Percutaneous hook wire assistance during laparoscopic excision of an intrarenal mass

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ABSTRACT

Completely endophytic renal tumours pose challenges in laparoscopic nephron-sparing tumour excisions, with the use of intraoperative imaging techniques (e.g. ultrasound) being crucial when managing such tumours. The use of a percutaneous hookwire for tumour localisations are in use in several other surgical fields, such as breast surgery. An asymptomatic 52-year-old man presented with an incidental small right sided solid 33-mm interpolar renal mass identified on computed tomography. A guided insertion of a percutaneous localisation wire was carried out prior to a laparoscopic partial nephrectomy to assist in intraoperative tumour landmark/margins identification. Operative time was 210 minutes with zero ischaemia time, with an estimated blood loss of 200 ml. No perioperative complications were observed and the patient was discharged two days postoperatively. Histology revealed the mass to be a Fuhrman grade 2 clear-cell carcinoma with a 2-mm clear surgical margin. The patient remained free of recurrence at 16 months of follow-up. We have reported our first experience of wire localisation prior to laparoscopic partial nephrectomy for an intrarenal mass, which to our knowledge could be the first of its kind in renal surgery. Percutaneous wire localisation of endophytic renal tumours is potentially safe and effective and can allow nephron-sparing surgery where laparoscopic ultrasound is not available. Longer-term and further evidence should be encouraged.

KEYWORDS

Wire localisation – Laparoscopic surgery – Partial nephrectomy – Endophytic renal mass – Intrarenal mass

Accepted 23 February 2019

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Introduction

It is reported that up to 50% of renal tumours are 'incidentalomas' found on radiological examinations carried out for other reasons. These incidentalomas tend to be small and amenable to nephron-sparing surgery. Small and completely endophytic renal tumours pose some difficulties in laparoscopic nephron-sparing tumour excision.¹ There are numerous technology-enhanced methods for tumour localisation in many surgical specialties. Localisation techniques include intraoperative ultrasound and the use of firefly in robotic surgery. The long-established hookwire assistance has an undisputed popularity in breast, lung and liver surgery.^{2–4} In breast surgery, wire localisation is a more popular technique favoured by the more accessible anatomical position of the breast and the reduced vascularity compared with the kidney. We report our experience with adapting the wire localisation principle in an endophytic renal tumour prior to laparoscopic zero-ischaemia partial

nephrectomy. To our knowledge, this is the first case of wire localisation for renal tumour reported in the medical literature.

Case history

A 52-year-old man presented with an incidental right-sided small solid renal mass. Computed tomography (CT) confirmed a 33-mm interpolar anterior renal mass with vascular enhancement in an entirely intrarenal position. A dimercaptosuccinic acid (DMSA) renogram showed a 56% split renal function on the affected right side. The patient opted for a laparoscopic partial nephrectomy. In view of the radiologically predictable difficulty in intraoperative tumour localisation without laparoscopic ultrasound, a CT-guided insertion of a localisation wire was carried out on the morning of the surgery (Fig 1).

The patient was anaesthetised and positioned in the left semi-recumbent lateral position as for laparoscopic transperitoneal renal surgery. One 12-mm and two 5-mm ports

Figure 1 The barbed localisation wire was inserted under computed tomography guidance to the centre of the tumour as seen in axial (A) and coronal (B) views.

were introduced and a 10-mmHg pneumoperitoneum was achieved. The Freehand™ robotic camera holder was used to navigate the laparoscope. The perinephric fat was dissected free and no visible tumour was identifiable. However, the presence of the wire allowed for clear access to the tumour site. A ruler placed on to the capsule allowed the capsule to be marked thus circumscribing the planned excision zone.⁵ A modified Rumel tourniquet was placed around the renal artery and hilar dissection and selective ligation of the tumour-feeding vessel was carried out with 3/0 vicryl. The capsule was incised using a Thunderbeat® system as planned. When full capsular circumcison was achieved the tumour partly popped up. The wire, which was attracted into the abdomen, was of moderate hindrance, largely compensated by its ability to help in lifting the tumour off its renal bed. A zero-ischemia tumour excision was achieved using energy based scalpel as per Grange-Mignot no-clamp technique.⁶ The specimen was immediately retrieved and its margins assessed (Fig 2). Renorrhaphy was carried out using 0' Vicryl. A 14-Fr drain was left in place.

The operative time was 210 minutes, warm ischaemic time was zero, and estimated blood loss was 200 ml. The patient made an uneventful recovery and was discharged home on the second postoperative day. No complications were recorded at 30 days on the Clavien–Dindo classification. The histology revealed a 35-mm Fuhrman grade 2 clear-cell carcinoma with 2-mm clear surgical margins.

The patient was free of recurrence at 16 months of follow-up. His postoperative serum creatinine remained within the normal range.

Discussion

Intraoperative tumour localisation in organ-preserving surgery can be challenging with small and endophytic tumours. In renal surgery, intraoperative endophytic tumour localisation may be achieved with laparoscopic ultrasound. This facility may not be available, as is the case in our institution and in several hospitals throughout Europe and the developing world. There is a paucity of other techniques reported in the literature for

Figure 2 The excised specimen was divided in the centre after extraction to ensure that the entirety of tumour was excised with intact margins.

intraoperative renal tumour localisation during laparoscopic nephron-sparing surgery.

In robotic surgery, there is an integrated fluorescence imaging technology with the latest XI DaVinci® system (Intuitive Surgical). A green dye is administered intravenously; it binds plasma proteins and under the robotic fluoroscopic camera it shows up 'firefly green'.⁷ This differentiates between cancerous and healthy tissue. In breast surgery, radioactive localisation has been reported. The radioactive seed technique involves loading titanium seeds with radioactive I-125; the seeds are then deployed into the sonographically detected lesion with an 18-gauge needle. Up to five days later, a hand-held gamma probe is used to show the skin site directly over the lesion. This technique has some advantages over the more widely reported and used wire localisation technique but it is bounded by the strict legislations of radioactivity. Magnetic marker localisation is a more recently reported technique in breast surgery, where a rice grain sized magnetic cylinder is implanted in the tumour and using a magnetic detection platform the tumour can be identified.⁸

Wire localisation remains the most widely reported technique in breast, liver and lung surgery. We have found one previous report of wire localisation for the laparoscopic excision of a retroperitoneal mass, but the use of wire localisation has not been reported in renal surgery.⁹ We adopted the concept in renal surgery. The introduction of the wire was carried out just before the surgery to minimise the potential risk of wire migration, one of the pitfalls of this technique. The tip of the wire is hooked to further minimise migration, and was placed at the deepest margin of the tumour to enable intraoperative decision on the completeness of the excision. We were impressed with

how stable the position of the wire was; despite the necessary extensive kidney mobilisation the wire maintained its initial position.

There is no evidence in the literature to judge the usefulness, effectiveness and safety of wire localisation of tumour in nephron-sparing surgery. Evidence from breast and video-assisted thoracic surgery suggest that it is an effective and useful technique. Our limited practical experience with this single case supports the same conclusion.

Regarding the safety of the technique, we can only extrapolate the published evidence from renal tumour biopsies and ablative techniques. The reported risk of bleeding is very low and the risk of seeding appears to be negligible in recent literature.^{10,11} In our case, the tumour could have also been treated using percutaneous ablative techniques such as cryotherapy; however, the patient opted for a surgical excision over these methods.

Another observation is that deep intrarenal tumours are less challenging than expected provided that the initial renal capsular and cortical incision circumscribe completely the lesion. In the absence of clamping, the tumour partly 'pops up' under the pressure of the perfused parenchyma. The presence of a localisation wire allows for an extra gentle 'lift' of the tumour and facilitates the tumour excision.

Can percutaneous wire localisation replace the use of intraoperative laparoscopic ultrasound? The laparoscopic ultrasound scan comes from the sonar that echo locates underwater objects, while the radiologist with his wire hook relates to our ancestors harpooning a large prey. Considering the unbalanced clinical evidence of our single case experience in localisation wire compared with the over 15 years of laparoscopic ultrasound-guided partial nephrectomy, we do not see the technique competing, but rather complementing this technique, to enable all patients with small endophytic renal tumours to be offered the best treatment for minimally invasive partial nephrectomy in all clinical settings. Where both options are available, the laparoscopic ultrasound localisation technique should be preferred as it is the non-invasive option.

Conclusions

We have reported our first experience of wire localisation prior to laparoscopic partial nephrectomy for an intrarenal mass, which to our knowledge could be the first of its kind in renal surgery. Percutaneous wire localisation of endophytic renal tumours is safe and effective and can allow nephron-sparing surgery where laparoscopic ultrasound is not available. Longer-term and further evidence should be encouraged.

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