FREQUENCY OF DETRUSOR LEAK POINT PRESSURES AMONGST PATIENTS WITH URODYNAMIC DIAGNOSIS OF DETRUSOR OVERACTIVITY

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ABSTRACT

Objective: To measure the frequency of high detrusor leak point pressures in patients with detrusor overactivity reporting for urodynamic evaluation.
Study Design: Cross sectional study.
Place and Duration of Study: Study was carried out at AFIRM Rawalpindi, from Oct 2016 to Nov 2018.
Material and Methods: Study subjects were selected after informed consent using non-probability consecutive sampling. Urodynamics study were performed and detrusor leak point pressures were calculated for patients who had detrusor over activity.
Results: A total of 110 patients were included in this study. The gender distribution was 24 female (21.8%) and 86 male subjects (78.2%). The mean age was 42.96 ± 19.85 years. The mean pDet at maximum cystometric capacity (MCC) was 30.85 ± 12.55). Out of 110, 56 subjects (50.9%) experienced involuntary leak during cystometric studies. Out of these, 30 cases (53.57%) had Detrusor Leak Point Pressures (DLPP) higher than 40cm of H_2O.
Conclusion: The finding of mean pDet is nevertheless suggestive of low compliance in large number of patients especially in SCI with or without high DLPP. Similarly frequency of dangerous DLPP is also worth concern.

Keywords: Detrusor overactivity, Neurogenic bladder, Urodynamics.

INTRODUCTION

Urodynamics (UDX) is a diagnostic procedure performed on the lower urinary tract consisting of a series of investigations that provides real time functional information regarding the storage and voiding of urine. A thorough clinical examination is the prerequisite to Urodynamic studies in order to accurately diagnose Lower Urinary Tract (LUT) disorders. Goal of UDX is to reproduce the patient symptoms and to determine the cause of the symptoms. It mainly focuses on lower urinary tract involving urinary bladder, sphincter and urethral function and their coordination in terms of the detrusor pressure and flow rate[1-3].

Assessments of leak Point Pressure (LPP) are performed for clinical symptoms of incontinence and/or over active bladder (OAB), which includes urgency, increased frequency and/or incontinence[4]. The two LPP being used in the clinical practice are Abdominal Leak Point Pressure (ALPP) and Detrusor Leak Point Pressure (DLPP). ALPP is a dynamic test which provides parameters about degree of intrinsic sphincter deficiency in cases of stress urinary incontinence (SUI).

DLPP measurement may predict the degree of potential risk to upper urinary tracts especially in the patients who have some neurological lesion in the form of TBI, Spinal Cord Injury (SCI), stroke and Multiple Sclerosis (MS) etc. Since both ALPP and DLPP represent different effects on the urethra, they are measured separately during routine Pressure Flow Studies (PFS)[5]. ALPP has been considered as a measure of intrinsic sphincter deficiency (ISD) for quite some time. It is postulated to be the mechanism behind most of the cases of SUI, other causes being because of ureteral hypermobility (UH). The possibility of most of the cases of SUI to have some degree of both UH and ISD cannot be ruled out affecting different patients in different ratios. Patients with ALPP less than 60 cm of water are diagnosed as cases of ISD. Those patients with

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ALPP greater than 90cm of water are diagnosed to have UH. ALPP can be measured during Valsalva maneuver or coughing. Valsalva maneuver is a preferred method over coughing as it allows graded increase in the intra-abdominal pressure compared to coughing where no control can be exerted by the patient on the intra-abdominal pressure[5]. Barnard[6] has shown greater success with sling management of stress incontinence.

This study primarily focuses on the frequency of the DLPP in patients diagnosed with detrusor over-activity. Many of the patients presented to UDX department for different reasons. International Continence Society (ICS) defines the term "DLPP" as "The lowest pressure at which leakage occurs in the absence of detrusor contraction or increase in intra-abdominal pressure". It is a measure of resistance of sphincter to increasing the detrusor pressure while bladder compliance is the resistance to increasing fluid volume. It actually depicts the histology of the detrusor and bladder wall as well as working of neuro-urological pathways. A DLPP value of more than 40cm of water is considered dangerous for upper urinary tracts by ICS. So it is imperative that patients with dangerous DLPP be identified and proper corrective measures taken in the form of dose adjustment of medications or in resistant case through surgical bladder augmentation or uretheroplasty. Whereas ALPP is defined by ICS as "minimum intra-abdominal pressure in the absence of detrusor contraction, at which leak occurs", Detrusor over activity (DO) is any increase in the pressure of detrusor in the absence of abdominal contractions usually associated with clinical symptom of urge to urinate. Previously ICS had given the cut-off value of 5 cm of water for any detrusor activity to be considered as DO, but in the latest guidelines ICS has changed the DO definition "as any increase in pDet as a result of involuntary detrusor contraction".

MATERIAL AND METHODS

A cross sectional study was conducted at diagnostics department of Armed Forces Institute of Rehabilitation Medicine Rawalpindi (AFIRM). Study duration was 2 years from October 2016 to November 2018. 110 Study subjects were selected after informed consent using non-probability consecutive sampling, out of all patients presenting for UDX investigations. The subjects included both genders between the age of 15 to 90. All patients underwent thorough history and clinical examination focused on determining the medical diagnosis. Patients underwent routine investigations including Blood and Urine complete picture, Renal Function tests, Urine Cultures Sensitivity, as well as Radiographic and Ultrasound evaluation of Lower Urinary Tract. Inclusion criteria included all subjects with evidence of DO on Urodynamic evaluation. Exclusion criteria included patients with impaired cognition and communication, patients with symptomatic urinary Tract Infection and those with history of surgery for any bladder related issue.

Urodynamic investigations were performed using 'Pico Smart 3000" Urodynamics machine manufactured by Menfils Medica, Rome, Italy. UDX comprised of filling phase and a voiding cystometrogram (CMG) along with electromyography (EMG) assessment of perineal muscles. A 9F double-lumen intra-urethral catheter was inserted into the bladder. One lumen was used for bladder filling at an average flow rate of 50 ml/min (according to ICS guidelines) and another was used to record intravesical pressure (Pves). A second 12F catheter was placed intrarectally to measure intra-abdominal pressure (Pabd). Detrusor pressure (Pdet) was automatically calculated by subtracting Pabd from Pves. Perineal EMG was performed using surface electrodes manufactured by SpesMedica, Spain. Leaks if any were observed and readings were recorded for Detrusor Leak Point Pressure in cm of H_2O. A cutoff value of 40cm of H_2O was chosen to delineate between low and high Detrusor Leak Point pressures (ICS Guidelines). Nominal data was noted for the subject's age, gender and diagnosis. Frequencies and percentages were calculated for descriptive data including gender, diagnosis and high and low Detru-

sor Leak Point Pressures (DLPP). Mean and standard deviation was calculated for age and pDet at Maximum Cystometric Capacity. Data were analyzed using SPSS version 25.

RESULTS

A total of 110 patients fulfilled the inclusion criteria and were enrolled in this study. The

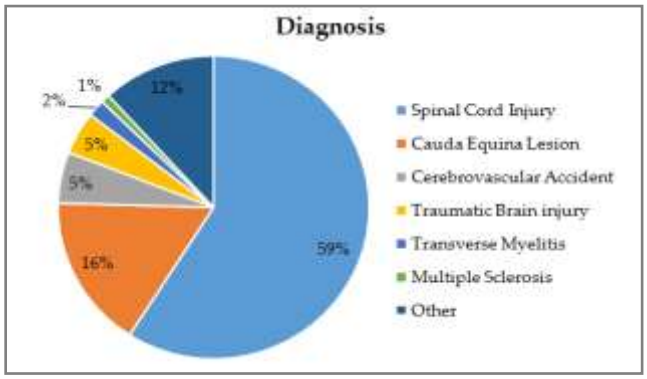

Figure-1: Distribution of clinical diagnosis causing DO in study subjects.

gender distribution was 24 female (21.8%) and 86 male subjects (78.2%). The mean age was 42.96 ± 19.85. The commonest diagnosis was Spinal Cord Injury 65 (59.1%), Cauda Equina Lesion 18 (16.4%), Cerebrovascular Accident 6 (5.5%) and

Table: Averages and measures of central tendency for pDet.

n	110
Mean	30.8536
Median	33.3500
Std. Deviation	12.55740
Range	49.10
Minimum	8.90
Maximum	58.00

Traumatic Brain injury 5 (4.5%) while 13 subjects (11.8%) were classified as "other" including patients with OAB symptoms, Stress incontinence, difficulty in passing urine, Pelvic inflammatory disease etc fig-1. The mean pDet at maximum cystometric capacity (MCC) was 30.85 ± 12.55 as shown in table. Out of 110, 56 subjects (50.9%) experienced involuntary leak during cystometric studies. Out of these, 30 cases (53.57%) had Detrusor Leak Point Pressures (DLPP) higher than 40cm of H_2O fig-2.

DISCUSSION

Detrusor over activity (DO) is defined as "A urodynamic observation showing involuntary detrusor contractions during the filling phase that can be spontaneous or provoked by coughing". It is divided into idiopathic and neurogenic DO. During the UDX procedure, it is essential to

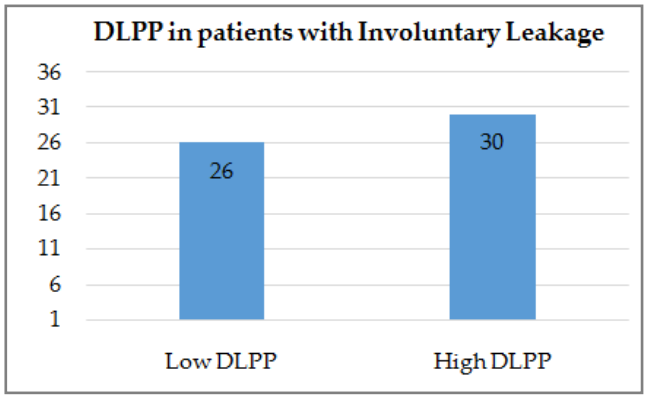

Figure-2: Frequency of Low and High DLPP in subjects with involuntary urinary leakage (n=56).

monitor the subject's perceived symptoms as well as signs on clinical examination, to provide correlation with the UDX findings. In 2002, the International Continence Society classified DO into two broad types: Phasic, signifies a series of involuntary contractions that may or may not result in leakage; and terminal, in which there is a single involuntary detrusor contraction resulting in leakage. At the same conference, OAB was defined as a set of symptoms urgency, nocturia and increased urinary frequency. The ICS reiterated the fact that most cases of OAB are managed in a conservative, nonsurgical manner with empirical therapy, in most cases without obtaining urodynamic verification of the likely diagnosis of DO. Most of the investigators have taken DLPP at terminal DO which may have erroneously given higher values of DLPP.

Patients presenting with OAB may also have UDX findings that can modify or completely alter the management protocols[7]. A patient with refractory urge incontinence may have concomitant urodynamic diagnoses of SUI, DO or BOO, and correction of these associated conditions may greatly improve the symptoms instead of going

for more invasive procedures. In the setting of mixed urinary incontinence, UDS may greatly help correlation.

DLPP was originally described by McGuire *et al*[1] in the evaluation of 42 myelodysplastic children. In their study the author found that patients with high DLPP i.e. >40 cm of water were at greater risk of developing upper urinary tract deterioration compared to those patients with DLPP <40 cm of water. The finding of 53.75% patients with high DLPP i.e. >40cm of water in diagnosed cases of DO in this study is quite alarming as most of the cases in clinical practice do not have the option of UDX and are started on medical treatment empirically as discussed earlier.

Wang *et al*[8] also demonstrated that DLPP >40 cm of water along with low compliance and Acontractile detrusor in voiding CMG were the main factors predicting upper urinary tract deterioration. Similarly Juma *et al*[9] suggested that risk of upper urinary tract damage is increased by 37% in cases of SCI with a DLPP higher than 40 cm of water and this possibility increases to 70% if DLPP are more than 70 cm of water.

DLPP has added special importance as an objective measurement of the outflow resistance provided by the urinary sphincter. Rather than signifying the pressures applied by bladder walls, Pdet is a measure of the urinary sphincter's outflow resistance. Hence pDet at the time of leakage via urethra is measured during UDX as DLPP, McGuire *et al*[4] deducts that the flow of urine into the bladder is obstructed as a result of the persistently high pressures seen during constant state of leakage at high DLPP and the intravesical pressures are directly transmitted to the renal parenchyma via an uninterrupted column of fluid. Bloom *et al*[5] noted that in a cohort of pediatric cases of progressive neurological disorder on regime of anticholinergic agents and Clean Intermittent Catheterization there was an observable decrement in the Leak Point Pressures and a similar increase in compliance after surgical intervention for high DLPPs. This study showed that a change in urinary bladder compliance brought upon by high DLPP causes decreased flow of urine via the ureters. The ureteric stasis and other upper urinary tract changes are not restricted simply to the pediatric population with progressive neurological disorders, because a high DLPP irrespective of its causative factors, results in a progressive decrement in detrusor compliance. Patients with other neurological disorders, including Spinal Injury, Traumatic Brain Injury, Stroke etc. are at a similar risk for upper urinary tract dysfunction. The stasis of urine because of incomplete emptying in long term ultimately leads to histological changes affecting overall compliance of the bladder wall[10].

Combs and Horowitz[11] described a unique method for assessing the DLPP. They measured DLPP in the standard way, and the catheter was removed. With the cessation of leakage, the catheter was re-inserted and pDet measured again, this cycle was repeated. They found out that in study subjects where DLPP was higher than 40 cm H_2O while catheterized and less than 40 cm H_2O with the catheter removed, only 5% went on to develop upper tract issues, whereas if both catheterized and uncatheterized cases had DLPP higher than 40 cm H_2O, the risk of Upper Urinary Tract Dysfunction was increased to 40%. Finding of high number of patients with high DLPP in the present study is indicative of less than satisfactory management of neurogenic bladders especially in SCI cases. The need to focus on providing optimal environment and training of the patients to avoid repeated UTIs cannot be over emphasized.

Regarding latest trends in the management of DO and high DLPP, McLatchie[16] has shown the presence of beta 3 receptors and their effect on DO through calcium channels confirming the study of Drake *et al*[12] about the effect of mirabegron. Similarly, the results of combination therapy for the treatment of DO with high DLPP with mirabegron and solifenacin have shown promising future for this highly resistant condition in chronic neurogenic bladders[13-15].

Newer techniques to manage DO and associated low compliance including pelvic floor exercises and Genital nerve stimulation have also increased the prospects of optimal management of neurogenic bladder[16-18].

CONCLUSION

The finding of mean pDet was suggestive of low compliance in large number of patients especially in SCI with or without high DLPP. This underlied the fact that despite best practices of CIC and fluid monitoring, the chances of chronic cystitis and pathological changes in the histology of bladder wall are a constant threat to upper urinary tracts. Similarly high frequency of High DLPP was also very concerning Early recognition of high DLPP would not only help in planning remedial measures but would also help in segregating cases destined for surgical options.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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