

A survey on robotic-assisted laparoscopic myomectomy technique among high-volume gynecologic robotic surgeons in Korea

Sa Ra Lee^{1*}, Sungwook Choi^{1*}, Al-Otaibi Mozon², Ju-Hee Kim¹, Jung Ryeol Lee³, Seok Ju Seong⁴, Mee-Ran Kim⁵

¹Department of Obstetrics and Gynecology, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea; ²King Fahad Military Medical Complex, Dhahran, Kingdom of Saudi Arabia; ³Department of Obstetrics and Gynecology, Seoul National University Bundang Hospital, Seoul National University College of Medicine, Seongnam; ⁴Department of Obstetrics and Gynecology, CHA Gangnam Medical Center, CHA University, Seoul; ⁵Department of Obstetrics and Gynecology, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea

Objective: This study aimed to investigate the of robotic-assisted laparoscopic myomectomy (RALM) techniques among Korean gynecologic robotic surgeons with heavy robotic gynecologic caseloads.

Methods: We conducted this online survey consisting of 11 questions regarding various aspects of RALM, such as the type of da Vinci system, number of skin incisions, trocar ports, robotic instruments, and suture materials, with a focus on multiport RALM. Twenty-one board-certified robotic gynecologic surgeons from 16 university-based tertiary medical centers responded.

Results: The da Vinci Xi was the most commonly installed system at the respondents' affiliated hospitals. In terms of instruments, monopolar curved scissors, fenestrated bipolar forceps, and mega suture needle driver were the most used. The most commonly used suture materials for serosal and myometrial layer closure were barbed suture materials, and the endometrial layer was most commonly closed with multifilament delayed absorbable suture material. Continuous running and baseball suture techniques were most frequently used for serosal layer closure.

Conclusion: This is the first study investigating RALM surgical methods among Korean gynecologic robotic surgeon with heavy caseloads, and the findings can be of a great benefit to beginners as well as experts in the field of robotic surgery.

Key Words: Robotic surgical procedures; Leiomyoma; Uterine myomectomy

INTRODUCTION

Uterine myomas are one of the most common benign gy-

necologic tumors affecting reproductive-aged women, with a varying prevalence of 4.5–68.6% globally, and 25–40% among Asians [1].

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• Corresponding author: Mee-Ran Kim

Department of Obstetrics and Gynecology, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, 222 Banpo-daero, Seocho-gu, Seoul 06591, Korea

E-mail: drmrkim@gmail.com

*Sa Ra Lee and Sungwook Choi contributed to this article equally and share the primary authorship.

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Clinical manifestations associated with uterine myomas include irregular and heavy menstrual bleeding, anemia, dysmenorrhea, pelvic pressure and pain, urinary incontinence, dyspareunia, infertility, preterm labor, and early and recurrent pregnancy loss [2].

Myomectomy is an appropriate surgical option for women with symptomatic myomas who wish to preserve their fertility [3,4]. The surgical methods for myomectomy have progressed from open abdominal myomectomy to minimally invasive surgery (MIS), such as laparoscopic myomectomy and robotic-assisted laparoscopic myomectomy (RALM) [5-8]. Recent studies have shown that RALM may have advantages over laparoscopic myomectomy in terms of blood loss, postoperative transfusion, and length of hospital stay, hence broadening the era of MIS myomectomy with cosmetic benefits [9-11].

Commonly performed techniques include multiport RALM, single-incision RALM (including single-site robotic surgery using the da Vinci Xi® or Si® systems (Intuitive surgical, Inc., Sunnyvale, CA, USA), and single-port robotic surgery using the da Vinci SP® system (Intuitive surgical, Inc.) [12,13]. However, in terms of the surgical techniques and materials used for RALM, there are many variations and personal preferences associated with each procedure. Therefore, we conducted a pilot online survey about RALM among Korean gynecologic robotic surgeons with heavy robotic gynecologic surgery caseloads. This study aimed to determine the RALM techniques used by the surgeons and apply the results to the training of residents and clinical fellows.

MATERIALS AND METHODS

We conducted an online survey regarding RALM. The study population comprised a relatively homogeneous group of Korean high-volume robotic gynecologic surgeons who, at the time of the survey, were members of the Executive Board of Directors of the Society of Korean Robotic Gynecology Surgery (SKRGS). All participants were Korean board-certified obstetricians and gynecologists with a heavy caseload of robotic operations. The 24 invited gynecologic surgeons' affiliations were 16 university-based tertiary medical centers throughout South Korea. Among the invitees, 21 (87.5%) responded to the survey.

We conducted two online surveys using Google Forms (Alphabet Inc., Mountainview, CA, USA). Participants were instructed to respond according to their recent surgical habits and were allowed to select multiple choices. The first survey consisted of 11 questions querying various aspects of RALM, such as the type of da Vinci system, number of skin incisions, trocar ports, robotic instruments, and suture materials. Single-incision RALM is not so popular neither in Korea nor globally. In addition, there are only limited number of instruments available for the single-incision RALM. Therefore, our survey focused on the questions about multiport RALM because we presumed that no much variation exist regarding instruments for single-incision RALM. The second survey was conducted on the next day following the first one, with additional questions to investigate the trend regarding the suture material for each procedure (questions 6–8). They were considered as follow up to some questions from the first survey, and the answers were analyzed separately. This study was approved by the Institutional Review Board of Asan Medical Center (approval No. 2021-1858).

RESULTS

Twenty-one surgeons participated in the first online survey, and 15 surgeons responded to the second online survey.

Among the da Vinci models employed, the Xi system was used by the highest proportion of respondents (95.2%); the Si and SP systems were used by 28.6% each, and X was used by 4.8% of participants (Fig. 1).

In terms of the number of ports used in most of RALM cases, 47.6% of participants reported using three ports, which was the most common response, followed by four ports (42.9%), and two ports (23.8%). There was also one

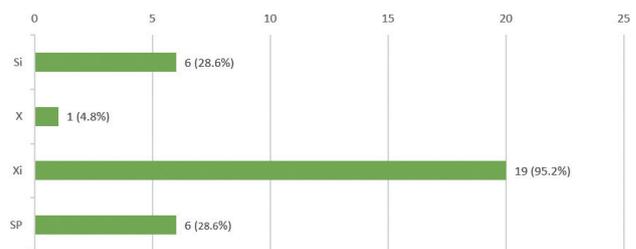


Fig. 1. The types of the da Vinci robotic systems.

respondent who reported using a single port, and one reported using a hybrid single port (Fig. 2).

In terms of port types, 33.3% of participants used a three-port umbilical multichannel port with two assist ports, while 23.8% used a four-port and two-port system with an umbilical multichannel and assist port. The use of three robotic ports accounted for 19% of the total, whereas four-port system using an umbilical multichannel port and three assist ports accounted for 14.3%. Additionally, a single port was used by 9.6% of participants (Fig. 3).

Hybrid procedure using both laparoscopy and robot-assisted laparoscopy was adopted by 38.1% of operators polled, only 19% reported performing single port in such procedures. The rate of occasional usage was 4.8% for sin-

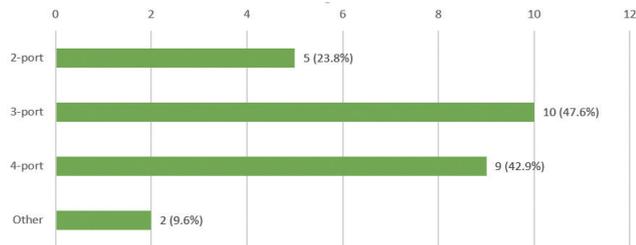


Fig. 2. The number of ports used in most cases of robotic-assisted laparoscopic myomectomy.

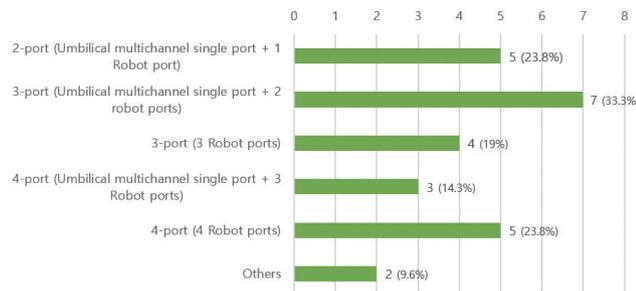


Fig. 3. Types of ports.

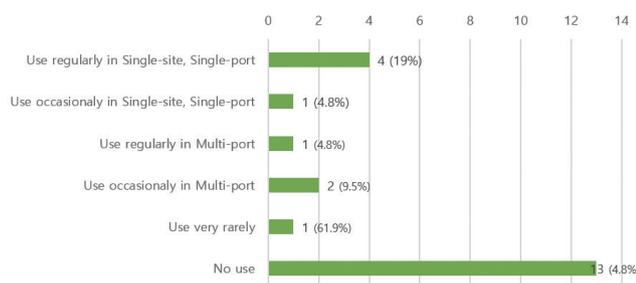


Fig. 4. Usage of hybrid technique (laparoscopy + robot-assisted laparoscopy).

gle-port cases, compared with 9.5% for multiple ports. The rate of regular use of hybrid procedure was 4.8%. A 4.8% rate of very uncommon use was also reported (Fig. 4).

For uterine incisions, 76.2% of participants utilized electricity-powered monopolar scissors, while 19% used cold scissors. A monopolar spatula and a laparoscopic advanced energy device were each employed by 9.5% of respondents (Fig. 5).

Regarding the type of suture material to use when the endometrium is exposed, the barbed 1-0 suture was the most commonly indicated (47.8%), followed by barbed 2-0 suture (17.4%). barbed 3-0 suture, multifilament 1-0 delayed absorbable suture, and monofilament 3-0 delayed absorbable polydioxanone suture (PDS) were also commonly used among the participant. Others included one of

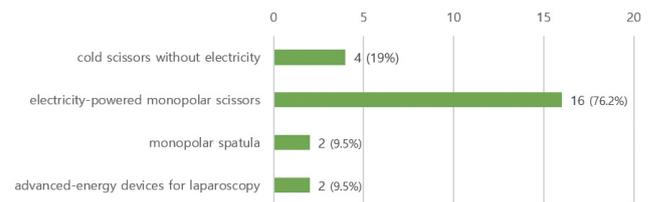


Fig. 5. Instruments used for uterine serosal incision.

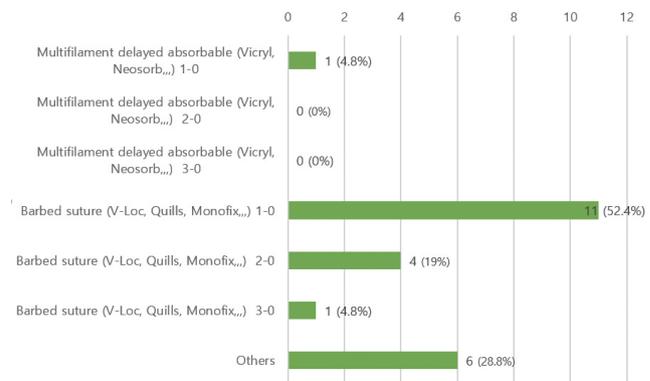


Fig. 6. Suture materials for myometrial closure.

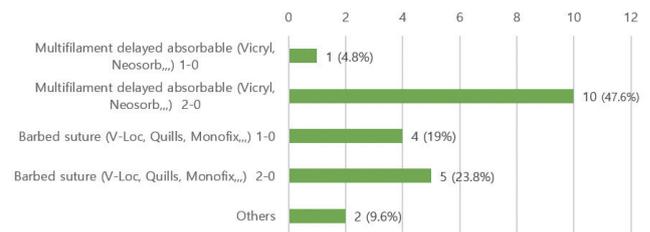


Fig. 7. Suture materials for endometrial layer closure in the case of endometrial cavity exposure.

the following: PDS 3-0 monofilament absorbable, 2-0 PDS, Monosyn, myometrial suture in two or three layers without endometrial repair, and monofilament delayed absorbable PDS 3-0 (Fig. 6).

When it comes to endometrial layer closure in case of endometrial cavity exposure, the most commonly used material was multifilament delayed absorbable suture 2-0 (47.6%), followed by barbed 2-0 suture (23.8%) and barbed 1-0 suture (19%). Additionally, Vicryl 1-0, Vicryl 3-0, and Monosyn were also reported at 4.8% each. Others included two surgeons each reporting the use of Vicryl 3-0 or

Monosyn (Fig. 7).

Barbed suture 1-0 was the most commonly utilized material for uterine serosa suture (33.3%), followed by barbed 2-0 suture (23.8%) and multifilament 1-0 delayed absorbable suture (19%). Multifilament 2-0 delayed absorbable suture was reported as being used by 4.8% of participants; others, including 1-0 PDS, 2-0 Monosyn, monofilament 2-0 delayed absorbable PDS were also counted (Fig. 8).

As for the method of serosal repair, continuous running suture, baseball suture, and simple interrupted suture were used, accounting for 42.9%, 38.1%, and 19% of responses, respectively (Fig. 9).

In terms of the type of bipolar forceps used, the fenestrated bipolar forceps was used by 71.4% of surgeons, while Maryland forceps had been used by 28.6% of respondents (Fig. 10).

In terms of needle holder, the Mega Suture needle driver (Intuitive surgical, Inc.) was the most commonly used (71.4%), followed by the Mega Suture cut needle driver (23.8%) and the Large needle driver (Intuitive surgical, Inc.) (4.8%) (Fig. 11).



Fig. 8. Suture materials for serosal layer repair.

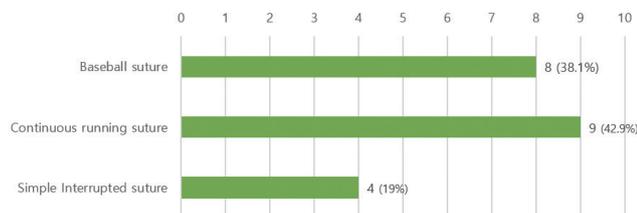


Fig. 9. Suture technique for uterine serosal closure.

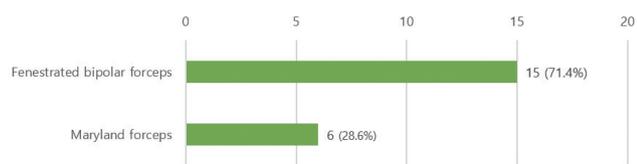


Fig. 10. Which type of bipolar forceps do you usually use?

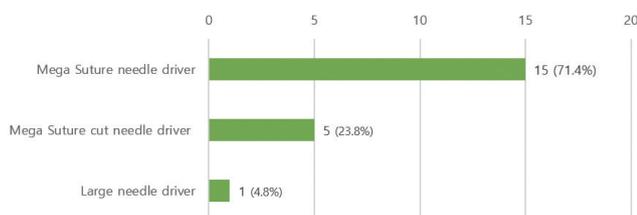


Fig. 11. What type of needle driver do you usually use?

DISCUSSION

To our knowledge, this is the first online survey to analyze the current surgical techniques used for RALM among Korean gynecologic surgeon with heavy caseloads. As fast as the volume of robotic surgery is growing, MIS platforms are replacing conventional laparoscopy with robotic surgery. The most popular gynecologic robotic operation is RALM. Robotic surgery is beneficial for less-experienced laparoscopic surgeons not only because it allows for faster and more accurate training compared with laparoscopic surgery, especially in terms of intracorporeal suturing, which is essential for successful RALM but also in minimizing intraoperative blood loss and risk of uterine rupture associated with pregnancy after RALM [14,15]. Therefore, the benefits of robotic surgery are further reinforced by RALM because the intracorporeal suturing is much easier than with the conventional laparoscopic myomectomy. We believe that the study results can be especially beneficial for beginners to RALM, and can also be used for the training of residents.

In terms of robotic systems used for RALM (question 1),

the result cannot be used to represent the superiority of certain type of robotic system over the other. It only presents comparisons of the available robotic systems installed in the 16 hospitals of the 21 respondents.

In terms of the number of skin incision for port insertion (question 2), most respondents (76.2%) used relatively few ports (one to three ports instead of conventional four ports), and in terms of the port type (question 3), most respondents (71.4%) used umbilical multichannel single ports. It seems that Korean gynecologic robotic surgeons are paying particular attention to reducing the number of skin incisions for the cosmetic benefits. In initial reports comparing conventional laparoscopy with robotic surgery, the need for more skin incisions with higher costs and longer operation time were the main disadvantages of the robotic surgery. However, with the development of single-incision robotic systems, single-site robotic systems, and single-port robotic system, the cosmetic benefits will be overcome in the near future.

According to the responses to question 4, 4.8% of surgeons had never used hybrid technique. Although most surgeons (61.9%) very rarely used the hybrid technique, when we consider that these respondents have heavy caseloads, we can interpret from these result that still there are some obstacles associated with the current robotic system which can be solved by RALM. Of course, the proportion of operations with hybrid technique can be reduced if surgeons use more ports with more robotic instruments; however, the higher costs of each robotic instrument will alleviate the advantage associated with RALM.

In terms of the instrument used for the serosal incision in case of multiport RALM (question 5), respondents most commonly used monopolar curved scissors (with or without electricity) (95.2%). Although permanent cautery spatula is less expensive than monopolar curved scissors, RALM requires multiple intracorporeal suturing and cutting of the thread; therefore, surgeons who use the monopolar curved scissors instead of the permanent cautery spatula can cut the thread without the need of an assistant's help. However, this result should be interpreted with consideration of the responses to question 10 about the type of needle driver used. The two surgeons who use the spatula for the serosal incision may use the needle driver to cut sutures (four surgeons). In terms of electricity status, cutting mode, or coag-

ulation mode, we did not include these details in the survey. Cold cutting and electrical cutting mode could minimize the thermal injury to the tissue and are preferable for tissue healing.

For cases of endometrial cavity exposure with incidental opening of the endometrial layer (question 6), the vast majority of respondents reported using multifilament delayed absorbable suture materials smaller than the suture materials for myometrial or serosal layer closure. In terms of the suture material for myometrial layer closure (question 7), in line with our expectations considering the current rapid increase in the use of barbed suture material for minimally invasive myomectomy for easier intracorporeal suturing than non-barbed suture materials, 42.8% of respondents reported using barbed sutures. The others used non-barbed suture materials, which have been used for laparotomy and conventional laparoscopic myomectomy. This proportion is not much higher than that associated with laparoscopic myomectomy, and this result can mean that although RALM is MIS, the difficulty of intracorporeal suturing associated with robotic surgery is similar to that associated with open surgery, and the respondents are high-volume surgeons who are highly skilled at intracorporeal suturing with conventional non-barbed suture materials.

In terms of the suture material for serosal layer closure, the proportion of respondents who use barbed suture materials was 57.2%. Most respondents (81%) used baseball or continuous running suture technique. All respondents used bipolar forceps, and fenestrated bipolar forceps were used more than Maryland bipolar forceps (71.4% vs. 28.6%). The shape of tips of each bipolar forceps are different; fenestrated bipolar forceps are rounded in shape and Maryland bipolar forceps are sharper with curved triangular ends, which can be much easier to use for sharp tissue dissection.

In terms of the type of needle driver used for multiport RALM, the Mega Suture needle driver (with or without a cutting function) was used by the vast majority of respondents (94.2%) and only one respondent (4.8%) reported using the Large needle driver (Intuitive surgical, Inc.). This was associated with the suture materials used. Notably, large needles attached to thicker suture material, such as 1-0 suture material, can only be grasped with the Mega Suture needle driver. Although the angle of jaw opening (0° to

30°) is identical among all the types of needle drivers for the multiport wristed needle drivers, the jaw length of the large needle driver (Intuitive surgical, Inc.) (1.0 cm) is smaller than the Mega Suture needle driver (Intuitive surgical, Inc.) (1.3 cm) and is suitable for the grasping of 2-0 or 3-0 suture materials, which are smaller than 0 or 1-0 suture materials. We also consider that costs increase by about USD 300 higher when needle drivers have the cutting function. For single-incision RALM, there is only one type of needle driver available: the wristed needle driver for single-site robotic system, as opposed to the SP needle driver for single-port robotic system for RALM. We did not include a question about the needle driver used for single-incision RALM.

The strength of this study is that it is the first study investigating RALM methods among the Korean gynecologic robotic surgeon with heavy caseloads. Although the number of respondents was small, we believe that the study results, and interpretations thereof, can be beneficial for both the beginners and experts of RALM. The findings can also be used not only for the training of residents, but also can be helpful for planning of clinical research regarding RALM. In the future, if more instruments are developed for single-incision robotic systems, further studies will be needed, especially to investigate single-incision RALM.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

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