
Hip, Knee, and Foot Pain During Pregnancy and the Postpartum Period

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Background. Although much has been written about low back pain during pregnancy, there are few studies regarding leg, foot, and hip pain. The purpose of this study was to investigate the prevalence and characterize the nature of lower extremity pain in women of childbearing age and to assess the impact of recent pregnancy on these symptoms.

Methods. In this case-control study, 107 consecutive postpartum women (case subjects) and 91 nulliparous women (controls) completed a questionnaire regarding hip, knee, and foot pain and potentially influencing factors.

Results. Postpartum subjects had more symptoms of leg and foot pain than did the controls (56% vs 37%; odds ratio [OR]=2.3; 95% confidence interval [CI], 1.2 to 4.7). A significant majority of pain (82%, $P<.05$) began during the second and third trimesters. Postpartum subjects also had a significantly higher prevalence of hip pain (38% vs 23%; OR=3.2; 95% CI, 1.4 to 7.0) and

foot pain (31% vs 22%; OR=2.2; CI, 1.1 to 4.5). History of previous pain complaints also were found to be risk factors for lower extremity pain during pregnancy for case subjects and in the past year for controls. There was a trend toward older age as a risk factor as well. Multiple pain complaints were more common among case subjects than among controls.

Conclusions. Lower extremity pain is common in women of childbearing age. Pregnant and postpartum women are more likely to develop new lower extremity symptoms than are nulliparous women. The timing of symptom onset in mid- to late pregnancy may suggest that biomechanical factors play a larger role than hormonal influences. Regular exercise appears to be neither protective against nor a risk factor for lower extremity pain during pregnancy.

Key words. Musculoskeletal, pregnancy, lower extremity, prevalence. (*J Fam Pract* 1996; 43:63-68)

Although back pain is widely recognized as a common musculoskeletal concomitant of pregnancy and much has been written on the subject, little attention has been given to lower extremity pain in pregnant women. A few specific syndromes have been highlighted, including transient osteoporosis of the hip¹⁻¹⁰ and osteonecrosis¹¹⁻¹³ and aseptic necrosis¹⁴⁻¹⁸ of the femoral head during pregnancy. With these exceptions, we know of no reports in the

English language on hip, knee, or foot pain in this patient population.

Hormonal and biochemical changes that occur during pregnancy would be expected to contribute to musculoskeletal dysfunctions, such as trochanteric bursitis, patellofemoral syndrome, and plantar fasciitis. The primary effector of hormonally mediated change is relaxin, which is produced by the corpus luteum, decidua, and chorion.¹⁹ This hormone, which has been widely studied, is thought to exert its influence by means of three mechanisms: activation of the collagenolytic system; alteration of the ground substance of connective tissue by increasing the water content and thus decreasing the viscosity; and regulation of new collagen formation by activating fibroblasts. The net

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result is a remodeling of connective tissue thought to be necessary to accommodate delivery of the infant.¹⁹

Although the effect of relaxin has been noted primarily in the sacroiliac region, ligamentous laxity with relaxation of peripheral joints also has been demonstrated during pregnancy.²⁰ Biomechanical factors associated with pregnancy and the postpartum period that could contribute to lower extremity musculoskeletal dysfunction include change in the center of gravity, changes in gait pattern, weight gain, an increase in the amount of time spent in the sidelying position, and increased lower extremity demand related to infant care.

Because the net effect of the hormonal and anatomical changes of pregnancy appear biomechanically disadvantageous to the lower extremity, we hypothesized that there is a higher prevalence of lower extremity pain in pregnant and recently pregnant women than in nonpregnant controls. This study characterized the location and aggravating and alleviating factors of lower extremity pain and examined potential confounding and influencing factors such as history of previous joint pain, baseline weight, change in weight, number of stairs in the home, and frequency and intensity of exercise. Given the almost total lack of data on the topic, a retrospective and observational study was performed to assess the prevalence and nature of lower extremity symptomatology in recently pregnant women and in control subjects who had never been pregnant.

Methods

A questionnaire was distributed in the waiting room of an obstetrics and gynecology clinic of a tertiary care medical center in the midwestern United States. One hundred nine consecutive women who presented for their 6-week postpartum check (case subjects) and 91 consecutive nulliparous women seen in the same clinic for either gynecologic care or reasons related to infertility were asked to fill out a questionnaire. Those who agreed to participate completed the questionnaire without assistance. The questionnaire solicited information about hip, knee, or foot pain since the onset of pregnancy (case subjects) or in the previous 10 months (control group), including the onset and duration of pain. Subjects were also asked to select from a list of choices the location of the pain, aggravating factors, and alleviating factors, and to supply information regarding previous history of pain or surgery in those joints, the number of stairs in their home, the number of times they estimate that they go up and down the stairs each day, and any forms of exercise they do on a regular basis. Regular exercise was defined as any athletic activity performed for at least 20 minutes three or more

times per week. Each subject was asked to record her current weight and height. Additionally, the recently pregnant women were asked their baseline prepregnancy weight and their maximum weight during pregnancy.

Of the 109 postpartum women surveyed, two did not complete the questionnaire and were therefore eliminated from the study. The remainder of cases (98% of the original group) and controls (100%) were included in data analysis. Power analysis determined that this number of cases and controls could determine a difference between groups that would yield an odds ratio (OR) of approximately 2 to 2.5 with a confidence level (CI) of 95% and a β value of .8. These values were considered clinically significant for this pilot study.

Analysis was carried out using contingency tables to examine differences between the groups. Stepwise multiple linear regression was performed to determine significant risk factors for lower extremity pain in any one of the three areas, in multiple areas, or in each individual area. Variables that had significant missing data and were not found to be significant risk factors on initial analyses were excluded from the final analysis. Regression analysis was also done on the case group to examine specific risk factors related to pregnancy. Epi Info²¹ and STRATA²² software was utilized for analysis.

Results

The average age of the recently pregnant women was 29.2 (standard deviation [SD] 5.7), with a range of 17 to 42. The average age of the nulliparous women was 31.6 (SD 5.7), with a range of 19 to 43 years. This difference in average age of 2.4 years was statistically significant ($P < .004$). While the frequency of previous hip and foot pain was the same for the two groups, the nulliparous women had a significantly higher prevalence of knee pain prior to this study ($P = .03$). Five patients, all from the control group, had a history of knee surgery. The pain lasted between 2 weeks and several months in all but two control patients, who reported significant knee pain that had lasted only a few days.

The recently pregnant women were not significantly different from the controls with respect to height, weight (pregnancy weight of case subjects vs current weight of controls), number of stairs in the home, and participation in regular exercise. Among the recently pregnant group of women, those with and without pain were not significantly different with respect to baseline weight, highest weight, change in weight, participation in exercise, number of stairs in the home, and frequency of stair climbing.

As shown in Table 1, pain throughout the lower extremity was common in both groups, with almost two

Table 1. Prevalence of Lower Extremity Pain

Area of Pain	Postpartum Subjects n (%) (n=107)	Nulliparous Controls n (%) (n=91)
Any or more than one of the three areas	71 (66)	54 (59)
Hip*	41 (38)	21 (23)
Knee*	24 (22)	37 (41)
Foot*	33 (31)	20 (22)
Multiple areas	24 (22)	16 (18)

*Patients reporting pain in this area may have also had pain in one or more other areas.

thirds of women experiencing pain in at least one joint (66% of cases, 59% of controls). Women who were recently pregnant were more likely to have had pain during their pregnancy or shortly afterward than the control group (OR=2.3; 95% CI, 1.2 to 4.7). Older patients and patients with previous knee and hip pain were at higher risk in both groups, although the CI for age approached 1.0, suggesting a trend rather than significance (Table 2). Multiple areas of pain were present in about one third of the women (34% of cases, 30% of controls; $P=.07$). Among postpartum women who reported lower extremity pain, a significant majority (82%, $P<.05$) noted the onset during the second and third trimester (Figure).

The hip was the most commonly affected area, with 38% of the case subjects and 23% of the controls reporting hip pain. Recently pregnant women had a significantly

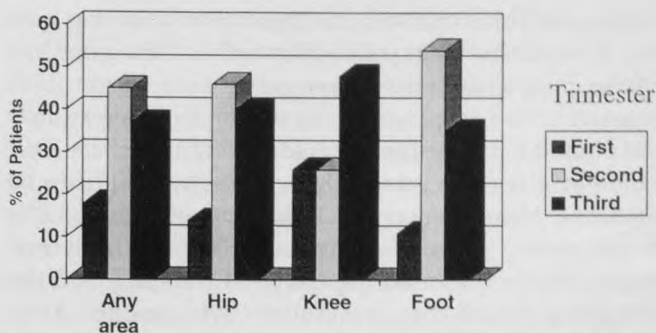


Figure. Onset of pain during pregnancy among case subjects experiencing leg and foot pain during pregnancy.

higher prevalence of hip pain (OR=3.2; 95% CI, 1.4 to 7.0). The knee was the second most commonly affected joint, with pain present in 22% of the cases and in 41% of the controls.

Regression analysis revealed that there was no statistically significant difference in the occurrence of knee pain between the two groups. Foot pain occurred in 31% of the recently pregnant group and 22% of controls, with a significant difference between the two groups (OR=2.2; 95% CI, 1.1 to 4.5). Prior history of pain was a significant risk factor in every area (Table 2). There was a significant association between age and knee pain, and between height and hip pain, but again, the CI was very close to 1.0, suggesting a weak association.

Much of the pregnancy-related hip pain began in the second and third trimesters (45.7% and 40%, respectively) (Figure). Only 14.3% of pregnancy-related hip pain began

Table 2. Significant Risk Factors for Lower Extremity Pain Among Postpartum Women Compared with Nonpregnant Controls

Area of Pain	Risk Factor	Odds Ratio	95% Confidence Interval	P Value
Any or more than one of the three areas ($R^2=.17$)	Pregnancy	2.3	1.2-4.7	.02
	Age	1.1	1.02-1.2	.01
	Prior history of knee pain	5.1	1.9-13.2	.001
	Prior history of hip pain	13.5	1.7-105	.01
Hip* ($R^2=.23$)	Pregnancy	3.2	1.4-7.0	.005
	Prior history of hip pain	28	8.5-92	<.001
	Height	1.1	1.004-1.12	.04
Knee* ($R^2=.26$)	Pregnancy	NS	—	NS
	Age	1.1	1.01-1.2	.03
	Prior history of knee pain	14	6.3-31	<.001
Foot* ($R^2=.07$)	Pregnancy	2.2	1.1-4.5	.03
	Prior history of foot pain	5.1	1.9-13.6	.001
Multiple areas ($R^2=.23$)	Pregnancy	2.6	0.9-7.3	.07†
	Prior history of hip pain	5.1	1.6-15.6	.005
	Prior history of knee pain	2.6	1.0-7.0	.05†
	Prior history of foot pain	8.0	2.0-32	.003

*Patients reporting pain in this area may have also had pain in one or more other areas.

†Indicates weak association between pain and risk factor.

during the first trimester. Average duration of hip pain was 4.1 months (range 0.5 to 10 months). Nearly one half of the pregnancy-related knee pain began in the third trimester, with the onset of the remainder being equally distributed between the first and second trimesters. Duration of knee pain averaged 8.8 months (range, 0.1 to 10 months). More than one half of the foot pain (53.8%) began during the second trimester; approximately one third (34.6%) began during the third trimester, and the remainder (11.5%) began during the first trimester. Average length of time foot pain was present during pregnancy was 3.9 months (range, 0.5 to 9 months).

Slightly more than one half of the recently pregnant women participated in some form of regular exercise before becoming pregnant, of whom only about one third continued to exercise during pregnancy. Forms of exercise included running, biking, swimming, walking, and aerobics. Exercise before and/or during pregnancy was not a risk factor for pain in the lower extremity. On the other hand, there was no evidence that exercise was protective against pain. Sixty-two percent of the nonpregnant women exercised regularly. As in the pregnant group, exercise was not a risk factor for lower extremity pain.

An examination of weight changes in recently pregnant women that included prepregnancy weight, highest weight during pregnancy, current weight, and amount of change, showed that weight was not a risk factor for lower extremity pain. Patients' estimates of how many flights of stairs they climbed or descended per day were also not significant predictors of lower extremity pain.

Discussion

The results of our study indicate that pregnancy is a significant risk factor for lower extremity pain, particularly of the hip and foot. The pain problems reported here were self-limiting but significant, generally lasting 2 weeks or more. The prevalence of lower extremity pain in this population appears to be comparable to that of low back pain, which was found in a number of studies²³⁻²⁷ to be about 50%.

Possible explanations for the cause of hip pain in pregnant women include referred pain from malalignment of the pelvic bones secondary to hormonally induced ligamentous laxity, pain from compression of the fetal head on the lumbosacral plexus or other structures, trochanteric bursitis from excessive time spent in a side-lying position, and intrinsic joint diseases, such as necrosis of the femoral head or transient osteoporosis of the hip. The latter two conditions are unlikely in our subjects, as pain was never so severe as to preclude weight bearing and generally resolved spontaneously within a few months.

Sacroiliac pain secondary to pelvic relaxation²⁸ is another possible cause. Despite the high frequency of hip pain during pregnancy among our case subjects, the pain tended to be self-limited, resolving in an average of 4 months.

Although the nonpregnant group actually had more knee pain than the recently pregnant women, regression analysis indicated there was no significant difference in the prevalence of knee pain between cases and controls once prior history of knee pain was taken into account. This finding was surprising, considering possible factors that could lead to knee problems in pregnancy. A previous study has shown an increase in knee joint forces when rising from a chair in women who were 36 weeks pregnant, compared with the same women after delivery.²⁹ In particular, patellofemoral forces and quadriceps tension were increased 83% and 100%, respectively, at 36 weeks' gestation compared with postpartum. Alteration of forces acting on the patella are felt to contribute to cartilage breakdown and pain,³⁰ commonly referred to as *chondromalacia patella* or *patellofemoral syndrome*. Another study has shown that increased Q angle (the angle between two imaginary lines that go through the hip and knee, representing the lines of pull of the quadriceps-patellar mechanism) of the knee is often an initiating factor in chondromalacia patella.³¹ It is possible that increased knee joint forces, combined with peripheral ligamentous laxity of pregnancy and subsequent changes in the Q angle of the knee, could have led to a higher prevalence of patellofemoral syndrome in the case subjects during pregnancy.

Pregnant and postpartum women had significantly more foot pain than did the nulliparous women. Similar to hip pain, foot pain tended to be self-limited, resolving in under 4 months on the average. Weight gain, increased lower extremity demands of infant care, and peripheral ligamentous laxity would predispose the recently pregnant women to plantar fasciitis, among other causes of foot pain.

Exercise during pregnancy has become more popular in recent years. Current recommendations from the American College of Obstetricians and Gynecologists state that pregnant women may continue a mild to moderate exercise regimen with certain precautions, provided no contraindications exist.³² Non-weight-bearing exercises are noted to decrease the risk of injury and are recommended with fewer restrictions than weight-bearing activities. This approach seems reasonable, based on the biomechanical factors we have noted above. Despite this, we did not identify exercise as a risk factor for lower extremity pain in general or for any individual area. On the other hand, neither regular exercise prior to nor exer-

cise during pregnancy had a protective effect against pain problems.

Most case subjects reported that their lower extremity pain began in the second or third trimester of pregnancy. Although this finding is subject to bias based on a tendency to recall more recent events, it is interesting because of what it might suggest about etiology. MacLennan and coworkers³³ have shown that relaxin levels are significantly higher in pregnant women than in nonpregnant controls, with the rise in serum relaxin occurring by the 6th week of pregnancy, holding steady through the second trimester, and dropping significantly in the third trimester. These investigators demonstrated that the highest levels of relaxin occur during a surge immediately preceding labor, and levels return almost to nonpregnant levels within 72 hours. Relaxin levels have been shown to correlate with pregnancy-related pelvic pain. In another study, MacLennan and colleagues³⁴ demonstrated that relaxin levels in 35 women with severe pelvic pain and pelvic joint instability were significantly elevated, compared with a control group of 368 pregnant women without pain. Furthermore, highest relaxin levels were found in those women whose pain was most incapacitating.³⁴ If relaxin-mediated changes alone were responsible for the occurrence of lower extremity pain, then a higher prevalence of symptoms would be anticipated in the first and second trimesters than in the third. Our study, however, indicates that the onset of lower extremity pain is more common in the later stages of pregnancy. This suggests that changes related to relaxin alone are not sufficient and that biomechanical factors, such as weight gain and fetal alignment, or other hormonally mediated changes are necessarily part of the equation.

We found no relation between lower extremity pain in pregnancy and factors such as height, weight, or degree of weight gain. This is consistent with the findings of Fast²⁴ and Mantle²⁶ and their associates, who found no relation between back pain in pregnancy and these factors. The biomechanical model of etiology is multifactorial. The failure of these factors to act as significant predictors suggests that none of them alone is important enough to consider without taking into account the entire clinical picture. Age was noted to reach statistical significance as a predictor for pain in any area and for knee pain, but the odds ratio and the confidence interval were close to 1.0, making the clinical significance of the finding questionable. The same is true for the association of height and hip pain. The trend toward more pain for older patients is not really surprising, but it is interesting to note that despite the significantly higher mean age in the control group, there was more pain in the postpartum group.

This study has some important limitations. The study was retrospective in design, the questionnaire had not

been previously validated, and further, it investigated a very subjective entity—pain. Despite these limitations, the study has merit as a simply designed, initial exploratory effort into a previously uninvestigated area. As with many retrospective studies, accurate recall, or more likely equivalently inaccurate recall, from the two groups of subjects is necessary for accurate conclusions to be made. Pregnancy, however, is an important event in a woman's life, during which a heightened sense of bodily awareness could be anticipated. As a result, the recently pregnant women may have been more aware of aches and pains. This possibility constitutes a significant limitation to the study.

Although none of the control group had ever had children, they might possibly have had pregnancies resulting in abortion or miscarriage in the past. We did not inquire about such situations, as we felt that questions about previous pregnancies were unnecessarily intrusive. Even if some of the nulliparous group had previously been pregnant, we would not expect prior pregnancies to have an effect on more recent pain, as hormonally mediated changes reverse quickly,³³ unknown pregnancies do not change biomechanical factors significantly, and other studies have shown that previous pregnancies are not a factor in back pain.²⁴

This study suggests that musculoskeletal pain in the lower extremity is common in all women, but pregnancy is a significant risk factor, especially for hip and foot pain. Biomechanical factors appear to play a larger role than hormonal influences in contributing to lower extremity pain in pregnant women. Exercise, amount of stair climbing, and amount of weight gain do not appear to increase or decrease the prevalence of lower extremity pain in pregnant women, but there was a trend toward more pain among older patients in both groups. This pain, however, tends to be self-limited and generally resolves within 4 months.

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