

Impact of traumatic
posterior urethral
injury on penile
vascular supply and
erectile function.

Does pre-operative
MRI have a role?

A single centre, prospective,
observational study

**“IMPACT OF TRAUMATIC POSTERIOR URETHRAL
INJURY ON PENILE VASCULAR SUPPLY AND ERECTILE
FUNCTION. DOES PRE-OPERATIVE MRI HAVE A ROLE?” -
A SINGLE CENTRE, PROSPECTIVE, OBSERVATIONAL
STUDY”**



**A dissertation submitted to The Dr. M.G.R. Medical University,
Tamilnadu, in partial fulfillment of the requirements for M.Ch.
Branch-IV (Genitourinary surgery) examination to be held in
August 2013.**

Department of Urology
Christian Medical College and Hospital
Vellore, Tamil Nadu

Certificate

This is to certify that the work incorporated in this dissertation entitled **“IMPACT OF TRAUMATIC POSTERIOR URETHRAL INJURY ON PENILE VASCULAR SUPPLY AND ERECTILE FUNCTION. DOES PRE-OPERATIVE MRI HAVE A ROLE?” - A SINGLE CENTRE, PROSPECTIVE OBSERVATIONAL STUDY**” is a bonafide work done by Dr. Rajadoss. M in partial fulfillment of the rules and regulations of MCh Branch IV (Genitourinary Surgery) examination of the Tamil Nadu Dr. M. G. R Medical University, Chennai to be held in August 2013.

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Page 11 Introduction Incidence of non-iatrogenic trauma to urethra is 1:1, 25,000.(1) A steady increase in the incidence of high velocity accidents is contributory. Non-iatrogenic urethral injury is more serious than iatrogenic trauma because the force required to injure is very high. The incidence of concomitant injuries may be as high as 86% and usually dominate the initial evaluation and management of such a patient.(1) Traumatic posterior urethral injury is associated with considerable morbidity. This may range from urethral distraction defect, urinary incontinence, and erectile dysfunction to anorectal fistula formation. Young males <40 years of age form the majority of those who...

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Impact of traumatic posterior urethral injury on penile vascular supply and erectile

BY RAJADROSS MUTHUKRISHNAPANDIAN 18102751 M.CH. UROLOGY



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Introduction

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Traumatic posterior urethral injury is associated with considerable morbidity. This may range from urethral distraction defect, urinary incontinence, and erectile dysfunction to anorectal fistula formation. Young males <40 years of age form the majority of those who present with traumatic posterior urethral injury.

Erectile dysfunction is seen in up to 50% of these individuals. Organic causes of erectile dysfunction would be injury to cavernosal nerves, internal pudendal vessels or both. Recent studies have highlighted the role of pre-operative penile color doppler and MRI pelvis in

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Introduction

Incidence of non-iatrogenic trauma to urethra is 1:1, 25,000.(1) A steady increase in the incidence of high velocity accidents is contributory. Non-iatrogenic urethral injury is more serious than iatrogenic trauma because the force required to injure is very high. The incidence of concomitant injuries may be as high as 86% and usually dominate the initial evaluation and management of such a patient.(1)

Traumatic posterior urethral injury is associated with considerable morbidity. This may range from urethral distraction defect, urinary incontinence, and erectile dysfunction to anorectal fistula formation. Young males <40 years of age form the majority of those who present with traumatic posterior urethral injury.

Erectile dysfunction is seen in up to 50% of these individuals. Organic causes of erectile dysfunction would be injury to cavernosal nerves, internal pudendal vessels or both. Recent studies have highlighted the role of pre-operative penile color doppler and MRI pelvis in evaluating these factors. Identifying the organic components of erectile dysfunction would enable cause-specific therapy for post-traumatic erectile dysfunction and identify the subgroup of patients who are likely to benefit from early penile rehabilitation.

Erectile dysfunction in patients with traumatic posterior urethral injury, most often comes to light after the urethral reconstruction. Post-operatively, it is difficult to ascertain whether the erectile dysfunction was the result of trauma or the operative intervention itself. Hence there is a need to evaluate erectile function status, vascular damage, and neurological damage and to study the impact of the magnitude of distraction defect and whether it correlates with the erectile dysfunction and the outcome of urethral reconstruction.

This prospective study was designed to evaluate patients presenting with posterior urethral distraction defect in the pre-operative period, using validated IIEF questionnaire, penile color doppler and MRI pelvis.

Aim and objectives

AIM

To study the impact of traumatic posterior urethral injury on erectile function and the role of penile color doppler and MRI pelvis in pre-operative evaluation.

OBJECTIVES:

- a) To study the prevalence of erectile dysfunction in patients with PFUDD using the validated IIEF questionnaire.
- b) To evaluate penile vascularity using color doppler
- c) To correlate penile blood supply with the following physical findings on MRI pelvis:
 - stricture length
 - extent of fibrosis
 - prostatic displacement and
 - corporal injuries
- d) To assess the impact of vascular changes and MRI findings on surgical outcome.

Review of literature

Epidemiology

Posterior urethral injury complicates up to 25% of pelvic fractures arising from blunt pelvic trauma. (2) The incidence of pelvic fracture is greatest in people aged 15-28 years. Most pelvic fractures in the younger patients result from high-energy mechanisms, whereas pelvic fractures in the elderly population occur from minimal trauma, such as a low fall.(3)

Majority of patients with traumatic urethral injuries were younger than 40 years.(4) These injuries pose a significant management challenge. They are frequently associated multi-organ injury, hemodynamic instability, distortion of pelvic and lower urinary tract anatomy, and potentially extensive fibrotic response secondary to urinary extravasations.

PFUDD

Morbidity associated with traumatic posterior urethral injury includes urethral stricture, erectile dysfunction, and urinary incontinence and anorectal injuries. These complications can cause chronic disability, leading to long-term emotional and physical distress and considerable monetary loss.(5)

Mr. Richard Turner-Warwick once stated “It is the urologist who will have to share, with the patient, the burden of any urological disability, when the thoracic, the abdominal, and even the orthopaedic aspects are probably long forgotten.” (6)

Classification of pelvic fracture

According to Tile’s classification, pelvic fractures can be categorized as A, B, and C;

A minimally displaced, stable fracture; rotationally unstable but vertically stable; and

rotationally and vertically unstable, respectively. The weak points in the pelvic ring are the pubic rami and symphysis. They are subjected to high energy forces at trauma, such as external rotation, lateral compression and vertical shear. (7)

Figure 1 Tile's type A



Figure 2 Tile's type B



Figure 3 Tile's Type C



Erectile dysfunction after pelvic fracture

In a cross-sectional study of male sexual function after pelvic ring fractures using the International Index for Erectile Function (IIEF), pubic diastasis was related to impaired erectile function and overall satisfaction. Urethral distraction defects occur mainly in Tile B and C pelvic fractures. (8) Men who sustain a PFUDD (Pelvic fracture urethral distraction defect) are at significantly greater risk for erectile dysfunction than those with no urethral distraction defect. Men with PFUDD injuries represent a target population for early penile rehabilitation.(9) Erectile dysfunction was defined by NIH consensus development conference as “the inability to achieve an erect penis as part of overall multifaceted process of male sexual performance, pelvic fracture being a major risk factor”(10,11)

Organic components of erectile dysfunction

It is assumed that erectile dysfunction is due to disruption of the cavernous nerves or branches of the internal pudendal arteries that pass in close proximity to the pelvic bones and posterior urethra.(12) In the cross-sectional study by Malavaud et al, diastasis of pubic symphysis was found to be related with erectile dysfunction and overall satisfaction. They suggested that this could be result of injury to cavernosal nerve.(8) Relaxation of smooth muscles in the corpora cavernosa is mediated by nitric oxide, which is controlled by parasympathetic nerve endings. (13,14) Cavernosal nerve fibers which are about 0.1 to 1.1mm in diameter are placed posterolateral to prostate gland and lateral to the membranous urethra.(15) They enter the perineum between the perineal membrane and inferior pubic ligament and reach the dorsal aspect of penis after passing through the suspensory ligament.(16) The critical course of cavernosal nerves places them at great risk of strain or injury following pubic diastasis which disrupts the urogenital diaphragm. Moreover, the cavernosal nerves are sensitive to trauma which can result in long term complications, which are also observed after radical prostatectomy or cystoprostatectomy. (15) These observations have led to the development of nerve-sparing techniques. Apoptosis of penile erectile tissue following denervation has been demonstrated in animal studies. (17)

Role of penile color doppler

Timothy O Davies et al, using MRI pelvis, penile color doppler to study 56 patients with posttraumatic impotence, concluded that, patients presenting with pelvic fracture urethral distraction defect (PFUDD) are at risk for ischemic necrosis. Penile duplex is an excellent screening tool to identify arterial insufficiency. Angiography will discover patients with

bilateral arterial injury without reconstitution, who appear to be at risk for ischemic necrosis. Concomitant injuries to the internal pudendal arteries can cause erectile dysfunction, abnormal deep penile vasculature and ischemic necrosis following reconstruction with primary anastomotic techniques. (18)

Armenakas et al evaluated the role of MRI and duplex ultrasound in the diagnosis and management of posttraumatic impotence. They concluded that intracavernous injection-enhanced duplex ultrasonography allowed the evaluation of penile vascular anatomy and physiology. Detailed anatomical information provided by MRI pelvis and functional data provided by duplex ultrasonography enabled identification of organic components of posttraumatic impotence and enable effective cause-specific therapy. (19)

Role of MRI

Pre-operative assessment of the posterior urethral defect is very important for the planning the urethral reconstruction.(20) The following factors will help in the pre-operative assessment: the urethral defect length, prostatic displacement, scar tissue extent, and presence of bladder base fistula. (6)

A combination of antegrade and retrograde urethrogram is considered the standard imaging of morphology and function of urethra. They provide details only of the urethral lumen.(21)

The male urethra has an approximate length of 22cm, from the bladder neck to the external urethral meatus. (22) The anterior urethra consists of the bulbar and penile urethra, while the posterior urethra consists of the prostatic and the membranous urethra. The anterior and posterior urethral segments are separated by the urogenital diaphragm. The pubo-prostatic ligaments anchor the posterior urethra to the pubic arch.(23) Traditionally, it was that the membranous urethra was most common site of posterior urethral injury associated with

pelvic fracture. However the present thinking is that the proximal most portion of the bulbar urethra, just distal to the urogenital diaphragm is actually the commonest site of injury.(24)

Figure 4 Typical Opposing urethrogram

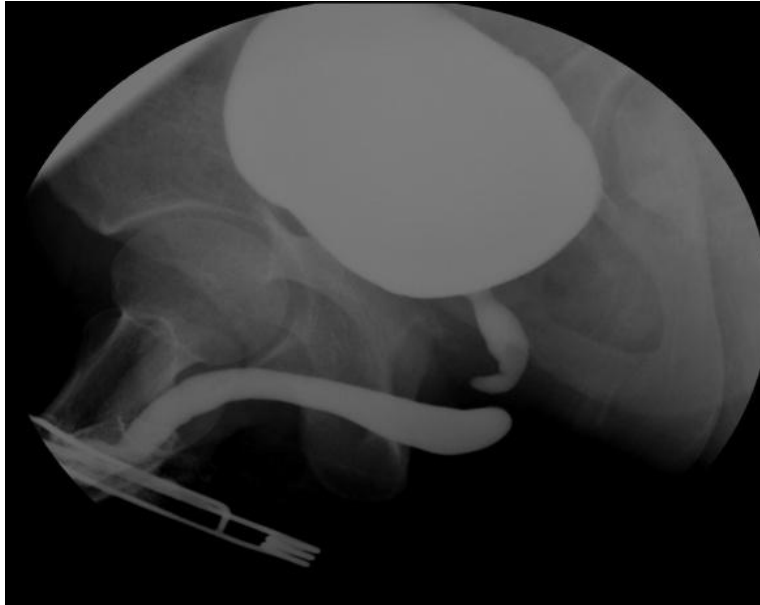


Figure 5 and 6 MRI T2WI HR sagittal and MR Urethrogram



However, this combination of retrograde and antegrade urethrograms can show a falsely long or short urethral defect if the prostatic urethra is incompletely filled or if an urinoma is present. (20) It is difficult to identify the displacement of prostate gland, extent of scarring, presence of cavernosal injuries or bladder base fistula using conventional urethrograms. Magnetic Resonance Imaging (MRI) has been used for measuring the exact urethral defect, assessing the extent of fibrosis, degree and direction of prostatic displacement and the presence of cavernosal injuries and bladder base fistula. (20)

Historic evolution of posterior urethroplasty

Historical evolution of the techniques of posterior urethroplasty can be grouped into two time periods, 1970s to 80s and 1990 onwards. In the former period transpubic urethroplasty as described by Pierce, Pain and Coombes, Waterhouse and Turner-Warwick was considered the gold standard for complex strictures. Webster and Ramon described an elaborated perineal approach in 1991. This included ancillary procedures like corporal body separation, inferior pubectomy, and retrocrural urethral rerouting. (25)

Prostatic displacement contributes more to the posterior urethral distraction defect complicating pelvic fracture more than urethral loss or defect. (26) The only solution for restoring urethral continuity is to bring the anterior urethra up to the prostate. The elasticity of bulbar urethra may help by providing an extra length of 4 to 5 cm, which could help bridge a 2 to 2.5 cm defect without tension. (27) If the defect was longer, the bulbar urethra has to take a straight and short route to the prostate, which is made possible using the elaborated perineal approach of Webster and Ramon or the perineo-abdominal transpubic approach of Turner-Warwick. (6,28,29)

Following posterior urethroplasty urinary continence is maintained by bladder neck mechanism alone, the distal urethral sphincter is non-functional. Missed or neglected bladder neck injury at the time of the primary injury can result in urinary incontinence. In a retrospective review of 155 cases by Koraitim, failed penile erection was the result of primary trauma in 15% and of surgical repair in 2 %.(30)

Indian scenario

Although India accounts for only 1% of the registered motor vehicles, it accounts for nearly 9 % of RTA deaths. (31) With increasing incidence in road traffic accidents, the expected number of those presenting with PFUDD is likely to increase in the future. Assessing the pattern of vascular injury and the extent of physical injury in this group could provide valuable information towards formulation of preventing measures and strategies. The proportion of male children and male adolescents affected with traumatic posterior urethral injury is higher in India compared to developed country like Italy (25.6% Vs 6%). The most common people affected by traumatic posterior urethral injury in India were pedestrians, bicycle riders and motorcyclists involved in road traffic accidents. (13)

Present concerns

Most studies described in the literature have been retrospective in nature. There is a great need for long term prospective data to further comprehend and characterize the natural history of pelvic fracture urethral distraction defect with its attendant morbidity in the Indian scenario. This has been the driving force behind this research work.

Material and Methods

Study design

This was a single center, prospective observational study. The duration of the study was from Feb 2011 till Dec 2012. The study was carried out under the department of Urology, Christian Medical College and Hospital, Vellore - a tertiary care, referral centre.

A small pilot study inclusive of 3 patients was carried out to assess the feasibility of the study. Following this, it was evaluated and approved by the Institutional Review Board and Ethics Committee.

Inclusion criteria

Consecutive male patients presenting with traumatic posterior urethral injury for a primary urethral reconstruction were included in this study.

Exclusion criteria

- Unwillingness to consent
- Co-morbid conditions like diabetes and hypertension with end organ damage
- Traumatic spinal cord injury
- Previous operative intervention
- Pre-existing erectile dysfunction.

Pre-operative evaluation

Following informed consent patients were assessed using a validated questionnaire, International Index of Erectile Function (IIEF). Pre-operative imaging with MRI pelvis and penile color Doppler were carried 3 months following the trauma.

Primary and secondary outcome

Primary outcome: Penile vascular supply.

Secondary outcome: Erectile function

Operative outcome

IIEF questionnaire

Erectile dysfunction score using the validated 15 point IIEF questionnaire

Scoring Algorithm for IIEF

Domain	Items
Erectile Function	1, 2, 3, 4, 5, and 15
Orgasmic Function	9, 10
Sexual Desire	11, 12
Intercourse Satisfaction	6, 7, 8
Overall Satisfaction	13, 14

Penile color doppler

Penile color doppler was done following intracavernosal (30µgm) papaverine injection and Serial peak systolic velocities were measured every 5 minutes till 25 minutes, end diastolic flow was measured at 25 minutes. This was performed in a quiet, comfortable environment, ensuring the privacy of the patient. Color doppler was performed by a single, experienced radiologist. The study was performed using 7.5 MHz, high frequency, linear probe on Toshiba Xario model. Privacy was ensured during the procedure. Patient was encouraged to manually stimulate following the intracavernosal injection. Following serial measurement, they were monitored for priapism for atleast 3 hours following the procedure.

Figure 7 Radiological equipment used: Toshiba Xaria for penile color doppler



Figure 8 Penile color doppler in progress



Variables of interest: the following established cut-offs were used.

Variable	Normal	Abnormal
Penile arterial diameter	>0.7mm	<0.7mm
Peak systolic velocity	>25cm/sec	<25cm/sec
End diastolic velocity	<8cm/sec	>8cm/sec

Table 1 Normal and abnormal variables in penile doppler

Sources: Lue TF, et al. Vasculogenic impotence evaluated by high-resolution ultrasonography and pulsed Doppler spectrum analysis. (32)

Lue TF. Functional evaluation of penile arteries with papaverine in contemporary management of impotence and infertility.(33)

Pharmacologic agent used for Penile color doppler



Figure 9 Papaverine ampoule and Insulin syringe

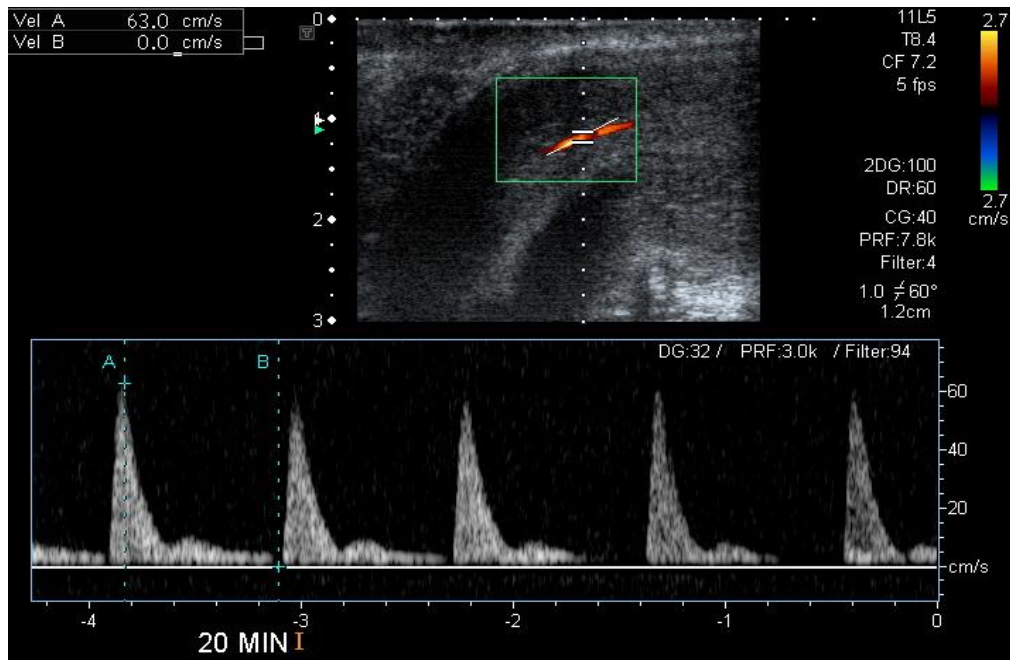


Figure 10 Color doppler at 20 minutes showing good flow

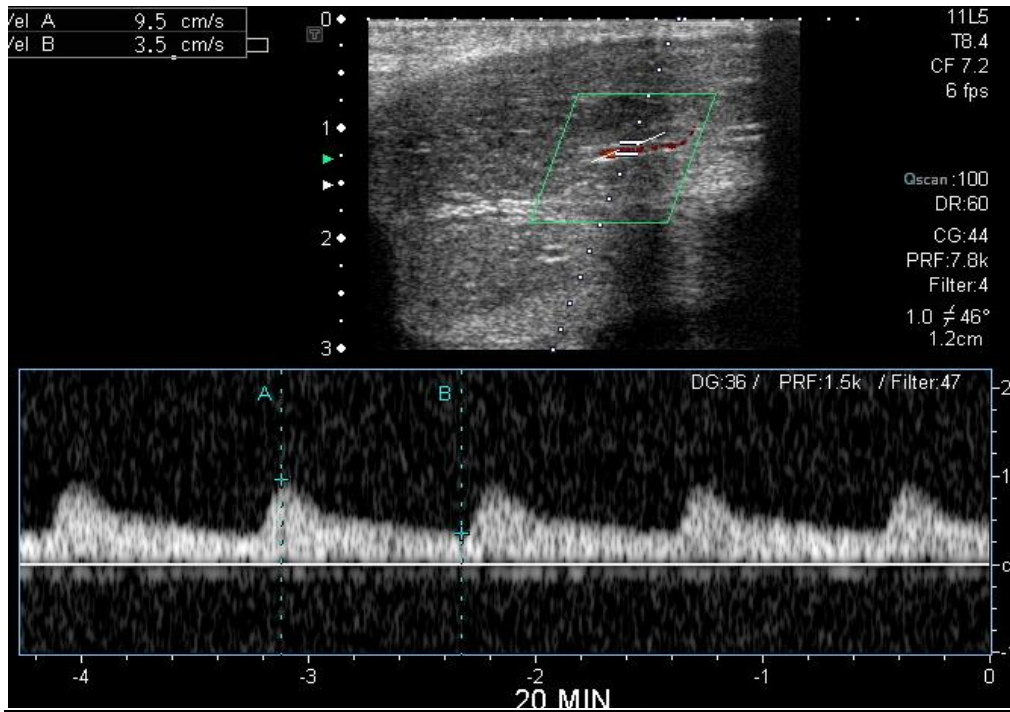


Figure 11 Color doppler at 20 minutes showing poor flow

MRI pelvis

MRI pelvis was done using Philips intera achievea 3.0 tesla. Anterior urethra was distended with normal saline using a 12 Fr. Foley catheter placed under aseptic precautions with a partially inflated bulb placed at the fossa navicularis. 2% Xylocaine jelly was used for local anaesthesia. Suprapubic catheter was clamped prior to the study to allow the bladder to be distended. The following image series were obtained: T2WI sagittal, axial, coronal; STIR_Long TE/RA, SshTSE, SPAIR, SENSE. TR: 3500ms, TE 90.0 ms, ST 3.0mm.

The following parameters were assessed by the same radiologist.

Length of urethral defect was the distance measured between the prostatic apex and the proximal most portion of the bulbar urethra. Direction of prostatic displacement was categorized superior, posterior, or lateral. Extent of scar tissue was categorized as Retropubic, prostatic, peri-prostatic, or subprostatic. Presence of para-urethral bladder base fistulas or injury to corpora cavernosa was also noted.

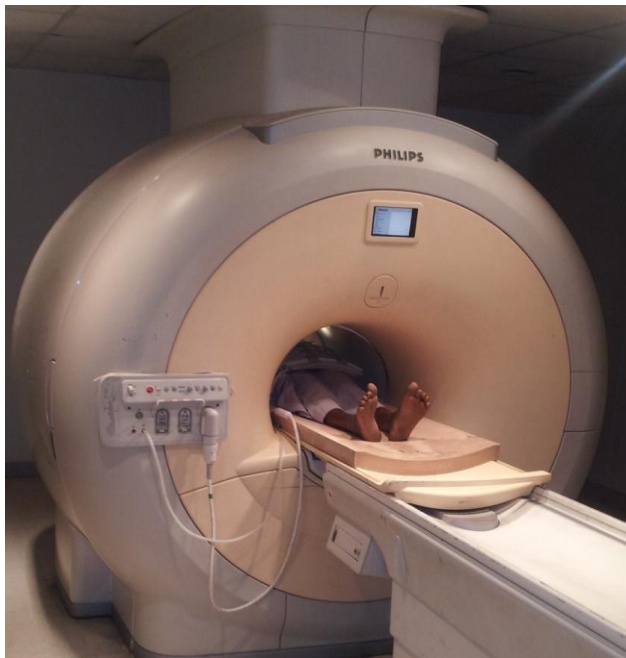


Figure 12 Philip Intera achievea 3.0 Tesla

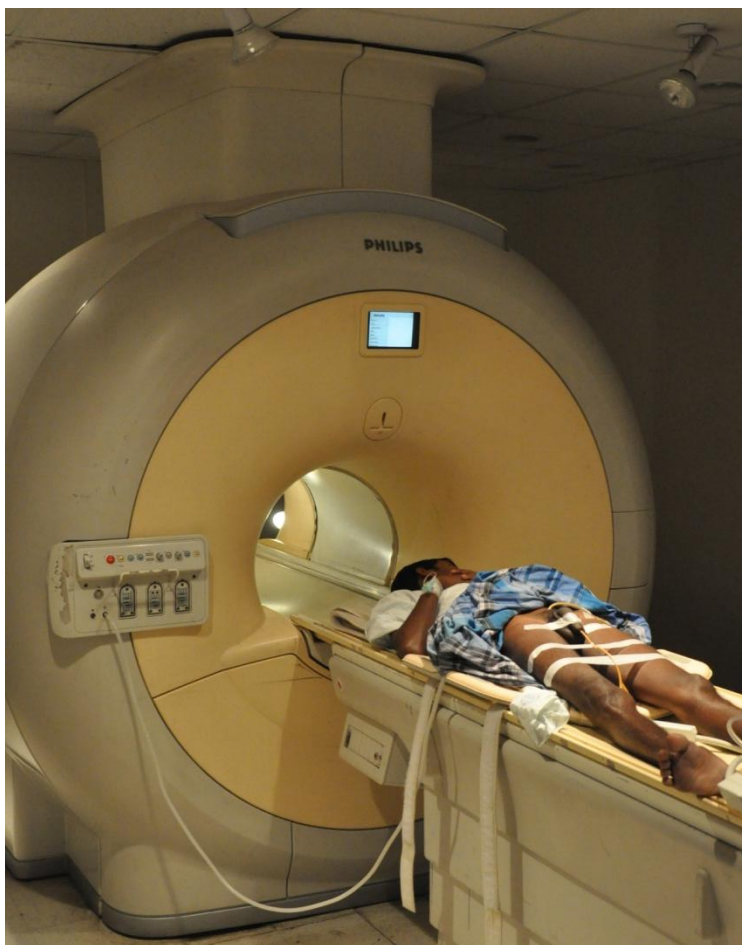


Figure 13 Patient prepared for MRI, clamped SPC, and saline distension of anterior urethra

Bias in the study was minimised by the following the protocol:

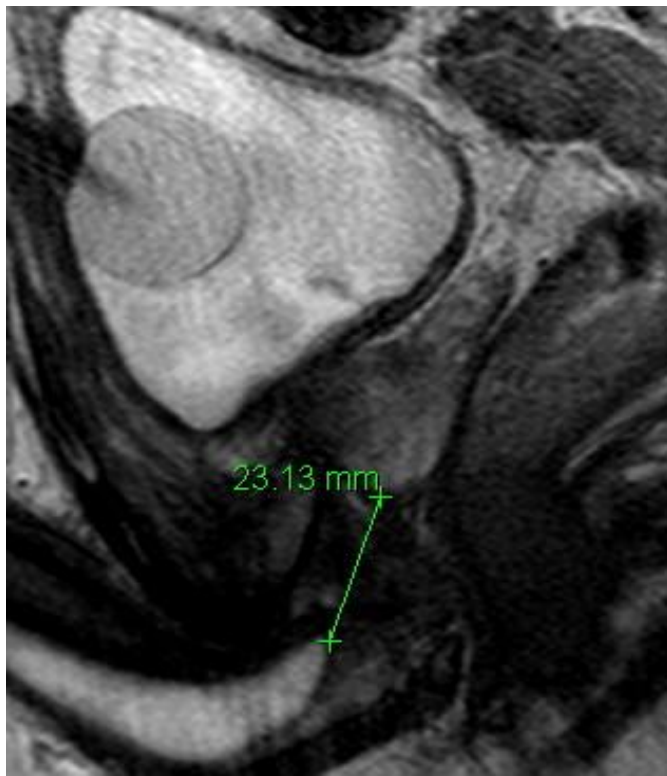
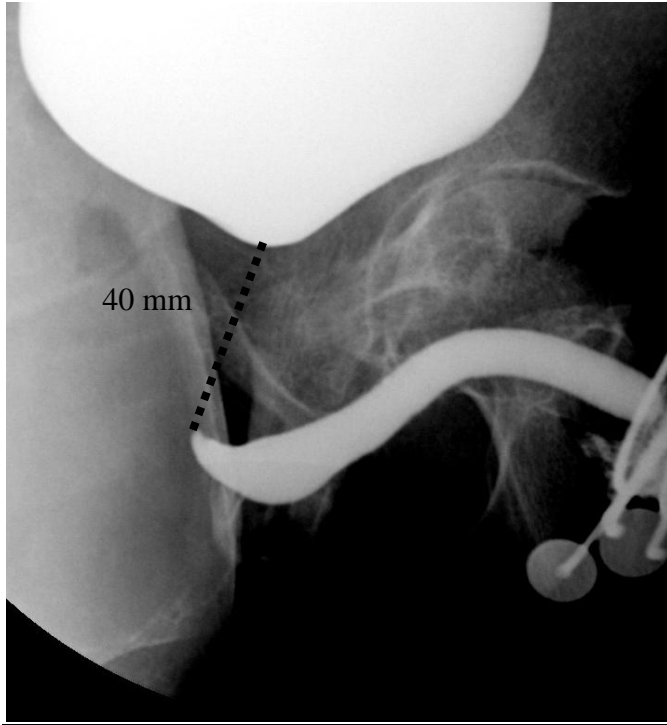
IIEF validated questionnaire was administered by principal investigator to all patients in a familiar language.

Dedicated radiologist reported all the MRI pelvis.

Dedicated radiologist performed and reported all the penile color doppler studies.

Intra-operative measurement of urethral distraction defect was by an experienced urology Consultant, using 5 Fr ureteric catheter.

Figure 14 and 15 Urethral distraction defect on MCU and MRI of the same patient



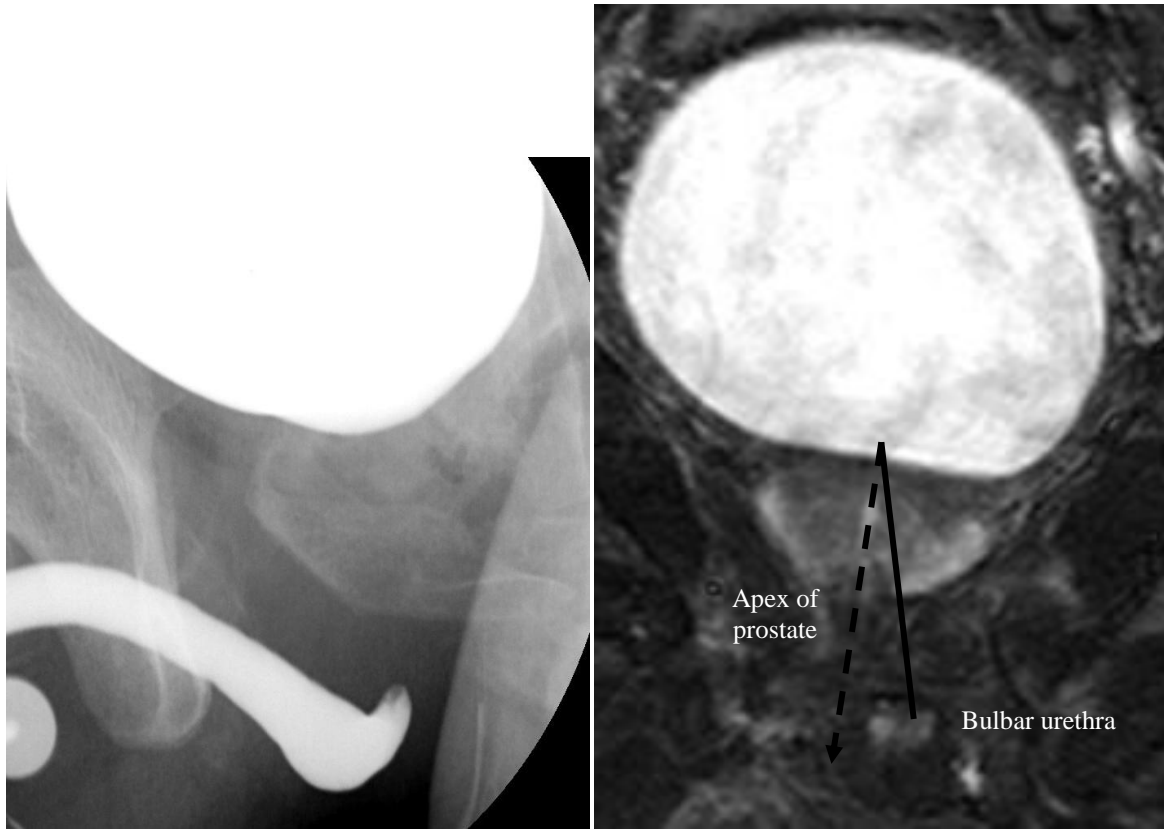


Figure 16 and 17 Prostatic displacement on MCU and MRI in the same patient

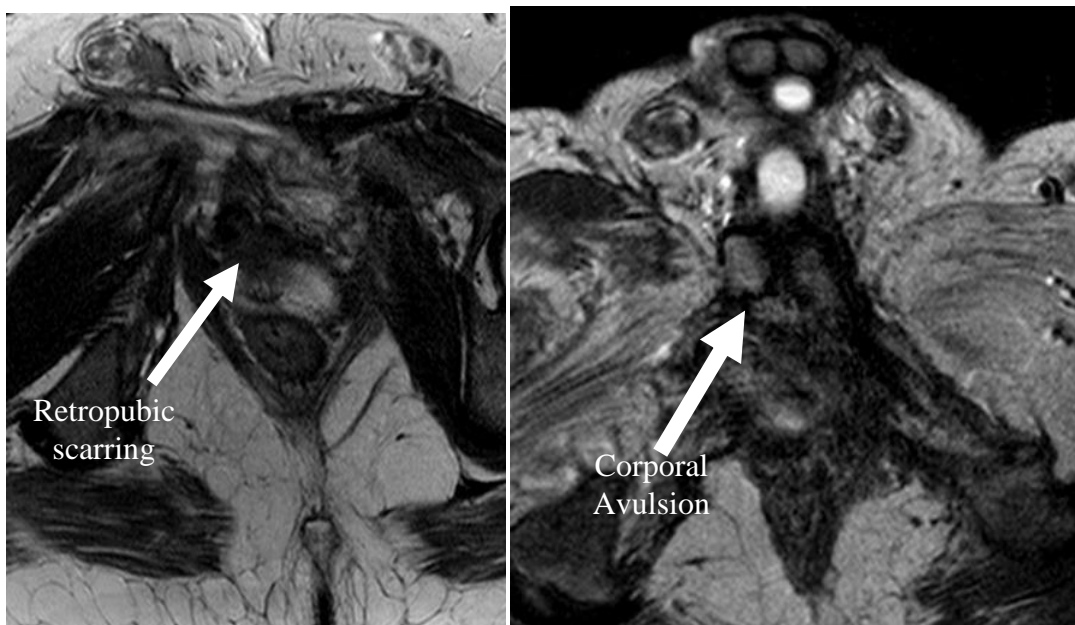


Figure 18 and 19 Retropubic scarring and corporal avulsion on MRI

Sample size

In the study by Shenfeld et al (12)72% had erectile dysfunction. Assuming a similar prevalence, for a confidence level of $\pm 10\%$ and 95% confidence interval, the expected sample size is 77.

$$N = z^2 pq / d^2$$

z = standardized normal variate of suggested confidence interval

p = proportion or prevalence of interest

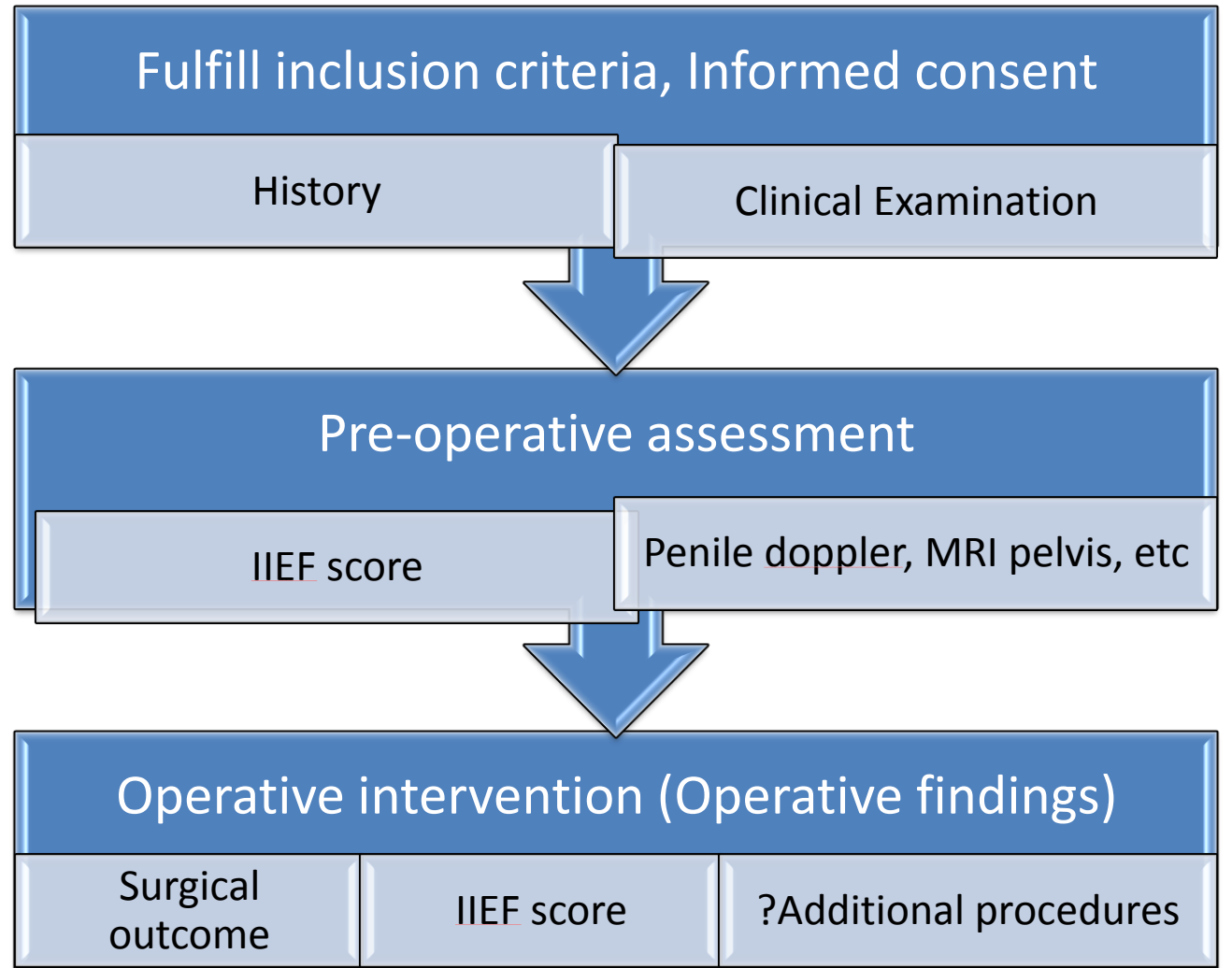
$$q = 1-p$$

d = the width or clinically expected variation. (Taken as 10% for our study)

Therefore, $n = 1.96 \times 1.96 \times 0.72 \times 0.28 / 0.1^2 = 77$.

With a precision of 10% and an incidence of 72%, the sample size required for the study is

77

FLOWCHART

DETAILS OF THE FLOWCHART

HISTORY: Mode of injury, time, date and place
Need for blood transfusion, emergency operation
Gross hematuria
Attempt at Urethral Catheterization / SPC
Co-morbid illness, smoking
IIEF-5 score

EXAMINATION: Abdomen: presence of injury, free fluid, and distention
Presence of perineal laceration, Blood at urethral meatus
Rectal exam: prostatic displacement, rectal injuries
Pelvic compression test
Spine
List other associated injuries

PREOPERATIVE ASSESSMENT

Routine investigations

Plain X-ray: Type of pelvic fracture (Scout film of the MCU may be used)
Side, stability, displacement

RGU + MCU Length of urethral defect
Degree of prostatic displacement

Special investigations

Penile duplex: Intracavernosal injection of Papaverine 30 μ g.

Normal arterial parameters: diameter 7mm, peak flow velocity >25cm/sec

Abnormal arterial parameters: diameter <7mm, psv <25cm/sec

Venous leak: End diastolic velocity > 8cm/sec

MRI Pelvis:

- Length of urethral defect
- Degree of prostatic displacement
- Extent of scar tissue
- Para urethral bladder base fistula
- Avulsion of corpora cavernosa

Intra-operative pictures

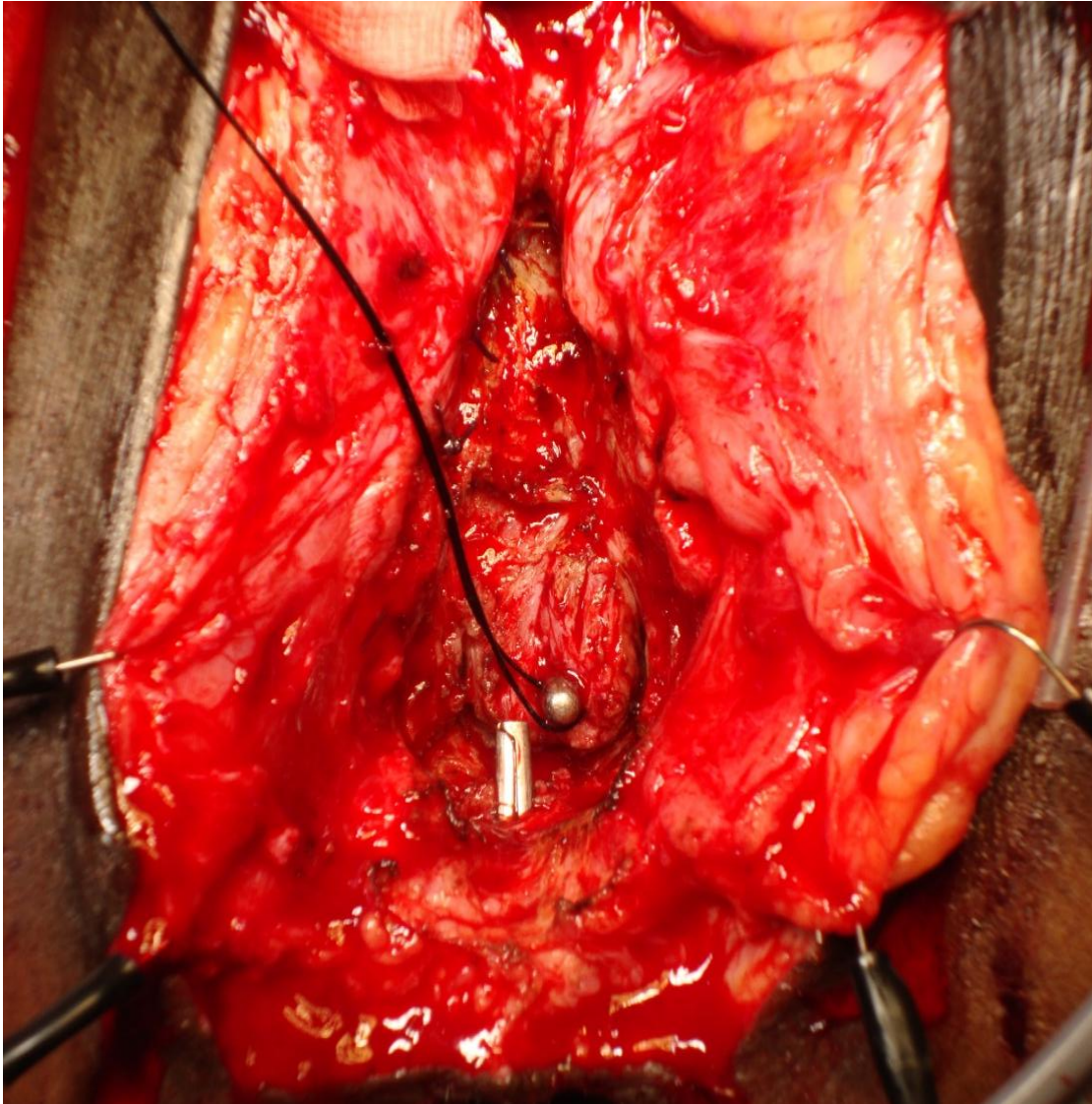
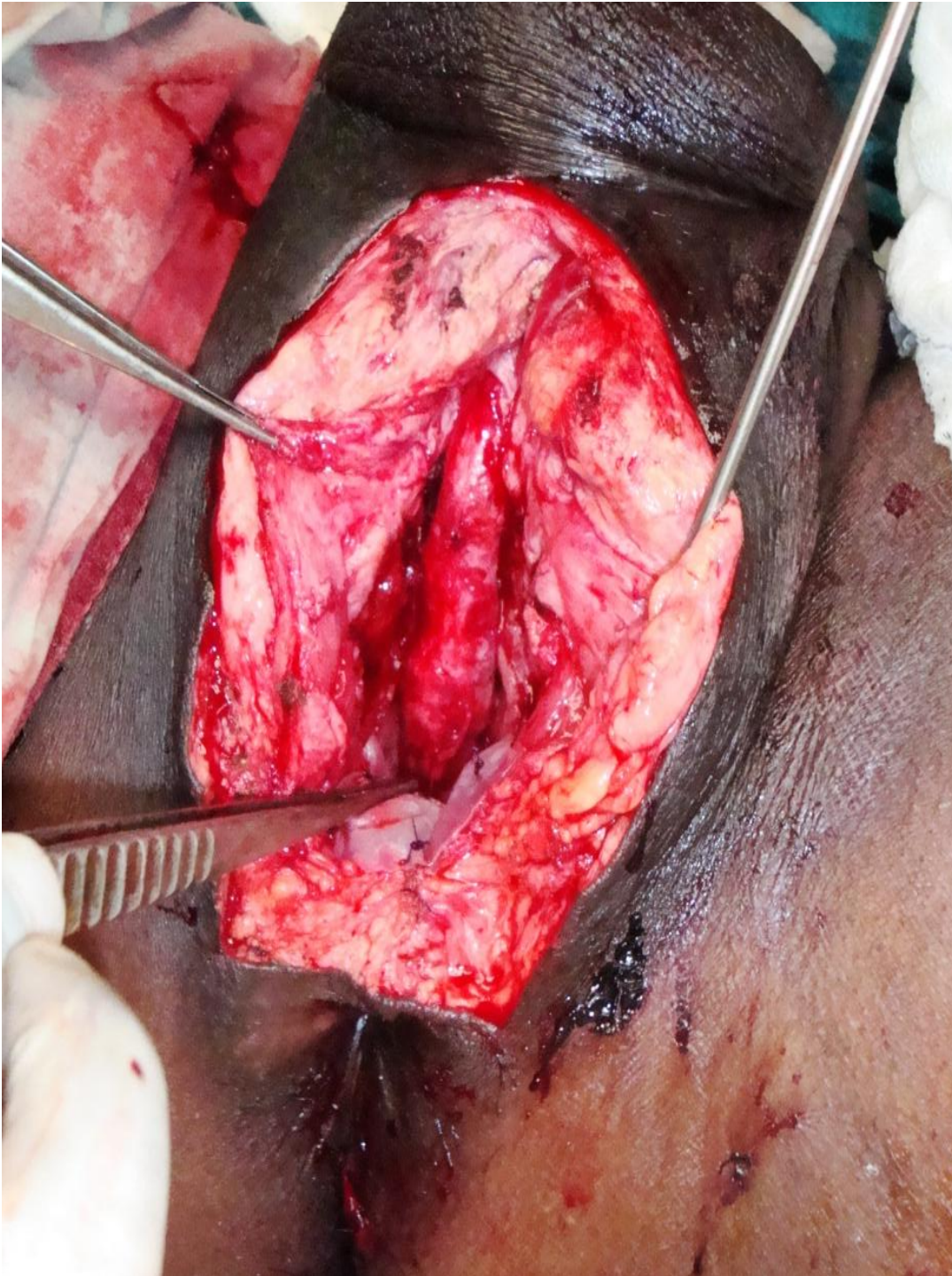


Figure 20 Identification of the prostatic urethra using Haygrove's.

Figure 21 Following completion of anastomosis and placement of wound drain



Post-operative protocol

Per urethral catheter was left in situ for 3 weeks following the operation.

Dressing was changed at 48 hours, and then as required. Wound drain was left in place for 48-72 hours. All patients received DVT prophylaxis in the form of low molecular weight heparin or unfractionated heparin till the time of discharge and compression stockings.

Urethral catheter was removed at 3 weeks. Uroflowmetry was done within 1 week following catheter removal.

Complete budget plan

Ideal sample size = 77

Target sample size in 2 years = 20

The extra cost incurred per patient would be:

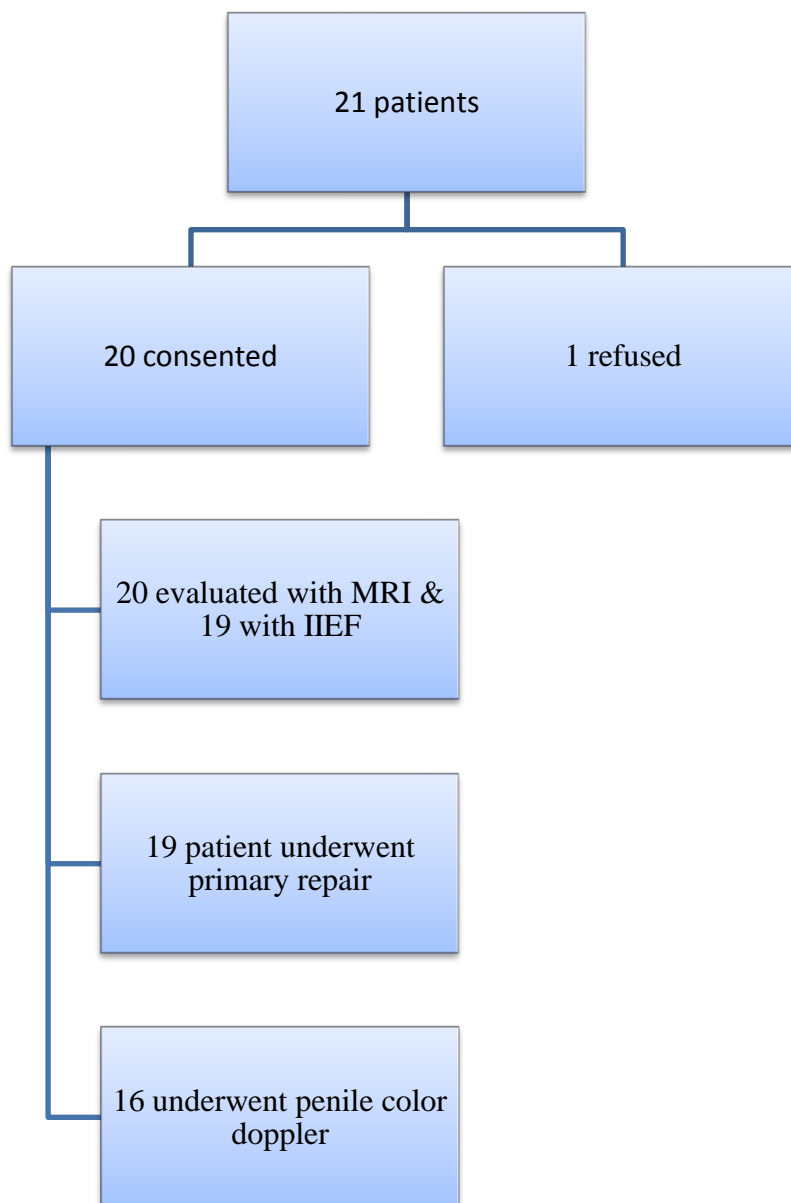
Penile color Doppler scan:	Rs. 1000
MRI pelvis:	Rs. 5100
Misc (Foleys, papaverine, xylocaine jelly, syringe)	Rs. 150.25
Total	Rs. 6250.25

Cost for the target sample size would be Rs 1, 24,100.50. Major part of this amount, Rs. 80,000 was sanctioned by Institution Review Board from Fluid Research Grant.

Statistical Analysis

Statistical analysis was performed using SPSS version 16 (IBM Corporation, USA). For quantitative variables, independent sample t-test was applied. For qualitative data the chi-square and Mann-Whitney-U tests were used to analyze the results. Pearson Correlation coefficient was used to study correlation.

Results

CONSORT DIAGRAM**Demography:**

The median age at presentation was 34 years age (range of 17-61 years). Majority (14/20 - 70%) of them were <40 years in age.

Initial Management

All patients underwent suprapubic catheterization.

None of the patients had undergone an attempt at primary realignment.

Three patients had associated anorectal injuries. They underwent diversion colostomy.

One patient underwent external fixation of pelvic fracture, rest were managed conservatively

Mode of injury

Road traffic accident	16
Fall from train	1
Fall from tractor	1
Fall from bullock cart	1
Crushed by collapsing wall	1

Table 2 Mode of injury

X ray Pelvis – Type of pelvic fracture**SIDE (n=9)**

Left	Right	Bilateral
5	6	9

Table 3 side of pelvic fracture**Tile's classification**

A	B	C
11	2	7

Table 4 Tile's classification**Evaluation by 15 point International Index for erectile function****IIEF (n=15)**

Nineteen patients completed all the domains of the IIEF questionnaire, mean of the total IIEF score was 37.2. Seventeen year old, unmarried boy could not meaningfully fill all the domains of IIEF questionnaire.

The mean score in the erectile function domain was 13.3. Seventy three percent (15/19) of patients had erectile dysfunction, while 36% (7/19) had severe erectile dysfunction.

IIEF domain	Mean	Possible points
Total IIEF	37.2	(75)
EF	13.3	(30)
IS	5.3	(15)
OS	6.3	(10)
SD	7.1	(10)
OS	5.2	(10)

Table no 5 Mean IIEF score (total IIEF and by each subset) (n=19)

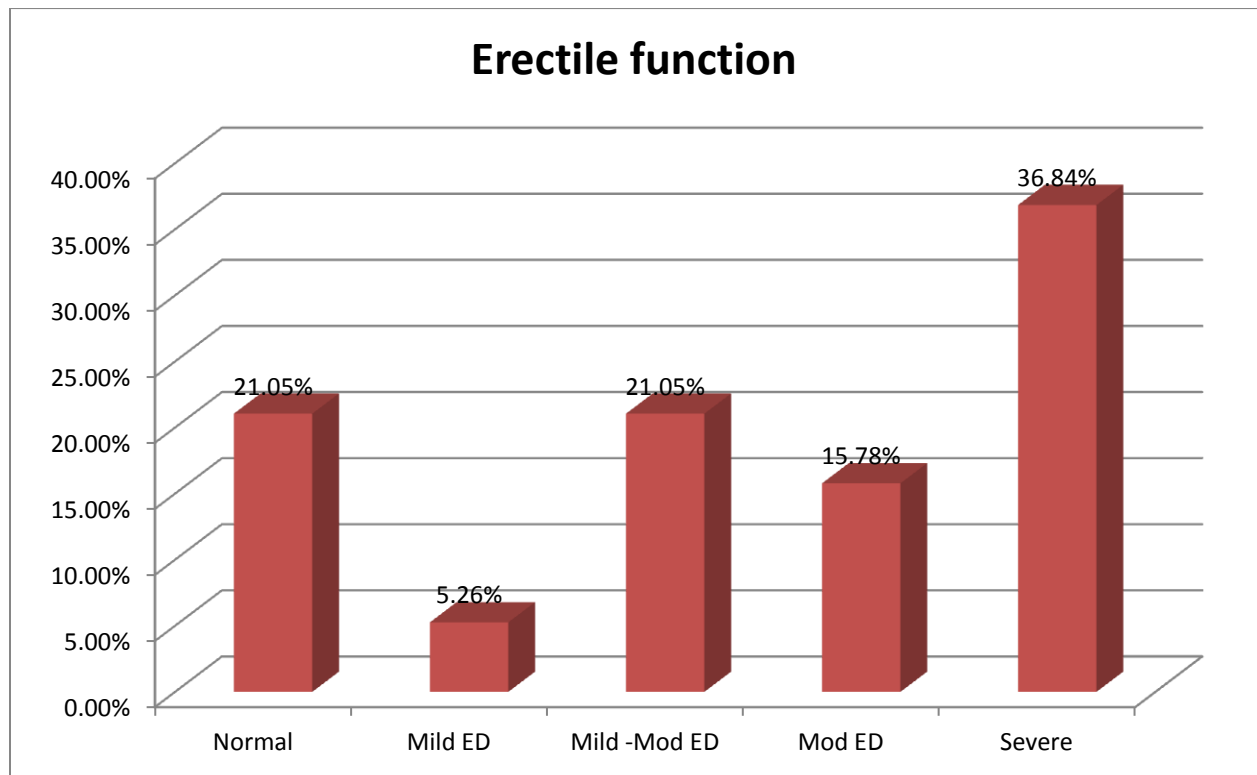


Figure 22 Distribution of patients based on IIEF-EF score.

As seen in Figure 22, only 21% of patients had normal erectile function, while 37% had severe erectile dysfunction.

Group 1	Normal (25-30)	n=4
Group 2	Mild & mod (7-24)	n=8
Group 3	Severe (0-6)	n=7

Table 6 Three groups based on IIEF-EF score

Three groups based on the IIEF-EF score were made. Further analysis was performed using the IIEF-EF score as the criteria.

Color doppler findings

Penile color doppler was done in 16 patients.

This was due to non-availability of dedicated radiologist to perform the color doppler in the immediate pre-operative period.

Sixteen patients were evaluated with penile color doppler, following intracavernosal papaverine injection, 11 patients had arterial PSV > 25 cm/sec, 5 patients had arterial PSV < 25 cm/sec. All patients had normal end diastolic flow.

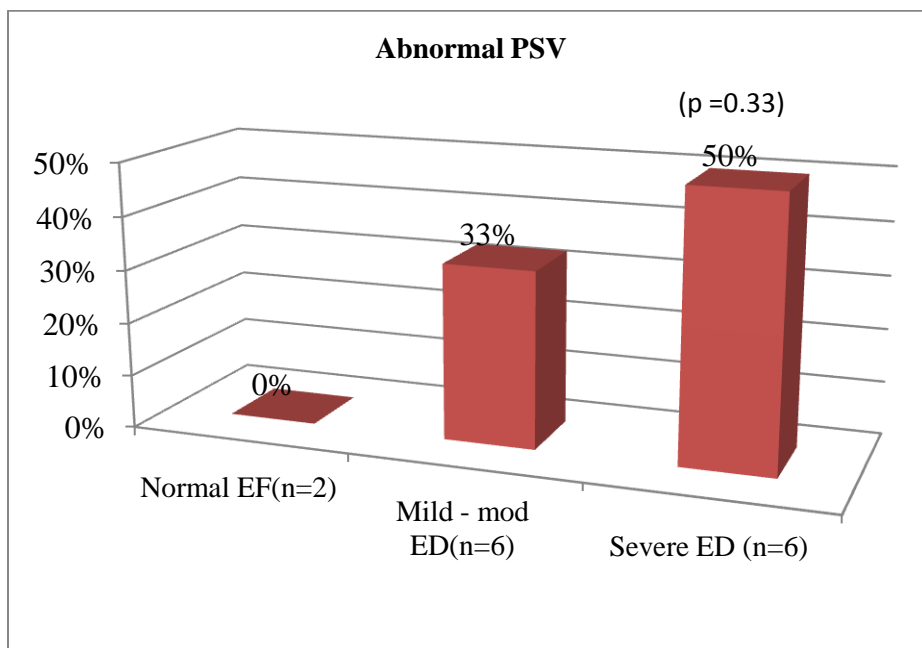
68.7% of patients had normal peak systolic velocity.

Peak systolic velocity VS erectile function score:

Peak systolic velocity	Median	(Range)
Normal (n=10)	13.5	(2-30)
Abnormal (n=5)	6	(1-18)
P value	0.230	

Table no7 Median IIEF score in patient with normal and abnormal PSV

Patients with normal peak systolic velocity had a higher mean erectile function score; however this correlation was not statistically significant.

IIEF-EF score VS abnormal PSV**Figure 23 Distribution of patients with abnormal PSV in the three groups**

MRI findings	No. present
Prostatic displacement	12
Retropubic Scar tissue	11
Bladder base fistula	0
Injury to corpora cavernosa	4

Table 8 Distribution of MRI findings among the patients

MRI pelvis showed prostatic displacement in 12 patients, 9 of whom had mild displacement and the remaining 3 having moderate displacement. Retropubic scarring was seen in 11 patients.

Four patients were found to have evidence of injury to corpora cavernosa. However, there was no avulsion of the corpora cavernosa from the ischium.

Three patients were found to have recto-urethral fistula. One of them was not evident on the routine combination of retrograde anterior urethrogram and micturating cystourethrogram.

The patient presented 3 months after trauma with a groin sinus. The sinus healed promptly following diversion colostomy.

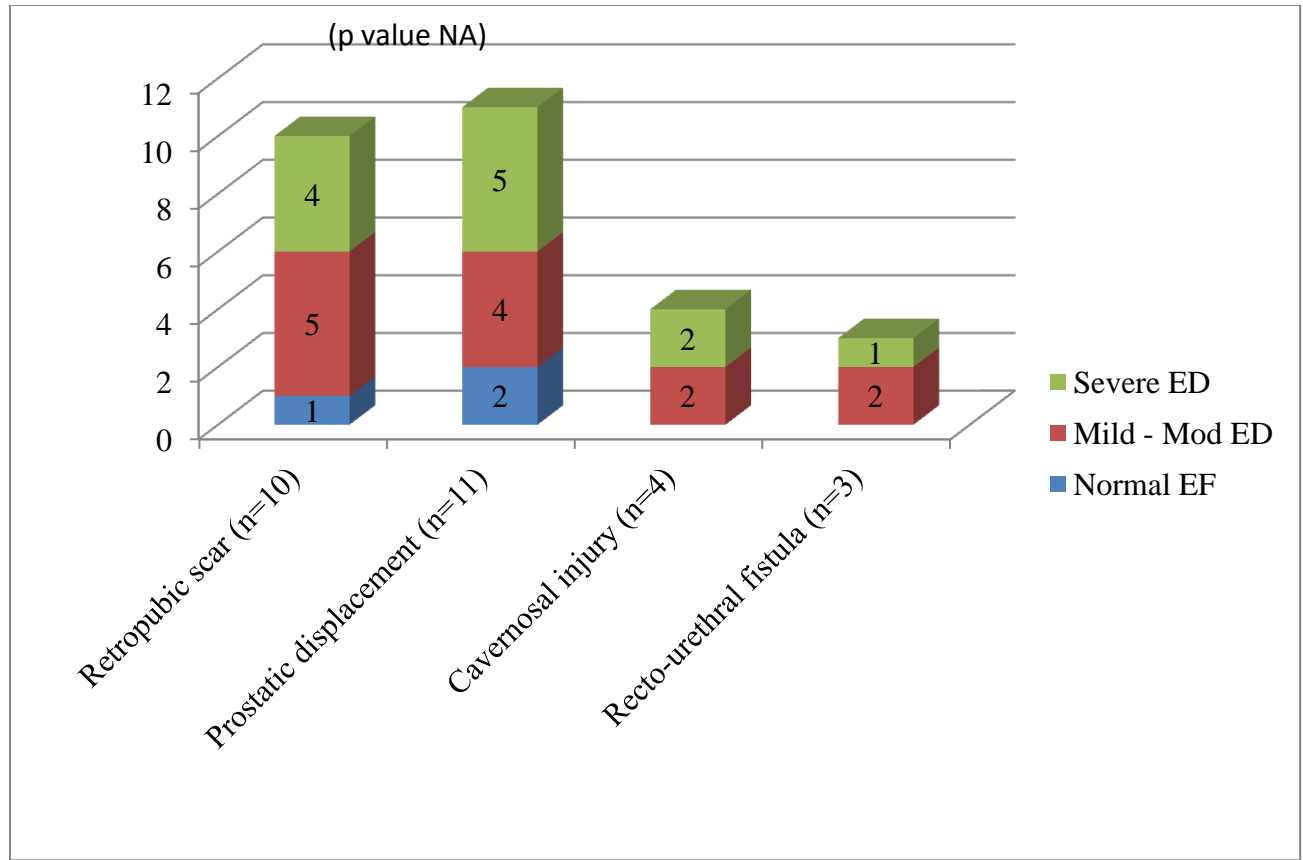
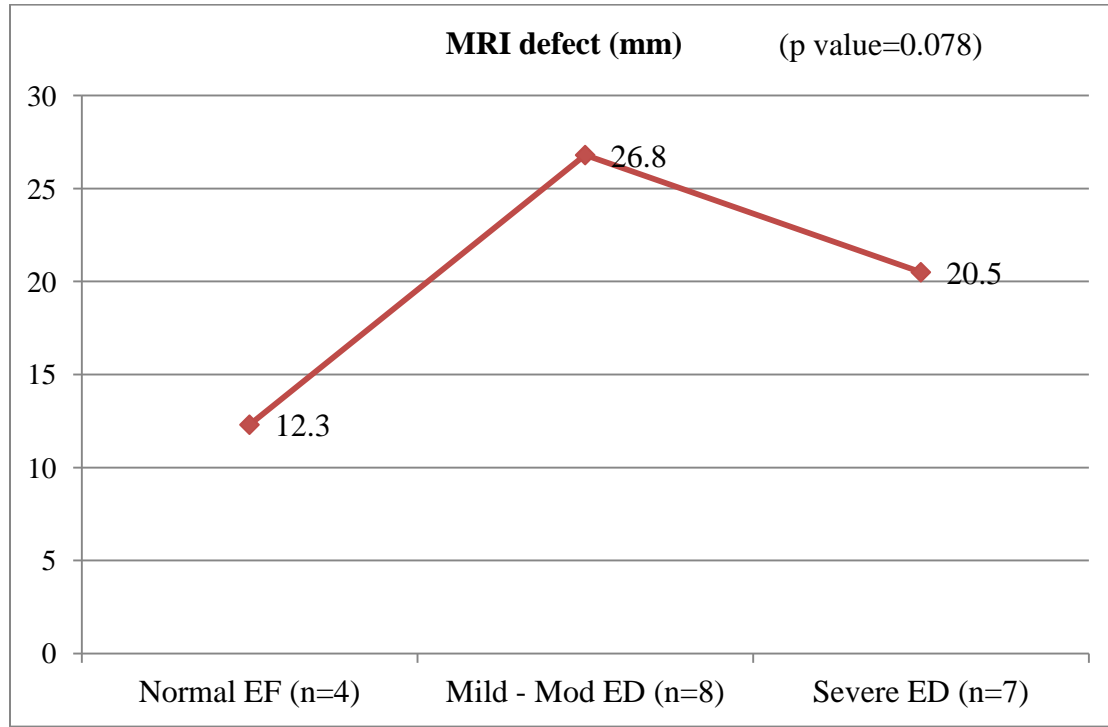


Figure 24 Distribution of MRI findings in the three groups

About 90% of patients who had either retropubic scarring or prostatic displacement had erectile dysfunction. All patients who were noted to have either cavernosal injury or recto-urethral fistula had erectile dysfunction. All the above mentioned findings have a significant impact on the erectile dysfunction. The presence of these findings on MRI could be related to the severity of trauma.

MRI defect**Figure 25 Mean MRI defect in the three groups**

The mean MRI defect in those with normal erectile function was lesser than those with erectile dysfunction; however this did not reach statistical significance. The MRI defect was measured from the prostatic apex to the proximal most portion of the bulbar urethra.

Longer urethral distraction defect on the MRI could be related to the severity of the trauma, which has an effect on the erectile function of the patient. When the urethral distraction defect measured on the micturating cystourethrogram or in the intra-operative period was compared with erectile function, there was no correlation.

Peak systolic velocity Vs Defect on MRI

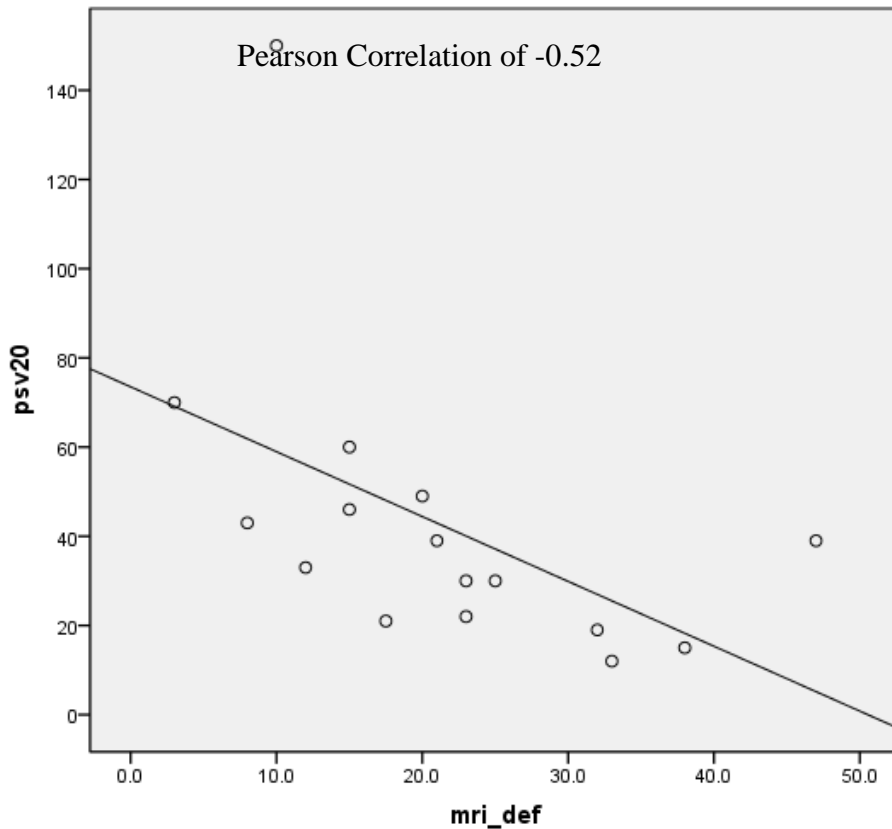


Figure 26 Correlation between peak systolic velocity and MRI defect

There was a negative correlation between the urethral distraction defect on MRI and the peak systolic velocity. Thus, patients with longer urethral distraction defects could be expected to have lower peak systolic velocity, which would imply a higher chance to have arterial insufficiency and erectile dysfunction. Length of the urethral distraction defect and peak systolic velocities could be related to the magnitude of the trauma.

Surgical outcome

Nineteen patients underwent anastomotic urethroplasty by progressive perineal approach.

One patient with complex fistula communicating with the rectum, perineum and left hip joint had recently undergone diversion colostomy and was awaiting definitive management.

The patients were categorized into 3 groups based on the operative outcome.

Surgical outcome	Qmax (ml/sec)	Number of patients (n = 19)
Good	> 15	12
Acceptable	> 15 After 1 EIU	5
Failed	<15	2

Table 9 Surgical outcome

The above classification was based on the previously published data from this department.

(34) Twelve patients had a good operative outcome, while five of them had an acceptable outcome. Two patients did not void following catheter removal. Both underwent suprapubic catheter placement. One patient underwent successful redo-anastomotic urethroplasty, while the other patient is yet to undergo a redo procedure.

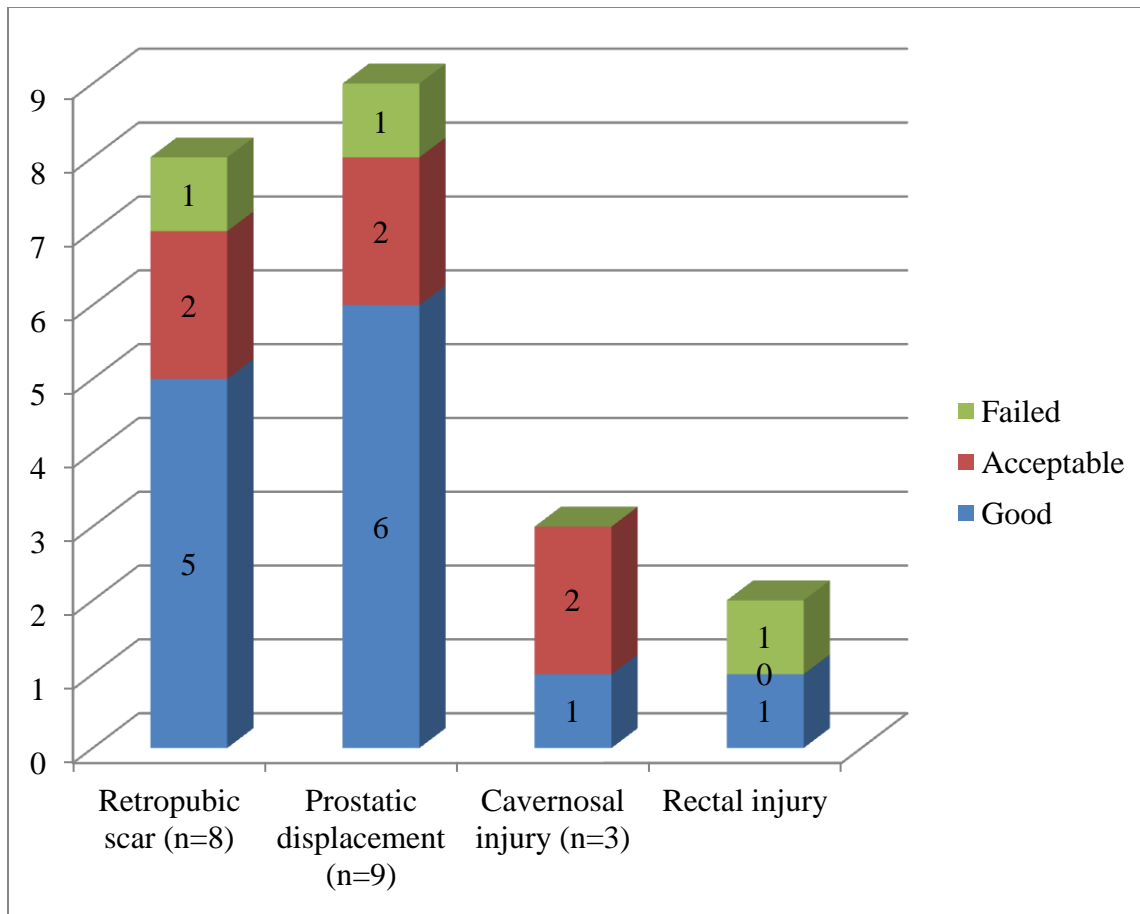


Figure 27 Comparing MRI findings with Surgical outcome

87.5% of patients with prostatic displacement and those with retropubic scarring had either a good or acceptable outcome. All 3 patients with cavernosal injury had a good or acceptable outcome. 50% of patients with rectal injury had good outcome. Presence of the above mentioned MRI findings did not have a significant impact on the surgical outcome.

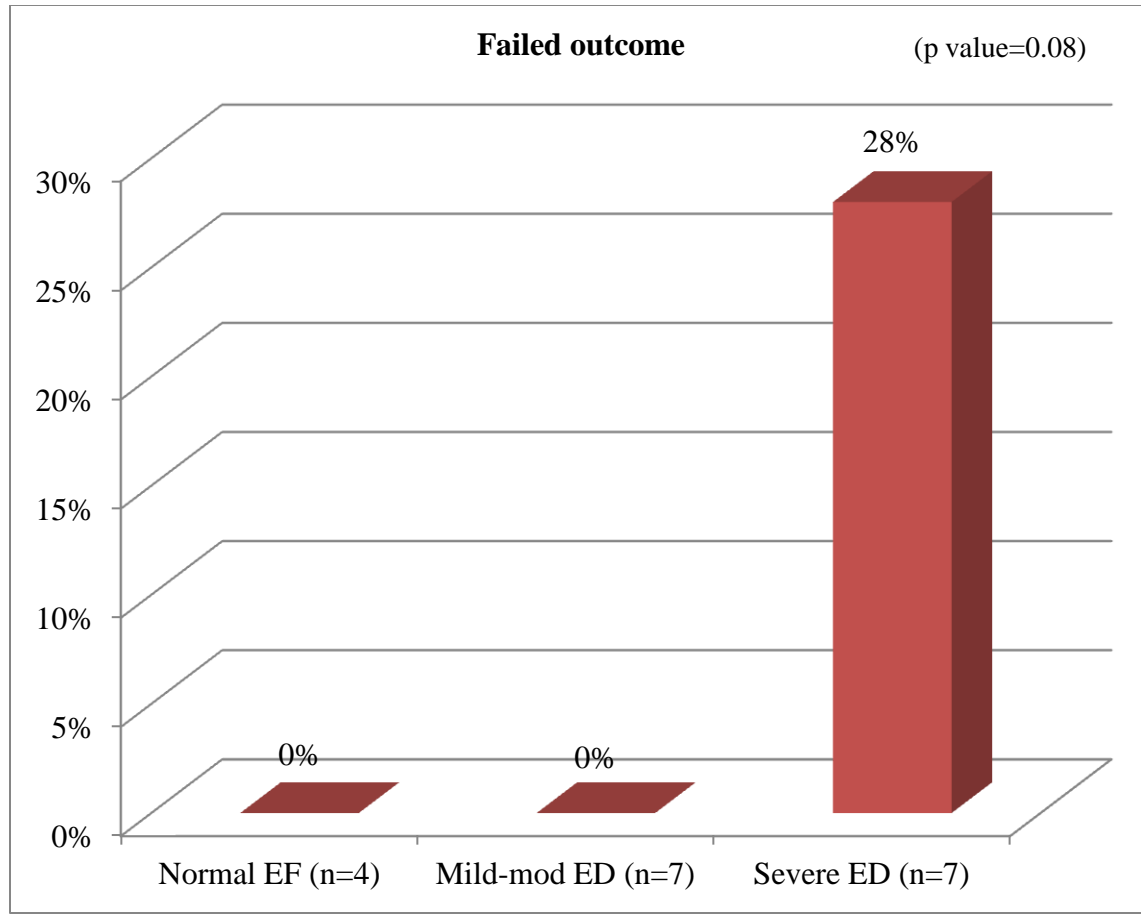


Figure 28 Comparing failed outcome with the erectile function scores

28% of patient with severe erectile dysfunction had a failed outcome. Both the patients who failed to void following urethral reconstruction had severe erectile dysfunction following the trauma. All the patients in the normal erectile function and mild to moderate erectile dysfunction had either a good or an acceptable outcome. Presence of severe erectile dysfunction in the preoperative evaluation appears to be important finding. This should prompt the clinician to evaluate further to prognosticate the operative outcome and the recovery of erectile dysfunction.

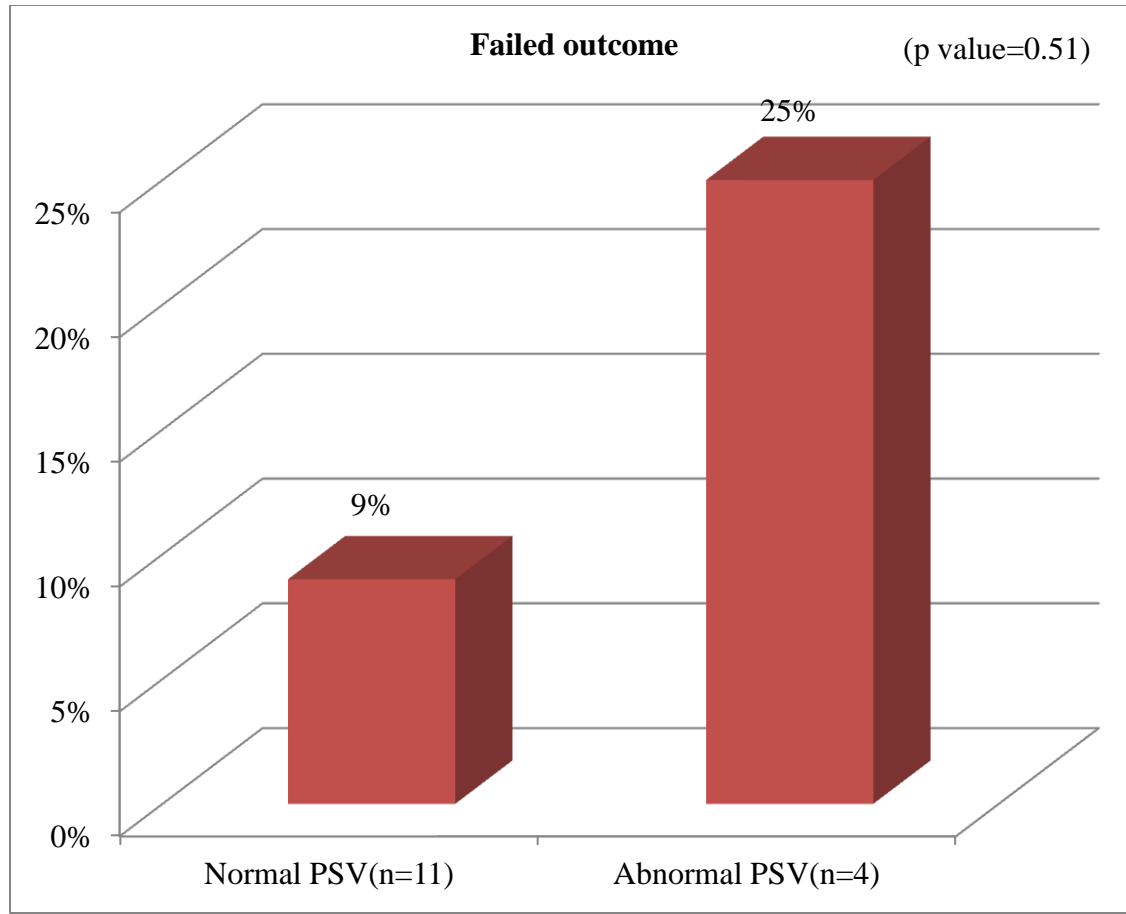


Figure 29 Comparing failed outcome with peak systolic velocity

One out of 11 patients (9%) who had normal peak systolic velocity had a failed repair, while one out of 4 patients (25%) who had abnormal peak systolic velocity had a failed repair. However, this relationship was not statistically significant. All three patients who had an acceptable outcome had a normal peak systolic velocity. This observation did not have a statistical significance. Normal penile vascularity appears to be an important factor that facilitates better wound healing and good operative outcome.

IMMEDIATE POST-OPERATIVE COMPLICATIONS:

Complication	Number affected	Additional Treatment
Wound infection	1	Local drainage, Regular dressings Culture specific antibiotics
Urosepsis	1	Culture specific antibiotics Antipyretics
Dengue fever	1	Supportive measures

Table 10 Immediate post-operative complications**Treatment in failed repairs:**

2 patients had urinary retention following catheter removal.

Suprapubic catheters placed.

One patient is awaiting redo urethroplasty.

One patient underwent redo abdominoperineal urethroplasty. He failed to void despite having a patent urethra on cystoscopy. Urodynamic evaluation revealed a hypo contractile bladder.

He was advised clean intermittent catheterization.

Treatment in Acceptable repairs:

Five patients with poor flow had soft strictures, underwent single additional procedure in the form of cystoscopy and dilation in outpatient department and were advised self calibration.

They had satisfactory urine flow with $Q_{max} > 15\text{ml/sec}$.

Discussion

Patients in the age group 17-61 years presented with PFUDD. Eight out of the 19 patients (42%) were ≤ 30 years. Sanjay Kulkarni et al in their review compared PFUDD in developing and developed countries. They found PFUDD more common in children and adolescents in India when compared to Italy (25.6% Vs 8%).(35) There are a few important differences when PFUDD occurs in children and pre-pubescent boys. Presence of rudimentary prostate and puboprostatic ligaments implies higher chance of injury to prostatic urethra and bladder neck resulting in more complex strictures.(5,36,37) Secondly, smaller glans with fewer vascular connections implies poorer retrograde blood flow to bulbar urethra. (38)

Pelvic fracture associated with posterior urethral injury has a significant impact on penile vascularity and erection. One of the most prominent findings was the high prevalence of erectile dysfunction based on validated IIEF questionnaire, 15 out of 19 patients (83%) having some form of erectile dysfunction and 7 out of 19 patients (39%) having severe erectile dysfunction. In the study by Shenfeld et al (12)72% had erectile dysfunction. Anger et al reported erectile dysfunction of some degree in 54% of patients with PFUDD and severe erectile dysfunction in 30%.(9) Corriere et al reported prevalence of erectile dysfunction following trauma as 25% (50/197). (39) Koraitim reported prevalence of erectile dysfunction after traumatic posterior urethral injury in 44 out of 110 (40%) patients who were sexually potent.(30) King reported prevalence of erectile dysfunction in 42% of patients with PFUDD when compared to 5% of patients with pelvic fracture alone.(40) Evaluation of nocturnal tumescence and rigidity has revealed erectile dysfunction in upto 84%.(41) The cause of erectile dysfunction following PFUDD is speculated to be neurovascular injury.(12)

Evaluation with penile color doppler in patients with erectile dysfunction helps in screening out patients with compromised blood supply. Vascular insufficiency could result in ischemic

necrosis of the anastomosis in addition to causing erectile dysfunction.(18) Mark et al reviewed 92 patients and found erectile dysfunction in 62%. Operation did not cause erectile dysfunction in a potent man. They also found that self-injection using intracavernous vasoactive drugs was successful in 24 out of 27 patients (89%), which could suggest that the etiology is neurological.(42) Shenfeld et al assessed 18 patients who abnormal or absent nocturnal erections on Rigiscan with penile duplex following intracavernosal Trimix injection. They found abnormal arterial flow in 5 patients (28%). They suggested that patients with erectile dysfunction with normal arterial flow probably had neurogenic aetiology, while those with erectile dysfunction with abnormal arterial flow could have mixed aetiology.(12)

Armenakas et al evaluated the role of penile color doppler and MRI in the evaluation of 15 patients who were rendered impotent following PFUDD. They found the cause of erectile dysfunction as vasculogenic in 12 out 15 patients (80%). In our study, 5 out 12 (41.6%) patient with erectile dysfunction had an abnormal arterial flow. Four patients who had normal erectile function had normal arterial flow as expected.

In a review of MRI done on 27 patients with PFUDD by Narumi et al, there was significant correlation between corporal avulsion with prostatic displacement on permanent erectile dysfunction, with a probability of 95%. Probability of normal erectile function in the absence of these findings was 83%.(43) In another study by Koraitim et al, 21 patients with PFUDD were assessed using MRI combined with antegrade urethrography. They found avulsion of cavernosa from the ischium as well as lateral displacement of prostate in all patients with erectile dysfunction. (20) Proximity of cavernosal nerves and internal pudendal arteries to the prostatic apex makes this observation interesting.(12) In our study, abnormal

peak systolic velocity was associated with the presence of retropubic scarring. The other MRI findings which could help predict erectile dysfunction were the presence of cavernosal injuries and prostatic displacement, though this did not reach statistical significance. In our study, MRI showed prostatic displacement in 13 patients and injury to corpora cavernosa in 4 patients, their association with erectile dysfunction was 86% and 100% respectively.

Another important advantage of MRI was the identification of exact length of the urethral distraction defect and the presence of rectourethral fistula. This would be of great help in the preoperative decision making process, in deciding the appropriate approach.(20) In our series, three patients were found to have recto-urethral fistula. Two of them presented with a diversion colostomy, done elsewhere at the time of trauma, while the third patient presented with groin sinus with intermittent discharge of pus, gas and bony spicules. MRI clearly showed the presence of complex recto urethral fistula with branching tracks leading onto the groin and right hip joint with features of right hip joint infective arthritis. He has undergone trephine end colostomy, awaiting resolution of infection.

The first surgical repair offers the best chance of success. (44) Re-stricture following the first repair can be technical, major causes of failure include inadequate excision of scar tissue at prostatic apex and lack of adequate fixation of healthy prostatic mucosa.(45)

Thus, MRI pelvis combined with retrograde urethrography and penile color doppler have very important role in evaluating men presenting PFUDD prior to the primary reconstructive procedure.

Limitations

- Small sample size
- 4 patients did not have penile color doppler
- Inter observer variability in measuring intra-op urethral defect
- Erectile function has been reported to improve with time, upto 18 months following the operation

The ideal sample size required to make a statistically significant inference would be 77 based on the abovementioned formula in materials and methods. This was an attempt to prospectively study the impact of traumatic posterior urethral injury on penile vascularity and erection using the validated IIEF questionnaire, penile color doppler and the role of MRI pelvis in pre-operative imaging. The purpose of this study was to make some meaningful observations and apply statistical analysis when appropriate.

Four out of the 20 patient enrolled in the study did not undergo pre-operative penile color doppler. This problem was faced in the initial period of the study, due to non-availability of the dedicated radiologist in the pre-operative period. This could probably decrease the decrease the strength of this study.

Nineteen out of the 20 patients were evaluated with IIEF-15 questionnaire. One patient, who was 17 year old bachelor, could not meaningfully answer the IIEF questionnaire with the exception of the sexual desire domain.

In addition to these factors, there was interobserver variability in the intra-operative measurement of the urethral distraction defect. A 5 Fr. Ureteric catheter was used to measure

the defect. The defect length could be measured only after the excision of all the callous tissue and mobilization of the bulbar urethra. The distraction defect varied based on the stretch applied to the mobilized bulbar urethra and angle at which the bulbar urethra was positioned in relation to prostatic urethra. With these limitation in view, we would cautiously make the following observation from this prospective study

Conclusion

Majority of patients presenting with traumatic posterior urethral injury were younger than 40 years. Erectile dysfunction was present in most of the patients. Severe erectile dysfunction was associated with abnormal peak systolic velocity and poor surgical outcome. MRI findings associated with poor peak systolic velocity was longer urethral distraction defect, prostatic displacement and presence of retropubic scarring. Cavernosal injury, prostatic displacement, retropubic scar and ano-rectal injury had significant correlation with erectile dysfunction. Hence, preoperative evaluation with penile color doppler and MRI pelvis has a pertinent role in management of patients with PFUDD who have severe erectile dysfunction.

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Annexure

1. Informed consent
2. Study pro forma
3. IIEF questionnaire
4. Patient details

Christian Medical College, Vellore

Department of Urology

INFORMED CONSENT

TITLE OF THE STUDY: A prospective observational study to assess penile blood supply and erectile function in patients with traumatic posterior urethral injury

You are being requested to participate in a study which will assess the effect of posterior urethral injury (following pelvic fracture) on the penile blood supply.

You have sustained pelvic fracture following trauma. This injury has also resulted in the disruption of your posterior urethra. The standard initial treatment for this includes suprapubic diversion of urine prior to the definitive operative management. Better results are obtained if the definitive operation is delayed for more than 6 weeks.

Normal Penile blood supply is important for normal erectile function and good operative outcome. This is measured using penile color doppler study. MRI Scan of the pelvis helps in correlating the penile blood supply with the extent of the injury.

Penile color Doppler study

This is an advanced ultrasound scan of the penis which measures the blood flow in and out of penis. The procedure is done on both the flaccid state and the erect state of the penis. It is important to stimulate the blood flow into the penis during this study to assess penile blood supply during erection. This is done by injecting vasoactive substance like papavarine into the base of the penis.

This test helps in the diagnosis of erectile dysfunction, and suggests the modality of treatment in patients with erectile dysfunction.

Intrapenile injectable substances include papavarine as a single agent or as bimix where its used along with phentolamine. Papavarine will be used as single agent for this study. There are few adverse effects of this study, which are Pain, Priapism, and Ecchymosis. However, these complications are uncommon.

Priapism is the presence of a persistent, usually painful, erection of the penis unrelated to sexual stimulation or desire. It is a urologic emergency that may result in permanent erectile dysfunction, if left untreated. If this occurs, it can be controlled and managed with use of counteracting substance and decompression of the erect penis.

MRI (Magnetic Resonance imaging)

This study uses Magnetic field and radio signals to form pictures of your body's internal structures. Studies of strong magnetic fields have detected no harmful effects on the body. However, the magnet can attract metal objects within or outside the body. The magnet may also cause malfunctions to any electronic or mechanical implants such as cardiac pacemakers, intracranial aneurysm clips, artificial heart valves or other devices. **IF YOU ARE AWARE OF ANY SUCH DEVICES, YOU MUST INFORM US BEFORE ANY MRI SCAN IS PERFORMED. THE DEVICE MAY BE INCOMPATIBLE AND MAY CAUSE HARM TO YOU.**

MRI of pelvis may involve placement of intra-urethral catheter to fill the urethra with water to obtain better images.

If you take part what will you have to do?

If you agree to participate in this study, you will be evaluated with penile color doppler and MRI of the pelvis along with other routine pre-operative evaluation prior to the definitive operative management. Your erectile function will be assessed using a standardized questionnaire (International Index for Erectile Function)

All other treatments that you are already on will be continued and your regular treatment will not be changed during this study.

If at any time you experience any problems, you will be expected to report this to the doctor.

Can you withdraw from this study after it starts?

Your participation in this study is entirely voluntary and you are also free to decide to withdraw permission to participate in this study. If you do so, this will not affect your usual treatment at this hospital in any way.

What will happen if you develop any study related injury?

We do not expect any injury to happen to you but if you do develop any side effects or problems due to the study, these will be treated at no cost to you. We are unable to provide any monetary compensation, however.

Will your personal details be kept confidential?

The results of this study will be published in a medical journal but you will not be identified by name in any publication or presentation of results. However, your medical notes may be reviewed by people associated with the study, without your additional permission, should you decide to participate in this study.

If you have any further questions, please ask Dr. Rajadoss. M (Tel: 0416 2282455/ 2282011).

CONSENT TO TAKE PART IN A CLINICAL TRIAL

Study Title: *A prospective observational study to assess penile blood supply in patients with traumatic posterior urethral injury.*

Study Number:

Participant's name:

Hospital No:

Date of Birth / Age (in years):

I _____
_____, son of _____

(Please tick boxes)

Declare that I have read the information sheet provided to me regarding this study and have clarified any doubts that I had.

I also understand that my participation in this study is entirely voluntary and that I am free to withdraw permission to continue to participate at any time without affecting my usual treatment or my legal rights.

I understand that my erectile function will be assessed using a standardized questionnaire.

I understand that two radiological evaluations, namely penile color doppler and MRI scan of the pelvis will be done on me.

I understand that I will receive free treatment for any study related injury or adverse event but I will not receive any other financial compensation

I understand that the study staff and institutional ethics committee members will not need my permission to look at my health records even if I withdraw from the trial. I agree to this access

I understand that my identity will not be revealed in any information released to third parties or published

I voluntarily agree to take part in this study

Name:

Signature:

Date:

Name of witness:

Relation to participant:

Date:

**IMPACT OF TRAUMATIC POSTERIOR URETHRAL INJURY ON
PENILE VASCULAR SUPPLY AND ERECTION**

STUDY PRO FORMA

Name: _____ Hospital Number: _____
Age: _____ Sex: _____
Address: _____
Co morbid illness: DM / HTN / Dyslipidemia / Vascular disease / others
Smoker: Yes / No

HISTORY:

Mode of injury: _____
Date and Time: _____
Place: _____
Need for blood transfusion: Yes / No
Emergency operation: Yes / No
Gross hematuria: Yes / No
Attempt at Urethral Catheterization: Yes / No
SPC: Yes / No
IIEF score _____

EXAMINATION:

Abdomen:
Presence of external injury: Yes / No
Free fluid: Yes / No
Distention: Yes / No

Presence of perineal laceration: Yes / No

Blood at urethral meatus: Yes / No

Rectal exam:

Prostatic displacement: Yes / No

Rectal injuries: Yes / No

Pelvic compression test: Positive / Negative

Spine: Normal / Abnormal

List other associated injuries

PREOPERATIVE ASSESSMENT

RADIOLOGICAL INVESTIGATIONS

Routine investigations

Plain X-ray: Type of pelvic fracture (Scout film of the MCU may be used)
Side: Left / Right / Both
Stable: Yes/ No (Vertically unstable / rotationally unstable / both)
Displacement: Present / Absent

RGU + MCU Length of urethral defect:mm
Degree of prostatic displacement: Mild/Moderate/ Severe

Special investigations

Penile duplex: Both on flaccid and erect state of penis
Intracavernosal injection of Papaverine 30µg. or

Arterial_Diameter >0.07cm, <0.05cm, inconclusive

Peak flow velocity >25cm/sec, <25cm/sec, inconclusive

End diastolic velocity >8cm/sec, <5cm/sec, inconclusive

MRI Pelvis:

Length of urethral defect:.....mm

Degree of prostatic displacement: (mild/moderate/severe)

Presence of scar tissue: Prostatic/ Peri-prostatic/ Retropubic

Para urethral bladder base fistula: Present / Absent

Avulsion of corpora cavernosum: Present / Absent

OPERATIVE INTERVENTION:

Anastomotic urethroplasty:

Approach: Perineal (simple/elaborated),

Perineo-abdominal transpubic

Operative findings: Confirmation of MRI findings / new findings

Length of urethral defect:mm

Degree of prostatic displacement: (mild/moderate/severe)

Extent of scar tissue: (Prostatic/Peri prostatic/Retropubic)

Para urethral bladder base fistula: Present / Absent

Avulsion of corpora cavernosum: Present / Absent

Assess vascularity: Good/ satisfactory/ poor

POST-OPERATIVE PERIOD:

Wound healing (? surgical site infection, grading)

Uroflowmetry – following urethral catheter removal & at >3/12

International index of erectile dysfunction-5 questionnaire at > 3/12

In cases of surgical failure,

Document the additional procedures

(Internal urethrotomy / redo-urethroplasty / other procedures)

In cases of erectile dysfunction,

Document the treatment given

(PDE-5 / Intracavernosal injections / penile implant/ revascularization procedure)

INTERNATIONAL INDEX OF ERECTILE FUNCTION (IIEF)

These questions ask about the effects that your erection problems have had on your sex life over the last four weeks. Please try to answer the questions as honestly and as clearly as you are able.

Your answers will help your doctor to choose the most effective treatment suited to your

Condition. In answering the questions, the following definitions apply:

- Sexual activity includes intercourse, caressing, foreplay & masturbation
- Sexual intercourse is defined as sexual penetration of your partner
- Sexual stimulation includes situation such as foreplay, erotic pictures etc.
- Ejaculation is the ejection of semen from the penis (or the feeling of this)
- Orgasm is the fulfilment or climax following sexual stimulation or intercourse

Over the past 4 weeks: Please check one box only

Q1 How often were you able to get an erection during sexual activity?

- 0 No sexual activity
- 1 Almost never or never
- 2 A few times (less than half the time)
- 3 Sometimes (about half the time)
- 4 Most times (more than half the time)
- 5 Almost always or always

Q2 When you had erections with sexual stimulation, how often were your erections hard enough for penetration?

- 0 No sexual activity
- 1 Almost never or never
- 2 A few times (less than half the time)
- 3 Sometimes (about half the time)
- 4 Most times (more than half the time)
- 5 Almost always or always

Q3 When you attempted intercourse, how often were you able to penetrate (enter) your partner?

- 0 Did not attempt intercourse
- 1 Almost never or never
- 2 A few times (less than half the time)
- 3 Sometimes (about half the time)
- 4 Most times (more than half the time)
- 5 Almost always or always

Q4 During sexual intercourse, how often were you able to maintain your erection after you had penetrated (entered) your partner?

- 0 Did not attempt intercourse
- 1 Almost never or never
- 2 A few times (less than half the time)
- 3 Sometimes (about half the time)
- 4 Most times (more than half the time)
- 5 Almost always or always

Q5 During sexual intercourse, how difficult was it to maintain your erection to completion of intercourse?

- 0 Did not attempt intercourse
- 1 Extremely difficult
- 2 Very difficult
- 3 Difficult
- 4 Slightly difficult
- 5 Not difficult

Q6 How many times have you attempted sexual intercourse?

- 0 No attempts
- 1 One to two attempts
- 2 Three to four attempts
- 3 Five to six attempts
- 4 Seven to ten attempts
- 5 Eleven or more attempts

Q7 When you attempted sexual intercourse, how often was it satisfactory for you?

- 0 Did not attempt intercourse
- 1 Almost never or never
- 2 A few times (less than half the time)
- 3 Sometimes (about half the time)
- 4 Most times (more than half the time)
- 5 Almost always or always

Q8 How much have you enjoyed sexual intercourse?

- 0 No intercourse
- 1 No enjoyment at all
- 2 Not very enjoyable
- 3 Fairly enjoyable
- 4 Highly enjoyable
- 5 Very highly enjoyable

Q9 When you had sexual stimulation or intercourse, how often did you ejaculate?

- 0 No sexual stimulation or intercourse
- 1 Almost never or never
- 2 A few times (less than half the time)
- 3 Sometimes (about half the time)
- 4 Most times (more than half the time)
- 5 Almost always or always

Q10 When you had sexual stimulation or intercourse, how often did you have the feeling of orgasm or climax?

- 1 Almost never or never
- 2 A few times (less than half the time)
- 3 Sometimes (about half the time)
- 4 Most times (more than half the time)
- 5 Almost always or always

Q11 How often have you felt sexual desire?

- 1 Almost never or never
- 2 A few times (less than half the time)
- 3 Sometimes (about half the time)
- 4 Most times (more than half the time)
- 5 Almost always or always

Q12 How would you rate your level of sexual desire?

- 1 Very low or none at all
- 2 Low
- 3 Moderate
- 4 High
- 5 Very high

Q13 How satisfied have you been with your overall sex life?

- 1 Very dissatisfied
- 2 Moderately dissatisfied
- 3 Equally satisfied & dissatisfied
- 4 Moderately satisfied
- 5 Very satisfied

Q14 How satisfied have you been with your sexual relationship with your partner?

- 1 Very dissatisfied
- 2 Moderately dissatisfied
- 3 Equally satisfied & dissatisfied
- 4 Moderately satisfied
- 5 Very satisfied

Q15 How do you rate your confidence that you could get and keep an erection?

- 1 Very low
- 2 Low
- 3 Moderate
- 4 High
- 5 Very high

Clinical Interpretation: Erectile function total scores can be interpreted as follows:

Score	Interpretation
0-6	Severe dysfunction
7-12	Moderate dysfunction
13-18	Mild to moderate dysfunction
19-24	Mild dysfunction
25-30	No dysfunction

Source: Rosen RC, Riley A, Wagner G, Osterloh IH, Kirkpatrick J, Mishra A. The international index of erectile function (IIEF) a multidimensional scale for assessment of erectile dysfunction. Urology. 1997 Jun; 49(6):822-30.

name	age	hosp_no	comorbidity	smoker	mode_inj	date_injur	bl_trans	emer_op
Noorullah	28	133420F	Nil	Nil	Hit by 4 wh	22.02.2012	4 units	Nil
Manoj Kurr	22	790715D	Nil	Nil	Fall from tr	23.09.2012		Nil
Sampath	21	894660D	Nil	Nil	RTA	04.03.2011		Nil
Kamal Sark	45	176430F	Nil	Nil	RTA	07.01.2012		Nil
Konda Sree	17	053304F	Nil	Nil	Fall from tr	Sep-11		Nil
Ganesan. P	48	129023F	Nil	Nil	RTA	14.10.2011		Nil
Hiralal Chal	25	014738F	Nil	Nil	RTA	Oct-09		Nil
Ashok Faba	40	242753D	Nil	Nil	RTA	Apr-08	NA	Nil
Manoharar	51	936116D	Nil	Nil	Fall from bi	06.05.2011	Nil	Bilateral IC
Shanjeeb K	33	015551F	Nil	Nil	RTA	Mar-11	NA	laparotomy
Manik Hazr	52	059925F	Nil	Yes	RTA	Jan-11	NA	Nil
Maidul Ahr	42	938955D	DM	Yes	RTA	Aug-10	NA	Primary re
Suresh	30	880389D	Nil	Nil	RTA	Feb-11	Nil	Nil
Kaushik Da	24	924684D	Nil	Nil	on bike hit	21.02.2011	Yes	Laparotom
Kuppusamy	61	915485D	DM	Nil	RTA	Apr-11	NA	Nil
Appadurai	39	517244C	Nil	Nil	Crushed be	09.02.12	Nil	Nil
Ajit kumar .	22	254597F	Nil	Nil	RTA	10.05.2012	NA	perianal de
Imran Ansa	23	344202F	Nil	Nil	RTA	18.08.2012	NA	Nil
Mohamme	38	300655F	Nil	Nil	RTA	Jun-12	NA	Nil
UMA CHAR	31	310817F	Nil	Yes	Crushed by	Jun-12	NA	Nil

hematuri	puc_trial	spc	iief_ef	iief_is	iief_of	iief_sd	iief_os	iief_tot
Nil	Yes	Yes	7	9	10	7	3	36
Nil	NA	Yes	30	11	10	7	10	68
Nil	NA	Yes	30	15	10	10	10	75
Nil	NA	Yes	2	2	1	4	3	12
Nil	Yes	Yes				8		
Nil	NA	Yes	1	0	1	10	2	14
Nil	NA	Yes	5	1	1	5	0	12
NA	NA	Yes	19	6	5	6	8	44
Yes	Yes	Yes	13	8	10	6	2	39
Yes	Yes	Yes	17	8	4	6	8	43
Yes	NA	Yes	14	4	4	4	2	28
NA	NA	Yes	18	6	4	6	8	42
Yes	Yes	Yes	12	0	10	10	8	40
Nil	Yes	Yes	6	3	10	10	2	31
NA	Yes	Yes	1	0	1	8	6	16
Yes	Yes	Yes	6	0	10	8	4	28
NA	NA	Yes	11	0	8	5	2	26
Nil	Yes	Yes	29	14	10	9	10	72
Nil	Yes	Yes	3	0	1	4	2	10
Yes	NA	Yes	30	14	10	9	9	72

ext_inj	free_fl	abd_dist	pel_comp	spine	asoc_inj	perineal	eum_bld	anal_ton
Nil	Yes	Yes	Yes	L4,5 S1 spinous proces	Nil	Nil	Nil	Normal
Nil	Nil	Nil	Yes	Nil	Nil	Nil	Nil	Normal
Nil	Nil	Nil	Yes	Nil	Nil	Nil	Nil	Normal
Nil	Nil	Nil	Yes	Nil	Nil	Nil	Yes	Normal
Nil	Nil	Nil	Yes	L5 end plat sacral #	Nil	Nil	Yes	Normal
Nil	Nil	Nil	Yes	Nil	Nil	Nil	NA	Normal
Yes	Nil	Nil	Yes	Nil	compound	Nil	NA	Normal
Subcutaneous	Nil	Nil	Yes	Nil	Right clavic	Nil	Nil	Normal
Nil	Nil	Nil	Yes	Nil	Nil	Nil	NA	Normal
Nil	Nil	Nil	Yes	Nil	Nil	Nil	Yes	Normal
Yes	Nil	Nil	Yes	Nil	Anorectal i	Yes	NA	Poor
Nil	Nil	Nil	Yes	Nil	Nil	Nil	Yes	Normal
Yes	Nil	Nil	Yes	Nil	Anorectal i	Present	Nil	Lax
Nil	Nil	Nil	Yes	Nil	Nil	Nil	Yes	Normal
Nil	Nil	Nil	Yes	Nil	Nil	Nil	Nil	Normal
Yes	Nil	Nil	Yes	Nil	Anal fistula	Present	NA	Normal
Nil	Nil	Nil	Yes	Nil	Nil	Nil	NA	Normal
Nil	Nil	Nil	Yes	Nil	Nil	Nil	Nil	Normal
Nil	Nil	Nil	Yes	Nil	Nil	Nil	NA	Normal

pros_dis	rect_inj	pelv_fr	side_bil	stabilty	displace	1_op	defect	prost_ur
Nil	Nil	Right sacru	Bilateral	Unstable	Yes	Nil	40	Not visualis
Nil	Nil	Left sacral	Bilateral	Unstable	Yes	Nil	7	Visualised
Nil	Nil	Superior pt	Bilateral	Unstable	Minimal	Nil	2	Visualised
Nil	Nil	Bilateral s	Bilateral	Unstable	Yes	Stabilisatio	50	Not visualis
Nil	Nil	Bilateral su	Bilateral	Unstable	Yes	Nil	25	Visualised
Nil	Nil	Bilateral inl	Bilateral	Stable	Minimal	Nil	44	Visualised
Nil	Nil	Bilateral inl	Bilateral	Unstable	Minimal	Right femu	7	Visualised
Nil	Nil	communitc	Bilateral	Unstable	Yes	debrideme	34	Visualised
Nil	Nil	Bilateral su	Bilateral	Stable	Minimal	Bilateral ICI	18	Visualised
Nil	Nil	Right super	Unilateral	Stable	Minimal	Nil	40	Visualised
Nil	Nil	Left superic	Unilateral	Stable	Minimal	Nil	13	Visualised
Yes, displac	Yes	Right pubic	Unilateral	Stable	Minimal	Primary req	25	Visualised
Nil	Nil	Right super	Unilateral	Stable	Minimal	Nil	55	Visualised
Yes, proxim	Yes	Right inferi	Bilateral	Unstable	Yes	Transverse	54	Visualised
Nil	Nil	Right super	Unilateral	stable	Minimal	Nil	46	Visualised
Nil	Nil	Bilateral su	Bilateral	Stable	Minimal	Nil	25	Visualised
Yes	Yes	Bilateral su	Bilateral	Stable	absent	perianal de	40	Not visualis
Nil	Nil	Right super	Unilateral	Stable	absent	Nil	30	Not visualis
Nil	Nil	Malgaigne	Unilateral	Unstable	Yes	Nil	10	Visualised
Nil	Nil	Right super	Unilateral	stable	Minimal	Nil	13	Visualised

col_dop	r_art_dia	l_art_dia	psv5	psv10	psv15	psv20	edv	mri_def
ied	13	14					30	5 23
	11	13					60	3 15
Not done								21
ied	9	9					30	3 25
	13	11					39	5 21
	9	11					21	7 18
	14	1					43	2 8
			20	23	38		39	5 47
	13	11	38	57	50		49 Nil	20
Not done								21
	13	10	34	41	38		33	3 12
	12	13					12	5 33
Not done								26
			22	24	33		46	4 15
Not done								17
	10	9	15	21	18		22	3 23
ied	11	11					19	8 32
ied	18	17					150 Nil	10
	12	12					15	6 38
	13	13	49	83	84		70 Nil	3

pros_dis	scar	bl_base	corp_cav	date_op	approach	add_proc	open_def	pros_dis
moderate	retropubic		present	16.07.12	Perineal sir	Nil	25	Severe
mild	nil		absent	31.06.2011	Perineal sir	Nil	10	Mild
nil	retropubic		absent	08.06.2011	Perineal sir	Nil	40	Mild
moderate	retropubic		present	14.05.2011	Perineal sir	Nil	40	Mild
mild	retropubic		absent	29.03.2012	Perineal sir	Nil	30	Nil
nil	retropubic		absent	19.04.2012	Perineal sir	Nil	10	Nil
nil	nil		absent	21.10.2011	Perineal sir	Nil	10	Nil
nil	retropubic		absent	23.06.2011	Perineal sir	Nil	10	Mild
nil	nil		absent	20.10.2011	Perineal sir	Nil	20	Nil
nil	nil		absent	05.09.2011	Perineal sir	Nil	15	Nil
mild	retropubic		absent	20.01.2012	Perineal sir	Nil	25	Nil
moderate	retropubic		absent	16.06.2011	Perineal sir	Recto-uret	45	Mild
nil	nil		absent	10.06.2011	Perineal sir	Nil	20	Mild
mild	nil		absent	06.06.2011	Perineal sir	Closure rec	40	Mild
mild	retropubic		present	26.09.2011	Perineal sir	Nil	20	Mild
mild	nil		absent	22.5.2012	Perineal sir	Nil	10	Nil
mild	retropubic	yes	present	COLOSTOMY done				
nil	nil		absent	02.12.12	Perineal sir	Nil	20	Nil
mild	retropubic		absent	19.10.12	Perineal sir	Nil	20	NIL
mild	nil	nil	nil	08.01.13	Perineal sir	Nil	20	Mild

scar	bl_bs_fis	corp_avl	vascular	healing	qmax	void_vol	pvr	iief_3
Retropubic	Absent	Absent	Abnormal	Good	10.8	416		110
Periprostat	Absent	Absent	Normal	Good	21.7	258		18
Periprostat	Absent	Absent	Normal	Good	29	412		0
Retropubic	Absent	Absent	Normal	Good	18	240		40
Periprostat	Absent	Absent	Normal	Good	30.2	179		49
Periprostat	Absent	Absent	Normal	Good			Poor	
Periprostat	Absent	Absent	Normal	Good	22	302		25
Periprostat	Absent	Absent	Normal	Wound infe	18			
Periprostat	Absent	Absent	Normal	Good	21	238		35
Periprostat	Absent	Absent	normal	Good	16.8	257		132
Periprostat	Absent	Absent	normal	Good	7.5	240		40
Periprostat	Absent	Absent	Abnormal	Good	29.9	187		11
Periprostat	Absent	Absent	normal	Good	14	496		23
Periprostat	Absent	Absent	normal	Good			Poor	
Periprostat	Absent	Absent	normal	Good			Poor	
Periprostat	Absent	Absent	normal	Good	27.2	471		48
Retropubic	Absent	Absent	NORMAL	Good	25	471		48
Periprostat	Absent	Absent	NORMAL	Good	24	230		24
Periprostat	Absent	Absent	Normal	Good	18	473		36

surg_out

self-calibration

Good

Good

Good

Good

Failed repair

Good

Good

self-calibration

self-calibration

self-calibration

Good

Good

Failed repair

self-calibration

Good

Awating operation

GOOD

GOOD

GOOD