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# Robot-Assisted Partial Nephrectomy for Treatment of Juxtaglomerular Cell Tumor of the Kidney: A Case Report

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## Abstract

***Background:*** A juxtaglomerular cell tumor (JGCT), or a reninoma, is a rare renal tumor that can cause secondary hypertension. This is the first reported JGCT that was resected through robotic surgery.
***Case:*** We present a case of a 27-year-old female patient with 1.35-cm-sized JGCT in the lower pole of the right kidney. We effectively removed a JGCT through robot-assisted partial nephrectomy without any complications.
***Conclusion:*** The robot-assisted partial nephrectomy procedure could be a suitable choice for JGCT resection.

**Keywords:** juxtaglomerular tumor, reninoma, robot-assisted partial nephrectomy, renin-producing tumor, renin, aldosterone

## Background

A JUXTAGLOMERULAR CELL TUMOR (JGCT) is a rare cause of secondary hypertension, and it is secondary to renin secretion of the tumor; hence, hypertension induced by JGCT is treated by removal of the tumor. In this case report, we present a JGCT case that was effectively treated with robot-assisted partial nephrectomy. To the best of our knowledge, this is the first reported JGCT that was resected through robotic surgery.

## Case Presentation

A 27-year-old Korean female patient visited Chung-Ang University Hospital in September 2015 with the chief complaint of headache. She had persistent high blood pressure (BP), with an initial BP of 190/125 mm Hg, and no familial history of hypertension. For emergent BP control, an oral beta blocker and hydrochlorothiazide were prescribed before the patient was evaluated. However, the medications were stopped after only one administered dose because of low compliance and the side effect of dizziness.

Laboratory tests revealed hypokalemia (serum potassium level at 3.2 mEq/L, with a normal range of 3.5–5.3 mEq/L) and increased plasma renin activity (13.37 ng/mL per hour in the supine position, with a normal range of 0.60–4.30 ng/mL per hour). Serum aldosterone level was within normal limits in both supine (45.32 pg/mL, with a normal range of 41.71–208.90 pg/mL) and standing positions (83.92 pg/mL, with a normal range of 67.40–335.10 pg/mL). Blood urea nitrogen, serum creatinine, 24-hour urinary vanilyl mandelic acid, timed urinary epinephrine, timed urinary norepinephrine, and 24-hour urinary free cortisol levels were within normal ranges. Arterial blood gas analysis did not exhibit any abnormalities.

A contrast-enhanced CT scan revealed an ~1.35-cm-sized bulging solid mass in the lower pole of the right kidney (Fig. 1). There was no evidence of renal arterial stenosis, adrenal masses, lymph node enlargements, or renal vein or inferior vena cava stenosis.

MRI also revealed an exophytic solid mass in the lower pole of the right kidney, with low T1 and high T2 signal intensity. The mass exhibited gradual and persistent enhancement with diffusion restriction. No fat component or calcification was observed.

After the evaluation, an angiotensin II receptor blocker, calcium channel blocker, and beta blocker were administrated to control the BP until the tumor was resected.

Based on the clinical, laboratory, and radiologic findings, the patient underwent a robot-assisted partial nephrectomy. Briefly speaking, the patient was placed in lateral position.

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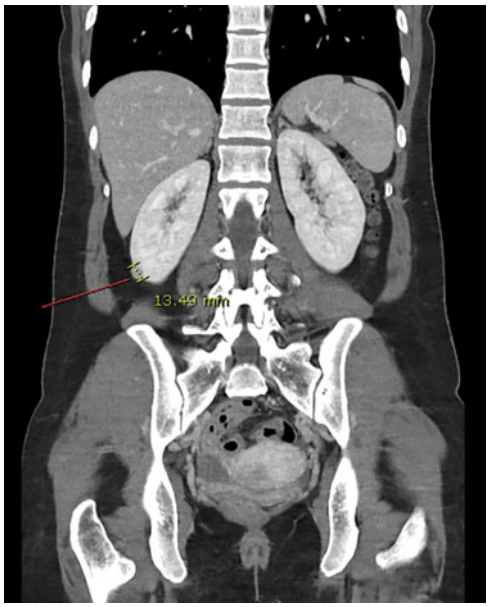


**FIG. 1.** Contrast-enhanced CT scan found out an ~1.35-cm-sized bulging solid mass in the lower pole of the right kidney.

Camera trocar was inserted at the lesion of 8 cm above the umbilicus using a Veress needle. Both robot trocars were placed at right angle into the target 8 cm from the camera trocar, and the additional robot trocar was placed 8 cm from the right robot trocar. Assistant port was placed in the umbilicus upper margin. The schematic diagram of the port placement is displayed in Figure 2. The da Vinci Surgical System Si® (Intuitive Surgical, Sunnyvale, CA) was docked. After the dissection of the ascending colon, the tumor was resected without vessel and renal pedicle clamping. Frozen biopsy was requested with resected tumor, and renorrhaphy was started by using absorbable sutures, polymer clips, and hemostatic agents. We confirmed that the tumor was with

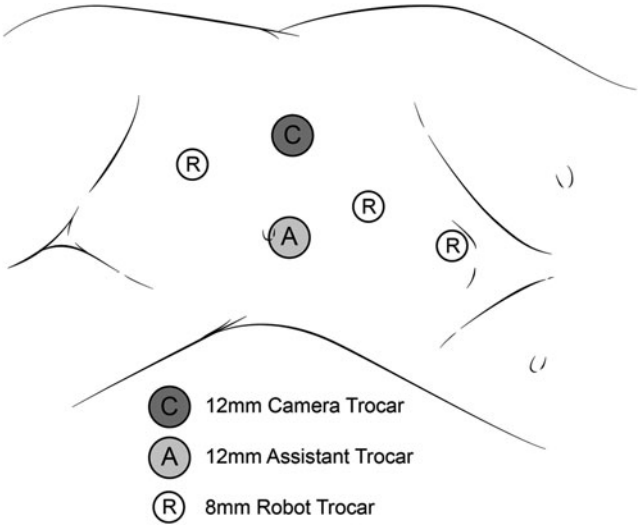


**FIG. 2.** A schematic diagram of the port placement of robot-assisted partial nephrectomy for removing juxtaglomerular cell tumor.

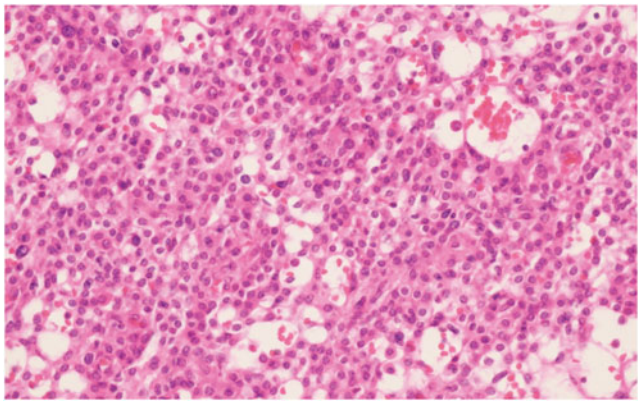

**FIG. 3.** The tumor consists of round or polygonal cells arranged in sheets punctuated by a network of delicate blood vessels.

clear resection margin by frozen biopsy, and renorrhaphy was carried out without additional tumor resection. Total surgical time was 160 minutes, and total blood loss was ~100 mL. The tumor was effectively removed without any complications or events during the surgery.

The resected tumor was well circumscribed with a soft flesh pale pink appearance and measured 2.0 cm in its maximum dimension. Histopathologic examination showed that the tumor consisted of solid sheets of closely packed uniform round and polygonal cells with over to round nuclei, pale to eosinophilic cytoplasm, inconspicuous nucleoli, and indistinct cell borders (Fig. 3). Immunohistochemical staining revealed that tumor cells were immunoreactive (positive) for vimentin, smooth muscle actin (focal), cluster of differentiation 117 (CD117), and CD34. The tumor cells demonstrated no reactivity (negative) for cytokeratin and human melanoma black-45 (HMB-45). An electron microscopy examination could not be performed.

After surgery, the patient's BP returned to the normal range without any antihypertensive medications, and the related symptoms disappeared. Plasma renin and serum potassium levels were also normalized.

## Discussion and Literature Review

Among the several causes of secondary hypertension, urologists should especially pay attention to renin-producing renal tumors such as JGCT, mesoblastic nephroma, oncocytoma, Wilm's tumor, or the clear-cell type of renal cell carcinoma, since the definite treatment option of the hypertension induced by these tumors is surgical excision.[1] JGCT, or reninoma, is a benign tumor with a female predominance and affects adolescents and young adults, with its peak prevalence in the second and third decades of life.[2] The tumor produces excessive amounts of renin, usually resulting in hyperaldosteronism, and induces secondary hypertension and hypokalemia. JGCT patients suffer from headaches, retinopathy, double vision, dizziness, nausea, vomiting, polyuria, and proteinuria.[2]

Typically, JGCT patients present secondary hyperaldosteronism caused by increased renin activity. However, in our case, serum aldosterone level in both the supine and standing positions was within the normal range. Our study

had some assumptions about the normal aldosterone level, which has diurnal variation and is affected by volume status, potassium level, emotional stress, and posture.[3] The use of diuretics, beta blockers, and calcium channel blockers and sodium intake can also affect aldosterone level. The several antihypertensive drugs administered to the patient could be one of the causes of the lack of correlation between aldosterone level and the clinical diagnosis. Therefore, patients with normal or low aldosterone level with high renin activity cannot be ruled out for diagnosis of JGCT.

Although there have been up to 100 JGCT case reports to date, to the best of our knowledge, this is the first in which the tumor was removed by robotic surgery. Although the robot-assisted partial nephrectomy procedure requires longer operation times than laparoscopic or open partial nephrectomy procedures,[4] it has been widely used worldwide and has several advantages than other operation methods. Robotic surgery exhibited a significantly lower frequency of perioperative complications and a lower risk of conversion and transfusion rates *vs* the laparoscopic partial nephrectomy procedure.[4] Patients who received robot-assisted partial nephrectomy experienced less blood loss, shorter hospitalization stays, and a lower frequency of complications as well as the cosmetic benefit than those who underwent an open partial nephrectomy procedure. No differences in tumor margin status and change in glomerular filtration rate and transfusion rate were observed between the two surgery methods.[4] In addition, robotic surgery could offer cosmetic benefit to the 27-year-old young woman comparing with other surgical techniques.

## Conclusion

We effectively removed a JGCT through a robot-assisted partial nephrectomy without any complications or events during or after the surgery. Urologists must always consider a renin-producing tumor as the possible cause of secondary hypertension. A robot-assisted partial nephrectomy could be one choice for tumor resection.

## Ethics Approval and Consent to Participate

Ethics committee approval was waived by the Institutional Review Board of Chung-Ang University according to its policy for the case reports

## Consent for Publication

Written informed consent for publication of clinical details and/or clinical images was obtained from the patient.

## Availability of Data and Materials

Not applicable.

## Authors' Contributions

O.J.K. wrote the case report and searched related articles or references. O.J.K., Y.K.L., H.R.K., and M.K.L. consulted clinicians and surgeons about the laboratory tests for the diagnosis and interpretation of the laboratory data. T.J.L. carried out histopathologic examination of the tumor. H.Y.W. gave medical treatment for blood pressure control and performed cardiovascular examination. S.Y.C., J.W.K., B.H.C., I.H.C., Y.T.M., K.D.K., and T.H.K. conducted robot-assisted partial nephrectomy. T.H.K. supervised the case report and searched related articles or references. All authors read and approved the final article.

## Disclosure Statement

No competing financial interests exist.

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**Abbreviations Used**

BP = blood pressure
CD = cluster of differentiation
CT = computed tomography
HMB-45 = human melanoma black-45
JGCT = juxtaglomerular cell tumor
MRI = magnetic resonance imaging

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