



Article

The relationship of placenta previa and history of induced abortion

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Abstract

Objectives: We evaluated the risk of placenta previa being associated with a history of induced abortion by different surgical procedures. *Methods:* Cases ($n=192$) were women who had a singleton delivery complicated by placenta previa at a major obstetric care hospital in western Washington state between April 1, 1990 and December 31, 1992. Controls ($n=622$) were women with singleton deliveries not complicated by placenta previa or abruption. Odds ratios, determined by logistic regression, approximate the relative risks. *Results:* Vacuum aspiration abortion was not associated with an increased risk of placenta previa (OR 0.9, 95% CI 0.6–1.5). However, the risk of placenta previa increased with the number of sharp curettage abortions (OR 2.9, 95% CI 1.0–8.5 for ≥ 3). *Conclusions:* Risk of placenta previa may be increased in a dose response fashion by multiple sharp curettage abortions. However, vacuum aspiration does not confer an increased risk, and may be a better alternative.

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Keywords: Placenta previa; Induced abortion; Dilation and curettage; Vacuum curettage

1. Introduction

Placenta previa (PP) complicates approximately one in every 200 births in the US. It typically is accompanied by voluminous third trimester bleeding and pre-term cesarean delivery [1–3]. Pre-term delivery resulting from PP is associated with increased rates of perinatal morbidity and mortality [1,4–6]. Although the maternal mortality due to blood loss found with this condition is rare in the presence of modern obstetric practices, PP confers

the potential for unexpected hemorrhaging that may become life-threatening in as little as 15 min [1,7].

It has been suggested that surgical abortion, such as those by vacuum aspiration (VA) or dilation and sharp curettage (D&C) may cause scarring and adhesions to the uterus, which then impede proper placentation in subsequent pregnancies [1]. The risk of PP in women with one or more prior induced abortions is reportedly 1.3–2.7 times that of women reporting no prior abortion [8–12]. Few studies, however, had sufficient power to examine the possible effect of multiple induced abortions. None have reported results

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related to analyses of different abortion procedures, which may differentially be associated with the occurrence of subsequent damage to the uterus. Early induced abortion by VA has been the most commonly used method for the last decade [13,14], but sharp curettage for induced abortion continues to be practiced in some settings in the US. We evaluated the association of PP with self-reported history of induced abortion, and examined the effects of multiple procedures and of type of abortion method used.

2. Materials and methods

All women whose pregnancies or deliveries were complicated by PP (ICD-9 codes 641.0 and 641.1) at the five major obstetric care hospitals in King County, Washington between April 1, 1990 and December 31, 1992 were identified as cases. This study was part of a larger study to evaluate risk factors for placental abnormalities (including placental abruption as well). Potential cases were excluded if the index pregnancy resulted in a multiple birth, was <20 weeks gestation, or if the infant birthweight was <500 g. Controls were selected from women with singleton births not complicated by either PP or abruptio placenta. They were frequency matched to cases on month, year, and hospital of delivery. They were also matched on weekday vs. weekend delivery to control for possible differences in diagnostic procedures utilized during these times. Permission to contact potential study subjects was requested from the patients' physicians. We identified 327 potential PP cases, of whom 41 were subsequently found to be ineligible because they did not meet study criteria. Of the remaining 286, permission from physicians for patient contact was not obtained for 35 women. After contact, 57 women refused to participate, two were lost to follow-up, and 192 (67%) were interviewed. Of the 1026 potential control subjects identified, 116 were found to be ineligible. Of the remaining 910, physician permission for contact was denied for 100, 183 women refused to participate, five were lost to follow-up, and 622 were interviewed (67%).

Approval for this study was granted from the institutional review boards for human subjects' protection of the participating hospitals prior to the conduct of the study. In-person interviews were conducted with the majority (97%) of participants; the remainder of the interviews were administered over the telephone. The structured interview included questions about lifestyle, demographics, and reproductive and medical histories. To obtain information about the number and type(s) of previous pregnancies a woman had had, the number of each type (miscarriage, ectopic/tubal pregnancy, induced abortion, stillbirth, single live birth, multiple live birth, and other) was specifically queried. Pregnancy information sheets were filled out for each of the previous pregnancies, which included information regarding: the outcome and date, length of gestation, presence of complications, and characteristics of the infant such as gender and birthweight. For pregnancies ending in induced abortion, information about the procedure (VA, D&C, or other method), gestational length, and presence of any complications was obtained. Since it was possible there would be confusion among the participants regarding the type of abortion procedure that had been used (since both VA and D&C may be referred to as 'dilation and curettage'), a list of procedures was included on the pregnancy information sheet, and VA was listed as the first method, so that women would be more likely to accurately report a 'Suction (Vacuum aspiration)' (wording used in questionnaire) abortion, rather than erroneously reporting a D&C.

To assess the risk of PP associated with a history of prior induced abortion, odds ratios (OR) and 95% confidence intervals (CI) were used to estimate relative risks. ORs were calculated using unconditional multivariate logistic regression. All calculations were performed using the STATA statistical package (Stata Corporation, College Station, TX). Factors that may have affected the occurrence of PP were evaluated for their potential effect on the relationships of interest, including: age at reference, the number of prior spontaneous abortions, parity, previous cesarean sections, previous dilation and curettage (for reasons other than induced abortion), previous PP, use of an intrauterine device (IUD), history of pelvic inflamma-

tory disease (PID), history of uterine fibroids, smoking habits, and race. Factors that altered the age-adjusted risk estimates by at least 10% were adjusted for in the final risk estimates, these included: age at reference, maternal smoking during the pregnancy, and parity. Analyses were completed both using the entire study population (Table 2), and excluding women without a previous pregnancy (Table 3), since women without a prior pregnancy could not have the exposure of interest, induced abortion.

3. Results

Cases were more likely than controls to be older than 30 years of age at the reference birth (64% vs. 52%; chi-squared P for difference in age distribution by case-control status = 0.01) (Table 1). Among women who had been pregnant prior to the index pregnancy, women with PP were somewhat more likely to have had a prior live birth; among parous women, cases were somewhat more likely to have had a prior cesarean section delivery. Cases were significantly more likely than controls to have used an IUD for contraception ($P=0.004$), and were more likely to have smoked after the first trimester of their index pregnancy (Fisher's Exact P for difference in smoking pattern during pregnancy = 0.005). There were no other significant differences for any variables by case-control status. Race and income did not substantially vary by case-control status, although the case group consisted of slightly more Asian women.

Having one or more prior abortions by any procedure (excluding infusion/induction) was not associated with a significantly increased risk of PP (OR 1.2, 95% CI 0.8–1.8) (Table 2). The risks of PP associated with 1, 2 or ≥ 3 prior abortions by any procedure were, respectively 1.0 (95% CI 0.7–1.6), 1.4 (95% CI 0.8–2.5) and 1.9 (95% CI 1.0–3.6) (Cochran–Armitage trend test, exact $P < 0.001$). Thirteen women had post-abortion infections (seven cases and six controls), and for these women, the OR of PP, was 3.6 (95% CI 1.1–11.5), compared with women who never had an abortion (data not shown).

Overall, having any prior VA abortions was not associated with an increased risk of PP (OR 0.9,

Table 1

Risk factors for placenta previa and their distribution, among women with a singleton delivery between 1990 and 1992 in western Washington state with and without placenta previa

Risk factor	Cases ($N=192$)		Controls ($N=622$)	
	<i>n</i>	%	<i>n</i>	%
Age at reference				
<20 years	8	4.2	29	4.7
20–29 years	61	31.8	271	43.6
30+ years	123	64.1	322	51.8
Had a prior spontaneous abortion ^a	63	39.1	160	34.6
Had a prior live birth ^a	126	78.3	329	71.1
Had a prior cesarean delivery ^b	36	28.6	89	27.1
Ever used an IUD	33	17.2	60	9.7
Ever had pelvic inflammatory disease	12	6.3	41	6.6
Ever had uterine fibroids	13	6.9	32	5.1
Had a prior dilation and curettage ^c	8	4.2	19	3.1
Smoking				
None while pregnant	138	73.8	500	80.9
1st trimester only	9	4.8	32	5.2
1st & 2nd trimesters	10	5.3	7	1.1
Entire pregnancy	30	16.0	74	12.0
Other pattern ^d	0	0	5	0.8
Race				
White	153	79.7	497	79.9
Black	8	4.2	34	5.5
Asian	24	12.5	55	8.9
Other	7	3.7	36	5.9
Household income				
<\$15,000/year	26	13.5	91	14.6
\$15,000 to <\$30,000	33	17.2	113	18.2
\$30,000 to <\$45,000	41	21.4	140	22.5
\$45,000 to <\$60,000	46	24.0	129	20.7
\$60,000 or more	46	24.0	147	23.6

^a Among women with prior pregnancy(ies).

^b Among women with prior delivery(ies).

^c Includes only D&Cs performed for purposes other than induced abortions.

^d Includes all smoking during pregnancy that was not classified in any of the previous categories (e.g. smoking only during the first and third trimesters); Fisher's Exact P -value.

95% CI 0.6–1.4), and there was not a significantly increased risk of PP associated with having 1 (OR 0.8, 95% CI 0.5–1.3), 2 (OR 1.0, 95% CI 0.5–2.2), or ≥ 3 prior VA abortions (OR 1.4, 95% CI 0.6–3.1) (Cochran–Armitage trend test, exact $P = 0.28$). A small number of women who had a VA abortion required a D&C immediately following the VA procedure (one case and 11 controls). Excluding these women from the analysis of VA

Table 2

Risk of placenta previa among women with a singleton delivery between 1990 and 1992 in western Washington state by number and type of prior induced abortions, relative to women who had no prior abortions

Abortion method	Cases (N=192)		Controls (N=621)		Multivariate model ^a	
	n	%	n	%	OR	(95% CI)
Any type ^b						
None	111	57.8	409	65.9	Ref.	
Any	81	42.2	212	34.1	1.2	(0.8–1.8)
1	40	20.8	135	21.7	1.0	(0.7–1.6)
2	20	10.4	49	7.9	1.4	(0.8–2.5)
3 or more	21	10.9	28	4.5	1.9	(1.0–3.6)
Vacuum aspiration ^{c,d}						
Any	46	23.9	151	24.3	0.9	(0.6–1.4)
1	23	12.0	96	15.4	0.8	(0.5–1.3)
2	11	5.7	34	5.5	1.0	(0.5–2.2)
3 or more	12	6.3	21	3.4	1.4	(0.6–3.1)
Dilation and curettage ^{c,d}						
Any	22	11.5	37	5.9	1.9	(1.0–3.4)
1	13	6.8	25	4.0	1.4	(0.8–2.6)
2	5	2.6	7	1.1	2.0	(1.0–4.0)
3 or more	4	2.1	5	0.8	2.8	(1.0–8.1)
Dilation and evacuation ^d						
1	1	0.5	4	0.7	0.7	(0.1–7.7)
Unknown methods						
1	9	4.7	15	2.4	1.9	(1.0–3.5)
2+	4	2.1	4	0.6	3.2	(1.0–10.1)
Infusion/induction methods ^d						
None	179	93.2	590	95.0		
1	0	0.0	12	1.9	–	–

^a Adjusted for age at reference, smoking during the pregnancy, and parity.

^b Surgical procedures only, women reporting unknown type(s) of procedure(s) are counted as surgical.

^c Also adjusted for history of abortions by vacuum aspiration or dilation and curettage.

^d Excludes women reporting one or more abortions of unknown method.

abortions did not have a substantial impact on the risk estimates of PP. After excluding these women, the risk estimates for having 1, 2, or ≥ 3 were 0.9 (95% CI 0.5–1.5), 1.1 (95% CI 0.5–2.4), and 1.7 (95% CI 0.7–3.9), respectively (data not shown). There was also little effect on the risk estimates for VA abortions when women who had also had another abortion(s) performed by D&C were excluded (three cases and two controls).

However, having any prior abortions by D&C was associated with a risk of 1.9 (95% CI 1.0–3.4). The risk of PP associated with having one prior D&C abortion was 1.4 (95% CI 0.8–2.6), the risk associated with two prior D&C abortions was 2.0 (95% CI 1.0–4.0), and the greatest risk (OR 2.8, 95% CI 1.0–8.1) was associated with having ≥ 3 prior D&C abortions (Cochran–Armi-

tage trend test, exact $P=0.01$). Excluding women who also had prior D&Cs for reasons other than pregnancy termination did not substantially change the estimates. Having had any prior abortions by other known methods (D&E or infusion/induction) was not associated with increased risks of PP.

When analyses were restricted to women who had at least one pregnancy prior to the index birth, the risk of PP associated with having had an abortion of any type was 1.2 (95% CI 0.8–1.8) relative to women who had never had an abortion (Table 3). The risk estimates that excluded nulligravid women generally followed the same pattern as the estimates within the entire cohort, although the magnitude of the estimates was attenuated. As before, VA abortion was not associated with risk

Table 3

Among women with a prior pregnancy, risk of placenta previa among women with a singleton delivery between 1990 and 1992 in western Washington state by number and type of prior induced abortions, relative to women who had no prior abortions

Abortion method	Cases (N=161)		Controls (N=462)		Multivariate model ^a	
	n	%	n	%	OR	(95% CI)
Any type ^b						
None	80	49.7	250	54.1	Ref.	
Any	81	50.3	212	45.9	1.2	(0.8–1.8)
1	40	24.8	135	29.2	1.0	(0.6–1.6)
2	20	12.4	49	10.6	1.3	(0.7–2.4)
3 or more	21	13.0	28	6.1	1.8	(0.9–3.5)
Vacuum aspiration ^{c,d}						
Any	46	28.6	151	32.7	0.9	(0.5–1.4)
1	23	14.3	96	20.8	0.7	(0.4–1.3)
2	11	6.8	34	7.3	1.0	(0.4–2.1)
3 or more	12	7.5	21	4.5	1.3	(0.6–2.9)
Dilation and curettage ^{c,d}						
Any	22	13.7	37	8.0	1.8	(0.9–3.3)
1	13	8.1	25	5.4	1.4	(0.7–2.6)
2	5	3.1	7	1.5	1.9	(0.9–3.8)
3 or more	4	2.5	5	1.1	2.6	(0.9–7.5)
Dilation and evacuation ^d						
1	1	0.6	4	0.9	0.8	(0.1–7.9)
Unknown methods						
1	8	5.0	11	2.4	2.1	(1.0–4.7)
2+	3	1.9	4	0.9	2.7	(0.7–10.3)

^a Adjusted for age at reference, smoking during the pregnancy, and parity.

^b Surgical procedures only, women reporting unknown type(s) of procedure(s) are counted as surgical.

^c Also adjusted for history of abortions by vacuum aspiration or dilation and curettage.

^d Excludes women reporting one or more abortions of unknown method.

of PP (OR 0.9, 95% CI 0.5–1.4). However, there was a suggestion of an increased risk of PP associated with having had 2 (OR 1.9, 95%CI 0.9–3.8), or ≥ 3 prior D&C abortions (OR 2.6, 95% CI 0.9–7.5). Using the Cochran–Armitage test, a significant trend in risk existed for any type abortion ($P=0.02$) and D&C abortion ($P=0.03$), but no trend was apparent for VA abortion ($P=0.75$).

4. Discussion

Although the occurrence of PP is relatively rare, serious adverse events are associated with its occurrence, including: maternal hemorrhage requiring blood transfusion [2,13], extended postpartum hospitalization, low birth weight (associated with premature delivery) [2,4], and increased need for hysterectomy following cesarean delivery

[2,3]. PP is also associated with increased perinatal morbidity (e.g. respiratory distress syndrome, low APGAR score, etc. [5,6]) and mortality [1,4]. More recently, Li, et al. reported that babies born of pregnancies complicated by PP or abruptio placenta were at 2.1 greater risk of sudden infant death syndrome (95% CI 1.3–3.1), compared with babies of uncomplicated pregnancies [15]. Given the serious nature of these associated events, it is important to identify women who may be at increased risk and thus may benefit from closer monitoring during their pregnancies.

Recent data from the US indicate that by age 45, 43% of women in the US will have had at least one abortion, and that two-thirds of women who elect to have pregnancy termination still intend to have children later in life [14]. Within our cohort, 42.2% of cases and 34.1% of controls had undergone elective abortion prior to the index

pregnancy. VA is generally thought to be safe and free of long-term sequelae. Thus, our findings of no increased risk of PP associated with this procedure is reassuring. Overall, we observed that having had a prior abortion by any procedure was not associated with a significantly increased risk of PP. However, our data suggest that having had multiple prior induced abortions, or an abortion that is complicated by infection may be associated with an increased risk of PP. Abortions performed by D&C also may be associated with an increased risk of PP, although in all estimates, our confidence intervals included one. Our results persisted when excluding nulligravid women from the analysis (a group whose inclusion could potentially lower the baseline risk of the reference group, women without a previous abortion).

Previous studies of the association of induced abortion and PP have reported conflicting results. Several controlled studies reported significantly increased risks of PP, with ORs ranging from 1.3 to 3.0, associated with a history of any induced abortions, and ORs ranging from 1.3 to 2.0 for two or more abortions, although the type of procedure performed was not evaluated [8–12]. However, both Rose et al. and Williams et al. reported no association of PP with prior induced abortion [16,17], but, in addition to limited power, the authors suggested that their observed lack of effect may be due to the use of suction curettage or VA, rather than sharp curettage, which would align their results with ours.

Past studies did not take into account the method of abortion, an important factor in our analysis. It is possible that D&C is more likely to cause damage or scarring of the uterus than VA, which is reflected in the suggestion of an increased risk of PP associated with D&C procedures in the current analysis. That multiple D&C abortions may be associated with even greater scarring (and subsequently greater risk of PP as suggested by our data) is also plausible. The theory of uterine scarring as the mechanism for the association of PP and induced abortion is supported by a previously reported dose-response association between cesarean section deliveries (a procedure that causes extensive uterine scarring) and PP occurrence [1,10,16,18].

Our analysis had several limitations, including the possibility of misclassification due to reporting bias. Since induced abortion is a sensitive issue, it is likely that we encountered under-reporting of the procedure, and it is also possible that women who have a pregnancy complication (such as PP) may be more likely to report previous induced abortions. However, it is unlikely that there would be a differential reporting bias by type of abortion procedure, which was the factor which we found to be an important modifier of risk in this analysis. Additionally, while it is unlikely that a woman would forget that she has had an induced abortion, she may forget details, such as the procedure(s) used, particularly after a long time. Although the questionnaire used in our study was designed to minimize these problems by eliciting details of each pregnancy, we did note instances where the length of gestation for the terminated pregnancy was inconsistent with the type of procedure reported. For example, three D&Cs and six VAs reportedly occurred after 14 weeks gestation; exclusion of these from their respective analyses, however, had no effect, nor did inclusion of these as D&E abortions (the more likely procedure for abortions performed after 14 weeks) alter the risk estimate for that procedure. It is unlikely that our results are biased by the exclusion of illegal abortions, since the majority of all of the participants' reproductive life was after 1973, when induced abortion was made legal by federal statute. It has been proposed that accuracy of self-reported abortion information may be improved by introducing abortion questions with a 'filter question,' similar to the approach we used for obtaining information on past pregnancies [19]. Despite these efforts, there was variability in the recall or reporting of prior abortions by cases and controls; 7% of cases had unknown type of abortions, compared with only 3% of controls ($P=0.02$).

The majority (73%) of induced abortions among study participants were performed by VA, which was the method used for more than 87% of all abortions performed in Washington state in 2000 [20]. Also, among the study participants, a significant number of D&C abortions were performed (23% of abortions reported; 7% of participants reported one or more D&C abortions), although it

is no longer a commonly used procedure for induced abortions in the US [20]. A small proportion of the women in the current study reported an abortion performed by D&E, which made it difficult to interpret results for this procedure, although no increased risk was observed.

In 1997, over 1.3 million induced abortions were performed in the US, and an estimated 46 million abortions are performed annually worldwide [14]. We observed no significant increase in PP risk associated with abortions being performed by VA, indicating the relatively safe nature of the procedure with respect to future reproductive outcomes. Other studies have shown the high level of peri-operative safety associated with suction curettage in performing abortions [21,22]. There is a suggestion that multiple induced abortions, particularly those performed by D&C, may be associated with an increased risk of PP. Because of this, pregnancies to women with a history of multiple such procedures may merit closer monitoring to help prevent adverse sequelae that may accompany this condition. It is important to consider that only 3% of abortions performed internationally occur in the US, and the implications of our findings may be greater for countries that continue to regularly use the D&C procedure to perform induced abortions (e.g. parts of Africa and South-east Asia [23,24]), particularly if there is limited ability manage post-abortion infections or PP complications.

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