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Title: The X-ray-analysis of femoroacetabular impingement – the relationship between cross-over sign, spinal alignment and impingement sign in the Iwaki Health Promotional Project

Abstract: [Background] Femoroacetabular impingement (FAI) is caused by acetabular retroversion and a prominence of the anterior acetabular wall. Some authors described about cross-over sign (COS) and posterior wall sign (PWS) in anteroposterior radiograph of the pelvis as typical radiological findings of FAI. The purpose of the present study was to investigate the prevalence of COS and PWS in general population and to estimate the correlation between these signs and pelvic tilt, spinal alignment and impingement sign (IS).

[Material and Methods] We retrospectively examined anteroposterior radiographs of the pelvis of 399 patients (798 hips) in Iwaki health promotional project. There were 149 men (the average age 49.0 years) and 250 women (the average age 53.0 years). The examination items were center-edge angle, Sharp angle, COS, PWS and pelvic tilt angle (PTA). PTA was estimated from the height of the obturator foramen divided by the distance between the mid-points of the inferior margins of the teardrops on the anteroposterior radiographs. We measured spinal alignment including thoracic kyphosis, lumbar lordosis and sacral tilt angle by spinal mouse. The presence of IS was investigated for 248 patients (496 hips).

[Results] Positive COS was seen in 18 patients (5.3%) in right hip, 13 patients (3.2%) in left hip and 9 patients (2.2%) in both hips. Positive PWS was seen in 53 patients (13.2%) in right hip, 76 patients (19.0%) in left hip and 50 patients (12.5%) in both hips. Positive COS and PWS coexisted with developmental dysplasia (DDH) in 5.4% and 35% respectively. Patients with DDH were significantly more likely to have acetabular retroversion than normal hip. PTA has increased with the age ($r=0.453$). As PTA increased, the degree of lumbar kyphosis also increased ($r=0.318$). PTA of the group of positive COS and PWS was smaller than that of the group of a negative COS and PWS ($p=0.023$). The correlation was not seen between positive COS, PWS and spinal alignment. Positive IS was seen in 23 patients (9.2%) in right hip, 22 patients (8.8%) in left hip and 7 patients (2.8%) in both hips. Positive IS with positive COS was seen in 2 patients (16.7%) in right hip, 2 patients (22.2%) in left hip. Positive IS with positive PWS was seen in 6 patients (19.4%) in right hip, 6 patients (12.2%) in left hip. Positive IS did not correlate with center-edge angle, Sharp angle or PTA.

[Discussion] Positive COS and positive PWS did not concern with spinal alignment in our study. COS and PWS did not correlate to IS. These results suggested that X-p findings such as COS and PWS did not relate to clinical findings and other factors (such as range of motion and patient's lifestyle) may have a role in onset of FAI.