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Temporary segmental renal artery occlusion using reverse phase polymer for bloodless robotic partial nephrectomy

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Purpose: Renal vascular clamping with ensuing warm ischemia is typically needed during robotic or laparoscopic partial nephrectomy. We developed a technique for angiographic delivery of the novel intra-arterial reverse thermoplastic polymer LeGoo-XL that allows temporary selective vascular occlusion with normal perfusion of the remaining kidney.

Materials and Methods: Eight pigs underwent a total of 16 selective angiographic occlusions of the lower pole segmental artery using gel polymer. The technical feasibility of 2 hemostatic techniques, perfusion hemostasis and local plug formation, was assessed in 4 pigs each. Selective ischemia time was recorded and the vascular occlusion site was noted radiographically and laparoscopically. The feasibility of reversing the polymer from solid back to liquid state to allow reperfusion was determined. Pathological analysis of the kidney was completed in these acute model pigs. In the last 2 cases lower pole robotic partial nephrectomy was done using the da Vinci surgical system.

Results: Selective lower pole ischemia was achieved in all 8 cases. Perfusion hemostasis yielded an inconsistent duration of occlusion (zero to greater than 60 minutes). Vascular occlusion time using local plug formation was more reliable (17 to 30 minutes) with consistent ability to reverse the plug to liquid state by cold saline flush. Two lower pole robotic partial nephrectomies were completed with minimal blood loss.

Conclusions: We developed a reliable technique of angiographic delivery of gel polymer for temporary vascular occlusion of selective renal artery branches using local plug formation. Ongoing studies are under way to assess technique consistency and the long-term effects of the polymer.

Editorial Comment

This is an interesting experimental study in pigs, on which the authors tested the intra-arterial injection of reverse thermoplastic polymer LeGoo-XL that allows temporary selective vascular occlusion. The polymer was used with the intend of facilitate hemostasis for laparoscopic partial nephrectomy of the lower (caudal) pole. The perfusion hemostasis was not reliable in achieving occlusion while when using a local plug formation for hemostasis the results were consistent, with occlusion time from 13 to 30 minutes. The authors performed 2 robotic partial nephrectomies and concluded that the technique allowed minimal blood loss. Nevertheless, the authors did not take into account previous studies on intra-renal anatomy in pigs. While the collecting system anatomy is very similar to that of humans (1), the arterial (2) and venous (3) intra-renal anatomy in pigs is different from that of humans in many aspects that would be interesting to be discussed. Also, there are many important differences in the upper and lower pole vascular anatomy, being the upper pole vessels much more complex in distribution. Although we cannot transpose the results to clinical setting, the study opened new avenue to enhance the possibility of partial nephrectomy.

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Sildenafil as a protecting drug for warm ischemic kidney transplants: experimental results

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Purpose: In an experimental model we studied the protective effects of the phosphodiesterase-5 inhibitor sildenafil on kidney grafts autotransplanted after 45 minutes of warm ischemia by vascular clamping, nephrectomy and 60 minutes of isolated hypothermic pump perfusion.