

## Early Endoscopic Primary Realignment Decreases Stricture Formation and Reduces Medical Costs in Traumatic Complete Posterior Urethral Disruption in A 2-Year Follow-up

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**Background:** There are presently several options for the management of posterior urethral disruption. However, these options remain controversial for several reasons. Thus, this medical issue has been continuously investigated.

**Methods:** From 1991 to 2001, 22 patients with complete posterior urethral disruption out of 720 urethral injury cases were retrospectively reviewed using strict criteria. The 22 cases were grouped into two different management groups, the endoscopic early realignment (ER) group and the delayed urethrotomy (DU) group. The frequency of optic internal urethrotomy for urethral strictures and individual medical costs were evaluated over a two-year period.

**Results:** The ER group had a mean frequency of  $1.3 \pm 0.82$  urethrotomies in the first year and  $1.8 \pm 1.23$  over two years while the DU group had a significantly higher urethrotomy frequency,  $2.5 \pm 1.35$  in the first year and  $4.1 \pm 1.91$  over two years. The costs for the DU group were 50% higher than the ER group at the end of second year.

**Conclusion:** An early endoscopic realignment operation saved up to NT 36,000 (New Taiwan Dollars) in costs with an average of 2.3 fewer further urethrotomy procedures in each case during the 2-year follow-up period. Therefore, early urethral realignment for traumatic complete posterior urethral disruption should be encouraged to prevent intractable urethral stricture and lower medical costs.

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**Key words:** posterior urethral injury, endoscopic realignment, economic costs

Complete posterior urethral disruption is a major complication of pelvic fracture secondary to blunt trauma and continues to be an arduous management problem for urologists.<sup>(1)</sup> It is usually associated with long-term complications such as stricture, impotence and incontinence. There is ongoing con-

trovery regarding the timing and method of management.<sup>(2)</sup> The primary goals of management of posterior urethral injuries are to re-establish urethral continuity, avoid stricture formation, and preserve sexual function.

Two methods are commonly used to deal with

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posterior urethral disruption. One is initial suprapubic diversion and delayed urethral repair with either open urethroplasty or endoscopic urethrotomy.<sup>(3-7)</sup> The second is immediate primary urethral realignment.<sup>(8-11)</sup> The published results of these two different urethral injury management methods appear quite varied, resulting from different case groups, severity of injury,<sup>(4)</sup> and timing of management.<sup>(5)</sup>

In this study, we present our experience in the treatment of complete posterior urethral disruption. The primary objective is to compare mid-term outcomes between early and delayed urethral realignment.

## METHODS

From 1991 to 2001, we retrospectively reviewed a total of 720 urethral injury cases in our hospitals. To minimize selection bias and ensure that the type of injury was homogeneous, inclusion criteria were designed to screen complete posterior urethral disruption cases. Cases were included if an intravenous pyelogram or computed tomography showed a high-riding bladder without evidence of bladder rupture, and a retrograde urethrogram revealed extraperitoneal contrast medium extravasation from the prostatomembranous portion and failed to show the contour of bladder.<sup>(12)</sup> A total of 22 cases fulfilled the criteria and thus were enrolled for this study; they were divided into the following two groups according to the method of management:

Group 1, early realignment (ER): 11 patients who underwent immediate or early realignment within two weeks.

Group 2, delayed urethrotomy (DU): 11 patients who underwent initial suprapubic cystostomy with delayed realignment.

The management was determined by the preference of the individual urologist, hemodynamic stability and associated injuries in the patient. The detailed treatment procedures for the two groups are described as follows. For the ER group, all patients received an initial suprapubic cystostomy for urinary diversion in the emergency room. The urethral continuity was then restored within two weeks by endoscopic urethral realignment as described by Towler and Eisen once the evaluation and management of other life-threatening injuries were completed.<sup>(13,14)</sup> Urethral catheters were left in place for an average of

six weeks after realignment. For the DU group, patients received only a suprapubic cystostomy for urinary diversion. No urethral realignment was performed or the initial attempt failed. The cystostomy tube was left in place for more than four weeks until retrograde and antegrade urethrograms exhibited secondary healing of the urethra. The urethral continuity was then restored by optic internal urethrotomy (OIU) under transrectal ultrasonographic guidance and suprapubic fiberoptic aid as described by Chuang.<sup>(7)</sup> Urethral catheters were left in place for another 4-6 weeks after urethral realignment. After urethral catheter removal, patients in both groups were assessed for self-voiding, post-void residual urine, and repeat urethrogram as indicated. Chart reviews included patient characteristics, such as age, sex, presentation, associated injuries, management and long-term outcomes. The outcomes were determined by patient visits and examinations as needed. The need for further urological interventions (e.g. urethral dilatation or internal urethrotomy) and the incidence of complications (e.g. urinary incontinence or urethral stricture) were then recorded for each group. Statistical analyses was performed with Student's t test and the nonparametric Mann-Whitney test using proprietary software. During the first two-year period, we also estimated the total costs for each patient according to both the procedures performed and the length of hospital stay. Next, we compared the average costs between the two groups, which was based on the payment system of the Bureau of National Health Insurance, a comprehensive medical care system supported by the Department of Health of Taiwan.

## RESULTS

All 22 patients in this study were male and more than half had motorcycle accidents.<sup>(13)</sup> The mean age of the participants was 21, and there was no statistical difference in age or associated injuries between groups. The ER group required  $2.8 \pm 5.1$  units of blood during the urethral realignment, but no transfusion was required in the DU group (Table 1). Endoscopic attempts were done initially in 15 patients and the success rate was 73.3%.

Following the initial treatment, urethral stricture complications developed in 21 out of the 22 cases (95%). Only one patient in the ER group was free

**Table 1.** Patient Characteristics

	Total	ER group	DU group	<i>p</i>
Number of cases	22	11	11	
Age	21.2 ± 6.2	20.2 ± 6.3	22.1 ± 6.0	0.746
Trauma at other sites	1.4 ± 0.67	1.63 ± 0.65	1.27 ± 0.22	0.21
Mean units of blood transfused		2.8 ± 5.1	0	< 0.01

**Abbreviations:** ER: early realignment; DU: delayed urethrotomy.

from stricture. One patient in each group was lost to follow-up. Therefore, a total of 20 patients completed the two-year follow-up. During these two years, the DU group needed more internal urethrotomies than the ER group (4.1 vs. 1.8) to overcome recurrent urethral strictures, which is a major, frequent complication of urethral injury. The average number of internal urethrotomies needed during the first year for each patient was 1.3 in the ER group and 2.5 in the DU group. After the first year, 2 more patients in the ER group were free from stricture. The other patients in the ER group needed, on average, only 0.71 urethrotomies/patient and some of them could tolerate self-hydrodilatation or dilation with a urinary catheter for minimal strictures. However, the average number of postoperative internal urethrotomies in the DU group still averaged 1.78 /patient within the second year (Table 2). One patient in the DU group underwent an open urethroplasty due to intractable urethral obliteration.

The costs of initial management in the ER group were 3 times that of the DU group (27,714 New-Taiwan [NT] dollars vs. 7,980 NT dollars) because of the emergency operations (Table 3). The mean costs in the DU group were higher than in the ER group at the end of the first-year of follow-up (68,537 NT dollars vs. 56,938 NT dollars). At the end of the second year, the DU group had spent a mean 104,505 NT dollars per patient, significantly more than the ER group mean of 68,178 NT dollars per patient (Fig. 1).

## DISCUSSION

Urethral injuries are uncommon.<sup>(15)</sup> Most of them are caused by blunt trauma from pelvic frac-

**Table 2.** Numbers of Internal Urethrotomies for Recurrent Urethral Stricture

	ER group	DU group	<i>p</i>
First year			
Number of cases	10	10	
Total frequency	13	25	
Mean frequency	1.3 ± 0.82	2.5 ± 1.35	0.034
Second year			
Number of cases	7	9	
Total frequency	5	16	
Mean frequency	0.71 ± 0.76	1.78 ± 1.20	0.061
Two years			
Number of cases	10	10	
Total frequency	18	41	
Mean frequency	1.8 ± 1.23	4.1 ± 1.91	0.009

**Abbreviations:** ER: early realignment; DU: delayed urethrotomy.

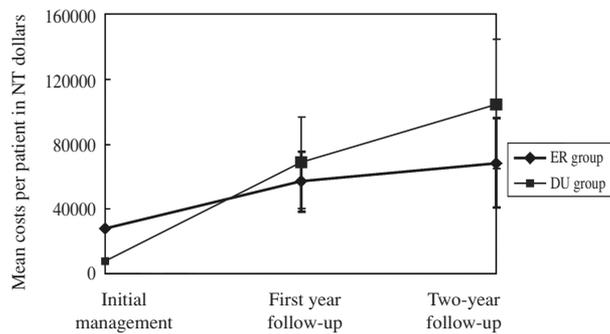
tures or straddle injuries. The key to the initial management of a urethral injury lies in prompt diagnosis, accurate injury staging, and proper selection of an intervention that minimizes the overall chances of debilitating complications such as incontinence, impotence, and urethral stricture.<sup>(16)</sup> Many reports have discussed the treatment modalities, but the ideal method of management remains controversial.

Primary suturing of a severed urethra was once

**Table 3.** Medical Costs of Groups

	ER group (n = 10)		DU group (n = 10)		p value
	Frequency	Medical costs	Frequency	Medical costs	
Initial management	1	27,714	1	7,980	
First year					
Urethroplasty	0	–	1	43,570	
OIU	1.3 ± 0.82	56,938 ± 18,507	2.5 ± 1.35	68,537 ± 28,104	0.493
Two years					
OIU	1.8 ± 1.23	68,178 ± 27,634	4.1 ± 1.91	104,505 ± 39,750	0.015

**Abbreviations:** ER: early realignment; DU: delayed urethrotomy; OIU: optic internal urethrotomy.



**Fig. 1** Medical costs of groups. Initial medical costs were low for suprapubic cystostomy in the DU group, but soon exceeded costs in the ER group because of the open urethroplasty and frequent urethrotomy procedures. Abbreviation used: NT: New Taiwan.

commonly performed. This treatment resulted in a lower rate of documented postoperative strictures (49%) than deferred treatments, but was abandoned because of the high rates of postoperative impotence (56%) and incontinence (21%), as shown in a large-scale review of 871 patients.<sup>(4)</sup> Since the 1970s, deferred treatment has been replacing primary suturing. A suprapubic urinary diversion followed by delayed repair has been the accepted general standard of care. By avoiding early intervention, postoperative impotence and incontinence have decreased to 19% and 4%, respectively.<sup>(4)</sup> The disadvantages include the need for prolonged suprapubic drainage and the inevitable urethral stricture. Several studies

have noted an associated risk of stricture formation as high as 100% after primary suprapubic urinary diversion, requiring major reconstructive surgery.<sup>(10,11)</sup> Alternatively, endourologic procedures to establish immediate urethral continuity have been developed and performed with reduced blood loss, shorter hospitalization, and potentially less severe stricture formation.<sup>(6,8,9,17)</sup> Primary realignment with minimally-invasive methods has become a common contemporary management option, particularly at high-volume trauma centers. Contemporary urethral realignment employs actual realignment with endoscopic guidance in an antegrade and retrograde fashion instead of a “railroading” technique. Immediate primary realignment is usually performed in patients with minimal trauma and a stable hemodynamic status. Early primary realignment is typically performed within 2-3 weeks after injury when pelvic hematomas should have begun to resolve and before significant scar formation.<sup>(2)</sup> Urethral realignment is delayed in cases of hemodynamic instability or associated injuries that preclude urologic manipulation. Either immediate or early realignment can achieve good results with low complication rates. Most recent series on primary endoscopic realignment are small and comprise various injury severities and types, but showed favorable outcomes in the rates of impotence (22%), incontinence (6%) and stricture formation (50%).<sup>(8)</sup>

In our study, we adopted the payment system of the Bureau of Nation Health Insurance to calculate medical expenditures, including procedure (anesthe-

sia and operation) fees and hospitalization (preoperative preparation and ward charges) fees, exclusive of costs for personal care assistant and daily salary loss. Patients with early endoscopic realignment needed an average of only 1.8 optic urethrotomy procedures in the first two years, and patients with delayed repairs needed two more procedures during the same period. The medical costs in the DU group were 1.5 times that of the ER group. Thus, early realignment is associated with lower costs and less stricture formation than delayed repair in cases of traumatic complete posterior urethral disruption.

Post-realignment stricture formation was found in 10 (91%) out of 11 patients who needed additional endoscopic procedures. The stricture rate was higher compared with other series, probably because all of our patients were severely injured and had completely disrupted urethras, while patients with partial disruption were included in other studies.<sup>(8,9,11)</sup> However, the average number of urethrotomy procedures required for each patient was comparable with the 1.2 procedures in Moudouni's series.<sup>(9)</sup> The impotence rate was not well documented in our study. Only 6 of 22 patients completed the sexual function survey and 2 patients in each group retained potency. It is generally believed that endourological procedures do not adversely affect erectile function since there is minimal manipulation of periprostatic tissue and no additional trauma to the cavernous nerve.<sup>(1,2)</sup> Furthermore, some authors have indicated that sexual and voiding complications seem to be the result of the injury itself, rather than the treatment modalities.<sup>(18,19)</sup> In a series of 29 patients with urethral disruption, Moudouni et al. demonstrated that 25 (86%) patients were potent after early endoscopic realignment.<sup>(9)</sup> Therefore, careful endoscopic realignment might not interfere with erectile function.

Only patients with complete posterior urethra disruption patients were recruited for comparison analysis in our study. We assumed that including patients with the most severe form of urethral injury (ie. complete disruption) might minimize selection bias. The decisive factors for the timing of intervention which concerned urologists were hemodynamic stability and the presence of other life-threatening injuries, which might not influence the outcome of urethral injury itself. There was a major limitation in this study. The patients in our series were treated about 10 years ago. Since 2002, we have advocated

an open anastomotic urethroplasty if recurrent and long segment urethral strictures occur. Therefore, further efforts must be made to evaluate the long-term outcomes after reconstructive urethroplasty has been incorporated into the strategy of stricture management.

In conclusion, our study demonstrated that early endoscopic realignment of traumatic complete posterior urethral disruption can reduce the frequency of urethrotomy procedures; this is a great benefit from the viewpoint of both management of complications and economic costs. Although early realignment is much more expensive initially and there is a greater risk of interfering with patient stability, we recommend that a urologist should not forgo early endoscopic intervention.

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## 在後段尿道全斷裂施行早期內視鏡重新接通手術 追蹤兩年可減少尿道狹窄及降低醫療成本

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- 背景：**後段尿道斷裂有許多不同的處理方式，但是結果仍存在差異性與爭議。故本篇論文旨在探討兩種內視鏡處置之成效。
- 方法：**自 1991 年至 2001 年，共有 720 個尿道受損的病例，其中 22 個病人符合後段尿道全斷裂的標準。按照處理方式的不同分為兩組：第一組，早期內視鏡重新接通術 (ER)；第二組，延遲性尿道切開術 (DU)。並評估兩年內因尿道狹窄所需內視鏡尿道切開術的頻率和每人平均醫療成本。
- 結果：**在 ER 組，於第一年平均施行  $1.3 \pm 0.82$  次尿道切開術，於二年內共  $1.8 \pm 1.23$  次手術；而在 DU 組則有統計學上更多的手術頻率，於第一年  $2.5 \pm 1.35$  次及於二年內共  $4.1 \pm 1.91$  次。在醫療成本上的評估則發現，在二年末時 DU 組的花費是 ER 組的一點五倍之多。
- 結論：**兩年的追蹤發現，平均每個病例，早期內視鏡重新接通手術可節省高達新台幣三萬六千元及減少二次再度施行尿道切開手術。因此，針對外傷性後段尿道全斷裂施行早期內視鏡重新接通手術能避免難治性尿道狹窄及節省醫療成本，是應該被鼓勵的。
- (長庚醫誌 2011;34:179-85)

**關鍵詞：**後段尿道斷裂，內視鏡尿道切開術，醫療成本

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