Women's Health Care

Mukkannavar et al., 1:10
http://dx.doi.org/10.4172/scientificreports.480

Research Article Open Access

Pelvic Girdle Pain after Child Birth: The Impact of Mode of Delivery

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Abstract

Purpose: During pregnancy or postpartum period, several women experience some degree of pelvic girdle pain (PGP). In India, information is lacking about the prevalence and possible risk factors of PGP evaluated during postpartum period. This study aims to determine the prevalence of PGP in postpartum women who underwent vaginal or caesarean mode of delivery, and to estimate possible associated factors with or without PGP in both modes of deliveries.

Methods: In this cross-sectional study, 284 postpartum women answered questionnaires and underwent clinical examinations. Clinical examination included pain provocation tests for the pelvis, as well as the active straight leg raise (ASLR) test. Probable associated factors were studied, using non-parametric tests and logistic regression analysis.

Results: In this study of 234 women, 41% reported pain in the pelvic girdle during postpartum period. Overall, 33% of the women experienced PGP after caesarean delivery, as compared with 8.3% of women after vaginal delivery. Low back pain (LBP) before pregnancy, parity, active straight leg raise test score ≥ 4, bilateral P4 test, and sitting position during breast-feeding were significantly associated with vaginal delivery group and caesarean delivery group during postpartum period. In both modes of delivery, the association of PGP with these common factors remained after adjustment for other study factors.

Conclusion: The results show high prevalence of PGP in women who had caesarean delivery than those who had a vaginal delivery. The finding suggests that during postpartum period, LBP before pregnancy, parity, ASLR test score ≥4, bilateral P4 test, and sitting position during breast-feeding were significantly associated with increased risk of PGP in both vaginal and caesarean modes of deliveries, but further studies are needed for definitive conclusions.

Keywords: Pelvic girdle pain; Posture; Breast-feeding; Mode of delivery; Low back pain

Introduction

Recently, many studies have focused on musculoskeletal disorders such as low back pain (LBP) or pelvic girdle pain (PGP) during pregnancy, postpartum period, or several years after childbirth [1-3]. Studies suggest that PGP is a particular form of LBP. PGP can arise either alone, or concomitantly with LBP [2]. The common site of PGP is between the gluteal fold and the posterior iliac crest, especially close to the sacroiliac joints, and can promulgate to the posterior thigh. Pain can also occur in conjunction with, or exclusively in, the symphysis. This pain is often associated with reduced standing, walking and sitting activities [2,4]. The majority of symptoms related to PGP gradually disappear after delivery; however, some women may have persistent problems for years, after childbirth [5-7].

Regardless of socioeconomic factors, PGP is prevalent worldwide [8]. Majority of studies on PGP have been carried out in western [9-12], and non-western countries [13-16], indicating that PGP is a universal problem. Based on European guidelines, the point prevalence of women suffering from PGP is 20%. The prevalence of post-pregnancy PGP declines, although pain persists for 1 to 2 years in 8-10% of women [1,17,18]. This variation in PGP prevalence rate could be lack of consistency in definitions, methodological limitations such as lower statistical power or confounding factors, and small sample size [2,3].

Childbirth events such as caesarean sections or vaginal deliveries and experience of birth, may have a long-term impact on women's health [19]. Nowadays, greater attention is being paid to the causes and consequences associated with various methods of delivery. Women undergoing vaginal delivery are more likely to experience perineal pain [20], while women undergoing cesarean birth report increased tiredness, breast-feeding problems and backache [20]. A recent study found that mothers experiencing a caesarean section or vaginal delivery were most likely to report postpartum pain as a serious problem [21]. Furthermore, it was revealed that elective caesarean section was associated with an increased risk of persistent low back and pelvic pain after pregnancy [22]. On the contrary to the findings of previous studies, few contradictory results also have been published [15,23]. Earlier, several studies reported that postpartum PGP correlates with prepregnancy history of LBP, multipara, heavy workloads, and previous trauma to the pelvis [1,2,15,18,24-26]. There are conflicting reports related to influence of parity [3,14,15,26,27], age [3,14,15,26,27], use of epidural/spinal anesthetic and analgesic techniques [3,14,15,26], and heavy workload during pre-pregnancy [3,15,26,27]. Most of these previous studies published were based on self-reports, and without clinical assessments for PGP. Furthermore, these studies did not uniformly classify PGP during pregnancy and postpartum.

Despite several studies on PGP, relatively little research have been carried out to elucidate some of the possible impacts of risk factors and occurrence of PGP from childbirth, particularly in relation to the

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Received July 06, 2012; **Accepted** October 18, 2012; **Published** October 22, 2012

Citation: Mukkannavar P, Desai BR, Mohanty U, Parvatikar V, KarwaD, et al. (2012) Pelvic Girdle Pain after Child Birth: The Impact of Mode of Delivery. 1:480. doi:10.4172/scientificreports.480

mode of delivery. Therefore, it seems important to recognize associated factors of PGP in different modes of deliveries that could contribute to better understanding of the cause of this condition, during the postpartum period. Lack of knowledge of the various impacts of the mode of deliveries during postpartum period on women with PGP has led to this study. This study presents the results on the occurrence of pain in different locations of pelvic girdle in postpartum women, who underwent vaginal or caesarean mode of delivery. The study also assessed factors possibly associated with or without PGP in women, who underwent vaginal delivery or caesarean delivery mode.

Materials and Methods

In this cross-sectional study, postpartum women were recruited from the outpatient and inpatient departments of obstetrics and gynecology department (OBG) at SDM College of Medical Sciences and Hospital, Dharwad. The present study is a separate analysis of data collected from a cross-sectional study of PGP, following delivery. Postpartum women included in the study were interviewed and also examined within one year of giving birth. Women willing to participate were briefed about the study and their written consent was taken. The medical ethics committee of the SDM College of Medical Sciences and Hospital, Dharwad approved the study.

A total of 284 postpartum women who were registered in the department of OBG were recruited consecutively between September 2009 and December, 2010. The postpartum women were interviewed using a questionnaire and were physically evaluated by two physiotherapists. Both therapists were blinded for all questionnaire data. All 284 women gave their informed consent for participation (100% participation). Furthermore, all these participants completed questionnaires on general and medical history, pain location using a pain drawing, previous LBP and breast-feeding.

Inclusion and exclusion criteria

Women with and without PGP in postpartum period were recruited. Pelvic girdle pain was diagnosed based on following criteria:

1. Pain experienced distal to L5 and pain in the pelvic girdle region between the posterior iliac crest and the gluteal fold, with or without radiation in the posterior thigh and calf, and with and without pain in the symphysis [28].
2. Pain which is reproducible by at least two or more positive pelvic pain provocation tests (two tests bilaterally) [28,29].
3. Positive pelvic pain provocation test must reproduce a familiar pain in the woman, with regard to location and quality [28].

Women with a history of systemic locomotor system disease, spinal problems, spinal fractures, hip pathologies such as arthritis, generalized osteoporosis, history of neoplasm and gynecological problems were excluded.

Clinical examination

In accordance with previous studies, following tests were included: functional test, i.e. the ASLR test [30] and P4 test [31], the long dorsal sacroiliac ligament test in postpartum women [7], modified Trendelenburg's test [32], Patrick Faber's test [32], symphysis pubis palpation test [32], distraction test [33] and compression test [34]. All these tests have been commonly used and have shown good interrater reliability.

After clinical examination, pain locations were identified within the pelvic area from pain drawings. The pain locations in the pelvic area were subsequently classified normal (no pain), pain in single SI only, pain in both SI (double SI), pain in all three joints (severe pain) and pain in symphysis only (symphysiolysis). In addition, pelvic joint pain in all three locations was considered as PGP associated with severe pain.

Study factors

Each study group (vaginal delivery and caesarean delivery) was dichotomized into women with PGP and no PGP (without PGP). The following associated factors were included in the univariate analysis: age category (coded: <20 years, 21-25, 26-30, 30-35, 36-40 years), BMI defined as kg/m^2 (coded: normal weight (18.5-24.9), overweight (25.0-29.9), extreme overweight (≥30), parity (coded: 1 (primiparous), 2 (two previous delivery), 3 (three previous delivery), time since present delivery (coded: <4weeks, 5-8weeks, 9-12weeks, >12weeks), smoking (coded: non-smoker; smoker), LBP before pregnancy (coded: no; yes) and epidural analgesia (coded: no; yes). Furthermore, work load of postpartum women were identified by three levels of self-determined physical activity: 1) Moderate work load: activity requiring a minimal amount of standing, slow walking that do not cause sweating; 2) Heavy work load: activity that required continuous walking and carrying loads 2-5 kg (might cause light sweating); 3) Very heavy work load: jobs required brisk walking, carrying heavy loads (>5 kg) that caused heavy sweating.

In accordance to previous studies [35,36], an ASLR score '4' and above was considered as a positive test (coded: sum<4; sum≥4). P4 test score (coded: negative, unilateral positive, bilateral positive), and sum of pain provocation test (coded: 0-1, 2-3, 4-5, 6-8) were categorized. Moreover, factors such as breastfeeding pattern (coded: no; yes), minutes per feeding (coded: 1-10 mins, 11-20 mins, >20 mins), frequency of feeding in 24 hours, i.e. feeds per day (coded: <5times; >5times) and position of feeding (coded: supine/side-lying, sitting, both) were added.

Data analysis

Descriptive data are presented as frequencies, mean and standard deviation (SD). In each mode of deliveries (vaginal or caesarean delivery), all variables associated with PGP were compared in subjects, with or without PGP. Chi square test or Fisher's exact test was performed, when appropriate. For each mode of delivery, a logistic model was constructed in which the outcome variable was dichotomous with the presence or albescence of PGP during postpartum. Logistic regression analyses (forward stepwise method) were performed for factors statistically significant at $P<0.05$ level in Chi square test or Fisher's exact test. Initially, univariate analysis was carried out for each independent and dependent variable to compute crude estimates. Thereafter, significant independent variables were entered into forward stepwise logistic regression analysis. The final adjusted model included significant variables with an accepted statistical significance level of $p<0.05$. The forward stepwise logistic regression analysis was once again confirmed by backward stepwise logistic regression. All analyses were performed with SPSS version 16.0 (SPSS Inc., Chicago, IL).

Results

A total of 284 postpartum women (96 vaginal deliveries and 188 caesarean deliveries) who registered in the department of OBG were enrolled for the study. The participants were aged between 20 years and 38 years, with the mean age of 25 years (SD=3.9). Baseline characteristics

of all women and descriptive data for women with vaginal and caesarean deliveries are presented in tables 1-3, respectively. At the time of evaluation, in vaginal delivery group, 24 women were assigned to "PGP" group and 72 to "No PGP group". Likewise, in caesarean delivery group, 92 women were assigned to "PGP" group and 96 to "No PGP group".

In the present study, the prevalence of postpartum PGP in Indian women was 42%, of whom 10% reported severe pain in all three pelvic joints. There was a much higher rate of PGP during postpartum period (33.3%) in the caesarean group, than in the vaginal group (8.3%). In the caesarean group, 51% of women reported experiencing PGP after their surgery, with 12% describing the problem as severe. Furthermore, with 25% of women who had vaginal delivery reported PGP during postpartum and 5% indicating as a severe problem (Table 1).

Fifty-three percent of the women in this study were non-housewives. We noticed that all women belonged to non-smoking group, hence smoking was not considered for the final analysis. Among primiparous mothers in vaginal group (Table 2), 12% of women reported PGP, compared with 67% of women with 2 previous deliveries, and 21% of women with 3 or more previous deliveries. Similarly, among primiparous mothers in the caesarean group (Table 3), 49% of women reported PGP, compared with 36% of women with 2 previous deliveries, and 15% of women with 3 or more previous deliveries.

Overall, 133 women (53%) reported to have low back pain before pregnancy, with 88% and 57% describing the problem as major in the vaginal (Table 2) and caesarean groups (Table 3), respectively. At the time of examination, 42% of women who had a vaginal delivery reported experiencing PGP from their surgery in the first 5 to 8 weeks after the delivery (Table 2). Likewise, in the caesarean group, 44% women had complaints of PGP in the first 9-12 weeks of postpartum (Table 3).

Characteristics	All women		Vaginal delivery		Caesarean delivery	
	Percent (%)	Mean±SD	Percent (%)	Mean±SD	Percent (%)	Mean±SD
Age (Years)		25.0 ± 3.9		27.1 ± 3.9		25.7 ± 5.0
Body mass index (kg/m²)		25.5 ± 2.8		25.0 ± 2.8		25.2 ± 2.7
Education						
≤10th Std	22.5		18.8		24.5	
<Graduation	31.3		31.3		31.4	
Graduation	29.2		30.2		28.7	
Post Graduation	16.9		19.8		15.4	
Work Status						
Non Housewife	52.5		46.9		55.3	
Housewife	47.5		53.1		44.7	
LBP before pregnancy						
No	53.2		42.7		58.5	
Yes	46.8		57.3		41.5	
PGP in Joints						
No Pain	57.7		75.0		48.9	
Single SI	10.6		4.2		13.8	
Double SI	13.0		8.3		15.4	
All three	9.5		5.2		11.7	
Symphysiolysis	9.2		7.3		10.1	

Table 1: Baseline characteristics of 284 postpartum women.

Variables	No PGP		PGP		Total		χ2 Test	P Value
	n	(%)	n	(%)	n	(%)		
Age category								
<20	8	11.1	2	8.3	10	10.4	6.482	0.166
21-25	40	55.6	10	41.7	50	52.1		
26-30	17	23.6	7	29.1	24	25.0		
31-35	6	8.3	4	16.7	10	10.4		
36-40	1	1.4	1	4.2	2	2.1		
Epidural Analgesia								
No	29	40.3	8	33.3	37	38.5	0.366	0.63
Yes	43	59.7	16	66.7	59	61.5		
Parity								
1	47	65.3	3	12.5	50	52.1	32.5	0.000*
2	16	22.2	16	66.7	32	33.3		
≥3	9	12.5	5	20.8	14	14.6		
ASLR Test								
<4	72	100	2	8.3	74	77.1	85.6	0.000*
≥4	0	0	22	91.7	22	22.9		
P4 Test								
Negative	72	100	0	0	72	75.0	96.0	0.000*
Unilateral Positive	0	0	10	41.7	10	10.4		
Bilateral Positive	0	0	14	58.3	14	14.6		
Sum Of Pain Provocation Test								
0-1	37	51.4	0	0	37	38.5	43.8	0.000*
2-3	34	47.2	12	50.0	46	47.9		
4-5	1	1.4	11	45.8	12	12.5		
6-8	0	0	1	4.2	1	1.0		
BMI Classification								
Normal Weight	12	16.7	5	20.8	17	17.7	0.21	0.897
Overweight	57	79.2	18	75.0	75	78.1		
Extreme Overweight	3	4.2	1	4.2	4	4.2		
LBP Before Pregnancy								
No	38	52.8	3	12.5	41	42.7	11.93	0.001*
Yes	34	47.2	21	87.5	55	57.3		
Breast Feeding Pattern								
Partially	29	40.3	11	45.8	40	41.7	0.229	0.633
Exclusively	43	59.7	13	54.2	56	58.3		
Minutes Per Feeding								
1-10 Min	29	40.3	11	45.8	40	41.7	0.523	0.77
11-20 Min	30	41.7	8	33.3	38	39.6		
>20 Min	13	18.1	5	20.8	18	18.8		
Frequency Of Feeding In 24 Hrs								
(Feeds Per Day)								
<5times	9	12.5	4	16.7	13	13.5	0.267	0.605
>5times	63	87.5	20	83.3	83	86.5		
Position Of Feeding								
Supine/Side-lying	41	56.9	3	12.5	44	45.8	38.16	0.000*
Sitting	11	15.3	20	83.3	31	32.3		
Both	20	27.8	1	4.2	21	21.9		
Work Load								
Moderate	52	72.2	18	75.0	70	72.9	0.486	0.784
Heavy	7	9.7	3	12.5	10	10.4		
Very Heavy	13	18.1	3	12.5	16	16.7		
Time Since Present Delivery								
<4wks	12	16.7	4	16.7	16	16.7	2.48	0.479
5-8wks	24	33.3	10	41.7	34	35.4		
9-12wks	34	47.2	8	33.3	42	43.8		
>12wks	2	2.8	2	8.3	4	4.2		

*** Significant at 5% level (p<0.05)**

Table 2: Descriptive data and test for difference between PGP and no PGP among vaginal delivery women.

Variables	No PGP		PGP		Total		χ2 Test	P Value
	n	(%)	n	(%)	n	(%)		
Age category								
<20	8	8.7	8	8.3	16	8.5	0.082	0.99
21-25	46	50.0	50	52.1	96	51.1		
26-30	26	28.3	26	27.1	52	27.7		
31-35	10	10.9	10	10.4	20	10.6		
36-40	2	2.2	2	2.1	4	2.1		
Epidural Analgesia								
No	37	40.2	37	38.5	74	39.4	0.55	0.814
Yes	55	59.8	59	61.5	114	60.6		
Parity								
1	61	66.3	47	49.0	108	57.4	5.89	0.05*
2	21	22.8	35	36.5	56	29.8		
≥3	10	10.9	14	14.6	24	12.8		
ASLR Test								
<4	92	100	6	6.2	98	52.1	1.65	0.000*
≥4	0	0	90	93.8	90	47.9		
P4 Test								
Negative	92	100	6	6.3	98	52.1	1.65	0.000*
Unilateral Positive	0	0	30	31.3	30	16.0		
Bilateral Positive	0	0	60	62.5	60	31.9		
Sum Of Pain Provocation Test								
0-1	92	100	37	38.5	129	68.6	82.4	0.000*
2-3	0	0	46	47.9	46	24.5		
4-5	0	0	12	12.5	12	6.4		
6-8	0	0	1	1.0	1	0.5		
BMI Classification								
Normal Weight	15	16.3	17	17.7	32	17.0	0.067	0.96
Overweight	73	79.3	75	78.1	148	78.7		
Extreme Overweight	4	4.3	4	4.2	8	4.3		
LBP Before Pregnancy								
No	69	75.0	41	42.7	110	58.5	20.18	0.00*
Yes	23	25.0	55	57.3	78	41.5		
Breast Feeding Pattern								
Partially	39	42.4	40	41.7	79	42.0	0.01	0.92
Exclusively	53	57.6	56	58.3	109	58.0		
Minutes Per Feeding								
1-10 Min	39	42.4	40	41.7	79	42.0	0.059	0.971
11-20 Min	37	40.2	38	39.6	75	39.9		
>20 Min	16	17.4	18	18.8	34	18.1		
Frequency Of Feeding In 24 Hrs								
(Feeds Per Day)								
<5times	13	14.1	13	13.5	26	13.8	0.014	0.907
>5times	79	85.9	83	86.5	162	86.2		
Position Of Feeding								
Supine/Side-lying	43	46.7	19	19.8	62	33.0	29.13	0.000*
Sitting	28	30.4	67	69.8	95	50.5		
Both	21	22.8	10	10.4	31	16.5		
Work Load								
Moderate	67	72.8	70	72.9	137	72.9	0.013	0.994
Heavy	10	10.9	10	10.4	20	10.6		
Very Heavy	15	16.3	16	16.7	31	16.5		
Time Since Present Delivery								
<4wks	15	16.3	16	16.7	31	16.5	0.11	0.96
5-8wks	33	35.9	34	35.4	67	35.6		
9-12wks	40	43.5	42	43.8	82	43.6		
>12wks	4	4.3	4	4.2	8	4.3		

* Significant at 5% level (p<0.05)

Table 3: Descriptive data and test for difference between PGP and no PGP among caesarean delivery women.

In addition, while breast-feeding, women experiencing vaginal delivery reported high percentage (83%) of PGP, while in a sitting position than in supine/side-lying (13%) or both positions (4%) (Table 2). Similarly, women delivered by caesarean section reported greater rate of PGP in sitting position (70%), than in supine/side-lying (20%) or both positions (10%) (Table 3).

In the present study, the sum of score of ASLR ranged from 0 to 10. In the caesarean delivery group, 94% women with PGP had reported an ASLR score of 4 or higher, during the postpartum period (Table 3), whereas in the vaginal delivery group 92% had reported an ASLR score of ≥4 (Table 2). At the time of examination, 59% women who were having PGP in the vaginal delivery group reported positive bilateral P4 test, and 42% reported positive unilateral P4 test (Table 2). Interestingly, in the caesarean group of women with PGP noted lower rates on P4 test (31% unilateral and 63% Bilateral) (Table 3).

Overall, in the vaginal delivery group, women with PGP differed significantly from without PGP (Table 2), in terms of LBP before pregnancy (P<0.001), parity (P<0.000), ASLR category (P<0.000), P4 test (p<0.000), sum of pain provocation test (p<0.000) and position of feeding (P<0.000). Similarly, we noticed that, women who were having PGP in the caesarean group differed significantly from women without PGP group (Table 3), in terms of LBP before pregnancy (P<0.00), parity (P<0.05), ASLR category (P<0.000), P4 test (p<0.000), sum of pain provocation test (p<0.000) and position of feeding (P<0.000). Age, epidural analgesia, BMI, breast-feeding pattern, minutes per feeding, frequency per feeding, work load and time, since present delivery was not different between women who were having PGP and women without PGP in the vaginal delivery group (Table 2), or the caesarean delivery group (Table 3).

Table 4 displays the crude and adjusted ORs with 95% CIs for PGP among women delivered by vaginal delivery. After adjustment for the other factors (Table 4), only five factors were associated with increased risk of PGP were

(1) LBP before pregnancy (adjusted OR, 1.7; 95% CI, 1.4-2.6)

(2) Sitting position during feeding (adjusted OR, 1.6; 95% CI, 1.1-4.3)

(3) ASLR test score ≥ 4 (adjusted OR, 2.0; 95% CI, 1.8-3.4)

(4) Bilateral P4 test (adjusted OR, 1.6; 95% CI, 1.1-3.0)

(5) Parity (2 previous delivery adjusted OR, 1.2; 95% CI, 0.6-2.1 and 3 or more previous delivery adjusted OR, 1.6; 95% CI, 1.1-2.6).

A stepwise logistic regression model demonstrated that other factors were not associated with PGP in the vaginal delivery group (P>0.05).

Similarly, in the caesarean group of women (Table 5), the logistic regression analysis showed that

(1) LBP before pregnancy (adjusted OR, 2.8; 95% CI, 1.5-4.1)

(2) Sitting position during feeding (adjusted OR, 1.8; 95% CI, 1.2-5.6)

(3) ASLR test score ≥4 (adjusted OR, 2.3; 95% CI, 1.2-3.5)

(4) Bilateral P4 test (adjusted OR, 1.7; 95% CI, 1.1-6.2)

(5) Parity (2 previous delivery adjusted OR, 1.4; 95% CI, 1.0-2.3 and 3 or more previous delivery adjusted OR, 1.1; 95% CI, 0.7-2.6) were associated with increased risk of PGP during

	Dependent Variable: PGP and No PGP					
Independent variables	**Crude Odds Ratios**	**95% CI**	**P Value**	**Adjusted Odds Ratios**	**95% CI**	**P Value**
Parity						
1	1.0[a]			1.0[a]		
2	1.5	1.2-1.9	0.02*	1.2	0.6-2.1	0.01*
≥3	1.7	1.4-2.3	0.02*	1.6	1.1-2.6	0.01*
ASLR Test						
<4	1.0[a]			1.0[a]		
≥4	2.3	1.1-4.6	0.03*	2.0	1.8-3.4	0.001*
P4 Test						
Negative	1.0[a]			1.0[a]		
Unilateral Positive	2.0	1.7-2.3	0.01*	1.2	0.6-2.1	0.23
Bilateral Positive	1.7	1.3-2.1	0.01*	1.6	1.0-3.7	0.001*
Sum Of Pain Provocation Test						
0-1	1.0[a]			1.0[a]		
2-3	2.3	1.8-3.3	0.03*	1.0	0.8-3.5	0.28
4-5	2.1	1.7-2.6	0.02*	1.7	0.9-4.2	0.74
6-8	1.8	1.3-2.5	0.02*	1.4	0.5-2.9	0.33
LBP Before Pregnancy						
No	1.0[a]			1.0[a]		
Yes	1.9	1.1-3.0	0.01*	1.7	1.4-2.6	0.001*
Position Of Feeding						
Supine/Side-lying	1.0[a]			1.0[a]		
Sitting	1.9	1.3-2.8	0.00*	1.6	1.1-4.3	0.001*
Both	1.6	1.1-2.3	0.02*	1.1	0.7-2.2	0.81

The adjusted odds ratios are adjusted for all the other independent variables presented in the table.
[a] Reference category; * Statistically significant at .05 level

Table 4: Crude and adjusted odds ratios with 95% confidence intervals (CI) for PGP among vaginal delivery women.

postpartum period. Furthermore, a stepwise logistic regression model demonstrated that other factors were not significant predictors of PGP in the caesarean delivery group (P>0.05).

Discussion

In this study of 284 women, 41% of the women reported pain in the pelvic girdle during postpartum period, with 10% describing the problem as severe in all three pelvic joints. The reported prevalence of PGP in our study was higher than in previous studies [1,2,9,37]. Overall, 33% of the women experienced PGP after caesarean delivery, as compared with 8.3% of vaginal delivery group. Furthermore, there was a much higher rate of severity of PGP in the caesarean group (12%) compared to the vaginal group (5%). In comparison to earlier studies, the results revealed that the prevalence of PGP in women undergoing caesarean delivery was much higher [22,38]. In a study by Mogren [22], it was found that 3.6% experienced low back and pelvic pain (LBPP) after vaginal delivery and 6% had recurrent LBPP and 8% experienced continuous LBPP. Furthermore, 4% experienced LBPP after caesarean section, 6% had recurrent LBPP and 7% experienced continuous LBPP. More recently, it was revealed that within one year after delivery, 20% of women reported pain after caesarean delivery, as compared to 17% after vaginal delivery [38]. As compared to this study, the results showed lower percentage of pain in women who underwent vaginal delivery. In addition, it was observed that in vaginal group, 12% of primiparous women reported PGP, compared with 67% of women with 2 previous deliveries, and 21% of women with 3 or more previous deliveries. Similarly, in caesarean group, 49% of primiparous women reported PGP, compared with 36% of women with 2 previous deliveries, and 15% of women with 3 or more previous deliveries. However, this has not been previously reported in the literature. Most of these previous studies were based on self reports, but diagnoses to identify PGP pain was not confirmed by clinical examination. Moreover, in these studies back pain and pelvic pain were considered as one condition. According to current guidelines [2], it has been clear that PGP and LBP are two different conditions that require different treatment strategies [39]. In the study, all postpartum women were clinically examined, regardless of having PGP pain or not. This helped to compare the findings of PGP and without PGP in postpartum women, and also to detect and explore test results of both the groups.

Earlier, a large number of studies have focused on risks and benefits of the mode of delivery [40]. According to previous literature, women who had a caesarean delivery experienced greater short and long-term morbidity, than their counterparts who had a vaginal delivery [41]. Based on these facts, when interpreting studies of the impact of cesarean delivery, one needs to consider that it may not be appropriate to compare women who delivered by cesarean, with those who delivered vaginally. Therefore in the study, the possible associated factors and occurrence of PGP were analyzed, particularly in relation to vaginal delivery, and as well as caesarean mode of delivery. To the author's knowledge, this is the first time that PGP in different modes of deliveries and its associated factors has been investigated in this study context.

The main results from this study were LBP before pregnancy, parity; ASLR test score ≥4, bilateral P4 test and sitting position during breast-feeding were significantly associated with vaginal delivery group and caesarean delivery group during postpartum period. In both modes of delivery, the association of these common factors with PGP remained after adjustment for other study factors. Interestingly, other factors had any predictive power with neither vaginal delivery nor caesarean delivery. These associations have not yet been described in women with PGP, who underwent vaginal or caesarean mode of

	Dependent Variable: PGP and No PGP					
Independent variables	**Crude Odds Ratios**	**95% CI**	**P Value**	**Adjusted Odds Ratios**	**95% CI**	**P Value**
Parity						
1	1.0[a]			1.0[a]		
2	1.7	1.1-2.5	0.02*	1.4	1.0-2.3	0.001*
≥3	1.5	0.9-2.4	0.01*	1.1	0.7-2.6	0.01*
ASLR Test						
<4	1.0[a]			1.0[a]		
≥4	3.4	1.2-5.4	0.00*	2.3	1.2-3.5	0.001*
P4 Test						
Negative	1.0[a]			1.0[a]		
Unilateral Positive	3.1	2.2-4.3	0.01*	1.7	1.1-6.2	0.15
Bilateral Positive	3.4	1.3-5.0	0.01*	2.5	1.3-4.3	0.001*
Sum Of Pain Provocation Test						
0-1	1.0[a]			1.0[a]		
2-3	3.4	1.7-4.9	0.04*	1.4	0.6-2.4	0.33
4-5	3.7	1.8-5.8	0.03*	1.7	0.5-3.0	0.43
6-8	3.2	1.6-6.6	0.01*	1.4	0.8-2.5	0.94
LBP Before Pregnancy						
No	1.0[a]			1.0[a]		
Yes	3.1	1.4-5.2	0.00*	2.8	1.5-4.1	0.001*
Position Of Feeding						
Supine/Side-lying	1.0[a]			1.0[a]		
Sitting	4.2	2.1-6.8	0.00*	1.8	1.2-5.6	0.001*
Both	2.0	1.3-4.4	0.01*	1.2	0.5-5.7	0.32

The adjusted odds ratios are adjusted for all the other independent variables presented in the table.
[a] Reference category; * Statistically significant at .05 level

Table 5: Crude and adjusted odds ratios with 95% confidence intervals (CI) for PGP among caesarean delivery women.

delivery. Furthermore, the associated factors identified in this study differ from those that have been reported before [2,42].

Overall, 47% of all women reported LBP prior to pregnancy, 58% reported LBP after vaginal delivery and 42% reported LBP after caesarean delivery. Furthermore, in both modes of deliveries, low back pain in the year preceding pregnancy was associated with PGP. This result is consistent with previous studies that reported increased risk of developing PGP with previous history of LBP [2,9,43]. In addition to LBP, parity factor was associated significantly with PGP in both the groups. Our results related to parity are consistent with previous studies [9,27,43,44]. According to a few authors, hormonal changes induce structural changes in pelvic joints after pregnancy [45-47]. Such changes could induce pain in both primiparous and multiparous women. Hence, pain that is associated with previous pregnancy or delivery may increase sensitivity to pain in the pelvic joints in a subsequent pregnancy [48,49].

Moreover, the results are consistent with one previous study that reported increased risk of developing PGP with ASLR test [36], but inconsistent with other studies [50,51]. Previously, it has been suggested that disease severity in postpartum PGP patients can be assessed using ASLR test [52]. Furthermore, it was concluded that there is an association between the ASLR test and mobility in the pelvic joints by neuromuscular activation pattern [53], but the evidence for these association is very weak. It can be hypothesized that in both modes of deliveries, PGP subjects having an ASLR score ≥4 are successful in compensating pelvic instability and impairment of motor control by enhanced activity of the surrounding muscles. In concurrence with results of others [30,50-52], the study revealed that bilateral P4 test was related to PGP in both modes of deliveries. Bilateral P4 test reveals a familiar pain, distinctly located deep in the gluteal area [31,54]. Furthermore, subclinical afflictions can be detected with these tests. Hence, these tests can be used in early identification of those patients at risk for severe conditions.

Interestingly, the data revealed that breast-feeding pattern, minutes per feeding, frequency of feeding and position of feeding was associated with PGP in both groups. However, in the final adjusted model, breast-feeding in a sitting position came out as statistically significant factor in both modes of deliveries. Till date, these associations have not yet been described in PGP literature. Although, breast-feeding is almost universal to our knowledge, only one study has been found which investigated breast feeding as a risk factor of PGP during postpartum [55]. The major finding of this study was that continuous breast -feeding and prolonged time of breast feeding were positively associated with persistent low back and pelvic pain, six months after delivery. However, Mogren [55] was limited to recall bias of PGP symptoms, and PGP was not confirmed by clinical examinations.

The association of breast-feeding in a sitting position and PGP during postpartum period appears to be an interesting problem. We hypothesize that this provocation of pain while sitting may partly be explained by an increased sensitivity to direct pressure, or tension on tender structures in the gluteal region and sacroiliac joints. Moreover, persisting kinetic disorders after childbirth might influence pain occurrence in the spine and pelvis [56].

This study has several limitations. One of the limitations is that this is a cross-sectional study of Indian postpartum women, and included a small sample of postpartum women from only one hospital, which may affect representativeness. Furthermore, all postpartum women were included within one year of childbirth. The study did not test the reliability and validity of the three levels of self-determined physical

activity, or work load of the postpartum women**.** Another limitation in our study is that without pain scale, self-reports of PGP may have influenced the estimated occurrence of severity of pelvic girdle pain. A few study factors in the study were not identified as predictors in the final stepwise logistic regression analysis. The results may underestimate the importance of these factors in Indian women.

Even though most women recover from PGP after delivery, specific postpartum factors are likely to be linked to the cause. The association of parity, previous LBP and breast-feeding position with PGP supports such a hypothesis. The results suggest that the impact of caesarean delivery on PGP may become more obvious, as caesarean rates increase worldwide. Therefore, the identification of the associated factors in the present study opens up new possibilities for the treatment and prevention of PGP.

Conclusion

The results of the present study identified a high prevalence of PGP in women who had caesarean delivery, than those who had a vaginal delivery. The severity of PGP in postpartum women was higher in the caesarean section group, than in the vaginal delivery group. The finding suggests that during postpartum period LBP before pregnancy, parity, ASLR test score ≥4, bilateral P4 test and sitting position during breast-feeding were significantly associated with increased risk of PGP, in both vaginal mode and caesarean mode of delivery, but further studies are needed before definitive conclusions may be drawn.

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