Venacavoscopy During Nephrectomy for Renal Cell Carcinoma With Inferior Vena Caval Thrombus

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Purpose: Renal cell carcinoma with inferior vena caval thrombus remains a complex challenge for the urologist. Aggressive surgery to remove all tumor can result in long-term survival. Liver transplant techniques, assistance from cardiac surgeons and bypass techniques can yield optimal vascular control but there is still a blind element inside the inferior vena cava when the thrombus is evacuated. We present data on a technique using a flexible cystoscope to evaluate the lumen of the intrahepatic and suprahepatic inferior vena cava after nephrectomy and tumor thrombectomy.

Materials and Methods: Seven patients underwent radical nephrectomy and tumor thrombectomy for renal cell carcinoma with inferior vena caval thrombus. During surgery and after removal of the tumor thrombus a flexible cystoscope was inserted into the venacavotomy for direct inspection of the inferior vena caval lumen. Any residual tumor was manipulated out of the lumen and removed. Patient records were reviewed for data on the time of this procedure, estimated blood loss, residual tumor, postoperative complications and survival.

Results: Venacavoscopy required an average additional 5.6 minutes and residual tumor was found in 3 of 7 patients. Average estimated blood loss was 1,170 cc and it was not affected by venacavoscopy. One patient experienced acalculous cholecystitis, possibly as a result of this procedure. Mean followup was 17.6 months with 5 of 7 patients alive.

Conclusions: Venacavoscopy is a safe, reliable method of intraoperative inspection of the inferior vena cava that uses equipment and techniques familiar to every urologist. This can help prevent incomplete thrombectomy and disastrous pulmonary embolus.

Key Words: kidney; vena cava; carcinoma, renal cell; endoscopy

Management of renal cell carcinoma with inferior vena caval tumor thrombus remains one of the most invasive treatments that urologists perform. Advances in surgical technique have resulted in decreased intraoperative and postoperative complications, and long-term survival rates between 30% and 50% can be achieved.[1,2] Nevertheless, despite complete vascular control inspection of the lumen of the vena cava after thrombus removal remains a blind component of the surgery. We describe a technique enabling direct visualization of the vena caval lumen using a flexible cystoscope.

MATERIALS AND METHODS

From 2002 to 2004, 7 patients with renal tumors and preoperative radiographic evidence of vena caval thrombus were treated with radical nephrectomy and tumor thrombectomy by 1 surgeon (GNS). All patients with thrombus below the diaphragm were treated with liver transplant techniques (venovenous bypass) for venous control. Patients with tumor thrombus extending above the diaphragm were treated with cardiopulmonary bypass and all were monitored with real-time intraoperative transesophageal echocardiography. No patients required cardiac arrest and hypothermia.

Before nephrectomy the renal artery was isolated, ligated proximal and distal, and divided. The vena cava was isolated above and below the involved renal vein and the contralateral renal vein. If tumor extended into the atrium, the vena cava was also isolated above the diaphragm. Rummel tourniquets were positioned at all of these levels around the vena cava, and around the porta hepatis and any identifiable vein entering the involved vena caval area. The Rummel tourniquets were then cinched down proximal and distal as well as around the contralateral renal vein and porta hepatis, leaving the intervening tourniquets loose. For tumors extending to the right atrium atriotomy was performed. The renal vein was then ligated divided and the kidney was removed from the operative field.

After nephrectomy and tumor thrombectomy in all patients a Foley catheter was passed up the vena cava and balloon extraction was attempted. At this point transesophageal ultrasonography did not detect any residual tumor in any of these patients. Using injectable normal saline irrigation with videoscopic monitoring a flexible 16Fr cystoscope was passed through the venacavotomy into the lumen of the vena cava. Since most if not all of the tumor thrombus had been removed, Rummel tourniquets above and below the venacavotomy kept blood loss to a minimum at the venacavotomy site.

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The cystoscope was manipulated up the vena cava using rotating Rummel tourniquets for hemostatic control until the endoscope reached the right atrium. This process involved advancing the endoscope approximately 3 to 5 cm at a time and tightening the Rummel tourniquets just proximal and just distal to the endoscope until finally the right atrium was entered. Visualization is surprisingly good with this technique because there is minimal bleeding in the segment controlled by the tourniquets. During venacavoscopy the hepatic veins can, indeed, be visualized and inspected for residual tumor thrombus.

Residual tumor thrombus was manipulated endoscopically or manually until it could be removed (figs. 1 and 2). The average amount of saline used for irrigation was 440 cc (range 215 to 695). Interestingly all residual tumor thrombi were not visualized on real-time transesophageal ultrasonography.

Patient charts were reviewed to determine biographical characteristics, followup, tumor stage, venacavoscopy time, residual tumor in the IVC, estimated blood loss, presence of disease, survival and complications attributable to venacavoscopy.

RESULTS

Table 1 lists the results. There were no intraoperative deaths. Average patient age was 67 years (range 57 to 77) at diagnosis. Venacavoscopy required an average of 5.7 minutes (range 3 to 9) and mean EBL was 1,170 cc (range 700 to 2,200). No significant blood loss (5 to 10 cc) could be attributed to venacavoscopy alone. Five of the 7 patients (71%) were alive at an average 16.4-months followup (range 10 to 27). Two patients died after 14 and 27 months, respectively. No patient had postoperative pulmonary embolus and 1 experienced acalculous cholecystitis.

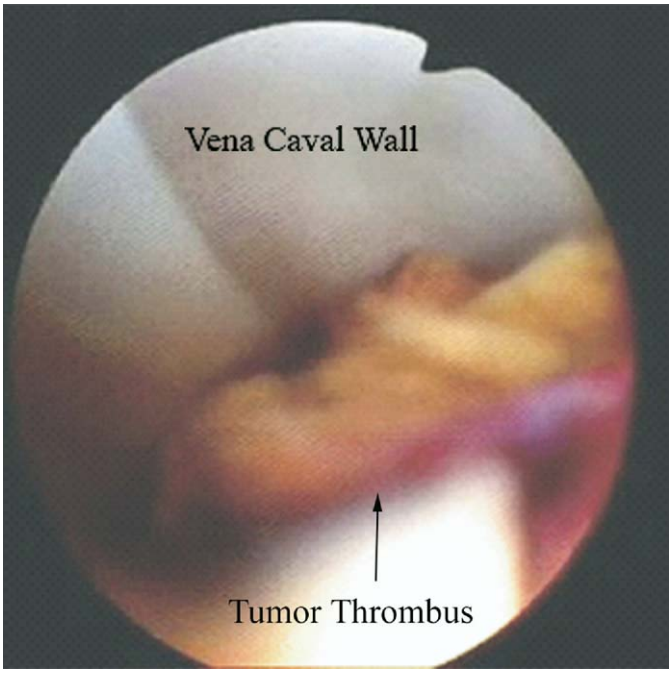

FIG. 1. Cystoscopy reveals residual tumor thrombus (arrow) in IVC just above diaphragm.

FIG. 2. Tumor thrombus removed with open thrombectomy (top) and additional tumor thrombus identified on venacavoscopy.

DISCUSSION

Malignancies of the kidney affect approximately 36,160 patients yearly and about 12,660 die annually of these cancers in the United States.[3] Renal cell carcinoma represents most of these cases and approximately 4% to 10% have extension into the IVC at presentation.[4–6] Multiple studies have confirmed that a 5-year survival rate in the range of 30% to 50% can be achieved with aggressive surgical management, possibly with the addition of immunotherapy.[2,7] The level of thrombus in the IVC at presentation does not affect outcomes but these patients have a poorer prognosis than those presenting with only renal vein thrombus.[2,8]

Techniques to remove inferior vena caval thrombus have evolved in the last 2 decades.[9] These techniques focus on minimizing blood loss and controlling the thrombus, especially when there is more extensive thrombus. Marshall et al described circulatory arrest, temporary exsanguination and hypothermia, which provide a bloodless field and allow time to complete the procedure.[10] This procedure carries a risk of neurological outcome, and many anesthesiologists and cardiothoracic surgeons prefer to avoid this technique.[11]

Recently groups described techniques that do not require circulatory arrest.[12] They involve liver transplant techniques to fully mobilize the liver and control the hepatic and portal vessels, and IVC. Venovenous bypass or cardiopulmonary bypass can also be used if necessary based on the level of the vena caval thrombus.[1,13] These techniques advocate the intraoperative use of transesoph-