



PROSPECTIVE COMPARATIVE STUDY OF PATIENTS OUTCOME AMONGST DIFFERENT SEQUENTIAL STEPS OF PROGRESSIVE PERINEAL APPROACH FOR TREATMENT OF PELVIC FRACTURE URETHRAL INJURY

Urology

Dr. Mukesh Gupta General Surgeon, 100 Bedded Hospital Atraulia, Azamgarh

Dr. Shirish Mishra* Assistant Professor, Dept Of Urology, Moti Lal Nehru Medical College , Prayagraj
*Corresponding Author

Dr. Deepak Kumar Gupta Assistant Professor, Dept Of Urology, Moti Lal Nehru Medical College, Prayagraj

Dr. Dilip Chaurasia Professor And Head Of Dept Of Urology, Moti Lal Nehru Medical College , Prayagraj

Dr. Gaurav Kumar Junior Resident, Dept Of General Surgery, Moti Lal Nehru Medical College , Prayagraj

Dr. Mukul Dahiya Senior Resident, Mahatma Vidur Autonomous State Medical College, Bijnor

ABSTRACT

Introduction: Pelvic fractures, often from high-energy injuries, can cause pelvic fracture urethral injury (PFUI), especially in males. PFUI can lead to complications like urethral stenosis, erectile dysfunction, and urinary incontinence. These injuries usually occur with significant trauma, such as vehicular accidents, and are indicated by blood at the meatus, inability to urinate, and a full bladder. Initial management involves suprapubic catheter placement, with delayed urethroplasty after 3-6 months being the gold standard treatment. This approach allows for local healing and successful tension-free anastomosis, reducing the risks of morbidity and complications. **Methodology:** The study included 75 patients aged 18-61 with pelvic fracture urethral injuries. Excluded were those with inflammatory, iatrogenic, congenital, recurrent, or post-radiation strictures. Patients underwent delayed urethroplasty with full bulbar urethra mobilization, end-to-end anastomosis, or additional procedures for tension. Postoperatively, patients had corrugated drains, and catheter removal was based on RUG findings. Success was defined by effective voiding and no further interventions, while failure included persistent or recurrent strictures. Statistical analysis used chi-square tests. **Result:** The study included 75 patients with pelvic fracture urethral injuries treated with progressive perineal urethroplasty. Procedures performed were urethral mobilization alone (52%), with corporal body separation (32%), and with inferior pubectomy (16%). The overall success rate was 88%, with urethral mobilization alone being the most successful (92.3%). Complications included erectile dysfunction (8%), re-stricture formation (16%), and wound infections (24%). Auxiliary procedures like Optical Internal Urethrotomy were effective for re-stricture management, highlighting the importance of tailored surgical approaches. **Conclusion:** Road traffic accidents were the primary cause of pelvic fracture urethral injuries. Perineal urethroplasty, the gold standard, shows excellent results. Key factors for success include maintaining urethral vascularity, meticulous scar tissue excision, and tension-free anastomosis. Achieving this may require distal urethral mobilization, crural separation, and occasionally inferior pubectomy. Recent approaches minimize steps, avoiding supracrural urethral rerouting. High-quality research is needed to improve diagnosis, management, and follow-up of urethral strictures.

KEYWORDS

Pelvic fracture urethral injury (PFUI), Urethral stenosis, Retrograde urethrography (RUG) , Voiding cystourethrography (VCUG)

INTRODUCTION

Pelvic fractures, typically caused by high-energy injuries like traffic accidents or falls from heights, can lead to pelvic fracture urethral injuries (PFUIs)^{1, 2}. PFUIs are more common in males due to anatomical differences, including a longer and less protected urethra^{3, 4}. These injuries can result in acute complications like urinary outflow obstruction, urine leakage, and secondary sepsis, as well as long-term issues such as urethral stenosis, erectile dysfunction, and urinary incontinence.^{2, 5}

Pelvic fractures are categorized by the direction of the force (anteroposterior compression, lateral compression, vertical shear, or combinations)⁶⁻⁸. Urethral disruption often occurs with multisystem trauma and is linked to fractures of the anterior pelvic ring or pubic diastasis⁹. "Straddle fractures" pose the highest risk of urologic injury^{1, 5}. The posterior urethra, especially at the bulbomembranous junction, is particularly vulnerable due to its anatomical attachments¹⁰. Diagnosis involves retrograde urethrography (RUG) and voiding cystourethrography (VCUG) for detailed imaging of the urethra¹¹. Immediate surgical exploration may be necessary in severe cases, but it carries high morbidity. The preferred treatment is immediate suprapubic cystostomy followed by delayed urethroplasty, typically after 3-6 months, to ensure proper healing and minimize complications^{1, 12, 13}. This approach has evolved to achieve a tension-free anastomosis, significantly improving outcomes^{14, 15, 16}.

MATERIAL AND METHODS

This study, conducted at the urology unit of Motilal Nehru Medical College, Allahabad, involved 75 cases of pelvic fracture urethral injury (PFUI) in patients aged 18 to 61 years. Approved by the ethical committee, the trial spanned from September 2018 to March 2024.

Case Selection

Inclusion Criteria:- Urethral injury associated with pelvic fracture.

Exclusion Criteria:

1. Inflammatory urethral stricture.
2. Stricture following traumatic catheterization.
3. Post-surgical urethral stricture.
4. Recurrent stricture.
5. Congenital urethral stricture.
6. Post-radiation stricture.

Evaluation and Management

Preoperative Evaluation:

- History and physical examination.
- Urine analysis and culture.
- Retrograde and voiding cystourethrography for stricture measurement.
- Broad-spectrum antibiotics before anesthesia.

Surgical Procedure

1. **Mobilization:** Full mobilization and spatulation of the bulbar urethra.
2. **Proximal End Preparation:** The proximal urethral end was similarly prepared
3. **Anastomosis:** End-to-end anastomosis if tension-free; otherwise, intercrural space was opened, and if needed, inferior pubic arch resection was performed.

Post-procedural Assessment and Follow-up

- Corrugated drain removed after 48 hours.
- Urinary drainage with 16 Fr silicone urethral catheter and 18-22 Fr suprapubic catheter.
- Follow-ups at three weeks, three months, and six months with clinical history, RUG, and uroflowmetry.

Success Criteria:

Successful urethroplasty indicated by good voiding without further intervention.

Failure Criteria:

1. Persistent stricture.
2. Recurrent stenosis.
3. Need for repeated urethral dilation.
4. Necessity for clean intermittent catheterization.

Statistical Analysis

Data were analyzed using the chi-square test to determine the statistical significance of the outcomes. This analysis helped compare the success rates among different surgical techniques and evaluate the impact of variables such as patient demographics, stricture length, and the presence of complications on the success of urethroplasty. The study underscored the importance of meticulous surgical techniques and comprehensive postoperative care in managing PFUI, demonstrating high success rates with progressive perineal urethroplasty.

RESULTS

The study included 75 patients who underwent progressive perineal urethroplasty at S.R.N. Hospital, Allahabad, from September 2018 to March 2024. The patients, aged 18 to 61 years with a mean age of 30.76 years, were predominantly in the 21-30 year age group, which comprised 52% of the cases. This age group is considered to be at the most active phase of life, contributing to a higher incidence of injury. The lowest incidence of urethral injury was observed in patients over 50 years old.

Age Distribution

1. 11-20 years: 9 patients (12%)
2. 21-30 years: 39 patients (52%)
3. 31-40 years: 15 patients (20%)
4. 41-50 years: 6 patients (8%)
5. 51-60 years: 3 patient (4%)
6. 61-70 years: 3 patient (4%)

Mode of Injury

The leading cause of urethral injury was road traffic accidents (RTA), accounting for 88% of cases, followed by falls from height at 12%.

1. **Road Traffic Accidents (RTA):** 66 patients (88%)
2. **Fall from height:** 9 patients (12%)

Procedures Performed

The study employed three different procedures of progressive perineal urethroplasty, based on the stricture length observed in preoperative urethrograms and intraoperative findings:

1. Urethral Mobilisation alone: 39 patients (52%)
2. Urethral Mobilisation with Corporal Body Separation: 24 patients (32%)
3. Urethral Mobilisation with Corporal Body Separation and Inferior Pubectomy: 12 patients (16%)

Procedure and Success

The overall success rate of perineal urethroplasty was 88%, with success defined as patients voiding well without the need for further interventions. Failure was noted in patients with persistent strictures, restenosis, or those requiring repeated urethral dilation and clean intermittent urethral catheterization.

Success Rates by Procedure

1. **Overall:** 75 patients, 63 successful (88%)
2. **Urethral Mobilisation alone:** 39 patients, 24 successful (92.3%)
3. **Urethral Mobilisation with Corporal Body Separation:** 24 patients, 21 successful (87.5%)
4. **Urethral Mobilisation with Corporal Body Separation and Inferior Pubectomy:** 12 patients, 6 successful (50%)

Statistical Analysis

- Comparison between urethral mobilisation and corporal body separation showed a p-value of 0.7155 (not significant at $p > 0.05$).
- Comparison between urethral mobilisation and inferior pubectomy had a p-value of 0.052 (not significant at $p > 0.05$).
- Comparison between corporal body separation and inferior pubectomy had a p-value of 0.15 (not significant at $p > 0.05$).

Proximal vs. Distal Urethral Mobilisation

The study also compared success rates between proximal and distal urethral mobilisation:

- Distal mobilisation: 36 patients, 33 successful (92.3%)
- Proximal mobilisation: 27 patients, 18 successful (75%)

Procedure and Mean Stricture Length

Stricture lengths were assessed preoperatively via urethrogram, with final decisions made intraoperatively. The procedures based on stricture length were:

1. **Urethral Mobilisation:** Mean stricture length of 1.9 cm
2. **Corporal Body Separation:** Mean stricture length of 2.9 cm
3. **Inferior Pubectomy:** Mean stricture length of 4.6 cm

Complications of Urethroplasty

The complications observed were erectile dysfunction, wound infection, and re-stricture formation.

Erectile Dysfunction

- **Overall:** 6 patients (8%)
- **Urethral Mobilisation:** 0 patients (0%)
- **Corporal Body Separation:** 3 patient (12.5%)
- **Inferior Pubectomy:** 3 patient (25%)

Restricture Formation

Out of 75 patients, 12 (16%) developed restricture:

1. **Urethral Mobilisation:** 3 out of 39 (7.7%)
2. **Corporal Body Separation:** 3 out of 24 (12.5%)
3. **Inferior Pubectomy:** 6 out of 12 (50%)

Auxiliary Procedures and Success Rate

Among the 12 patients who developed restricture, 9 were treated successfully with Optical Internal Urethrotomy (OIU), achieving a 75% success rate for auxiliary procedures:

- **Urethral Mobilisation:** 3 patient, 100% success
- **Corporal Body Separation:** 3 patient, 100% success
- **Inferior Pubectomy:** 6 patients, 50% success

Wound Infection:

Out of 75 patients, 18 (24%) developed wound infections, which resolved with regular cleaning and dressing:

- Urethral Mobilisation: 9 patients (23%)
- Corporal Body Separation: 6 patients (25%)
- Inferior Pubectomy: 3 patient (25%)

This study highlights the effectiveness of perineal urethroplasty in managing urethral injuries, particularly those caused by road traffic accidents. The procedures showed high success rates, with urethral mobilisation alone being the most successful. The study also underscores the importance of preoperative assessment and intraoperative decision-making in achieving optimal outcomes. Complications such as erectile dysfunction and re-stricture formation were noted, with auxiliary procedures like OIU proving beneficial in managing re-stricture cases. The need for high-quality research in the diagnosis, management, and follow-up care of urethral strictures is emphasized to further improve patient outcomes.

DISCUSSIONS

This study involved 75 patients who initially visited S.R.N. Hospital, M.L.N. Medical College, Allahabad following urethral injuries. All patients underwent suprapubic cystostomy at their first presentation and were scheduled for progressive perineal urethroplasty after 3 to 4 months. The definitive procedures included urethral mobilization alone, urethral mobilization with corporal body separation, and urethral mobilization with corporal body separation and inferior pubectomy.

Patient Demographics and Causes of Injury

Age and Activity: The patients were aged 18 to 61 years, with the majority (52%) being 21-30 years old. All were sexually active. Injury Causes: The most common cause of urethral injury was road traffic accidents (88%), followed by falls from height (12%).

Preoperative Assessment

Stricture Length: The length of strictures, assessed preoperatively, ranged from 1.4 cm to 6.0 cm, with a mean of 2.63 cm.

Types of Procedures Performed

Procedures: Out of all patients, 39 underwent urethral mobilization

alone, 24 underwent urethral mobilization with corporal body separation, and 12 underwent urethral mobilization with corporal body separation and inferior pubectomy.

Success Rates

Overall Success: The overall success rate was 88%.

By Procedure

- Urethral mobilization alone: 92.3% success.
- Urethral mobilization with corporal body separation: 87.5% success.
- Urethral mobilization with corporal body separation and inferior pubectomy: 50% success.
- **Comparative Studies:** Similar studies showed varied success rates, such as 93.4% for simple perineal urethroplasty (Santosh S.K. et al., 2010)¹⁸ and 89.3% for simple perineal anastomosis (Fu Qiang et al., 2009)¹⁷.

Success Based on Stricture Length

- **Shorter Strictures:** Stricture lengths of 1-2 cm had a 100% success rate.
- **Medium Strictures:** Strictures of 2-3 cm had an 88.9% success rate.
- **Longer Strictures:** Strictures of 3-7 cm had a 50% success rate.

Comparison of Distal and Proximal Mobilization

- **Distal Mobilization:** Perineal anastomosis with only distal mobilization had a 92.3% success rate.
- **Proximal Mobilization:** More extensive proximal urethral mobilization (including corporal body separation and inferior pubectomy) had a 75% success rate.

Postoperative Complications

- Re-stricture Formation:
- **Urethral mobilization alone:** 3 case managed by OIU and CSIC.
- **Urethral mobilization with corporal body separation:** 3 case managed by OIU in two settings.
- **Urethral mobilization with corporal body separation and inferior pubectomy:** 6 cases, 3 managed successfully by OIU, the other 3 required redo perineal anastomosis.
- **Comparative Studies:** Chethan JV et al. (2016)²⁰ reported a success in 24 of 26 patients, with failures identified within the first 3 postoperative months.

Erectile Dysfunction

- Overall, 6 patients (8%) developed erectile dysfunction post-surgery.
- None of the patients with urethral mobilization alone developed erectile dysfunction.
- 3 out of 24 patients (12.5%) who underwent corporal body separation developed erectile dysfunction.
- 3 out of 12 patients (25%) who underwent inferior pubectomy developed erectile dysfunction.
- **Comparative Studies:** Chethan JV et al. (2016)²⁰ reported that 3 out of 18 potent patients preoperatively lost their potency post-surgery.

Wound Infection

- 18 patients (24%) developed wound infections postoperatively.
- Infections resolved with regular cleaning and dressing.
- **Comparative Studies:** Mathur R, Sudarshan O, Lukesh P (2014)¹⁹ reported a 2.9% wound infection rate in their study.

The study highlights the high success rates of progressive perineal urethroplasty, particularly for shorter strictures and simpler procedures like urethral mobilization alone. The data also underscore the importance of careful patient selection and procedure planning to minimize complications like re-stricture formation and erectile dysfunction. Comparative analyses with other studies reinforce the findings and provide a broader context for understanding the outcomes of various urethroplasty techniques.

CONCLUSION

Major mode of injury were road traffic accidents followed by fall from height. Perineal urethroplasty is the gold standard and The results of perineal anastomotic repair of PFUI are excellent. Important steps to avoid recurrence include maintaining the vascularity of urethra, Meticulous and complete excision of scar tissue is critically important

to optimise the outcome after perineal urethroplasty and tension free anastomosis. After removal of scarred portion, in order to achieve tension free anastomosis , adequate mobilization of distal urethra, crural separation, and inferior pubectomy is done sequentially. Moreover most of the defects are not long and necessity beyond 2 steps is rarely required .Inferior pubectomy is important in achieving a tension-free anastomosis in patients with long strictures. In recent years there has been a move to minimise the steps required to achieve a tension-free anastomosis, primarily by avoiding supracrural re-routing of the urethra. Supracrural urethral rerouting is almost never necessary for success during posterior urethroplasty. Overall there is a need for more high quality research in the work up, management, and follow up care of urethral stricture.

Conflict Of Interest: All authors declare no conflict of interest.

Source Of Funding: None.

Consent: As per international or university standards, the authors have collected and preserved written participant consent.

Ethical Approval: As per international or university standards, the author(s) has collected and preserved written ethical permission.

REFERENCES

1. Koraitim MM. Pelvic fracture urethral injuries: the unresolved controversy. *J. Urol.* 1999; 161: 1433-41.
2. Gomez RG, Mundy T, Dabey D et al. SIU/ICUD consultation on urethral strictures: pelvic fracture urethral injuries. *Urology* 2014; 83: \$48-58.
3. Hagedorn JC, Voelzke BB. Pelvic-fracture urethral injury in children. *Arab. J. Urol.* 2015; 13: 37-42.
4. Johnsen NV, Dmochowski RR, Young JB, Guillaumondegui OD. Epidemiology of blunt lower urinary tract trauma with and without pelvic fracture. *Urology* 2017; 102: 234-9.
5. Mundy AR, Andrich DE. Urethral trauma. Part I: introduction, history, anatomy, pathology, assessment and emergency management. *BJU Int.* 2011; 108: 310-27.
6. Tile M. Pelvic ring fractures: should they be fixed? *J. Bone Joint Surg. Br.* 1988; 70: 1-12.
7. Bjurlin MA, Fantus RJ, Mellett MM, Goble SM. Genitourinary injuries in pelvic fracture morbidity and mortality using the National Trauma Data Bank. *J. Trauma* 2009; 67: 1033-9.
8. Andrich DE, Day AC, Mundy AR. Proposed mechanisms of lower urinary tract injury in fractures of the pelvic ring. *BJU Int.* 2007; 100:
9. Basta, A. M., Blackmore, C. C., & Wessells, H. (2007). Predicting Urethral Injury From Pelvic Fracture Patterns in Male Patients With Blunt Trauma. *The Journal of Urology*, 177(2), 571-575.
10. Colapinto V, McCallum RW. Injury to male posterior urethra in fractured pelvis: a new classification. *J Urol* 1977; 118: 575-580.
11. Barratt RC, Bernard J, Mundy AR, Greenwell TJ. Pelvic fracture urethral injury in males-mechanisms of injury, management options and outcomes. *Transl. Androl. Urol.* 2018; 7: S29-62.
12. Wessells H, Angermeier KW, Elliott S et al. Male urethral stricture: American Urological Association Guideline. *J. Urol.* 2017; 197: 182-90.
13. Iman J. Tips for successful open surgical reconstruction of posterior urethral disruption injuries. *Urol. Clin. North Am.* 2013; 40: 381-92.
14. Webster GD, Ramon J. Repair of pelvic fracture posterior urethral defects using an elaborated perineal approach: experience with 74 cases. *J. Urol.* 1991; 145: 744-8.
15. Bhatt NR, Merchant R, Davis NF et al. Incidence and immediate management of genitourinary injuries in pelvic and acetabular trauma: a 10-year retrospective study. *BJU Int.* 2018; 122: 126-32.
16. P. Joshi, D.Desai, S. Surana, H. Orabi, and S. Kulkarni, "PD29- 11 magnetic resonance imaging (mri) in pelvic fracture urethral injuries to evaluate urethral gap: a new point of technique," *The Journal of Urology*, vol. 197, no. 4S, 2017.
17. Fu, Q., Zhang, J., Sa, Y.-L., Jin, S., & Xu, Y. (2009). Transperineal Bulboprostatic Anastomosis in Patients With Simple Traumatic Posterior Urethral Strictures: A Retrospective Study from a Referral Urethral Center. *Urology*, 74(5), 1132-1136.
18. Singh, S., Pawar, D., Khandelwal, A., & Jagmohan. (2010). Transperineal bulboprostatic anastomotic repair of pelvic fracture urethral distraction defect and role of ancillary maneuver: A retrospective study in 172 patients. *Urology Annals*, 2(2), 53. doi:10.4103/0974-7796.65104
19. Rajkumar Mathur, Sudarshan Odiya, Lukesh Patil. "Experience and Challenges in the Management of Pelvic Fracture Urethral Distraction Defect (PFUDD) By Excision and End to End Urethroplasty". *Journal of Evolution of Medical and Dental Sciences* 2014; Vol. 3, Issue 21, May 26; Page: 5859-5866,
20. Chethan JV, Dr. Rajendra B Nerli, Dr. Abhijith Musale, Dr. Shankar K, Shridhar Ghagane, 6 Dr. Murigendra B Hiremath. Pelvic fracture urethral distraction defects: Early outcome of progressive perineal repair. Volume 2; Issue 3; March 2016; Page No. 71-74