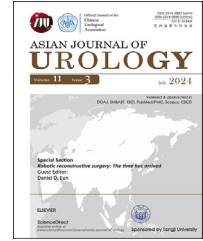


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## Letter

## Initial experience with robot-assisted adrenalectomy for giant adrenal tumors



Dear Editor,

Adrenocortical carcinomas and adrenal cysts, including pseudocysts, are uncommon tumors [1,2]. No consistent approach to surgery for large adrenal tumors including cysts, has been established, and especially when malignancy is suspected, consideration is still given to the option of laparotomy. Using robot-assisted surgery, we successfully performed the resection of a giant adrenal pseudocyst and a giant adrenocortical carcinoma, as reported previously [3], underlining the advantages of robot-assisted surgery for large adrenal tumors.

Two cases of robot-assisted resection of adrenal tumors of 10 cm in diameter were reviewed from April to October 2022 at the Izumi City General Hospital, Osaka, Japan. The patients provided written and verbal consents for participation. This study was approved by the institutional review board of Izumi City General Hospital, Osaka (IRB No. 22-J18). The study conforms to the provisions of the Declaration of Helsinki. Patient 1 had an 11.3 cm × 6.2 cm left adrenocortical carcinoma (Fig. 1A), whereas Patient 2 had a 10 cm × 10 cm left adrenal cyst (Fig. 1B). Endocrinological examinations revealed no abnormalities in either of the cases. Since adrenal cyst could not be ruled out as a primary retroperitoneal malignancy [3], we decided to perform a resection using the da Vinci Xi system (Intuitive Surgical, Inc., Sunnyvale, CA, USA), with four main and two assistant ports (Fig. 1C) [3]. A single, skilled surgeon operated on both patients. Both cases were approached transabdominally; the console time was ≤2 h; and the estimated volume of intraoperative hemorrhage was 20 mL and 5 mL, respectively. Intraoperatively, Patient 1 had a tumor that slightly adhered to the surrounding tissue, rendering resection feasible, despite bearing numerous afferent blood vessels. Regarding the tumor of Patient 2, although mild adhesion was observed between the mesentery and tumor tissue, only the cystic lesions were successfully removed (Fig. 1D). No perioperative complications occurred, and the

patients were discharged on Day 10 and Day 7 after surgery, respectively. Histopathological results showed that Patient 1 had an adrenocortical carcinoma with no resection stump, and Patient 2 had an adrenal pseudocyst. Patient 1 showed no recurrence or metastasis 9 months after surgery.

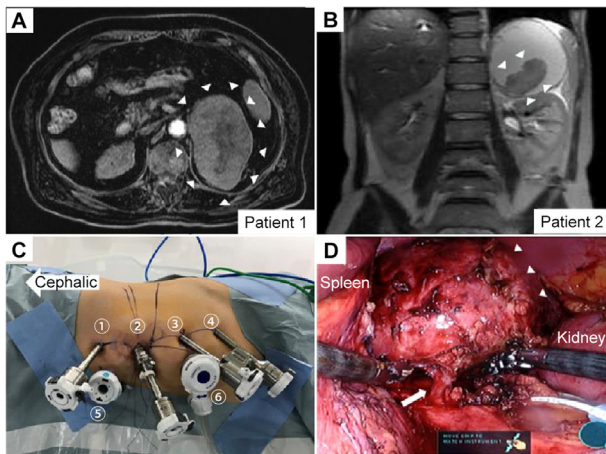
Surgical resection is performed for adrenal cysts and tumors for which adrenocortical carcinoma cannot be ruled out. Reports on laparoscopic and robot-assisted surgery for large adrenal tumors are scarce; hence, their long-term outcomes, usefulness, and safety remain unclear. Thompson et al. [4] have compared laparoscopic and robot-assisted adrenalectomy and found large tumor diameters to be a prognostic factor for robot-assisted surgery, suggesting that robot-assisted adrenalectomy tends to be selected more often for large adrenal tumors. However, only four reports have mentioned using robot-assisted surgery for adrenal tumors of 10 cm in diameter [5].

Laparoscopic surgery for large adrenal tumors has been shown to involve high risks of intraoperative decapsulation, localized recurrence, and adrenal cyst rupture [6]. These are considered to be caused by a decrease in the working space due to increased tumor sizes, making the manipulation of forceps difficult. Compared with laparoscopic surgery, robot-assisted surgery enables the delineation of a desired, precisely defined, three-dimensional near field devoid of blurring, which enables peeling and dissection without shaking, even in narrow spaces in which the forceps wrist joint is highly mobile. In addition, using a third arm offers advantages such as efficient space maintenance and ease of routine operations. Therefore, the risks of decapsulation, presence of resection stumps, and intraoperative cyst rupture are avoided. In our experience, a reliable field of view and sufficient working space facilitate resection precision while securing the resection stump. A retrospective comparative evaluation of the use of laparoscopic and robot-assisted surgery for large adrenal tumors showed that for tumors that were ≥5 cm in diameter, robot-assisted surgery reduced the surgical duration and rate of transfer to laparotomy [7], similar to our experience.

The disadvantage of robot-assisted surgery is that the surgeon has no sense of touch, necessitating great care when handling forceps. However, its advantages outweigh the disadvantage, rendering this technique safe and highly

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**Figure 1** Imaging and intraoperative findings related to robotic-assisted adrenalectomy. (A) An 11.3 cm×6.2 cm substantial tumor ( $\Delta$ ) was found in the left adrenal gland, and the inside of the tumor showed a low absorption area that necrosis was suspected; (B) A 10 cm×10 cm cyst was observed in the left adrenal gland, and the contents indicated hyperintensity on both T1- and T2-weighted abdominal magnetic resonance imaging; a septum and a 52-mm solid component were found inside the cyst ( $\Delta$ ); (C) Ports for robotic adrenalectomy: ① 8 mm, port; ② 12 mm, camera; ③ 8 mm, port; ④ 8 mm, port; ⑤ 12 mm, assistant; and ⑥ 12 mm, assistant (AirSeal™ Insufflation System, CONMED Japan KK, Tokyo, Japan); (D) Intraoperative findings for Patient 2; a blood vessel (arrow) flowing into a giant tumor ( $\Delta$ ) was observed, which was thought to be the central vein of the adrenal gland.

reproducible for large tumors with regard to oncology and postoperative recovery. Based on a report that collated various definitions of tumor sizes [7], a tumor with a diameter  $\geq 5$  cm is considered large. Adrenal tumor size is also considered to have no impact on postoperative functional outcomes [8–10]. The acceptable upper size limit for robotic surgery remains to be determined.

One limitation of this study was the small number of patients and the short duration of observation for adrenocortical carcinoma. Therefore, further studies with more patients and longer observation times should be conducted.

## Author contributions

*Study concept and design:* Takayuki Ohzeki.

*Data acquisition:* Takayuki Ohzeki, Hiroyuki Kita, Remon Kunishige, Taiji Hayashi, Tsukasa Nishioka, Koichi Sugimoto.

*Data analysis:* Takayuki Ohzeki.

*Drafting of manuscript:* Takayuki Ohzeki.

*Critical revision of the manuscript:* Takayuki Ohzeki, Taiji Hayashi, Tsukasa Nishioka, Koichi Sugimoto, Takafumi Minami, Kazutoshi Fujita.

## Conflicts of interest

The authors declare no conflict of interest.

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