Comparative Assessment of the Effect of Pregnancy and Labour on Pelvic Floor Using Transperineal Ultrasonography of Urethrovesical Junction Mobility and Perineometery for Pelvic Floor Muscle.

Mervat M. Ebrahim, MD, Taiseer M. Mohamad, MD, Omama A. Taher, Msc.

Department of Obstetrics and Gynecology, Faculty of Medicine, Azhar University
omomtaher5@gmail.com

Abstract: **Objective:** To prospectively evaluate the role of trans-perineal ultrasound in the diagnosis of female with urinary incontinence compared to perineometery for pelvic floor muscle. as the golden standard. **Conclusion:** Transperineal ultrasound is a simple, easily conducted examination that can be used as screening imaging modality in pregnant patients to assess urinary incontinence during pregnancy and after labour (6 weeks – 6 months) in comparison for perinenometeryto diagnose patients who are in need for further assessment.
[Mervat M. Ebrahim, Taiseer M. Mohamad, Omama A. Taher. **Comparative Assessment of the Effect of Pregnancy and Labour on Pelvic Floor Using Transperineal Ultrasonography of Urethrovesical Junction Mobility and Perineometery for Pelvic Floor Muscle.** *Nat Sci* 2018;16(7):24-28]. ISSN 1545-0740 (print); ISSN 2375-7167 (online). http://www.sciencepub.net/nature. 5. doi:10.7537/marsnsj160718.05.

Key Words: Transperineal ultrasound – Stress incontinence – perineometery for pelvic floor muscle - hypermobility – Intrinsic sphincteric deficiency – Uretherovesical.

1. Introduction

URINARY incontinence is a bothersome condition for many women, with an overall prevalence of approximately 40% **[1]**. Any leakage at least once in the past year, ranges from 2 5 to 5 1 %, Weekly urine leakage was reported in 10% of women in an ethnically diverse urban population **[2]**.

The precise anatomical and physiological mech-anisms involved in urinary incontinence are poorly understood. Urinary continence occurs because maximum urethral pressure remains greater than intravesical pressure during bladder filling, and increases in intra-abdominal pressure are transmit-ted equally to the bladder and proximal urethra. The vesical neck and proximal urethra are normally intra-abdominal structures that lie above a well-supported pelvic diaphragm and they are positioned in such a way to promote the equal distribution of forces to the bladder and urethra during increases in intraabdominal pressure **[3]**. Poor anatomical support of the bladder neck, bladder base and proximal urethra, resulting in descent and hyper-mobility outside the intra-abdominal transmission zone, is considered the pathological basis of stress urinary incontinence **[4]**.

Although it is not a life-threatening disease, it might have a significant influence on the phys-ical, psychological, and social well-being of the affected patients **[5]**. Stress, urge, and mixed urinary incontinence are the most common sub-types of urinary incontinence **[1]**.

Transperineal ultrasound especially has provided a good visualization of the urinary bladder, bladder base, urethrovesical (UV) junction, urethra and the symphysis pubis **[6]**. It has been used as an alternative to conventional radiological tech-niques to assess the dynamic changes of the ure-throvesical junction and proximal urethra for two decades **[7]**. It has been shown to detect the overall reduction of urethral muscular wall thickness in urinary incontinence **[8].**

Aim of the work

This study will conduct to:

1- Determine a relationship between urethrovesical junction mobility during pregnancy and development of urinary incontinence using transperineal ultrasound in correlation with type of labour.

2- Evaluate the effect of LAM injury in women after labour and development of prolapse using perineometer.

2. Patient and Method

This cohort study will be carried out on pregnant women recruited in an obstetric unit of Al-Zhraa University Hospital.

The study will done on 147 primigravida women without symptoms of pelvic floor disorder before the pregnancy which will be subdivided in two groups according to mode of delivery either vaginal delivery or ceaserain section.

The cases will compared with control group (including 42 women).

Inclusion criteria include:

- singleton physiological pregnancy,
- age≤ 40 years.

Exclusion criteria include:

- cigarette smoker,
- Any chronic diseases as hypertension, diabetes, chronic bronchitis,…ect.

- morbid obesity (defined as BMI≥ 40 kg/m2, or ≥ 35 kg/m2 and experiencing obesity-related adverse health effects),
- conditions affecting pregnancy such as placenta previa, placenta accreta, and severe intrauterine growth restriction and pre-eclampsia,
- women whose had a macrosomic newborn (weight > 4,000 g), a breech delivery or a shoulder dystocia delivery.
- Connective tissue diseases, Parkinson's disease, multiple sclerosis,
- pelvic organ prolapse of any degree,
- SUI pre-existing pregnancy,
- previous pelvic surgeries involving the urinary system and pelvic floor, structural abnormalities of the urinary tract, chronic bladder infections, and spinal cord injuries,
- use of drugs potentially affecting micturition.
- None of the patients included in the study had undertaken pelvic floor muscle training prior to the study.
- Operative vaginal delivery (use of forceps or vacuum extractor) and various degrees of pelvic floor defects or severe perineal lacerations.

The control group include 42 women of age matched healthy volunteers were enrolled as controls.

Exclusion criteria were the same as for the pregnant women, excluding pregnancy-related exclusion criteria. Controls were not affected by pelvic floor defects or SUI as determined by history and clinical examination.

Written informed consent was obtained.

At each visit History, Clinical examination, Transperineal ultrasound and perineometer will done.

1- As regard history, the cases will asked if they had experienced symptoms of stress urinary incontinence (SUI), urge urinary incontinence (UUI), faecal incontinence to loose/liquid stool or solid stool (FI) and pelvic organ prolapse (POP).

2- Clinical examination for signs of incontinence by inspection, cough stress test and bimanual examination of associated prolapse.

3- Transperineal ultrasound scans: one scan in controls and three scans in pregnant women between 38 and 40 weeks of pregnancy, and 6 weeks and 6 months after delivery. Pregnant women were divided into two groups according to the type of delivery, VD or CS.

All patients underwent perineal ultrasonography performed by experiencedgynaecologists with a special interest in urogynaecology using MIDSON ultrasound machine with a 3.5-MHz convex probe using a translabial-perineal approach and a midsagittal plane. Prior to the beginning of the study, the intra-observer and inter-observer variabilities of the ultrasonographic parameters were assessed in a sample of 20 women and found to be < 5 %.

Perineal ultrasonography was performed with the woman in the lithotomy position. Bladder volume varied from 100 to 300 ml. The position of the UVJ was recorded at rest and continuously during coughing and maximum Valsalva manoeuvore. The central part of the curved array probe was placed at the same level as the inferior border of the symphysis, with the radial line kept horizontal. Care was taken to prevent rotation of the convex ultrasound probe in the sagittal plane and to place the probe only lightly against the perineum during the various procedures.

we defined the position of the bladder neck as the angle between the line going from the UVJ to the intersection of two reference lines (point A, Fig. 1), passing respectively along the posterior and inferior margins of the pubic symphysis (PVA). The posterior urethrovesical angle (RVA), also known as angle beta and its changes in response to increases in abdominal pressure will be evaluated.

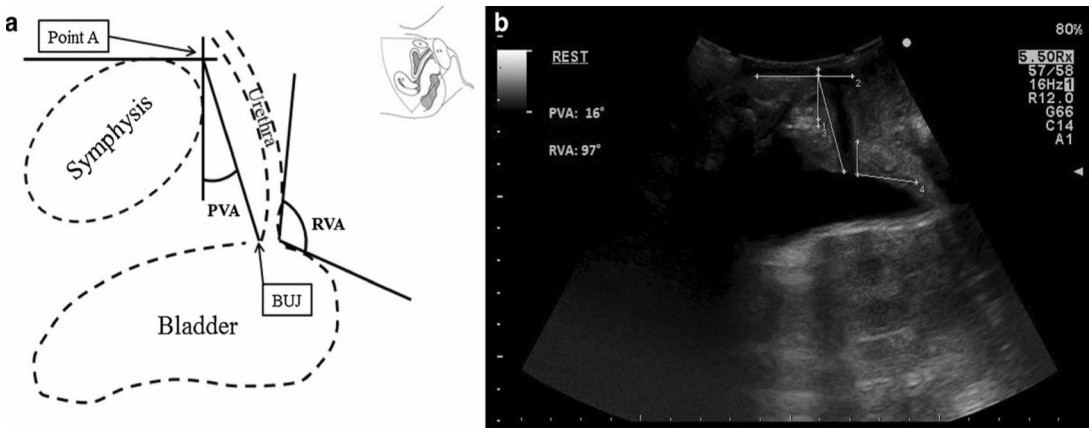

Figure 1: Ultrasonographic measurement of PVA and RVA. a Schematic drawing. b Ultrasound scan picture. PVA pubovesical angle; RVA retrovesical angle; BUJ urethro-vesical junction.

4- Perineometery, Pelvic muscle strength was evaluated by perineometery, the manometer used in this study was the Peritron TM 9300 perineometer (Cardio-Design, Australia). It consisted of an air-¢lled silicone rubber sensor (standard-in£ation), with an insertion collar attached, to ensure repeatability of insertion depth on each occasion. According to the manufacturer's design information, the soft or pressure sensitive zone on the sensor was designed to cover the area of PFM contraction in 95% of subjects. The sensor was connected to the unit via an 80 cm plastic tube. The unit measured pressure in cmH2O.

3. Results

Data were collected, coded, revised and entered to the Statistical Package for Social Science (IBM SPSS) version 20. The data were presented as number and percentages for the qualitative data, mean, standard deviations and ranges for the quantitative data with parametric distribution and median with inter quartile range (IQR) for the quantitative data with non parametric distribution.

Chi-square test was used in the comparison between two groups with qualitative data and ***Fisher exact test*** was used instead of the Chi-square test when the expected count in any cell found less than 5.

Independent t-test was used in the comparison between two groups with quantitative data and parametric distribution and ***Mann-Whitney test*** was used in the comparison between two groups with quantitative data and non parametric distribution.

The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following:

P > 0.05: Non significant (NS)
P < 0.05: Significant (S)
P < 0.01: Highly significant (HS)

Table (1): Demographic data in control group

	Min	Max	Mean	SD
Age	18	34	25.60	4.63
Weight	58	82	69.57	6.80

This table that mean of age is 25.6 with range from 18 to 34 years but mean of weight is 69.5 with range from 58 to 82 kg.

Table (2): Comparison between MOD as regards perineometry pressure (36-38 weeks), 6 weeks and 6 months after labour

		NVD		CS		Chi square test	
		No.	%	No.	%	X^2	P-value
Perineo- pr (36-38 wks)	Negative	36	40.4%	17	29.3%	1.890	0.169
	Positive	53	59.6%	41	70.7%		
Perio 6wks	Negative	21	23.6%	3	5.2%	8.725	0.003
	Positive	68	76.4%	55	94.8%		
Perio 6 months	Negative	14	15.7%	1	1.7%	7.518	0.006
	Positive	75	84.3%	57	98.3%		

This table shows that there was statistically significant increase in perineometry pressure after 6 weeks and after 6 months of labour but there was no statistically significant in perineometry pressure among mode of delivery.

Table (3): Comparison between MOD as regards posterior uertheovesical angle (36-38 weeks of pregnancy) at rest and stress and control

	Pregnant 36-38 wks				Control				Independent t-test	
	Mean	SD	Min	Max	Mean	SD	Min	Max	t	P-value
P. angle rest	137.51	5.44	126	148	103.88	1.77	100	107	39.011	0.002
P. angle stress	147.01	6.74	136	159	112.31	1.89	108	115	32.714	0.004

This table shows that there was statistically significant increase in posterior uertheovesical angle at rest and stress among pregnant women (36- 38 weeks) whatever mode of delivery.

Table (4): Comparison between MOD as regards posterior uertheovesical angle at rest and stress 6 months after labour

	NVD				CS				Independent t-test	
	Mean	SD	Min	Max	Mean	SD	Min	Max	t	P-value
P. angle in rest after 6 months	112.00	4.46	106	128	108.38	3.42	102	126	5.254	0.000
P. angle in stress after 6 months	118.79	4.79	110	134	114.43	3.73	108	135	5.862	0.000

This table shows that there was statistically significant decrease in posterior uertheovesicalangle at rest and stress 6 months after labouramong mode of delivery.

4. Discussion

Urinary incontinence is a bothersome condition for many women; with an overall prevalence of approximately 40%.

During pregnancy and child birth, changes in the pelvic floor may be anticipated due to hormonal changes, weight of the gravid uterus and possible trauma during delivery.

As the pregnancy advances, we have documented distal movement of bladder neck, cervix and anorectal junction and enlargement of the hiatal area.

Bladder neck mobility is essential for the assessment of patients with UI. Modalities used for the assessment of bladder neck mobility as urodynamic study or MRI are considered expensive and might be inconvenient to patients. That is why ultrasonography should be an essential modality in lower urinary tract assessment in patients complaining of UI. Together with history, clinical examination and urodynamic; it has been shown to improve the accuracy of the diagnosis of the functional and morphological disorder.

There are several ultrasonographic parameters have been used to determine the bladder neck position and mobility in patients with SUI. For example, ultrasonographic detection of urethral descent, loss of RVA and the presence of urethral funnelling are often associated with the presence of SUI. The functional integrity of the pelvic floor plays an important role in the mechanism of continence in women. The proximal urethra and the anterior vaginal wall are closely connected and attached to the muscles of the pelvic diaphragm and to the arcus tendineus of the pelvic fascia. Therefore, UVJ mobility on ultrasonography may be correlated with (hyper) mobility of the above-mentioned pelvic floor structures. Changes induced by pregnancy and child birth possibly invalidate the "functional synergy" of the pelvic floor, as described by DeLancey et al (DeLancey et al, 2007).

Because of the limited knowledge of the long-term effects of pregnancy on the pelvic floor, we evaluated possible changes in posterior urethrovesical angle and perineometry after delivery and their correlation with SUI symptoms in pregnant women in comparison with a control group, and also evaluated the impact of VD and CS on these changes.

The current prospective observation study was designed to evaluate TP ultrasound findings in pregnant women between 36 to 38 weeks then 6weeks and 6 months after delivery as regard posterior urethrovesical angle and perineometry, reasoning that changes in the pelvic floor due to hormonal changes would be minimal by that time and we compared posterior urethrovesical angle and perineometry with findings in the control group which is women in child bearing period with no history of any urogynecological complaint aiming to determine a relationship between urethrovesical junction mobility during pregnancy and development of urinary incontinence in correlation with type of delivery. Also, Evaluate the effect of LAM injury on pelvic floor disorders in women after labour and health-related quality of life.

The study included 147 pregnant females and another 42 females as their controls. The mean age of cases was 25.6 ± 4.6 years, while that of controls was 26.6 ±4.63 years.

The Posterior urethrovesical angle was measured at rest in control group is 103.88 + 1.77 with range from 100 to 107 but mean of this angle at stress is 112.31+ 1.89 with range from 108 to 115

In the patient group, There was 60.5% of patient is vaginal delivery, while 39.5 % was CS mean of age in patient group is 25.18 with range from 17 to 37 years.

We use perineometry for evaluation of the effect of LAM injurgy and found that perineometry pressure 100% positive in control group (table 2), while there was 29.3% negative and 70.3 % positive in pregnant female (36-38 weeks) and statistically significant increase in perineometry pressure after 6 weeks of labour (5.2% negative and 94.8% positive) and after 6 months of labour (1.7% negative and 98.3% positive) but there was no statistically significant in perineometry pressure among mode of delivery (table 5).

In our study we found that there was statistically significant increase in posterior uertheovesical angle at rest (for vaginal delivery mean 137+ 5.44) and (for CS 134.7 +5.02) also, at stress (for NVD 147.01+6.74) and (for CS 143.8 + 5.64) among pregnant women between 36- 38 weeks whatever mode of delivery (table6).

The increase in posterior urethrovesical angle reflect hypermobility of Bladder neck, this angle represent one of the main factors in preventing urinary incontinence.

Shek KL et al, 2010 found that urethral mobility has been reported in Caucasian women 4 months after childbirth, but this was only associated with vaginal delivery for the proximal urethral mobility, which is the site of the bladder neck. At postnatal examinations, the descent of the cervix in comparison to first-trimester observations was significant at rest, VM and PFMC in both the vaginal delivery group and CS group.

Elenskaia et al.2013, also found significant descent of POP-Q C point 14 weeks after delivery and they found a descent of the C point 1 year after delivery as compared to in the second trimester in the CS group, but this was not statistically significant as there were only 17 subjects in their study.

In Chan et al 2014, study, the descent was observed in both vaginal delivery and CS groups even at1 year after delivery. In the 22 women who underwent elective CS before the start of labor, the cervix was found to be at a lower position. This suggests that the descent of the cervix, and hence the uterus, can be observed in pregnancies beyond 35 weeks of gestation, and that the changes persist at least until 1 year after delivery.

A pregnancy reaching the third trimester, regardless of the mode of delivery, has an effect on the pelvic floor postnatally.

As Cosimo Cosimato et al, 2015 found that, the prevalence of SUI in pregnant women was slightly higher than reported previously, and shows a progressive worsening during pregnancy. In women who delivered by CS, a marked reduction in the incidence of SUI, as evaluated by the ICIQ-SF questionnaire, was observed 6 weeks after delivery, as compared to the incidence at 38 weeks of gestation and after VD. After 6 months, symptoms of SUI decreased to 14 % and 4 % after VD and CS, respectively. This difference may suggest on the one hand a protective effect of CS and, and on the other hand, an influence of hormonal factors in both the onset and decline of SUI symptoms during pregnancy and the puerperium.

A significant difference between the PVA and RVA is that the RVA reflects the dynamic spatial variations in bladder and urethra and the PVA reflects the relationship between a static structure (the pubic symphysis) and a dynamic structure (the UVJ). Di Pietto et al., 2008 measured the “pubis– urethra distance”, which is the distance between the posterior margin of the pubic bone and the posterior wall of the midurethra and the inclination angle of the urethral axis which is obtained by drawing a line through the major axis of the pubic bone and a line through the longitudinal axis of the urethra. As Di Pietto et al. reported, this reference point is subjectively determined and thus was not used in this study. Moreover, the mobility of the urethra changes after pregnancy. Thus, the use of the UVJ is more objective for evaluating postpartum modification of the bladder and urethra.

Therefore, evaluation of the association between PVA and RVA could be more reliable than evaluation of RVA alone in the early assessment of SUI after delivery.

So that Cosimo Cosimato et al, 2015 is the first study seeking to establish a relationship among ultrasonography-acquired PVA and RVA and SUI symptoms. And found that the increase in RVA after pregnancy and delivery persist longer than increase in PVA. Further studies are needed to confirm these results and to establish their clinical value.

In our study we found that, there was statistically significant decrease in posterior uertheovesical angle in rest and stress 6 weeks after labour among mode of delivery (table 7).

Mean of the angle was 124,81 at rest and 131, 58 at stress for VD while for CS 122,09 at rest and 128,83 at stress.

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5/27/2018