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EDITORIAL COMMENT

We commend the authors on the publication of this large series of robotic partial nephrectomy using the early unclamping technique. This retrospective study presents a single center experience of 463 patients over a 9-year period with an impressive cohort and range of tumor complexities. The manuscript pays special attention to operative, perioperative outcomes, and complications, specifically pseudoaneurysm and urine leak which are of particular concern after this procedure. Patients had a minimum follow-up time of 30 days, which should be adequate to detect pseudoaneurysm and urine leak. Though these complications are rare they typically present within this time frame. The authors hypothesize that early unclamping reduces rates of pseudoaneurysm by facilitating identification of arteries that otherwise may have been concealed by completing the renorrhaphy prior to unclamping.

Pseudoaneurysm occurs when an artery wall is injured and the vessel bleeds into a potential space. These lesions are weak, unstable, and have a potential for life-threatening hemorrhage that can be devastating if not recognized and managed urgently. Partial nephrectomy creates the perfect scenario for development of pseudoaneurysm by exposing vessels during tumor resection, likely on occasion creating sidewall branch arterial injuries, then rapidly reapproximating the renal parenchyma with fairly imprecise sutures. Every needle pass thrown to achieve immediate hemostasis is a potential source of arterial injury and delayed hemorrhage. Unanswered questions remain about pseudoaneurysms and their pathophysiology – why are they so rare? Why are they painful at presentation? Why do patients typically develop hematuria as the high pressure blood finds its way into the collecting system – is this a testament to the nature of the repair or directly related to the pathology of the complication?

Though this series detected no symptomatic pseudoaneurysms over their follow-up period, we would caution attributing this to the use of early unclamping technique. After all, once the clamps are released, suturing continues until hemostasis is assured, and one might even expect pseudoaneurysm rates to be higher, given more sutures are thrown in the defect compared to fully clamped renorrhaphy. There are a number of other factors that may have contributed to this favorable finding including the surgeons being fellowship trained, experienced assistants, and avoidance of bolsters, which could otherwise contribute to dead space when the bolster breaks down and a false sense of security. If we are interested in investigating pseudoaneurysm and urine leak rates, studies should ideally be randomized and patients should be screened for the outcome. However, since it would require over 5700 patients to detect a 50% reduction in this rare complication, perhaps our efforts are better spent elsewhere.

This study shows that early unclamping is safe in experienced hands with immediate and delayed complication rates that are comparable to standard methods. We look forward to seeing this group's data on long-term renal functional outcomes, which is the primary goal of reducing ischemic time.

AUTHOR REPLY

We would like to thank the reviewers for their insightful comments. In our experience, we have reported low rates of pseudoaneurysm (PA) and urine leak after robotic partial nephrectomy utilizing the early unclamping (EU) technique. We agree that good surgical technique, experience of the surgeon and team, and elimination of bolsters are contributing factors that minimize complications. However in our opinion, the EU technique as described is the main difference here, not surgeon experience. The other series of partial nephrectomy discussed in our manuscript come from very accomplished surgeons, yet PA and urine leak still occurred, perhaps due to technique.

We also agree that the pathophysiology of PA is not completely understood. Vessels that bleed may favor the path of least resistance – the renorrhaphy bed and any violated collecting system that has been inadequately repaired – causing blood to enter this space, resulting in hematuria. Whatever the cause, PA should be exceedingly rare using a properly performed EU approach, even early in one's experience. In our opinion, as discussed in the manuscript, direct control of arterial bleeding prior to renorrhaphy, and direct repair of the collecting system during suturing of the resection bed are the most important factors preventing PA formation and urine leak.

We also acknowledge that additional suturing during EU could theoretically cause further vessel injury. There is no evidence however that the EU technique uses more suturing than other techniques. In fact, there may be fewer overall sutures used as we do not oversew venous bleeders, only arterial bleeding. Furthermore, using the robotic bipolar device to control individual segmental vessels during resection may be helpful. In our opinion the EU approach is more straightforward than superselective clamping or “off-clamp” partial nephrectomy, allowing both for low complication rates and a short warm ischemia time (WIT). Although renal functional outcomes were not the focus of this particular study, shorter WIT is still an important modifiable risk factor for kidney injury during partial nephrectomy and efforts to safely minimize WIT should continue.

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