

Clinical Paper

# Minimally Invasive management of delayed recognition iatrogenic ureteric injury

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## ABSTRACT

**Introduction:** Iatrogenic ureteric injuries are a rare but serious complication of abdomino-pelvic surgery which can be associated with significant morbidity. 65-80% of ureteric trauma is only identified in the postoperative period. Current guidelines recommend stent insertion or urinary diversion via percutaneous nephrostomy. Good quality evidence on success and outcomes remains scant and the optimum treatment pathway unknown.

**Methods:** A retrospective review of all delayed presentation ureteric injuries treated in our unit between 2005 and 2013 was performed. Clinical, treatment and outcome data were collected in a custom proforma.

**Results:** 19 patients with 21 injured ureters met inclusion criteria. 16/19 (84.2%) injuries were sustained during gynaecological procedures with 10 (52.6%) of these during total abdominal hysterectomy. Suspected mechanisms from diagnostic studies was defined as partial transection in 9/21 (42.9%), complete transection in 3/21 (14.3%) and perforation in 1/21 (4.8%).

Median time from injury to presentation was 16 days (IQR 7-25). 11/21 (52.4%) had successful stenting with a median time to stent placement of 25 days (IQR 18.5-42). Those with failed stenting had a median time to attempted stenting of 65 days (IQR 10-91.3). Those with successful stenting 3/11 (27.3%) had resolution requiring no further intervention. 6/11 (54.5%) required open reconstruction, with the remaining two patients unfit for reconstruction and managed with long term stents. With successful stenting median time to definitive surgery was 413 days (IQR 156-476).

**Conclusion:** Success rates for stenting are similar to those reported in the literature (55% vs. 44-59%), but resolution rates are significantly lower (15% vs. 44-80%). Data for an endourological approach as a possible long-term solution is limited by heterogeneity, and a further well conducted multicentre prospective study is required

## INTRODUCTION

Iatrogenic ureteric injuries are a rare but serious complication of abdomino-pelvic surgery which can be associated with significant morbidity.

Reported intraoperative injuries to the ureter include ligation, transection, electrocautery and avulsion, with 80-90% of damage occurring in the distal third. Iatrogenic ureteric injuries may occur during open, laparoscopic or endoscopic surgery and are a potential complication of any intra-abdominal or pelvic procedure. Colorectal, vascular and urological surgery are all implicated but gynaecological procedures account for more than 50% of ureteric injuries, occurring in 0.5-10% of all hysterectomies.<sup>1-4</sup>

The incidence of ureteric trauma ranges from 0.05-30% in all pelvic surgery, and is higher in patients with recognised risk factors.<sup>1,5-6</sup> When identified intra-operatively, immediate repair and secured drainage affords fewer complications and superior outcomes.<sup>7-9</sup> However, 65-80% of ureteric trauma is only identified in the postoperative period, current

guidelines recommend stent insertion or urinary diversion via percutaneous nephrostomy.<sup>1</sup> Unrecognised ureteric trauma may be associated with significant morbidity including fistula formation, sepsis and renal impairment, often requiring additional treatment and prolonged hospital stays.<sup>2,10</sup>

Traditionally, delayed and early open reconstructive repair was practiced, but with the advance of minimally invasive procedures, novel techniques have been described with variable outcomes.<sup>5,9,11-15</sup> Good quality evidence on success and outcomes remains scant and the optimum treatment pathway unknown.<sup>16</sup> Previous studies have been limited by heterogeneous injury type and severity as well as short follow-up periods.

The purpose of this study was to review the management of

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delayed intervention in ureteric injury at our institution over an eight-year period, comparing interventions and outcomes with those of similar studies.

## MATERIALS AND METHODS

Cases of delayed presentation ureteric injury managed at our institution between 2005 and 2013 were identified from coding records. Exclusion criteria were: injuries sustained due to external trauma; minor injuries (American Association of Surgical Trauma grade <2 [Table 1]) and injuries undergoing immediate repair. Nineteen patients (21 ureteric injuries) met inclusion criteria.

TABLE 1.

*Adapted from Moore et al.<sup>17</sup>*

Ureter injury scale		
Grade*	Type of injury	Description of injury
I	Hematoma	Contusion or hematoma without devascularisation
II	Laceration	< 50% transection
III	Laceration	≥ 50% transection
IV	Laceration	Complete transection with < 2cm devascularisation
V	Laceration	Avulsion with > 2cm of devascularisation

\*Advance one grade for bilateral up to grade III.

A retrospective review of case notes and radiology electronic systems was performed and data collected on a pre-designed proforma. Demographic data, risk factors, operative details, subsequent management (attempted and successful) and outcomes were all recorded.

Statistical analysis was performed using Prism® (GraphPad Software Inc, San Diego, California) software. Fishers exact test was used for categorical variables and Mann-Whitney U for continuous variables.

## RESULTS

Nineteen patients with 21 injured ureters were treated at our institution, referred from 8 different centres.

18/19 (94.7%) patients were female with a mean age at time of presentation of 46.7 years (range 29-63). Pre-disposing risk factors were identified in 12/19 (63.2%) with malignancy accounting for eight (42.1%) of these, previous surgery for two (10.5%) and major haemorrhage a further two (10.5%).

16/19 (84.2%) injuries were sustained during gynaecological procedures with 10 (52.6%) of these during total abdominal hysterectomy. The non-gynaecological cases were flexible

ureterorenoscopy, completion proctatectomy and sigmoid colectomy, all for benign conditions.

12/21 (57.1%) were encountered on the left side, 9/21 (42.9%) on the right. In two patients, the injuries were bilateral. The most common site encountered was lower third with 19/21 (90.5%) of injuries seen here.

Due to the retrospective nature of the study and delayed presentation of cases, the mechanism of injury was difficult to accurately determine in the majority of cases. 3 cases presented with uretero-vaginal fistulae. Documented suspected mechanisms from diagnostic studies was defined as partial transection in 9/21 (42.9%), complete transection in 3/21 (14.3%) and perforation in 1/21 (4.8%). The remainder were unknown.

Median time from injury to presentation was 16 days (IQR 7-25). 19/21 (90.5%) had attempted ureteric stenting (retrograde and/or antegrade). The remaining two patients had percutaneous nephrostomy (PCN) drainage and contrast studies, the injuries were deemed too severe for successful bridging of the defect. They both proceeded to delayed reconstruction. In 12/21 stenting was attempted at presentation, in a further seven PCN was inserted with delayed attempted stenting.

Overall 11/21 (52.4%) had successful stenting (7 retrograde, 4 antegrade) with a median time to stent placement of 25 days (IQR 18.5-42). Those with failed stenting had a median time to attempted stenting of 65 days (IQR 10-91.3). Whilst failed stenting group had a longer median time to presentation, these results did not reach statistical significance ( $p=0.19$ ) due to small numbers involved (Fig 1.)

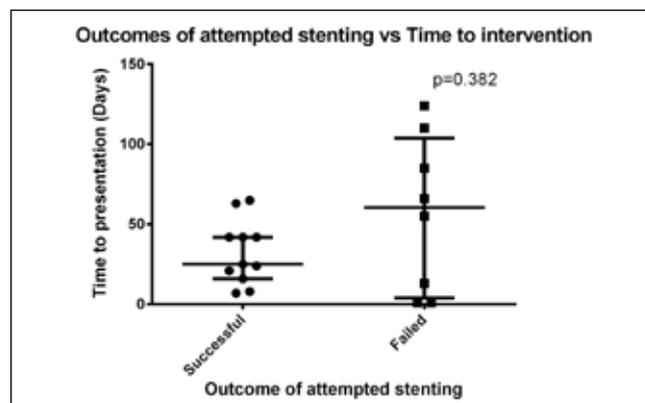


Fig 1.

Seven patients with failed stenting, and 2 in which it was deemed not possible, proceeded to delayed open reconstruction, with a median time to definitive surgery of 240 days (IQR 86.8-291). Of those with successful stenting 3/11 (27.3%) had resolution requiring no further intervention. 6/11 (54.5%) required open reconstruction, with the remaining two patients unfit for reconstruction and managed with long term stents. With successful stenting median time to definitive surgery was 413 days (IQR 156-476).



TABLE 2.  
Previously published Iatrogenic Ureteric Injury Series'

Previous Literature					
Lead Author	Year	Cohort	Successfully Stented	Resolution	Follow Up (mo)
Dowling RA <sup>(5)</sup>	1986	23	11 (48%)	8 (35%)	n.r
Cormio L <sup>(13)</sup>	1993	30	16 (53%)	16 (53%)	23
Ku JH <sup>(20)</sup>	2003	17	10 (59%)	11 (64%)	n.r
Park JH <sup>(17)</sup>	2012	18	8 (44%)	6 (33%)	6
<b>Our Series</b>		<b>21</b>	<b>11 (52%)</b>	<b>3 (14%)</b>	<b>23</b>

For all patients with ureteric injury the mean number of invasive procedures required until definitive repair was 3 (Range 2-6). Two patients managed with long-term stents have required repeated procedures to renew stents.

## DISCUSSION

Iatrogenic ureteric injuries are a rare but potentially serious risk of abdomino-pelvic surgery, when they do occur, prompt recognition and management is vital to prevent significant and long-term morbidity. The majority of significant injuries occur during non-urological surgery, often with a delay in recognition. Selzman et al. demonstrated that most injuries sustained during non-urological procedures were detected post-operatively, were more complicated and required more complex repair. In comparison, injuries obtained during urological procedures are more commonly identified intraoperatively and managed with insertion of a ureteric stent.<sup>10</sup> In our study, the presence of just 1 major delayed recognition ureteric injury resulting from urological surgery adds weight to this statement, compared with 20/21 (95.2%) occurring during non-urological procedures.

Conditions increasing the risk of ureteric injury include any existing pathology which disrupts the normal anatomy of the ureters. Examples include endometriosis, pelvic inflammatory disease, malignancy and previous pelvic surgery or radiotherapy.<sup>18</sup> Such risk factors were identified in 12/19 (63.2%) of the patients in our study.

The established management of delayed recognition ureteric injuries involves delayed repair 3-6 months following the initial injury, to allow resolution of inflammatory processes and re-establish tissue planes. More recently, primary management by endourological intervention has been shown to significantly decrease morbidity, reduce re-operation rates and aid spontaneous recovery.<sup>10, 18-19</sup> Lask et al. demonstrated placement of a percutaneous nephrostomy (PCN) alone allowing up to 80% of the injured ureters to recover patency.<sup>20</sup> These resolution rates have not been successfully replicated in other studies. In our series 10/21 were treated with PCN drainage (after failed stenting), all subsequently required open reconstructive procedures. Further studies have attempted management with ureteric stenting, successful stenting has been demonstrated in 44-59%, with resolution rates between 33-64% (Table 2).<sup>5, 13, 18, 21</sup>

11/21 underwent successful retrograde or antegrade stenting. Three cases of spontaneous resolution without stricture were seen. The remainder were either reliant on long-term stents (n=2) or proceeded to reconstruction (n=6).

Our findings suggest that PCN alone does not yield spontaneous resolution of injuries. Successful stenting rate was similar to previous studies. Resolution rate was however considerably lower (14%).

There are several reasons why resolution rates in our study may be significantly lower than with other published work. Firstly, our inclusion criteria were strict with only moderate-severe ureteric injuries included (American Association of Surgical Trauma grade  $\geq 3$ ). Similar studies by Park and Ku may have yielded better results partly due to the fact ureteric injuries were not excluded on the basis of severity.<sup>18, 21</sup> Secondly, many of these studies included both intra- and postoperatively detected ureteric injuries, whereas our series only included those identified postoperatively, a factor predisposing to lower resolution rates.<sup>5, 13, 21</sup> Finally, it must also be considered that our series included a long follow up time of 23 months compared to much shorter periods documented in other studies.

Our results suggest that regardless of approach, multiple interventions are required to restore ureteric patency. Successful stenting led to resolution in 14% of patients, we therefore suggest a minimally invasive approach in the first instance, to secure renal drainage and reduce sepsis. This can be with nephrostomy or stent drainage, but patients should be counseled regarding the likelihood of requiring further surgery.

Our study is limited by small number of participants, heterogeneous injury mechanisms and the retrospective nature of data collection.

## CONCLUSION

The incidence of delayed, post-operative recognition ureteric injuries was significantly higher in non-urological procedures. Extra care should be taken in all types of abdominal/pelvic surgery in patients with known risk factors as the likelihood of ureteric damage is increased. Success rates for stenting are similar to those reported in the literature (55% vs. 44-59%), but resolution rates are significantly lower (14% vs.



44-80%). Data for an endourological approach as a possible long-term solution is limited by heterogeneity but successful initial ureteric stent placement will lead to resolution in some cases. A further well conducted multicentre prospective study is required to define patient selection.

Conflict of Interest: None

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