Int Urogynecol J (2004) 15: 99–105
DOI 10.1007/s00192-004-1119-y

ORIGINAL ARTICLE

Pauline Chiarelli · Barbara Murphy · Jill Cockburn

Promoting urinary continence in postpartum women: 12-month follow-up data from a randomised controlled trial

Received: 1 July 2002 / Accepted: 10 January 2003 / Published online: 23 January 2004

Abstract A physiotherapist-delivered continence promotion program was recently implemented with postpartum women in Australia. A previous randomised controlled trial demonstrated that the program was effective in promoting pelvic floor exercises and continence at 3 months postpartum. The present study compares pelvic floor exercise frequency and continence status for women in the intervention and 'usual care' control groups at 12 months postpartum. While there was no significant difference in continence status, women in the intervention group were more likely than those in the control group to be practising pelvic floor exercises at adequate frequencies. In turn, continued adherence to pelvic floor exercises at 12 months was predictive of continence at that time. Potential strategies for enhancing women's adherence to pelvic floor exercise regimes during and beyond the postpartum year are discussed.

Keywords Adherence · Birth · Pelvic floor exercises · Postpartum · Urinary incontinence · Women

Introduction

A physiotherapist-delivered program designed to promote urinary continence among postpartum women through regular practice of pelvic floor exercises was recently implemented in Australia. The program incorporates both exercises to strengthen the pelvic floor and established principles of health promotion to encourage adherence. It was developed with input from both women in the postpartum [1] and experts in continence management [2]. A comprehensive review of previously developed programs for pelvic floor muscle strengthening enabled identification of the exercise parameters relevant for improving pelvic floor muscle function in postpartum women [3].

While other comparable programs have been used successfully in the *treatment* of established female urinary incontinence [4, 5], few interventions have focussed on *preventing* incontinence in asymptomatic women. Two recent studies demonstrated the benefits of postpartum pelvic floor exercise training on urinary incontinence at 6 months [6] and 10 months [7] postpartum. However, both studies were limited by their small sample sizes. The benefits of pelvic floor muscle training during pregnancy have also been recently demonstrated [8].

Our program has been shown to be effective both in encouraging pelvic floor exercise adherence and in promoting continence at 3 months postpartum. In a randomised controlled trial involving 676 postpartum women, those who were offered the program were significantly more likely to be performing adequate pelvic floor exercises at 3 months postpartum and showed significantly less incontinence than were those receiving 'usual' postpartum care [9].

The present study is the long-term follow-up of women from the previous report, and assesses the effectiveness of the program in encouraging pelvic floor exercise adherence and in promoting urinary continence at 12 months postpartum. There were three hypotheses. First, that the prevalence of urinary incontinence at 12 months postpartum would be lower for women in the intervention group than for women in the usual care control group. Second, that women in the intervention group would be practising pelvic floor exercises more frequently at 12 months postpartum than women in the control group. Third, that both of these

P. Chiarelli (✉)
School of Health Sciences, Discipline of Physiotherapy,
Box 24 Hunter Building, University of Newcastle,
University Drive, 2308 Callaghan, Australia
E-mail: Pauline.Chiarelli@newcastle.edu.au
Tel.: 61-2-49216046
Fax: 61-2-49217902

B. Murphy · J. Cockburn
School of Medical Practice and Population Health,
University of Newcastle, NSW, Australia

variables—study group and pelvic floor exercise frequency—would have an independent significant effect on continence status at 12 months.

Method

The methods were reported in detail when 3-month follow-up data were reported [9]. The methods will be described briefly below.

Setting

The study was conducted within the postpartum wards of three hospitals in the Hunter Region, NSW, Australia. The hospitals were a 580-bed metropolitan public teaching hospital with 3,208 births a year, a 68-bed metropolitan private hospital with 962 births a year and a 170-bed rural, public hospital with 1,150 births a year. Data were collected between August 1998 and February 2000.

Study design

The study was conducted as a randomised controlled trial.

Sample

Women were eligible to join if they had a forceps or ventouse assisted delivery and/or delivery of a high birth-weight baby (≥4,000 g).

Sample size calculation

Estimates of the prevalence of postpartum urinary incontinence range from 7–30% [10, 11, 12]; for sample size calculation we have assumed a prevalence of 30%. To detect a 10% difference between intervention and control groups at $\alpha = 0.05$ and $\beta = 0.80$ and using the formula given by Pocock for two-sided comparisons [13], a final sample of 290 women who fit the criteria was required in each group. The reduction of incontinence from a prevalence of 30 to 20% corresponds to an odds ratio of 0.58. Allowing for a 20% dropout, we needed to recruit about 350 women in each group.

Development of the intervention

The intervention was multifaceted and incorporated a pelvic floor exercise program based on physiological evidence of the muscles that need to be trained to strengthen the pelvic floor, along with general advice about bladder habits (including recommendations regarding fluid intake, frequency of urination, and avoiding constipation) and care of the perineum. It included strategies to enhance adherence such as tailoring the exercise program to the functional abilities of each woman's pelvic floor muscles, discussion of barriers to exercise, negotiating with the woman about the most convenient times for her to carry out her pelvic floor exercises, and the provision of reminders. Women were encouraged to perform a tailored number of pelvic floor muscle contractions initially, working up to a maximum of six contractions three times per day.

Baseline data collection in hospital

Eligible women were approached on the ward by one of three physiotherapists, usually within 48 h of delivery. Consenting women completed a structured interview that measured sociodemographics and experiences of urinary incontinence before pregnancy and following their recent delivery. After this, women were randomised either to a usual care control group or to an intervention group. The physiotherapists were blind to the woman's allocation until the structured interview was completed

Intervention group

The women randomised to the intervention group were seen once by the physiotherapist during their stay in hospital and again for a single visit with the same physiotherapist at 8 weeks postpartum. The visit occurred either at the hospital (for 67% of women) or, if transport was a problem, at the woman's home (33%). The intervention was delivered in about 20 min; the follow-up visit was completed in about 30 min.

Usual care group

The usual care group received routine postpartum care, which did not involve a visit from a physiotherapist. There were no restrictions for women in undertaking any postnatal exercises, including those recommended by other healthcare professionals.

Follow-up survey

Participants were interviewed by telephone 12 months after their recruitment into the study. The interviewer was blind to the group allocation of the women being interviewed. Women were posted a bladder diary prior to the interview.

Measures

Primary endpoint: urinary incontinence at 12 months

The major endpoint for the study was urinary incontinence at 12 months measured as a dichotomous variable. Women were classified as incontinent if they responded 'occasionally', 'often' or 'always' to any of the following items at the 12-month follow-up survey. *In the last month have you:*

- leaked even small amounts of urine when you were coughing, sneezing, laughing or lifting?
- gone to the toilet urgently for fear you would leak?
- leaked even small amounts if you had to wait to use the toilet?
- leaked even small amounts on your way to the toilet?
- leaked even small amounts if you hadn't gone to the toilet immediately when you first felt the need?

The first item relates to symptoms of stress incontinence while the others relate to symptoms of urge incontinence [14]. The questions have been shown to be valid when measured against a 2-h and a 48-h home pad test [15] and to be acceptable to women in the immediate postpartum [16]. Based on the recommendation of the International Continence Society that a bladder diary be used to validate self-reported measures [14], women completed a three-day bladder diary prior to the follow-up interview to enhance recall.

Secondary endpoint: performance of pelvic floor exercises

Women were asked how often they were performing pelvic floor exercises. Response options were 'not at all', 'weekly or less', 'several times a week', and 'daily or more'. Based on literature which recommends that pelvic floor exercises should be carried out at least every second day, frequencies of 'several times a week' and

higher were coded as 'adequate' while lower frequencies were coded as 'inadequate'.

Confounders

Personal characteristics Age and body mass index (BMI) were ascertained from the women's medical notes.

Women's other experiences of urinary incontinence While women were still in hospital, they were asked if they had experienced urinary incontinence since the baby was born. The response options were: 'yes', 'no' and 'don't know'. Women who had a urethral catheter in situ were coded as 'don't know'.

Women were also asked if they had experienced urinary incontinence at times other than during pregnancy or since the baby was born, as a measure of incontinence prior to this pregnancy. The response options were: 'yes', 'no' and 'can't remember'. The latter were coded as 'continent'.

Perineal status The perineal status of the women was determined from the birth register as an intact perineum, a graze, tear (not sutured), tear with sutures, an episiotomy, or episiotomy and a tear.

Collagen status The collagen status of women was measured in two ways. Firstly, hypermobility as assessed by thumb to wrist hyperabduction – thumb to touch wrist, third finger metacarpo-phalangeal hyperextension to 90°, and elbow hyperextension beyond 180°. Hypermobility was taken to be present when two of the three measures were positive. The second collagen marker was the presence of abdominal striae, and their visual assessment as either mild or marked [17, 18].

Type of delivery This was categorised as to whether instruments were used or not.

Data analysis

The effectiveness of the intervention was analysed by 'intention to treat'. Pearson Chi Squared Statistic was used to test for differences between intervention and control groups in pelvic floor exercise frequency and continence status at 12-months postpartum. Logistic regression, using continence status at 12 months as the outcome measure and including both study group and frequency of pelvic floor exercises as predictor variables, determined the effect of the intervention while controlling for any residual confounding from variables specified a priori, including age, obesity, parity, perineal trauma, collagen status and type of delivery.

Results

Response rate

During the data collection period, 1,326 women fitted the description for the reference population and therefore were the source population for this study. Of these women, 913 were approached and 720 consented to take part. This represents response rates of 54.3% of the available source population, and 78.9% of those women approached.

There were no statistically significant differences between the overall mean age and parity of the women in the study and those who were missed, transferred out or not approached. While the differences in mean age (3 years) and mean parity (0.4 births) between the private and public hospitals were statistically significant, they were not considered to be of clinical significance. Women were seen on average 2.06 days postpartum ranging from 0 to 10 days. Only one woman was seen at 10 days postpartum. The mode for visits was 1 day postpartum.

Table 1 shows the demographic characteristics and parity of women in control and interventions groups at the initiation of the trial, while Table 2 shows the factors identified a priori as potential confounders for the study in each of the groups. Compared with Australian Perinatal Statistics, except for parity and education, the sample characteristics were very similar to the national norms. Compared with the national statistics, our sample had more primiparous women (52.5 vs. 39.7%) and fewer women with four or more births (1.9 vs. 9.9%).

Retention of women in the study

In total, 370 women were randomised to the intervention group and 350 to the control group. At the 12-month follow-up interview, 49 (13.2%) intervention group women and 50 (14.3%) control group women had dropped out of the study. Women who had become pregnant in the 12-months since the trial was initiated (n=27 in intervention group; n=25 in control group) were excluded from the analyses. Sixty-four women in the intervention group did not attend the 8-week follow-

Table 1 Characteristics of women in intervention and control groups

Variable	Intervention		Usual care		*p*
	N=294	%	N=275	%	
Age group					
15–19	7	2.4	13	4.7	-
20–24	47	16.0	52	18.9	-
25–29	100	34.0	97	35.3	-
30–34	101	34.4	80	29.1	-
35–39	33	11.2	31	11.3	-
40–44	6	2.0	2	0.7	.309
Parity					
One	158	53.7	141	51.3	-
Two	76	25.9	79	28.7	-
Three	49	16.2	38	13.8	-
Four or more	11	3.8	17	6.2	.117
Marital status					
Married/de facto	269	91.5	246	89.5	-
Single	23	7.8	26	9.5	-
Wid/div/sep	2	0.7	2	0.7	-
Other	0	0	1	0.4	.664
Education					
Some secondary	109	37.1	112	40.7	-
HSC or equiv	66	22.4	50	18.2	-
Trade certificate	29	9.9	36	13.1	-
Tertiary	90	30.6	77	28.0	.336

Wid/div/sep widowed, divorced or separated; *HSC or equiv* higher school certificate or equivalent

Table 2 Clinical characteristics of women in the intervention and control group at baseline

Variable	Intervention		Usual care		*p*
	N=294	%	N=275	%	
Incontinent before recent pregnancy					
Yes	52	17.7	44	16.0	.336
Incontinent immediate postpartum					
Yes	32	10.9	25	9.1	-
Don't know	21	7.1	9	3.3	.081
Age					
Over 35 years	29	9.9	24	8.7	.374
Body Mass Index[a]					
Overweight/obese	95	32.9	104	38.1	.114
Perineal trauma					
Tear with sutures and/or episiotomy	198	67.3	171	62.2	.115
Joint hypermobility					
Yes	39	13.3	32	11.6	.323
Abdominal striae					
Marked	61	20.7	64	23.3	.266
Instrumental delivery					
Any	134	45.6	116	42.2	.232

[a]BMI data missing for seven women

up visit. As analysis was on an 'intention to treat' basis, these women were included in the outcome analyses.

Adherence to pelvic floor exercises

Overall, there was a significant association between experimental group and frequency of pelvic floor exercises (χ^2 (3, N =569)=59.95, p =0.001). As shown in Table 3, women in the intervention group were more likely than those in the control group to be doing pelvic floor exercises at frequencies up to weekly, while women in the control group were more likely to be doing no pelvic floor exercises at all. Women in the intervention group were also more likely than those in the control group to be practising pelvic floor exercises at 'adequate' frequencies (χ^2 (1, N =569)=3.40, p =0.039). Amongst women in the intervention group, adequate pelvic floor exercise frequency was significantly associated with continued use of the adherence aids included in the intervention program, namely the sticky dots and/or posters (χ^2 (3, N =288)=59.95, p =0.001). To illustrate change over time, the proportion of women reporting 'adequate' pelvic floor exercise practice at 3 and 12 months postpartum are shown in Table 4. In both groups, lower proportions of women were performing adequate pelvic floor exercises at 12 months, compared with 3 months.

Continence status

At 12 months postpartum, there was no difference between the two groups in the prevalence of incontinence (χ^2 (1, N =569)=0.251, p =0.340). To illustrate change over time, rates of incontinence at 3 and 12 months postpartum are shown in Table 4.

Table 5 sets out the results of the logistic regression analysis. Although study group was not a significant predictor of continence at 12 months postpartum, the frequency of women's pelvic floor exercise practice was. After controlling for residual confounding, compared with women doing none at all, the adjusted odds ratio of incontinence for women practising 'daily' pelvic floor exercises was 0.39 (95% CI=0.19–0.77; p =0.007); for women exercising 'several times per week' the adjusted odds ratio was 0.51 (95% CI=0.27–0.96; p =0.036); and for women practising pelvic floor exercises 'weekly or less' the adjusted odds ratio was 0.40 (95% CI=0.19–0.82; p =0.013). The experience of incontinence before the most recent pregnancy and being overweight or obese prior to pregnancy also had an independent significant effect on continence status at 12 months.

Table 3 Differences between intervention and control women in 12-month PFXs

	Total (N=569) n (%)	Intervention (n=294) n (%)	Control (n=275) n (%)
PFX frequency			
None at all	98 (17.2)	16 (**5.4**)	82 (**29.8**)
Weekly or less	265 (46.6)	161 (**54.8**)	104 (**37.8**)
Several times per week	134 (23.6)	76 (25.9)	58 (21.1)
Daily or more	72 (12.7)	41 (13.9)	31 (11.3)

Bold figures have standard residuals ≥1.96 indicating statistical significance. *PFX*pelvic floor exercise

Table 4 Proportion of women performing 'adequate' PFXs and incontinence for intervention and usual care groups at 3 and 12 months postpartum

	Intervention		Usual care	
	3 months (N=348) n (%)	12 months (N=294) n (%)	3 months (N=328) n (%)	12 months (N=275) n (%)
PFXs at adequate frequency	292 (83.9)	117 (39.8)	189 (57.6)	89 (32.4)
Incontinent	108 (31.0)	101 (34.4)	126 (38.4)	100 (36.4)

'Adequate frequency' denotes several times per week or more.*PFX* pelvic floor exercise

Discussion

The findings suggest that the intervention had a positive impact upon women's practice of pelvic floor exercises at 12 months postpartum. Women in the intervention group were more likely than women in the control group to be doing pelvic floor exercises, and to be doing them at 'adequate' frequencies.

In addition, the findings suggest that the practice of pelvic floor exercises at 12 months postpartum promotes

Table 5 Results of logistic regression predicting incontinence at 12 months postpartum

Variables in order of entry	n	*P* value	Adj odds ratio	Lower 95% CI	Upper 95% CI	Crude odds ratio	Lower 95% CI	Upper 95% CI
Group								
Usual care	273	-	1.00	-	-	-	-	-
Intervention	289	0.735	0.94	0.64	1.37	0.90	0.64	1.28
Continence status before pregnancy								
Continent	468	-	1.00	-	-	-	-	-
Incontinent	94	0.003	2.12	1.28	3.50	2.35	1.50	3.69
Continence status immediate postpartum								
Continent	476	-	1.00	-	-	-	-	-
Incontinent	56	0.067	2.08	0.95	4.57	1.96	0.93	4.10
Don't know	30	0.178	1.91	0.74	4.92	1.67	0.68	4.09
PFX frequency								
Not at all	96	-	1.00	-	-	-	-	-
Weekly or less	262	0.013	0.40	0.19	0.82	0.43	0.21	0.85
Several per week	133	0.036	0.51	0.27	0.96	0.57	0.31	1.04
Daily or more	71	0.007	0.39	0.19	0.77	0.44	0.23	0.85
Age								
35 years & under	509	-	1.00	-	-	-	-	-
Over 35 years	53	0.182	1.53	0.82	2.87	1.61	0.91	2.85
Body Mass Index								
Normal and below	363	-	1.00	-	-	-	-	-
Overweight/obese	199	0.041	1.50	1.02	2.20	1.67	1.17	2.39
Parity	562	0.454	1.09	0.87	1.38	0.90	0.75	1.08
Perineal trauma								
Minor or none	199	-	1.00	-	-	-	-	-
Tear with sutures, and/or episiotomy	363	0.558	0.89	0.59	1.33	0.81	0.57	1.16
Joint hypermobility								
No	493	-	1.00	-	-	-	-	-
Yes	69	0.574	1.17	0.68	2.03	1.06	0.63	1.79
Abdominal striae								
None or mild	440	-	1.00	-	-	-	-	-
Marked	122	0.217	1.33	0.85	2.07	1.45	0.96	2.18
Instrumental delivery								
No	317	-	1.00	-	-	-	-	-
Any	245	0.197	0.76	0.50	1.16	0.71	0.50	1.00

Parity entered as continuous variable, score range 1–5

continence at this time. The odds of women being continent at 12 months postpartum was highest for those practising pelvic floor exercises on a daily basis. Importantly though, the practice of pelvic floor exercises at *any* frequency significantly improved the odds of being continent at 12 months postpartum.

Nonetheless, the intervention itself does not appear to have been successful in promoting continence at 12 months postpartum. The rates of continence at 12 months postpartum did not differ significantly between the intervention and control groups. This is despite the apparent positive impact of the program on continence status at 3 months postpartum [9].

It is possible that the intervention, involving one visit by a physiotherapist while the woman was in hospital and one follow-up consultation with the physiotherapist at 8 weeks postpartum, was not intensive enough to encourage all intervention-group women to sustain their pelvic floor exercises in the longer term. That a more intensive 12-week pelvic floor exercise training program produced significant improvements in urinary incontinence symptoms at 10 months postpartum supports this interpretation [7]. Indeed, of those women in our study practising adequate pelvic floor exercises at 3 months, more than half were no longer doing so by 12 months postpartum. Interestingly, we saw a similar though less pronounced decline over time in performance of pelvic floor exercises in the control group. It seems that pregnancy in itself motivates women to do pelvic floor exercises more frequently. Consistent with this, women in the control group reported that they were much more likely to do pelvic floor exercises during rather than prior to pregnancy [3]. The decline in performance of pelvic floor exercises over time parallels findings from nearly all studies that have monitored adherence after an effective adherence-aiding strategy has been withdrawn [19]. Such studies document a deterioration in adherence back toward prior low levels, suggesting that ongoing and sustainable methods of encouraging long-term adherence are needed.

There are a number of behavioural strategies that might be useful in enhancing ongoing adherence to pelvic floor exercise regimes. Reminders, including stickers, calendars and diaries, have been shown to improve adherence with medication regimes [20]. Likewise in the present study, continued use of the sticky dots and/or posters at 12 months postpartum was significantly associated with continued adherence to pelvic

floor exercise regimes. The present intervention also incorporated individual tailoring and negotiating around convenient times for doing pelvic floor exercises, both strategies having been shown in previous studies to enhance adherence [21]. While they appear to have promoted *initial* adherence to pelvic floor exercise regimes for women participating in the present study, it is likely that ongoing tailoring and feedback is necessary to sustain *ongoing* adherence over the postpartum year.

This raises the question of the most appropriate 'access point' for ongoing reminders and encouragement for maintenance of the pelvic floor exercise regime to supplement or replace the 8-week physiotherapy visit proposed here. While mail reminders are a relatively inexpensive option, individual consultations with a health professional are preferable as they enable tailored feedback and support in the context of a per vaginum (PV) examination. Physiotherapists are acknowledged experts in the areas of female urinary incontinence and pelvic floor exercises and are trained in pelvic floor muscle assessment in the context of PV examination. In addition, continence-related advice and support given by physiotherapists is well received by postpartum women [3]. Likewise, obstetricians routinely perform PV examinations, placing them in a good position for providing feedback and support in the context of pelvic floor muscle assessment. However, neither physiotherapists nor obstetricians are routinely consulted by women throughout the postpartum year, thus reducing the viability of both options. In contrast, general practitioners (GPs) are consulted relatively often during the postpartum year [22] and are seen as a credible source for continence-related advice and support [1]. GPs therefore appear to be the most appropriate health professional for ongoing encouragement of pelvic floor exercises in terms of their availability to postpartum women. A survey has shown that nearly two thirds of GPs recommend routine examination of the perineum, vagina and pelvic floor at the 6-week check-up, providing an ideal opportunity for feedback and education. However, fewer than half the sample of GPs believed that physical issues including urine and bowel symptoms should be routinely discussed with postpartum women [22]. A targeted education campaign to inform GPs about the benefits of *ongoing* pelvic floor exercises could go some way to addressing any concerns GPs have in discussing such issues and assisting them to encourage ongoing adherence with exercise regimes. In addition, undergraduate medical programs need to teach pelvic floor muscle assessment as an integral part of PV examinations, as has been recently instigated at the University of Newcastle (NSW, Australia).

In addition to GPs, midwives are another potential access point for continence promotion education and support. While Australian midwives tend to be available to women only in the immediate postpartum, a recent UK initiative has trialed the provision of community-based midwife care in the first 3 months postpartum. The program, designed to identify and manage women's individual needs, was found to be acceptable and feasible within current UK service provision [23]. Such extended care by midwives could provide an opportunity for interventions to improve women's adherence with pelvic floor exercises. Again though, midwives need to be informed about the importance of ongoing, regular exercise for promoting continence and to be routinely trained in pelvic floor muscle assessment.

There are some potential limitations to this study, all of which have been noted previously [2]. First, the study response rate indicates that only 54.3% of women eligible for the study actually participated. However, as 79% of the women approached agreed to enter the study, bias due to non-consent was minimised. Second, as the sample was drawn from only three hospitals, the external validity of the study might have been compromised. Importantly though, the three hospitals served diverse population groups: urban public, urban private and rural. Third, women were not blind as to whether they were in the intervention or control groups. In an attempt to reduce social desirability bias, women were explicitly told that the study was not measuring their individual exercise practice in any punitive fashion, but rather whether the intervention helped them to remember to do their pelvic floor exercises.

There were also a number of strengths in this study. First, we used a randomised controlled design. Second, the sample size was sufficient to detect around 8% difference between groups as statistically significant. Third, the data were analysed as 'intention-to-treat'. Randomised controlled trials are highly idealised and do not mirror the 'real life' of clinical practice. As this study set out to examine how effectively exercise program adherence was sustained, the lack of exercise adherence by the women in this study gives a realistic outcome that mirrors the potential for pelvic floor exercise performance amongst postpartum women.

Conclusions and implications

The findings from this study have two important implications. First and most importantly, women's practice of pelvic floor exercises at 12 months postpartum appears to significantly reduce the odds of incontinence at that time. This finding underscores the importance for women of practising pelvic floor exercises throughout the postpartum year, not just in the early postpartum period.

Second, although the intervention did not promote continence at 12-months postpartum, it does appear to have encouraged the ongoing practice of pelvic floor exercises for many women in the intervention group. While both intervention and control groups showed attrition in pelvic floor exercise practice, adherence remained higher amongst women in the intervention group. However, the levels of adherence were not sufficient to sustain the intervention effect seen at 3 months. In order to encourage adherence at a level adequate enough to promote continence at 12 months post-

partum, we need to consider behavioural principles that will increase the likelihood that behaviour change will be sustained. Ideally, women need feedback and support in the context of pelvic floor muscle assessment by a health professional provided periodically throughout, and possibly beyond, the postpartum year.

References

1. Chiarelli P, Cockburn J (1999) The development of a physiotherapy continence promotion program using a customer focus. Aust J Physiother 45:111–120
2. Chiarelli P (1999) What the experts said: developing a post partum continence promotion program. Australian Continence Journal 5:41–42
3. Chiarelli P (2001) Female urinary incontinence in Australia: prevalence and prevention in postpartum women. Newcastle University, Newcastle, Australia, PhD thesis
4. Bo K, Talseth T (1994) 5 year follow up of pelvic floor muscle exercise for treatment of stress urinary incontinence. Neurourol Urodynam 13:374–376
5. Hahn I, Milsom I, Fall M, et al (1993) Long term results of pelvic floor training in female stress urinary incontinence. Br J Urol 72:421–427
6. Sampselle CM, Miller JM, Mims BL, et al (1998) Effect of pelvic muscle exercise on transient incontinence during pregnancy and after birth. Obstetrics & Gynecology 92:406–412
7. Meyer S, Hohlfeld P, Achtari C, et al (2001) Pelvic floor education after vaginal delivery. Obstetrics & Gynecology 97:673–677
8. Reilly ET, Freeman RM, Waterfield MR, et al (2002) Prevention of postpartum stress incontinence in primigravidae with increased bladder neck mobility: a randomised controlled trial of antenatal pelvic floor exercises. Br J Obstet Gynaecol 109:68–76
9. Chiarelli P, Cockburn J (2002) Promoting urinary continence in post partum women: a randomised controlled trial. BMJ 324:1241–1243
10. Viktrup L, Lose M, Rolff M, et al (1992) The symptom of stress incontinence caused by pregnancy or delivery in primiparas. Obstetrics and Gynaecology 79:945–949
11. Wilson PD, Herbison RM, Herbison GP (1996) Obstetric practice and the prevalence of urinary incontinence three months after delivery. Br J Obstet Gynaecol 103:154–161
12. Miller Y, Chiarelli P, Brown W (2004) Urinary incontinence across the lifespan. Neurourol Urodynam (in press)
13. Pocock SJ (1982) Statistical aspects of a clinical trial design. The Statistician 31:1–18
14. ICS (1976) First report on the standardisation of lower urinary tract function. Urinary incontinence. Procedures related to the evaluation of urine storage: cystometry, urethral closure pressures, units of measurement. British Journal Urology 48:39–42
15. Gunthorpe W (2000) The development of a GP-based treatment program for women with urinary incontinence. Neurology and Urodynamics 19:595–607
16. Chiarelli P, Campbell E (1997) Incontinence during pregnancy. Prevalence and opportunities for continence promotion. Aust N Z J Obstet Gynaecol 37:66–73
17. Sayer T (1994) Stress incontinence of urine: a connective tissue problem? Physiotherapy 80:143–144
18. Sayer T, Dixon J, Hosker G, et al (1990) A study of paraurethral connective tissue in women with stress incontinence of urine. Neurourol Urodynam 9:319–320
19. Cockburn J (2000) Patient education and strategies to improve compliance. In: Walls R, Jenkins C (eds) Understanding asthma. McLaren and Petty, Sydney
20. Rand CS, Wise RA (1993) Adherence with asthma therapy in the management of asthma. Review and Clinical guidelines. John Hopkins School of Medicine, Maryland
21. Wilson SR, Scamagas P, German DF, et al (1993) A controlled trial of self-management education for adults with asthma. Am J Med 94:564–567
22. Gunn J, Lumley J, Young D (1998) The role of the general practitioner in postnatal care: a survey from Australian general practice. Br J Gen Pract 48:1570–1574
23. MacArthur C, Winter HR, Bick DE, et al (2002) Effects of redesigned community postnatal care on women's health 4 months after birth: a cluster randomised controlled trial. Lancet 359:378–385

Editorial comment

This is an important study that adds to the understanding of the benefit of pelvic muscle training in the reduction of postpartum urinary incontinence. It converges with the findings of several other randomized controlled trials that also demonstrate the value of this behavioral intervention. Particularly important is the partial dose/response relationship showing the lowest odds ratio of risk of UI in women doing pelvic muscle training as well as a significantly reduced risk of UI at 12 months postpartum for women reporting practicing any pelvic muscle training at all. Also noteworthy is the finding that adherence aids such as reminder dots increased the likelihood of women in the treatment group practicing pelvic muscle training. This extends evidence of the value of reminder aids demonstrated in other adherence literature such as asthma self-care regimes to specific intervention for urinary incontinence. Providers should incorporate this information into routine postpartum education.