ORIGINAL RESEARCH

Sundry presentations of penile fracture and role of Ultrasonography and MRI in resolving the diagnostic and surgical plan dilemma- An analysis of six cases and literature review

[1]Harbhupinder Singh, [2]Harjinder Singh, [3]Tejinderpal Kaur Grewal, [4]Savleen Kaur

[1,2,4]Department of Urology, Government Medical College, Patiala, Punjab, India
[3]Department of Anaesthesia, Government Medical College, Patiala, Punjab, India

Corresponding author
Harbhupinder Singh
Department of Urology, Government Medical College, Patiala, Punjab, India

Received: 24 March, 2023 Accepted: 27 April, 2023

ABSTRACT

Background: Penile fracture is a relatively rare condition having sundry presentations andcan be diagnosed on history, clinical examination and ultrasonography. Fracture at the site of crus penis are rare and needs further preoperative radiological evaluation. Urgent surgical interventionis warranted for good long-term outcomes. **Methods**: We retrospectively reviewed the data of penile fracture patients who presented to our hospital between February 2022 and February 2023 .Detailed history, clinical examination and penile ultrasonography was done in all admitted patients and MRI pelvis was done in suspected case of penile crus injury in view of atypical presentation and normal ultrasonography.Surgical exploration was done in all admitted patients. **Results:** Six patients with penile fracture were included in the study.The most common cause of injury was vaginal intercourse. Exploration was done in four patients and two managed conservatively due to delayed presentation. Fractures were present in distal corpora, mid ventral corpora, proximal dorsal corpous and left crus region. Repaired with 3-0 absorbable and non-absorbable sutures. There was no post operative sequelae in all the operated patients. **Conclusion:** Penile fracture is usually diagnosed on history, clinical examination and ultrasonography but MRI is very promising in diagnosing and surgical planning of penile crus injuries. Eary surgical intervention is preferred as it is associated with better outcomes and fewer long term complications.

Key Words: Penile fracture, Magnetic Resonance Imaging, Erectile Dysfunction, International Index of Erectile Function

INTRODUCTION

Penile fracture(PF) is a rare and important urological emergency but highly underreported due to fear and embarrassment. It warrants urgent surgical management for successful outcomes otherwise it leads to potential long-term complications. It results because of forceful bending of erect penis against resistance leading to tunica albuginea tear.Most documented casesinvolve rupture of one or both of the corpora cavernosa,with a reported incidence of associated urethral injury ranging from 3% to 38%[1].Vaginal intercourse is the most common cause [2] but non-coital etiology i.e masturbation,rolling over on the bed,falling on to the erect penis and penile manipulations are also reported especially in some middle eastern countries [3].The patient may recall hearing a cracking(pop-up) sound followed by rapid detumescence and intense local pain.Hematoma,bruising and deformity of penis then follows(egg plant deformity)[4].A palpable tunical defect and haematoma with a 'rolling sign'are usually considered pathogonomic features for this condition[5].The distinctive features for associated urethral injury are blood at meatus,inability to void and haematuria.The patients history and physical examination are sufficient in majority of the cases to reach a provisional diagnosis of a penile fracture but pre-operative exact site of tear can only be determined by additional radiological investigations. Ultrasonography with resolution grey scale imaging and new high frequency broadband transducers alone or in combination with colour and pulsed wave

doppler form the basis for evaluation of penile trauma[6].In atypical presentation especially tear involving crus of penis,false penile fracture and suspensory ligament rupture,Magnetic Resonance Imaging (MRI) is a better diagnosing tool as it has better soft tissue imaging quality and can show tunical tears noninvasively[7].Early surgical intervention is a key to surgical outcome.We report a sundry presentation of PF cases and pre-emtive role of ultrasound and MRI in diagnosing corporal/crus tear which helped in planning the surgical approach.

METHODS

We conducted a retrospective observational study for one year between February 2022 and February 2023 in the department of urology,Government Medical College Patiala,India.Approval for study has been obtained from Institutional Ethics committee vide letter no. Trg.9(310)2023/14800 dated 16/05/2023.We had six patients with a PF,out of whichfour were admitted to our hospital and two consulted during OPD hours.Detailed history, physical examination and Penile ultrasonography was done in all the patients.Ultrasonography was done by 7.5 -12 MHz linear probe transversely from base to tip of penis on both dorsal and ventral aspect as well as longitudinally[8].Both corpora cavernosa,corpora spongiosa,tunica albugenia,superficial and deep dorsal vein, dorsal arteries and cavernosal arteries identified and colour doppler was used for any abnormal vascularity or malformations. MRI was done in one patient in whom penile ,posterior scrotal and perineal ecchymosis was the only physical finding (atypical clinical presentation) and penile ultrasonography showed no breach in corporal tunica albugenia or urethral injury . MRI was performed with 1.5 T machine and axial,coronal,sagittal T2-weighted and pre-contrast and post- contrast T1-weighted sequences were taken,Fig.1&2.

Surgical exploration was done in all(four) patients.Two patients presented in opd after four weeks of injury when it was healed.Informed written consent was obtained from the patients before surgical exploration.Foley catheterization was done in all the patients. Injection Amoxycillin plus clavunate and amikacin was given half an hour before surgery.We performed a subcoronal circumferential incision in three patients and penis was degloved to identify the exact location of the fracture.Fig. 3&4.We removed the hematoma and defined the exact place of the defect of the tunica albuginea.Fig.5&6.Repaired it by suturing with 3-0 inverted absorbable or nonabsorbable sutures in continuous manner.Fig.7&8.In one patient left crus fracture was detected which was repaired through perineal incision.Penile compression dressing was applied as appropriate.All patients had Foleys catheter drainage and it was removed on the fourth day of surgery.

RESULTS

Our study included six cases of PF with age ranged from 26 to 65 years(a mean of 43.66 yrs).Four patients presented within a median of 72 hrs after trauma(Range 48 -120 hrs).Two patients presented four weeks after the injury.Five were married and one was single.All injuries happened during erection;five during vigorous vaginal intercourse when penis slipped out and hit the partners perineum and one during rolling over bed with erect penis. One patient used tadalafil 10 mg before sexual intercourse. Demographic and clinical profile of the patients is as detailed in Table-1.Clinical examination revealed three patients hadpenile swelling and bluish discoloration of skin,egg plant deformity(Aubergine sign),Fig9.One patient had only bluish discolorationof proximal penile shaft,posterior scrotum and perineum without any penile swelling(Butterfly Sign),Fig 10.

On penile ultrasonography the tear in tunica albugenia with overlying haematoma was identified in three cases and a nodule in two cases who presented late.However ultrasound could not detect any fracture in a patient who had penile crus injury.The tear in corpora cavernosa was clearly seen as discontinuity in white echoes of this layer and a wedge shaped hypoechoic area in cavernosa with peripheral broad base at the area of tear [9].On MRI Pelvis the corpora cavernosa fractures were clearly depicted as a discontinuity of the low signal intensity of Tunica Albugenia.These findings were most evident on T1-Weighted images and also depicted on T2-weighted images.Images after contrast medium administration showed considerable enhancement only at rupture site.Subcutaneous extratunical haematoma were recognizable on T2-Weighted images but much more significant at post contrast T1-weighted images .[10]In one of our caseMRI pelvis showed a breach in tunica albugenia at root of penis on left side crus extending up to bulbomembranous junction of urethra with overlying penile acute haematoma of size 3.6 x 2.0 cm,which corroborated with findings on surgical exploration .

Surgical exploration was done in four patients;three through circumferential subcoronal incision and one through midline perinealincision.One patient had 1.0 cm oblique tear in right lateral distal corpora behind the glans,Fig11.Another had 1.5cm and 9mm transverse tears on the dorsal aspect of respective corpora at the root of penis,Fig 12.Third one had linear tear(1.0 cm inner lamella and 2.5 cm outer lamellae of tunica albugenia) on ventral aspect of mid penile shaft beneath and adjacent to corpous-spongiosum,Fig 13.Fourth one had 1.5 cm oblique tear in proximal left crus,Fig 14.

There were no urethral or suspensory ligament injuries.Tunica albugenia tears were repaired with vicryl or prolene 3-0 sutures and Gittes test performed to check any leakage.After hemostasis, subcoronal incision was closed in interrupted manner with 3-0 chromic catgut sutures without circumcision.On

subsequent follow up there was excellent wound healing and none of patients had distil penile skin necrosis,Fig.15.

One of the operated patient had a small non-tender nodule over the injury site after two weeks of repair and it resolved spontaneously after four weeks.Two patients who presented in opd had a nodular thickening at the fracture site. One patient had mild Erectile Dysfunction(ED) withInternational Index of Erectile Function (IIEF) score of 21-22 and another had mild deviation of 10 degree of penis.All the operated patients were followed for three months postoperatively and none had penile curvature, nodule,deformity or erectile dysfunction.

Table-1: **Demographic & Clinical Profile of the patients**

S.No.	Age (Yrs)	Time of Presentation	Etiology	Crackling Sound	Pain	Detume-scence	Swelling	Discoloration	Deformity	Palpable Defect/ Nodule	Haematoma
1	48	48h	Intercourse	Yes	Yes	Yes	Yes	Yes	Yes	Defect	Yes
2	35	72h	Intercourse	Yes	Yes	Yes	Yes	Yes	Yes	Defect	Yes
3	65	48h	Intercourse	Yes	Yes	Yes	Yes	Yes	Yes	Defect	Yes
4	40	120h	Intercourse	Yes	Yes	Yes	No	Yes	No	No	Yes
5	38	28 days	Intercourse	No	Yes	Yes	No	No	No	Nodule	No
6	24	30 days	Rolling over bed with erect penis	No	Yes	No	No	No	No	Nodule	No

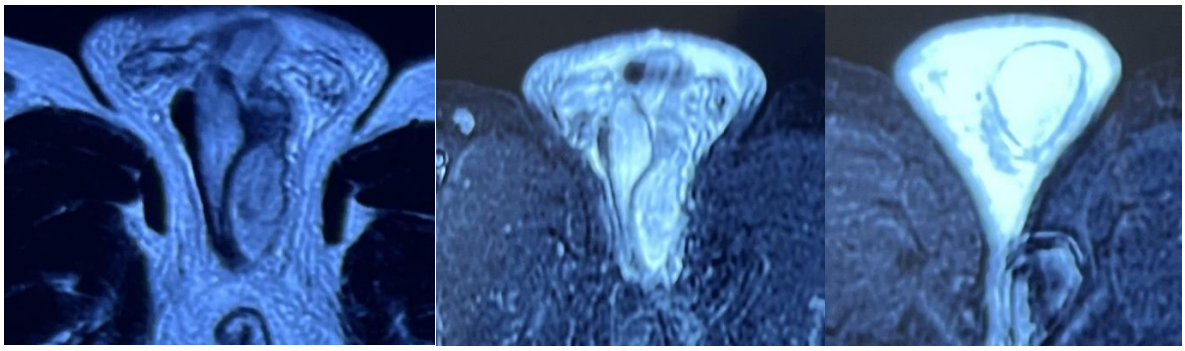


Fig.1MRI Axial Section(T1 weighted,T2 weighted and Contrast Enhanced Images)Showing left crus fracture.

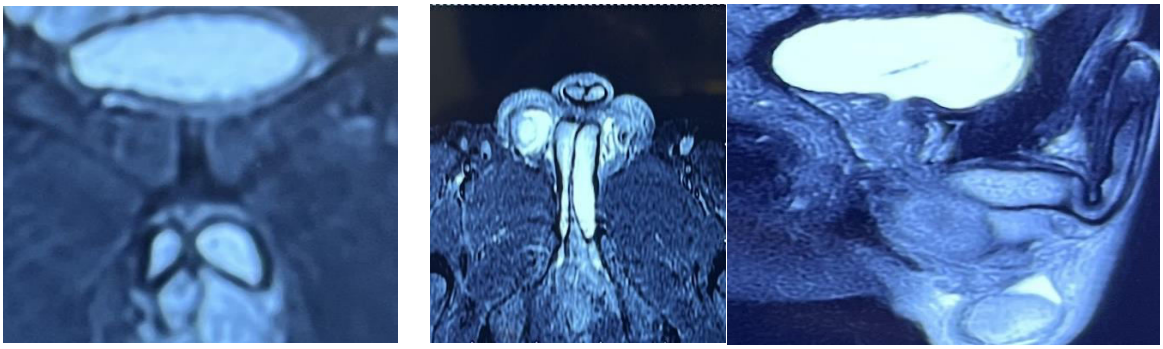


Fig.2MRI (Coronal and Sagittal Sequences) showing left crus fracture and haematoma

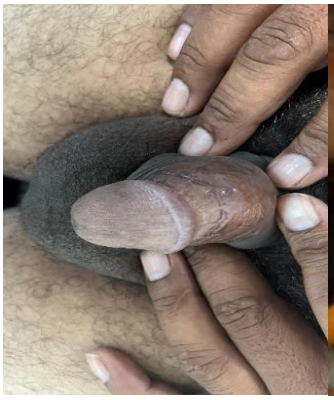


Fig. 3(Circumcoronal incision)

Fig. 4 (Penile degloving)

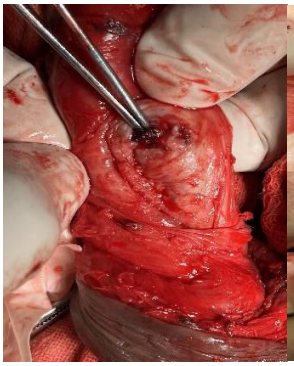
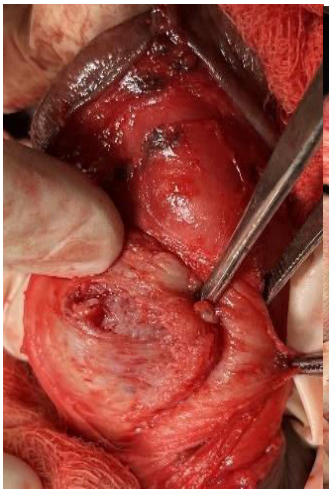


Fig.5(Haematoma & Defect Site,Mid ventrum)Fig.6(Haematoma & Defect Site Left Crus)



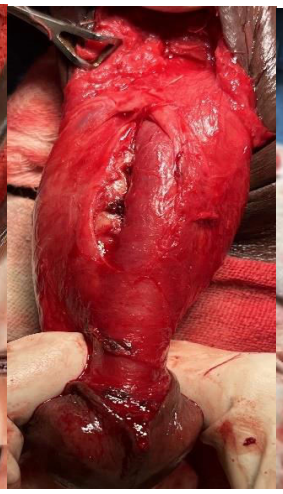


Fig.7(Ventral tear repaired with Vicry 3-0)

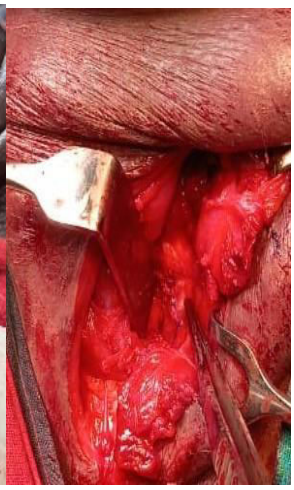


Fig.8(Left Crus tear repaired with prolene 3-0)

Fig.9(Aubergine Sign)

Fig.10(Butterfly Sign)


Fig.11(Distil Tear)


Fig .12(Dorsal DoubleTear)

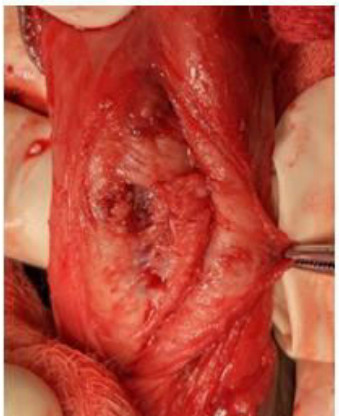


Fig.13(Ventral Tear)


Fig.14(Left Crus Tear)


Fig.15(Repair without circumcision)

DISCUSSION

PF is rupture of corpous cavernosum of an erect penis ,most of patients report late orit is underreported due to embarrassing nature of the condition especially in Indian scenario. The first report of this condition is credited to an Arab physician ,Abul Kaseem ,in Cordova over 1000 years ago[11].Since the introduction of Phosphodiesterase-5 inhibitors and their use by middle aged males, it is being reported increasingly.Tunica albugenia ruptures due to its marked thinning(0.25-0.5 mm)during erection along with simultaneous marked short-term pressure increase which approaches or exceeds the tensile strength of the tunica during acute abrupt loading or bending of the erect penis[12].While the average arterial pressure in the erect penis is around 100mmHg, the pressure must be above 1500mmhg for the corpus cavernosumto rupture.Trauma sustained during sexual intercourse is reported as the main cause of penile injury in United States of America;manipulating the erect penis to achieve detumescence is reported as a major cause in the Middle East [13],whereas rolling over an erect penis in bed and masturbation are the commonest causes in Japan[14].The practice of taghaandan in the middle east may contribute to the high incidence of self-inflicted penile fracture in the region.It means ‘to click’ in Kurdish,and it involves bending the shaft of erect penis to achieve detumescence or pleasure.This practice is common in Kermanshah,Iran.Lack of sex education in the general population may be one of the reasons,the self-inflicted PF is much more common in the Middle East compared to western countries[15]. Injury commonly occurs on the right side and the ventrolateral aspect of the proximal third of the penis as this area corresponds to thinning of the Bucks fascia,as it splits with one lamella continuing to surround the corpora cavernosum and another to invest the corpus spongiosum [16].In our spectrum of cases most of the patients were married and vigorous sexual intercourse was the commonest cause followed by rolling over an erect penis in bed and majority fractures were on right side.

Diagnosis of most penile fractures is made on clinical history and examination findings.The usual history is of an injury during sexual activity with a snapping or popping sound followed by pain,rapid detumescence and deformed swollen penis.The rupture of tunica with intact Bucks fascia results in an ‘aubergine’sign(Fig9).With disruption of Bucks fascia ,spread of haemorrhage may occur around Colles fascia to perineal,scrotal and lower abdominal wall and represent a ‘butterfly’ injury pattern(Fig.10).Occasionally ,the ‘rolling’sign may be felt at the site of tunica fracture but difficult to locate due to tenderness and overlying oedema.A condition imitating penile fracture may occur due to disruption of dorsal penile artery or vein or non-specific dartos bleeding but no rupture of tunica albugenia is seen in these patients.These false fractures due to dorsal vein

disruption are associated with history of childhood circumcision as it causes stretching of penile skin which may lacerate during intercourse[17].There are only few cases of penile crus injury and mechanism differ from one case to another[18].In one of our case it happened during intercourse in doggy style position when erect penis slipped during the act and penile base hit the ischial bone of the partner leading to increased intracorporal pressure which was transmitted posteriorly and dissipated after breach in the left crus occurred as penile cylinders are contiguous anatomical structures.PF may be associated with urethral injury and which could be partial or complete.It should be suspected in patients with gross haematuria,microscopic haematuria or who are unable to micturate[19].

Imaging is required particularly in patients with an atypical clinical presentation or with severe local pain or swelling that prohibits a thorough physical examination of the penis.Various radiological Investigations like ultrasound,MRI,Retrograde urethrography and Cavernosography have been used to reach a diagnosis[20].These investigations rarely influence the course of management[21].But ultrasound in every overt or covert penile fracture case and MRI especially in false penile fractures,suspensory ligament fracture and penile crus injuries helps in reaching a conclusive preoperative diagnosis and planning the surgical incision.It also helps in planning the procedure through perineal incision thus avoiding the negative exploration through circumcoronal incision and preventing long term complications as reported in literature.This case highlights the importance of MRI in diagnosing the crus injury with unusual presentation and early surgical repair through perineal incision.Hinev[22]in his review has recommended immediate surgical treatment of all cases of penile fracture;also emergency surgical repair offers a chance for complete recovery,even in the presence of urethral injury and is the best method for providing a good functional prognosis.However a delayed operation is selected in some selected cases[23].There is no definitive consensus on the surgical repair timing.Several reports have indicated that the long-term results of immediate or delayed repair are almost equal.Some authors have recommended delayed repair of PF [24,25].Even when presentation is delayed up to one week,operative management has shown to yieldgood results[26] as one of our patient also presented after five days and surgical outcomes were excellent and there was no post-operative sequelae.Subcoronal degloving incision with excellent visualisation of both corporal compartments and facilitating repair of any concomitant urethral injury is the most suitable surgical approach.Removing the overlying haematoma with no or minimal debridement and closing the tunical gap with interrupted or continuous 3-0 absorbable or nonabsorbable inverting sutures is approved.

After surgery,Gittes test may be performed to confirm the tunica integrity. In uncircumcised patients strong consideration be given to performing limited circumcision at the conclusion of the repair because wide mobilization of the foreskin may place the distil prepuce at risk for ischemia[27] but in our patients subcoronal incision was closed without circumcisionand all had uneventful recovery,Fig.15.Long term outcomes following early surgery are reported in literature to be good with satisfactory erectile function[3].Long term complaints following fracture repair are varied and range from painful erection and intercourse to erectile dysfunction and priapism[28].Earlier reports recommended non-surgical management i.e Conservative which included bed rest,pressure dressings,catheterization and ice-packs for24-48 hrs in addition to antibiotics,fibrinolytics,oestrogens and diazepam for suppressing erections[29]. Kalash and Young Jr [30] reported that the complication rate of conservative treatment before and after 1971 was 10% and 53%,respectively,including deformity of the penis,pulsatile diverticulum,decrease in rigidity and failure of conservative treatment. One of operated patient had a tender nodule at repair site which got resolved at four weeks could be due to leakage of blood during spontaneous nocturnal erections.We assessed the patients sexual function with IIEF-5 questionnaire prior to trauma and subsequently at three months follow up.Patients undergoing repair within eight hours of injury have been found to have significantly better long term outcomes than patients who underwent surgery 36 or more hours after the fracture occurred [27,31] but all of our operated cases were able to resume their sexual activity as before at three months and there was no erectile dysfunction even after delayed repair as range of the time interval from injury to operation was 48 to 120 hrs with a median of 72 hrs. One patient who presented late and managed conservatively had mild ED,responsive to an on demand Phosphodiesterase-5 inhibitor.

CONCLUSION

Fracture penis is a rare urological emergency in which history and clinical findings are usually diagnostic.Pre-op Penile ultrasound and in rare cases MRI Pelvis (suspicious clinical features with negative ultrasonography findings)is very useful in deciding the site of fracture and surgical approach thus preventing negative exploration and long-term complications.Early intervention is strongly recommended but surgery should be offered in delayed presentation also to prevent long term sequelae.

REFERENCES

1. Zargooshi J.Penile fracture in Kermanshah,Iran:report of 172 cases.J Urol2000;164:364-6.
2. Eken N.Fracture of the penis.Br J Surg.2002;89:555-65.

3. Zargooshi J.Sexual function and tunica albugenia wound healing following penile fracture:An 18-year follow up of 352 patients from Kermanshah,Iran.J Sex Med.2009;6:1141-50.
4. Morey AF,Dugi DD 3rd.Genital and lower urinary tract trauma.In:WeinAJ,Kavoussi LR,Partin AW,Novick AC.editors.Campbell-Walsch urology.10th ed.Philadelphia:Elsevier-Saunders,Co;2012;2507,2520.
5. Walton JK.Fracture of the penis with laceration of the urethra.Br J Urol 1979;51:308-9.
6. Bello JO(2012) Synergism of clinical evaluation and penile sonographic imaging in diagnosis of penile fracture:a case report.J Med Case Rep6:321
7. Koifman L,Barros R,Junior RA,Cavalcanti AG,Favorito LA.Penile fracture:diagnosis,treatment and outcomes of 150 patients.Urology 2010;76:1488-92.
8. Ash A,Miller J,Preston D.Point-of-care ultrasound used to exclude penile fracture.Crit ultrasound J.2012;4(1):17.
9. Anil Kumar Shukla et al.Role of Ultrasonography in Grading of Penile Fractures.Journal of Clinical and Diagnostic Research.2015 Apr,Vol-9(4):TC01-TC03
10. Guler I,Odev K,Kalkan H,Simsek C,Keskin S,Kilinc M.The value of magnetic resonance imaging in the diagnosis of penile fracture.Int Braz J Urol.2015;41:325-8
11. Taha SA,Sharayah A,Kamal BA et al.Fracture of the penis:surgical management.Int Surg 1988;73:63-64.
12. M.S. Ei-Bahnasawy and M.A.Gomha,"Penile fractures:the successful outcome of immediate surgical intervention", International journal of impotence Research,vol.12,no.5,pp.273-277,2000.
13. R.El Atat,M.Sfaxi,M.R.Benslama et al,"Fracture of the penis:management and long-term results of surgical treatment.Experience in 300 cases,"Journal of TraumaInjury,Infection and Critical Care,vol64,no.1,pp.121-125,2008.
14. T.Ishikawa,M.Fujisawa,H.Tamada,T.Inoue, and N.Shimatani,"Fracture of the penis:nine cases with evaluation of reported cases in Japan,"International Journal of Urology, vol.10,no.5,pp.257-260,2003.
15. C.Bastianpillai,A.Wang,J.Kumaradevan,S.Chitale.Accidental,Non-masturbatory,Non-intercourse Related,Self-Inflicted Penile Fracture:Case report and Review of Literature.Urology Case Reports 12(2017)45-46.
16. Morey AF,Rozanski TA.Genital and lower urinary tract trauma.In:Partin AW,Peters CA editors.Campbell-Walsh Urology.9th ed.vol.3.Ch.83.Philadelphia,PA:Saunders;2007.
17. Feki W,DerouicheA,Belhaj K et al.False penile fracture:report of 16 cases.Int J Impot Res 2007;19:471-473.
18. Srinivas BV,Vassan SS,Mohammad S.A case of penile fracture at the crura of the penis without urethral involvement:rare entity.Indian J. Urol2012;28:335-7.
19. Amer T,Wilson R,Chlosta P et al.Penile fracture:a meta-analysis.Urol Int 2016;96:315-329.
20. Rahmouni A,Hoznek A,Duron A et al.Magnetic resonance in penile rupture:aid to diagnosis.J Urol 1995;153:1927-1928.
21. Agarwal MM,Singh SK,Sharma DK et al.Fracture of the penis:a radiological or clinical diagnosis?A case series and literature review.Can J Urol2009;16:4568-4575.
22. A.Hinev,"Fracture of the penis:treatment and complications,"Acta Medica Okayama,vol.54,no.5,pp.211-216,2000.
23. Reddy SVK,Shaik AB,Srinivas K. Penile injuries:a 10 year experience. Can Urol Assoc.J.2014;8:e626-e631.
24. Nasser TA,Mostafa T.Delayed surgical repair of penile fracture under local anaesthesia.J Sex Med.2008;5:2464-9.
25. Narayansingh V,Hariharan S,Goetz L,Dan D.Late delayed repair of fractured penis.J.Androl.2010;31231-3.
26. el-Assmy A,el-Tholoth HS,Mohsen T,Ibrahiem el-HI.Does timing of presentation of penile fracture affect outcome of surgical intervention?Urology2011;77:1388-91.
27. Morey AF,Dugi DD 3rd.Genital and lower urinary tract trauma.In:WeinAJ,Kavoussi LR,PartinAW,NovickAC.editors.Campbell-Walsh urology.10th ed.Philadelphia:Elsevier-Saunders,Co;2012;2507,2520.
28. Muentener M,Suter S,Hauri D,Sulser T.Long term experience with surgical and conservative treatment of penile fracture.J Urol 2004;172:576-579.
29. R.N.Farah,R.Stiles jr and J.C.Cerny,"Surgical treatment of deformity and coital difficulty in healed traumatic rupture of the corpora cavernosa,"Journal of Urology,vol.120,no.1,pp.118-120,1978.
30. S.S.Kalash and J.D.Young Jr,"Fracture of penis:controversy of surgical versus conservative treatment,"Urology,vol.24,no.1,pp.21-24,1984.
31. Karadeniz T,Topsakal M,Ariman A,Erton H,Basak D.Penile fracture:differential diagnosis,management and outcome.Br J Urol 1996;77:279-81.