



## Foley's catheter test in stress incontinent patient before and after anterior pelvic floor

Takwa N. Mohammad, Suha H. Hayawi\* and Eaman H. Raouf

Dep. of Obstetrics and Gynecology, Al-Imamain Al-Kdhemain Medical City, Iraq.

\*Corresponding author: [drsuha71@yahoo.com](mailto:drsuha71@yahoo.com)

### Abstract

This study is to evaluate the diagnostic value of pediatric Foley's catheter test before and after pelvic floor repair with Kelly sutures. Our study design as a prospective study carried on 33 patients with urinary incontinence symptom. Patients evaluated by full history examination and performing a pediatric Foley's catheter test on them to diagnose those patients with stress urinary incontinence and treat them by pelvic floor repair with Kelly sutures and repeat the pediatric Foley's catheter test after the operation to evaluate the outcome of the surgery. The sensitivity, Specificity, positive and negative predictive values for Foley's catheter test in the diagnosis of stress urinary incontinence, and in the follow up of the patients after anterior pelvic floor repair with Kelly sutures. The result in our sample that complaining from urinary incontinence 72% above age of 40 years old, 79% have more than 4 vaginal deliveries, 61% have cystocele and 48% of them have positive pediatric Foley's catheter test. Those with positive Foley's catheter test diagnosed as having stress urinary incontinence treated by anterior pelvic floor repair with Kelly sutures in which pediatric Foley's catheter test were negative after 2 months and 6 months follow up after surgery, the conclusion was that stress urinary incontinence more common in women over age of 40 years old and those with higher number of vaginal deliveries. Foley's catheter test can be used for diagnosis of stress urinary incontinence and in the follow up after surgical treatment. The aim of this study was to use of a simple test which is Foley's catheter test as described by Arya et al in the diagnosis of stress urinary incontinence (Intrinsic sphincter deficiency) and evaluation of the result of pelvic floor repair in those patients by follow up two and six months after the operation.

Keywords: Foley's catheter test, pelvic floor, incontinent patient, Iraq.

### Introduction

Urinary stress incontinence: Urinary incontinence is a medical condition that has significant negative effect on the quality of life. It is a condition that has multiple etiologic factors like female sex, advancing age, child birth, smoking, obesity, and conditions that cause chronic cough such as chronic bronchitis and asthma (Jong, 2003). Urinary stress incontinence defined as an involuntary loss of urine that occurs during physical activity such as coughing, sneezing laughing or exercise (Bradly, 2002). Studies have documented that about 50% of all women have occasional urinary incontinence, 10% of them have regular incontinence and about 20% of women over age 75 years' experience daily urinary incontinence. Amoripoll (1991) showed that at least 3.5 million women have this problem in UK (Edmonds 1999). While in Americans females there are more than 13 million sufferers from urinary

incontinence (Johnson, 2001).

Female urinary incontinence and pelvic prolapsed: As women reach middle age, more and more will experience some degree of incontinence, these problems often correlate to the number of children a woman has borne. Many patients have stress urinary incontinence in association with cystocele, a hernia of the bladder into the vagina. As a result of weakness of the muscles and tissues that hold urine in the bladder (Rovner, 1997). Robinson found that in a symptomatic perimenopausal women aged 45 – 55 years, only 3% had a degree of prolapse for which surgeons might recommend surgical repair depending upon symptoms (Frederick, 2000).

Anatomy of urinary bladder: The bladder is hollow muscular organ composed of smooth muscle fibers known as the detrusor muscle, contraction of this muscle results in simultaneous reduction of the bladder in all its diameters. In women the smooth

muscle of the bladder neck is also different from that of the detrusor muscle with orientation of the muscle bundles obliquely or longitudinally, they don't form a sphincter in women. The urethelium lining of the bladder is composed of two or three layers of transitional cells (Edmonds, 1999).

**Anatomy of female urethra:** The normal adult female urethra is about 3–5cm in length and 8 mm in diameter. It is lined by pseudo – stratified transitional epithelium in its proximal half and distally by non-keratinized stratified squamous epithelium beneath this is a rich vascular plexus which contributes up to one third of the urethral pressure and which decreases with age., beneath this there is a longitudinal smooth muscle which is continuous with the detrusor muscle, contraction of this muscle cause shortening and opening of the urethra, around the middle third there is a circular striated muscle fibers called the external sphincter (rhabdosphincter urethrae) or the intrinsic sphincter mechanism which responsible for urethral closure at rest (Johnson, 2001).

**Nerve supply:** The detrusor muscle is innervated by parasympathetic nerve (S2-S4) and receives a rich efferent supply. Sympathetic out flow is from (T10 - L2) visceral afferent fibers travel with the thoracolumber and sacral efferent nerves conveying the sensation of bladder distension. Urethral smooth muscle is innervated by sympathetic efferent fibers, cholinergic stimulation of these produces contraction. The rhabdosphincter urethrae supplies via sacral nerve roots (S2-S4) which travel with the pelvic splanchnics to the intrinsic smooth muscle of urethra. The levatorani is innervated by motor fibers of S2-S4 origin, which travel via the pudendal nerve (Edmonds, 1999).

**Pelvic floor muscle and fascia:** Pelvic floor muscles include the levatorani, internal obturator and piriform muscles, and superficial and deep perineal muscles. Pelvic floor fascia divided into that covering the pelvic floor muscles and endopelvic fascia, which is divided into:

- 1- pubocervical fascia .
- 2- Lateral cervical ligament.
- 3- Uterosacral ligament.
- 4- Posterior pubourethral ligament.

Loss of support by pubocervical fascia and posterior pubourethral ligament which are the most important structures supporting the urethro cervical junction and maintaining continence will lead to cystocele, urethrocele or cystourethrocele and disturb continence. (Edmonds, 1999).

**Physiology of normal urination:** The ability to hold urine and maintain continence is dependent on

normal function of lower urinary tract, the kidneys, and nervous system. Additionally, the person must possess the physical and psychological ability to recognize and appropriately respond to the urge to urinate. The process of urination involves two phases:

1. The filling and storage phase .
2. The emptying phase .

The average person can hold approximately 350-550ml of urine. The ability to fill and store urine properly requires a functional sphincter muscle, controlling output of urine from the bladder, and a stable bladder wall to retain urine. The emptying phase requires the ability of the detrusor muscle to appropriately contract to force urine out of the bladder. Additionally, the body must also be able to simultaneously relax the sphincter to allow the urine to pass out of the bladder (Bradly, 2002). Micturition is a reflex action, controlled by higher centers in the brain. The reflex is initiated when the volume of urine reaches about 300 ml, stretch receptors in the bladder wall are stimulated and transient impulses to the central nervous system, and the individual has a conscious desire to micturate (Jong, 2003).

**Effect of pelvic floor muscles in urinary control:** The pelvic floor muscles perform four major functions which include:

- 1-Support of the organ systems within the pelvis and lower abdomen.
- 2-Closure of the urethra to maintain continence.
- 3-Signaling to the bladder, when voiding is desired.
- 4-Opening of the urethra by total relaxation to allow for complete and effortless urination.

If any of the above functions are disturbed, normal bladder control will be disrupted.

The pelvic floor muscles are normally under voluntary control. That is, we are able to contract or relax them at will. This voluntary control feature is in contrast to the smooth muscle of the body of the bladder. This smooth muscle functions automatically without direct voluntary control. When we want to stop flow of the urine for example, we contract the pelvic floor muscles, which lift the pelvic floor about a half-inch and closes off the bladder.

The coordinated interaction between the smooth muscle and voluntary muscle is essential for normal bladder function (Fischer Rasmussen W 1986).

**Urinary incontinence:**

**Classification of urinary incontinence:** Urinary incontinence is best classified according to etiology:

1. Genuine stress incontinence (urethral sphincter incompetenc).

2. Detrusor instability (hyper-reflexia) .
3. Retention with over flow .
4. Fistulae – vesicovaginal, uretrovaginal, urethrovaginal complex.
5. Congenital abnormalities, e.g. epispadias , ectopic ureter, spinabefidaoculta
6. Urethral diverticulum .
7. Temporary, e.g. urinary tract infection, faecal impaction.
8. Functional, e.g. immobility (Edmonds, 1999).

Investigations and diagnosis of urinary incontinence:

1. Gynecological examination: Should be included in the basic evaluation of incontinent women. Cystocele and uterine prolapsed were significantly more common in the incontinent women than in the continent ones. Urinary incontinence is found in 35% of women presenting with one or more abnormal findings at the pelvic examination and in 15% of those with normal gynecological examination (Brocklehurst, 1993, Herding *et al.*, 1986).

2. Stress provocation test: This performed by asking the patient to cough vigorously while the examiner observes for urine loss from the urethra , if the bladder is empty the test will be negative. Stress provocation test positive in 90% of patient with genuine stress in continence or mixed incontinence and only 18% of those with detrusor instability (Summit *et al.*). The Bonney test is done after a positive stress test, the index and middle finger of the examiners are pressed against the anterior vaginal wall, without pressing on the urethra, the stress test is repeated, and if no leakage, the Bonney test is positive. Positive Bonney test indicate that the patient will benefit from surgery (Migliorini *et al.*, 1987 Bhatia *et al.*, 1983),

3. Neurological examination: Neurological examination should be a part of the basic clinical examination of incontinent patients, but providing the medical history does not indicate a possible neurological back ground. Urinary incontinence most frequently associated with neurological disorders like multiple sclerosis, stroke, dementia, diabetes and back trauma( Brocklehurst, 1993).

4. Measurement of residual urine: May be due to outlet obstruction or reduced bladder contractility resulting in over flow incontinence. A residual volume less than 50-ml are normal. Over flow incontinence is more common in elderly women and after surgery (Rasmussen, 1986).

5. The frequency volume chart: Urinary diary may use for diagnosis and evaluation of treatment. The self-reporting urinary diary is the time and volume

of all voiding during a certain period of time. Sometime drinking volumes are also recorded. This chart is easily understood but the addition of extra – items may reduce compliance. <sup>(8)</sup>

6. Urinalysis: Symptomatic urinary tract infection is more common in incontinent than continent women (Brocklehurst, 1993).

7. Urodynamic test: A variety of measurements can be made for bladder function.

- a. Capacity .
- b. Volume at which the bladder muscles reflexively contracts .
- c. Pressure it generates .
- d. Maximum pressure the sphincter can resist .
- e. Speed of emptying (Ricker Polsdorfer 1998).

8. Foley's catheter test: In this test a pediatric Foley's catheter of 8-French caliber was used for selection of patients with genuine stress incontinence due to intrinsic sphincter deficiency. This test can be performed in two ways either by inserting the pediatric Foley's catheter on an empty bladder then withdrawing it from the urethra after inflation of the bulb by 3-5 ml, the test consider positive (indicating the presence of genuine stress incontinence) if the catheter withdrawn completely from the urethra (Arya *et al.*, 2001), used this test as an office screening test for intrinsic urethral sphincter deficiency or by insertion of the catheter in to the bladder and ask the patient to do valsalva maneuvers after the bladder was filled to a volume of 150 ml. of saline. The lowest intravesical pressure that produced gross urine leakage or VLPP (Valsalva leak point pressure) was recorded by a micro-transducer inserted with the catheter to the bladder. Alford *et al.* (2001) also used this test in selection of patients with genuine stress incontinence and VLPP of 100 cm/H<sub>2</sub>O or greater without any evidence of detrusor instability and treated them by anterior colporraphy. They treat 15 patients complaining from stress incontinence symptoms by this technique, 13 of them were completely continent at a mean follow up of 43 months. Women with grade three genital prolapse or higher or those with detrusor instability diagnosed by complete urodynamic studies were not subjected to this test.

Treatment of stress incontinence: The choice of treatment depends on the severity of the symptoms and the extent that the symptoms interfere with life style. There are four major categories of treatment:- Behavioral changes, pelvic floor muscle training, medication and surgery (Catherin, 2002).

A – Behavioral changes:

1. Changing fluid intake.

2. Changing voiding pattern.
3. Constipation can worsen urinary incontinence .
4. Weight loss.
5. Modification of activity level to avoid movements that cause greater leakage of urine.

**B – Pelvic floor muscle therapy:**

1. Kegel exercises.
2. Vaginal cones to strengthen the muscles of pelvic floor.
3. Bio – feedback and electrical stimulation used to identify the correct muscle group to work (Catherin, 2002).

**C – Medications:**

1. Alpha–adrenergic agonist drugs such as phenylpropanolamine and pseudoephedrine.
2. Tricyclic antidepressant imipramine.
3. Estrogen therapy, taken by mouth, skin patch or cream used to improve urinary frequency, urgency and burning in postmenopausal women.

**D – Surgery:** Used to cure the cause of incontinence.

1-Collagen injection: Minor procedure described firstly by Politano 1974 (Wilson *et al.*, 1996).

2-Anterior vaginal repair or paravaginal repair:- In 1913 Kelly described the anterior vaginal repair which is the oldest surgical procedure for correction of stress incontinence (Jong, 2003). It is less effective if the cystocele is caused by a defect in the attachment of the support tissue to the muscles of the sides of the bladder and vagina (Harris *et al.*, 1995). There are reports of success rates about 37 – 84% at the five years follow up but the recurrence rate about 46.81% after five years. Even in cases of recurrence, the severity of symptoms is less severe than before surgery (Yuthadej, 2002).

3- Retropubic suspension: It is a group of surgical procedures performed through an abdominal incision to elevate the bladder and urethra within the pelvic region. These procedures include Burch colposuspension and Marshall – Marchetti – Krantz. In 1949, the Marshall–Marchetti – Krantz (MMK) procedure was described. Many modifications of this procedure have done by (Jong, 2003).

4-Sling procedure: Require a small abdominal incision and vaginal incision. A sling is formed by taking a piece of the abdominal tissue (fascia) or a piece of synthetic material and using it to compress the urethral sphincter in the 80–90% cure rate. Many modifications of the sling procedure have been developed including recently the tension – Free vaginal tape sling procedure TVT and TOT (Catherin, 2002).

5- Artificial urinary sphincter

6- Laproscopiccolposuspension

Complication: Physical complications such as vaginal discharge, vulvar irritation and pain during intercourse are relatively rare and mild.

Prevention: Performing Kegel exercises during and after pregnancy can decrease the risk of developing stress urinary incontinence after childbirth. (Catherin, 2002).

How successful is repair surgery for stress incontinence: The cure rates varied from 50–70% for vaginal procedure (anterior repair alone or anterior repair with needle suspension) to 80% for the abdominal surgical approach (Burch Retropubic Urethropex), cure rate is best for the new procedures – TVT & TOT – both gives cure rate about 85-95%. In mild stress incontinence the vaginal procedure alone had an 80% , 5 years cure rate, so vaginal procedures still have a role in some cases, especially if the urinary loss is mild (Frederick 2000).

### Materials and Methods

A prospective study involved (33) patients presenting of urinary incontinence symptoms with physical efforts. They underwent a Foley's catheter test. Setting was Baghdad Teaching Hospital between October 2003 and October 2004. Medical history was taken from them concentrating on the age, parity, mode of delivery, menstrual state and any condition which cause increase intra-abdominal pressure such as obesity, chronic cough, chronic constipation, etc. Then physical examination was done to confirm the presence of stress incontinence by straining, coughing, and also Bonney test performed then Foley's catheter test Arya *et al.* method was done to confirm the diagnosis of stress incontinence.

In Foley's catheter test the patient were put in dorsal position, the pediatric Foley's catheter 8–French inserted on an empty bladder, then the bulb inflated by 3-5 ml of saline then the catheter withdrawn from the urethra, the test is positive if the inflated bulb could be withdrawn completely through the urethra, this mean that this patient has stress urinary incontinence (intrinsic sphincter deficiency) as a cause of incontinence, if not, the test was negative which mean that incontinence is due to other causes. After full assessment of our patients by history, physical examination and Foley's catheter test. We select those patients with stress urinary incontinence diagnosed by positive

Foley's catheter test in combination with cystocele and treat them by anterior pelvic floor repair. A patient was followed up after two months and six months to assess the result of the operation by patient history and repeating the pediatric Foley's catheter test at these periods.

### Results and Discussion

During the study period, (33) patients having stress urinary incontinence symptoms underwent Foley's catheter test. The most common age group was (50-59) years old, which form about 30%. In general about 72% of them were above 40 years old, this shown in Table (1), Figure (1). During physical examination we found that about 61% of patients have cystocele in association with urinary incontinence, the remaining which form 39% did not have cystocele but have urinary incontinence symptoms, this shown in Table (2) and Figure (2). After performing Foley's catheter test, the test was positive in 48% of patients, and the remaining was negative test, which form 52% of the sample, this shown in Table (3) and Figure (3). Number of vaginal deliveries in positive Foley's catheter test patients was form (4-6) vaginal deliveries in 44%, (7-9) vaginal deliveries in 25% and (1-3) vaginal deliveries in 19%, this shown in Table (4) and Figure (4).

Table (1): Age distribution of total number of patients included in the study

Age (Ys)	Number	Percent
30-39	9	27.3
40-49	8	24.2
50-59	10	30.3
60-70	6	18.2
Total	33	100

Table (2): Distribution of total number of patients is according to the presence of cystocele.

Percent	Number	Percent
100	33	100
60.6	20	60.6
39.4	13	39.4

Table (3): Distribution of patients according to the result of Foley's catheter test

Foley's catheter test	Number	Percent
Positive	16	48.5
Negative	17	51.5
Total	33	100

Table (4): Distribution of positive Foley's catheter test patients According to the number of vaginal deliveries.

Number of VD	Number	Percent
1-3	3	18.8
4-6	7	43.8
7-9	4	25
≥10	2	12.5
Total	16	100

In those patients with positive Foley's catheter test: The most common age group also between (50-59) years old, which form about 38%, in general more than 99.3% of those patients above 40 years old, this shown in Table (5) and Figure(5).

Table (5): Age group distribution of positive Foley's catheter test

Age group	Number	Percent
30-39	5	31.3
40-49	4	25
50-59	6	37.5
60-70	1	6.3
Total	16	100

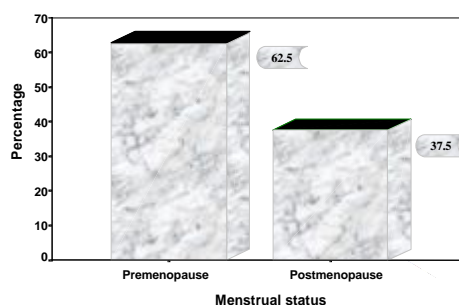


Figure (1): Age groups distribution of total number of patients included in study. the presence of cystocele.

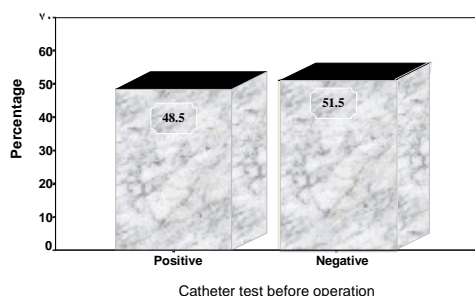


Figure (2): Distribution of the total number of patients according to the presence of cystocele.

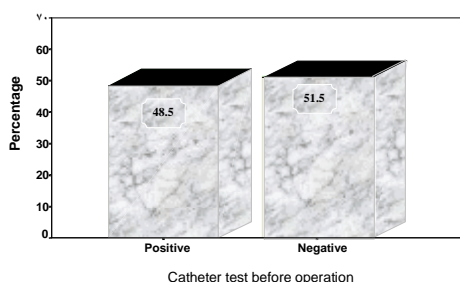


Figure (3): The distribution of patients according to the result of Folly catheter test.

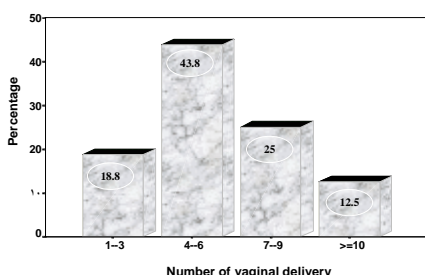


Figure (4): Distribution of positive Foley's catheter test patients according to the number of vaginal deliveries.

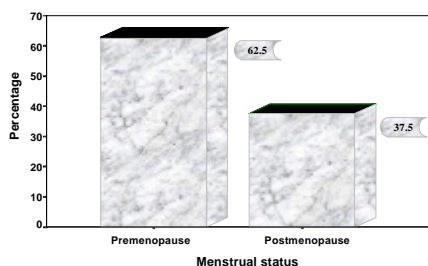


Figure (5): Distribution of positive Foley's catheter test patients according to menstrual state.

In this study we used a simple test for the selection of patients with stress urinary incontinence by performing Foley's catheter test. 33 patients with urinary incontinence symptoms underwent Foley's catheter test, 16 (48%) of them the test was positive, which is nearly similar to the (Arya *et al.*, 2001) study were (44%) showed positive test .Patients with positive catheter test were treated by anterior pelvic floor repair with Kelly sutures to correct the defect by strengthening the pubo-cervical fascia which is a part from levator ani muscle that contribute additional closure force on the urethra at physical effort. During follow up of those patients with anterior pelvic floor repair, after two months and six months there is no any postoperative complications, and regarding stress urinary incontinence symptoms disappeared completely

during this period evaluating by history from the patients and repeating the Foley's catheter test in these periods (after 2 months and after 6 months from the operation), in which the test was negative in all those patients at 2 months follow up but after 6 months only 6 patients came and examined in which the test also negative but still the result need further evaluation at one year and 5 years follow up. The sensitivity, specificity, and positive and negative predictive value for diagnosing stress urinary incontinence by Foley's catheter test were 49%, 100%, 100%, and 59.5% respectively in this study, while Arya *et al* give sensitivity, specificity, and positive and negative predictive values of 78%, 81%, 76%, and 81% respectively for the same test when use as a screening test for stress urinary incontinence in outpatient clinics (William, 2001). This difference may be due to small sample collected in our study and time the was limited for the selection of cases in outpatients clinic. In comparison with other studies, our study showed that the mean age of the patients with urinary incontinence symptoms (including those with stress urinary incontinence diagnosed by catheter test) were 50 years old which nearly similar to the findings of many studies showed in Table (6) (Rovner, 1997; Frederick, 2000; William, 2001; Wilson *et al.*, 1996; Sarah, 2003)

Table (6): Mean age of urinary incontinence in different studies.

Study	Mean Age(Y)
Present Study	50
Tenece Malloy	45
Robinson <i>et al</i>	50
Jackson <i>et al</i>	42.5
William, Alford	51.5
Sarah Hamilton	50

This study showed that urinary incontinence, related strongly with parity especially those with vaginal deliveries, in which about 80% of our sample have more than 4 vaginal deliveries which is statistically highly significant, that is similar findings in many studies, (Bradey, 2001; Wilson *et al.*, 1996; Williams, 2001) those explain that stress urinary incontinence is often seen in women who have had multiple pregnancies (increase number of vaginal deliveries). Also we find that the majority of our patients included in this study have pelvic floor relaxation, about 60% of the sample, which is nearly similar to Bradly (2001) study who said that stress urinary incontinence most common in patients with cystourethrocele or rectocele, Hording *et al.* (1986) showed that about 72% of the sample have genital prolapse, which differ



from only one study done by William S. Alford in which 60% of their sample were postmenopause, this is usually due to pelvic floor muscle weakness which occur in the postmenopausal period because of estrogen deficiency (William, 2001).

### Conclusions

1. Stress urinary incontinence is more frequent above 40 years of age and with increased number of vaginal deliveries.
2. Most patients with cystocele associated with urinary incontinence.
3. Pediatric Foley's catheter test (Arya method) can be used as an outpatient clinic diagnostic test for stress urinary incontinence.
4. Patients with stress urinary incontinence with cystocele can be treated surgically by anterior pelvic floor repair with Kelly sutures with good result but need long term follow up.
5. Pediatric Foley's catheter test can be used for follow up after surgical treatment of stress urinary incontinence.

### Recommendation

The specificity of Foley's catheter test in the diagnosis of stress urinary incontinence encouraging for its further use in diagnosis and in follow up of patients after surgical treatment to evaluate the outcome of the surgery. Lower sensitivity of Foley's catheter test due to small sample in comparison with other studies make the need for further prospective studies to evaluate the usefulness in applying this technique as a routine diagnostic test for stress urinary incontinence in outpatient clinics before and after surgical treatment.

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