Persistent urinary incontinence and delivery mode history: a 6 year longitudinal study

Christine MacArthur*, Cathryn M A Glazenerb, P Don Wilsonc, Robert J Lancashirea, G Peter Herbisonc, Adrian M Grantb

a University of Birmingham, UK
b University of Abderdeen, UK
c University of Otago, New Zealand

*Professor Christine MacArthur
Department of Public Health and Epidemiology
University of Birmingham
Birmingham B15 2TT, UK
Tel: +44 (0)121 414 6770
Fax: +44 (0)121 414 7878
Email: C.MacArthur@bham.ac.uk

Short headline: Longitudinal study of urinary incontinence and delivery modes
Objective: To investigate the prevalence of persistent and long term postpartum urinary incontinence and associations with mode of first and subsequent delivery.

Setting: Maternity units in Aberdeen (Scotland), Birmingham (England) and Dunedin (New Zealand).

Design: Longitudinal study

Population: 4214 women who returned postal questionnaires 3 months and 6 years after the index birth.

Methods: Symptom data were obtained from both questionnaires and obstetric data from case-notes for the index birth and the second questionnaire for subsequent births. Logistic regression investigated the independent effects of mode of first delivery and delivery mode history.

Main outcome measures: Urinary incontinence – persistent (at 3 months and 6 years after index birth) and long-term (at 6 years after index birth).

Results: The prevalence of persistent urinary incontinence was 24%. Delivering exclusively by Caesarean section was associated with both less persistent (OR=0.46, 95% CI 0.32 to 0.68) and long term urinary incontinence (OR=0.50, 95% CI 0.40 to 0.63). Caesarean section birth in addition to vaginal delivery however was not associated with significantly less persistent incontinence (OR 0.93, 95%CI 0.67 to 1.29). There were no significant associations between persistent or long-term urinary incontinence and forceps or vacuum extraction delivery. Other significantly associated factors were increasing number of births and older maternal age.

Conclusions: The risk of persistent and long term urinary incontinence is significantly lower following Caesarean section deliveries but not if there is another vaginal birth. Even when delivering exclusively by Caesarean section, the prevalence of persistent symptoms (14%) is still high.
INTRODUCTION

Childbirth is well documented as a major risk factor for urinary incontinence. It has generally been considered that delivery by Caesarean section provides protection. Cross-sectional studies, based on both general population and postpartum samples,\textsuperscript{1-6} as well as pathophysiological studies\textsuperscript{7-10} have produced data to support this. However, there is little information on the prevalence of persistent postpartum urinary incontinence and the relationship between this and delivery history. Longitudinal studies of incontinence in postpartum populations have had only short follow up\textsuperscript{11,12} or were not large enough to examine the effects of delivery mode history.\textsuperscript{13,14}

We have recently shown that whilst forceps delivery was predictive of persistent symptoms of faecal incontinence, neither a first birth Caesarean section nor delivering exclusively by Caesarean section were associated with a reduction in these symptoms.\textsuperscript{15} The aim of this longitudinal study, which is based on the same population, was to examine the prevalence of persistent and long term urinary incontinence six years after birth and to consider the effect of mode of first and subsequent deliveries.

METHODS

All women who delivered during one year (1993/1994) in three maternity units, in Aberdeen (Scotland), Birmingham (England) and Dunedin (New Zealand), were sent a postal questionnaire at three months postpartum to assess prevalence of incontinence. These deliveries are referred to throughout as the ‘index births’. Those with urinary incontinence were invited to take part in a randomised controlled trial (RCT) of the effects of an intensive pelvic floor exercise programme (see later) and 28% agreed.\textsuperscript{16}
The questions to ascertain presence, effects and type of urinary incontinence are given in the appendix to the related paper published in this issue. The Hospital Anxiety and Depression (HAD) scale and a general health question, 'how are you feeling generally' were also included. The questionnaire was designed by the study team with the questions on incontinence in accordance with the International Continence Society definitions.

Six years after the index birth a second postal questionnaire ascertained later symptoms, using the same questioning. This questionnaire also obtained date and mode of all deliveries, which enabled mode and age of first birth to be determined for the women who had been multiparous at the index birth. Obstetric and maternal data relevant to the index birth was obtained from the hospital case-notes. Ethnic origin data was only available from Birmingham: since it is known that Dunedin and Aberdeen had almost no local south Asian population, women in these centres were classed as non-Asian. The initial study and follow-up were approved by ethics committees in all centres.

**Outcome measures**

The primary outcome of the study was persistent urinary incontinence, defined as any involuntary loss of urine at both three months and 6 years. Secondary outcomes were:

- long-term incontinence, defined as occurrence at 6 years irrespective of three month occurrence
- persistent stress incontinence, defined as stress incontinence occurring both at three months and 6 years.
Research questions

The research questions were whether mode of first delivery predicts persistent urinary incontinence and whether delivery mode history predicts both persistent and long-term urinary incontinence. The questions relating to delivery mode history were pre-specified based on the 3 month findings and asked about the effect of: delivering exclusively by Caesarean section; having Caesarean section and vaginal deliveries; and ever having any forceps delivery.

Statistical analysis

Multiple logistic regression was the main statistical analysis tool in assessing the independent effects of delivery mode on symptom outcomes. To investigate the effect of mode of first delivery the variables entered into the model were: mode of first delivery (spontaneous vaginal delivery (SVD)/forceps/vacuum/Caesarean section); maternal age at first birth (<25/25-29/30-34/35+); total number of births at follow-up (one/two/three/four or more); and south Asian ethnic origin (non-Asian/Asian). Detailed obstetric data were only available for the index births, and a second model restricted to primiparae at index birth examined additional obstetric variables as potential independent variables: onset of labour (not induced/induced); perineal trauma (intact/episiotomy/laceration); second stage labour duration (under 1 hour/1 hour or more); birthweight (quartiles); and pre-pregnancy body mass index (quartiles and no response category).

To examine delivery mode history a variable created from the reported birth histories categorised women based on all her deliveries into: Caesarean section birth(s) only; any forceps delivery; all other delivery histories. To further explore Caesarean section history another variable categorised all deliveries into Caesarean section birth(s) only; Caesarean section and vaginal deliveries; no Caesarean section deliveries (ie vaginal deliveries only).
RESULTS

10,989 women had been sent a questionnaire at three months postpartum and 7,879 had replied. Excluding subsequent known deaths, 7,872 questionnaires were sent at 6 years with 847 returned as undelivered by the Post Office. 4,214 were returned completed, a response rate of 54%. Mean duration since index birth was 5.97 years (SD=0.32) and for women who had been multiparous at index birth, mean duration from their first birth to follow-up was 10.9 years (SD 3.8).

Comparisons of the index birth case-note data for the respondents and non-respondents at 6 years showed that more non-respondents had been under 25 years (32% vs 18%, p<0.001) and more were Asian (10% vs 4.7%, p<0.001). Mode of index delivery of non-respondents was similar to respondents (SVD 70% vs 69%; Caesarean section 16% vs 16%; forceps 10% vs 10%; vacuum 3.8% vs 5.3%). The rate of urinary incontinence at three months was similar for respondents (33%) and non-respondents (34%).

Prevalence of persistent urinary incontinence

The prevalence of persistent urinary incontinence (at both 3 months and 6 years) was 24% (1010/4211 - 3 women did not answer). Table 1 shows the prevalence and ‘severity’ of urinary incontinence at each time and separately for primiparae at index birth. Point prevalence had increased from 33% (1390) at 3 months to 45% (1904) at 6 years. 9% (380) of the sample had symptoms at 3 months which had resolved by 6 years, whilst 21% (894) were non-symptomatic at 3 months but had become symptomatic at 6 years (Table 1). Among symptomatic women at 3 months, the proportion who still had symptoms at 6 years was 73% (1010/1390): this rate was similar among the index primiparae (71%,400/566). Among the women without symptoms at 3 months, symptoms at 6 years were reported by 33% (463/1396) of
those who had a subsequent birth(s) and 30% (431/1425) of those who did not. We
had information on the onset of urinary incontinence prior to first pregnancy only in
relation to the index pregnancy and 3.2% (63/1941) of these women reported pre-
pregnancy symptoms.

Severity and effects of persistent urinary incontinence

Persistent urinary incontinence at 6 years was reported daily or more often by 12%
(120/1010) of women, and a few time a week by a further 21% (208). 23% (231)
sometimes used a pad to protect against leakage and 11% (111) used one all day
and/or all night. 47% (477) reported an effect on hygiene, 16% (166) on home life,
35% (356) on social life, 21% (162/783 who worked) on work life, and 13% (120/915
with a partner) on sex life. Median VAS, assessing the overall extent of the problem
(higher=worse), was 25.0 with 22% (226) scoring 50 or more.

Persistent urinary incontinence was associated with more adverse general health:
7.1% (72/1010) with persistent symptoms said generally they were “not very well” or
“not at all well”, compared with only 3.8% (121/3201) of those without persistent
symptoms ( p<0.001). Mean HAD scores at 6 years were also significantly greater:
mean anxiety score was 6.6 in women with persistent urinary incontinence compared
with 5.5 (diff=1.1 95% CI 0.9 to 1.3, p<0.001); and mean depression scores were 6.3
and 5.3 respectively (diff=1.0, 95% CI 0.8 to 1.3, p<0.001).

Reported delivery histories

Data on the mode and dates of deliveries other than the index births were reported in
the follow-up questionnaires. The accuracy of these was examined by comparing
case-note data for the index birth and reported data for the same birth. This showed
98% of reported Caesarean sections and 98% of Spontaneous vaginal deliveries to
be consistent with case-notes, and 87% of forceps and 88% of vacuum extraction
births. The largest inaccuracies (though still small) were 17/220 vacuum extraction deliveries reported by women as forceps, and 17/445 forceps deliveries reported as SVD. Delivery dates showed similar high levels of consistency.

Mode of first delivery and persistent urinary incontinence

The logistic regression model of the effects of first delivery mode on persistent urinary incontinence showed this to be significantly less common in women who had a first Caesarean section delivery and no association for forceps or vacuum extraction delivery (Table 2). Older maternal age at first birth and increasing number of births both showed independent associations and there was no association for ethnic group. The subsequent histories and symptoms of the 671 women (see Table 2) whose first birth was by Caesarean section were further examined: 12/121 (9.9%) who had no further births experienced persistent urinary incontinence, as did 44/314 (14%) who only had further Caesarean section(s) (p=0.33) compared with 52/235 (22%) of those who had at least one subsequent vaginal delivery (p=0.007 and p=0.018 respectively).

The second logistic regression model restricted to primiparae at index birth showed that inclusion of the additional obstetric variables did not alter the associations with mode of first delivery, maternal age, number of births or ethnic group. Symptoms were less likely with a first delivery by Caesarean section (OR 0.36, 95% CI 0.25 to 0.53) and there were no associations with forceps (OR 1.00, 95% CI 0.75 to 1.35) or vacuum extraction (OR 1.11, 95% CI 0.77 to 1.61). None of the additional obstetric variables showed associations with persistent urinary incontinence. Only pre-pregnancy Body Mass Index was associated, with women in the heaviest quartile (BMI 25+) reporting more symptoms (OR 1.55, 95% CI 1.08 to 2.22).
Delivery mode history and persistent and long term urinary incontinence

Delivery mode history may be more important in affecting urinary incontinence risk than first delivery mode. By 6 year follow-up mean total births was 2.4, and mean time since last birth was 4.4 years. The association between persistent urinary incontinence and delivery mode history could only be examined in the sub-group of 2146 women (51%) who had had no further births since the index birth, showing that delivering exclusively by Caesarean section was associated with a reduced likelihood of persistent urinary incontinence and there was no association for any forceps deliveries. (Table 3). The model to further examine Caesarean section history (Table 4) found that relative to women who had only vaginal deliveries, a delivery history that included abdominal and vaginal deliveries was not associated with any less persistent urinary incontinence. Numbers were too small to separately specify the combinations of type of Caesarean section in the model. Among the 252 women who delivered exclusively by Caesarean section, 57 had only pre-labour Caesarean section(s), 7 (12%) of whom had persistent incontinence, compared with 10/105 (10%) who had only Caesarean section(s) during labour and 19/90 (21%) who had both types.

Since the three month symptoms could not relate to deliveries occurring after this, in investigating delivery mode history in the whole sample the outcome examined was ‘long-term’ (at 6 years irrespective of 3 month occurrence) rather than persistent urinary incontinence. This showed the same pattern of associations (Table 5).

Stress incontinence

72% (726/1010) of the women with persistent incontinence reported stress incontinence at both 3 months and 6 years. Incontinence with urgency was reported by 39% (391). The logistic regression analysis to examine the effects of first delivery
mode on persistent stress incontinence (comparable with Table 2) showed the same pattern of associations as for any incontinence: fewer symptoms with first delivery by Caesarean section (OR 0.53, 95% CI 0.41 to 0.70) and no associations for forceps (OR 0.99, 95% CI 0.81 to 1.21) or vacuum extraction (OR 1.02, 95% CI 0.72 to 1.43).

The same delivery mode history associations (comparable with Table 5) were also shown as for any incontinence: less long-term stress incontinence with exclusive Caesarean section deliveries (OR 0.51, 95% CI 0.40 to 0.64) and no association for any forceps delivery (OR 0.90, 95% CI 0.77 to 1.05).

**Randomised controlled trial participants**

516 women had been participants in our RCT of conservative treatment of urinary incontinence (263 in treatment arm), which found less urinary incontinence at 12 months postpartum relative to controls but no association at 6 years. All analyses in the present report were repeated excluding trial participants (not shown) and did not shown any differences in any of the delivery or maternal associations found for persistent or long term urinary incontinence.

**DISCUSSION**

This longitudinal study has shown that delivering exclusively by Caesarean section was associated with less persistent urinary incontinence, with about half the likelihood of symptoms. The association was not altered when those women who took part in the related treatment RCT were excluded and was consistent for ‘stress incontinence’ and for ‘severe’ symptoms (data not shown). We found no evidence of any association between persistent or long-term urinary incontinence and forceps or vacuum extraction delivery, but older maternal age and greater total number of births were associated with increased symptoms.

Our investigation of faecal incontinence in the same sample showed a completely different delivery mode history pattern: significantly more faecal incontinence with
any forceps delivery but no association for exclusive Caesarean section deliveries.

Maternal age and total births however, showed the same associations for faecal as
for urinary incontinence.\textsuperscript{15}

It has generally been assumed that Caesarean section delivery protects against
urinary incontinence and several studies, based on postpartum\textsuperscript{1,5,11,12,20} and general
populations\textsuperscript{2-4} have found this association. Pathophysiological studies have also
demonstrated less damage, although neurological function may be affected by
Caesarean section during labour.\textsuperscript{7-10} Our study comprised a longitudinal cohort
investigation of urinary incontinence in a postpartum population large enough to
examine the effect of delivery mode history. Viktrup et al\textsuperscript{13} followed 278 primiparae
to 5 years postpartum and found no statistically significant association between first
birth by Caesarean section and stress urinary incontinence at follow up, but noted
few Caesarean deliveries (18\%) in their sample. The large Norwegian community
study of urinary incontinence (EPINCONT) separately identified women who had
delivered exclusively by Caesarean section and found the (age-adjusted) point
prevalence of 16\% in this group (n=669) to be significantly lower than the 21\%
prevalence in the group (n= 11299) who only had vaginal deliveries.\textsuperscript{3}

We found no evidence of less urinary incontinence where the delivery history
included both Caesarean section and vaginal deliveries, consistent with two much
smaller studies.\textsuperscript{21,22} Among the women who delivered exclusively by Caesarean
section, our comparison of types of Caesarean section was based on smaller
numbers, but this did not seem to provide any indication of fewer symptoms from
exclusively delivering by pre-labour Caesarean section.

Most investigations have studied either any urinary incontinence or only stress
incontinence. Those that have separated type have generally found no association
between childbirth factors and urge incontinence.\textsuperscript{3,22} Our main analyses were any
incontinence, but the separate investigation of stress incontinence showed the same
pattern of associations as for any incontinence. Numbers with urge incontinence were too small to separately examine this group.

An independent association was found between persistent incontinence and increasing number of births. Other studies have found higher point prevalence associated with greater parity.\(^2\)\(^6\)\(^,\)\(^23\) We found older maternal age at first birth was also an independent predictor of persistent urinary incontinence, even after taking account of delivery mode history. An age association is consistent with other studies.\(^22\)\(^,\)\(^24\)\(^-\)\(^27\) We found no association between persistent incontinence and forceps, either for first or any delivery. This is consistent with most other studies, although two smaller studies did find a significant increase after forceps.\(^11\)\(^,\)\(^12\) Most other studies have examined point prevalence of incontinence rather than persistent symptoms based on longitudinal data.

Asian ethnic group was a predictor of faecal incontinence in this sample\(^15\)\(^,\)\(^28\) but there was no association for urinary incontinence. We found no other studies of postpartum incontinence in Asian women.

An important strength of this study was that it was a large longitudinal investigation. Nevertheless there was loss to follow-up over time: of the 10989 women who delivered and 7879 followed at 3 months, only 4214 were followed to 6 years. From the first questionnaire data however we know that the 6 year respondents had had a similar rate of urinary incontinence at 3 months to non-respondents. We had obstetric and maternal data on all index deliveries and the obstetric characteristics of respondents at 6 years were similar to non-respondents. More older women, more primiparæ and more Caucasian women responded on both occasions. These differences might affect symptom prevalence but it is more difficult to see how differences between responders and non-responders might affect obstetric associations.

The delivery history data relied on reports from the women, since hospital records were only available for the index births. Error in women’s recall of all their delivery
modes is possible, but for deliveries where we had data from both sources
discrepancies were small.

CONCLUSIONS

This study has shown that just under three-quarters of cases of urinary incontinence
occurring soon after a first birth persist to 6 years later. Delivery exclusively by
Caesarean section incurs about a halving in the odds of persistent urinary
incontinence but even among this group the prevalence of persistent incontinence,
was still relatively high, at 14%. A Caesarean delivery with other vaginal birth(s) was
not associated with fewer symptoms.

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