ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

DOI: 10.5336/urology.2021-86305

Repair with Purse-String Suture Technique in Circular Glans Penile Defects Involving the Distal Urethra: Observational Study

Distal Üretrayı İçine Alan Sirküler Glans Penis Defektlerinde Purse-String Sütür Tekniğiyle Onarım: Gözlemsel Çalışma

Anvar AHMEDOV[a], Mehmet SEVİM[b]

[a]Clinic of Plastic, Aesthetic and Reconstructive Surgery, Başakşehir Çam ve Sakura City Hospital, İstanbul, TURKEY
[b]Department of Urology, Kütahya University of Health Sciences Evliya Çelebi Training and Research Hospital, Kütahya, TURKEY

ABSTRACT Objective: Circular necrotic wounds, including the urethral meatus and distal urethra, can be seen on the glans penis of patients in intensive care units (ICU) due to long-term application of urethral catheters. In this article, we aimed to explain the purse-string suture (PSS) technique that we use in such wounds in the urethral meatus. **Material and Methods:** Twelve male patients who were treated in Kütahya Health Science Univesity Evliya Çelebi Research and Training Hospital between January 2017 and January 2020 in the neurology and general ICU and who developed circular necrotic pressure wounds in the urethral meatus due to long-term use of urethral catheters were included in the study. Wounds were repaired with PSS technique in all patients. The data of the patients were collected retrospectively. Demographic data of the patients, urethral defect lengths, postoperative success rates, complications and managing these complications were evaluated. **Results:** The mean age of the 12 patients included in the study was 67.5±16.76 years. The mean length of the urethral defect formed in the patients during the operation was calculated as 2.25 (interquartile range 0.7) cm. The number of patients who came and were reached for regular control was 8 (66.7%). Two (16.7%) patients died due to their main diseases. Wound infection developed in 2 (16.6%) patients and urethra-cutaneous fistula developed in 1 (8.3%) of the patients, and these 3 (25%) patients were treated by re-operation. **Conclusion:** PSS is an easy-to-use technique with good cosmetic and functional results in the closure of circular defects of the distal urethra.

Keywords: Urinary catheterization; urethra; reconstructive surgical procedures; suture techniques

ÖZET Amaç: Üretral kataterlerin uzun süreli uygulanmasına bağlı olarak yoğun bakım ünitelerinde (YBÜ) tedavi gören hastaların glans penislerinde üretral meatusu ve distal üretrayı da içine alan sirküler nekrotik yaralar görülebilmektedir. Bu yazımızda, üretral meatusta ortaya çıkan bu tür yaraların cerrahi tedavisinde uyguladığımız "purse-string sütür (PSS)" tekniğini anlatmayı amaçladık. **Gereç ve Yöntemler:** Kütahya Sağlık Bilimleri Üniversitesi Evliya Çelebi Eğitim ve Araştırma Hastanesi nöroloji ve genel YBÜ'lerinde Ocak 2017-Ocak 2020 tarihleri arasında tedavi gören ve uzun süreli üretral sonda kullanımına bağlı üretral meatusta sirküler nekrotik bası yarası gelişen 12 erkek hasta çalışmaya dâhil edildi. Hastaların tamamının yaralarına PSS tekniği ile onarım gerçekleştirildi. Hastaların verileri retrospektif olarak toplandı. Hastaların demografik verileri, üretral defekt uzunlukları, cerrahi sonrası başarı oranları ve karşılaşılan komplikasyonlar ve bu komplikasyonlarla başa çıkma yöntemleri değerlendirildi. **Bulgular:** Çalışmaya dâhil edilen 12 hastanın yaş ortalaması 67,5±16,76 yıl idi. Ameliyat esnasında hastalardaki üretral defektin ortalama uzunluğu 2,25 (çeyrekler arası aralık 0,7) cm olarak hesaplandı. Düzenli kontrole gelen ve ulaşılan hasta sayımız 8 (%66,7) idi. İki (%16,6) hasta, ana hastalıkları sebebiyle hayatını kaybetti. Hastalardan 2'sinde (%16,7) yara yeri enfeksiyonu ve 1'inde (%8,3) üretro-kutanöz fistül gelişti ve bu 3 (%5) hasta reopere edilerek tedavi edildi. **Sonuç:** PSS, distal üretranın sirküler defektlerinin kapatılmasında güvenilir, kozmetik ve fonksiyonel olarak iyi sonuç veren ve kolay kullanılabilir bir tekniktir.

Anahtar Kelimeler: Üriner kateterizasyon; üretra; rekonstrüktif cerrahi prosedürleri; sütür teknikleri

Long-term indwelling urethral catheters are generally used at home in hospital, and private healthcare settings for reasons such as ensuring the urinary discharge of patients receiving treatment, eliminating retention, monitoring urine output, ensuring continuous or intermittent washing of the bladder, and pro-

Correspondence: Anvar AHMEDOV
Clinic of Plastic, Aesthetic and Reconstructive Surgery, Başakşehir Çam ve Sakura City Hospital, İstanbul, TURKEY/TÜRKİYE
E-mail: anvar.ahmedov@yahoo.com

Peer review under responsibility of Journal of Reconstructive Urology.

Received: 20 Sep 2021 ***Received in revised form:*** 18 Nov 2021 ***Accepted:*** 30 Nov 2021 ***Available online:*** 06 Dec 2021

tecting the area in patients with incontinence. There are many well-known and common complications associated with the use of long-term urinary catheters, such as urinary tract infections, crusting due to mineral deposits, and peri-catheter leakage. One of the complications that may occur is glanular necrosis, which occurs with the progression of erythema and edema around the urethral meatus and involves the urethra.[1] In the literature, there are few studies reporting penile or glans necrosis. The etiological causes of this condition can be listed as the presence of uncontrolled diabetes mellitus, chronic renal failure in which calciphylaxis occurs, systemic vasculitis, injection of intra-cavernous vasoactive agents, drug use, infections, paraphimosis, and complications secondary to penile and urethral surgeries.[1-5] In some cases, hypoxia and necrosis of a tissue may develop due to arterial microthrombosis.[6] Although glans penile necrosis is initially treated by the methods such as antibiotics, fluid therapy, and surgical debridement, partial or total penectomy may be required in the later stages, depending on the degree of necrosis.[2,6] There are options such as primary closure, secondary wound healing, skin grafts and flaps in the repair of these tissue defects.[7] The size, depth, localization of the defect and the condition of the surrounding tissues should be considered in the selection of these techniques to achieve the best functional and cosmetic results.[8]

In 1985, Peled et al. described the purse-string suture (PSS) technique, which provides complete closure of circular defects by reducing the surface area with minimal scarring, by utilizing the extensibility and flexibility properties of the skin in breast surgery.[9] In our study, we described the PSS technique, which we applied in the reconstruction of the defect after debridement or subtotal penectomy due to circular necrosis of the glans penis involving the urethra due to long-term urethral catheterization in the intensive care units (ICU), and our results with the literature data.

MATERIAL AND METHODS

This study was started with Kütahya Health Sciences University Ethics Committee's permission dated 15.04.2021 and numbered 2021/07-03. All steps of the study were planned and applied carefully, according to the Declaration of Helsinki. Twelve male patients who were treated in the Neurology and General ICU in Kütahya Health Sciences University Faculty of Medicine Evliya Çelebi Training and Research Hospital between January 2017 and January 2020 and who were consulted with us due to necrotic circular wounds in the urethral meatus due to long-term use of indwelling urethral catheters were included in the study. Data were collected from the electronic patient records. Demographic data of the patients, American Society of Anesthesiology (ASA) risk scoring, comorbidities, self-care competence, size of urethral defects, early and late complications and success rates were evaluated. The criteria for the inclusion of patients in the study were circular necrosis developing in the distal urethra and its extension up to 5 mm proximal to the glanular, coronal, or coronal sulcus (Figure 1). Other penile necroses not involving the urethra were not included in the study. Whether the developing necrosis that was due to vasculitis, was evaluated with collected pathology materials intraoperatively. The patients were followed daily for the first 7 days postoperatively and weekly

FIGURE 1: Preoperative images of the patient.

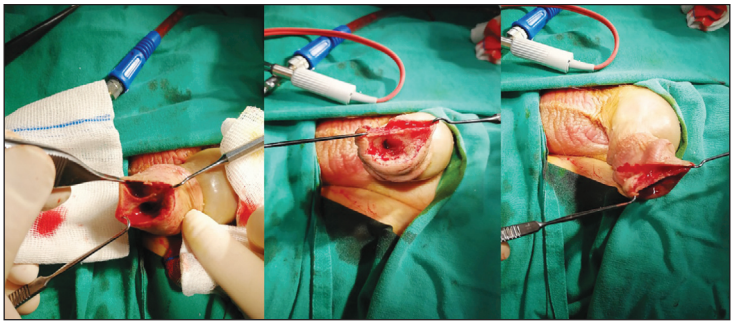

FIGURE 2: Intraoperative surgical debridement of the patient and preparation of flaps.

for the first month. After discharge, the patients were followed up monthly for 6 months.

Surgical Technique: The patients were operated in on the supine position under spinal and general anesthesia. Prophylaxis was provided by intravenous cefazolin (Cezol® 1 g; Deva, İstanbul, Turkey) administered to the patients before anesthesia induction. The urethral meatus of the glans penis and the necrotic tissues present in the distal urethra were debrided into healthy tissues with a good blood supply (Figure 2). After hemostasis, a 2 mm thick, 8-10 mm deep skin flap was circularly removed from the glans penile defect to the corona penis. In cases where necrotic tissues extended to the frenulum, the incision line was planned to remain in the inferior oblique (Figure 2). The urethra was removed and mobilized from the surrounding tissue in a flap-shaped anatomical dissection plan of 2-3 cm in length without impairing its capillarity and blood supply. Since the diameter of the urethral lumen did not match the diameter of the glans penis, the glans flap was sutured to the urethral flap with the PSS technique (by approximating the inconsistent lengths of their diameters) using 4/0 round rapid vicryl (Figure 3 and Figure 4). A 16 F urethral catheter was applied to the patient after surgery. For the post-operative care of the patient, wound care with Q-type rods and dressing to envelop the penis was performed using topical 0.2% nitrofurazone (Furacin® ointment, Eczacıbaşı, İstanbul, Turkey).

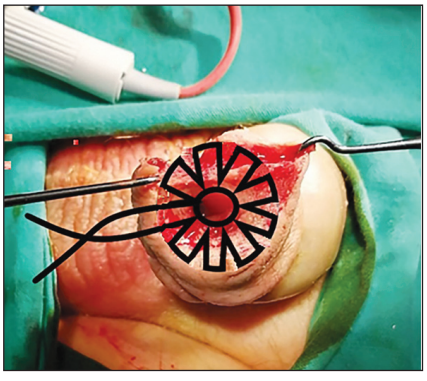

FIGURE 3: Schematic suturing image.

STATISTICAL ANALYSIS

IBM Statistical Package for the Social Science version 22.0 (SPSS Chicago, Illinois, USA) program

FIGURE 4: Image of the defect after purse-string suture repair: Repair of tissues with smaller urethral diameter and larger glans diameter with purse-string suture technique.

was used for statistical analysis in this study. Continuous variables were expressed as mean±standard deviation. Categorical variables were shown as percentages.

RESULTS

The mean age of the 12 patients included in the study was calculated as 67.5±16.76 (42-97) years. While 1 (8.3%) of the patients had no comorbidity (ASA 1), 6 (50%) had mild systemic disease (ASA 2), 4 (33.3%) had severe systemic disease (ASA 3) and 1 (8.3%) had life-threatening condition (ASA 4). The median length of the urethral defect formed in the patients was calculated as 2.25 (0.7) cm. The length of the flap prepared from the glans penis was approximately 1 cm, and the urethra was mobilized distally at a distance of more than 2 cm. No tissue tension was occurred at the repair line of the flaps in any of the patients. Two (16.6%) patients hospitalized in the neurology and general ICU died due to their main diseases. Simultaneous additional surgery was performed in 3 (25%) of the patients due to different diseases. Among the patients we operated on, wound infection developed in 2 (16.6%) patients and urethrocutaneous fistula developed in 1 (8.3%) patient, and these 3 (25%) patients were treated by re-operation (Table 1, Table 2). No vasculitis was found in the wound pathologies of any patient, and their pathologies were reported as necrosis. It was considered that necrosis developed due to catheter compression. The use of urinary catheters due to neurological deficits continued in 8 (66.7%) of our patients (Figure 5). The number of patients who came and was reached for regular control was 8 (66.7%), and in the controls performed, 5 (41.7%) of these patients continued their lives with catheters. Retrograde urethrography was taken for control purposes (Figure 6). No urethral stricture was observed in any of the patients.

DISCUSSION

Long-term use of urethral catheters in ICU may lead to necrotic circular wounds involving the urethral meatus on the glans penis. In patients hospitalized in the ICU, weakening of the immune system, comorbidities, reproduction of resistant microorganisms due to long-term antibiotic use, and disruption of tissue nutrition and oxygenation of urethral catheters pave the way for necrosis in the glans. Necrotic tissue characteristically has a moist, yellow, green, or gray appearance, however, it may become thick, black eschar if the wound dries. In the presence of necrotic tissue, wound healing is impaired due to a lack of oxygen and nutrients. The accumulating dead tissue may also act as a breeding ground for bacteria and mask the underlying fluid or abscess accumulation. Proper removal of necrotic tissue is an important step in wound healing.[10]

TABLE 1: Patients' demographic data and surgical findings.

Patient No	Age	ASA	Length of urethral defect (cm)	Additional surgery	Need for care	Complication	Result
1	70	2	2.5	No	Yes	Urethrocutaneous fistula	Recovered
2	69	3	2.3	No	Yes	Wound infection	Recovered
3	79	2	1.5	No	No	No	Recovered
4	54	4	1.8	No	Yes	No	Ex
5	50	2	2.2	No	No	No	Recovered
6	86	3	2.8	No	No	No	Recovered
7	69	2	2.5	No	No	No	Recovered
8	46	2	2.4	No	No	No	Recovered
9	42	1	2	No	No	No	Recovered
10	97	3	2.3	Bilateral orchiectomy	Yes	No	Ex
11	69	3	1.8	Internal urethrotomy	No	No	Recovered
12	79	2	1.7	Fournier's surgery	Yes	Wound infection	Recovered

ASA: American Society of Anesthesiology.

TABLE 2: Patients' demographic data, lesion characteristics and prognosis.

	n=12	
Age (Mean±SD)	67.5±16.76	
Length of defect [Median (IQR)]	2.25 (0.7)	
Additional surgical intervention (n, %)	No: 9 (75)	Yes: 3 (25)
Complication (n, %)	No: 9 (75)	Yes: 3 (25)
Mortality (n, %)	2 (16.6)	

IQR: Interquartile range; SD: Standard deviation.

FIGURE 5: Postoperative 4th week view of the patient (wound healing is completed).

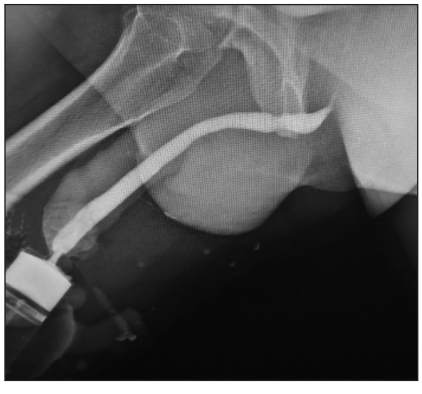

FIGURE 6: Postoperative 4th week urethrography.

In their study, Kohler et al. demonstrated that the length of the penile urethra was extended by flexing as much as the difference in penile length when the penis became erected from a flaccid state and that it could be withdrawn when the penis turned into a flaccid state.[11] In the study conducted by Krishnamoorthy and Joshi, the mean length of the urethra was measured between 14-22.5 cm in the age range of 18-94 years, and the mean length was reported as 17.55±1.42 cm.[12] In the same study, it was determined that the mean length of the urethra was maximum by 17.73±1.58 in the measurements on the same population in the 51-60 age range. It is considered that the urethral length of the patients increases after the age of 60, which is caused by age-related atrophy.

In the study entitled urethral advancement in patients with primary distal hypospadias involving 20 patients aged 6-24 months, Hashish et al. showed that the urethra could be advanced for several centimeters easily and the distal urethral defect could be easily closed with this method.[13] It was reported that the cases were performed with a penile tourniquet. While the undesirable urethral injury was observed in 5% of patients, intraoperative bleeding was observed in 25% of them and it was stopped by cauterization. As an early postoperative complication, edema, hematoma, superficial and deep infection were observed, and as a long-term complication, it was reported that meatal stenosis, meatal retraction and urethrocutaneous fistula developed. Meatal retraction and erectile dysfunction developed in one patient. The PSS technique enables circular defects to be completely closed by reducing the surface area by using the extensibility and flexibility properties of tissues.[9] We did not use a penile tourniquet in our study, in which we used the PSS technique completely, and we did not encounter complications such as bleeding or urethral injury. Due to the advanced age of our patient group, the use of only a urethral flap was not considered due to the atrophy caused by advanced age. The defective space that emerged with the advancement of the glans flap was reconstructed with both structures. We considered that 1 (8.3%) patient who developed urethrocutaneous fistula paved the way for it because he was the patient with the longest urethral defect in the study.

In another similar study conducted by Haider et al., the distal urethral defect was closed by urethral mobilization and advancement in 60 anterior hypospadias patients with a mean age of 57.1±38.7 months.[14] It was reported that urethral retraction was

observed in 2 patients and urethral stenosis was observed in 4 patients. The rate of urethral stenosis was found to be much lower only in mobilization and advancement of the urethra, due to the wider surface of the glans flap, PSS keeps the urethral lumen everted in a convex position for 4-8 weeks, which eliminates the possibility of stenosis.

Shalaby et al. showed that the PSS technique is effective, safe and feasible in closing the peritoneum, with no recurrence and with outstanding cosmetic results in an article which was describing pediatric hernia repair.[15] Park et al. described in their study which is involving the closure of head and neck wounds in 39 patients, that the PSS technique is fast and easy to apply, and it is a successful technique in round wounds that result in a smaller scar.[16] In a case report reported by Oshodi and Castaneda, they successfully applied the PSS technique to buffer the wound by suturing after resection in cornual ectopic pregnancy.[17] Cammarata et al., in their study for the closure of circular skin defects, compared PSS and full-thickness skin graft with each other and stated that the advantages of PSS were confirmed in terms of feasibility, application speed and reduction in the mean defect area.[18] According to the meta-analysis results published by Rondelli et al., they showed that the infection rate in surgical wounds in the closure of stoma was statistically significantly lower when the purse-string closure technique was compared with the conventional closure techniques, and they found no significant difference between the 2 techniques in terms of the duration of surgery, the length of hospital stay, incisional hernia, and intestinal obstruction rates.[19] Statistically significant reduction of wound infection depending on the choice of PSS technique can reduce the postoperative complication rate, thus improving patient outcomes and reducing costs for the healthcare system.

In his book chapter, Shubailat opened the subject of glans skin flaps extensively and showed that glans skin flaps had a flexible and widespread use.[20] Due to the presence of a glans defect in our study, a 2 mm thick flap was removed and sutured to the urethra with PSS. Infection developed in 2 (16.7%) patients and they were sutured again after appropriate antibiotic therapy and wound debridement. Except for these patients, no problems were observed in wound healing. We considered that the fact that simultaneous surgery of Fournier's gangrene was performed in 1 of these patients who developed wound infection, and the fact that the other 1 patient was under treatment in the ICU for a long time paved the way for the infection. We think that the reduction in the projection of the glans by removing the necrotic tissues and bringing the tissues closer to each other is the only disadvantage of the technique.

In our study, we demonstrated that we performed debridement in patients who developed circular penile necrosis involving the distal urethra after a long-term urethral catheter in the ICU and then successfully performed the repair with the PSS technique. To the best of our knowledge, although there are publications reported as case reports in the literature, there is no study on the approach to penile necrosis.

The retrospective design of our study was the most important limitation. Another limitation is that this study could not be conducted with more patients. However, we believe that these results may be guiding for surgeons in the management of circular necrotic wounds of the distal urethra.

CONCLUSION

We consider that the PSS technique presented in this study is an easy-to-use technique with reliable, cosmetic and good functional results which provide primary repair without tissue tension by taking advantage of the elasticity of the tissue in closing the circular defects of the distal urethra. Prospective studies with a larger number of patients and a control group are needed to reveal more accurate and precise results.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or mem-

bers of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Anvar Ahmedov, Mehmet Sevim;* ***Design:*** *Mehmet Sevim, Anvar Ahmedov;* ***Control/Supervision:*** *Anvar Ahmedov;* ***Data Collection and/or Processing:*** *Anvar Ahmedov;* ***Analysis and/or Interpretation:*** *Mehmet Sevim, Anvar Ahmedov;* ***Literature Review:*** *Mehmet Sevim;* ***Writing the Article:*** *Mehmet Sevim, Anvar Ahmedov;* ***Critical Review:*** *Anvar Ahmedov, Mehmet Sevim;* ***References and Fundings:*** *Anvar Ahmedov;* ***Materials:*** *Mehmet Sevim.*

REFERENCES

1. Alvarez Múgica M, Jalón Monzón A, González Alvarez RC, Fernández Gómez JM, Martín Benito JL, Regadera Sejas FJ. Necrosis de glande secundaria a uretrectomía por recidiva tumoral de un carcinoma transicional de alto grado [Glans necrosis secondary to urethrectomy due to tumoral recurrence of a high grade transitional carcinoma]. Actas Urol Esp. 2007;31(2):178. Spanish. [Crossref] [PubMed]
2. Montoya Martínez G, Otero García JM, López Samano V, González Martínez J, Serrano Brambila E. Necrosis de pene: revisión de 18 casos en el Hospital de Especialidades Centro Médico Nacional Siglo XXI [Penile necrosis: a review of 18 cases at the Hospital de Especialidades Centro Médico nacional Siglo XXI]. Arch Esp Urol. 2006;59(6):571-6. Spanish. [Crossref] [PubMed]
3. Congregado Ruiz B, Medina López RA, Cruz Navarro N, Forrubia Romero FJ, Leal Arenas J, Monta-és Medina P. Necrosis de glande por arteritis granulomatosa necrotizante [Glands necrosis caused by necrotizing granulomatous arteritis]. Arch Esp Urol. 2002;55(4):448-51. Spanish. [PubMed]
4. Ohta A, Ohomori S, Mizukami T, Obi R, Tanaka Y. Penile necrosis by calciphylaxis in a diabetic patient with chronic renal failure. Intern Med. 2007;46(13):985-90. [Crossref] [PubMed]
5. Tarrass F, Benjelloun M. Necrosis del pene como rara manifestación de calcifilaxis en la uremia [Penis necrosis as an unusual manifestation of calciphylaxis in uremia]. Nefrologia. 2008;28(1):118-9. Spanish. [PubMed]
6. Arrabal-Polo MA, Pareja-Vilchez M, Lahoz-Garcia C, Gonzalez-Torres S, Valderrama-Illana P, Arrabal-Martin M. Glans necrosis produced by trauma during masturbation. Arch Sex Behav. 2013;42(8):1391-3. [Crossref] [PubMed]
7. Patel KK, Telfer MR, Southee R. A "round block" purse-string suture in facial reconstruction after operations for skin cancer surgery. Br J Oral Maxillofac Surg. 2003;41(3):151-6. [Crossref] [PubMed]
8. Yazar Ş, Kılıç B, Gökkaya A. "Purse String" yönteminin şakak bölgesindeki geniş defektlere uygulanması [Purse String suture method for large defects on temple area]. Türk Plastik Rekonstrüktif ve Estetik Cerrahi Dergisi. 2006;15(3):144-9. [Link]
9. Peled IJ, Zagher U, Wexler MR. Purse-string suture for reduction and closure of skin defects. Annals of Plastic Surgery. 1985;14(5): 465-9. [Crossref] [PubMed]
10. Singhal A, Reis ED, Kerstein MD. Options for nonsurgical debridement of necrotic wounds. Adv Skin Wound Care. 2001;14(2):96-100; quiz 102-3. [Crossref] [PubMed]
11. Kohler TS, Yadven M, Manvar A, Liu N, Monga M. The length of the male urethra. Int Braz J Urol. 2008;34(4):451-4; discussion 455-6. [Crossref] [PubMed]
12. Krishnamoorthy V, Joshi PB. Length of urethra in the Indian adult male population. Indian J Urol. 2012;28(3):297-9. [Crossref] [PubMed] [PMC]
13. Hashish MS, Elsawaf MI, Moussa MA. Urethral advancement procedure in the treatment of primary distal hypospadias: a series of 20 cases. Annals of Pediatric Surgery. 2017; 13(1):29-37. [Crossref]
14. Haider N, Hashim I, Iqbal MA, Wasti AR, Chaudhary SH, Ahmad A, et al. Outcome of urethral mobilization and advancement after anterior hypospadias surgery. Annals of Pediatric Surgery. 2019;15(1):1-4. [Crossref]
15. Shalaby R, Negm M, El-Sawaf M, Elsaied A, Shehata S, Hamed A, et al. Needlescopic disconnection and peritoneal closure for pediatric ınguinal hernia repair: a novel technique. Surg Laparosc Endosc Percutan Tech. 2021. [Crossref] [PubMed]
16. Park H, Lee Y, Yeo H, Park H. Surgical refinement of the purse-string suture for skin and soft tissue defects of the head and neck. Arch Craniofac Surg. 2021;22(4):183-92. [Crossref] [PubMed] [PMC]
17. Oshodi O, Castaneda J. Use of the purse-string suture to conservatively manage a cornual ectopic pregnancy. Cureus. 2021;13(4): e14249. [Crossref] [PubMed] [PMC]
18. Cammarata E, Zavattaro E, Astolfi S, Airoldi C, Giorgione R, Boggio P, et al. Purse-string suture versus full-thickness skin graft: An efficacy and safety comparison study. Dermatol Ther. 2021;34(3):e14909. [Crossref] [PubMed]
19. Rondelli F, Franco L, Balzarotti Canger RC, Ceccarelli G, Becattini C, Bugiantella W. Purse-string closure versus conventional primary closure of wound following stoma reversal: Meta-analysis of randomized controlled trials. Int J Surg. 2018;52:208-13. [Crossref] [PubMed]
20. Shubailat GF. Glans skin flap. In: Strauch B, Vasconez LO, Hall-Findlay EJ, Lee BT, eds. Grabb's Encyclopedia of Flaps. Vol 3. 3rd ed. USA: Lippincott Williams & Wilkins; 2009. p.1225-9. [Link]