Pelvic floor disorders related to pregnancy: a prospective observational study

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KEY MESSAGES

1. Pelvic floor changes and disorders may occur during pregnancy. Symptoms are prevalent after delivery.
2. Levator ani muscle injury occurs following vaginal delivery. Pelvic floor changes occur regardless of mode of delivery.
3. Antenatal symptoms of pelvic floor disorders increase with maternal age and body mass index; pelvic floor changes are a risk factor for postnatal pelvic floor disorders.

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Introduction

Pelvic floor disorders (urinary incontinence, pelvic organ prolapse, and faecal incontinence) are an important public health issue because of their high prevalence, deleterious effects on quality of life, and impact on the healthcare system.[1] The number of surgeries performed for urinary incontinence and pelvic organ prolapse has increased in Hong Kong women.[1]

The prevalence of urinary incontinence has been reported to be 16-60% during pregnancy and 16-34% following delivery. Faecal incontinence and pelvic organ prolapse have been reported by 5-22% and >80% of women after delivery, respectively. There is evidence of pelvic floor changes after delivery. Most studies have focused largely on the effect of delivery in Caucasian women with evaluation commenced in late pregnancy and continued until shortly after delivery. Antenatal information is limited, as is that related to ethnic differences.

The Pelvic Floor Distress Inventory (PFDI) and Pelvic Floor Impact Questionnaire (PFIQ) can be used to assess different types of pelvic floor disorder and their impact on a woman's quality of life. Chinese validated versions are available and their responsiveness has been validated.[2,3] Translabial ultrasonography has been established to assess pelvic floor biometry and levator hiatus.

This prospective observational study aimed to assess the prevalence and types of pelvic floor disorder that occur during pregnancy until one year after delivery.[4-8] The relationship of pelvic floor anatomy and pelvic floor disorders during and after pregnancy, and risk factors were explored. These might have an impact on the management of pregnancy and delivery.

Methods

Ethics approval and informed consent were obtained. All Chinese nulliparous women who reported no pelvic floor disorders prior to pregnancy at their first trimester visit (10-13 weeks of gestation) were recruited and assessed at the second (24-28 week) and third (35-38 week) trimesters. They completed the Chinese PFDI and PFIQ,[2] and underwent standard translabial three-dimensional ultrasonography at rest, during a Valsalva manoeuvre, and during pelvic floor muscle contraction.

Time and mode of delivery were determined by obstetric indications and included vaginal delivery (VD), operative vaginal delivery involving ventouse extraction or forceps delivery and elective or emergency Caesarean section (CS).

Women were followed up at 8 weeks, 6 and 12 months postpartum. Pelvic floor disorder symptoms were again assessed by PFDI and PFIQ. Gynaecological examination was performed to determine any POP according to the Pelvic Organ Prolapse-Quantification System. Translabial ultrasonography was performed to determine the position of the bladder neck (BN), cervix, and ano-rectal junction relative to the level of the reference point (postero-infereior edge of the pubic symphysis), the hiatal area (HA) and presence of any levator ani muscle (LAM) injury.

Results

In all, 442 women were recruited; their mean age was 30.6±3.8 years and mean body mass index (BMI) was 21.0±2.8 kg/m^2 in the first trimester. Of them, 405 (91.6%) completed all antenatal assessments,[6] and 328 (74.2%) completed the whole study (12 months after delivery).[5,7,8]

The prevalence of stress urinary incontinence (SUI), urge urinary incontinence (UUI), and prolapse symptoms significantly increased with advancing gestation (Table 1).[5] Higher maternal age was associated with antenatal SUI and UUI; higher maternal BMI was associated with faecal incontinence.[5]

As pregnancy advanced, the BN, cervix, and the ano-rectal junction descent increased significantly; and the HA enlarged significantly (Table 2).[6,7]

Antenatal SUI and UUI were associated with a more distal position of the BN; third trimester prolapse symptoms were associated with a significantly larger HA and greater descent of the ano-rectal junction, whereas second trimester faecal incontinence was associated with a larger HA.[6]

The mean gestation at delivery was 39.2±1.9 weeks and mean birth weight was 3.07±0.46 kg. For women who underwent VD, 26 (9.9%) was given intrapartum epidural analgesia and 191 (95.0%) required episiotomy.

LAM injury was not detected in any women antenatally. After delivery, 57/263 (21.7%, 95% confidence interval [CI]=16.7-26.7%) women who underwent VD sustained injury to the LAM and included spontaneous VD (n=31, 15.4%), ventouse extraction (n=16, 33.3%), and forceps delivery (n=10, 71.4%).[4] None who underwent CS had LAM injury; only operative VD increased the risk of LAM (odds ratio [OR]=3.09).[4] Indication for operative VD was not associated with LAM injury.

At 12 months, the prevalence of SUI and UUI was 25.9% (95% CI=21.5-30.6) and 8.2% (95% CI=5.2-11.2), respectively.[5] After VD, the respective prevalence was 29.7% and 9.1% (Table 1).[5] The prevalence of faecal incontinence of solid/loose stool was 4.0% (95% CI=1.9-6.1); risk factors for SUI were VD (OR=3.6), antenatal SUI (OR=2.8), and UUI (OR=2.4); and predictors of UUI were antenatal UUI (OR=6.4) and maternal BMI during the first trimester (OR=1.2), whereas the risk factor for faecal incontinence at 12 months was antenatal faecal incontinence (OR=6.1) [Table 3].[5]

Generally, the BN and cervix were at a lower position at 8 weeks. As time following VD increased, the BN returned to an upper position, and HA reduced (Table 2).[7] By 12 months, the BN was more distal during Valsalva manoeuvre and displacement had increased; the cervix remained at a lower position.[7] Subgroup analysis of spontaneous and operative VD groups revealed no significant difference in any pelvic floor biometry.

After CS delivery, the BN and ano-rectal junction were lower during Valsalva manoeuvre only, compared with the first trimester.[7] The cervix was lower in all postures; the HA remained increased.[7] Subgroup analysis showed no difference in pelvic floor biometry between the elective and emergency CS groups. The cervix was lower at 12 months than during the first trimester in the 22 women who had no labour.[7]

The BN was lower in the VD than CS group at 8 weeks but not at 6 or 12 months after delivery. Nonetheless, HA remained significantly increased.[7]

At 12 months, during Valsalva manoeuvre, 90 (35.6%) women in the VD group and 24 (31.4%) women in the CS group had irreversible over-distension (HA at 12 months was >20% increase than at first trimester).[7] Presence of LAM injury increased the risk of irreversible over-distension. If

TABLE 1. Prevalence of urinary incontinence (UI) and faecal incontinence during pregnancy and after first delivery, and comparison between vaginal delivery (VD) and Caesarean section (CS) groups at 12 months after delivery (Reproduced with permission from: Chan SS, Cheung RY, Yiu KW, Lee LL, Chung TK. Prevalence of urinary and fecal incontinence in Chinese women during and after first pregnancy. Int Urogynecol J 2013;24:1473-9.)

Symptoms	No. (%) of subjects								
	Trimester of pregnancy (n=328)			Postnatal (n=328)			At 12 months		
	First	Second	Third	8 weeks	6 months	12 months	VD (n=252)	CS (n=78)	P value
Stress UI	30 (9.1)	106 (32.35)*	124 (37.8)*†	61 (18.6)*†‡	72 (22.0)*†‡	85 (25.9)*†‡	74 (29.4)	11 (14.1)	0.009
Urgency UI	16 (4.9)	17 (5.2)	47 (14.3)*†	29 (8.8)*‡	18 (5.5)‡	27 (8.2)*‡	23 (9.1)	4 (5.2)	0.28
Mixed urinary incontinence	8 (2.4)	11 (3.3)	34 (10.4)*†	16 (4.9)‡	14 (4.3)‡	22 (6.7)	18 (7.1)	4 (5.3)	0.57
Any urinary incontinence	38 (11.5)	112 (34.1)*	134 (41.8)*†	74 (22.6)*†‡	76 (23.2)*†‡	90 (27.7)*†‡	79 (31.3)	11 (14.5)	0.004
Faecal incontinence with normal stool	2 (0.6)	6 (1.8)	3 (0.9)	3 (0.9)	1 (0.3)	1 (0.3)	1 (0.4)	0	--
Faecal incontinence with liquid/loose stool	9 (2.7)	11 (3.4)	10 (3.0)	17 (5.2)	12 (3.7)	13 (4.0)	11 (4.4)	2 (2.6)	0.74
Flatus incontinence	124 (37.8)	137 (41.8)	120 (40.9)	100 (30.5)	79 (24.1)	60 (18.3)	45 (17.9)	15 (19.2)	0.78
Any faecal incontinence (excluding flatus incontinence)	10 (3.0)	15 (4.6)	11 (3.4)	17 (5.2)	12 (3.7)	13 (4.0)	11 (4.4)	2 (2.6)	0.74

* P<0.05 as compared to first trimester
† P<0.05 as compared to second trimester
‡ P<0.05 as compared to third trimester

TABLE 2. Comparison of pelvic floor biometry before and after delivery in vaginal delivery and Caesarean delivery groups (Reproduced with permission from: Chan SS, Cheung RY, Yiu KW, Lee LL, Chung TK. Pelvic floor biometry of Chinese primiparous women 1 year after delivery: a prospective observational study. Ultrasound Obstet Gynecol 2014;43:466-74.)

Variable	Trimester			Postnatal			P value (ANOVA to compare the pelvic floor biometry at postnatal 8 weeks, 6 months, and 12 months)	Partial Eta squared (≤0.01=small, 0.06= moderate, ≥0.14=large effect)
	First	Second	Third	8 weeks	6 months	12 months		
Vaginal delivery group								
At rest								
Bladder neck (BN) position (cm)	-2.89±0.37	-2.82±0.44	-2.59±0.60	-2.78±0.38*‡	-2.89±0.36†‡	-2.83±0.64 ‡	<0.05	0.10
Cervix (cm)	-5.36±1.48	-4.84±0.99	-4.60±0.98	-4.51±1.15*†	-4.55±1.00*†	-4.54±1.11*†	0.71	0.003
Ano-rectal junction (cm)	-2.0±0.79	-1.68±0.91	-1.36±0.99	-2.13±0.93†‡	-2.17±0.78*†‡	-2.12±0.82 †‡	0.68	0.003
Hiatal area (cm^2)	11.3 6±2.40	12.27±2.62	12.92±3.21	12.30±2.71*‡	12.02±2.66*‡	11.95±2.37 *†‡§	0.12	0.02
At Valsalva								
BN position (cm)	-2.55±0.51	-2.20±0.61	-2.03±0.66	-1.95±0.73*†	-2.11±0.69*	-2.10±0.78*	0.01	0.04
BN displacement from rest (cm)	0.82±0.56	1.17±0.67	1.08±0.67	1.46±0.81*†‡	1.38±0.83*†‡	1.42±0.90*†‡	0.23	0.01
Cervix (cm)	-4.80±1.63	-4.42±1.30	-4.09±1.31	-3.81±1.29*†‡	-3.75±1.21*†‡	-3.86±1.14*†‡	0.33	0.01
Ano-rectal junction (cm)	-1.35±0.90	-0.86±0.99	-0.65±1.16	-1.09±1.11*†‡	-1.12±0.97*†‡	-1.04±1.05*†‡	0.53	0.01
Hiatal area (cm^2)	12.63±2.17	13.86±3.71	15.02±4.65	15.13±4.04*†	14.31±4.5*‡	14.20±4.21*‡	<0.05	0.07
At pelvic floor contraction								
BN position (cm)	-2.96±0.40	-2.94±0.54	-2.83±0.41	-2.79±0.56*†	-2.90±0.38*†‡	-2.91±0.41*	0.001	0.06
BN displacement from rest (cm)	0.42±0.30	0.57±0.59	0.61±0.42	0.56±0.56*	0.54±0.39*	0.58±0.64*	0.63	<0.01
Cervix (cm)	-5.32±1.39	-4.99±1.20	-4.73±0.94	-4.64±1.05*†	-4.63±1.07*†	-4.73±0.92*†	0.29	0.01
Ano-rectal junction (cm)	-1.97±0.76	-1.71±0.86	-1.52±0.89	-2.14±0.80*†‡	-2.12±0.81*†‡	-2.08±0.73†‡	0.51	0.01
Hiatal area (cm^2)	9.63±2.17	10.14±1.97	10.62±2.21	10.76±2.28*†	10.04±2.17*‡	9.99±2.11*‡II	<0.05	0.16
Caesarean delivery group								
At rest								
BN position (cm)	-2.94±0.36	-2.81±0.49	-2.46±0.89	-2.87±0.31‡	-2.83±0.30*‡	-2.83±0.30*‡	0.60	0.02
Cervix (cm)	-5.40±1.06	-4.78±1.01	-4.60±1.09	-4.56±0.97*	-4.39±0.82*†	-4.54±0.97*	0.35	0.03
Ano-rectal junction (cm)	-1.8±0.89	-1.64±0.90	-1.23±1.03	-1.99±1.04†‡	-2.00±0.82†‡	-1.90±0.85†‡	0.64	0.01
Hiatal area (cm^2)	11.06±2.38	11.99±2.56	12.72±3.04	10.62±2.05†‡	10.26±2.27*†‡	10.91±1.98†‡§	0.02	0.11
At Valsalva								
BN position (cm)	-2.57±0.47	-2.26±0.55	-2.11±0.53	-2.31±0.44*‡	-2.22±0.54*	-2.14±0.64*	0.05	0.09
BN displacement from rest (cm)	0.81±0.53	1.09±0.64	1.10±0.67	1.00±0.61*	1.15±0.72*	1.26±0.77*	0.01	0.13
Cervix (cm)	-4.98±1.02	-4.43±1.05	-4.13±1.56	-3.93±1.16*†	-3.61±1.08*†‡	-3.64±1.16*†‡	0.05	0.09
Ano-rectal junction (cm)	-1.29±0.94	-0.89±0.97	-0.74±1.05	-1.00±0.97*	-0.96±0.92*‡	-0.80±0.97*	0.18	0.05
Hiatal area (cm^2)	11.80±2.78	13.63±3.26	14.62±3.72	12.47±3.11†‡	12.34±3.60†‡	12.94±3.02*†‡	0.07	0.08
At pelvic floor contraction								
BN position (cm)	-2.93±0.36	-2.96±0.38	-2.86±0.45	-2.89±0.39	-2.82±0.37*†	-2.85±0.38†	0.45	0.02
BN displacement from rest (cm)	0.39±0.30	0.54±0.30	0.61±0.37	0.57±0.36*	0.52±0.39*	0.47±0.33‡	0.20	0.05
Cervix (cm)	-5.45±0.97	-5.17±0.94	-4.84±0.90	-4.68±1.38*†	-4.55±0.89*†	-4.66±0.95*†	0.52	0.02
Ano-rectal junction (cm)	-1.92±0.92	-1.79±0.83	-1.45±0.90	-2.0±0.79‡	-2.08±0.80†‡	-1.91±0.64‡	0.15	0.05
Hiatal area (cm^2)	9.46±2.12	10.11±1.99	10.33±2.21	8.95±1.74*†‡	8.83±1.86*†‡	9.22±1.67†‡II	0.06	0.08

* P<0.05 as compared to first trimester
† P<0.05 as compared to second trimester
‡ P<0.05 as compared to third trimester
§ P<0.05 between vaginal delivery and caesarean delivery at rest
II P<0.05 between vaginal delivery and caesarean delivery at pelvic floor muscle contraction

TABLE 3. Multivariable logistic regression for risk factors of urinary incontinence (UI) and faecal incontinence in women at 12 months after first delivery (Reproduced with permission from: Chan SS, Cheung RY, Yiu KW, Lee LL, Chung TK. Prevalence of urinary and fecal incontinence in Chinese women during and after first pregnancy. Int Urogynecol J 2013;24:1473-9.)

Variable	OR (95% CI)	P value
Stress UI (n=328, χ^2 (6)=53.3, P<0.005)		
Vaginal delivery	3.58 (1.57-8.14)	0.002
Antenatal stress UI	2.81 (1.48-5.32)	0.002
Antenatal urgency UI	2.35 (1.13-4.92)	0.023
Maternal age	1.10 (1.0-1.19)	0.05
Maternal body mass index (BMI) at 12 months after delivery	1.11 (0.94-1.33)	0.20
Maternal BMI at first trimester	1.05 (0.84-1.30)	0.68
Urgency UI (n=328, χ^2 (4)=31.7, P<0.005)		
Antenatal urgency UI	6.44 (2.52-16.43)	<0.005
Maternal BMI at first trimester	1.21 (1.06-1.38)	0.006
Antenatal stress UI	2.00 (0.74-5.40)	0.17
Maternal age	1.05 (0.93-1.18)	0.47
Faecal incontinence (n=328, χ^2 (2)=9.2, P<0.01)		
Antenatal faecal incontinence	6.1 (1.75-21.5)	0.005
Maternal BMI at first trimesters	1.18 (0.99-1.39)	0.06

women with LAM injury were excluded, 41 (14.1%), 86 (29.7%), and 36 (12.4%) women had irreversible over-distension at rest, and during Valsalva manoeuvre and pelvic floor muscle contraction, respectively.[7] Only maternal age in the first trimester was a significant risk factor for irreversible over-distension at rest (OR=1.12).[7]

Compared with women in the no injury group, more women who sustained injury to the LAM had descent of the BN (by Pelvic Organ Prolapse-Quantification System) at both 8 weeks and 12 months, and had prolapse symptoms at 8 weeks but not at 12 months.[8] Pelvic Organ Prolapse Distress Inventory general and Urinary Distress Inventory obstructive subscale scores were higher at 8 weeks although no differences in PFDI and PFIQ were evident by 12 months.[8]

Discussion

In our study, the prevalence of antenatal SUI, UUI, and faecal incontinence during different trimesters was similar to that in previous Caucasian studies. About 50% of women remained continent. Higher maternal age was a risk factor for antenatal SUI; higher maternal BMI was a risk factor for faecal incontinence.

There was a 15 to 25% increase of HA during the third trimester compared with the first trimester. There was a 27 to 41% increase of HA in women during the third trimester compared with non-pregnant nulliparous women. There was significant descent of the BN, cervix, and ano-rectal junction as gestation advanced. Nonetheless, BN mobility tended to be less compared with Caucasians. There are no longitudinal data to enable comparison of cervix and ano-rectal junction position during pregnancy.

Antenatal SUI was associated with a more caudal position of the BN and a larger HA. HA at rest was associated with prolapse symptoms and third trimester faecal incontinence.

After the first VD, 21.7% of Chinese women sustained LAM injury. This is comparable with previous studies although obstetric practices differed. Only operative VD was a risk factor. Forceps delivery has been reported to result in more trauma to the vagina compared with ventouse extraction. It appears that the same is true for the pelvic floor.

The prevalence of urinary incontinence after the first delivery was similar to the pooled prevalence of urinary incontinence (25.5%), SUI (12%), and UUI (3%) in previous Caucasian studies. At 12 months, VD (including operative VD) and antenatal SUI and UUI were risk factors for SUI; antenatal UUI and higher maternal BMI during the first trimester were risk factors for UUI. This suggests that the pathophysiology of urinary incontinence begins during pregnancy, before the onset of labour or delivery. Our study identified only greater maternal age to be associated with antenatal SUI and UUI. The prevalence of postnatal faecal incontinence (4%) was similar to previous reports, with its antenatal presence being the only risk factor. The effect of episiotomy on postnatal faecal incontinence remains controversial.

The BN position became lower during

pregnancy and at 8 weeks, but thereafter tended to revert to its position of the first trimester. Nonetheless, it remained significantly lower at 12 months. There were also more instances of BN displacement. At 8 weeks, there was more displacement in the VD group, but no difference between the VD and CS groups by 12 months.

Descent of the cervix remained significant in both VD and CS groups even at one year. In the 22 women who had no labour, the cervix was at a lower position. This suggests that descent of the cervix and hence the uterus occurs in women who carry a pregnancy beyond 35 weeks of gestation, and that the changes persist until at least one year after delivery. A pregnancy that reaches the third trimester, regardless of mode of delivery, has an effect on the pelvic floor postnatally. Further study is required to confirm if the changes persist after one year.

There was significant distal movement of the ano-rectal junction in both the VD and CS groups at 12 months. Episiotomy may not confer any protection against posterior compartment descent after delivery.

HA was persistently larger in the VD group than the CS group. The most important factor related to irreversible hiatal distension was LAM injury, followed by greater maternal age.

Partial or complete recovery of LAM was evident in 20.8% of women. This is similar to previous reports. By 12 months, the pelvic floor partially 'recovered'; the BN returned to a more proximal position from 8 weeks, although it remained significantly lower compared with its position during the first trimester.

More women in the LAM injury group had BN and anterior compartment descent at 8 weeks. This was compatible with a higher Pelvic Organ Prolapse Distress Inventory general subscale score (meaning more severe symptoms) at 8 weeks. Nonetheless, the overall PFDI and subscale scores in women with LAM injury were much lower, compared with another cohort of Chinese women with mild POP.[9] Childbirth and LAM injury are important contributing factors to pelvic floor disorders, despite not related to symptoms at 12 months. This suggests that other factors contribute to the onset of pelvic floor disorders after delivery, eg antenatal SUI, UUI, and faecal incontinence. Other pelvic floor changes or injury may also contribute to pelvic floor disorders, eg BN mobility, HA, concomitant anal sphincter injury.

Conclusions

Some symptoms of pelvic floor disorders begin during pregnancy. In our study, the prevalence of SUI, UUI, faecal incontinence, and prolapse symptoms was 25.9%, 8.2%, 4%, and 7.6%, respectively, 12 months after delivery. Pelvic floor anatomical changes were observed by translabial ultrasonography during pregnancy and until 12 months following delivery. There was increased pelvic organ mobility and increased HA after delivery. Irrespective of the mode of delivery, sustained pelvic floor anatomical changes were detected. Some symptoms of antenatal pelvic floor disorders and pelvic floor anatomical changes are related to symptoms of postnatal pelvic floor disorders. It may be beneficial to teach women pelvic floor exercises to reduce symptoms.[10]

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Results of this study have been published in References 4 to 8.

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