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SKILL AND TALENT

Use of near infrared fluorescence during robot-assisted laparoscopic partial nephrectomy☆

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Abstract

Background: Partial nephrectomy is the treatment of choice for T1a tumors. The open approach is still the standard method. Robot-assisted laparoscopic surgery offers advantages that are applicable to partial nephrectomy, such as the use of the Firefly® system with near-infrared fluorescence.

Objective: To demonstrate the implementation of fluorescence in nephron-sparing surgery.

Case report: This case concerned a 37-year-old female smoker, with obesity. The patient had a right kidney tumor measuring 31 mm, which was found using tomography. She therefore underwent robot-assisted laparoscopic partial nephrectomy, with a warm ischemia time of 22 min and the use of fluorescence with the Firefly® system to guide the resection. There were no complications. The tumor was a pT1aN0M0 renal cell carcinoma, with negative margins.

Robot-assisted renal laparoscopic surgery is employed for nephron-sparing surgery, with good oncological and functional results. The combination of the Firefly® technology and intraoperative ultrasound can more accurately delimit the extent of the lesion, increase the negative margins and decrease the ischemia time.

Conclusion: Near-infrared fluorescence in robot-assisted partial nephrectomy is useful for guiding the tumor resection and can potentially improve the oncological and functional results.

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PALABRAS CLAVE
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Uso de la fluorescencia cercana al infrarrojo en nefrectomía parcial laparoscópica asistida por robot

Resumen

Antecedentes: La nefrectomía parcial es el tratamiento de elección para tumores T1a, siendo el abordaje abierto aún el estándar. La cirugía laparoscópica asistida por robot ofrece ventajas aplicables a la nefrectomía parcial como el uso del sistema Firefly® con fluorescencia cercana al infrarrojo.

Objetivo: Mostrar la aplicación de la fluorescencia en una cirugía preservadora de nefronas.

Caso clínico: Mujer de 37 años, fumadora, con obesidad. Tumor renal derecho de 31 mm como hallazgo en tomografía por lo que es sometida a nefrectomía parcial laparoscópica asistida por robot, con tiempo de isquemia caliente de 22 minutos y uso de fluorescencia con sistema Firefly® para guiar la resección, sin complicaciones, con carcinoma de células renales pT1aN0M0, márgenes negativos.

La cirugía renal laparoscópica asistida por robot se emplea para cirugía preservadora de nefronas, con buenos resultados oncológicos y funcionales. La combinación de la tecnología Firefly® con el ultrasonido transoperatorio puede delimitar con mayor precisión la extensión de la lesión, pudiendo aumentar los márgenes negativos y disminuir el tiempo de isquemia.

Conclusión: La fluorescencia cercana al infrarrojo en la nefrectomía parcial asistida por robot es útil para guiar la resección del tumor y potencialmente poder mejorar los resultados oncológicos y funcionales.

Introduction

The first laparoscopic procedure that involved kidney was performed by Clayman in 1991.[1] Partial nephrectomy was developed in an attempt to preserve renal units and reduce the morbidity of the procedure. As experience has increased with regard to partial nephrectomy, its indications have expanded, encompassing tumors of greater size and complexity while incorporating the laparoscopic approach.[2] Among the main disadvantages of partial nephrectomy both open and laparoscopic is greater difficulty to find an optimal plane of resection, with major problems to achieve adequate hemostasis and the possibility of positive margins.[3] With the addition of robotic assistance from this century and the advent of technologies such as near-infrared fluorescence adapted to the DaVinci® system (Firefly®) the process has been facilitated and the results of partial nephrectomy have improved.

The aim of the study is to show the application of near-infrared fluorescence coupled to the DaVinci system in a nephron-sparing surgery and to demonstrate the potential benefits that exist with its use.

Case presentation

37-Year-old woman with obesity and smoking. She underwent an abdominal CT in which a right renal exophytic tumor of 31 mm was shown in the mid pole (Fig. 1), with a score according to RENAL scale of 6 p, with no evidence of metastatic disease and normal preoperative studies, creatinine clearance of 88 mL/min. She underwent robot-assisted laparoscopic partial nephrectomy, with warm ischemia time of 22 min and clamping of 2 renal arteries, the dissection plane was corroborated by the Firefly® system after intravenous administration of indocyanine green (Fig. 2), tumor of approximately 3 cm is resected on lateral side with monitoring of the depth of resection by intraoperative ultrasound (BK Medical®, Fig. 3), without involvement of collecting systems. Renorrhaphy of the tumor bed was performed in 2 planes, using barbed suture (V-loc®, Covidien), hem-o-lock staples to secure the ends of the suture and use of hemostatic agents, FloSeal® in the faced tumor bed and Tisseel® on renorrhaphy after releasing the ischemia (Fig. 4); there were no trans- or postoperative complications, with surgical time of 150 min. The patient was discharged after 2 days without drainage, with pathology report of renal cell carcinoma pT1aN0M0, Fuhrman 2, with negative margins. Currently asymptomatic, with no evidence of recurrence at 12 months and with preserved renal function evidenced by creatinine clearance of 83 mL/min.

Discussion

Currently, to determine the success of partial nephrectomy, as in radical prostatectomy, the ''trifecta'' criterion is used, which implies negative margins, minimal decrease in renal function (linked to ischemia times limited to <25 min and/or parenchymal preservation >90%) and without perioperative complications.[4] Even the extension to ''pentafecta'' has been proposed by incorporating to the 3 variables already discussed, the long-term maintenance of adequate renal function, and a state free of recurrence. The focus of preservation of renal function can be improved by taking into account 5 points: the quality of the residual tissue, the amount of functional renal tissue, the resection speed, the