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1: Numerical model to optimise the angle of approach in shock wave lithotripsy for renal stones

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Introduction: In shock wave lithotripsy, the energy incident on the stone can be blocked by features such as bone and air. The aim of this study was therefore to use a computational model to investigate the effect of altering the angle of approach on the shock wave that arrives at the stone.

Materials and methods: Anonymised computed tomography data from 56 pre-shock wave lithotripsy renal stone patients were used as the basis for computer models onto which shock wave cones comprising 170 individual rays were super-imposed. Shock wave cones were focused onto renal stones in the computed tomography images and then systematically swept through angles in both the cranio-caudal and lateral directions. For each shock wave position two parameters were calculated: (a) mean focal amplitude and (b) standard deviation of ray arrival time.

Results: Compared to a perpendicular approach, optimisation of angle of approach increased the mean focal amplitude by 15% ($p < 0.005$) and decreased standard deviation of arrival time from 1.24 μs to 0.63 μs ($p < 0.005$). Maximum mean focal amplitude occurred at an angle of approach of 30° lateral and 10° caudal to the perpendicular. Minimum standard deviation of arrival time occurred at an angle of approach of 50° lateral and 10° caudal to the perpendicular.

Conclusions: Optimisation of the angle of approach in shock wave lithotripsy improved modelled shock wave

focal amplitude and synchrony of arrival at stones which should result in better fragmentation.

Conflicting interests

The authors declare that there is no conflict of interest.

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2: Laparoscopic metastasectomy for local recurrences: A durable procedure in experienced hands

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Introduction: Excision of solitary distant metastases following radical nephrectomy for renal cell carcinoma appears to prolong patients' survival in small non-randomised cohorts. The evidence in management of localised recurrences is limited. Pure laparoscopic metastasectomy in those is challenging and to our knowledge has never been reported before. We describe our centre's experience in this procedure.

Methods: We retrospectively reviewed the laparoscopic excisions of local renal cell carcinoma recurrences. Clinical parameters were reviewed through our electronic Patient Pathway Management system. Data was collated for demographics, tumours' histopathological characteristics and oncological outcomes.

Results: Of fourteen patients (seven males, seven females, median age: 53 years), all but two patients had high risk renal cell carcinoma. Metastasis was detected between

three months to 10 years post nephrectomy. The excised tissue showed renal cell carcinoma metastasis in 11 patients (10 negative margins) and reactive node in one case. One patient had exploration and no lump was excised; he subsequently progressed and started on systemic treatment four months later. One patient had excision of a benign lump; further imaging showed persistent disease and had subsequent open resection. There was minimal morbidity with only one Clavien-Dindo IIIb complication (postoperative laparotomy for bowel obstruction). In median follow-up of seven months (1–80) post metastasectomy, one patient developed further local recurrence (on surveillance) and seven patients distant metastases respectively. Six of them died (five from metastases, one unknown); most died within 24 months, one 80 months later. Six patients have no recurrent disease.

Conclusion: Laparoscopic excision of local renal cell carcinoma recurrence, although challenging, is a valid treatment option in high volumes centres.

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3: Can ureterolysis provide optimal management of ureteric obstruction caused by retroperitoneal fibrosis?

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Introduction: Controversy exists around the best management of ureteric obstruction caused by retroperitoneal fibrosis. Ureteric stents are commonly used but do they provide optimal relief of obstruction? How can alternative management in the form of ureterolysis with omental wrap compare?

Patients and methods: Altogether 135 patients were managed through our retroperitoneal fibrosis service between January 2012–March 2016. Fifty patients out of 135 (37%) underwent ureterolysis. Data was collected prospectively.

Results: Fifty patients underwent ureterolysis. Median time with stent prior to ureterolysis: 3.2 years (4 months–10.4 years), 41/50 (82%) complained of stent symptoms, 14/50 (26%) patients had <30% function in one kidney on DMSA. Unilateral 7/50 (14%), bilateral 43/50 (86%). Indication: stent failure 26/50 (55%). Stent symptoms 19/50 (35%), nephrostomy dependent 3/50 (6%), primary 2/50 (4%). Forty-five out of 50 (90%) procedures were open, 5/50 (10%) robotic-assisted. Additional procedures:

11/48 (22%) including nephrectomy for non-function (seven), ureteric reconstruction (three) and AAA repair (one). Median operative time: 3.2 h (2–5.5), median blood loss: 390 ml (20–1200), median length of stay: six days (2–21). Complications: no Clavien V; 7/50 (14%) Clavien III or IV. Median follow up: 25 months (3–47), 48/50 (96%) remain stent-free post-ureterolysis, 41/50 (82%) had improvement in eGFR post-ureterolysis compared to eGFR with stents in situ – median improvement 8 ml/kg/m² (range 2–38). Twenty-two out of 50 (44%) had ≥15% improvement in GFR. No ureters treated by ureterolysis have re-obstructed from retroperitoneal fibrosis.

Conclusions: Whilst ureterolysis can be challenging it appears to provide optimal relief of obstruction and thereby better renal function than ureteric stents; it also allows patients the opportunity to be free of stents, stent symptoms and stent changes.

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4: Revision laparoscopic pyeloplasty is the preferred management for post-pyeloplasty PUJ obstruction

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Introduction: A previous audit at our institution showed revision laparoscopic pyeloplasty to be superior to endopyelotomy for the treatment of recurrent PUJ obstruction (success rate 96% vs 71%). All patients with post-pyeloplasty PUJ obstruction are now considered in the first instance for revision laparoscopic pyeloplasty. We present the re-audit of revision laparoscopic pyeloplasty outcomes at our institution.

Patients and methods: We retrospectively analysed our database of patients who have undergone revision laparoscopic pyeloplasty for post-pyeloplasty PUJ obstruction.

Results: Between 2008–2015, 22 (11 female: 11 male) patients with a history of failed pyeloplasty had a revision laparoscopic pyeloplasty with at least 12 months follow-up. Median age 39 years (17–68). All patients had a transperitoneal, dismembered pyeloplasty. Mean operative time=215 min. Median length of stay=2 days (1–11). Post-operative complication (Clavien-Dindo 3) was observed in 2/22 (9.1%) patients. No patient required conversion. Median follow-up=50.5 months (13–91). 18/22 (success rate 82%) patients did not require any further intervention. Those

patients who required further intervention were more likely to have an intra-renal pelvis. Median time for failure following revision laparoscopic pyeloplasty was 10.5 months (3–22).

Conclusion: Revision laparoscopic pyeloplasty is a safe and effective treatment for post-pyeloplasty, recurrent PUJ obstruction. We suggest that revision laparoscopic pyeloplasty should be the preferred treatment for all patients with an extra renal pelvis on pre-operative imaging. Patients with an intra-renal pelvis may be better served by endopyelotomy. Due to its greater complexity and relative low frequency, we suggest revision laparoscopic pyeloplasty should be performed in high volume centres.

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5: The impact of obesity on percutaneous nephrolithotomy outcome: Analysis of a UK national database

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Introduction: There is an obesity epidemic in the Western world. The objective of this study was to investigate whether obesity affected percutaneous nephrolithotomy outcome.

Patients and methods: Data submitted to a national registry between 2010–2015 were analysed according to body mass index. We evaluated patient demographics and outcomes including complications and stone free rate.

Result: Body mass index was recorded for 3439 (48.6%) of 7062 procedures. Of these, 2538 patients (74%) were either overweight (35%) or obese (39%) and only 802 (23.4%) had a normal body weight ($18.5 \leq$ body mass index < 25). Two-thirds of patients of normal weight had no comorbidity (Charlson score 0) but this fell to only half (51%) of those who were obese. Rates of failed access (about 1%) and abandonment of procedure (about 5%) appeared independent of body mass index. Intraoperative complications were commonest in obese patients compared to other body mass index groups combined (8.3% vs 6.4%, $p=0.04$) and there was a non-significant trend to higher post-operative complication rate (19.8% vs 15.8%, $p=0.08$). Fever/sepsis rate was higher in obese patients (15.0% vs 12.4%, $p=0.04$) but transfusion rate was not (2.2 vs 2.8%, $p=0.32$). Stone free rate was not significantly

lower in obese patients compared to the other body mass index groups (69.7% vs 72.9%, $p=0.07$).

Conclusion: About three-quarters of patients having percutaneous nephrolithotomy in the UK are clinically overweight or obese (body mass index ≥ 25) and this was associated with greater comorbidity. Stone-free rates were comparable in all groups and the complication rate was only slightly higher in obese patients.

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6: Assessing the volume-outcome relationship for percutaneous nephrolithotomy in 2014 and 2015 – analysis using British Association of Urological Surgeons registry data of over 4000 cases

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Introduction: This study aims to investigate the relationship between surgeon case volume and outcomes after percutaneous nephrolithotomy within the UK.

Patients and methods: The study used data from the British Association of Urological Surgeons registry, a mandatory database which records information on all percutaneous nephrolithotomies performed, for 2014 and 2015. Details were retrieved from the highest quartile volume surgeons and compared to the lowest quartile volume surgeons. A series of comparisons of outcomes was then made between the 'high volume' and the 'low volume' groups. These outcomes included clearance on imaging at day one, blood transfusion, sepsis, complications and post-operative length of stay. These comparisons were made for all stones according to their Guys Stone Score complexity, graded from 1–4. Comparisons were carried out using Fisher's exact test.

Results: Altogether 4035 percutaneous nephrolithotomies were recorded. Those surgeons in the lower quartile performed five and four percutaneous nephrolithotomies or less in 2014 and 2015 respectively, and those in the upper quartile performed over 18 and 17 in the same time frame. Overall stone clearance, by imaging at day one, was higher in the higher volume surgeons for Guys Stone Score 1 (93% vs 80%, $p=0.01$), 2 (74% vs 63%, $p=0.01$), 3 (66% vs 50%) and 4 stones (37% vs 35%, $p=0.41$), although not significantly for the latter. There was no difference in post-operative transfusion rates or sepsis. Complication

rates were higher for lower volume surgeons (9.6% vs 4.7%, $p=0.009$).

Conclusion: Lower volume surgeons have higher complication rates and lower stone-free rates after percutaneous nephrolithotomy.

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7: Developing a renal stone patient-reported outcome measure: Stages 1, 2 and 3

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Introduction: Outcomes from surgery have traditionally been based on surgeon-reported outcomes. A paradigm shift in assessing healthcare productivity from output to qualitative outcome has led to increased interest in patient-reported outcome measures. Our project aims to develop a disease-specific renal calculus patient-reported outcome measure. Here we present the first, second and third stages of this study.

Methods: Stage 1: patient input and generation of patient-reported outcome measure content. Patients with radiologically proven renal calculi who had undergone a range of management options were invited to participate in focus groups or semi-structured interviews, until saturation was reached and no further themes identified. All comments were transcribed, collated and recurring themes were identified. Stage 2: drafting and item selection for the renal stone-specific patient-reported outcome measure. Stage 3: refine, reduce and validate with further patient input. Our study has HSC REC approval.

Result: A total of 36 patients participated in four focus groups and 22 semi-structured interviews. Major issues reported and number of items selected for the patient-reported outcome measures included pain (four), anxiety (four), limitations to social life and tiredness (four), urinary symptoms (three), dietary change impacts (three) and gastrointestinal symptoms (one).

Conclusion: Although pain was the most frequent symptom, other health-related and social well-being issues significantly impacted the patients' lives. Following completion of Stages 1, 2 and 3 we are proceeding to reproducibility, responsiveness and test-retest validation in a pilot study with the EQ5DL (Stage 4). We will progress to use our disease-specific renal calculus patient-reported outcome

measure to prospectively evaluate outcomes in renal calculus therapy.

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8: Analysis of factors influencing stone-free rate in over 1000 flexible ureterorenoscopies

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Introduction: Flexible ureterorenoscopy is used increasingly in the management of renal calculi. This study assesses the influence of stone size, location, flexible ureterorenoscope type (analogue vs digital) and stone density on outcome.

Patients and methods: This study involved retrospective analysis of all patients undergoing a flexible ureterorenoscopy and Holmium laser lithotripsy between 2002–2015 in a single UK centre. Single-treatment success was defined as satisfactory visual clearance of stone bulk, radiopacities <2 mm on computed tomography, and no further treatment.

Results: Altogether 1086 treatments were performed on 835 patients, median age=56 years.

When stratified by stone size, single treatment success was 96% (<5 mm), 90% (5–10 mm), 89% (11–15 mm), 81% (16–20 mm), 66% (21–30 mm) and 29% (>30 mm), and overall of 89.5% in <20 mm. Of 94 patients with stone size 21–30 mm, 86 (91.5%) were stone-free after their second flexible ureterorenoscopy. In stones >30 mm repeated flexible ureterorenoscopy achieved 69.4% stone-free rate. Single treatment success rates according to location were 86.5% (lower pole), 91.9% (mid pole), 81% (upper pole), 79.5% (renal pelvis) and 78% (caliceal diverticula) respectively. The introduction of digital flexible ureterorenoscope in 2009 did not significantly change the stone-free rate (91% for analogue versus 91.5% for digital). The Hounsfield unit density of the stone, measured by preoperative computed tomography scan, revealed stone-free rates in <1000 versus >1000 Hounsfield units were not statistically different ($p=0.248$, chi-square test).

Conclusion: Stone clearance of nearly 90% can be achieved for stones <20 mm, and with two procedures similar success in up to 30 mm. Stone density, digital technology and stone location do not significantly influence outcome.

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9: Percutaneous nephrostomy in malignant ureteric obstruction: Who benefits?

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Introduction: Percutaneous nephrostomy for malignant ureteric obstruction is a common method of urinary diversion. There are no clear guidelines/selection criteria to guide decision-making; particularly in recurrent/advanced disease. Watkinson et al. stratified patients into four groups. We carried out a retrospective study to identify survival benefit following percutaneous nephrostomy and morbidity.

Methods: Altogether 86 patients were identified (55 male, 31 female) undergoing percutaneous nephrostomy in a single centre, median age of 74 years. Groups were defined as per Watkinson et al. – Group I: non-malignant complication from previous surgery/radiotherapy (14 patients), Group II: untreated primary (20), Group III: relapsed disease viable treatment option (28) and Group IV: relapsed disease no treatment option (24). The most common primary tumour was of the bladder (34%). Of the patients, 57% were inserted as an emergency (sepsis 34%, AKI/hyperkalaemia 57%).

Results: Median survival post- percutaneous nephrostomy was 35.5 days in Group IV versus 212 and 207.5 in Groups II and III. One-year survival was zero in Group IV, 14 (20%) in Group II, four (16%) in Group III. Of Group IV patients, 76% had nephrostomies *in situ* at death (6% Group I, 10% Group II, 50% Group III). Twenty-six patients required readmission for percutaneous nephrostomy complications with a median of five days in hospital.

Conclusions: Group IV patients have significantly shorter overall survival compared to Groups I–III. Group IV patients spent 19.7% of time before death in hospital due to complications vs 2.4% and 0.6% in Groups II and III. The decision for percutaneous nephrostomy must consider the stage of malignancy, further treatment options, comorbidities and potential impact on quality of life.

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I0: A third-party independent retrospective review of the use of Memokath stents to manage ureteric strictures in a high-volume tertiary referral centre

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Introduction: Ureteric stricture management may be conservative, involve ureteric stents, metallic stents or endoscopic or reconstructive surgery. DJ stents can be effective, but can cause storage symptoms and require six-monthly prophylactic replacement. Memokath stents may be useful in patients at high risk for reconstructive surgery, and those with terminal diagnoses. Few long-term outcomes are reported.

Patients and methods: Diagnosis and management of ureteric strictures with Memokath stents, including long-term effectiveness was reviewed using electronic patient records. Outcomes included stent complications (migration/blockage), stent duration, need for stent change, salvage therapy, surgical intervention and mortality.

Results: Between 2007–2013, 100 patients aged 23–87 years (mean 57), received Memokath stents: 59% for malignant strictures, 20% were bilateral. Twenty-five patients had no complications, and 21 patients died of malignant disease (11 with their original Memokath *in situ*). Complications were migration (46%), blockage (34%), non-functional kidney (8%) and urosepsis (6%). When complications occurred, 27% had replacement Memokath with numbers ranging from 1–5 per patient. Twenty-five patients have Memokaths *in situ* (14 the original). Fifteen patients have J-J stents *in situ*, seven other stents, 12 have had major surgery, three are on dialysis and 13 have no stent.

Conclusions: This review highlights the need for careful patient selection. Some had good results: alive with Memokath *in situ* or dying of their primary pathology without need for stent change. The potential severity of complications is indicated by patients requiring major surgery. Benign strictures require radiological and endoscopic assessment before treatment. Primary reconstructive surgery should be considered before resorting to metallic stents.

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