



Urethral Reconstruction for an Iatrogenic Female Urethral Rupture Following Foley Catheterization with Pelvic Organ Prolapse Repair: A Case Report and a Review of Literature

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Abstract

Introduction: In the earlier days, urethral injury was most commonly seen because of obstetric trauma but now it is been more seen iatrogenically after urogynecological surgeries. Even though they are not very common, it's pertinent to know their management. We have described an interesting case of pelvic organ prolapse repair with urethral reconstruction for a traumatic rupture of the urethra after improper Foley catheterization and related literature to the case.

Patient and Methods: Our index case was a 67-year-old lady who presented with something coming out through per vaginal for the past 2 years, along with urinary incontinence following Foley catheter insertion. On examination, she had grade uterine 4 (Baden-Walker halfway system) prolapses with grade 2 cystocele and a grade 1 enterocele, along with a bivalved urethra at 12 'O' clock and 6 'O' clock position starting close to the bladder neck and going up till the urethral meatus. Vaginal hysterectomy with anterior and posterior compartment repair along with urethral reconstruction was done as the patient wanted a definitive treatment.

Results: The patient has been dry for the past 12 months post-surgery, along with no recurrence of prolapse.

Conclusion: Urethral reconstruction can be performed with pelvic organ prolapse repair as a single-stage procedure with good outcomes.

Keywords: Foley catheter related complication; Pelvic organ prolapse surgery; Urethral reconstruction; Urethroplasty; Urinary incontinence; Vaginal hysterectomy

Abbreviations

UD: Urethral Diverticulum; AC: Anterior Colporrhaphy; AI Procedures: Anti-Incontinence Procedures; BMI: Body Mass Index; PUC: Per Urethral Catheterization; VCUG: Voiding Cystourethrogram; VFR: Vaginal Flap Repair; UR: Urethral Reconstruction; PAS: Pubovaginal Autologous Sling; PS: Posterior Vaginoplasty; POP: Pelvic Organ Prolapse; VH: Vaginal Hysterectomy; MUS: Mid-Urethral Slings

Brief Summary

A case of urethral reconstruction with pelvic organ prolapse repair with good outcomes has been described with good outcomes.

Introduction

The olden days had witnessed urethral injury related to obstetric trauma when the urethra suffered pressure necrosis against the fetal head in cases of prolonged, obstructed labor [1]. Nowadays iatrogenic trauma is the most common cause of urethral injury that presents after improper instrumentation [2]; the estimated risk being 3.2 per 1000 during a hospital stay [3]. According to Chapple [4], partial urethral tears are usually associated with iatrogenic causes and the other forms of iatrogenic trauma include urethral injury because of endoscopy, synthetic sling placement, diverticulectomy surgery and vaginal surgeries. However, iatrogenic injury to the urethra, bladder neck and trigone causing urinary incontinence is rare [5].

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Received Date: 28 May 2022

Accepted Date: 18 Jul 2022

Published Date: 22 Jul 2022

Citation:

Bahuguna G, Kurkal N, Anand A, Gite VA, Jha N, Swain P. Urethral Reconstruction for an Iatrogenic Female Urethral Rupture Following Foley Catheterization with Pelvic Organ Prolapse Repair: A Case Report and a Review of Literature. *Ann Clin Case Rep.* 2022; 7: 2259.

ISSN: 2474-1655

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Pelvic organ prolapse presents with bothersome lower urinary tract symptoms which can be extremely incapacitating at times that a patient might want a definitive resolution of her symptoms and removal of the uterus along with needed specific compartment repair. A case of vaginal hysterectomy for a grade 4 pelvic organ prolapses along with compartment repair for grade 3 cystocele and grade 1 enterocele with urethral reconstruction for an uncommon, iatrogenic traumatic rupture of the urethra during Foley insertion is described here, with good outcomes.

Methods and Methodology

Sixty three years old lady presented to us with something coming out per vaginum for the past 2 years. It was minimal to start with and she would reposit it back before passing urine or stools. However, for the past 6 months, she found it difficult to put it back as the prolapse had become swollen. She developed dribbling of urine for the past 4 months when she was admitted to a hospital and a urethral Foley catheterization was done. She developed dribbling of urine in spite of being on the Foley catheter and reported that the procedure of Foley catheter insertion had been quite painful with a little bleeding related to the procedure. She denied any form of urinary incontinence prior to the Foley catheter insertion. She had previous three vaginal deliveries with no obstetric or neonatal complications and she had been hypertensive for 10 years, maintaining normal blood pressure on tablet Telmisartan 40 mg once a day with a BMI of 28 kgm² and no other co-morbidities.

Urogynecological examination showed a bivalved urethra at 12 'O' clock and 6 'O' Clock position starting close to the bladder neck and going up to the urethral meatus. The urethral meatus had widened and she had a peri Foley catheter leaking of urine with grade uterine 4 (Baden-Walker halfway system) prolapse with grade 2 cystocele and a grade 1 enterocele (Figure 1, 2A). The prolapsed part had become quite edematous because of long-standing prolapse so she was on vaginal packing (roller gauze with betadine solution and liquid paraffin) twice a day for about 10 days to decrease the congestion. Ultrasound of the kidney urinary bladder showed normal bilateral kidneys with irregular bladder walls and settled echogenic debris suggestive of cystitis. Urine routine and microscopy showed 15 pus cells/ HPF and urine culture suggestive of *Enterococcus* species sensitive to nitrofurantoin, so she was started on Tablet Nitrofurantoin 200 mg BD for 7 days. Cystoscopy showed urethra as patulous, bladder neck wide open, anterior bladder wall normal, posterior bladder wall laid open with prolapsed bladder neck; the trigone seemed inflamed with bilateral ureteric orifice normal (Figure 1A, 1B). The remaining urethral length was about 2 cm. Pre-anesthetic fitness was obtained and an option of vaginal hysterectomy with anterior and posterior compartment repair along with urethral reconstruction was given which the patient consented to as she wanted a definitive option for her symptoms.

Surgical steps

- The patient was taken in a low lithotomy position under spinal combined epidural anesthesia.
- Hydrodissection with Injection of normal saline was done in the paracervical region (Figure 2B).
- A circumferential cervical incision was taken anteriorly just below the bladder reflection (Figure 2C).
- The vagina was mobilized anteriorly with the help of a

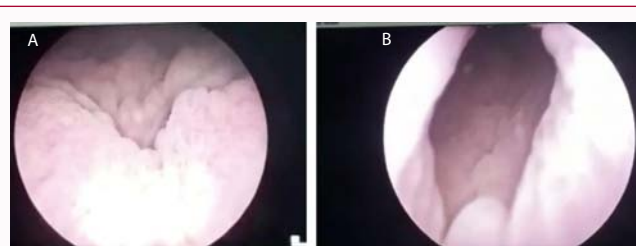


Figure 1: A) Cystoscopic image showing inflamed trigone and prolapsed bladder neck. B) Cystoscopic image showing patulous urethral opening.

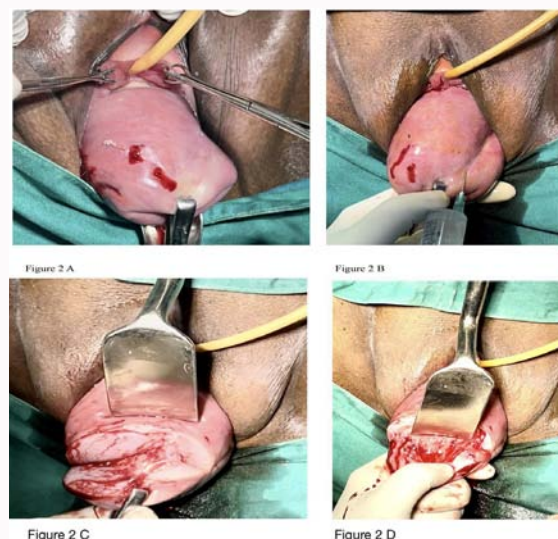


Figure 2: A) bivalved urethra at 12 O clock and 6 O Clock position, grade uterine 4 (Baden-Walker halfway system) prolapse with grade 2 cystocele and a grade 1 enterocele. B) Hydrodissection with Injection of normal saline. C) A circumferential cervical incision was taken anteriorly just below the bladder reflection. D) The vagina was mobilised anteriorly with the help of bladder retractor.

bladder retractor and the anterior cul-de-sac was opened with the help of blunt and sharp dissection (Figure 2D, 3A).

- The posterior cul-de-sac was opened sharply by making a bold cut in the posterior vaginal wall held by the Allis forceps between the uterosacral ligaments (Figure 3B).
- Bilateral uterosacral ligaments were clamped, cut and ligated by vicryl No 1, followed by transfixation of the cut pedicles. Both pedicles were tagged individually by a curved artery (Figure 3C).
- Bladder retractor was inserted in the vesicouterine space to keep the bladder away (Figure 3D).
- Bilateral uterine vessels were clamped, cut and ligated by vicryl No 1, followed by transfixation of the cut pedicles (Figure 3D).
- Right side fallopian tube, round ligament and ovarian vessels were clamped, cut and transfixed by vicryl No 1, with the pedicle tagged by a straight artery (Figure 4A).
- The uterus was held by an Allis forceps and kept away on the other side (Figure 4B).
- Left side fallopian tube, round ligament and ovarian vessels were clamped, cut and transfixed by vicryl No 1, with the pedicle tagged by a straight artery (Figure 4C).

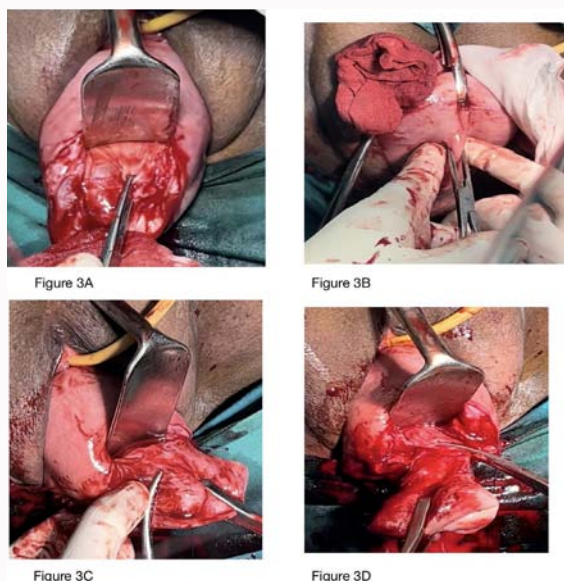


Figure 3: A) anterior cul-de-sac was opened with the help of blunt and sharp dissection. B) the posterior vaginal wall held by the Allis forceps between the uterosacral ligaments. C) right uterosacral ligament clamped. D) left uterine vessels clamped.

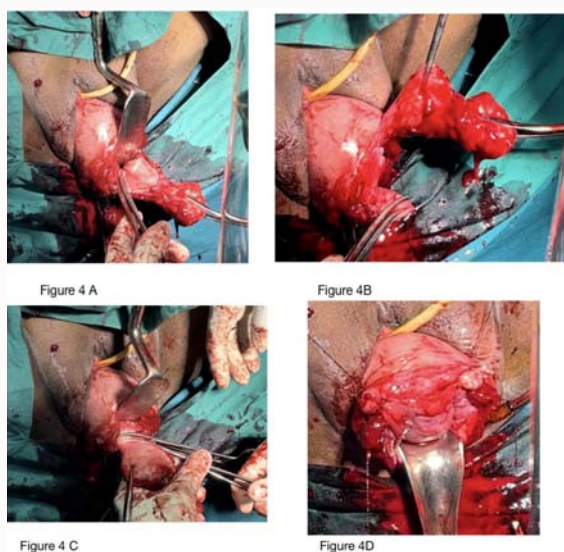


Figure 4: A) Right side fallopian tube, round ligament and ovarian vessels were clamped. B) The uterus was held by an Allis forceps and kept away on the other side. C) Left side fallopian tube, round ligament and ovarian vessels were clamped. D) All the pedicles were inspected for any bleeding.

- The uterus was delivered out and sent for histopathology.
- All the pedicles were inspected for any bleeding (Figure 4D).
- The cul-de-sac was obliterated by getting both the uterosacral pedicles in the midline by going through both the uterosacral pedicles and tying them in the midline.
- The redundant posterior peritoneum was sutured in 2 to 3 continuous layers by vicryl no 2 to obliterate it (Figure 5A).
- Allis forceps were used to hold the anterior vaginal wall at the vaginal apex and hydrodissection was done by injecting normal saline (Figure 5B).

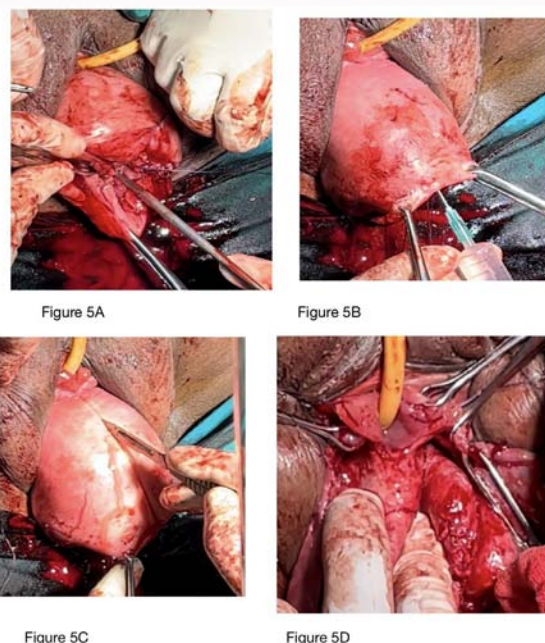


Figure 5: A) the redundant posterior peritoneum was sutured in 2 to 3 continuous layers by vicryl no 2. B) hydrodissection was done injecting normal saline. C) Bilateral vaginal flaps were created by incising the anterior vaginal wall in the midline. D) created vaginal flaps and the mobilised urethra.

- Bilateral vaginal flaps were created by incising the anterior vaginal wall in the midline (Figure 5C) and inserting scissors just below the vaginal epithelium and dissecting the entire cystocele from the vaginal wall. The assistant held the created vaginal flap by multiple Allis forceps to give gentle traction for dissection and the dissection was carried out until the inferior pubic rami were reached bilaterally (Figure 5D).
- Both the bivalved urethral edges were held by Babcock forceps and stay sutures were taken by vicryl no 4.
- Periurethral dissection was done to mobilize the urethra circumferentially (Figure 5D, 6B).
- The bivalved urethral edges were approximated primarily by vicryl no 4 in a continuous manner anteriorly (12 'O' clock) and posteriorly (6 'O' Clock) (Figure 6A) to restore the urethral lumen.
- Dorsal reconstructed urethra was buttressed by the periurethral tissue by interrupted sutures with vicryl no 4 (Figure 6C).
- Plication sutures were taken at the urethrovesical junction by vicryl no 2 in an interrupted manner to support the posterior urethra.
- Ventral reconstructed urethra was buttressed by the pubocervical fascia by interrupted sutures with vicryl no 4.
- A purse-string plication suture was taken by vicryl no 2 to reposit the prolapsed bladder.
- Ventral reconstructed urethra was buttressed by the left vaginal flap which is insinuated right up to the right inferior pubic rami so that the sutures to close the anterior vaginal wall do not overlap the reconstructed posterior urethra (Figure 6D).
- The redundant vaginal flaps were trimmed bilaterally.
- The anterior vaginal wall was closed by vicryl no 2 in an

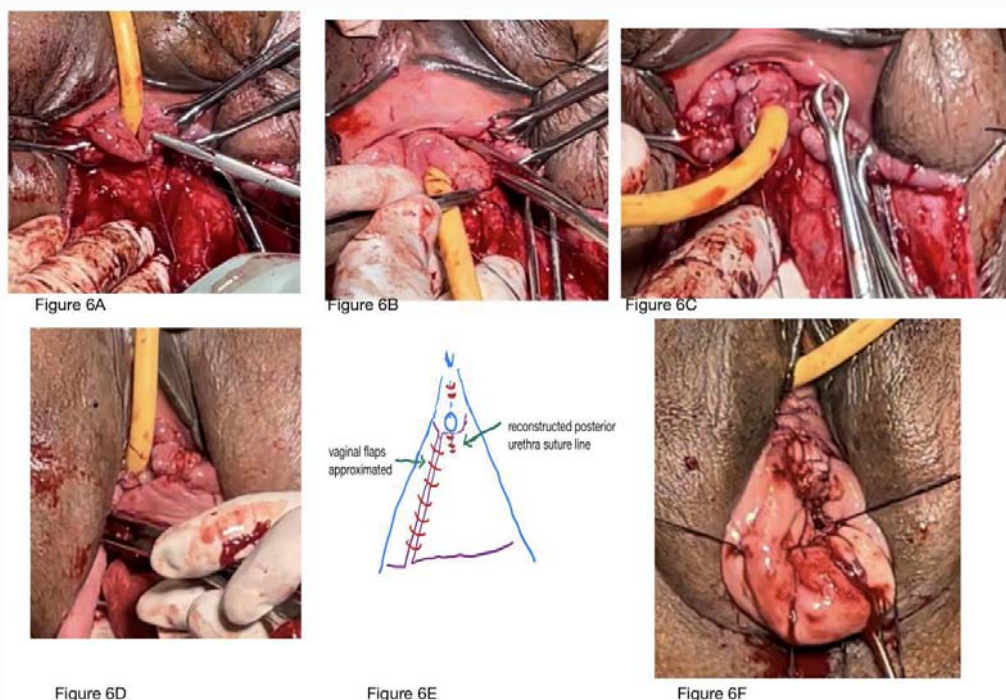


Figure 6: A) The bivalved urethral edges were approximated primarily by vicryl no 4 in continuous manner anteriorly (12 O clock) and posteriorly (6 O Clock) to restore the urethral lumen. B) Mobilisation of the urethra by periurethral dissection. C) Dorsal reconstructed urethra was buttressed by the peri-urethral tissue by interrupted sutures. D) Ventral reconstructed urethra was buttressed by the left vaginal flap which is insinuated right upto the right inferior pubic rami so that the sutures to close the anterior vaginal wall do not overlap the reconstructed posterior urethra. E) Diagrammatic representation of the vaginal flap closure. F) The anterior vaginal wall flaps after approximation.

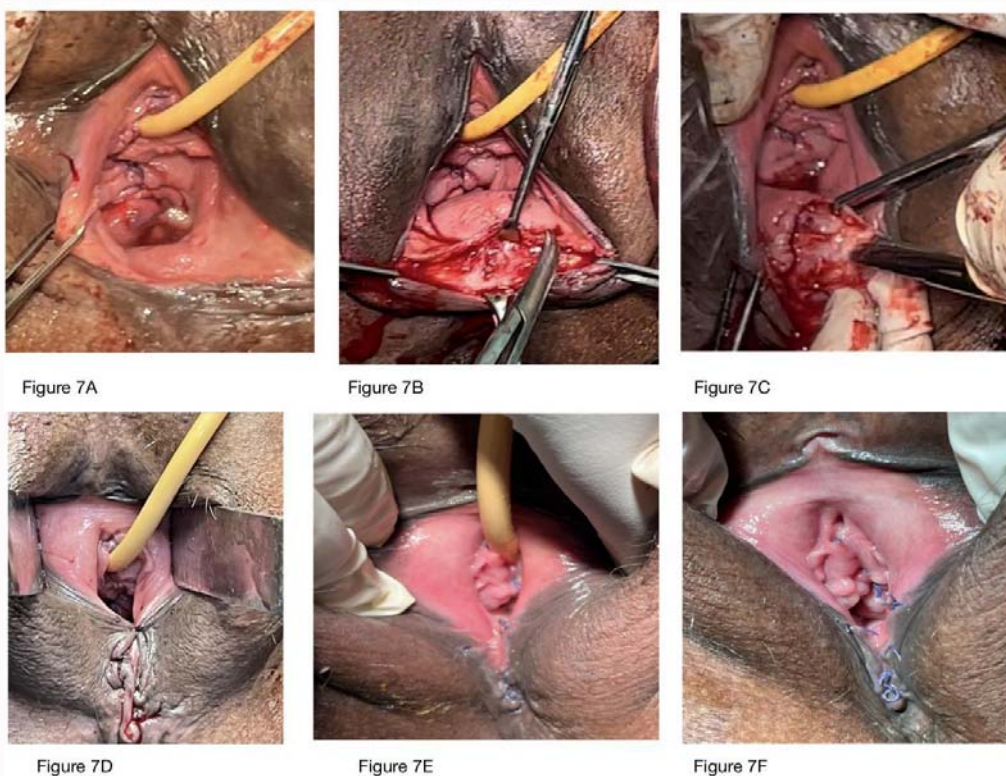


Figure 7: A) After urethral reconstruction, cystocele repair and vault closure. B) A wedge-shaped perineum was cut to reconstruct the perineum. C) Bilateral vaginal flaps were created by incising the posterior vaginal wall in the midline and dissecting the entire rectocele from the anterior wall of the rectum. D) Final post-operative picture. E) Day 21 post-operative picture. F) Day 28 post-operative picture after Foley removal.

interrupted manner (Figure 6F).

- The uterosacral ligaments were anchored to the posterior vaginal wall bilaterally.
- Vaginal vault was closed by vicryl no 1 in an interrupted manner and picture after vault closure (Figure 7A).
- Hydrodissection with Injection of normal saline was done just below the posterior vaginal wall.
- Three Allis forceps were used to hold the vaginal wall posteriorly and form a triangle on gentle traction (Figure 7B).
- A wedge-shaped perineum was cut to reconstruct the perineum (Figure 7B).
- Bilateral vaginal flaps were created by incising the posterior vaginal wall in the midline and dissecting the entire rectocele from the anterior wall of the rectum (Figure 7C).
- A purse-string plication suture by vicryl no 2 was taken to reposit the prolapsed rectum.
- The posterior vaginal was closed by vicryl no 2 in an interrupted manner and the perineum was reconstructed (Figure 7D).
- Vaginal packing was done with roller gauze dipped in betadine solution.
- The Foley catheter was fixed to the anterior abdominal wall with adhesive sticking in a form of a gentle loop to minimize tension on the neourethra.

The operative time was about 3 h with a blood loss of approximately 250 ml to 300 ml. Vaginal packing was removed on day 1 post-operatively. She was kept on intravenous antibiotics for 3 days and then shifted to oral antibiotics for a total of 7 days. The patient was kept on PUC for 4 weeks and she did not report any pericatheter leaking of urine post-operatively (Figure 7E) shows day 21 post-operative status. Post-operative urine culture sent on day 2 post-surgery was sterile. After 4 weeks a VCUG was performed which showed no extravasation of urine and successful voiding with insignificant urinary post-void residual volume. Hence, PUC was removed, on day 28 (Figure 7F) post-operative images shows a near normal looking neomeatus. She was followed up after 1 month, 3 months, 6 months and 12 months maintaining urinary continence. Ethical committee approval has been taken to publish this case.

Discussion

Etiology of iatrogenic urethral injury

Post-traumatic urethral injury is rare in females because of its short course, mobility and the urethra is protected under the bony pelvis with no significant attachments to the pubis [4]. In the developing countries, urethral injuries were seen as part of complicated labor whereas in the developed countries urethral injuries are mostly caused by trauma or iatrogenic causes [6]. Erosion of the urethra by the synthetic pubovaginal slings is the emerging new cause of urethral injuries encountered lately [7] and requires more extensive urethral repair because it is complicated by removal of the graft material.

Routine Foley insertion can sometimes go wrong, and there have been cases of bladder rupture [8] and incomplete ureteral rupture in a neurologically impaired person [9]; warranting extreme caution when inserting Foley catheter in every patient. A 14 Fr-16 Fr Foley

catheter with a 5 ml to 10 ml balloon is recommended for women to reduce the pressure effects on the urethra and the bladder neck by Igawa et al. [10] as long term Foley catheterization can cause pressure necrosis of the urethra needing urethral reconstruction later [11].

Diagnosis of iatrogenic urethral injury

A thorough history to know the exact cause of injury would help to plan the management and a thorough urogynecological examination to look for the extent and the site of urethral injury. Cystourethroscopy tells us about the condition of the remaining urethra, particularly the proximal urethra and the internal urethral sphincter [1]. In a case of urethral injury it is important to rule out a concomitant bladder injury before we plan a surgical repair.

Management of iatrogenic urethral injury

The goal of urethral reconstruction after a urethral injury is to achieve a continent and an unobstructed urethra. However, considering the lack of standardization in urethral reconstruction restoring the anatomy and the urethral function is a challenge. The second hurdle is accomplishing the surgical repair of the anatomy and the function in a single-stage procedure; correcting the anatomy is restoring the torn urethra and correcting the function means preserving the urinary continence. Urinary incontinence is most commonly encountered because of the sphincteric loss [12] similarly seen in our patient.

The literature related to urethral reconstruction is quite diverse and there is no standardization regarding the best technique. The surgical technique of urethral repair largely depends on the extent of damage to the urethra and the surgeon's expertise. If there is minimal disruption, a single layer of interrupted sutures can suffice, a bigger defect would need a vaginal flap and if lateral tissue is insufficient then a U-shaped vaginal wall can be rotated to create the posterior urethral wall. However, in cases of extensive scarring, a labia minora flap can be raised to cover the defect [7]. Sufficient mobilization of the periurethral tissue is important for a tension-free reconstruction followed by a multi-layered closure of the defect, along with adequate blood supply and a continuous urinary drainage form essential features of surgical repair [1].

Timing of the urethral reconstruction: In the earlier days, the timing of urethral reconstruction was after 3 to 6 months after the injury has occurred; however, with the advent of flaps and grafts, it has become feasible to perform when the tissue is out of any infection or inflammation [1]. However, a well-vascularized flap is essential in cases of severe injury and compromised blood supply. So a urethral repair can be performed immediately, or there can be a delayed primary repair (10 to 14 days) and at times a late repair which is after 3 months [4].

Single stage urethral reconstruction with concomitant anti-incontinence procedure: Summond et al. [13] had 40/50 patients with iatrogenic urethral injury and total incontinence (AC \pm VH in 27, UD in 11 and transurethral bladder neck dissection in 2). All the patients had 75% or more loss of the urethral floor. Primary closure was performed in 25 cases, lateral relaxing incisions were taken in 3, labial skin flap was taken in 12 cases and Martius flap was taken in 10 patients. A second stage retropubic urethrovaginal suspension was performed in 20 patients with a cure rate of 74% (37/50) and improved in 8% (4/50) (Table 1).

Blaivas et al. [5] in their series of 10 incontinent women with extensive urethral injury because of operative complications (UD in

6, AC in 2 and AI-procedures in 2 patients) performed a concomitant anti-incontinence procedure (pubovaginal sling in 6, modified Pereyra operation in 3, and modified Kelly plication in 1). 6/10 were continent after a single-stage procedure and the remaining 3/10 had SUI with VVF in 1/10. An anti-incontinence procedure was performed as a second stage procedure in the 3 patients with SUI with success.

Flisser et al. [7] performed urethral reconstruction in 67/74 women for iatrogenic reasons (UD 28, urethral injury after Pereyra procedure 18, AC 10, gynecological surgery resulting in fistula in 3, synthetic material erosion 5, urethral obstruction from previous surgery 3). Vaginal Flap Repair (VFR) alone 10/74, VFR with autologous pubovaginal sling 56/74, VFR with modified Pereyra repair 5/74, VFR with Kelly plication 1, Urethrolisis with primary urethral repair in 1 and Tanagho anterior bladder flap in 1 was done. Preoperative incontinence was in 62/74 and postoperatively 54/74 (87%) women had improved or cured incontinence. Four had SUI cured by 2 stage procedure and 2 had de novo urge incontinence. Flisser et al. [7] deemed staged procedures and the use of bladder flaps as “unnecessary” in their experience and advocated VFR along with pubovaginal sling as an anti-incontinence procedure.

In a review by Blaivas et al. [1] in 2008, less than 500 patients with severely injured urethra were described in English literature and successful reconstruction was achieved in 67% to 100% with continence in 55% to 92% of them, after a single-stage procedure. Incontinence was about 50% to 84% in women where an anti-incontinence procedure was not performed concomitantly; however, secondary procedures performed subsequently were successful in most of the patients. It was advocated that proximal urethral injuries have as high as a 50% chance of urinary incontinence unless a concomitant sling has been used. Hence, Blaivas et al. [1] preferred an autologous pubovaginal sling concomitantly at the time of urethral reconstruction in cases of sphincteric incontinence.

A case of urethral injury along with the sphincter has been cited by Wadie et al. [14], while enlarging the vaginal introitus and was treated successfully with a PAS and posterior vaginoplasty, a similar case of urethral injury extending up to the bladder neck at 6 ‘O’clock position following a longitudinal complete urethral incision for a mistaken vaginal septum was described by Albayrak et al. [15] leading to total incontinence and corrected by a rectus fascial sling.

Rosenblum et al. [16] in their review described urethral erosion by synthetic sling as the entry of the sling substance into the urethral lumen which is treated by complete surgical removal of the foreign body, debridement and reconstruction primarily with or without the use of Martius flap along with an autologous fascial sling for SUI. Similarly Amundsen et al. [17] in their series of 9 patients with urethral erosion following pubovaginal (1 autologous and 8 synthetic) sling insertion described locating the urethral erosion cystoscopically and then incising the sling near the erosion with debridement of the urethra and then primary reconstruction along with augmentation with Martius graft. In a case of a synthetic sling, the whole sling was removed and in non-synthetic slings, it was “peeled out” of the urethra. However, in this series 30 months after surgery all the patients had some form of voiding dysfunction (urinary retention in 4, urge incontinence in 3 and mixed incontinence in 2); one of the patients with SUI required a pubovaginal sling later.

Reconstructive vascular flaps for post-traumatic urethral

reconstruction: Approaches for urethral reconstruction described by Blaivas et al. [1] include using anterior or posterior bladder flaps and vaginal wall flaps.

Flisser et al. [7] used flaps in 60/74 patients, Martius in 58, omental in 3, gracilis myocutaneous in 1; Martius flap was found to improve the outcome of the surgery as it would prevent the breakdown of the repair and thereby a recurrent fistula. Tubularized pedicle flaps of the buccal mucosa, neurovascular pudendal thigh flap and rectus abdominis myocutaneous flap have come up recently [6].

A modified neurovascular pudendal thigh flap (Singapore flap) was described by Zorn et al. [18] for complete urethral reconstruction following previous urogynecological surgeries in 2 patients. In 1 patient a tubularized flap was anastomosed to the bladder neck, but she developed bladder neck stricture after 2 months and required urethral dilation. For the 2 patient, a flap was used to cover up an inlay urethroplasty.

Post-operative urethral catheterization after urethral reconstruction: Chapple et al. [4] recommended bladder drainage for about 4 weeks for complete urethral healing; we had kept our patient on per urethral catheterization for 4 weeks with good outcomes.

Complications related to urethral reconstruction: One of the early complications of urethral injury is an infection which can lead to an abscess formation, warranting early urinary diversion and antibiotics to prevent complications [4].

In cases of urethral injury, the bladder can develop low compliance, over activity and impaired contractility which in most cases improves after successful urethral reconstruction [1].

Sling concomitant with POP repair in pre-operative SUI cases: Post POP repair there is a 25% to 40% chance of developing SUI (de novo or worsening) because of the unkinking of the urethra in previously continent women [19] concomitant sling surgery reduces the chances of postoperative SUI at the cost of increased risk of complications related to the AI procedure. However, in cases of preoperative SUI, a concomitant sling surgery along with POP repair had a significantly decreased rate of SUI at 1 year follow up [19]. Autologous fascial pubovaginal slings in comparison to synthetic mesh MUS have a higher risk of voiding dysfunction post-operatively along with greater morbidity associated with fascia harvesting [19]. Autologous fascial pubovaginal slings may be preferred in cases of urethral reconstruction where the autologous fascia offers concomitant urethral reinforcement and there is a risk of erosion and foreign body action associated with the synthetic material of MUS [20]. In our case, the patient reported acute onset of urinary incontinence following painful Foley insertion so primarily urethral reconstruction was sought along with VH and a second stage AI procedure was planned if she had persisted urinary incontinence.

Urethral reconstruction concomitant with POP repair: To our current knowledge, this is one of the first cases of urethral rupture during improper Foley catheterization treated successfully with urethral reconstruction, which was concomitantly performed with a vaginal hysterectomy and compartment repair in a single-stage procedure.

Conclusion

Even though Foley catheterization is a simple procedure but needs to be done with caution as improper insertion can lead to major

urethral injuries. Hence, in the present era of increasing medical litigation, knowing the management of iatrogenic urethral trauma is important, even though it is quite uncommon.

Pelvic organ prolapse repair and urethral reconstruction can be accomplished in the same setting; however, the need for an anti-incontinence procedure needs to be individualized.

Authors Contribution

Bahuguna G, Project development, manuscript writing. Kurkal N, Manuscript editing. Anand A, Manuscript editing, Jha N, Data collection, Gite VA, Manuscript editing. Swain P, Data collection.

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