ROBOTIC PARTIAL NEPHRECTOMY

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Recently, there has been increased incidental radiologic detection of small renal tumours[1]. Historically their biologic natural history is 60–70% malignant (renal cell carcinoma) and 30–40% benign (angiomyolipoma, oncocytoma)[1]. Their nature may be further elucidated by MRI scan, or renal biopsy. In a medically well patient the gold standard would be surgical excision. Otherwise observation and surveillance is initially suitable with intervention dependent on growth rate. The traditional open flank incision is morbid in that there can be chronic wound pain from nerve injury or wound bulge, notwithstanding the inpatient stay of at least 7–10 days for analgaesic reasons.

Laparoscopic partial nephrectomy is technically demanding because laparoscopic suturing is difficult. Also, visualisation via the assistant holding the camera, which is not completely still, and who may also be required to use suction at the same time through a separate port – makes the procedure less than satisfactory. It has been shown that for pT1a lesions (<4cm in diameter), long term oncologic outcomes for partial nephrectomy are comparable to radical nephrectomy, with the added benefit of renal mass/glomerular preservation[2].

Robotic-assisted partial nephrectomy has the key advantage of improved dexterity for suturing during renorraphy. Other advantages are improved vision with camera stillness, and tremor filtration. Possible disadvantages include lack of tactile feedback, and a psychological sense of surgeon discomfort given he is not operating at the patient's bedside, and is removed from the patient whilst inside the robotic viewing console. This is most concerning during renal hilar dissection of the renal vein and artery. This is why the bedside assistant surgeon must be familiar and experienced with the procedure.

Experienced robotic teams are able to produce good outcomes.These outcomes include: median warm ischaemic time (WIT) <30 min. (should be closer to 20 min.), positive surgical margin rate <5 – 8%, estimated blood loss <300 mL., total operative time <120 – 180 min., Clavien grade I-III overall complication rate <15% (which includes angio-embolisation for post-operative renal bleeding or urine leak)[3]. The medium to long term post-operative serum creatinine and eGFR should not change by much more than a slight deterioration[3].

Surgeon and team inexperience leads to a worsening of all the aforementioned outcomes. This also applies to cases performed within the learning curve, which is around 20 – 25 cases. In these instances it is necessary that sound proctoring and surgical assistance is available to maintain standards. It is felt that previously experienced laparoscopic surgeons have fewer learning curve problems. The use of the da Vinci surgical skills simulator has been shown to shorten the leaning curve[4].

Warm ischaemic time (WIT) relates to the period of time the renal artery is clamped during tumour excision, followed by suture reconstruction of the kidney. Longer than 30 min. is associated with long term renal filtration injury. Various renorraphy methods are described, but the overall aim is to limit WIT to 20 – 25min[5]. Haemostatic agents play a role here. These include Tisseel and/or FloSeal[5]. However the most important technique is deep followed by cortical, tamponade closure of the kidney. This includes en-mass closure of any collecting system defect. Failure to achieve tight closure will result in either or both post-operative renal bleeding or urine leak from an open collecting system.

My feeling is that at the current stage of the evolution of robotic-assisted partial nephrectomy in Sydney, patient and tumour selection is pivotal. The ideal case would be a female, not thin, even slightly overweight, with a T1a less than 4cm tumour, located either laterally or off the renal lower pole and quite exophytic, not endophytic or central, not near the hilum, not upper pole or medial, and not posterior. The reason that an overweight female is better is that the abdominal wall muscles are more pliable, and the intra-abdominal working space during pneumoperitoneum tends to be best. The lean and muscular male will tend not to distend as well and so the working space for the robotic arms can be limited. The bed side assistant should be a colleague surgeon with almost the same level of experience as the primary operator. Intra-operative ultrasound can be used in more endophytic tumours to help define surgical planes.

More complex cases can be attempted, with the understanding that the risk of bleeding and or urine leak are higher[3]. Also the conversion to open rate is higher, and of course the positive surgical margins rates are higher in direct proportion to increasing tumour size, and increasing tumour complexity as per the R.E.N.A.L. scoring system[3].

References available on request.

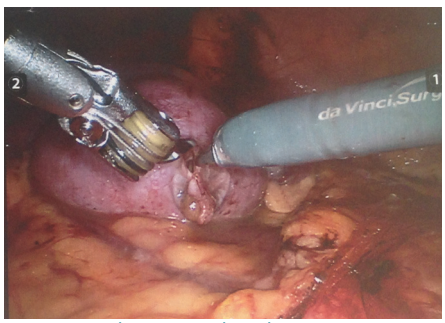

Figure 1: Robotic partial nephrectomy: Excision of lower pole benign renal cyst.

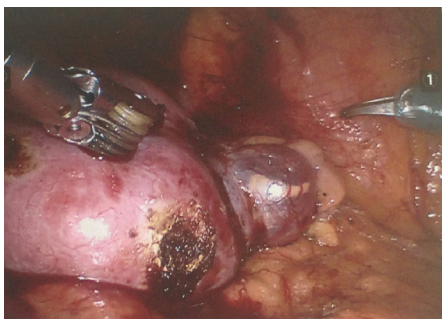

Figure 2: Robotic partial nephrectomy: Cauterised renal cyst (foreground) and cystic/solid exophytic lower pole renal tumour (background).

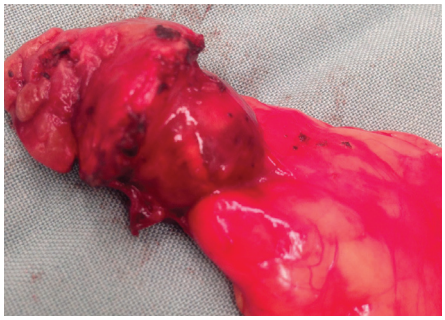

Figure 3: Renal cell carcinoma, pT1a clear cell Fuhrman grade 2, negative surgical margins by 6mm, overlying Gerota's fat attached, (by robotic excision).