Original Article

Urethral Catheterization, Still a Dilemma!!

Urethral Catheterization

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ABSTRACT

Objective: To highlight the mechanism of iatrogenic urethral injury, lack of skills in catheterization among junior doctors and prevention strategies for urethral injury.

Study Design: Prospective observational analytical cross sectional study.

Place and Duration of Study: This study was conducted at the Urology Department of Tertiary Care Teaching Hospital, Dera Ghazi Khan from February 2019 to February 2020.

Materials and Methods: We recruited145 male patients referred from emergency& in-patients of this hospital, who had iatrogenic urethral injury due to faulty techniques of insertion or removal of Foley catheter. While the patients who pulled out Foley catheter themselves in altered state of consciousness, <18 years and female patients were excluded. A questionnaire was designed for collecting patient demographics, mechanism of Foley catheter related Urethral injury, setting of incidence of urethral injury, grade of healthcare professional performing catheterization &management of injuries.

Results: The ages of the patients ranged from 21 to 80 years, with mean age 64.4 ± 5.2.Out of 145 patients who had iatrogenic urethral injuries related to Foley catheterization,110(76%) patients had urethral injury because of Foley balloon inflation in urethra and in 10 (7%) patients Foley catheter was removed without deflating it's balloon. Whereas 25(17%) patients had multiple manipulation/attempts of urethral catheterization which lead to injury.

Regarding the grade of health care professional. Out of 145 iatrogenic urethral injuries, 77(53%) catheterization was performed by house officers, 53 (37%) catheterization by PGR/MO and 15(10%) by paramedical/nursing staff. The major reasons for catheterization 61(42%) were measurement of urine output followed by catheterization for urinary retention due to enlarged prostate were 54(37%).

Conclusion: Urethral catheterization still a dilemma, and associated with iatrogenic urethral injuries which is mostly done by junior doctors explaining their lack of the essential skills and knowledge about technique of catheterization, its removal and penile anatomy. This study highlights the imminent need for more intensive training and better simulation models for UC insertion.

Key Words: Iatrogenic, Urethral Injury, Foley Catheter, Lack of Skills, Prevention of Urethral Injuries

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INTRODUCTION

Indwelling urinary catheters have been an integral part of medical care since the invention of Foley catheter in the 1930s by Frederick Foley who designed a rubber tube with a separate lumen which was and still used to inflate a balloon which holds the Foley catheter to be kept in the urinary bladder.16% to 25% of hospitalized patients have an indwelling Foley catheter[1,2,3.]

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Annually more than five million patients have been inserted Indwelling urinary catheters, 4% in the patients who need care at home to 25% inthe patients at hospital.[4] Although Urethral catheterization is a frequently performed urological procedure, it can lead to significant morbidity and even mortality.[5]Routine insertion of Foleys urethral catheters can be challenging or even difficult in certain condition e.g such as urethral strictures, severe phimosis and false passages in urethra that increase the chances of urethral injuries.[6].Many medical devises are used specifically by a trained personnel but this is not always true in case of Foley catheter where diverse healthcare professionals of all grades and skills e.g. urologist, non-urological physicians, surgeons, interns, post graduate trainee ,paramedical and nursing staff perform the catheter insertion[7,8]

Junior doctors specially house officer deals patient more frequently at the first encounter so they should be safe, confident, safe and competent enough at performing Foley catheterization at the end of their training.[9] A study conducted in a Irish teaching

hospital reported that three quarters of catheterization associated injuries occurred when the procedure was performed by interns[7].

Improper techniques of urethral catheter insertion lead to urethral injury in male patients, which are preventable. However these iatrogenic injuries often over looked despite that an approximately 0.3% of hospitalized patients suffer these injuries causing significant patient morbidity, cost of treatment and complications[10,11,]Foley catheter-related urethral injury occurs by diverse mechanisms. To recognize and to prevent them, two main mechanisms found responsible. One of them is Foley catheter insertion and other is removal of it .Significant urethral trauma can occur when the Foley catheter balloon is inappropriately filled in the urethra, which is relatively non-distensible organ, instead of inflation of balloon in urinary bladder; or when the catheter and already filled catheter balloon is accidentally pulled out of the bladder either by patient himself or by untrained medical and paramedical staff without deflation .[12,13]

The incidence of iatrogenic Foley catheter related injuries found to be 6.7/ 1000 Foley scatheters inserted. [11]An American study reported an incidence of 3.2 cases per all 1000 male admissions to a single hospital[10]Research in a single institution in Ireland revealed that of 864 inpatient referrals to a urology department, 6% related to urethral injury resulted from male catheterization by clinicians other than urologists[7]

Catheter insertion in males is difficult as structure and length of male urethra may render it vulnerable to injury a fact that remains unrecognized by many health care providers, with added difficulty due to enlarged prostate or urethral stricture being common in males .Iatrogenic urethral injury associated with catheter insertion may have devastating long-term sequelae for example, urethral strictures, leading to difficult catheterization& consequently more chances of injury. What are the ways to manage difficult Foley,s catheterization are not well known ,thereby increasing the risk of complication. [14,15,16]

The proportion of morbidities of iatrogenic injury to urethra, manifesting as penile and perineal pain, bleeding, urinary retention, urinary infection and/or urethral scarring, is not known but it is likely substantial.[17.]Moreover, Urethral trauma can result in increased invasive procedures, such as suprapubic catheterization, flexible cystoscopy, urethral dilatation, as well as future difficulty with catheterization/ urethral stricture leading to recurrent urinary retention and urinary tract infection.[11]

MATERIALS AND METHODS

Participants Recruitment: This study was conducted from February 2019 to February 2020 in the urology department of tertiary care teaching hospital Dera Ghazi Khan .After approval of the Local Ethics Committee, we recruited145 male patients referred from emergency& in-patients of this hospital, who had iatrogenic urethral injury due to faulty techniques of insertion or removal of Foley catheter. While the patients who pulled out Foley catheter themselves in altered state of consciousness, <18 years males and female patients were excluded.

Data Collection Procedure: A questionnaire designed to gather data relating to patient demographics, mechanism of Foley catheter related Urethral injury (inadvertently inflation of balloon in urethra, removal of balloon without deflation or multiple attempts of Foley catheterization), setting of injury (urethral injury happened inside the hospital or outside the hospital), grade of healthcare professional performing the Urethral catheter (house officers, medical officers ,paramedical/nursing staff) management of urethral catheter injuries and associated complications. Proforma also included information regarding whether it is first catheterization or previously catheterization done and the most common indications of the catheterization were also noted.

The questionnaire was filled by the attending urology doctor by history form patients and his attendants, physical examination, checking the medical record of the patients, discussing with doctor who initially performed urethral catheterization.

At the time of initial evaluation either senior urology medical officers or consultants identified the injury and complications. Standardized definition of iatrogenic UC injuries was used from previously published studies[11]Urethral catheter insertion injury defined as reported by the physician requesting for consultation of difficult/ failed catheter placement with subsequent poor catheter drainage, inability to place a catheter despite repeated attempts, haematuria , along with penile swelling and inadvertently inflating the balloon in the urethra (noticed by urologist). Additionally, certain conditions, as urethral and/or perineal pain, blood at the urethral meatus,a non-draining catheter that could not be irrigated, retrograde/antegrade urethrogram demonstrating urethral traumaand cystoscopic evidence of urethral injury were noted by urology team.

Immediate complication like penile/peri-urethral swelling, urethral bleeding, urinary retention, perineal /penile pain were notes .All patients were managed with empirical broad-spectrum antibiotic. Management strategy was noted as well.

Data Analysis: The general descriptive statistics were calculated for all variables of interest, including, age, mechanism of injury, grade of health care professional who performed catheterization , setting of injury ,the reason of catheterization, catheterization performed first time or multiple times.

RESULTS

Age: The age of the patients ranged from 21 to 80 years, with mean age of the patients 64.4 ± 5.2.

Mechanism of catheterization leading to injury: Out of 145patients who had iatrogenic urethral injuries related to Foleycatheterization,110(76%) patients had urethral injury because of Foley balloon inflation in urethra and in 10 (7%) patients Foleycatheter was removed without deflating it's balloon. Whereas 25(17%) patients had multiple manipulation/attempts of urethral catheterization.

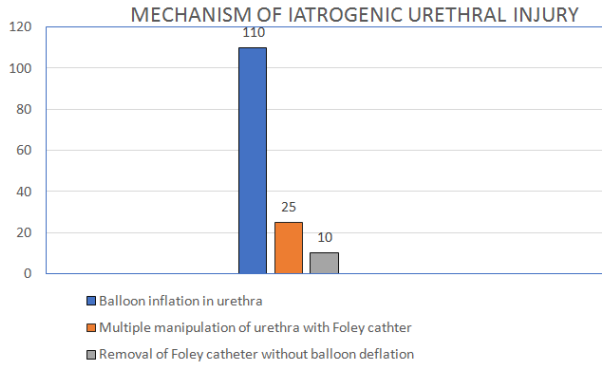

Figure No.1: Mechanism of injury

Setting of incident of urethral injury: Out of 145 iatrogenic urethral injuries, 85(59%) occurred in emergency patients ,and 60 (41%) from in-patient . Out of 145patient with urethral injury for 95(66%) patients it was their first catheterization whereas 50(34%)patients had previous history of multiple catheterization.The major reason of catheterization was measuring urine put (n=61,42%) followed by, for retention due to enlarged prostate (n=54,37%).Other indications mentioned in table.

Table No.1: Setting of incident of urethral injury

	Categories	Frequ-ency (n=)	%ages
Catheterization happened in	Emergency	85	59
	Indoor / Inpatient's	60	41
Catheterization episode	First time	95	66
	Recurrent	50	34
Reason for catheterization	Retention due to Enlarged prostate	54	37
	For measuring urine out put	61	42
	Retention due to Vesical stone	14	10
	Retention /difficult urination due to Stricture urethra	16	11

Grade of health care professional performing urethral catheterization: Out of 145 iatrogenic urethral injuries, house officers did 77(53%) traumatic catheterization, 53 (37%) injuries by PGR/MO and 15(10%) by paramedical/nursing staff.

Table No.2: Grade of healthcare professional

	Categories	Frequency (=n)	%age
Catheterization process performed by	House officers	77	53
	PGR/MO	53	37
	Para-medical/ nursing	15	10

Injuries, associated Complications and their management: All patient presented with cluster of symptoms due to urethral injury e.g. urinary retention followed by haematuria/penile bleeding, perineal or periurethral edema and genitalia pain.122(84%) patients were managed by placing supra pubic catheter under USG guidance who had absolute urinary retention. Few patients (n= 15/10%) with partial retention or severe difficulty in passing urine were successfully and gently attempted per urethral catheter by a urology team with adequate lubrication and analgesia.

While 8 (6%) Patients have undergone cystoscopy and catheterization as suprapubic catheter was not possible because of low capacity bladder (inadequate bladder filling);where cystoscopy showed false passages.

Table No.3: Management of urethral injuries

	Categories	Frequency (F=n)	%age
Management	Re catheterization	15	10
	Suprapubic cystostomy	122	84
	Cystoscopy & catheterization	8	6

During follow up Patients who had supra pubic cystostomy were advised to have retro grade urethrogram after 6 weeks and mostly found to have urethral stricture and for them we have to do internal optical urethtrotomy/urethral dilatation. Few patients presented with late complication like recurrent urethritis, epididymorchitis and even prostatitis

DISCUSSION

Urethral cauterization (UC) is performed routinely in hospital / clinic settings. Approximately 25% patients admitted in hospitals are catheterized during their inpatient stay. The incidence of iatrogenic UC injuries found is 6.7 per 1000 catheters inserted.[10] Total Incidence of 3.2 cases per all 1000 male admitted to

hospital were observed in an American study.[17]In a Polish study , conducted between 1995 and 1999, 32.9% urethral injuries resulted from Foley catheterization[18]

Mechanism of injury: Trauma results from inappropriate or vigorous force applied during Foley catheter insertion, or from inflation of the balloon while still in the urethra or inadvertently removing the catheter without balloon deflation as mention in current study. Although life-threatening complication are un-common, iatrogenic urethral injury is associated with devastating consequences e.g. urethral strictures, urinary incontinence etc . Males are more commonly affected due to their longer urethra. [19] .

Wu AK, Alex et al observed that inflation of balloon in urethra have high pressure in the urethra almost two times greater than when the balloon is filled in urinary bladder .As urethra is relatively non distensible organ, as compared to bladder so more injures happen in urethra. It was also found in their study that balloon pressure is high in the distal part of uretha(e.g fossa navicularis than proximal urethra.).Interestingly Foleys balloon with larger filling volumes need more force to extract from the bladder when it is filled completely. Itjustifies the injury of urethra when inserting catheter incorrectly or removing the cathter without deflation of balloon. [20. 21]

Setting of injury : In current study most Foleys catheterization 85(59%)were done in emergency, where patients are usually attended by junior doctors and paramedics at the very first; It is not uncommon for them to attempt insertion of catheter which if failed then repeated attempts with same or different catheter done , or another doctor tried to insert Foleys catheter. So multiple catheterization attempts leads injury the urothelium, which is a delicate structure being 3 to 4 cell layered only. Repeated unsuccessful attempts cause lots of physical and psychological distress and causing further difficulty in Foley catheterization &future reconstruction as well.[22]

Difficult catheterization also leads to urethral injuries as in case of enlarged prostate &urethral stricture where forceful manipulation or multiple attempts can lead to significant urethral morbidity.[19, 15]As in current study 16patients (11%)had history of stricture urethra and 54(37%)patients were catheterized for enlarged prostate ,both can lead to difficult catheter insertion & consequently urethral injury.[15,21]

Similarly Previous catheterization also pose difficulty in Foley catheter insertion leading to multiple or forceful attempts ,so more risks of urethral injuries ,as in our study 50(34%)patient had history of previous catheterization. Additionally management of Iatrogenic urethral injuries involves more invasive procedure like suprapubic cystostomy and even cystoscopy that leads to increase hospital stay and cost of treatment as well.

Grade of health care professional:Insertion of Foleys a Catheter is being carried out by different medical staff with variable skills, experience & knowledge about it.[7] We found in current study that Foley catheter insertion done mostly by house officers and post graduate residents(PGRs)/MOs,77(53%) &53 (35%) respectively of the tertiary hospital ,that signifies the lack of anatomical knowledge of male urethra &lack of confidence in skills for insertion catheter. Iatrogenic urethral injuries also done by non doctors. i.e. paramedical / nursing staff. This deficiency leads to urethral injuries and it complications in our study.Lots of published literature discuss about the junior doctor's attitude ,knowledge and skills for Foleys catheter. An Irish study reported that 864 referral to urology 6% of the urethral injuries were caused by catheterization done by non-urologist physicians[23] Increasing clinical experience is thought to reduce the chance of causing an iatrogenic UC injury. Interestingly, the current study demonstrated that 53 (35%) UC injuries were caused by PGR or MOs, more experienced grades of doctors who are routinely in involved in UC. These findings suggest that correct technique and appropriate training of those routinely involved in these procedures, as well as auditing of iatrogenic injuries with a view to focused training sessions is necessary in the future.

In a recent study at a tertiary care medical centre ,concluded that house officers have inadequate supervision, training, confidence and knowledge for Foley catheter insertion and it reflects 74% incidence of iatrogenic urethral injuries by house officers. [23,24,] several studies observed that junior doctors have low confidence and less exposure while in medical school in inserting Foley catheter.[25] This lack of confidence and insufficient experience is reflected by the fact that one in five first-year U.K. interns had never performed male catheterization and nearly half (45%) had never performed a female catheterization after one year of medical practice.[26]

Training or education in surgical subspecialty specially urology is very limited regarding the clinical rotation and at medical college level Increased syllabus of medical students doesn't let the medical students to learn skills in this overlooked subspecialty, that leads to lack of skills during internship.[27]That ,s why who did not get clinical rotation in urology, obviously will not get skills and knowledge about urethral catheter training. Beside this another hurdle for training that patients are very reluctant to get examined specially their genitals ,by junior doctors which is very common specifically in private hospitals. In USA , during a single academic year it was found that there was only a median of nine-third-year medical students got clinical rotation in urology.[28]

Prevention of the foleys catheterization complications: Studies on iatrogenic UC injuries tend

to focus on interns and interventions for prevention are usually aimed at this grade of healthcare professional. So at the end of the study prevention strategy was planned to avoid injuries and their morbidity. Most important point of strategy was to plan a formal lecture & videos including anatomy of male urethra along with step by step practical demonstration of catheterization procedure, with particular emphasis on the key points of lubrication, position of the penis and the extent to which a catheter should be inserted. The importance of history taking prior to the insertion should be stressed and conditions and scenarios that are associated with increased risk of urethral injury upon catheterization should be discussed. Hopefully it will decrease the incidence of Foleys catheter related injuries and associated morbidities.

Literature reviewed emphasised that Foley catheter training should start in medical school so when internship is started which is very hectic and they can't focus on catheter training , they would be already competent in this skill. Secondly junior doctors and para medicals should be supervised by seniors for , proper techniques of catheterization is essential to prevent urethral injuries in patients.

New techniques of Foley urethral catheterization are under survey which include guide wires, urethral balloon dilation, directed hydrophilic mechanical dilators and direct vision endoscopic catheter systems insertion.In view of the significant morbidity caused by Foleys catheters, there is need to provide a research agenda for developing a safer alternative[29]

devised by Davis et al provides a protective mechanism a novel safety syringe catheter to reduce UC injuries by controlling the threshold inflation pressure and is being currently tested in the clinical setting.[30]

CONCLUSION

Urethral catheterization still a dilemma, and associated with iatrogenic urethral injuries ,which is mostly done by junior doctors explaining their lack of the essential skills and knowledge about technique of catheterization , its removal and penile anatomy. This study highlights the imminent need for more intensive training and better simulation models for UC insertion. We also emphasize the role for the development of safer urinary catheters in the near future.

Author's Contribution:

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