

Iatrogenic Ureter Injuries: Eleven Years Experience in A Tertiary Hospital

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SUMMARY

Iatrogenic ureteric injuries are rare complications of abdomino-pelvic surgery but associated with high morbidity from infection and possible loss of renal function. A successful repair is related to the timing of diagnosis, site of injury and method of repair. This study was a retrospective review of outcomes of iatrogenic ureteric injury and factors contributing to successful operative repair. Twenty consecutive cases referred to the Urology Unit of the UKM Medical Center during an 11-year period from 1998 to 2009 were reviewed. Thirteen patients were diagnosed intra-operatively and underwent immediate repair. Seven patients had delayed diagnosis but also underwent immediate repair. In our series, there was no significant difference in outcome between injuries diagnosed intraoperatively versus injuries with delayed diagnosis. There was significant difference in the outcomes between methods of ureteric repair where ureter reimplantation via psoas hitch or Boari flap yielded better results than primary end-to-end anastomosis. Three patients suffered loss of renal function from unsuccessful ureter repair. We conclude that all iatrogenic ureteric injury should be repaired immediately in the absence of overt sepsis. Ureter reimplantation using a Boari flap or psoas hitch is preferred to the end-to-end anastomosis especially when there is delayed diagnosis.

KEY WORDS:

Iatrogenic; injury; ureter; trauma

INTRODUCTION

Iatrogenic ureter injuries are rare complications of abdomino-pelvic surgery but associated with high morbidity due to the risk of infection and possible loss of renal function. Gynaecological surgery and colorectal surgery are the common surgeries associated with risk of iatrogenic ureteric injury as the ureters run close to the field of dissection¹⁻³. Studies suggest prognosis is better when injury is detected intra-operatively and primary repair is performed³⁻⁵. The method of repair is dependent on the level of injury and the length of the healthy proximal ureter.

In general, injuries of the proximal third ureter repaired using end-to-end ureteric anastomosis while injuries to the middle third are preferentially repaired using either end-to-end ureteric anastomosis or a Boari flap with ureteric reimplantation. Injuries of the distal third of the ureter are usually repaired using a psoas hitch⁶.

We present our experience in the management and outcome of iatrogenic ureteric injuries treated in the UKM Medical Center over an eleven year period. The primary aim of this review was to evaluate the overall outcome (preservation of function of the affected kidney) of all patients with iatrogenic ureteric injury. The secondary aim was to evaluate factors contributing to successful operative repair and to recommend management strategies in treating and preventing future injuries.

MATERIALS AND METHODS

This is a retrospective review of twenty consecutive iatrogenic ureteric injuries treated by the Urology Unit of UKM Medical Center during an 11-year period from 1998 to 2009 identified from a prospectively maintained database. The case notes were retrieved from the record office and the pertinent information was recorded into a spreadsheet. Patients or their next of kin were contacted to determine their current status if the patients were no longer on regular follow-up. Variables such as gender, age at the time of injury and side of injury were recorded as well as information about the indication for surgery, type of surgery performed, location of injury, when the injury was identified, method of repair and outcome of repair. The injuries were classified as intra-operative diagnosis or delayed diagnosis. Delayed diagnosis was defined as injuries detected post-operatively while intra-operative diagnosis were injuries detected intra-operatively during the initial surgery that resulted in the iatrogenic injury. A repair was deemed successful if there are no anastomotic related complications and the subsequent preservation of unilateral kidney function on follow up. Intravenous Urography (IVU) was used to assess renal function and exclude strictures or hydronephrosis. The statistical analysis of outcomes was performed using Fisher's exact test and a P value equal to or less than 0.05 was considered statistically significant.

RESULTS

Twenty iatrogenic ureter injuries were treated by the Urology unit during the 11-year period. Eleven of the injuries involved the left ureter and 9 involved the right ureter. Three of the patients were male (15%) with a mean age 49.6 (range 41-67) years and there were 17 female patients (85%) with a mean age of 50.0 (range 37-67) years. Mean follow up was 2.3 years (6 months to 9 years).

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The frequency of ureteric injuries according to surgical specialty and their aetiology are depicted in Table I. Gynaecological surgery had the highest number of iatrogenic ureteric injuries with 14 cases, followed by colorectal surgery with 4 cases and 2 cases from urology.

In our series, thirteen iatrogenic injuries (65%) were diagnosed intra-operatively and repaired primarily while 7 were delayed in diagnosis. Table II shows the type of corrective surgery performed and timing of diagnosis with their respective outcomes. Nine patients underwent primary end-to-end anastomosis with a covering stent (7 upper ureter, 2 mid ureter). Two injuries were repaired with a psoas hitch and one underwent reimplantation with a Boari flap. All patients who underwent reimplantation with either a psoas hitch or Boari flap recovered without complication. Outcome of the 9 injuries repaired with an end-to-end anastomosis are shown in Table II. One patient presented with an infected urinoma a week after primary end-to-end anastomosis requiring percutaneous drainage of the urinoma and a percutaneous nephrostomy. He was however, successfully treated conservatively without any further surgical intervention. One patient diagnosed intra-operatively, sustained prolapse of the ureter mucosa during ureterorenoscopic lithotripsy of a ureter calculus. It could not be stented intra-operatively, hence patient underwent percutaneous nephrostomy to preserve renal function pending definitive repair. Unfortunately, the patient's renal function rapidly deteriorated and the kidney was unsalvageable. Only four patients treated primarily with an end-to-end ureteric anastomosis with ureteric stenting healed uneventfully without complications.

In the seven patients with delayed diagnosis of iatrogenic injury, 5 patients presented with ureterovaginal fistulas while the remaining two patients were diagnosed with retrograde pyelographies when they developed sudden renal impairment post operatively. Patients developed ureterovaginal fistulas within one week to 30 days post-operatively. Two of these patients underwent reimplantation with a psoas hitch and 4 patients were treated with a Boari flap immediately upon diagnosis. All these patients were treated successfully without complications. One patient was initially treated with an end-to-end ureter anastomosis but developed a leak one week later. The patient was subsequently treated with a Boari flap and recovered without further complication.

Sixteen patients underwent surveillance with IVU, except for 4 patients (two who succumbed to advanced malignancy soon after surgery, one patient who had prolapse of his ureter mucosa and one patient who developed an infected urinoma). Three of these 16 patients were noted to have hydronephrosis on the side of injury during follow-up. Despite attempts to preserve renal function via ureter dilatation, the three patients ended up with non-functioning kidneys on the side of injury. Two of these patients had defaulted follow up for a period of time before presenting with hydronephrosis.

Table III demonstrates the outcomes between patients who had early diagnosis of ureteric injuries compared to those who had delayed diagnosis. In our series, all seven patients

who had delayed diagnosis of ureteric injury were successfully treated although one patient required a second procedure when the primary end-to-end ureteric anastomosis leaked. All patients who had delayed diagnosis underwent early repair once iatrogenic injury was diagnosed. Eight of 11 patients whom had intra-operative diagnosis and repair had successful outcome. Overall there was no statistically significant difference between the outcomes of patients who were diagnosed intra-operatively was compared to those who had a delayed diagnosis (Fisher's exact test two-tailed P value = 0.24). Patients who underwent ureteric reimplantation either with a Psoas hitch or a Boari flap had significantly better outcomes compared to those who were repaired primarily with an end-to-end ureteric anastomosis (Fisher's exact test two-tailed P value was 0.023, refer table IV).

DISCUSSION

Despite advances in open and endoscopic surgery, iatrogenic ureteric injuries remain a rare but dreaded complication. Iatrogenic injury is frequently encountered in gynaecological surgery especially during hysterectomies. The close proximity of the ureters to the uterus and cervix increase the chances of injury especially if the uterus is enlarged or the dissection is difficult due to malignancy and adhesions^{7,8}. Our series similarly demonstrated that gynaecological surgery was the most common cause for iatrogenic ureteric injury and all the injuries occurred during hysterectomies.

The timing of ureter repair has been frequently debated. The general consensus stat that injuries diagnosed intra-operatively should be repaired primarily and often has the best prognosis. However, for patients with ureter injuries diagnosed post-operatively (delayed), a conservative approach by urine diversion followed by a late repair once all oedema and inflammation has resolved had been reported to yield better outcomes compared to immediate early repair⁹. This does not appear to be true in our series where all patients underwent immediate repair upon a delayed diagnosis of a ureter injury. All 7 patients were successfully treated although one patient required a second procedure when the primary end-to-end ureter anastomosis leaked.

Early repair of ureter injuries diagnosed post-operatively (delayed) is feasible in the absence of gross contamination or sepsis. Meticulous technique and adequate debridement is vital as well as reimplantation or repair without tension. However, percutaneous nephrostomy to divert urine away from the injury and preserve renal function is a prudent alternative if the patient is unwell or the burden of infection is too great. One patient had presented with an infected urinoma after primary end-to-end anastomosis and was successfully treated with percutaneous nephrostomy and percutaneous drainage of the urinoma.

Ureterovaginal fistulas are a common presentation of iatrogenic ureter injuries diagnosed post-operatively. Five of seven cases of delayed diagnosis of ureter injuries presented in this manner. Early repair in these cases resulted in good outcomes. Hence, we do not advocate urinary diversion via percutaneous nephrostomy with delayed repair if there is no overt sepsis and if primary repair is feasible.

Table I: Frequency of ureteric injuries according to surgical specialty and their aetiology

Sites	Type of Surgery	No of cases
Gynaecology (14 cases)	Total abdominal hysterectomy and bilateral salphingoophrectomy (TAHBSO)	10
	Laparoscopic assisted vaginal hysterectomy and salphingoophrectomy (LAVH+BSO)	1
	Laparoscopic assisted hysterectomy(LAH)	1
	Wertheim's hysterectomy	1
	Simple hysterectomy	1
Colorectal (4 cases)	Exploration of enterocutaneous fistula	1
	Laparoscopic anterior resection	1
	Laparotomy; Hartmans procedure	1
	Open left hemicolectomy	1
Urology (2 cases)	Ureterorenoscopiesurgery	2
	Total	20

Table II: Type of corrective surgery performed and timing of diagnosis with their respective outcomes

No		Outcome	No
Intraoperative diagnosis			
	N=13		
End to end anastomosis and stent	9	Healed without complication	4
		Succumbed to primary illness	2
		Progressed to non function kidney	2
		Presented a week later with infected urinoma	1
Psoas hitch and reimplantation	2	Healed without complication	2
Baori Flap and re implantation	1	Healed without complication	1
Percutaneous nephrostomy (failed stenting) ^a	1	Progressed to non function kidney	1
Delayed diagnosis			
	N=7		
End to end anastomosis and stent	1	Noted leak on RPG a week later, underwent Baori flap and reimplantation	1
Psoas hitch and reimplantation	2	Healed without complication	2
Baori flap and reimplantation	4+1 ^b	Healed without complication (including case that leaked after primary end to end anastomosis)	4+1
Total	20+1	Total	20+1

^a total prolapsed of ureteric mucosa during ureterorenoscopic surgery, could not stent intraoperatively

^b patient initially had primary anastomosis but noted leak on RPG, underwent Baori flap and reimplantation
RPG retrograde pyelogram

Table III: Outcomes between patients with intra-operative diagnosis and delayed diagnosis of ureter injuries

	Successful	Unsuccessful	Total
Intra operative diagnosis	8	3	11 [€]
Delayed diagnosis	7	0	7
Total	15	3	18

[€] two patient who succumbed soon after surgery were not included
Fisher's exact test, the two tailed P value equals 0.24 (not significant)

Table IV: Outcomes between patients who underwent reimplantation techniques versus end-to-end ureter anastomoses

	Successful	Unsuccessful	Total
Reimplantation with psoas hitch/ Baori flap	10	0	10
End to end ureter anastomosis	4	4	8 [€]
Total	14	4	18

[€] two patient who succumbed soon after surgery were not included
Fisher's exact test two-tailed P value equals 0.023 (statistically significant)

It was statistically proven in our series that patients who underwent ureteric reimplantation either with a Psoas hitch or a Boari flap had better outcomes compared to those who were repaired primarily with an end-to-end ureteric anastomosis. This could be attributed to the possible element of de-vascularization that occurs when performing the end-to-end anastomosis due to the dissection to achieve adequate length and a tension free anastomosis.

CONCLUSION

Our experience in managing iatrogenic ureteric injuries shows that repair should be performed as soon as possible regardless of whether the injury was diagnosed intra-operatively or diagnosis was delayed as long as there is no sepsis and the patient is fit for surgery. There seems to be no significant difference in outcome when the diagnosis is delayed although the repair is slightly more difficult. Ureteric reimplantation techniques with either a Boari flap or a psoas hitch yield better and more consistent outcomes as compared to end to-end ureteric anastomoses especially when the diagnosis of ureteric injury is delayed.

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