

ONFH における立位矢状面での骨盤傾斜

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本研究では ONFH107 症例における立位矢状面での骨盤傾斜 (APP angle) を測定し、骨盤傾斜に影響を及ぼす因子を検討した。APP angle は Stage が 3A から 4 へと進行するにつれ有意に減少し、Stage 進行に伴い骨盤は後傾する傾向にあることが示唆された。性別、年齢、BMI、誘因、pelvic incidence、壊死領域のサイズ、JIC type、および対側股関節の状態を考慮しても、Stage は APP angle に関連する唯一の独立した因子であることが示された。

1. 研究目的

Given that pelvic tilt influences the load on the femoral head, it is possible that posterior pelvic tilt in the standing position could accelerate femoral head collapse progression in ONFH. However, little is known about the sagittal pelvic posture in the standing position in patients with ONFH. This study aimed to test our hypothesis that the sagittal pelvic posture in the standing position correlates with the progression of femoral head collapse in ONFH.

2. 研究方法

From July 2016 to December 2020, 234 patients diagnosed with ONFH who underwent surgical treatment at our institution were evaluated for potential inclusion in this retrospective analysis. The inclusion criteria were: 1) onset age ≥ 18 years; 2) diagnosis of atraumatic ONFH; 3) JIC stage III at the first visit to our hospital; 4) no history of surgery on the spine, hip, or lower extremities; 5) availability of a standing plain radiograph of the hip just before surgery; 6) recognizable femoral head morphology on the plain radiographs at the first visit and just before surgery; and 7) no hip dysplasia. In patients with bilateral ONFH, the more severely collapsed side was included. Finally, 107 patients (107 hips) were included in this study.

The size of the necrotic lesion was measured by MRI using method four reported in a previous study¹⁾, and was furtherly stratified as $< 50\%$ involvement and $\geq 50\%$ involvement. The location of the necrotic lesion was classified according to the Japanese Investigation Committee (JIC) classification system²⁾. Using a 2D-3D matching method as previously described³⁾, sagittal pelvic posture in the standing position was quantified as the angle formed by the anterior pelvic plane and the z-axis in the sagittal view (APP angle). An APP angle $< 0^\circ$ indicated posterior pelvic tilt. Femoral head collapse progression in post-collapse stage ONFH was quantified as collapse speed. Collapse speed was calculated with the following formula: [(collapse extent just before surgery) - (collapse extent at first visit)] / (time from the first visit to surgery).

3. 研究結果

The mean APP angle just before surgery was -4° (SD, 6° ; range, -27° to 13°), the mean pelvic incidence was 46° (SD, 10° ; range, 30° to 77°), the mean size of the necrotic lesion was 48% (SD, 15%; range, 15% to 90%), and the median collapse speed was 0.42 (range, 0.01 to 3.0) mm/month.

As ONFH progressed from JIC stage IIIA to stage IV, APP angle decreased significantly and

continuously. After accounting for all the analyzed factors, specifically sex, age, BMI, etiology, pelvic incidence, size of necrotic lesion, JIC type, and contralateral hip condition, both the exploratory data analysis and multivariate regression analysis demonstrated that size of necrotic lesion, JIC type, and APP angle were significantly associated with collapse speed in patients with post-collapse stage ONFH. In addition, the APP angle showed a negative correlation with collapse speed ($r = -0.40$, $p < 0.0001$), and size of necrotic lesion showed a positive correlation with collapse speed ($r = 0.36$, $p < 0.0001$). Collapse speed was significantly higher in patients with JIC type C2 ONFH than those with JIC type C1 ($p < 0.0001$) or JIC type B ($p < 0.0001$).

Furthermore, after stratifying by the size of the necrotic lesion ($< 50\%$ involvement and $\geq 50\%$ involvement) and location of the necrotic lesion (JIC type C1 and C2), a significant negative correlation was observed between APP angle and collapse speed in each group.

4. 考察

It is important to understand the mechanism of femoral head collapse progression in ONFH because it generally leads to a hip OA change, which significantly worsens patient prognosis. Recently, the high pelvic incidence was reported to be associated with femoral head collapse occurrence during pre-collapse stage ONFH, potentially mediated by posterior pelvic tilt⁴. Moreover, posterior pelvic tilt in the standing position has been reported to cause decreased femoral head coverage and impair the hip loading environment in both dysplastic and nondysplastic hips.⁵⁻¹¹ Although the above information suggests that posterior pelvic tilt in the standing position might influence the femoral head collapse progression in ONFH, no research has investigated this issue. In this study, ONFH progression from JIC stage IIIA to stage IV was associated with a significant and continuous increase in posterior pelvic tilt in the standing position. After controlling for the potential factors, we found that the size and location of the necrotic lesion

and the sagittal pelvic posture in the standing position were associated with collapse speed in patients with post-collapse stage ONFH. In addition, posterior pelvic tilt in the standing position was significantly correlated with faster collapse speed ($p < 0.0001$).

5. 結論

Sagittal pelvic posture in the standing position might be associated with femoral head collapse progression in patients with post-collapse stage ONFH. In addition to the size and location of the necrotic lesion, standing pelvic posture should be evaluated in patients with ONFH.

6. 研究発表

1. 論文発表
なし
2. 学会発表
なし

7. 知的所有権の取得状況

1. 特許の取得
なし
2. 実用新案登録
なし
3. その他
なし

8. 参考文献

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