Editorial

Robot assisted adrenalectomy: a handy tool or glorified obsession?

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Abstract: Robotic surgery has recently expanded its horizon in urology apart from radical prostatectomy, one of them being adrenalectomy. Till now, laparoscopic adrenalectomy has established itself as the procedure of choice for benign adrenal disorders. Brandao *et al.* have recently accomplished a thorough systematic review and meta-analysis of nine trials comparing laparoscopic and robotic adrenalectomy. There was no significant difference between the two groups in terms of conversion rate [odds ratio (OR): 0.82; 95% CI, 0.39-1.75; P=0.61] and operative time (WMD: 5.88; 95% CI, −6.02 to 17.79; P=0.33). There was a significantly longer hospital stay in the conventional laparoscopic group (WMD: −0.43; 95% CI, −0.56 to −0.30; P<0.00001), as well as a higher estimated blood loss (WMD: −18.21; 95% CI, −29.11 to −7.32; P=0.001). There was also no statistically significant difference in terms of postoperative complication rate. The authors seem to support the use of robot for adrenalectomy. However, robotic surgery suffers from cost issues and some technical drawbacks that limit its use in routine practice. Larger and appropriately powered randomized controlled trials are needed to establish and justify its use for performing adrenalectomy.

Keywords: Robotic assisted; robotic; adrenalectomy; laparoscopic adrenalectomy; phaeochromocytoma

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Surgical management of adrenal disorders, especially benign, has seen a paradigm change in the approach. According to the Nationwide Inpatient Sample (1), 83% of adrenalectomies from 1998 through 2006 were performed by open approach. In 1992, Gagner *et al.* performed the first laparoscopic adrenalectomy for small adrenal tumor (2). Over the last decade though, laparoscopy has gained a foothold and established itself as the preferred modality of choice for adrenalectomy (3). It results in less blood loss, earlier ambulation, shorter hospital stay, and faster return to normal activity (4). The wide acceptance of the laparoscopic approach has been made possible due to increasing experience of the surgeons, advances in techniques and equipment and increased awareness among patients (5). Despite all these advantages, laparoscopy is not without its technical drawbacks. The use of nonarticulated instruments with ergonomically inadequate handle design coupled with working through fixed entry points limits the maneuverability of instruments while operating. Looking at the conventional flat two-dimensional image surgeon misses out on depth perception that makes dissection less precise. Heavy dependence of surgeon on the assistant to hold and move the camera in sync with his movements serves as a handicap to control the operating field (6,7). All these shortcomings require a lot of experience and dedicated teamwork to achieve proficiency and in overcoming the steep learning curve.

The use of robot has had an impact on surgical practice in many specialities and particularly urology. The advent of robotics has minimized most of the above drawbacks of laparoscopic surgery. Gill *et al.* first demonstrated the feasibility of performing adrenal surgery by robotic assistance in a porcine model (8). Piazza *et al.* performed the first robotic adrenalectomy in 1999 for Conn’s syndrome with the AESOP robotic platform (9). In 2001, Horgan and Vanuno described robotic adrenalectomy with the da Vinci surgical robot system (Intuitive Surgical, Inc., Sunnyvale, CA, USA) (10). Since then more than 50 studies have been published on robotic adrenalectomy (11-18), establishing it as safe, feasible and effective approach for dealing with adrenal gland disorders. The multi-articulated instruments and the three-dimensional (3D), magnified images provided by its stable camera platform greatly benefit the laparoscopic procedure and offer the surgeon a comfortable and ergonomically optimal operating position (19). These advantages are particularly relevant in certain situations like adrenal-sparing surgery (20), obesity, and large lesions (11,21).

Robotic surgery has its own set of drawbacks namely, financial and technical. The advance technology comes at a higher initial setup cost, high maintenance and running cost along with expensive semi disposable instruments. Robotic procedures have been roughly shown to be 2.3 times more costly than compared to conventional laparoscopic procedures (11). Apart from cost, it also suffers from some technical shortcomings. Firstly, there is all-important loss of haptic feedback to the surgeon. The surgeon has manly to rely on his intuition and experience to overcome this handicap. Secondly, it requires frequent change of instruments, which is laborious and time consuming. Although the variety of instruments has considerably increased in robotic surgery such as harmonic scalpel, suction devices, clip applicators etc. There is still reliance on assistant to carry out important steps in the procedures. Thirdly, it becomes difficult from an anesthetist perspective as they find the access difficult to the transfixed abdomen and hence altering the ventilation dynamics becomes a problem.

Many studies have been published in the literature comparing laparoscopic and robotic adrenalectomy (11-18,21,22), with most finding the later approach favorable in terms of blood loss, hospital stay and skin-to-skin operative time. In a recent systematic review of approaches used for adrenalectomy, Chai *et al*. observed that given the current evidence, robotic surgery is safe and feasible but has not shown any particular advantage over laparoscopy to date. Cost reductions or further improvements in surgical outcomes are necessary to expand the use of robotic adrenalectomy (23).

In a meta-analysis and systematic review comparing robotic and laparoscopic adrenalectomy (24), Brandao *et al*. selected nine comparative studies including one randomized controlled trial. The authors found that there was no significant difference between the two approaches in terms of operative time and conversion rate. Robotic technique was although preferable as it entailed a shorter hospital stay and lesser blood loss as compared to laparoscopic technique. There was also a trend favoring robotic approach in terms of complications albeit it didn't reach statistical significance. Although the authors provided in-depth comprehensive review on the subject, the quality of available evidence was low and inconclusive. The review also suffered from inadequate sample size to ground clinically relevant evidence.

As detailed in the article, there is considerable heterogeneity in the included studies for evaluating blood loss, hospital stay and operative time. This has largely been attributed to surgeons with different levels of experience, the shorter learning curve for the robotic group and the variety of treated diseases (benign, malignant, functioning, and nonfunctioning adrenal masses). Furthermore, inclusion of transperitoneal as well as retroperitoneal approach in the analysis may have confounded the overall results. They would have been better off comparing the two approaches exclusively in the laparoscopy and robotic groups.

One of the important points that the authors did not highlight was the intraoperative stability that the robot provides to the surgeon while handling a sensitive functional adrenal tumor. The main advantage of robotics lies in ease of dissection that is aided by better visualization, endowrist and articulating instruments and precise movement by filtering of tremors. All these advantages are best exemplified while handling of functional adrenal tumors, which require minimal manipulation to avoid any inadvertent hemodynamic event. Weingarten *et al*. studied the hemodynamic changes in patients undergoing laparoscopic adrenalectomy for pheochromocytoma (25). Although the latter patients had a greater maximal systolic blood pressure and had received a greater amount of intravenous fluids, no differences were found in the postoperative surgical outcomes and hospital stay. Aliyev *et al*. observed three cases of arrhythmias in the laparoscopic group and none in the robotic group while operating for pheochromocytoma (22). Morino *et al*. although recorded two severe intraoperative crisis episodes in patients who underwent robotic adrenalectomy (15). This can be explained by the fact that surgeons were still in their learning curve and getting used to the loss of tactile feedback.

The authors seem to support the use of robotic assistance over standard laparoscopy in performing adrenalectomy as it provides for shorter hospital stay and lesser blood loss. However, the detected difference of half a day in hospital stay and 25 mL of blood loss between the two groups is not clinically relevant to justify the superiority and use of robotic surgery in adrenalectomy at the cost of higher expenses. The authors failed to emphasize more on the cost issues related to robotic surgery. On an average, robotic surgery tends to be more expensive by $700-1,000 as compared to laparoscopy even after excluding initial setup and maintenance cost (11,17,22). Hence, it is unclear whether the substantial cost of the robotic procedure is justified since the outcomes are equivalent. Thus, the costs of the initial purchase of the robot and instruments, as well as its maintenance, are obstacles to the expansion of robotic adrenalectomy.

To conclude, robotic adrenalectomy overcomes many drawbacks of the conventional laparoscopy and appears more desirable to the surgeons because of precise dissection, improved view and ergonomic advantages. Conversely, it fails to provide any distinct benefit over laparoscopy in terms of outcome and patient comfort. Larger and adequately powered randomized controlled trials are needed to generate functional evidence that detects and highlights the differences (if any) between the two modalities.

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Footnote

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