

CYSTOMETRIC EVALUATION OF VESICAL FUNCTION IN NORMAL PREGNANCY AND PUERPERIUM

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The physiological changes of the urinary system in association with pregnancy are proof of the intrinsic relationship of the urinary and genital tracts. The common changes in bladder function seen during and immediately after pregnancy are frequency of micturition, stress incontinence and retention of urine.

The first research on the use of cystometry in the investigation of the physiology of the bladder was made by Heidenhain and Colbert in 1858. Modern cystometry is the outgrowth of the work done by Rose (1927). The study was then taken up by others.

The present study was aimed at finding out the physiological changes that occur in the bladder to account for the vesical irritability in pregnancy, increased capacity in puerperium and stress incontinence in pregnancy and puerperium.

Material and Methods

Cystometry using the simple water instillation cystometer (Fig. 1) and increment filling (50 ml at a time) with normal saline at 125 drops/min. was used to evaluate bladder function. Forty-five

women (15 in each trimester) in the 3 trimesters of normal pregnancy and 45 normal puerperas were studied. The puerperas were divided into 3 groups of

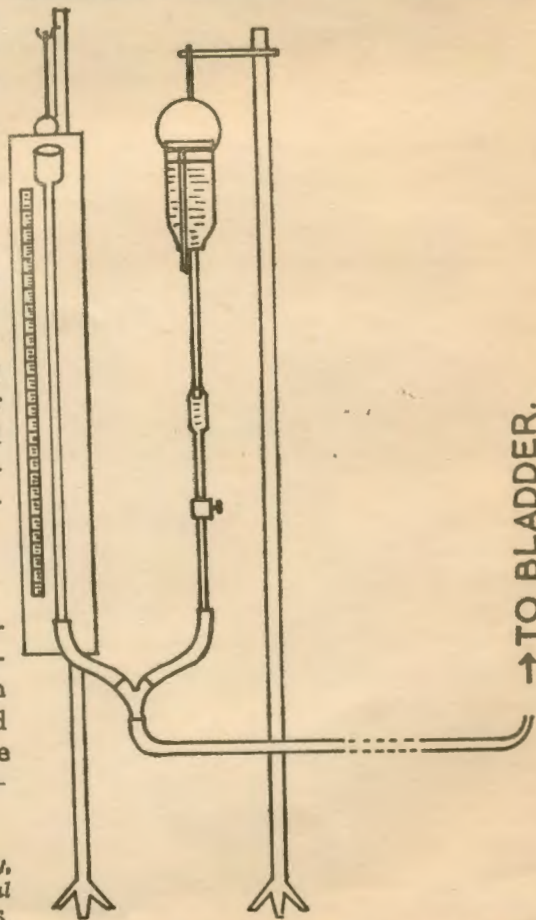


Fig. 1. Diagrammatic representation of the simple water instillation cystometer.

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15 each according to the interval between delivery and study as

1. within 24 hours
2. between 48 hours and 4 days and
3. 5 days or later.

Fifty normal non-pregnant women were studied as control.

The following were analysed in each group and then compared:

1. Frequency of micturition.
2. Presence of stress incontinence.
3. Residual urine.
4. Intravesical pressure with an empty bladder.
5. Bladder volume (in ml) and pressure (in cm of normal saline) at the
 - (a) first desire to void
 - (b) sensation of discomfort
 - (c) maximum bladder capacity

6. Maximum voluntary pressure (M.V.P.).
7. The nature of the cystometric curve.
8. Any special observation.

Observations

Frequency of Micturition and Stress Incontinence. Most of the non-pregnant and pregnant women had a diurnal frequency of 4-7. Nocturnal frequency increased with the duration of pregnancy (Table I). One non-pregnant woman, 7 pregnant and 3 puerperal women had stress incontinence.

Residual -Urine. Almost all nonpregnant and most pregnant women had residual urine of less than 15 ml. Residual urine was maximum within 24 hours of delivery and decreased thereafter (Table II).

TABLE I
Nocturnal Voiding Habits Amongst Non-pregnant and Pregnant Women

Number of voiding acts	Non-pregnant women	PREGNANT WOMEN		
		First trimester	Second trimester	Third trimester
One or none	35 (70%)	8 (53.3%)	5 (33.4%)	0
2-3	15 (30%)	5 (33.3%)	6 (40.0%)	7 (46.6%)
More than 3	0	2 (13.3%)	4 (26.5 %)	8 (53.3%)
Total	50	15	15	15

TABLE II
Residual Urine

Volume in ml	Non-pregnant	PREGNANCY			PUERPERIUM		
		First trimester	Second trimester	Third trimester	Within 24 hrs.	48 hrs. to 4 days	5 or more days
0-15	49	14	13	12	5	11	11
16-30	1	0	1	1	2	2	3
>30	0	1	1	1	8	2	1
Total	50	15	15	15	15	15	15

Intravesical Pressure of the Empty Bladder. The intravesical pressure was 0-2 cms in the non-pregnant women in the first 2 trimesters of pregnancy. In the third trimester the intravesical pressure was greater than 2 cms or if less than 2 cms, underwent a steep rise with the first few ml of saline instillation. In the puerperium the pressure was 0 cm and sometimes on the negative side within 24 hours of delivery.

Intravesical Volumes and Pressures

First Desire to Void. There was no appreciable difference in volume at first desire to void between non-pregnant and pregnant women, whereas puerperas, especially within 24 hours of delivery accommodated larger volumes (Table III).

Intravesical pressures were high in the third trimester.

Maximum Bladder Capacity. The bladder could accommodate large volumes immediately after delivery with progressive decrease to near non-pregnant values thereafter (Table IV). Intravesical pressures showed a rise as pregnancy advanced but were low in the puerperium.

The maximum voluntary pressure exerted was high both in the non-pregnant and pregnant states but low in the puerperium.

The Character of the Cystometric Curve. The cystometric curve in the non-gravid women was a gradually ascending one with increments of 0.5 cm intravesical pressure with every 50 ml of

TABLE III
First Desire to Void—Comparison of Bladder Volumes

Volume in ml.	Non-pregnant	PREGNANCY			PUERPERIUM		
		First trimester	Second trimester	Third trimester	Within 24 hrs.	48 hrs. to 4 days	5 or more days
0-200	37	10	2	7	1	5	2
201-400	13	5	12	6	5	7	7
401-600	0	0	1	2	2	3	5
>600	0	0	0	0	7	0	1
Total	50	15	15	15	15	15	15

TABLE IV
Maximum Bladder Capacity—Comparison of Volumes

Volume in ml	Non-pregnant	PREGNANCY			PUERPERIUM		
		First trimester	Second trimester	Third trimester	Within 24 hrs.	48 hrs. to 4 days	5 or more days
0-500	23	4	0	3	0	0	1
501-1000	27	9	14	12	8	10	10
1001-1500	0	2	1	0	5	4	4
>1500	0	0	0	0	2	1	0
Total	50	15	15	15	15	15	15

bladder filling till the sensation of discomfort was reached (Fig. 2). Thereafter the curve began to rise more steeply. The volume at sensation of discomfort was 100-150 ml less than that at maximum bladder capacity. This was a constant finding.

volume (Fig. 2). Wide oscillations of the saline column with respiration were observed in the late second trimester. In the third trimester the curve did not exhibit a constant pattern. Wide fluctuations of the column with deep respiration and Braxton Hisk's contractions made readings difficult (Fig. 2). The lowest level reached with each increment was recorded. The patients found it difficult to lie in the supine position for long. This was also reflected as fluctuations in the height of the saline column.

In the immediate puerperium there was no proportionate rise of intracystic pressure with each increment filling (Fig. 3).

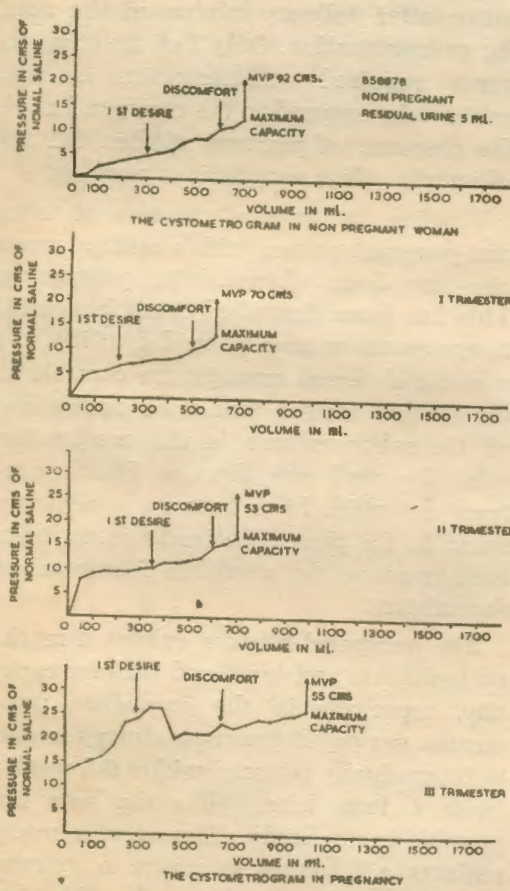


Fig. 2. The cystometrogram in normal non-pregnant woman (control) and in different trimesters of pregnancy.

The curve followed the same pattern in the first trimester (Fig. 2). In the second trimester the resting pressures were high, or if low at the beginning, increased rapidly with the first 50 ml of filling. The curve remained in this high position with pressure increasing with increase in the

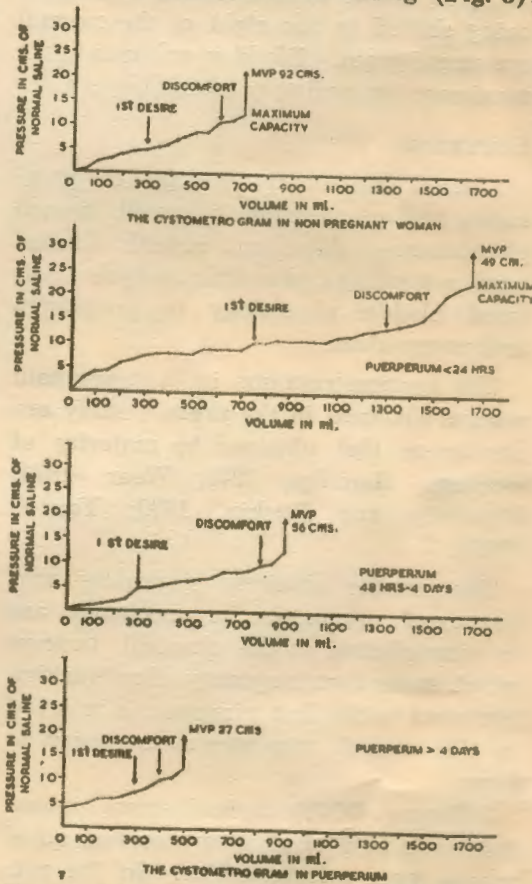


Fig. 3. The cystometrogram in normal non-pregnant woman (control) and in different days puerperium.

The curve was a low flat one. The cystometric curve showed a tendency to approach that of the non-pregnant state as the puerperium advanced (Fig. 3).

Comparison of the Different Groups. Increased frequency of micturition started at any time during the course of pregnancy, but once it started, it progressed till term. There was no relationship between frequency of micturition and bladder capacity. Bladder sensations decreased with duration of pregnancy and the decrease was more marked immediately after delivery. This was seen by the first desire to void, discomfort, and pain due to overdistension of bladder being shifted to the right of the normal cystometrogram. Bladder volumes were maximum immediately after delivery.

Discussion

Altered bladder physiology in pregnancy and puerperium is a well known phenomenon. Literature reveals limited work regarding cystometric analysis of altered bladder physiology in pregnancy and puerperium.

The cystometrograms in non-pregnant women obtained in the present study are similar to that obtained by majority of workers (Lapides, 1970; Wear, 1974; Boyarsky and Ruskin, 1970; Yousef, 1956).

The results obtained regarding frequency of micturition in pregnancy are in contradiction to the classical concept which states that frequency of micturition increases in the first trimester, is relieved in the second trimester to reappear at term.

Jeffcoate (1975) noticed stress incontinence in 50% of pregnant women, all of whom were primigravidae. In the present study, only 13.3% of pregnant women, all of whom were multigravidae,

had stress incontinence during pregnancy. No primigravida had the complaint. In the 6.9% puerperas who had stress incontinence, the complaint started during pregnancy.

The bladder in pregnancy was found to empty well. The practice of early ambulation after delivery minimized the need for catheterization. Only 2 of the 45 puerperas required catheterization in this series. As opposed to the common belief, the presence of perineal stitches did not adversely affect spontaneous voiding.

Baseline intravesical pressure of near non-pregnant values with a sudden steep rise has been observed in pregnancy. This has been described even in normal nonpregnant women (Lapides, 1970), but was not observed amongst the controls of the present series. The wide oscillations of the saline column in the manometer tube observed with Braxton Hick's contractions which have been so persistently noted in the present series have not been mentioned in the available literature on the subject.

The puerperal bladder exhibited marked hypotonia and increased bladder capacity, especially in the immediate postpartum period. Normal physiology is said to be gradually restored within 6-8 weeks. Such a long term follow up was not possible in our study. However, in many patients, a tendency to revert to normal was observed as early as the fifth day postpartum.

Summary

One hundred and forty women were studied by cystometry to evaluate their bladder function. Of these 140 cases, 50 were non-pregnant women taken as control, 45 were pregnant women and 45 puerperas.

The study revealed that increased frequency of micturition may start at any time during the course of pregnancy. Once it started, it became progressively worse till term. This finding is against the classical concept regarding frequency of micturition in pregnancy.

There was increased incidence of stress incontinence in pregnancy compared to that in the non-pregnant state.

Increase in bladder capacity was marked in the immediate puerperium and this showed a tendency to revert to normal within 5 days of delivery. Bladder sensations and intravesical pressures were markedly diminished immediately after delivery and were regained within the same period of time.

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