Normal and Pathologic Findings of the Pelvic Ring Joints Postpartum Using MRI

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Abstract

The aim was to assess the pelvic ring joints postpartum and to discern normal postpartum findings and pathologic lesions. Images were obtained in 6 symptomatic women after delivery, in 13 women after uncomplicated vaginal delivery and in 11 healthy, non-pregnant women. Mean signal intensity of cartilage of the symphysis pubis was significantly different on T1w and T2w MR images in postpartum women compared to nulliparous women (p<0.001), indicating higher water content of the pubic cartilage. MRI is a useful adjunct to clinical examination to identify patients with lesions of the pelvic ring postpartum.

Introduction

Pelvic joints undergo changes during pregnancy and delivery due to hormonal influence and mechanical stresses. Characteristic symptoms like suprapubic pain, tenderness, swelling, and characteristic waddling gait, are normally associated with the clinical diagnosis of a rupture of the symphysis pubis (1). MRI is very sensitive to visualize and assess soft tissue changes and potential injuries of soft tissue and pelvic girdle joints after delivery (2).

Methods

19 postpartum women (mean age 36.5 years, range 19-37 years) and 11 healthy, non-pregnant women (mean age 30 years, range 22-42 years) were studied. 6 of the 19 postpartum women were patients with severe pelvic girdle pain (Table 1). Four of these six symptomatic patients had suprapubic pain; one patient had pain of the right iliacus joint; one patient reported pain of the whole pelvic ring. Two of the six women had antepartum symptoms related to preceding pregnancies and Cesarean sections were performed. Pregnancy status was para 1 in 6 cases and para 2 in 4 cases. MRI was performed 2 to 12 days postpartum. All six patients had clinical follow-ups after 12 months. Pregnancy status of the 13 women (mean age 25, age range 19-34 years) with uncomplicated vaginal delivery was para 1 in 6 cases, para 2 in 8 cases, para 3 in 1 case and para 4 in 2 cases. These women were scanned between 2 and 5 days after delivery.

Images were acquired at 1.5 T (Gyroscan ACS II, Philips Medical Systems). T2w-TSE images (TR 4000 ms, TE 250 ms, FA 90°, slice thickness 6 mm, gap 0.6 mm, FoV 300 mm, matrix 182 x 256, turbo factor 33, NEX 2) were obtained in sagittal orientation. T1w-TSE (238x129/90°/40/150/204/256/256/2/4) and T2w-TSE (238/150/90°/40/150/204/256/256/2/4) images were acquired in parasagittal orientation with a ring surface coil to examine the pubic symphysis. Iliacoscal joints were imaged with a FoV of 300 mm in coronal orientation using the same sequences. No intravenous contrast medium was administered.

Images were evaluated by two investigators in consensus, and the following parameters were obtained: (i) distances of the interpubic gap, (ii) signal intensities of cartilage of the pubic symphysis on T1w- and T2w-TSE images, (iii) mean intensities of the image background noise for both sequences using corresponding ROIs, and (iv) focal signal changes of pubic bones. Special findings on images of the symphOMATIC group were also noted. Mean signal intensities of cartilage on T1w and T2w images, SNR1 and SNR2, were both determined from ROIs with an area of 10 mm² and normalized by the corresponding mean background signals, N0 and N0, using similar ROIs. Ratios of these normalized signals were calculated according to the relation:

\[ R_{nor} = \frac{S_{1}/N_0}{S_{2}/N_0} \]

Nonparametric Mann-Whitney-Tests were used to compare \( R_{nor} \) of the different subgroups: nulliparous vs. all postpartum; nulliparous vs. healthy postpartum; healthy postpartum vs. symptomatic postpartum women. A value of \( p \leq 0.05 \) was considered statistically significant.

Results

Mean distances of the interpubic gap were 5.0±0.6 mm (range 4.0-6.0 mm) in the nulliparous group, 6.0±0.9 mm (range 4.0-7.0 mm) in the healthy postpartum group and 6.0±1.4 mm (range 4.0-8.0 mm) in the symptomatic group, respectively. Both the asymptomatic postpartum subgroup (n=13, p=0.005) and the total postpartum group (n=19, p=0.0003) had significantly larger interpubic gaps compared to the nulliparous group. No statistically significant difference was found between the asymptomatic and the symptomatic postpartum group.

Mean values of \( R_{nor} \) were 0.18±0.07 (range 0.1-0.3) for the nulliparous group, 0.30±0.14 (0.08-0.55) for the healthy postpartum group and 0.65±0.6 (0.19-1.61) for the symptomatic group (Fig 1). Significantly larger \( R_{nor} \) values were obtained for both the asymptomatic postpartum subgroup (n=13, p=0.002) and the total postpartum group (n=19, p=0.001) compared to the nulliparous group. No statistically significant difference was found between the asymptomatic and the symptomatic postpartum group. Focally increased signal intensities on T2w and decreased signal intensities on T1w images of the parasymphyseal pubic bones, classified as focal edematous changes, were observed in 8 of 13 healthy postpartum women and in 5 of 6 symptomatic postpartum women. In the symptomatic group there were 3 women with small unilateral edemas and 2 with edema of both parasymphyseal pubic bones. None of the nulliparous women had any edematous changes of the pubic bones. In one of the six symptomatic patients MRI revealed rupture of the symphysis cartilage, fluid collection in the interpubic gap and a protrusion of pubic ligaments. In one patient suffering from pain of the right sacroiliac region increased signal intensity was noted in the right sacrum on T2-weighted images and decreased signal intensity on corresponding T1-weighted images. A sacral stress fracture was diagnosed. Normal postpartum MRI status of the pelvic ring was observed in another patient who reported pain of the whole pelvic ring. Although the patient received treatment on her demand, she still reported persistent pain in different joints after one year.

Discussion

Evaluation of normalized pubic cartilage signal intensities revealed a significantly higher mean value of \( R_{nor} \) in postpartum women than in nulliparous women. This indicates higher water content of the pubic cartilage during and after pregnancy, since it is well known that hormonal changes during pregnancy influence water content of tissues (3). Normal and pathologic changes of the pelvic ring after delivery, especially the symphysis pubis, have been observed and quantitated in the present study. MRI may confirm the clinical diagnosis of a symphyseal rupture. Small bruises of the pubic bones and small signal changes of the pubic cartilage, which are present in asymptomatic women after delivery, should be considered normal.

Table 1. Clinical patient data of the symptomatic postpartum group

<table>
<thead>
<tr>
<th>Subject</th>
<th>Age</th>
<th>Para</th>
<th>Date of Scan</th>
<th>Symptomatic Pain</th>
<th>Distance of Interpubic Gap (1)</th>
<th>Diagnosis of MRI Findings of the Symphysis Pubis</th>
<th>Intensity of Cartilage</th>
<th>Presence of Asymptomatic Pain</th>
<th>Pain after One Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>2</td>
<td>1</td>
<td>No</td>
<td>4.0 mm</td>
<td>Normal</td>
<td>0.18</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>1</td>
<td>2</td>
<td>Yes</td>
<td>4.0 mm</td>
<td>Ruptured</td>
<td>0.65</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>2</td>
<td>2</td>
<td>No</td>
<td>5.0 mm</td>
<td>Ruptured</td>
<td>0.30</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>2</td>
<td>2</td>
<td>Yes</td>
<td>6.0 mm</td>
<td>Ruptured</td>
<td>0.65</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>32</td>
<td>1</td>
<td>3</td>
<td>Yes</td>
<td>6.0 mm</td>
<td>Ruptured</td>
<td>0.65</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>34</td>
<td>2</td>
<td>3</td>
<td>No</td>
<td>5.0 mm</td>
<td>Ruptured</td>
<td>0.65</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Fig. 1. Plot of normalized signal intensity ratios, \( R_{nor} \), of the pubic cartilage of the nulliparous (n=11), the asymptomatic postpartum (n=13) and the symptomatic postpartum (n=6) groups, respectively.

References