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Research Article

Pre-operative CT for ureteric stones ≤ 7mm – reducing the negative URS rate

S. Vaggers[1*], R. Menzies-Wilson[1], S. Folkard[1], E. Balai[1], S. Runa[1], K. Atalar[1], B. Berry[1], C. Bastianpillai[1], S. Graham[1], P. Pal[1]

1* Department Of Urology Whipps Cross University Hospital, United Kingdom

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Objective:
Patients with ureteric stones can pass their stones before their ureteroscopy (URS) resulting in a negative URS. We introduced pre-operative CT KUBs for patients listed for URS for a ureteric stone with the aim of reducing the negative URS rate. We also measured the radiation dose of the CT KUBs and URSs.
Methods:
We retrospectively audited all patients with ureteric stones listed for an elective URS across three audit periods. We recorded whether they had a CT KUB within one week of surgery and the result of this CT KUB and whether they had a negative URS.
Results:
Our audit returned a total of 108 patients across three audit periods. The rate of spontaneous stone passage was significantly higher for stones ≤7mm (30.99%) compared for stones >7mm (8.11%) (p=0.0079). Over the study period the use of pre-operative CT KUB within one week of surgery for stones <7mm increased from 16.67% to 50%. At the same time the percentage of patients with a negative URS reduced from 11.9% to 4.00%. The radiation dose of a CT KUB was 9.89 mSv (SD 2.59) compared 2.82 mSv for a URS (SD 3.28) (p=<0.0001).
Conclusion:
Pre-operative CT KUB is an effective way to reduce negative URS rate. Low dose CT KUBs (<3.5mSv) are comparable to the radiation dose of a URS

Keywords: Ureteric stones,CT KUB,Imaging

INTRODUCTION

Where conservative management of a ureteric stone has failed, or is likely to fail, Ureteroscopy (URS) may be indicated to remove the stone. URS is typically performed as an elective day-case procedure and so patients listed for URS for ureteric stones often wait a number of weeks for their procedure. In this time, they will sometimes be unaware that they have passed their stone before the procedure risking an unnecessary 'negative' URS. Spontaneous passage of stones is dependent on the site and location of the stone, with the size of the stone being the most influential factor [1].

*Corresponding author. S. Vaggers, E-mail: sophie.vaggers@doctors.org.uk

A multi-centre prospective trial (MIMIC) noted the rate of spontaneous stone passage to 89% for stones less than 5mm, 49% for stones ≥5–7 mm, and 29% for stones >7 mm [2].

URS, like all operations, carry complications and so should be avoided if possible. A global study of URS found a complication rate of 7.4%, including infection, persistent haematuria, renal colic, migrated double-J stent and transitory vesicoureteral reflux, , ureteral perforation (0.65%) and ureteral avulsions (0.11%) [3]. Significant complications from anaesthesia are rare but well recognised. A meta-analysis in 2012 showed that the mortality related solely to the anaesthetic is currently 34 per million [4]. A negative URS A systematic review

showed a negative URS rate of 4 to 14% [5]. These unnecessary operations carry a risk which could result in harm to patients and could even have medico-legal consequences so some centres have introduced pre-operative low dose CT KUB for elective URS. Low dose CT KUB has a radiation dose of (<3mSv) whilst maintaining its sensitivity (99%) and specificity (94%) for diagnosing urinary tract calculi.

In this study we evaluated the effectiveness of introducing pre-operative CT KUB in reducing the negative elective URS rate. We also compare the radiation dose of a CT KUB and a negative URS to assess the safety of pre-operative CTKUBs.

MATERIALS AND METHODS

We retrospectively audited all patients with ureteric stones listed for an elective URS before and after a change in departmental policy to use pre-operative CTKUBs for elective URS operations.

The initial audit was from February 2017-September 2017. After the initial audit period of 6 months, the urology team were encouraged to book CT KUBs within one week of surgery or ideally on the day of surgery to determine if the stone had already passed. If patients had an ipsilateral renal stone which could be targeted during the URS then a pre-operative CT KUB was not necessary. Patient choice was also factored into the decision about whether to do a pre-operative CT KUB.

The first re-audit was from August 2018-February 2019. Further teaching and re-emphasis of the message was performed prior to a second re-audit from June 2019-September 2019. No patients were excluded.

All data was recorded on electronic computer records. Data retrieved included: patient's age; stone size (reported by a radiologist review of the diagnostic CT KUB); timing and results of pre-operative CT KUB; and operative findings. A negative URS was defined as neither finding a ureteric stone nor an ipsilateral renal stone amenable to intervention during the operation.

The radiation dose of all pre-operative CT KUBs and all URSs were also recorded. Continuous independent variables were tested using independent samples t test. Dichotomous data were tested using Fisher's exact test. Fisher's exact test results are displayed as p values and of t test are displayed with p values and 95% confidence intervals.

RESULTS

Our audit returned a total of 108 patients across all three audit periods (24 in the initial audit, 27 in the first re-audit and 20 in the second re-audit). The mean age was 67.49 (SD=14.49), and the mean stone size was 6.88mm (SD=2.64) and the mean size of stone passed was 5.18mm (SD=1.77). The rate of spontaneous stone passage was 30.99% for stones ≤7mm and 8.11% for stones >7mm.

The percentage of patients with ureteric stones ≤7mm receiving a pre-operative CT KUB within one week increased from 16.67% to 50% over our study period (see figure 1). This was inversely correlated with rates of negative URS (from 11.9% to 4.00%) and correlated

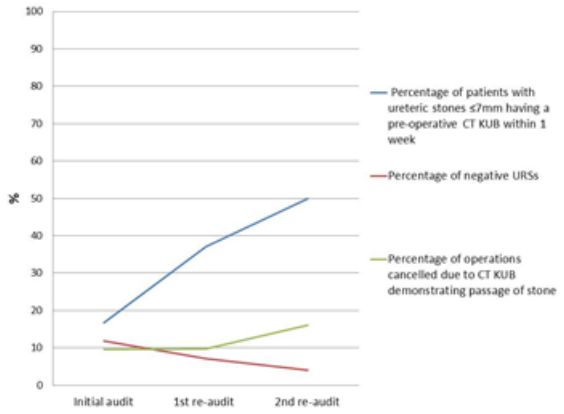

Figure 1: The percentage of patients with ureteric stones ≤ 7mm receiving a pre-operative CT KUB within one week compared with the rates of negative ureteroscopies (URS) and rates of cancellation of operations due to CT KUB demonstrating passage of ureteric stones.

With cancellation of operations due to CT KUB demonstrating passage of ureteric stones (9.52% to 16.00%).

CT KUB had significantly more radiation (9.89 mSv; SD 2.59) than URS (2.82 mSv; SD 3.28) (p=<0.0001).

DISCUSSION

No prior studies, to our knowledge, have demonstrated the impact of increasing the number of CT KUBs on reducing the negative URS rate.

Our results demonstrate that prior to intervention our negative URS rates were similar to that reported other studies reported in the literature. By the introduction of pre-operative CTKUBs our negative URS rate significantly decreased and so avoided potential harm to these patients.

The main risk of CT KUB is the radiation dose. Our study showed a radiation dose of 9.89 mSv for a CT KUB compared to 2.82 mSv for a URS. However, the CT scanner in this centre can only do standard CT KUBs. Many centres have access to a low-dose (<3.5 mSv) or ultra-low dose (<1.9 mSv) CT KUBs. Where this is available, the radiation dose of a CTKUB is comparable or even lower than a URS. For distal stones the CT KUB can be limited to just the distal urinary system to further reduce the radiation dose.

Cancellation of 16% of URSs pre-operatively created additional space for urgent and emergency acute stone operations and reduced the waiting list for stone operations.

Other centres have evaluated their negative URS rates and found positive predictive factors such as female gender, small stone size, distal location and younger age. An alternative scanning all patients with ureteric stones ≤7mm pre-operatively could be an algorithm based on multiple patient and stone features to prioritise imaging those patients most at risk of a negative URS.

LIMITATIONS AND FUTURE RESEARCH

There are limitations with this study. We have not considered that some patients may have a negative CT KUB but still have a stone remaining. This has an increased risk if patients have a stent inserted as sometimes the stone is not visible next to the stent. It is important to be very careful in these patients and to only use CT KUB for larger stones in pre-stented patients. In addition, patients with concerning histories or equivocal scan results may need to be followed up with ultrasound and renal function tests. A URS may still be indicated in these patients with decisions being made on a case-by-case basis. Furthermore, this is a retrospective review in single centre study. Further studies are needed to determine if these results are reproducible at other hospitals.

A cost analysis of CT KUB for all patients with ureteric stones compared with URS could provide a financial argument for implementing pre-operative CTKUBs. Investigating patient satisfaction of a negative URS compared with CT KUB would determine if this approach improves the patient's experience of ureteric stone management.

CONCLUSION

Negative URS should be avoided to prevent complications for patients. Pre-operative CT KUB has been shown in this study to reduce negative URS rate. Low dose CT KUB has a comparable radiation dose than negative URS in this study.

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