

# Early endoscopic realignment of traumatic anterior and posterior urethral disruptions under caudal anaesthesia – a 5-year review

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#### Disclosures

None.

## SUMMARY

**Objective:** We recently described early rigid retrograde endoscopic realignment of the disrupted urethra under caudal anaesthesia in the outpatient setting. This retrospective study was performed to evaluate our medium-term results. **Patients and methods:** A retrospective review of patients who had early rigid retrograde endoscopic realignment of traumatic urethral disruptions in our institution over a 5-year period was done and the relevant data extracted and analyzed. **Results:** Fourteen acutely ruptured urethras (10 posterior and four anterior) were endoscopically realigned early in the study period. Nine (90%) of the posterior disruptions occurred at bulbo-membranous urethra (distal to the external sphincter mechanism). Thirteen of the ruptured urethras (93%) were successfully realigned (nine posterior and four anterior) and postoperative clean intermittent self-calibration (CIC) was instituted in 10 patients. The mean follow-up period was 36.6 months (range 18–54 months). The mean operating time and the median hospital stay were 22 min (range 8–68 min) and 3 days (range 1–10 days), respectively, and were shorter in patients with injuries of the anterior urethra than those with posterior urethral tears ( $p \leq 0.0001$ ). Post-realignment, all 13 patients were potent and continent. Two patients required additional procedures (direct vision internal urethrotomy or urethral dilation) and one patient has remained on CIC i.e. a stricture rate of 21%. **Conclusion:** Early retrograde endoscopic realignment under caudal analgesia is suitable and cost-effective for patients with acute traumatic urethral disruptions and has good medium-term results. In addition, an early postoperative regimen of CIC significantly reduced stricture-formation in our series.

#### What's known

Traumatic urethral disruption is associated with high morbidity and its standard treatment (suprapubic catheterisation and delayed open urethroplasty) is highly technical. Early endoscopic realignment avoids major surgery and prolonged catheterisation and is preferable to open urethroplasty where possible. It is associated with a high stricture rate but most strictures are treated with either urethromy or dilation. Recurrent strictures are treated with clean intermittent self-calibration (CIC) or urethroplasty.

#### What's new

Early retrograde endoscopic realignment under regional analgesia is suitable and cost-effective for patients with anterior and posterior urethral disruptions and has good short- to medium-term results. Our stricture rate is comparable or lower to those previously reported in the literature and we attribute this in part to our early postoperative regimen of CIC, modifications to our technique to make it even less invasive and inadvertent patient selection.

## Introduction

Traumatic urethral disruption presents a difficult management problem to urologists worldwide because of the morbidity associated with the injury and the complexity of its treatment (1–3). As the injury is relatively uncommon, few patients are seen by individual surgeons making the acquisition of the high level of expertise required for urethral reconstruction difficult (4). Despite this, several treatment procedures have been described for this injury of which delayed urethroplasty is the most common approach (4–8) but this may take several hours and is highly technical.

Endoscopic urethral realignment of posterior urethral disruption was first described by Sachse in 1974 as a delayed procedure (9), and later for early primary reconstruction by Towler and Eisen (10). This procedure has recorded a high success rate and it

avoids major surgery and prolonged catheterisation in majority of patients in whom it is successful. It is, however, associated with a high postoperative stricture rate, although most are amenable to either urethrotomy or dilation (11,12). Patients with recurrent strictures are placed on a regime of clean intermittent self-calibration (CIC) or offered urethroplasty (5,8,11,13,14).

We recently described a procedure for early endoscopic realignment of ruptured posterior urethras using the rigid Sacht urethrotome under regional anaesthesia in the outpatient endoscopy unit (15). Similar to others (13,14), we have found the operation useful for anterior urethral disruptions as well, and as such it is now the treatment of choice for all urethral injuries that present acutely to our institution. We now present our 5-year experience with this procedure in our institution.

## Methods

### Procedure

The procedure was described in detail in our earlier paper (15). Briefly, a suprapubic catheter is inserted in all patients at presentation. The realignment is then performed between 5 and 21 days postinjury and after life-threatening injuries have been attended to and the patient stabilised (with suspected or confirmed bladder neck injury being an absolute contraindication). Then, under antibiotic cover (gentamicin and cephalosporin) and caudal anaesthesia (using 200 mg of lignocaine, 20 ml of 1% lignocaine with adrenaline), the patient is placed in the modified Lloyd-Davies position. The disrupted urethra is realigned using the Sache Optical urethrotome, and a size 16 Fr G Foley catheter (Beromed GMBH Hospital Products, Berlin, Germany) inserted into the bladder over a guide-wire to act as stent (this may be left on free drainage or spigotted as is preferred).

### Follow-up

Our patients were discharged from our service as soon as their postoperative condition permits, either to their homes or to another service (if requiring care for other organ injuries sustained). A peri-catheter urethrogram was done in the fourth week post-realignment to confirm healing of the disruption and both catheters were removed once restoration of urethral continuity was ascertained. After the first three cases, all patients in our cohort whose urethral rupture are successfully realigned have been commenced on CIC a week after catheter removal, and are instructed to do this on alternate days for 3 months and twice weekly for 3 months thereafter. They are also instructed to recommence CIC after this period should they feel that their urine flow is reducing and to report to the next outpatient clinic for review. All patients are seen in the outpatient clinic at three-monthly intervals for 6 months, then at six-monthly intervals for 2 years and yearly thereafter or at the patients' request.

### Patients and data

The retrospective observational study was done at the Department of Surgery, University College Hospital, Ibadan Nigeria, a Federal Government-owned teaching hospital. Review of the medical notes of all patients diagnosed with traumatic urethral disruption who had early rigid retrograde endoscopic realignment between June 2001 and May 2006 and having at least 12 months of postoperation follow-up data was carried out. The relevant patients' radiographic and operative data were abstracted and de-identified prior to analysis in keeping with the rules of our Institutional Review Board.

The data extracted for analysis were: patient demography, presence of pelvic fractures and/or other injuries, the anatomical location of the urethral injury per radiology, type of urethral injury (i.e. partial or complete), time interval to realignment, the duration of the procedure/operation, length of hospital stay, crude flow rate after removal of catheter, length of follow-up and presence of complications (specifically erectile dysfunction, incontinence and stricture formation).

## Results

### Characteristics of the patients and their injuries

Fourteen of 18 male patients (78%) with ruptured urethra who had attempted early rigid retrograde endoscopic realignment met the study criteria over the 60-month period (see Table 1). The mean follow-up period was 35.8 months (range 18–54 months). The mean and median ages of the patients were 35 and 27 years respectively (range 19–82 years). The patients with posterior urethral injuries were significantly younger than those with anterior disruptions (10% of patients with posterior disruptions > 40 years vs. 50% of the patients with anterior urethral injuries ( $p \leq 0.0001$ )).

All patients had a retrograde urethrogram performed and this study identified the disruption as being posterior in 10 patients (the prostatic urethra in one and the bulbo-membranous urethra in nine) and anterior (proximal bulbar urethra) in the remaining four patients. Nine of the 10 posterior urethral disruptions (69% of the patient series) were caused by crush injuries of the pelvis [eight from road traffic accidents (RTAs) and one from fall from a height], and all of these patients had associated pelvic fractures and significant injuries to other organs/systems that required resuscitations/stabilisation procedures prior to the realignment of their urethra. The remaining posterior tear was caused by traction on the stenting catheter following a delayed open urethroplasty of post-traumatic posterior urethral stricture. On the other hand, none of the four anterior urethral injuries (caused by fall-astride accidents) were associated with injuries to the bony pelvis.

### Peri-operative details

Successful endoscopic urethral realignment was achieved in 13 of the 14 patients (all four anterior disruptions and nine of the 10 posterior urethral injuries), giving a 93% success rate (Table 1). The nine patients with posterior disruptions in whom the realignment was successful were those whose retro-

**Table 1** Summary of patients who had early primary rigid endoscopic realignment of traumatic (a) anterior urethral rupture+ and (b) posterior urethral rupture+

S/N	Initial	Age (years)	Site of injury	Degree of disruption	Mechanism of injury	Associated injuries	Time to realignment (days)	Operation time (min)	Remark	Hospital stay (days)	Length of follow-up (months)
(a)											
1	OA	19	Anterior (proximal bulbar)	Partial	Fall astride	Nil	3	8	Successful	1	44
2	AB	35	Anterior (proximal bulbar)	Complete	Fall astride	Nil	5	16	Successful	1	36
3	AA	47	Anterior (proximal bulbar)	Complete	Fall astride	Nil	8	14	Successful	1	27
4	AA	82	Anterior (proximal bulbar)	Complete	Fall astride	Nil	6	9	Successful	2	18
(b)											
1	OM	25	Posterior Goldman Type 2 (bulbomembranous)	Complete	RTA	Type B2 pelvic fracture, head injuries, superficial soft tissue injuries	13	33	Successful	5	54
2	AO	27	Posterior Goldman Type 2 (bulbomembranous)	Complete	RTA	Intraperitoneal bladder rupture, small bowel injury, type C pelvic fracture	12	30	Successful – had urethral dilation 6 months post-realignment	4	50
3	TA	48	Posterior Goldman Type 2 (bulbomembranous)	Complete	RTA	Chest trauma, type C pelvic fracture	10	20	Successful	3	48
4	PO	33	Posterior Goldman Type 3 (bulbomembranous)	Complete	RTA	Soft tissue injuries, type B1 pelvic fracture	11	68*	Failed – had open urethroplasty**	10	47
5	OK	26	Posterior Goldman Type 2 (bulbomembranous)	Partial	Fall from height	Type B1 pelvic fracture, superficial injuries	7	15	Successful – recommenced CIC for 1 month 8 months post-realignment	3	42
6	AM	39	Posterior Goldman Type 2 (bulbomembranous)	Complete	RTA	Type B2 pelvic fracture, renal contusion, superficial injuries	9	25	Successful	2	34
7	OO	32	Posterior Goldman Type 2 (bulbomembranous)	Complete	RTA	Type B2 pelvic fracture, soft tissue injuries	15	22	Successful	1	33
8	TO	27	Posterior Goldman Type 2 (bulbomembranous)	Complete	Traction on catheter post end-to-end anastomosis	Nil	2	47*	Successful – had DVIU 10 days postcatheter removal	8	30
9	OA	22	Posterior Goldman Type 2 (bulbomembranous)	Complete	RTA	Type B2 pelvic fracture, head injuries, superficial soft tissue injuries	5	28	Successful	1	26
10	BS	25	Posterior Goldman Type 2 (bulbomembranous)	Complete	RTA	Type C pelvic fracture, chest and head injury	17	23	Successful – continues to require CIC for short periods > 1 year post-realignment***	1	20

+All patients had suprapubic catheters inserted at presentation.

\*Two cases of peri-operative sepsis occurred in the two patients whose procedures lasted longer than 40 min.

\*\*This patient was excluded from all analysis except the census of procedures and incidence of sepsis.

\*\*\*This patient offered both DVIU and open urethroplasty but declined further investigation and treatment.

grade urethrogram had located the injury in bulbo-membranous urethra. Importantly, at endoscopy the disruption was seen to be distal to the external sphincter mechanism in all these patients. In the single patient whose injury had been located radiographically in the prostatic urethra, the disruption was at the prostate-membranous urethra and he was the only patient in which the procedure failed.

The mean time to realignment for all patients was 10 days (range 2–17 days), while the mean operating time was 22 min (range 9–69 min) with satisfactory anaesthesia/analgesia during and immediately after the procedure. The mean operative time was significantly shorter in patients with anterior urethral disruptions when compared with those of posterior injury [12 min vs. 32 min ( $p \leq 0.0001$ )]. The median stay on the unit was 3 days (range 1–8 days) and patients requiring other/further specialist services were transferred/referred as appropriate. This index was also significantly shorter in patients with anterior injuries in whom procedures were carried out mainly considering them as day-cases ( $p \leq 0.0001$ ). In the immediate postcatheter removal period, all the patients were potent and continent and the mean postcatheter flow rate was 21 ml/s (range 19–23 ml/s).

Self-calibration was not instituted in the first three patients with successful realignment following catheter removal and two of these men (67%) developed strictures requiring direct vision internal urethrotomy (DVIU) and urethral dilation at 2 weeks and 6 months postcatheter removal, respectively, with a satisfactory outcome. These men were taught CIC after their additional procedures and have remained stricture-free since. An early 6-month CIC regimen was, therefore, instituted in the 10 subsequent patients (all four anterior injuries and six of the posterior tears). After institution of this regimen none of these 10 patients have required additional procedures for strictures during the follow-up period (mean 32.5 months). The post-realignment additional procedure rate of this series was, therefore, 15% (20% for posterior urethral injuries). However, two men (both with posterior injuries) needed to recommence CIC intermittently after the initial 6-month postoperative period and one of them has now been intermittently self-calibrating twice weekly for longer than 1 year. This patient has so far declined to have additional investigations/procedures for a presumed stricture (cystoscopy/retrograde urethrogram DVIU and/or open urethroplasty) as he prefers to continue with CIC whenever necessary. The overall (presumed) stricture rate of our series is, therefore, 21% (Table 2).

Two patients with posterior urethral disruption whose procedures lasted 47 and 68 min, respectively,

became septicaemic in the immediate postoperative period i.e. an infection rate of 15%. Both patients were treated successfully with intravenous fluids and parenteral doses of ceftriaxone and gentamicin.

## Discussion

The management of traumatic urethral disruptions remains controversial but supra-pubic catheterisation and delayed urethroplasty remains the classical treatment (3). However, the morbidity of the injury and the technical demands and morbidity of the urethroplasty (especially for posterior urethral disruptions) make early minimally invasive, short and at least equally effective treatment options attractive. Primary realignment where possible is therefore the preferred treatment (2), and good results have been reported with early primary endoscopic realignment of injury of both the anterior (13,14) and posterior urethra (11,12). The successful realignment rate of 93% in this series provides additional evidence to support the choice of this treatment strategy in selected patients. Early endoscopic realignment is particularly well-suited for anterior urethral injuries which are more likely to be isolated, and are partial or short even when complete (2). Accordingly the procedure is usually quite short (mean operation time < 15 min), and the patients likely to be discharged on the same day.

The availability of a technique that avoids general anaesthesia has improved our ability to provide satisfactory and cost-effective care for patients who present with traumatic urethral disruption in our institution. In virtually all other series, the endoscopic realignment of urethral disruptions was performed under general or spinal anaesthesia (6,11–13). However realignment of the anterior urethra has also been achieved under topical anaesthesia (14). We have found early primary endoscopic realignment under regional anaesthesia suitable for patients with traumatic anterior and posterior urethral disruptions who present to our institution within 3 weeks of their injury and the procedure is now our first choice in these patients. In this regard, caudal anaesthesia has been very effective in ensuring adequate anaesthesia during the operation and affording satisfactory analgesia for a variable period afterwards. It adds little to the patient's overall morbidity and makes urethral reconstruction possible in patients who may be unsuitable for general anaesthesia caused by associated injuries or old age, with the resultant prospect of early disposal as seen in this series. Furthermore, the avoidance of general anaesthesia, the use of the outpatient endoscopy suite, the short hospital stay and reduced duration of catheteri-

**Table 2** Comparison of results of early primary endoscopic realignment of (a) acute anterior urethral injuries and (b) posterior urethral disruptions from various authors/institutions

Report	Number of patients	Mean duration of follow-up (months)	Stricture rate (%)	Incontinence rate (%)	Impotence rate (%)	Type of anaesthesia
(a)						
Present study	4	31.3	0	0	0	Regional (caudal)
Ying-Hao et al. (14)	16	56	12.5	0	0	Topical
Maheshwari and Shah (13)	7	49.2	50	0	NR	Spinal
(b)						
Present study	9	37.4	33*	0	0	Regional (caudal)
Gheiler and Frontera (5)	3	6	33	0	0	GA
Moudouni et al. (11)	29	68	41	0	14	GA
Tazi et al. (12)	36	34	36.1	0	19.4	GA
Jepson et al. (16)	8	50.4	62.5	12.5	37.5	GA
Kitelb et al. (6)	8	18	50	16.7	0	GA

\*Includes one patient with presumed stricture as the patient-declined investigations.

sation and thus period of unemployment result in a total cost that is < 20% of the cost of the classical treatment (suprapubic cystostomy and delayed urethroplasty). This significant reduction in the cost of treatment is especially welcome in a resource-constrained setting, such as ours, as it has enabled us to treat more patients than under the old protocol and ensured patient compliance and follow-up.

Endoscopic realignment of traumatic anterior and posterior urethral rupture is commonly associated with a high stricture rate. Hence the incidence of presumed post-realignment stricture rate of 29% in this series with this injury is on the lower side of that reported by others (12.5–62.5%) (5,6,11,12,16). Of particular significance is the fact that only 20% of the patients on the early 6-month CIC regime have presumably developed a stricture in the medium term (as they continue to require CIC intermittently) when compared with 67% of patients operated upon before the institution of the regime. This suggests that CIC is as effective in reducing primary stricture formation in the majority of patients following endoscopic realignment (when instituted early for 3 months) as it is in preventing re-stricturing in those with recurrent strictures in other studies (6,11,13,14,17). Despite the above, strictures that form at the site of injury after early endoscopic realignment are usually easier to manage than the inevitable long segment, fibrous strictures with displaced and mal-aligned urethral ends seen in patients treated with delayed urethroplasty (5,18). This is because early reconstruction brings the avulsed urethral ends into close proximity and reduces the seepage of urine into the peri-urethral tissues limiting periurethral inflammation. As such, the resultant stricture is typ-

ically short and less dense and can usually be managed by dilatation and/or urethrotomy. These minimally invasive procedures were successful in both our patients with proven strictures. Furthermore, early endoscopic realignment does not compromise the result of a formal urethroplasty for those strictures that are refractory to endoscopic treatment (either because of stricture length or multiple recurrences). Interestingly, both patients who were required to intermittently self-catherize in the second series declined to undergo further investigations or procedures. This is probably because of the cost of these investigations and procedures, and the fact that they had become used to CIC in the early postoperative period. As such having to do so intermittently now did not seem to justify the cost [which is considerable in our environment and would be fully borne by the patient (19)].

Similar to earlier reports (5,11–14), all patients with realigned anterior and posterior urethral injuries in this series were continent postoperatively. Anterior urethral injuries are not typically associated with incontinence and hence our results in these patients were not surprising. However incontinence is not uncommon following repair of posterior urethral disruptions (6,16). Posterior urethral disruption is classically described as occurring at the prostate-membranous urethra and incorporating the urethral sphincter (5,20), but this description is now being challenged. A recent anatomic study that found in majority of patients with this injury disruption was located at the bulbo-membranous urethra and thus distal to the urethral sphincter (21). Our endoscopic findings provides further support for this later assertion as the site of injury was at the bulbo-membranous

urethra in nine of our 10 patients with posterior urethral disruption. We, therefore, concur that the continence mechanism is spared in majority of patients with posterior urethral disruptions and that this plays a significant role in preserving continence following reconstruction in these patients. This postulation is further supported by the finding that all our nine patients with bulbo-membranous injuries were continent postoperatively, while the single patient with prostate-membranous injury was incontinent before and after successful open urethroplasty (endoscopic realignment being unsuccessful).

The other major complication of posterior traumatic urethral injury is erectile dysfunction. As with incontinence, the occurrence of this complication has now been recognised as being more related to the severity of the injury (particularly the type of pelvic fracture and involvement of the bladder neck), the age of the patient and the length of the distraction defect rather than the treatment modality (22,23). Erectile dysfunction has been recorded in 14–72% of patients with posterior urethral disruptions (5,11,12,16,23). This complication occurs more commonly in patients with pelvic fractures and is more often neurogenic, rather than vascular, in origin (24). Interestingly, despite the fact that 90% of our patients with successfully repaired posterior urethral injuries had associated pelvic fractures, all retained their potency postoperatively. We are presently unable to explain this finding, however, it is possible that the fact that our patients represent a selected series as most patients with severe injuries may have died before or shortly after arriving at the hospital [because of the lack of a prehospital service in our country (25)].

Infection of the pelvic haematoma was a major drawback of early open realignment of posterior urethral distractions as this may lead to life-threatening septicaemia and urethral necrosis (26). In this regard, early endoscopic realignment is carried out as aseptically sterile as possible using a reduced flow of the irrigating fluid and appropriate prophylactic antibiotics (6,13,15). Despite these precautions, peri-operative infections occurred in two of our patients both of whom had procedures lasting longer than 40 min. We believe that the prolonged duration of the operations contributed significantly to the occurrence of this complication in these patients, and we now limit our operating time to 40 min after which the procedure would be abandoned if still uncompleted.

## Conclusion

Early retrograde endoscopic realignment under regional analgesia is suitable and cost-effective for patients

with anterior and posterior urethral disruptions and has good short- to medium-term results. Our complication rates (stricture-formation, peri-operative infections and erectile dysfunction) are comparable or lower to those previously reported in the literature and we attribute this in part to our early postoperative regimen of CIC, modifications to our technique to make it even less invasive and inadvertent patient selection. However, a longer follow-up of these patients is required to assess the maintenance of these results on the long term.

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