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Prevention of postpartum stress incontinence in primigravidae with increased bladder neck mobility: a randomised controlled trial of antenatal pelvic floor exercises

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Objective To test whether supervised pelvic floor exercises antenatally will reduce the incidence of postpartum stress incontinence in at-risk primigravidae with bladder neck mobility, ultrasonically proven.

Design Single blind, randomised controlled trial.

Setting Antenatal clinic in a UK NHS Trust Hospital.

Sample Two hundred and sixty-eight primigravidae attending an antenatal clinic at approximately 20 weeks of gestation with bladder neck mobility, on standardised valsalva, of 5mm or more linear movement. The median age was 28, ranging from 16 to 47 years.

Intervention Patients randomised to supervised pelvic floor exercises ($n = 139$) attended a physiotherapist at monthly intervals from 20 weeks until delivery. The exercises comprised three repetitions of eight contractions each held for six seconds, with two minutes rest between repetitions. These were repeated twice daily. At 34 weeks of gestation the number of contractions per repetition was increased to 12. Both the untreated control group and the study group received verbal advice on pelvic floor exercises from their midwives antenatally.

Main outcome measures Subjective reporting of stress incontinence at three months postpartum. Pelvic floor strength, using perineometry, and bladder neck mobility measured by perineal ultrasound.

Results Of the 268 women enrolled, information on the main outcome variable was available for 110 in the control group and 120 in the study group. Fewer women in the supervised pelvic floor exercise group reported postpartum stress incontinence, 19.2% compared with 32.7% in the control group (RR 0.59 [0.37–0.92]). There was no change in bladder neck mobility and no difference in pelvic floor strength between groups after exercise, although all those developing postpartum stress incontinence had significantly poorer perineometry scores than those who were continent.

Conclusions The findings suggest that antenatal supervised pelvic floor exercises are effective in reducing the risk of postpartum stress incontinence in primigravidae with bladder neck mobility.

INTRODUCTION

There is good evidence that vaginal delivery can be associated with damage to the innervation of the pelvic floor as well as direct trauma to levator ani muscle and endo-pelvic fascia. This may result in the development of genuine stress incontinence[1–4]. Postpartum stress incontinence can occur in up to 34% of women[5]. Pregnancy itself might be relevant with 31%–47% reporting antenatal stress incontinence[6,7]. However *de novo* stress incontinence after delivery is uncommon[8–10]. Not all patients develop stress incontinence after vaginal delivery and attempts to identify women at risk (e.g. using possible markers for connective tissue weakness such as joint hypermobility[11]) have not been successful.

One possible marker might be bladder neck mobility. In an earlier study[12] a group of primigravidae at risk of developing postpartum stress incontinence was identified, using perineal ultrasound to assess bladder neck mobility antenatally. In this study of 116 primigravidae, those with a bladder neck mobility >5mm on linear movement (equivalent to an angle of rotation more than 10 degrees) were found to be at higher risk of developing postpartum stress incontinence. Approximately half of the women with bladder neck mobility reported stress incontinence three months postnatally. Significantly more of these patients had complained of antenatal stress incontinence than the remainder who were dry. Interestingly, in those patients with bladder neck mobility who were continent at three months, significantly more had performed regular postnatal pelvic floor exercises. This might suggest that pelvic floor exercises are protective in this at risk group.

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There is good evidence that postnatal pelvic floor exercises are effective in the treatment of postpartum stress incontinence[7,13,14]. Few studies exist using antenatal pelvic floor exercises[15,16] despite the possibility that these might be effective in preventing postnatal stress incontinence[5]. The aim of this study was to assess the effect of supervised antenatal pelvic floor exercises in the prevention of postpartum stress incontinence in this at risk group with bladder neck mobility. A randomised, controlled trial was carried out on primigravidae with bladder neck mobility as previously defined[12]. Local ethical approval was granted. Written, fully informed consent was obtained from all participants.

METHODS

All primigravidae attending the antenatal clinic of a NHS Trust Hospital with 4500 deliveries per year were invited to have a perineal ultrasound scan to measure bladder neck mobility at approximately 20 weeks of gestation. Measurement of bladder neck mobility was as previously described[12,17]. The women were positioned sitting upright with their feet in stirrups. Using an ultrasound scanner (Pie Medical Scanner 100, Maastricht, The Netherlands) with a 5MHz curvilinear probe, images were taken at rest and with a standardised Valsalva manoeuvre. As in the previous study[12], the women were asked to blow into a modified sphygmomanometer to a pressure of 30mmHg, which corresponds to approximately 40cm H_2O. Those with a bladder neck mobility of more than 5mm on linear movement following standardised valsalva were invited to take part in the study. For a sample of the patients repeat measurements were made on each of these patients by the same observer and by a separate observer to obtain measures of intra and inter-observer error. Exclusion criteria were any pre-pregnancy urinary incontinence or neurological disorder.

Patients were then randomised to either supervised pelvic floor exercises with a physiotherapist (F.P.) during the antenatal period, or to a control group. A separate sample of 20 subjects was used to obtain measures of reproducibility for bladder neck mobility measurements.

Randomisation

All primigravid women attending the antenatal clinic at booking were invited to take part in the screening for bladder neck mobility. Women with mobile bladder necks who had given their informed consent were allocated to one of two study groups. Simple randomisation was used, from pseudo-random numbers generated by computer. Because women in the pelvic floor exercise group had to be referred to the physiotherapist, the allocation schedule was held by the study co-ordinator. The physiotherapist operated from separate premises. The observers carrying out the assessments of pelvic floor strength, bladder neck mobility and reported symptoms were blind to the allocation. The physiotherapist was blind to the pelvic floor strength and bladder neck mobility results.

Interventions

Both groups were likely to have received verbal advice on pelvic floor exercises from their midwives at antenatal classes. This was not part of the study protocol, but is part of routine antenatal care. Patients randomised to supervised pelvic floor exercises attended a physiotherapist at monthly intervals from 20 weeks until delivery; this was done on a one-to-one basis, as it might be more effective than group sessions.

The pelvic floor exercise regimen as described by Bo[18] was used. The exercises comprised three repetitions of eight contractions each held for six seconds, with two minutes rest between repetitions. These were repeated twice daily. Patients were also instructed to contract the pelvic floor every time when coughing or sneezing. At 34 weeks of gestation the number of contractions per repetition was increased to 12. Those unable to follow this due to inability to contract the pelvic floor had individualised programmes until they could follow the study regimen. Further measurements of bladder neck mobility and pelvic floor strength and recording of urinary symptoms were carried out on both the pelvic floor exercise and control groups at 34 weeks of gestation and at three months postpartum.

Main outcome measure

Patients were questioned at three months postpartum as to whether they had any stress incontinence. The incontinence was again classified in an identical manner to the previous study[12] as mild, moderate or severe, if stress incontinence occurred once a week, twice or more per week, or daily, respectively. Those with no leakage in the previous four weeks were classified as continent. Patients who reported only urge incontinence were not included. Even if subjects withdrew from the study, unless they said they did not wish to be contacted further, they were followed-up as near as possible to three months postpartum and questioned about stress incontinence, either by letter or telephone.

A one-hour International Continence Society pad test was requested in all patients to assess volume of leakage at three months postpartum. These were performed at home using the International Continence Society instructions and the pads, sealed in plastic bags, were returned as soon as possible for weighing.

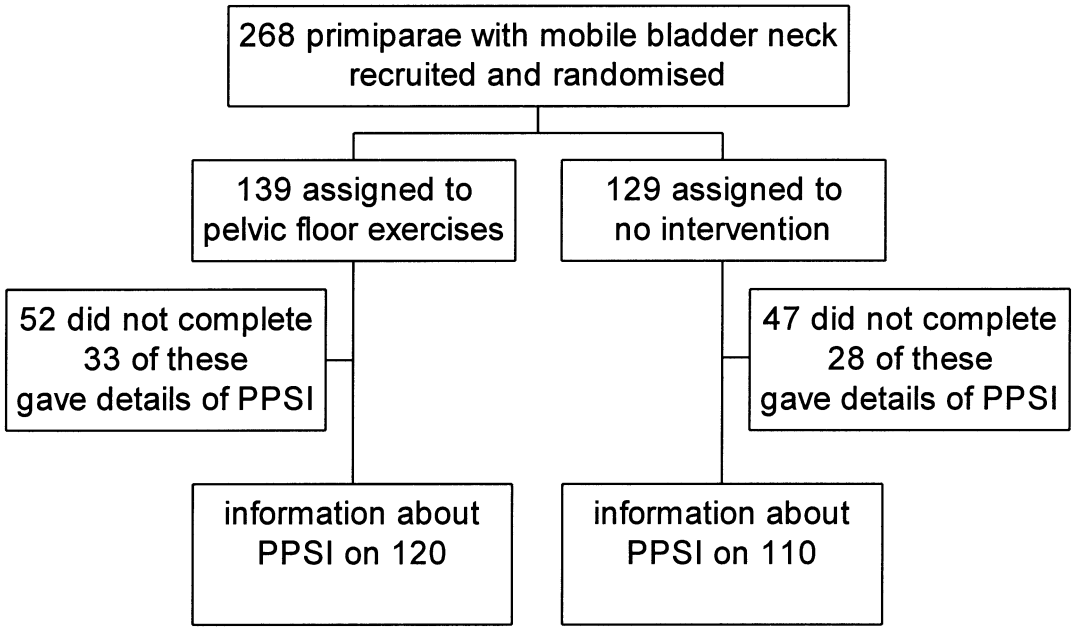

Fig. 1. Trial profile.

Secondary outcome measures

Pelvic floor muscle strength was assessed at each visit by perineometry (Peritron, Neen HealthCare, East Dereham, Norfolk, UK). An observer blinded to the patients' symptoms and study group carried out the measurements. Two measurements associated with inward movement of the probe were taken and the mean recorded. Bladder neck mobility was also assessed at each visit as previously described. Joint hypermobility was assessed at each visit using a recognised method[19], to explore any association between both joint and bladder neck mobility and postpartum stress incontinence. Striae were assessed as before on a scale from one to three[12]. Quality of life was measured using Short Form 36 and the King's Health Questionnaire in both groups at randomisation and three months postpartum.

Compliance

Compliance in the study group was monitored using diaries to record the number of daily exercises performed from 20 weeks to delivery. These were categorised into three groups:

1. No diary data;
2. Those patients who had recorded <28 days (total) of pelvic floor exercises;*
3. Patients who had recorded doing ≥ 28 days (total) of pelvic floor exercises antenatally.

The control group did not keep any formal record of pelvic floor exercises they might be doing (pelvic floor exercises are encouraged as part of standard antenatal care). However, as part of the history recorded at each visit, for both pelvic floor exercise and control groups, each woman was asked if she was doing any pelvic floor exercises, and if so, how frequently.

Sample size and statistical analysis

The trial sample size of 130 test subjects and 130 controls was based on the results of the previous study[12]. Forty-five percent of the women in this study with increased bladder neck mobility, as defined above, reported stress incontinence postpartum. Bo[18] suggests that supervised pelvic floor exercises might yield 60%–70% cure rates. For this study a more conservative cure rate of around 50% was predicted for the purpose of deciding sample size. That is, it was anticipated that 20%–25% of the test group will be incontinent postpartum. Again, taking the more conservative prediction of 25% and comparing this to 45% of the controls, a two-group continuity corrected χ^2 test with a 5% two-sided significance level will have 90% power to detect the difference between these proportions when the sample size in each group is 128. Reducing the power to 80% would allow for a 25% attrition rate on this starting sample size.

The analysis was carried out on all subjects where the primary outcome variable (postpartum incontinence) was

* This period was selected as the minimum period that is likely to be required to show a measurable effect of exercise, based on the results presented by Bo *et al.*[20] who found significant strength increase at one month.

available, irrespective of whether the intervention was adhered to (intention-to-treat). Nominal categorical data were tested using exact forms of χ^2 test. Relative risks and their 95% confidence intervals were calculated for comparisons of proportions[21]. Continuous data were compared using analysis of variance and *t* tests. Cohen's kappa was used to derive a measure of agreement for the pad test validation of reported continence. *P* values <0.05 were considered significant. Confidence intervals are all 95%. Measurement error for bladder neck mobility was calculated according to the methods described by Bland[22], expressed as within-subjects coefficient of variation. The influence of covariates on the primary outcome variable was explored using logistic regression.

RESULTS

Two hundred and sixty-eight women were enrolled and randomly allocated to the study groups. Information on the main outcome of the study was available for 230 women, that is 120 in the pelvic floor exercise group and 110 in the control group (Fig. 1). In total, 101 withdrew from the study before completion. This was for various reasons, principally time and travel to the hospital (although travel expenses were met by the study), dislike of perineometry and ultrasound. A number of women stayed in the trial but refused to have perineometry carried out.

Analyses presented here are based on the 230 women where there is information about the main outcome variable. Median age was 28, ranging from 16 to 47 years. Characteristics collected at inclusion were comparable (Table 1). Also included here are details of mode of delivery showing that this was also comparable between groups.

Regarding quality of life measures (at randomisation), of the eight scales that derive from the Short Form-36 Health Survey, average scores were high at >70% (good health, good functioning), except for vitality where the average score was 54%. The scores were comparable between groups. (The raw data are not presented as this would generate a large complex table which would add little to the overall analysis.)

Similarly, the Kings Health Questionnaire also generates eight scales. Average scores were low, <16% (low scores represent no problems), except for sleep/energy where the average score was 30%. For many subjects there was no problem at all. The scores were comparable between groups.

Table 1. Characteristics of the subjects. NVD = normal vaginal delivery; CS = caesarean section; BMI = body mass index.

	PFE group $n = 120$	Control $n = 110$
Age: median (range)	27 (17–42)	29 (16–47)
Bladder neck mobility >10mm: *n* (%)	25 (20.8)	29 (26.4)
Mode of delivery: *n* (%)	$n = 118$	$n = 110$
NVD	78 (66.1)	72 (65.5)
Ventouse	13 (11.0)	22 (20.0)
Forceps	8 (6.8)	2 (1.8)
CS	19 (16.1)	14 (12.7)
Elbow hyperextension: *n* (%)	$n = 88$	$n = 83$
+ve	10 (11.4)	12 (14.5)
BMI: mean (SD, *n*)	24.9 (4.2, 112)	24.1 (4.3, 108)
Perineometry (cm H_2O) at 20/40: mean (SD, *n*)	9.5 (5.4, 78)	10.4 (6.7, 84)

Table 2. Antenatal intervention and compliance. PPSI = postpartum stress incontinence; PFE = pelvic floor exercise.

Groups	*n*	PPSI present	RR (95%CI)
Control*	110	36 (32.7)	1
PFE			
No diaries	52	8 (15.4)	0.47 (0.23, 0.90)
<28 days exercise	13	5 (38.5)	1.18 (0.52, 2.15)
28^+ days exercise	55	10 (18.2)	0.56 (0.30, 0.99)

* Control group not asked to keep a diary. Other categories referenced to this for the calculation of RR.

Antenatal intervention and compliance with pelvic floor exercises (Table 2)

Those patients performing pelvic floor exercises for 28 days or more were less likely to have postpartum stress incontinence compared with the control group and to those doing exercises for less than 28 days. The proportion continent for each compliance category varies significantly ($\chi^2 = 8.49$, d.f. 3, $P = 0.036$). The group who failed to complete the diary had a lower incidence of postpartum stress incontinence (15.4%). Patients at clinic visits, both exercise and control groups, were asked whether they had been doing pelvic floor exercises. Of those with diaries indicating they had done at least 28 days exercises eight of the 55 said they were no longer doing them at all or only occasionally. Five of the 13 with diaries recording less than 28 days of exercise were either not exercising at all or occasionally, and only four stated they were still exercising regularly. Of the 52 not returning any completed diaries, 24 claimed to be exercising regularly with 20 not or occasionally exercising. Of the 110 controls, 56 claimed to have done regular pelvic floor exercises and 37 stated they were not or only occasionally exercising.

Table 3. Incontinence three months postpartum. Values are given as *n* (%).

	PFE group ($n = 120$)	Control ($n = 110$)	RR (95%CI)
PPSI at 3/12	23 (19.2)	36 (32.7)	0.59 (0.37,0.92)
Pad test	($n = 74$)	($n = 74$)	
+ve pad test	7 (9.5)	8 (10.8)	0.87 (0.35,2.23)

Table 4. Pad test validation of reported incontinence. Values are *n* (%).

	PPSI present ($n = 43$)	PPSI absent ($n = 105$)
Pad weight gain 1+g	11 (25.6)	4 (3.8)

Reported postpartum stress incontinence (Table 3)

Fewer patients in the pelvic floor exercise group (19.2%) reported postpartum stress incontinence compared with controls (32.7%) at three months (Table 3). The relative risk was 0.59 (CI 0.37 to 0.92), which was significant ($\chi^2 = 5.52$, d.f. = 1, $P = 0.023$). Most subjects with any degree of incontinence reported only mild incontinence; two (one per group) reported severe incontinence and eight (five control, three pelvic floor exercise group) moderate incontinence. These figures were too small to use separately in any analysis, so they were grouped with those reporting mild incontinence.

Pad test

The one-hour International Continence Society pad test was performed in 148 patients three months postpartum. The greatest weight gain was 6.5g, and only three patients had weight gains of 3g or more. The degree of incontinence in these patients was mild and many of those patients reporting postpartum stress incontinence had a negative pad test. Weight gains of less than one gram are usually regarded as dry, so the nil and 0.5g category have been combined. There was no difference between the groups for a positive (1g or more) pad test (Table 4).

The level of agreement between reported incontinence and the pad test (Table 4) was assessed using Cohen's Kappa. Level of agreement $\kappa = 0.27$, CI 0.11 to 0.43. This suggests only a fair strength of agreement[22]. Over half (56%) those subjects reporting postpartum stress incontinence (24 out of a total of 43) showed no leakage on the pad test, and a further 19% showed 0.5g or less pad weight increase (eight out of 43).

Bladder neck mobility and pelvic floor strength

Information was available on 166 subjects (Table 5) for change in bladder neck mobility. There was no difference between the groups. Inter- and intra-observer variation, expressed as within-subjects coefficient of variation, were 32% and 25%, respectively, between and within authors E.R. and A.W. Perineometry was carried out on 132 patients at three months postpartum. There was no significant difference in pelvic floor strength between the groups (difference = 1.0, CI -1.3–3.4) (Table 5).

Mode of delivery, body mass index and joint hypermobility

These factors may have had an effect on the primary outcome of the trial, being implicated in the mechanisms leading to the development of incontinence. They were used as explanatory variables in logistic regression with postpartum stress incontinence as the response variable and group the initial explanatory variable. As can be seen from Table 1, these factors are comparable across the two groups. This was reflected in the logistic regression analyses, where there was no improvement in the model by their inclusion, either individually or together. These factors were also looked at in an exploratory fashion, (these comparisons were not included in the study design and should be regarded only as descriptive).

There were no significant differences in proportions between continent and incontinent subjects and mode of delivery. There was no association between bladder neck mobility at 20 weeks and joint hypermobility status, except for elbow hyperextension ($t = -2.03$, d.f. 167, $P = 0.044$, difference = −0.12, CI −0.24 to −0.003).

There were no differences in body mass index at three months between the groups but those patients who were dry had a lower body mass index than those who had postpartum stress incontinence, i.e. 24.1 body mass index in the dry group compared with 25.4 in the postpartum stress incontinence group ($t = -2.047$, d.f. 218, $P = 0.042$, difference = −1.31, CI −2.57 to −0.05).

Quality of life measures

At three months, there was no difference between the study groups on any of the eight scales of the Kings Health Questionnaire, and all mean scores were low at <20% (including sleep/energy). One of the eight scales of the Short Form-36, general health, showed a significant

Table 5. Other outcome measures. BNM = bladder neck mobility.

	PFE group			Control			Difference means	(95% CI)	*P*
	Mean	SD	*n*	Mean	SD	*n*			
Change BNM (mm) 20/40–3/12	−0.16	0.44	84	−0.08	0.48	82	−0.08	−0.22, 0.07	0.28
Perineometry (cm H_2O) 3/12	11.5	7.9	68	10.5	5.5	64	1.0	−1.3, 3.4	0.38

difference between the pelvic floor exercise group and the control group; the exercise group had a mean of 84.4% (SD 13.5, $n = 76$) and the control group 77.2% (SD 16.3, $n = 72$), giving a mean difference of 7.2 (CI 2.4–12.1) ($t = 2.94$, df = 146, $P = 0.004$).

DISCUSSION

Having previously reported a group at risk for developing postnatal stress incontinence, this study has attempted to assess the preventative effect of antenatal pelvic floor exercises in such women. In this study 33% of women with increased bladder neck mobility reported postpartum stress incontinence. This is less than the 48% reported in the first study[12]. This difference might have been due to selection bias in the previous observational study, or a study effect on the control group.

Bo *et al.*[23] have described what they term the 'avis effect'; in the case of this trial, the potential stimulus of the control subjects to carry out pelvic floor training (which they will have been advised to do by their midwives) by attending for pelvic floor strength and bladder neck mobility measurements during the study. Over half the women in the control group did claim to have carried out pelvic floor exercises during their pregnancy.

Apart from this randomised, controlled trial, no other studies have tried to assess bladder neck mobility in relation to postpartum stress incontinence. A recently published paper on antenatal incontinence failed to show any association with bladder neck mobility[24]. No data are presented postpartum[24].

Supervised pelvic floor exercises are known to be more effective than verbal instruction[5,25] and in this study supervised exercises led to a significant reduction in the incidence of symptoms of postpartum stress incontinence in the study group compared with controls (Table 3). This is similar to the findings of Sampselle *et al.*[15] who found a reduction in postpartum stress incontinence following supervised antenatal pelvic floor exercises in a small unselected group of primigravidae. This further supports the view that it is antenatal, rather than postnatal pelvic floor exercises, which are preventative[5].

As with any behavioural intervention particularly in asymptomatic primigravidae, compliance and dropouts are problematic. Large dropout rates have been noted in similar studies in pregnancy[14,26,27]. However, the unwillingness of some patients to undergo investigations (perineal ultrasound, perineometry and pad test) was disappointing as regular contact was provided.

Patients allocated to the pelvic floor exercise group were asked to complete compliance diaries from enrolment to delivery. As few patients complied as per protocol, a minimum of 28 days exercise was chosen, *a posteriori*, as a measure of compliance (period required before an effect can be detected[20]).

Compliance has been shown to be associated with the patient's perception of her ability to contract the pelvic floor, and the severity of the incontinence[28]. As most women had mild postpartum stress incontinence, this might have affected compliance. We found that 18.2% of those who completed more than 28 days exercises reported postpartum stress incontinence compared with controls (32.7%) or those who performed less than 28 days exercise (38.5%) (Table 2). This suggests a causal relationship between exercise and outcome.

The group who failed to fill in diaries had a similar incidence of postpartum stress incontinence (15.4%) to those performing 28 days or more pelvic floor exercises. Retrospective reporting of exercising, at follow up visits, indicated that the no-diary group were exercising, as were a large proportion of the control group. The control group were not assessed for ability to do pelvic floor exercises correctly nor were any exercises they did supervised.

As mentioned above, of interest was the lower incidence of postpartum stress incontinence in the control group compared with the findings of the original study (33% *versus* 48%). One explanation could be a study effect on the control group, resulting in them performing regular pelvic floor exercises, as mentioned above. It has been suggested that pelvic floor strength antenatally is maintained postnatally[29] and our data seem to support this (Tables 1 and 5).

Bladder neck mobility

It is questionable whether bladder neck mobility can be improved by supervised pelvic floor exercises. No difference was seen in mobility before and after exercises in the study group compared with the control group. This has been noted in other studies[30]. Patients taught pelvic floor exercises for genuine stress incontinence learn to prevent stress incontinence during exertion by contracting the pelvic floor beforehand, something referred to as the 'knack'[31]. During perineal ultrasound patients were asked to valsalva without instruction to contract the pelvic floor. It is possible therefore that no change in bladder neck mobility would be seen. Another possible explanation for the lack of change in bladder neck mobility might be that pelvic floor exercises act on the mid-urethra rather than the bladder neck. This has been seen following the operation of TVT where a prolene tape is inserted at the mid-urethra. Bladder neck mobility remains unchanged following this operation despite restoration of continence[32]. It is possible that pelvic floor contraction could act in a similar way.

Pad test

In this study as in others[10,13] the severity of the postnatal incontinence at three months was mild objectively (on pad

testing). Approximately 60% of women were prepared to perform a one-hour home International Continence Society pad test. Table 4 shows that 32 out of 43 (74%) women complaining of postpartum stress incontinence had losses of 0.5g or less. One patient who claimed to be dry had a loss of 6.5g. Whether this is a false positive result is unclear. High false positives have been reported with pad tests[33]. Urodynamic studies are recommended as an objective outcome measure for interventions in incontinence research[34]. However these seem to be unreliable in pregnancy[27] and were not used in this study.

Labour and delivery

Evidence for the role of obstetric factors in the development of postnatal stress incontinence is not clear. As in the previous study[12], no association was seen between mode of delivery, length of second stage, birthweight, head circumference, episiotomy or epidural. This is contrary to the findings of others (who were investigating neuromuscular damage to the pelvic floor in childbirth rather than symptoms[2,35]). The reason is not clear but might be due to smaller numbers of operative deliveries. For example, while more women in the control group who were delivered by ventouse reported postpartum stress incontinence compared with the test group (42% *versus* 23%) this difference was not statistically significant. Nonetheless, if this was a true effect it might suggest that pelvic floor exercises are preventative even in ventouse delivery. A study with larger numbers of instrumental deliveries would be required to assess this. There was no difference in postpartum stress incontinence with regards caesarean section *versus* vaginal delivery or between elective and caesarean sections performed in labour. As seen before[5,36] elective caesarean section was not completely protective as two of five women delivered by elective caesarean section reported postpartum stress incontinence. This suggests that caesarean section with its increased morbidity might not be an appropriate method of prevention.

Constitutional factors

It has been proposed that weak pelvic floor collagen might be important in the genesis of genuine stress incontinence[37] and this might be relevant during pregnancy where connective tissue is weaker than in the non-pregnant[38]. Joint hypermobility has been proposed as a marker for connective tissue weakness and subsequent development of prolapse and genuine stress incontinence[39]. However, no differences were found in other studies[11] and the only effect found in this study was for elbow hyperextension. Obesity is known to be associated with the development of genuine stress incontinence[40] and thought to be a possible risk factor for postpartum stress incontinence[41]. An increase in body mass index at three months was noted in those women complaining of postpartum stress incontinence compared with those who did not (25.4 *versus* 24.1, $P = 0.042$). This was for all patients; there was no difference between groups. Dietary and fitness/exercise advice to reduce weight might therefore be important postnatally as a further method of prevention. It might also help in the performance of pelvic floor exercises but further study is necessary to test this hypothesis.

Quality of life measures

Both the Short Form-36 and Kings Health Questionnaire scores suggested that the impact of postpartum stress incontinence was minimal. There was, however, a higher score for the general health measure in the Short Form-36 in those in the exercise group compared with the control group.

These findings and the results of the pad tests suggest that women in this study did not have severe (i.e. daily) incontinence. This has been seen in other studies[11]. However there is a strong association between genuine stress incontinence and a past history of postnatal incontinence and parity[42,43]. It is possible that postpartum stress incontinence might be a forerunner for worsening stress incontinence due to the effects of further deliveries, ageing and the menopause on the pelvic floor.

CONCLUSIONS

Supervised pelvic floor exercises resulted in a lower incidence of postpartum stress incontinence in the intervention subjects compared with controls. Compliance seems to be associated with an improved outcome. Bladder neck mobility was unchanged before and after pelvic floor exercises. This was probably not surprising, as it's the 'knack' of contracting the pelvic floor at the time of increased abdominal pressure that maintains continence. Incontinence was mild as judged by pad testing and quality of life measures. However, the symptoms might be the 'forerunner' for worsening stress incontinence with ageing; analogous to anal incontinence in older women with a history of third degree anal sphincter tears many years before. Supervised pelvic floor exercises have been shown to be more effective than verbal instruction. It is unlikely that this service would be available to all due to a lack of physiotherapists trained in pelvic floor exercises nationwide. Midwives could be trained to do this. However, pelvic floor exercises are but one part of ante- and postnatal care and time constraints could be prohibitive. It would appear reasonable therefore, to target those at risk and offer supervised pelvic floor exercises. Women with antenatal bladder neck mobility can be easily iden-

tified using perineal ultrasound. As with all behavioural interventions, particularly in those with minimal or no symptoms, compliance and motivation by patient and therapist are essential. Long term follow up is important to assess continence following further pregnancies. This is ongoing in these patients.

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