

The First Ever Robotic-Assisted Laparoscopic Radical Nephrectomy with Inferior Vena Cava Thrombectomy Performed in Thailand: A Case Report of Atypical Presentation of Urothelial Carcinoma with Tumor Thrombus

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Background: Robotic-assisted surgery was proposed as an alternative to open surgery for management of inferior vena cava (IVC) thrombus together with radical nephrectomy in complex renal mass. Here, the authors reported the first case of this type to be managed via this surgical technique in Thailand.

Case Report: A 76-year-old Thai female presented with right renal mass with tumor thrombus in the IVC extending 3 cm above the level of the renal vein. The presumed diagnosis was renal cell carcinoma of the right kidney with level 2 tumor thrombus in IVC, clinical staging T3bN0M0. The patient underwent robotic-assisted laparoscopic IVC thrombectomy together with right radical nephrectomy at Siriraj Hospital (Bangkok, Thailand) in May 2020.

Results: The operation proceeded uneventfully without immediate complication. The postoperative reduction of IVC diameter was approximately 30%. Total IVC clamp time was 50 minutes, operative time was five hours, with docking time of 20 minutes and console time of 250 minutes, estimated intraoperative blood loss was 2,600 mL, and length of hospital stay was four days. At 30-days and 90-days postoperation, no thromboembolic event or compromising lower extremity venous return was detected. The pathological report revealed high-grade urothelial cell carcinoma with invasion into perinephric fat. Carcinoma involvement was observed in the tumor thrombus and IVC wall (T4N0M0).

Conclusion: Robotic-assisted surgery of the IVC is a complex operation that requires robotic surgical proficiency and a highly experienced team. The observed success in the present case demonstrated the feasibility of this procedure in Thailand. Additional benefits include less postoperative pain, reduced blood loss, smaller surgical wound size, and shorter length of hospital stay.

Keywords: Robotic-assisted laparoscopic radical nephrectomy; Inferior vena cava thrombectomy; Thailand

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During the past decades, the surgical management of conditions affecting the inferior vena cava (IVC) has developed in several aspects. To describe

one, robotic-assisted surgery was proposed as an alternative to open surgery for management of IVC thrombus together with radical nephrectomy in advanced stage renal cell carcinoma. The minimally invasive nature of this procedure reduces estimated blood loss, reduces postoperative pain, and decreases the length of hospital stay. Other benefits of robotic-assisted surgery include improved visualization, meticulous suturing, and enhanced dexterity relative to vascular control. However, IVC surgery is a complex operation associated with high morbidity and mortality. Robotic surgery in this clinical setting is challenging and requires proficiency in both anatomy and robotic surgical skill. Here, the authors reported the first case in Thailand to undergo robotic-assisted laparoscopic radical nephrectomy with IVC thrombectomy.

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Figure 1. Coronal view of magnetic resonance imaging shows an infiltrative right upper pole kidney tumor 6.3×5.7×5.4 cm in size. The arrow indicates the location of the tumor, which exhibits heterogeneous low intensity in the T2-weighted phase.

Case Report

A 76-year-old Thai female underwent ultrasonography to investigate the cause of kidney failure. A tumor was found at the upper pole of her right kidney. In addition to kidney failure (estimated glomerular filtration rate [eGFR] 10.74 mL/minute/1.73 m²), she also had underlying hypertension. Non-contrast computed tomography (CT) of the abdomen revealed a total endophytic hyperdensity mass at the upper pole of the right

kidney, which was 6 cm in diameter, with renal vein thrombus. Magnetic resonance imaging (MRI) of the whole abdomen was then performed to evaluate the characteristics of the tumor. The MRI finding was infiltrative right upper pole kidney tumor that was 6.3×5.7×5.4 cm in size (Figure 1), intermediate to hypointensity in T1-weighted (T1W) image, and heterogeneous low intensity in T2W image. Signal drop off observed during in-phase imaging suggested intratumoral hemorrhage. In addition to the kidney mass, there was also an infiltrative tumor thrombus in the right renal vein, and in the infrahepatic IVC extended 3 cm above the level of the renal vein (Figure 2). The most likely diagnosis was renal cell carcinoma of the right kidney with level 2 tumor thrombus in IVC, clinical staging T3bN0M0. The patient was scheduled to undergo robotic-assisted laparoscopic right radical nephrectomy with IVC thrombectomy at the authors' center, which was Siriraj Hospital, Bangkok, Thailand, in May 2020. The robotic surgical system used was a da Vinci Xi Surgical System (Intuitive, Sunnyvale, CA, USA). Under general anesthesia, the patient was positioned in the left lateral decubitus position at 90 degrees. The first 8 mm Robotic Davinci Xi port was placed at the right paraumbilicus, followed by placement of the other three 8 mm Robotic Davinci Xi ports on the right mid axillary line in linear fashion. A 12 mm laparoscopy port was then placed below the mid axillary line to serve as an assistant port (Figure 3). A 30° down scope was used together with da Vinci Monopolar Curved scissors, Finestrated Bipolar Forceps, and ProGrasp Forceps. The operation

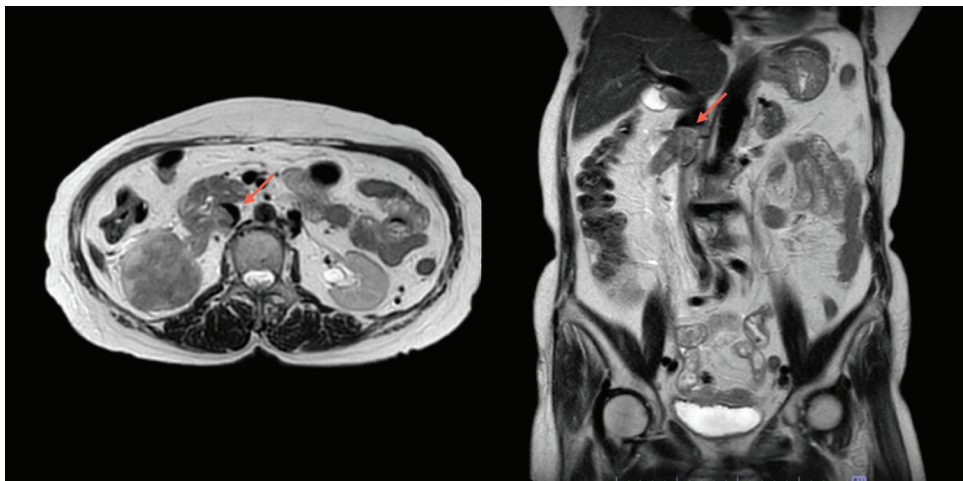


Figure 2. Infiltrative tumor thrombus (arrow) in the right renal vein, and in the infrahepatic inferior vena cava extending 3 cm above the level of the renal vein.

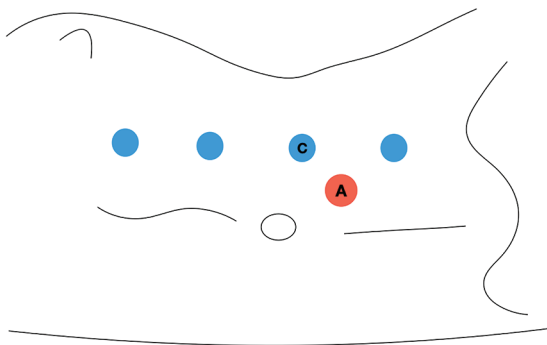


Figure 3. The four 8 mm Robotic Davinci Xi ports were positioned on the right mid axillary line in linear fashion. A 12 mm laparoscopy port was then placed at below the mid axillary line to serve as an assistant port (C: camera port, A: assistant port).

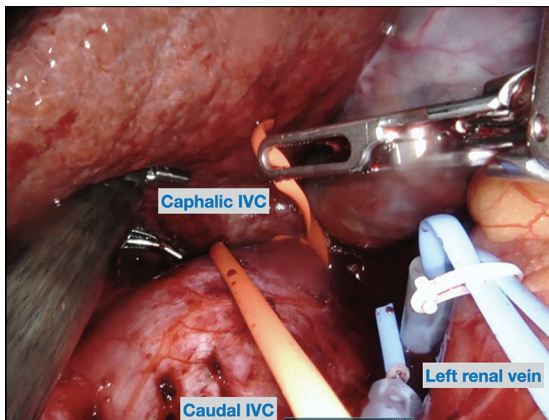


Figure 4. The caudal IVC, left renal vein and cephalic IVC were dissected and controlled with vascular loop by modified Rommel tourniquet.

started with medial mobilization of the ascending colon and Kocherization of the duodenum until the IVC and aorta could be observed. Intraoperative intracorporeal ultrasound was used to identify the level of tumor thrombus in the IVC. The caudal IVC, left renal vein, and cephalic IVC were consecutively dissected and controlled using a modified Rommel tourniquet fashioned using vessel loops (Figure 4). The right renal artery was double ligated using Hem-o-lok® clips (Weck Closure Systems, Research Triangle Park, NC, USA). The IVC was controlled using Weck clips (Weck Closure Systems) on a snugger tube positioned over the vascular loop. The cavotomy was performed via vertical incision at the anterior surface of the IVC (Figure 5A). The tumor thrombus was removed from the endothelium (Figure 5B, C) and the IVC, which had sustained tumor invasion, was partially resected. En-bloc removal of

the tumor thrombus and the right kidney was then performed. The cavotomy was repaired using Gore-Tex 4-0, double layer (W.L. Gore and Associates, Inc., Newark, DE, USA) after intraluminal heparinization (Figure 5D). A robotic needle holder was used to facilitate meticulous suturing. After removal of the IVC clamping, no gross bleeding was detected. A Jackson-Pratt drain was placed at the right renal fossa before abdominal closure. The postoperative reduction of the inside diameter of the IVC was approximately 30%. The total IVC clamp time was 50 minutes, operative time was five hours including docking time of 20 minutes and console time of 250 minutes, and estimated intraoperative blood loss was 2,600 mL. The patient was given four units of blood intraoperatively. The operation went well without perioperative complication, and she was discharged from the hospital on postoperative day 4. At 30-days and 90-days postoperatively, no thromboembolic event or compromising lower extremity venous return were detected. Histopathologic analysis revealed high-grade urothelial cell carcinoma with invasion through the renal parenchyma into perinephric fat. Carcinoma involvement was observed in the tumor thrombus and IVC wall (Figure 6), compatible with pathological stage T4N0M0.

Discussion

Robotic-assisted surgery was first introduced at Siriraj Hospital in 2007. The two most commonly performed major robotic-assisted urologic surgical procedures at the authors' center are radical prostatectomy and partial nephrectomy. At present, there are four robotic surgical systems, two of those are da Vinci Xi Surgical Systems acquired in August 2019. After gaining added experience and improved competence in robotic surgery, the physicians decided to perform a more complex operation.

Robotic-assisted surgery was proposed as an alternative to open surgery for management of IVC thrombus together with radical nephrectomy in patients with advanced stage renal cell carcinoma. Even though the oncologic outcome is the same as yielded by open surgery, the benefits of robotic surgery include smaller surgical wound size, less postoperative pain, less blood loss, and shorter length of hospital stay⁽¹⁾. Most previous studies (all cases series/no randomized controlled trials) of robotic surgery in this clinical setting, found a shorter length of hospital stay in robotic surgery compared to open surgery at 2.5 days versus 4 to 5 days, respectively⁽¹⁾. However, robotic cavotomy is a complex operation

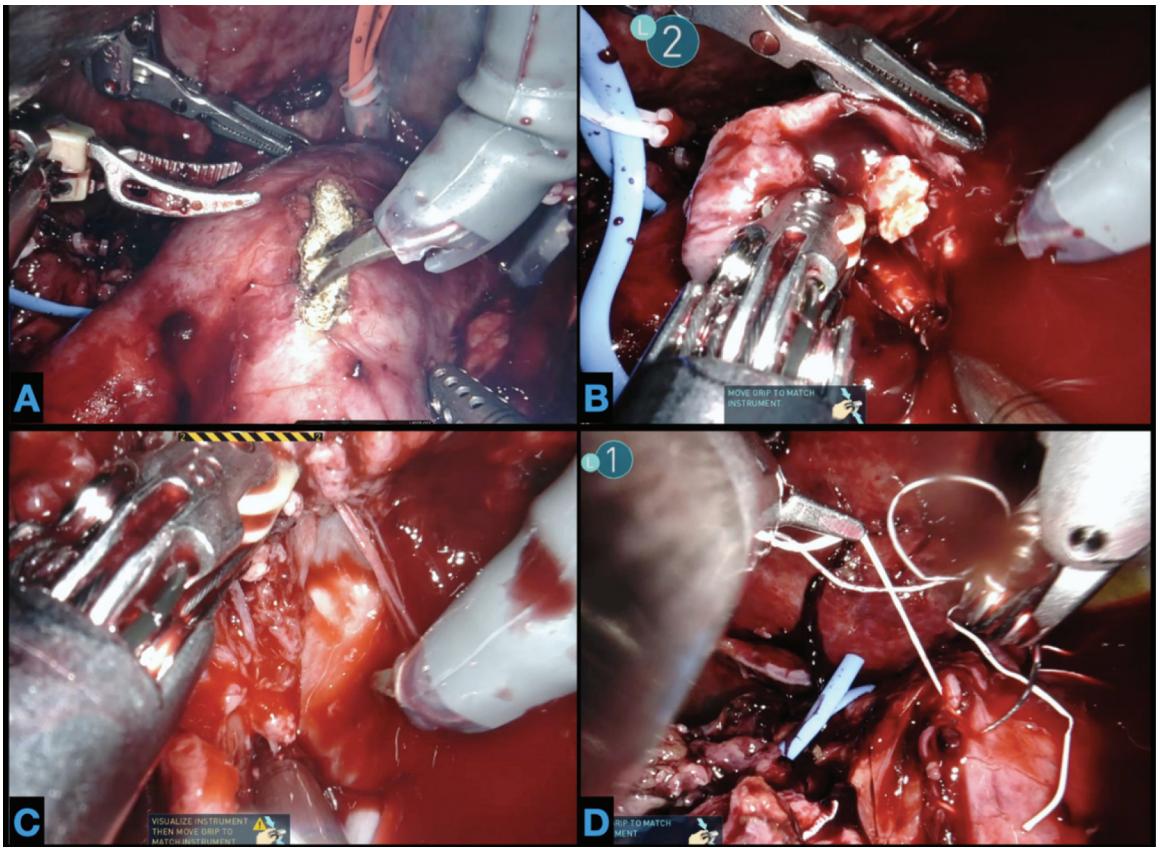


Figure 5. Surgical steps of the procedure. (A) Vertical incision over the anterior surface of the inferior vena cava for cavotomy. (B) Removal of the tumor thrombus from the endothelium. (C) Separation of the tumor thrombus from the endothelium. (D) Repair of the cavotomy using Gore-Tex 4-0, double layer.

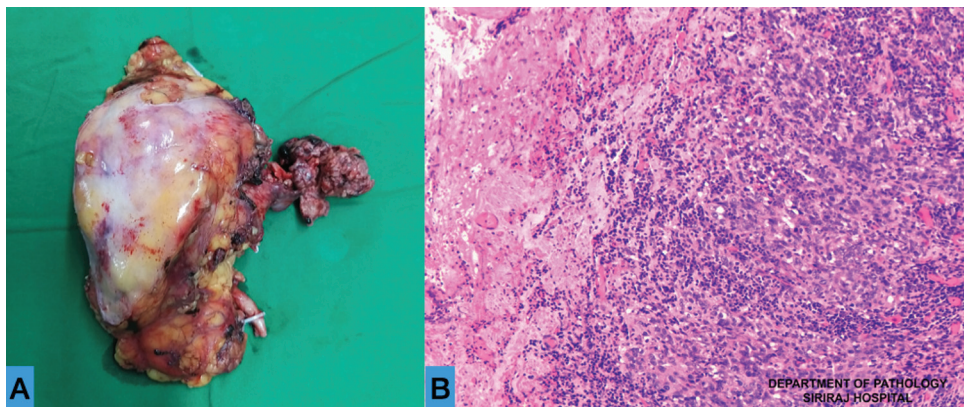


Figure 6. The gross specimen (A) and histopathologic analysis of the excised tumor thrombus and inferior vena cava wall (B). The inset image shows the gross specimen of the excised tumor thrombus and the repaired inferior vena cava.

with a 4.6% mortality rate. Massive intraoperative bleeding requires rapid management, and control can be difficult to obtain when using a robotic system. Another complication of concern when performing a robotic-assisted cavotomy is the risk

of a thromboembolic event, which is slightly higher compared to open surgery, which is at 17% to 22% within 90 days after surgery in robotic cavotomy^(1,2).

In March 2020, the authors decided to perform a radical nephrectomy with IVC thrombectomy

for the first case of cavotomy at the authors' center. The procedure is complex and requires a highly experienced surgical team, often utilizing robotic-assisted techniques for better visualization and precision. The decision to perform IVC thrombectomy requires careful evaluation of the patient's overall health, the extent of tumor thrombus involvement, the potential for complete resection, and the expertise of the surgical team. To achieve an optimal result, an appropriate patient selection is important when performing a procedure for the first time. For the authors' first procedure, they chose a right nephrectomy instead of a left nephrectomy due to the complexity of IVC control. The tumor thrombus was at level 2 without sign of extensive venous invasion or lymphadenopathy.

After a literature review to acquaint themselves with all of the reported surgical techniques, the authors performed the operation as described. The present case operation differed from the previous reported operations relative to estimated blood loss. In the present case, blood loss was estimated to be 2,600 mL, which is higher than the estimated 170 to 500 mL blood loss in other reported cases⁽¹⁻³⁾. The reason for this difference in blood loss was that the surgeon did not control the lumbar vein and did not use a vascular stapler or any sealing device. Assistant manual compression on the lumbar vein provides adequate visualization for thrombectomy but causes higher blood loss during cavotomy. The operative time of 300 minutes was similar to the previously reported operative times of 327 minutes^(1,2). Similarly, the present case IVC clamp time of 50 minutes was within the previously reported range of 27 to 50 minutes⁽¹⁻⁴⁾.

The surgeons opted for double-layer Gore-Tex (expanded polytetrafluoroethylene, ePTFE) to repair the cavotomy because this material is strong enough to withstand the tension exerted by the robotic arm during suturing. Gore-Tex is preferable to Prolene mesh relative to precise knot positioning. Moreover, the diameter of the thread fit to the needle hole on the IVC helps to prevent hole leakage along the suture line when using a Gore-Tex graft compared to a Prolene mesh graft.

In contrast to the authors' presumed diagnosis of renal cell carcinoma, histopathology showed high-grade urothelial carcinoma. Urothelial carcinoma is a common malignancy of the kidney accounting for approximately 10% of all kidney cancer. However, urothelial carcinoma with tumor thrombus is extremely rare. Most cases of renal mass with IVC

thrombus are shown on histopathologic analysis to be renal cell carcinoma. MRI is a useful diagnostic method for differentiating benign and malignant kidney lesion, but it cannot confidently distinguish renal cell carcinoma from other subtypes or differentiate central renal cell carcinoma from upper tract urothelial carcinoma, especially MRI without diffusion-weighted imaging and dynamic contrast-enhanced imaging. The signs that favor urothelial carcinoma over renal cell carcinoma on MRI include mass located in the center of the collection system, collection system defect, extension to ureteropelvic junction, absence of cystic and necrotic area, and absence of hemorrhage⁽⁵⁾. All of the signs and findings in the present patient suggested renal cell carcinoma. From the clinical finding, the authors decided to perform a radical nephrectomy instead of a nephroureterectomy. However, since 50% of the patients with urothelial carcinoma with IVC invasion died within six months⁽⁶⁾, the risk of disease recurrence with distal ureter involvement was discussed with the patient and her relatives. Based on the present patient's poor prognosis, the authors decided to closely surveil the patient instead of performing a distal ureterectomy. Regrettably, but not surprisingly, the patient developed multiple site metastasis, including lymphadenopathy around the surgical base, to the liver and lung, six months after the operation. Due to the advanced stage of her disease and poor kidney function, no systemic treatment was given. It is notable that the patient was still alive with stable disease in the last follow-up at 10 months after the operation.

Conclusion

Robotic-assisted surgery of the IVC is a complex operation that requires robotic surgical proficiency and a highly experienced team. The observed success in the present case demonstrated the feasibility of this procedure in Thailand. Additional benefits include smaller wound size, less postoperative pain, lower blood loss, and shorter length of hospital stay. Longer-term study is needed to determine if there was any oncologic outcome benefit of robotic assisted surgery over open surgery.

What is already known on this topic?

Robotic surgery is a minimally invasive approach that reduces estimated blood loss, reduces postoperative pain, and decreases the length of hospital stay. However, surgical management of malignant renal tumor with IVC thrombus is

challenging due to high morbidity and mortality even in open approach.

What does this study add?

Robotic surgery in this clinical setting is challenging and requires proficiency in both anatomy and robotic surgical skill. The observed success in this case demonstrates the feasibility of this procedure in Thailand. Additional benefits include less post-operative pain, reduced blood loss, smaller surgical wound size, and shorter length of hospital stay.

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This was an unfunded study.

Conflicts of interest

The authors declare no conflict of interest.

References

1. Rose KM, Navaratnam AK, Abdul-Muhsin HM, Faraj KS, Eversman SA, Moss AA, et al. Robot assisted surgery of the vena cava: Perioperative outcomes, technique, and lessons learned at The Mayo Clinic. *J Endourol* 2019;33:1009-16.
2. Murphy C, Abaza R. Complex robotic nephrectomy and inferior vena cava tumor thrombectomy: an evolving landscape. *Curr Opin Urol* 2020;30:83-9.
3. Abaza R. Initial series of robotic radical nephrectomy with vena caval tumor thrombectomy. *Eur Urol* 2011;59:652-6.
4. Abaza R. Robotic surgery and minimally invasive management of renal tumors with vena caval extension. *Curr Opin Urol* 2011;21:104-9.
5. Wehrli NE, Kim MJ, Matza BW, Melamed J, Taneja SS, Rosenkrantz AB. Utility of MRI features in differentiation of central renal cell carcinoma and renal pelvic urothelial carcinoma. *AJR Am J Roentgenol* 2013;201:1260-7.
6. Diaz RR, Kwon JK, Lee JY, Nahm JH, Cho KS, Ham WS, et al. Renal pelvic urothelial carcinoma with vena caval thrombus mimicking renal cell carcinoma. *Korean J Urol* 2014;55:624-7.