complex noninvasive diagnostics, such as ultrasonography and magnetic resonance imaging.

The endoscopic procedures facilitate wide-ranging diagnostics and simultaneously therapeutic management, ensuring minimal invasion and high safety of the surgery.

They should be considered diagnostics and treatment of choice in the pathology of vulva, vagina, developmental anomalies of sex organ and adnexal tumors in patients of the developmental age.

INTRODUCTION

Early proper diagnostics and treatment of developmental age pathologies in most cases facilitate correct sex organ development, as well as reproductive functions formation. To make the foregoing possible, it is necessary to apply minimally invasive and safest methods providing the least invasive medical management. Contemporary endoscopic tech-

niques allow such advantages and thus should pose standard diagnostic and therapeutic management in pediatric and adolescent gynecology.

The main application field of the endoscopic methods in case of the mentioned group of patients is the diagnosis and treatment of vulvar and vaginal pathologies, developmental anomalies of sex organ and ovarian tumors.

Abbreviations

FIGO	– International Federation of Gynecology and Obstetrics
MRI	– magnetic resonance imaging

The use of endoscopic methods should always be preceded by the complex noninvasive diagnostics, such as transabdominal ultrasonography and, in case of older patients, transvaginal ultrasound scanning with the possibility of assessing blood flow in adnexal tumors and three-dimension (3D) ultrasonography of small pelvis. Whenever the developmental anomalies are suspected, magnetic resonance imaging (MRI) is employed as a diagnostic management of choice due to the complexity of anomalies. MRI not only precisely demonstrates the pathologically changed anatomy, but also the topography of sex organ, which enables proper qualification for surgical [21]. Sensitivity and specificity of the foregoing method in the developmental anomalies diagnostics reaches 100% [4].

The endoscopic diagnostics in pediatric and adolescent gynecology includes the application of such procedures as: vaginoscopy, hysteroscopy and laparoscopy.

The vaginoscopy is used to minimize the invasive evaluation of vagina and vaginal part of uterine cervix without hymen injury. The examination is conducted by means of an instrument used in hysteroscopy or a specially designed vaginoscope. The vaginoscopy was performed for the first time by Hungarian pediatrician Dobszay, in 1939, by means of a self-designed vaginal tube-shape speculum. The vaginoscopes used nowadays are available in different sizes, according to the diameter of a hymen hole. Due to cold light sources supplied by optical fibre, as well as an integrated system magnifying the picture, the contemporary vaginoscopes provide fair visualization of the vaginal wall and vaginal part of the uterine cervix. Additional equipment, such as forceps used to remove foreign objects, facilitate simultaneous therapeutic management, eliminating the cause of complaints.

The vaginoscopy is more often performed by means of diagnostic hysteroscopes due to their greater availability [10]. Hysteroscopic telescopes measure only 3.5–5mm in their outer diameter, which guarantees minimal invasion of the examination, whereas continuous flow of medium and xenon light source facilitate precise imaging of vaginal walls and exocervical surface. Integrated working channel and wide range of available instruments enable safe removal of pathological changes. Additional advantage of a hysteroscope is its connection with a camera, which allows multimedia data collection used for treatment effects control, as well as for educational purposes.

The recommended indications for vaginoscopy in pediatric and adolescent age include [6, 23]:

1. Recurrent vulvar and vaginal infections
2. Vulvar and/or vaginal injury
3. Suspicion of foreign objects presence
4. Unexplained vaginal bleeding
5. Developmental anomalies of sex organ (isolated or connected with androgyny)
6. Developmental anomalies of anus and lower urinary track
7. Tumors (Gartner's duct cyst, clear cell adenocarcinoma, sarcoma botryoides)

The necessity of sedation, or even general anaesthesia, should always be considered individually for this group of patients, taking into account the possibility of psychological injury [21].

The laparoscopy is used in the diagnostics and treatment of adnexal tumors, as well as the developmental anomalies of sex organ. In the latter, laparoscopy facilitates ultimate diagnosis and therefore allows a proper corrective procedure.

Application of the endoscopic techniques in diagnostics and treatment of the developmental anomalies of sex organ

The frequency of sex organ developmental anomalies is estimated at 0.5–2.9% [8]. The multiplicity of possible disorders of the Mullerian tract (ductus paramesonephricus) development results in the anomalies' high polymorphism – ranging from Mayer-Rokitansky-Küster syndrome (i.e. absence of uterus and vagina) to double uterus with double vagina.

Symptoms of sex organ disorders are usually discovered during puberty in form of recurrent abdominal pain, primary amenorrhea, difficulties in sexual initiation and infertility [13].

The use of endoscopic methods in many cases facilitates not only prompt and unambiguous diagnosis but also simultaneous correction of found defects.

An imperforate hymen (hymen imperforatus) is one of the most frequent developmental anomaly [17]. In case of the lack of prompt diagnosis and treatment, it may lead to sex organ injury and decrease the reproductive capabilities in the future. The blockage of menstrual blood flow leads to vaginal hematoma and thereafter to hematoma of uterus, hematoma of fallopian tubes and blood relocation into the peritoneal cavity. It can result in fallopian tubes injury and high prevalence of endometriosis in that group of patients [17]. The treatment procedure in such cases includes hymen perforation and precise inspection of the vagina and vaginal part of the uterine cervix by means of hysteroscope to exclude coexisting disorders. In case of future conception problems, laparoscopy should be taken into consideration in order to evaluate the fallopian tubes and peritoneal cavity for endometrial foci [12].

A transverse vaginal septum is a developmental disorder much more rare than hymen atresia. Apart from performing imaging examinations, the diagnosis in this case is based on vaginoscopy. This procedure facilitates precise evaluation of type and localization of the septum. The diagnosis of a complete septum obstructing menstrual blood flow is an indication early, complete resection of the septum [4]. In case of a partial septum, it is possible to postpone the procedure until the initiation of sexual activity, as the septum has to be removed only when the disorder causes dyspareunia [4].

Mayer-Rokitansky-Küster syndrome is another malfunction, occurring with the prevalence of 1 in 4000–5000 female neonates [1, 5]. The syndrome is characterized by congenital absence of the vagina and the uterus (or presence of a septate uterus) with the proper structure of fallopian tubes and functioning ovaries. Therefore, the first symptom of the defect is the absence of menstrual bleeding and inability to begin sexual activity. In this case, the application of endoscopic techniques is limited to the diagnostic laparoscopy in order to confirm the diagnosis and differentiate with the congenital agenesis of vagina. Laparoscopic control can also be used during a neovagina formation surgical procedure.

The application of endoscopic techniques is of greater importance in case of such malfunctions as duplication of genital organs, especially in diagnostics and treatment of the uterine septa.

The septa are among frequently occurring congenital uterine malformations – 2-3% of the whole population [16, 18]. The septum may be located only within the cervix (so called double-mouthed uterus or bifurcate uterus), but much more often it is located within the body of the uterus (corpus uteri), dividing the uterine cavity completely or partially (so called septus and subseptus uterus or substate and subseptate uterus).

Among all congenital uterus malformations, the presence of the septum is the cause of the vast majority of obstetric failures. Only 3% of pregnancies reach term, 9% terminate prematurely, whereas 80% are miscarried [7].

One of the basic issues in the diagnostic proceeding determining further proper therapeutic management is differentiation between the uterine septum and the bicornuate uterus. In the latter, the endoscopic correction of the malfunction is impossible and Strassmann's operation is recommended, resulting in the removal of the duplication and uterine horns connection. In case of the uterine septum, the diagnostic management consists of hysteroscopy with the septum morphology evaluation and laparoscopy in order to differentiate between the uterine septum and the bicornuate uterus [9, 14]. However, it should be kept in mind that the preliminary diagnosis is possible in a noninvasive manner by means of 3D ultrasonography and magnetic resonance, especially in case of the youngest group of patients.

After having properly diagnosed and qualified a patient to a correction surgery, the time of its performance is another important issue. The uterine septa are usually discovered during infertility diagnostics and in such cases the necessity of the septum removal is beyond doubts. In case of the younger patients the decision of surgery performance has to be made individually, taking into account the severity of the malfunction and, above all, the patient's will. However, it is recommended to postpone the surgery until sexual maturity.

In case of the uterine septum treatment, the application of the endoscopic techniques is the management of choice, since they ensure greater security and treatment effectiveness, as well as they are incomparably less invasive in comparison to alternative abdominal methods. In order to cut the septum the following endoscopic devices are used: scissors – in case of fibrous septum, electroresectoscope and Versa-Point bipolar electrode – in case of connective tissue septum [2]. In comparison to the widespread monopolar resectoscope, the basic advantage of Versa-Point electrodes is the possibility to use isotonic liquids (0.9% NaCl) as the medium, which significantly reduces the risk of electrolyte disorders and hypervolemia. Moreover, the bipolar electrode causes the effect of tissue vaporization. It ensures perfect hemostasis and prevents tissue remnants formation, which makes the procedure easier and shortens its duration. The employment of Versa-Point electrodes in surgical hysteroscopes with telescopes measuring 5.5mm in diameter is very important in this group of patients, due to the future procreative plans and genital size. Such a minimalization of instruments enables only a slight cervix dilation, which reduces tissue traumatization and the risk of cervical insufficiency in the future. Moreover, Versa-Point bipolar electrodes, in contrary to monopolar electrodes, are much more precise – only 1 mm² of the lateral tissue is damaged when the electrode is used. Thus, the risk of thermal injuries of myometrium and, consequently, the rupture of pregnant uterus after the surgery performed by means of endoscopy is minimal. Taking the foregoing into account, Versa-Point bipolar electrodes should be used as the management of choice for the septum removal and other intrauterine changes in young female patients. The surgery of the uterine septum vaporization should be performed in the laparoscopic assistance. Such a procedure provides ultimate differentiation between the uterine septum and the bicornuate uterus (uterus bicornis), as well as reduces the risk of uterine perforation [11]. To avoid the uterine wall perforation, the surgery should be terminated when hysteroscopic image in the panoramic capture shows both fallopian tubes uterine ostia or when steady transparency of hysteroscopic light through the uterine fundus to the abdominal cavity is visible [7]. It has been proved that leaving a small fragment of the septum (up to 1 cm of length), rather than risk the uterine muscle injury, is preferable. Such

a small septum does not have a negative impact on the reproductive abilities in women [3].

The efficiency of the foregoing procedure is proved by the fact that nowadays the percentage of full-term pregnancies after the endoscopic uterine septum removal reaches 80% [7].

Another malfunction diagnosed and treated by means of endoscopic techniques is an asymmetric bicornuate uterus with an obstructed uterine horn. Such a diagnosis can be stated after a precise laparoscopic evaluation of the sex organ. Furthermore, hysteroscopy should be performed in order to diagnose whether the obstructed uterine horn is connected to the uterine cavity, thus enabling the menstrual blood flow or not. In case of the obstruction and clinical symptoms connected to menstrual blood retention, it is recommended to surgically remove the obstructed horn [4].

Application of endoscopic techniques in diagnostics and treatment of ovarian tumors

The treatment strategy of adnexal tumors in young patients is difficult, because two things need to be taken into consideration: the operation radicalism and the influence of the treatment on the somatic development and fertility. Therefore, the conservative management is recommended and it usually consists of enucleation of the tumor or unilateral adnexectomy.

The choice of conservative treatment requires the use of all necessary methods of preoperative diagnostics, as well as the precise diagnosis of clinical stage of ovarian tumor. In case of children, FIGO scale is employed for the mentioned purpose [19].

The prevalence of the type of ovarian tumors in children:

- germ cell tumors (60–70%)
- ovarian stromal tumors (20%)
- epithelial tumors (4–12%)

The analysis of the histopathological results in respect to age groups revealed that the malignant germ cell tumors are more frequently diagnosed in the youngest females, whereas in older patients cysts and benign tumors – usually mature teratomas [21, 22]. Malignant tumors are diagnosed in 8% of all developmental age ovarian tumors [21].

Indications for surgical treatment of ovarian tumors [20]:

- tumor 6 cm in diameter, visible via ultrasound imaging in three subsequent menstrual cycles, in patients who reached their reproductive age
- rapidly growing tumor
- suspicion of tumor malignancy basing on imaging and laboratory examinations
- the torsion of ovarian tumor pedicle

- suspicion of ovarian cyst rupture
- lack of precise diagnostic tools to evaluate the changes in small pelvis

Doppler ultrasonography is a standard preoperative diagnostic tool in case of adnexal tumors, except for the evaluation of morphological criteria. It facilitates the assessment of vascular resistance, velocity of blood flow and the tumor vascularization, thus increasing the sensitivity and specificity of preoperative diagnosis of malignant changes. The application of 3D ultrasonography provides further contributions allowing better evaluation of the tumor internal structures and volume [15].

The laparoscopy is becoming a more and more popular method of adnexal tumors treatment in children due to its little invasiveness, quick recovery and less severe pain complaints after the surgery. The laparoscopy can be performed after full noninvasive diagnosis showed benign character of the pathological adnexal mass. If the preoperative examinations provide any suspicion of malignancy, laparotomy has to be performed as it makes staging more precise and allows the operator to perform a more radical surgery.

Contraindications for laparoscopic removal of adnexal tumors include [20]:

- the family history of ovarian and colon tumors
- the suspicion of malignancy on the imaging examinations
- high serum concentration of CA-125
- tumor diameter exceeding 20 cm (due to the risk of tumor perforation during the instruments implementation).

The diagnostic difficulties in the preoperative evaluation of the tumor character are quite frequent, therefore it is always necessary to assess the macroscopic structure of the tumor, its localization, relation to the surrounding organs, as well as to evaluate other organs in the abdominal cavity during laparoscopy.

In case of a benign tumor diagnosis, its removal is preferably performed via enucleation or tightening the endo-loop on its pedicle, conditionally via its coagulation and amputation. The process of the tumor extraction should be performed with endo-catch bags to prevent peritoneal dissemination of its contents.

Should there arise any suspicion of malignancy during the laparoscopic examination, the evaluation of the tumor clinical stage is to be performed. The samples for intraoperative histopathological examination and liquid for cytological examination ought to be collected. On the basis of the foregoing, it should be decided whether to perform laparoscopy or convert to laparotomy.

Concluding remarks

The endoscopic procedures facilitate wide-ranging diagnostics and simultaneously therapeutic management, ensuring minimal invasion and high safety of the surgery. The above mentioned characteristics make the endoscopic procedures the management of choice in the diagnostics and treatment of the pathologies of vulva, vagina, the developmental anomalies of sex organ and adnexal tumors in patients of the developmental age.

However, it should be remembered that the qualification of the youngest patients to such procedures should be made only after all noninvasive diagnostic methods, including ultrasonography with 3D and Doppler imaging option and, in justified cases, magnetic resonance tomography have been applied.

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