

# Robotic Management of Endometriosis: Discussion of Use, Criteria and Advantages: a Review of the Literature

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Ioannis D. Gkegkes<sup>1,\*</sup>, Christos Iavazzo<sup>2</sup>, George Iatrakis<sup>3</sup>, Paraskevi-Evangelia Iavazzo<sup>4</sup>, Fani Pechlivani<sup>5</sup>, Evangelia Antoniou<sup>5</sup>, Konstadia Bakalianou<sup>6</sup>

## ABSTRACT

Endometriosis is a very common benign condition affecting fertility and quality of life. Different methods, either definitive or fertility sparing are used for its management by using open, laparoscopic, and robotic techniques. This is a literature review presenting the role and the advantages of robotic surgery in endometriosis. Such a management is effective, safe, and feasible in hands of well-trained multidisciplinary teams even for severe cases of endometriosis.

## KEYWORDS

da Vinci<sup>®</sup> robot; endometriosis; treatment; advantages; criteria; quality of life

## AUTHOR AFFILIATIONS

<sup>1</sup> Department of Surgery, Royal Devon and Exeter NHS Foundation Trust, Exeter, UK

<sup>2</sup> Department of Gynaecological Oncology, The Christie Hospital, Manchester, UK

<sup>3</sup> Department of Obstetrics and Gynaecology, Technological Educational Institution of Athens, Athens, Greece

<sup>4</sup> Department of Paediatrics, General Hospital of Rethymno, Rethymno, Greece

<sup>5</sup> Department of Obstetrics and Gynaecology, Technological Educational Institution of Athens, Athens, Greece

<sup>6</sup> Department of Obstetrics and Gynecology, General Hospital "Agia Olga", Athens, Greece

\* Corresponding author: 17C James House Residential Village, EX2 5DS, Bovemoors Lane, Exeter, UK; e-mail: ioannisgkegkes@gmail.com

Received: 4 July 2019

Accepted: 17 November 2019

Published online: 10 February 2020

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Acta Medica (Hradec Králové) 2019; 62(4): 147–149

<https://doi.org/10.14712/18059694.2020.3>

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## INTRODUCTION

Endometriosis occurs in 5–15% of the general population and although a benign condition, sometimes it might require difficult surgical dissections as it could be locally infiltrative, invasive, and widely disseminated. The typical patient is nulliparous, infertile, and around 30-years-old. The most common sites of endometriosis intra-abdominally include adnexae (two out of three cases), pouch of Douglas, uterosacral and broad ligaments, uterovesical fold, ureters, bladder, appendix, rectosigmoid colon or caecum, and small bowel loops (1, 2).

The treatment options of endometriosis include medical (e.g. progestins, danazol, GnRH- analogues) or surgical options which could be classified as most definitive (including hysterectomy and bilateral salpingo-oophorectomy) or fertility-sparing with the aim to excise all peritoneal endometriotic implants and adhesions but preserve fertility (3–6). Laparoscopic or open techniques, depending on each surgeon's preference and experience, are offered as treatment options, while recently robotic procedures are also suggested.

The da Vinci® surgical system received FDA approval in 2005. Robotic procedures have been introduced in order to improve surgical performance. Increased dexterity, greater range of motion, and better depth perception are the main advantages of robotic-assisted techniques (7). Its limitations include lack of tactile feedback and increased cost (8). Robotic procedures combine the advantages of open and laparoscopic procedures and are another alternative in the management of endometriosis.

The aim of this narrative review is to present the use, the criteria, and the advantages of robotic surgery in the treatment of endometriosis.

## DISCUSSION

Different techniques including open, laparoscopic or robotic procedures can equally be used in the management of endometriosis (9–11). The patient is preoperatively assessed with imaging scans including ultrasound and MRI and she signs the informed consent when she is informed about the type of planned procedure and possible risks of it including infection, bleeding, and injury of adjacent organs. Multidisciplinary experts, including gynaecologists, urologists, and general surgeons, should cooperate in order to achieve the optimal outcome in the most severe cases.

Fertility-sparing techniques are used in order to destroy all endometriotic implants and remove all the possible adhesions. Removal and not lysis of them is preferred. Endometriomas larger than 3 cm are also excised either with cystectomy, or if that is not technically possible, with oophorectomy. If tubes are affected, salpingectomy is performed and IVF procedures are used for pregnancy achievement. If both adnexae are affected and bilateral salpingo-oophorectomy is essential, the uterus is preserved and donor eggs could be used for pregnancy. In robotic cases, all endometriotic implants are either excised or destroyed with scissors or diathermy. Segmental bowel

resections, rectal shaving, and partial bladder resection are described in the literature (12). Ureteral endometriosis could be treated with partial ureterectomy and ureteroneocystostomy (13). Special care should be taken during the excision from small or large bowel and/or urinary tract to avoid any injuries. However, deep infiltrative endometriosis of the rectovaginal septum is one of the most severe types of endometriosis (14). For this reason, any hidden endometriosis should be completely excised to avoid developing deeper nodular lesions in the future (14). It was recently shown that infiltrating colorectal endometriosis could be safely and effectively treated robotically even by performing a rectosigmoidectomy if that is essential (1). In case of most definitive techniques, total or even modified radical hysterectomies plus bilateral salpingo-oophorectomies might be essential to treat the disease. Of course, as in open and laparoscopic techniques, preoperative use of GnRH analogues for three to six months can improve surgical success.

Robotic system preserves the advantages of conventional laparoscopy while it offers the possibility to the gynaecologist to dissect down and into the narrow pelvic floor. It is suggested that a diagnostic laparoscopy should be used in order to clarify the range of the disease in the upper abdomen before docking the robot in order to know exactly where the disease is. In robotic systems, the CO<sub>2</sub> pressure required for exposure is often lower in correlation with traditional laparoscopy as result of the mechanical lift of the robot (15). Robotic procedures can be safely performed after taking into account the physiological changes of pneumoperitoneum and steep Trendelenburg position during a preoperative anaesthetic review (16). Robotics, also shares similar benefits of laparoscopy including smaller incisions (at most 10 to 12 mm) (15). The three-dimensional stereoscopic vision by the use of binocular optics, the filtration of the tremor, and the less operator fatigue are some of the obvious advantages of such operations. The articulated instruments permit a wide range of motions while they increase the ability of the surgeon to work efficiently. All the above mentioned advantages can lead to more anatomical procedures. In addition, the 360° motion of the robotic wrist permits the fine adhesiolysis and removal of any suspicious nodule, even if it is quite deep. More specifically, Patzkowsky et al., comparing robotic to laparoscopic treatment in over 500 patients, showed that age, body mass index, operative time, and estimated blood loss were not statistically different between the two procedures. Furthermore, robotic techniques could be easier used in larger uterus, cases with more severe adhesions, and stage III-IV endometriosis (17). However, the rates of urinary tract infections were higher in the robotic group (17). According to another study, including women treated with robotic-assisted laparoscopy for stage III and IV endometriosis, the median actual surgical time was 145 minutes (ranging from 67 to 325 minutes), while the median blood loss was 100 ml (ranging from 20 to 400 ml) depending on the severity of the case and the experience of the surgeon (18). Another study group, showed that uterine weight higher than 250 grams and older age predispose to longer surgical time (19). In all those studies, the rates of conversion

to open surgery and blood transfusion are minimal. So, the robotic assisted surgery also permits the realization of a key hole operation which can be interpreted into significantly less blood loss, less pain, shorter recovery time, as well as shorter hospital stay and better aesthetic result. Additionally, a shorter hospital stay and a quicker return to normal activity may mean less postoperative problems such as infection or pulmonary embolism. Last but not least, the use of robotic systems gives the opportunity of rapid acquisition of surgical skills required in order to perform laparoscopic surgery, while at the same time enable gynaecologists to reach at least as good clinical outcomes as conventional laparoscopy and within shorter operating times once they exceed the initial stage of the learning curve.

On the other hand, the high costs of use, the bulky machinery, and the need for staff training are the most important drawbacks in the utilization of robot in such operations. Of course, entry of new robotic systems in the market, as well as the use of the robot by different surgical teams, and in a high volume of patients could decrease the cost disadvantage. Short term complications include vaginal cuff abscess (18), ureterovaginal fistulas (20), and higher rates of urinary tract infection caused by extended use of Foley catheter for urinary retention (21). A rare case of rhabdomyolysis and compartment syndrome, after a 12-hour duration robotic operation, is also presented in the literature (22), showing the need for training and time managing of such operations. Although larger prospective studies as well as longer follow-up periods are necessary to clarify the long term outcomes including fertility results, pain, and quality of life, it seems that robotic management of even severe cases of endometriosis is an effective, feasible, and safe alternative in well-trained hands as it was also shown in a recent systematic review (23) and can be used without compromising the principles of open or laparoscopic operations.

## CONFLICT OF INTEREST

No conflict of interest was declared by the authors.

## FINANCIAL DISCLOSURE

The authors declared that this study has received no financial support.

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