

# Current status of robot-assisted urologic surgery in Saudi Arabia: Trends and opinions from an Internet-based survey

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## Abstract

**Objectives:** The objective of this study is to assess the current status of urologic robot-assisted surgery (RAS) in Saudi Arabia and evaluate perceptions of its importance and utility.

**Methods:** A 59-item questionnaire was E-mailed to urologists and trainees in Saudi Arabia to assess the demographics and individual and institutional surgical practices of minimally invasive surgery (MIS) with a focus on RAS and urologic subtypes.

**Results:** Ninety-five surveys were completed. Nearly 53%, 46%, and 21% of respondents were formally trained in laparoscopic surgery, MIS, and RAS, respectively. Forty percent had used a robot console during training. Nearly 72% of participants felt that RAS training should be included to accomplish their career goals and stated that it would strengthen the department academically and financially. The absence of a robotic system (45%) and administrative disinterest with lack of support (39%) were the most common deterrents. Robot-assisted radical prostatectomy (RARP), robot-assisted radical cystectomy (RARC), and robot-assisted radical nephrectomy (RARN) were regarded as the gold standard for 34%, 23%, and 17% of respondents, respectively. Respondents would recommend RARP (74%), RARC (50%), and RARN (57%) for themselves or their family. The greatest perceived benefits of RAS were its ease of use and improvement in the patient's quality of life.

**Conclusion:** Urologists in Saudi Arabia recognize the superiority of RAS over traditional surgical methods but lack exposure, training, and access to RAS. This survey reveals increasing acceptance of RAS and willingness to incorporate the technology into practice.

**Keywords:** Education, laparoscopy, minimally invasive surgery, robotics, training

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## INTRODUCTION

Robot-assisted minimally invasive surgery (RAS-MIS) allows less experienced laparoscopic surgeons to perform higher quality operative procedures.<sup>[1,2]</sup> These techniques result in a shorter hospital stay and recovery time, reduced blood loss, and fewer complications compared to open surgery.<sup>[3]</sup> However, some limitations of RAS include lack of tactile

feedback, a fixed-port system, longer operative times, and prohibitive costs.<sup>[4,5]</sup> Detailed surveys that assessed the practice patterns and opinions of urologic surgeons have led to interesting insights about RAS.<sup>[6-8]</sup> Therefore, the present study aimed to evaluate the perceived utility of RAS in Saudi Arabia.

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## METHODS/PROCEDURES

An Internet-based, 59-item questionnaire was sent to 238 practicing urologists in the KSA who attended the 2015 Saudi Urological Association Meeting in the first quarter of 2015. The survey was E-mailed to urology physicians and trainees, and the questionnaire was available on the study website for 3 months to give respondents the opportunity to complete it online. Reminder E-mails were sent after 2 months to encourage those who missed the first invitation to complete the survey. Only one response per computer was allowed to avoid duplicate responses.

The survey comprised five sections inquiring about demographics and individual and institutional surgical practice patterns of MIS with a focus on RAS. Perceptions of MIS, in general, were also assessed, specifically those regarding RAS oncology procedures for prostate, bladder, and kidney treatment. The first section covered baseline characteristics, including geographical region, age, gender, current level of training, and years of practice. The second section assessed training, the number of MIS procedures performed in general, and the number of laparoscopic and RAS procedures performed specifically. The third section assessed institutional aspects, including staff and MIS or RAS fellowship programs. The fourth section evaluated the importance of robotic surgery training for career goals and the importance of developing a robotic surgery program. The fifth and final section was specialty-specific and assessed perceptions of RAS subtypes, including robot-assisted radical prostatectomy (RARP), robot-assisted radical cystectomy (RARC), and robot-assisted radical nephrectomy (RARN) or robot-assisted partial nephrectomy (RAPN).

Data were analyzed using a commercially available Statistical Package for the Social Science (IBM SPSS Statistics V22.0, Chicago, IL, USA). Descriptive data were presented as number of responses and percentages. Fisher's exact test was used for comparing discrete variables, and a two-tailed  $P < 0.05$  indicated significant differences among groups.

## RESULTS

### Demographics and practice patterns

The survey response rate was 40%, with 95 surveys completed. Most respondents (93.7%) were males with different levels of training, and >45% had been in urology practice for at least 10 years. Nearly 53% of respondents were formally trained in laparoscopic surgery, 46% were formally trained in MIS beyond residency training, and only 21% were formally trained in RAS. More than half (66.8%)

of respondents had either performed or assisted in laparoscopic surgery, with 43% performing 2 or more laparoscopic operations. Forty percent of respondents had used the surgical robot console in their training courses, and 38% had participated as console surgeons, including 11.6% who had performed at least two RAS operations as console surgeons. Of those who had only been exposed to RAS, 58% stated that they would perform the procedure in the future.

A total of 66.8% of respondents cited at least two surgeons performing laparoscopic surgery at their institutions. Fellowship-trained staff at respondents' institutions totaled 79% in laparoscopic surgery and 23% in RAS. Nearly 37% of respondents' institutions offered MIS fellowship programs; most of them were genitourinary or multiple programs that included at least two MIS fellowships. These programs were incorporated with an endourology (42%) or urologic oncology (16%) fellowship. With respect to RAS, 33.7% of respondents had a dedicated RAS support team in place, and 25% of respondents planned to hire new faculty to establish an RAS program at their institution [Table 1].

### Impact of robot-assisted surgery subtypes

Almost 24.2% of respondents felt that RAS training should be included to meet their career goals, and 68.4% would pursue a separate RAS fellowship if given the opportunity. A total of 66.3% would take additional courses to integrate RAS into their practice, with almost 70% choosing an MIS fellowship [Figure 1]. Respondents were asked about the usefulness of RAS programs to their departments or clinical practice. Nearly 29.5% stated that RAS programs would strengthen the department academically and/or financially, whereas about 28% stated that RAS programs would strengthen only MIS at their departments. About 45.3% of respondents cited the need for an institutional robot system and identified administrative disinterest with lack of institutional support as the main obstacles to the development of a robotic program. Another 16% stated lack of academic evidence or operation room allocation as the main obstacle to the development of a robotic program [Figure 2].

### Robot-assisted radical prostatectomy

Twenty-two percent of respondents had performed RARP, including 48.1% who performed <50 RARP surgeries/year, 3.7% who performed 50–100 surgeries/year, and 9.3% who performed >100 operations/year. Less than one-third (28.4%) had upgraded their operative skills to RARP. The more traditional open radical prostatectomy (ORP) was still being performed (65.3%) at most respondents' institutions with

89% having performed <10 surgeries/year and 11% having performed >10 surgeries/year. However, many institutions

had witnessed a decrease in ORP case volume per year. Laparoscopic radical prostatectomy (LRP) was still being performed in 20% of respondents' institutions.

**Table 1: Demographic characteristics and clinical practice of respondents (n=95)**

	Number of respondents (%)
Location of practice (n=91)	
Makkah	12 (13.2)
Jeddah	35 (38.5)
Riyadh	18 (19.8)
Al-Madinah	6 (6.6)
Others	20 (22.0)
Sex	
Male	89 (93.7)
Female	6 (6.3)
Age (years)	
25-30	26 (27.4)
31-40	30 (31.6)
41-55	31 (32.6)
>55	8 (8.4)
Level of training	
Faculty	33 (34.7)
Consultant	8 (8.4)
Specialist	8 (8.4)
Fellow	18 (18.9)
Resident	28 (29.5)
Years practicing urology	
0-4	27 (28.4)
4-10	25 (26.3)
>10	43 (45.3)
Formal training in laparoscopic surgery	
Formal training in MIS beyond residency training	50 (52.6)
Formal training in RAS	44 (46.3)
Laparoscopic cases performed as a surgeon or first assistant	
0-1	54 (66.8)
≥2 (2-5)	41 (43.2)
RAS cases performed as a console surgeon	
0-1	84 (88.5)
≥2 (2-4)	11 (11.6)
Use of a surgical robotic console (at a training course)	
Will perform RAS after graduation	38 (40)
No	14 (14.7)
Yes	37 (38.9)
Unsure/not applicable	44 (46.3)
Number of institutional surgeons performing laparoscopic surgery	
0-1	41 (43.1)
≥2 (2-5)	54 (66.8)
Fellowship-trained staff in laparoscopic surgery	
Fellowship-trained staff in RAS	75 (78.9)
Institutional MIS fellowship	
Overall	35 (36.8)
Specialty of MIS fellowship (n=34)	
Genitourinary	17 (50)
Laparoscopic	7 (20.6)
Multiple	10 (29.4)
Departments with MIS program incorporated	
Endourology	40 (42.1)
Urologic oncology	15 (15.8)
Leading department in the adoption of RAS	
General urology	24 (25.3)
Endourology	12 (12.6)
Laparoscopic oncology	20 (21.1)
Hiring new faculty to establish RAS program	24 (25.3)

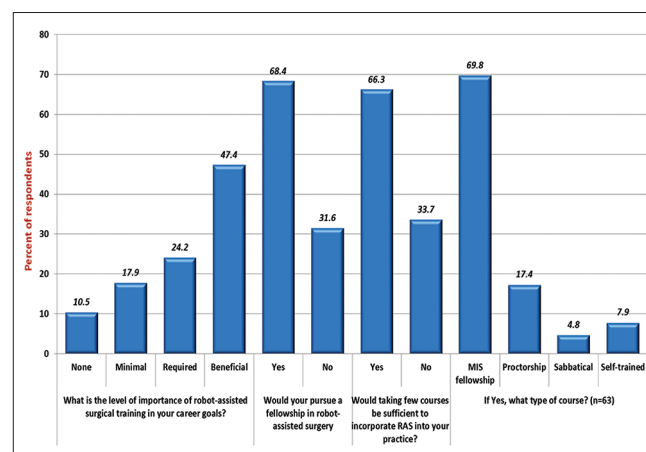
MIS: Minimally invasive surgery, RAS: Robotic-assisted surgery

Nearly 34% of respondents cited RARP as the gold standard for prostatectomy; 21% believed it to be as good as open or laparoscopic procedures, 12.6% described it to be better, while 14.7% believed it was too early to form judgments regarding RARP [Figure 3]. Nevertheless, most of the respondents (73.7%) would recommend RARP over ORP (11.6%) or LRP (14.7%) for themselves or their family [Figure 4].

### Robot-assisted radical cystectomy

Only 3.2% of respondents had personally performed RARC, and this procedure had not been performed at all in 65% of their institutions. The more traditional open radical cystectomy (ORC) was performed by 36% of respondents and laparoscopic radical cystectomy (LRC) by 7.4%. Nearly 42% believed that 100–200 RARC procedures should be performed to be comfortable with the technique while most of them (51.4%) cited that <50 cases would be sufficient. Only 23% of respondents declared RARC to be the gold standard for cystectomy; 40% believed RARC to be as good as ORC or LRC, 11.6% described it to be better than open or laparoscopic approaches, while 11.6% believed it too early to form judgments regarding RARC [Figure 3]. Nevertheless, 50% of respondents would recommend RARC over either ORP (40%) or LRP (9.5%) for themselves or their family [Figure 4].

After RARC and pelvic lymph node dissection, most respondents (53.7%) believed that urinary diversion should be performed either open or laparoscopically while 46.3% reported that urinary diversion should be performed robotically as well. Only 6% of respondents believed



**Figure 1: Importance of robotic surgery training to career goals**

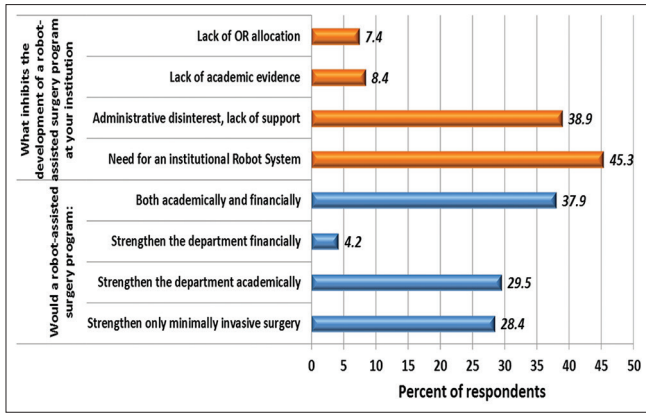


Figure 2: Importance of developing a robotic surgery program

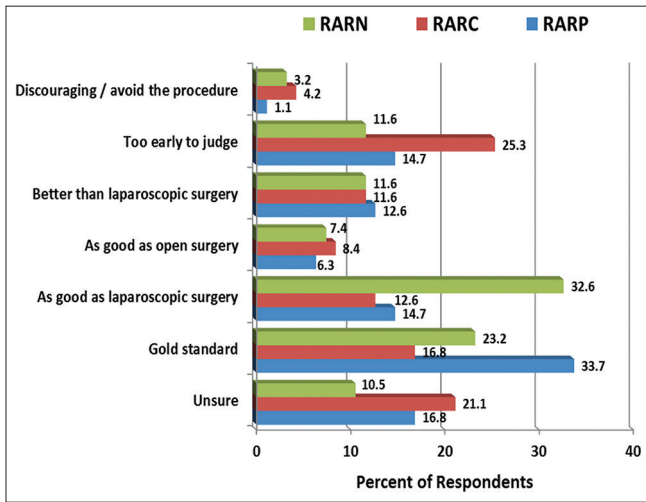


Figure 3: Perceptions of robot-assisted surgery subtypes

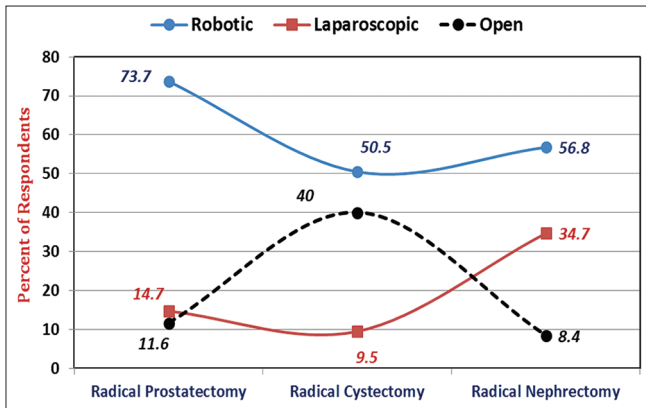


Figure 4: Responses to question: "If you or one of your family members needs surgery, what will you recommend?"

proximal lymph node dissection to be challenging using the robot while most of them (78%) were not sure. Similarly, 73% were not sure if there was an advantage to an extended pelvic lymph node dissection with the robotic da Vinci® Surgical System (Intuitive Surgical Inc., Sunnyvale, CA, USA) while only 16.8% believed that it was advantageous.

### Robot-assisted radical nephrectomy

RARN and RAPN were performed by 20% and 23.2% of respondents, respectively. Of 56 respondents, 37.5% had performed <50 surgeries/year while 9% had performed 50–100 operations/year. The more traditional open radical nephrectomy (ORN) and laparoscopic radical nephrectomy (LRN) were still being performed in 75.8% and 65.3% of respondents' institutions, respectively, at a volume of >10 cases/year for ORN (55%) and LRN (57%). Nearly one-third of respondents (31.6%) had upgraded their operative skills in ORN to LRN, whereas 76.8% and 63.2% felt that at least 50 procedures were needed to be comfortable with RARN and RAPN, respectively.

Forty-nine percent reported that the greatest advantage of RARN was ease of performance while 36% cited a quality-of-life advantage. Almost 76% of respondents believed that RARN would not prolong the warm ischemia time, but 40% felt that the console surgeon should rely more on laparoscopic assistance. Almost 24.2% reported that robotic arms would have difficulty reaching the bladder cuff during nephroureterectomy while 50% of respondents were not sure. Advantages of RARN or RAPN over laparoscopic techniques included benefits of 3D vision (26.3%), EndoWrist® action (24.2%), and instrument mobility (17.9%). Twenty-five percent of respondents believed it was too early to judge RARN, 21% believed it to be as good as open or laparoscopic procedures, and only 16.8% cited RARN to be the gold standard of radical nephrectomy [Figure 3]. Nevertheless, most respondents (56.8%) would recommend RARN over ORN (8.4%) or LRN (34.7%) for themselves or their family [Figure 4].

### Impact of location, level of training, and duration of practice

The region of Riyadh had significantly higher numbers of faculty and consultants (67%) than Makkah (58%), Jeddah (43%), Al-Madinah (50%), and other areas (15%,  $P=0.027$ ). A significantly larger number of faculty/consultant surgeons in Riyadh were trained in MIS than their colleagues elsewhere (65.9% vs. 31.5%,  $P=0.001$ ), but numbers were comparable to their colleagues in terms of formal RAS training (22% vs. 20.4%,  $P=0.85$ ). Despite the fact that both groups had been formally trained in laparoscopic surgery (61% vs. 46.3%,  $P=0.21$ ), faculty/consultant surgeons had performed more laparoscopic surgeries (97.5% vs. 77.7%,  $P<0.001$ ) and used the robotic console more frequently during training (47.4% vs. 24.1%,  $P<0.001$ ). Urologists with different training levels had similar perceptions of RAS subtypes, the importance of robotic surgery training for career goals, and the development of a robotic surgery program.

Significantly larger number of respondents in practice for 10 or more years reported having had training in laparoscopic surgery (56% vs. 42%,  $P = 0.02$ ) and MIS beyond residency (69.8% vs. 27%,  $P < 0.001$ ) but had comparable RAS training with those practicing for <10 years (23.3% vs. 19.2%,  $P = 0.80$ ). Those in practice for >10 years reported significantly greater use of surgical robots in training (61.2% vs. 30.8,  $P = 0.04$ ). Both groups comparably stated that they would pursue a fellowship in RAS if given the opportunity (70% vs. 67%,  $P = 0.79$ ) and that taking additional courses would be sufficient to incorporate RAS into their practice (70% vs. 44.3%,  $P = 0.52$ ). Both groups were also comparable in the numbers and perception of RAS subtypes, importance of robotic surgery training for career goals, and development of a robotic surgery program.

## DISCUSSION

Currently, RAS is most frequently used in urological and gynecologic oncological surgery and has been successfully adopted in complex procedures involving the prostate, kidney, and urinary bladder.<sup>[9-11]</sup> RAS has gained worldwide popularity as a significant adjunct to laparoscopy, adding to the armamentarium for MIS. The three-dimensional magnified vision, depth perception, EndoWrist<sup>®</sup> technology with seven degrees of freedom, and precision with intuitive movement provided by RAS make intracorporeal dissection and suturing considerably easier.

However, the learning curve associated with MIS and laparoscopy has been identified as a training obstacle for postgraduate trainees and attending urologists.<sup>[12]</sup> Shay *et al.* found that urologists were more likely to perform laparoscopy if they had been trained during their residency than if they had not.<sup>[13]</sup> Therefore, it is advocated that optimal MIS training with a focus on RAS should take place in fellowships and postgraduate courses, which have the benefit of virtual reality simulators.<sup>[14]</sup> Although there are ten da Vinci<sup>®</sup> robots in the KSA, the low volume of robotic caseload negatively impacts resident's teaching and compromises their training.<sup>[15]</sup> Currently, there are six robotic systems distributed among four major hospitals in Riyadh, two in the Eastern Province hospitals, and two in the Western Region hospitals. There are only nine indexed case reports from the KSA with no reports from any other Middle Eastern countries.

Approximately one-half of our respondents in the KSA were formally trained in laparoscopic surgery and MIS while only 21% were formally trained in RAS. However, most of those who were not exposed to RAS stated that

they intended to perform the procedure in the future. Forty percent of our respondents had used a robot console during training courses, but 63% had not participated as a console surgeon. These figures are more promising than reports from a previous survey, wherein respondents in the Middle East and Asia were significantly less likely to have had formal training in RAS (11% vs. 40%) and use of robotic consoles in training courses (20% vs. 60%) than those in Europe and North America.

Yuh *et al.* surveyed 291 urologists to compare the status of urologic laparoscopy and RAS worldwide. Nearly 80% of respondents had performed MIS, and 64% had prior formal training.<sup>[6]</sup> Duchene *et al.* found a favorable attitude toward robotics among postgraduate urologists, where 80% believed that RAS would increase the volume of potential procedures. Moreover, 45% believed that RAS would become the standard of care within the next decade.<sup>[14]</sup> Similarly, 94% of gynecologic oncology fellows in the United States felt comfortable using the robot, and respondents confirmed that they would use this technology in their future practice.<sup>[16]</sup> Respondents from western countries performed significantly more RAS, as expected.<sup>[6]</sup> Based on these data, it could be argued that the rate of RAS adoption is growing as a worldwide trend.

Seventy-two percent of our respondents felt that RAS training should be required as a part of their career goals and believed that it would strengthen their departments both academically and financially. However, the absence of a robotic system together with administrative disinterest and lack of support were the most common deterrents for incorporating RAS. These findings support the results of Guru *et al.* where 78% of respondents similarly felt that RAS training should be required as a part of their career goals.<sup>[7]</sup> Yuh *et al.* also cited the absence of a robotic system as an obstacle to the development of RAS programs in most institutions.<sup>[6]</sup> Widespread adoption of robotic surgery is challenged by the high cost (\$1.5 to \$2.2 million) of purchasing and maintaining the da Vinci<sup>®</sup> Surgical System. An annual maintenance cost of about \$138,000 has been reported, with average costs per case ranging from \$1500 to \$2000.<sup>[16]</sup> Other challenges may include lack of operating room support and availability of skilled technical staff.

In the current study, RARP and RARN were performed by <25% of respondents, whereas only 3.2% had performed RARC. Moreover, after performing RARC, most respondents believed that urinary diversion should be performed either through open or laparoscopic surgery. Less frequent performance of RARC over

other robotic procedures showed that RARC remains a controversial means of bladder extirpation. While RARC has been successfully attempted at select centers, its precise long-term benefits are not well established. Of 297 worldwide surveyed urologists, only 10% have performed either RARC or RARN and 21% have performed RARP.<sup>[7]</sup>

However, 70% of surgeons in the Guru *et al.*'s study had upgraded their skills from RARP to RARC versus only 12.6% of our local respondents. RARP (9%), RARC (6%), and RARN (16%) rates in the Middle East and Asia were significantly lower than these RAS procedure rates (38%, 15%, and 32%, respectively) in Europe and North America. However, nearly one-third of our respondents had upgraded their ORN skills to LRN and RARN, which was comparable to the 30% reported by Guru *et al.*<sup>[7]</sup> Only 6% of our respondents believed proximal lymph node dissection after RARC to be challenging using the robot while 78% were not sure. About 73% were not sure if there was an advantage to an extended pelvic lymph node dissection using the da Vinci<sup>®</sup> system. These data were not in agreement with Yuh *et al.* where about half of the respondents believed that RAS proximal lymph node dissection with the da Vinci<sup>®</sup> system was not challenging.<sup>[6]</sup> These differences may be due to the small number of RARC procedures performed by our respondents. In agreement with the literature, our respondents felt that the greatest advantages of RARC and RARN were ease of performance and quality of life while cancer treatment was cited less often.<sup>[17,18]</sup> Most of our respondents believed that RARN would not prolong warm ischemia time as previously reported.<sup>[19]</sup>

Limitations of our Internet-based survey may include selection bias and recall bias. Selection bias is possible by respondents who may have been more inclined to take the survey due to their interest in MIS, RAS, or new technology in general, which limits the generalizability of our results. Recall bias may have occurred with surgeons overestimating the number of procedures performed. Several responses were left blank on some surveys, but the vast majority of data were complete. Another limitation was a low response rate although an even lower response rate of 9.5% was reported by Duchene *et al.*<sup>[14]</sup> Furthermore, the design of the present study did not allow for further comparative or subanalysis of data. This study does, however, address the literature gap regarding practice patterns of MIS and RAS in Saudi Arabia.

## CONCLUSION

Despite the fact that most of our respondents did not consider RAS to be the surgical gold standard for

prostatectomy, cystectomy, and nephrectomy, most of them would recommend RAS for themselves or their family.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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