Is there any correlation between femoral anteversion and acetabular morphology in developmental dysplasia of the hip?

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OBJECTIVE

Femoral anteversion in developmental dysplasia of the hip (DDH) is generally larger than that of normal subjects. The anatomical abnormalities in femur and acetabulum in DDH were reported by many authors. However, they were often described separately. This study is conducted to observe whether the proximal femoral morphology has any correlation with the acetabular morphology, such as acetabular version and the acetabular coverage on the femoral head.

METHODS

This retrospective study was approved by our institutional review board.

Patients

We reviewed 69 hips from 43 female patients with DDH. Hip dysplasia was defined as a lateral center edge angle of Wiberg [1] that was less than 20 degrees as measured on an anteroposterior pelvic radiograph. The average age was 39.6 years, five of the patients had a history of treatment of congenital dislocation of the hip. The control group included 49 normal hips in 44 patients with osteoarthritis of the hip using CT images.

Measurement

The 3-dimensional morphological features of the hip using CT images were examined in this study. The femoral anteversion was defined as the angle between the femoral neck axis and the epicondylar axis (Fig.1a). The neck shaft angle was measured with correcting by femoral anteversion. The acetabular anteversion was defined as the acetabular opening angle in the axial plane through the femoral head center (Fig.1b). The Sharp angle was defined as the acetabular opening angle in the coronal plane (Fig.1c). The acetabular sector angles described by Anda et al. [2] were measured in three directions; anterior, superior, and posterior as an indicator of acetabular coverage on the femoral head (Fig.2).

Fig.1: 3-dimensional measurement of the hip. a) The femoral anteversion b) The acetabular anteversion c) The Sharp angle

Fig.2 Acetabular sector angles (ASA) described by Anda et al. were measured in three directions; anterior, superior, and posterior.

Statistical analysis

Any correlation between these factors were analysed using a Pearson’s correlation coefficient. Wilcoxon rank sum test was used for the comparison of demographic data.

RESULT

Femoral anteversion and the acetabular morphology (Fig.3a, b, c)

Femoral anteversion was significantly correlated with anterior and superior acetabular coverage in DDH (femoral anteversion versus anterior and superior sector angles: p=0.0156 and p=0.0157, Fig 3a). Femoral anteversion in DDH also had significant correlation with Sharp angle (p=0.0312, Fig 3b). Acetabular anteversion in DDH showed a wide range from a subject to a subject and showed no correlation with femoral anteversion. No correlation was noted with any measurements in normal hips (data not shown).

Neck-shaft angle and the acetabular morphology (Fig.3d)

There was no significant correlation between neck-shaft angle and acetabular morphology in DDH. In normal hips, the femoral neck-shaft angle was significantly correlated with the Sharp angle (p=0.0253) and the anterior coverage of the femoral head (p=0.0030).

Fig.3: Correlation between the femoral and acetabular measurements. The circle on the graph showed the 95% probability ellipsoid. The blue area showed DDH group and red area showed control group. a) Femoral anteversion versus Sharp angle. b) Femoral anteversion versus anterior acetabular sector angle. c) Femoral anteversion versus acetabular anteversion d) Femoral neck-shaft angle versus anterior acetabular sector angle.

CONCLUSION

Our 3D analysis showed the femoral anteversion was significantly correlated with the acetabular coverage and acetabular deficiency, and was not correlated with the acetabular anteverision. These results suggested the interaction between the acetabular and femoral development in DDH.

REFERENCE