



# Musculoskeletal findings on MRI among postpartum women with persistent pelvic pain

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## Abstract

**Introduction and hypothesis** Persistent postpartum pelvic pain affects one in six women, and its source is often unexplained in the absence of obvious clinical findings. Musculoskeletal injuries during childbirth are common and can be detected using MRI or US; however, pelvic imaging is not standard of care in evaluating women with persistent pain. We hypothesize that clinical symptoms in women with unexplained persistent postpartum pelvic pain will correlate with musculoskeletal abnormalities identified on MRI in > 50% of cases.

**Methods** Retrospective cohort study of women with persistent postpartum pelvic pain who underwent a pelvic MRI for this indication. Chart review was performed. MRI findings were classified as major (bone fracture, levator ani avulsion) or minor (edema, inflammation or partial levator ani defect). Descriptive statistics were used to describe the study population.

**Results** Of the 252 women seen for postpartum pelvic pain, 18 patients met our study criteria. Half of women were primiparous (55.6%,  $n = 10$ ). Operative delivery occurred in 27.8% ( $n = 5$ ), 22.2% ( $n = 4$ ) had anal sphincter lacerations, and 38.9% ( $n = 7$ ) had prolonged second stage of labor. Median time from delivery to MRI was  $4.5 \pm 5.13$  (IQR) months. Musculoskeletal abnormalities were found in 94.4% ( $n = 17$ ) of cases; 38.8% ( $n = 7$ ) were major and 55.6% ( $n = 10$ ) were minor abnormalities. All findings correlated with presenting symptoms.

**Conclusion** Of women with persistent postpartum pelvic pain, 94.4% had musculoskeletal abnormalities supporting their clinical symptoms. Pelvic floor imaging should be considered in women with unexplained persistent postpartum pelvic pain to accurately manage the source of their pain.

**Keywords** Postpartum pain · Pelvic pain · Childbirth injury · Magnetic resonance imaging

## Introduction

Pelvic pain during pregnancy and following childbirth is present in up to one third of all childbearing women and is often viewed as an expected or normal aspect of postpartum recovery. In the majority of cases, pelvic pain resolves by 6 weeks postpartum [1, 2]. However, persistent pain lasting beyond the 6-week postpartum period has been reported to occur in 17% of women at 3 months [2] and 9% at 24 months after delivery

[3]. In addition to adversely affecting quality of life, persistent postpartum pelvic pain has an economic impact due to increased utilization of healthcare and sick leave [4–6].

A possible explanation for persistent postpartum pelvic pain is unresolved or untreated musculoskeletal injuries. Currently, there is little guidance for healthcare providers on how to evaluate women with persistent postpartum pelvic pain that lasts beyond the traditional 6-week postpartum period. As a result, women's symptoms, and their underlying causes, remain untreated.

At our institution, patients with pelvic floor symptoms or at high risk for pelvic floor disorders related to recent delivery (i.e., anal sphincter injury) are referred to a specialty postpartum pelvic floor clinic called the Michigan Healthy Healing After Delivery (MHHAD) Clinic. This clinic is staffed by fellowship-trained urogynecologists. Patients with a suspected musculoskeletal etiology of their pain are often referred for magnetic resonance imaging (MRI).

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The purpose of this study is to describe the prevalence and types of musculoskeletal abnormalities and their clinical correlation in a cohort of women who underwent pelvic MR imaging for the indication of persistent postpartum pelvic pain. We hypothesize that imaging findings will be present in > 50% of women and that these findings will significantly aid diagnosis and management of such patients.

## Materials and methods

We conducted a retrospective cohort study of postpartum women referred to the MHHAD clinic who underwent a pelvic MRI for persistent postpartum pelvic pain between July 1, 2007, which is when the MHHAD clinic started, and November 30, 2019. The study was approved by the University of Michigan IRB (HUM00173025). Patients were identified in the electronic medical record system using the Electronic Medical Record Searching Engine (EMERSE) [7]. Search terms included “pelvic MRI” and “Michigan Healthy Healing After Delivery.” After the initial query, a chart review was performed to identify women who met study inclusion criteria, which included: (1) MHHAD visit with a primary indication of persistent postpartum pelvic pain, defined as pain lasting beyond the 6-week postpartum period, and (2) MRI pelvis ordered for the indication of pelvic pain. Additional demographic and clinical data abstracted included maternal age at delivery, race/ethnicity, parity, birth weight, mode of delivery (spontaneous vaginal delivery, operative delivery, cesarean section), history and type of episiotomy or perineal lacerations, length of second stage, epidural use, presence of shoulder dystocia and physical examination findings. Prolonged second stage of labor was defined as > 150 min [8]. From the initial MHHAD visit, type of pelvic pain was described by its location. Along with pelvic pain, sexual dysfunction was assessed, which was defined as an active complaint of dyspareunia, a clinical diagnosis of vaginismus or if intercourse had not been resumed for fear of pain. All MRI images were reviewed by a fellowship trained musculoskeletal radiologist (K.G.-U.). Levator ani defects were scored by two of the authors (C.W.S. and F.P.). MRI musculoskeletal abnormalities were classified as major (bone fracture, levator ani avulsion) or minor (edema, inflammation or partial levator ani defect). Descriptive statistics were used to describe the study population.

## Results

Out of 2055 women seen in the MHHAD clinic during the 12-year period, 252 were seen for an indication of pelvic pain; of those, 18 (7%) met our inclusion criteria. Average age was  $29.9 \pm 5.5$  years, average body mass index was  $27.8 \pm 9$  kg/m<sup>2</sup>, 88.9% ( $n = 16$ ) were Caucasian, and 55.6% ( $n = 10$ ) were primiparous.

Table 1 shows the delivery characteristics of the cohort. At the most recent delivery, 27.8% ( $n = 5$ ) had an episiotomy and an operative vaginal delivery (forceps,  $n = 3$ ; vacuum,  $n = 2$ ). Obstetrical anal sphincter injuries occurred in five women as well. The median number of months between delivery and presentation to clinic was 2 (IQR 1.4, 4.5), and pain complaints were often multifocal. The most common locations of pain were the pubic bone ( $n = 7$ ), sacrum/coccyx ( $n = 7$ ) and vagina ( $n = 6$ ). Sexual dysfunction was reported by 72% ( $n = 13$ ) of our cohort, including two patients who had not yet attempted intercourse at 4–5 months postpartum because of pain.

**Table 1** Delivery variables among women with persistent postpartum pelvic pain

Variable	Number of patients (%) $N = 18$
Location of delivery	
Hospital	17 (94.4)
Home	1 (5.6)
Mode of delivery	
Spontaneous vaginal	12 (66.7)
Vacuum-assisted vaginal	2 (11.1)
Forceps-assisted vaginal	3 (16.7)
Cesarean	1 (5.6)
Epidural use ( $N = 16$ )	
Yes	12 (66.7)
No	3 (16.7)
Not documented	3 (16.7)
Length of second stage > 150 min ( $N = 15$ )	
Fetal position	
Occiput anterior	4 (22.2)
Occiput posterior	4 (22.2)
Vertex (unspecified)	6 (33.3)
Not documented	4 (22.2)
Neonatal birth weight > 4000 g	3 (16.7)
Shoulder dystocia	
Yes	2 (11.1)
No	14 (77.8)
Not documented	2 (11.1)
Episiotomy	
Yes	5 (27.8)
No	12 (66.7)
Not documented	1 (5.6)
Perineal laceration ( $N = 14$ )	
First degree	4 (22.2)
Second degree	5 (27.8)
Third degree	4 (22.2)
Fourth degree	1 (5.6)

The median time from delivery to MRI was 4.5 (IQR 2.3, 7.4) months. Four women had their first MHHAD clinic visit prior to 6 weeks postpartum; however, for all women in this category, the pain persisted past the 6-week period, after which time the MRI was ordered. Musculoskeletal abnormalities were found on MRI in 94.4% ( $n = 17$ ) of cases, and all positive MRI findings correlated with patients' presenting symptoms. Major MRI abnormalities were seen in 38.8% ( $n = 7$ ) of patients including 33.3% ( $n = 6$ ) with pelvic bone fractures (pubis,  $n = 3$ ; sacrum,  $n = 1$ ; ilium,  $n = 1$ ; coccyx,  $n = 1$ ). Uni- and bilateral levator ani avulsion with extensive muscle and pubic bone edema were also seen in 11% ( $n = 2$ ) (Fig. 1). Minor MRI abnormalities were seen in 55.6% ( $n = 10$ ) and included bone marrow edema in 50% ( $n = 9$ ), partial levator ani defects in 33.3% ( $n = 6$ ), sacroiliac joint edema in 22.2% ( $n = 4$ ) and pubic symphysis separation in 5.6% ( $n = 1$ ). One woman had a normal MRI (Table 2).

Treatment plans were established with a multidisciplinary approach. All patients were referred to physical therapy, and 22% ( $n = 4$ ) were also referred to either Physical Medicine & Rehabilitation or Orthopedic Surgery. Additional procedures for pelvic pain were performed in 28% ( $n = 5$ ) and included myofascial trigger point injections ( $n = 3$ ), pudendal nerve block ( $n = 1$ ), botulinum toxin injection ( $n = 1$ ) and sacroiliac joint injection of local anesthetics and steroids ( $n = 1$ ). Work leave paperwork was requested by 22% of patients ( $n = 4$ ) because of debilitating pain and inability to perform professional activities.

## Discussion

This retrospective study presents MRI findings in a cohort of women with persistent postpartum pelvic pain seen at the Michigan Healthy Healing After Delivery Clinic. Musculoskeletal abnormalities on MRI, consistent with presenting symptoms, were seen in 17 out of 18 women (94.4%), reaching an even higher incidence than we initially hypothesized. The most common finding was pelvic bone edema, and

pelvic bone fractures were seen in a third of cases. These findings substantially added to the clinical reasoning behind treatment plans.

Our study extends the literature by presenting the utility of selective use of MRI investigating postpartum pain in a clinical setting. Miller et al. [9] used MRI at 7 weeks and 8 months postpartum to identify musculoskeletal injuries in 59 women at high risk for childbirth-related pelvic floor injury based on obstetrical factors. While 91% of women had musculoskeletal injuries on MRI at 7 weeks postpartum, these injuries largely resolved over time so that by the 8-month postpartum MRI, pelvic bone fractures and edema were only seen in 3.4% and 14% of women, respectively. Pain symptoms were not reported by Miller so it is unknown how many of the women with positive MRI findings had persistent pelvic pain. In contrast, women in our study underwent MRI at a median of 4.5 months postpartum, but had a rate of pelvic bone fracture and bone edema more consistent with that seen at 7 weeks postpartum in Miller's study, suggesting non-resolving or chronic injuries. Furthermore, the current study provides evidence that women's symptoms of persistent postpartum pain should be taken seriously by providers and fully evaluated as imaging findings correlating with symptoms were seen in the vast majority. In the authors' experience, validating pain symptoms with a discrete physical examination or imaging finding has therapeutic benefit, especially for women whose symptoms have been previously disregarded or minimized.

Prior studies have reported the prevalence of postpartum sexual dysfunction to be 41–83% 2–3 months after delivery [10]. In the current study, seven in ten women with persistent pelvic pain reported sexual dysfunction. This finding is not unexpected as dyspareunia and vaginismus are often myofascial in origin. Unfortunately, we were unable to robustly assess improvement in these symptoms after treatment so it is unknown whether sexual dysfunction resolved after improvement in pelvic pain.

Limitations of our study include the use of a racially and ethnically homogeneous cohort from a specialized postpartum



**Fig. 1** Illustration of MRI major findings: axial T1-weighted MR image shows a right levator ani defect (arrow) with normal levator ani muscle on the left (**a**); axial T2-weighted image shows a left pubic bone fracture

(arrow) with cortical discontinuity (**b**); coronal STIR image shows marrow edema in the right sacrum (arrow) with central linear, low-signal consistent with a right sacral fracture (**c**)

**Table 2** MRI findings among women with persistent postpartum pelvic pain

Subject number	Age at delivery (years)	BMI (kg/m <sup>2</sup> )	Total parity	Mode of recent delivery	Length of second stage (hours)	Birth weight (grams)	Episiotomy	Type of perineal laceration	Location of pain	MRI findings and symptoms correlated	MRI findings	Major findings	Minor findings
1	20	25.4	1	VD	2	4790	No	2nd degree	Right-side pelvis and vagina	Yes	Right iliac focal stress fracture	Right iliac focal stress fracture	
2	32	28.06	2	VD	Unknown	3935	No	1st degree	Right pubic bone	Yes	Widening of pubic symphysis Right pubic bone fracture Bilateral labral tears	Widening of pubic symphysis Right pubic bone fracture	
3	38	21.63	1	Vacuum	4	2870	Median	4th degree	Coccyx	Yes	Acute angulation of coccyx Fracture of coccyx	Acute angulation of coccyx Fracture of coccyx	
4	26	22.5	1	VD	2.5	3060	Yes, unknown type	2nd degree	Vagina, coccyx	Yes	Bilateral levator ani avulsion Bilateral pubic symphysis edema	Bilateral levator ani avulsion Bilateral pubic symphysis edema	
5	32	55.62	1	VD	12	3020	No	2nd degree	Left pubic bone and vulva	Yes	Left levator ani defect	Left pubic bone fracture	
6	27	24.6	1	Forceps	6	3235	Mediolateral	3rd degree (3A)	Vulva, vagina, perineum	Yes	Left pubic bone fracture	Left pubic bone fracture	
7	33	26.48	2	VD	Unknown	4520	No	3rd degree, NOS	Pelvis, low back	Yes	Bilateral levator ani avulsion Stress fracture of right sacrum extending into sacroiliac joint	Bilateral levator ani avulsion Stress fracture of right sacrum extending into sacroiliac joint	
8	23	30.61	1	Forceps	3.3	3235	Medio-lateral	Unspecified	Rectum	Yes	Right levator ani defect Rectal wall thickening	Right levator ani defect Rectal wall thickening	Minor findings
9	41	26.28	4	VD	1	3090	No	1st degree	Pubic bone, hips, low back	Yes	Sacroiliac joint edema Pubic symphysis edema	Sacroiliac joint edema Pubic symphysis edema	
10	26	25.64	2	VD	Unknown	3401	No	1st degree	Right vulva, pubic bone, right leg	Yes	Right levator ani defect Asymmetric thickening of the right ischiococcygeus/puborectalis muscles	Right levator ani defect Asymmetric thickening of the right ischiococcygeus/puborectalis muscles	
11	36	33.28	3	Cesarean, repeat	N/A	3140	N/A	N/A	Pubic bone, pelvis	Yes	Acute on chronic right sacroilitis	Acute on chronic right sacroilitis	
12	26	32.49	1	VD	1	3040	No	Right sulcal, right labia	Left sciatic pain, vagina	Yes	Bilateral sacroiliac joint sclerosis Pubic symphysis edema	Bilateral sacroiliac joint sclerosis Pubic symphysis edema	
13	29	19.38	1	Forceps	1	3373	Mediolateral	Unspecified	Right sacrum/coccyx	Yes	Left pubic symphysis and sacroiliac joint edema	Left pubic symphysis and sacroiliac joint edema	
14	33	23.92	1	VD	3	4125	No	3rd degree (3A)	Coccyx	Yes	Possible small stress injuries Bilateral sacroiliac joint edema worse on right versus left	Possible small stress injuries Bilateral sacroiliac joint edema worse on right versus left	
15	34	20.92	1	Vacuum	3	3450	No	2nd degree	Left buttock, coccyx, pelvis	Yes	Right sacroiliac joint edema Coccyx edema	Right sacroiliac joint edema Coccyx edema	
16	31	24.95	2	VD	3.5	3742	No	1st degree	Pubic bone left vagina and groin	Yes	Left levator ani defect	Left levator ani defect	
17	24	19.44	2	VD	1.5	2920	No	2nd degree	Coccyx, left pelvis/vagina	Yes	Public bone edema Left levator ani defect	Public bone edema Left levator ani defect	
18	28	41.18	1	VD	Unknown	3635	No	3rd degree (3C)	Public bone	No	Normal MRI	Normal MRI	

pelvic floor clinic, which may restrict generalization of our results. Additionally, MRI is costly and not available in all healthcare systems. However, some of these findings such as levator ani avulsion and pelvic bone fractures may be detected using imaging tools such as plain radiography and ultrasound, which are typically available even in low-resource settings. Strengths include clinical correlation established with MRI findings and the contribution of clinical guidelines on how to manage this subgroup of women.

In conclusion, with the exception of one case, all women in our cohort who underwent pelvic MRI for persistent postpartum pelvic pain with suspected musculoskeletal etiology had abnormalities correlated with their presenting complaint. Therefore, we suggest that pelvic floor imaging be considered in women with persistent postpartum pelvic pain when symptoms are not explained by clinical assessment to accurately diagnose and treat the source of their pain.

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M.E. Duarte Thibault: Data collection, data analysis, manuscript writing.

K. Gaetke-Udager: Manuscript writing, manuscript editing.

D.E. Fenner: Manuscript editing.

C.W. Swenson: Project development, manuscript writing, manuscript editing.

### Compliance with ethical standards

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