RESEARCH ARTICLE

IMAGING MODALITIES ON FEMORAL NECK ANTEVERSION (FNA): RECENT ADVANCES AND FUTURE PROSPECTIVE

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ABSTRACT

Background: Femoral neck anteversion (FNA) now frequently observed globally. Presently its higher incidence located in our country like India. Three-dimensional computed tomography (3D CT) by some investigators proposed as the gold standard for measurements of the femoral neck ante version angle (FNA).Particularly, developmental dysplasia of the hip (DDH) is a simple and reliable imaging method. We using by non-ionizing technique determine the consistency between measurements of the FNA in DDH using 3D CT and magnetic resonance imaging (MRI) to estimate the precision, reliability, and reproducibility of FNA.

Material and methods: The 3D CT and MRI were used to measure the FNA among patients, including girls and boys, with a mean age of 3-4 years (age range, 1-12 years), We performed independently by our radiologists and scientist at different time frames (2-3 weeks). Later on the radiologists had higher consistency was observed between the MRI and 3D CT.

Results: This measurement we summarizes (intraclass correlation coef cient (ICC) of 0.906, $P < 0.05$). The mean inter-observer & intra-observer agreements were higher.So for MRI (ICC = 0.949 and 0.965, respectively, $P < 0.05$ for both) and for 3D CT (ICC = 0.943 and 0.967, $P < 0.05$ for both) respectively. We compared with 3D CT and MRI provided a precise, reliable, reproducible and new method of measuring the FNA in DDH. MRI is now recommended as an appropriate technique for measurement of the FNA in DDH, and this approach could replace 3D CT.

Conclusion: MRI delivers no ionizing radiation and offers a better display of soft tissue pathological changes above then 80% of FNA.

INTRODUCTION

Three-dimensional computed tomography (3D CT) has been regarded by some investigators as the gold standard for measurements of the femoral neck anteversion angle (FNA) in developmental dysplasia of the hip (DDH) earlier. But now a simple and reliable imaging method using a non-ionizing technique is needed to verify this statement. Now MRI is recommended as an appropriate technique for measurement of the FNA in DDH. But this approach could replace 3D CT because it delivers no ionizing radiation and offers a better

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display the soft tissue and changes occured pathologically (Mao *et al.*, 2015). Anatomical reconstruction of the hip is among the main requirements for hip arthroplasty to be successful and resurfacing arthroplasty (RA) could improve replication of the native joint geometry. FNA wisely been evaluated only by using standard radiographs. Therefore we eagerly performed a computed tomography (CT) study to assess restoration of hip geometry after total hip resurfacing (HR), comparatively with the non-operated side (NOS).HR does not change native extra-medullary hip geometry by more than 5mm and/or 5° according to earlier hypothesis. Gluteal tendinopathy and greater trochanteric pain syndrome (GTPS) remain incompletely understood. Sofar, despite of their pervasiveness in clinical practice. No study has been analyzed the morphometric characteristics of the hip on magnetic

resonance imaging (MRI) systematic way in larger number of sample size (Arnould *et al.*, 2015). Recently wide range of *intra- and inter*-rater reliabilities of the trochanteric prominence angle test (TPAT) has been introduced the transcondylar angle test (TCAT) as an alternative to the TPAT and using by a smartphone as a reliable measurement tool. So femoral neck anteversion (FNA) measurement reliabilities of the TPAT and the TCAT also interesting test. However, the reliability of using a smart phone as a clinical measurement tool. Its correlation between the difference value of medial knee joint space (KJS) between rest and tested positions and the difference value (DV) between the TPAT and TCAT were assessed frequently. Followed by these new developments there is a intra paucity to verify this statement is quite essential in treatment and research (Moulton *et al.*, 2015).

MATERIAL AND METHODS

We obtained for 100 (FNA) and 50 (ETT) patients who attended a our hospital for instrumented gait analysis between 2007 and 2016. The measurement of the FNA and assessment of MRI could replace 3D CT. The 3D CT and MRI were used to measure the FNA among patients, including girls and boys, with a mean age of 3-4 years (age range, 1-12 years),We performed independently by our radiologists and scientist at different time frames(2-3 weeks). Later on the radiologists had higher consistency was observed between the MRI and 3D CT. The normal non-operated side served as the control in each patient. The primary evaluation criteria were femoral offset (FO) and femoral neck anteversion (FNA) and the secondary criteria were cup inclination angle, cup anteversion angle, and lower-limb length.

RESULTS

This measurement summarizes (intraclass correlation coef cient (ICC) of 0.906, P < 0.05). The mean inter-observer & intra-observer agreements were higher. So for MRI (ICC = 0.949 and 0.965, respectively, P < 0.05 for both) and for 3D CT (ICC = 0.943 and 0.967, P < 0.05 for both) respectively. We compared with 3D CT and MRI provided a precise, reliable, reproducible and new method of measuring the FNA in DDH. MRI is now recommended as an appropriate technique for measurement of the FNA in DDH, and this approach could replace 3D CT. Because it delivers no ionizing radiation and offers a better display of soft tissue pathological changes above then 80%.

DISCUSSION

Although Informed clinical decision making for femoral and/or tibial de-rotation osteotomies requires more accurate measurement of patient function through gait analysis and anatomy. We need through physical examination of bony torsions and validity of gait analysis. It has been extensively observed regarding the accuracy of physical examination measurements. The femoral and tibial torsion were compared between CT-scans and physical examination measurements of femoral neck anteversion (FNA) and external tibial torsion (ETT). We obtained for 100 (FNA) and 50 (ETT) patients who attended a our hospital for instrumented gait analysis between

2007 and 2016. Physical examination methods we studied forfemoral neck anteversion and the trochanteric prominence angle test (TPAT).So, the maximum hip rotation arc midpoint (Arc midpoint) and for external tibial torsion (ETT).The transmalleolar axis (TMA) result observed that all physical examination measurements statistically differed to the CT-scans. So that physical examination be considered as screening techniques rather than definitive measurement methods for FNA (Sangeux *et al.*, 2014) Now avoiding this biases we also adopt to compare measuring femoral neck anteversion angle (FNA) in a 2D&3D method. Latter on this method makes a measure corrections to compensate errors. We introduced by the individual placement of patients in the CT scanner. CT-examined patients were included: men and women. Right side FNA was measured twice with each method by one observer, measuring intraobserver variability. Both methods are based on the following anatomy: femoral head center, center at the level of lesser trochanter and posterior apex of the femoral condyles. Moreover, intraobserver variability was improved with the 3D-CT method (Olesen *et al.*, 2013). These differences between femoral neck anteversion (FNA) and torsion angle through 3D CT reconstruction was performed. Researchers reported on healthy adult volunteers' femur were reconstructed by 3D CT. But they included 15 males and 15 females only. So within an average age of (43.66 +/- 7.57) years old ranging from 25 to 75 years. The FNA and the torsion angle by image post-processing, measuring torsion FNA is the angle between the line and the surface with the sharp angle towards the lower outside. In these torsion angle is the angle between the two surfaces with the sharp angle towards the lower back (Zhu *et al.*, 2012). Abnormal femoralneck anteversion (FNA), acetabulum anteversion (AA) had along been implicated in the etiogenesis of hip osteoarthritis (OA). Hence this developmental dysplasia of the hip (DDH) and impingement, instability wear in total hip arthroplasty (THA). Indian population are sparse on this topic FNA. Hence clinically, AA and the combined anteversion (CA= FNA+ AA) in Indian adults.FNA, AA and CA were prospectively measured in 172 normal hips in 86 Indian adults using standardized computed tomographic (CT) methods earlier. This data was compared with the established Western values including median values and interquartile ranges were 8 degrees (6.5-10.0 degrees) for FNA. At the same time 19 degrees (16.0-22.0 degrees) for AA and 27 degrees (23.5-30.0 degrees) for CA evaluation. AA and CA values were significantly (P<0.05) lower in males and lower FNA in males (Maheshwari *et al.*, 2010). The value of 3-dimensional CT in the treatment of developmental dislocation of hip (DDH) femoral neck anteversion (FNA) and morphology of acetebulum in patients with DDH hips were studied by three-dimensional CT imaging. The femoral head containment improved advantages of 3D CT scan. FNA includes manifestation of acetebular morphology and correct measurement of the femoral neck ante version (FNA) evaluation of operative procedure and efficacy. The 3-dimensional CT method is deserved to use widely in the treatment of developmental dislocation of hip among children is necessary (Jiang *et al.*, 2009). Exploring this factors influencing acetabular development after closed reduction in developmental dislocation of the hip (DDH) provide theoretical basis for improving the therapeutic effects. Most of closed

reduction treatment of DDH. A total of 100 children with single side DDH who were treated by closed reduction were still followed up. The AI and AI (D/W) of dislocation hip were measured at the 12th month after reduction. Twelve factors unlike gender, side, age, education, socioeconomical status, AI and AI (D/W) of dislocation hip before reduction, degree of dislocation, the rate of width of femoral head, femoral neck ante version of dislocation hip before reduction, h/b rate, cut off adductor and skeletal traction taken as an independent variables. AI and AI (D/W) at the 12th month after reduction were taken as dependent variables. We performed multiple linear stepwise regression analysis was used to screen the major influencing factors. Age, gender, degree of dislocation, h/b rate, the rate of width of femoral head and femoral neck anteversion exerted obviously influence on AI and AI (D/W), and then age, degree of dislocation and FNA had positive correlation with AI and negative correlation with AI (D/W). So the rate of width of femoral head and h/b rate had negative correlation with AI and positive correlation with AI(D/W). Development of acetabular of female patients was faster than that of male patients. Age, gender, degree of dislocation, concentric reduction or not, the development degree   of femoral head   before   reduction   and proximal femoral shape are the major infuencing factors for acetabular development (Li *et al*., 2009). Accurate limb and pelvic conformation evaluation using computed tomography (CT)   be useful in planning canine hip dysplasia (CHD) treatment. This   helping to understand the pathogenesis of osteoarthritis and CHD. Technically, a new method for femoral neck anteversion angle (FNA-angle) measurement in CT, and to compare it to the established radiographic standard biplanar method. CT FNA-angle measurement method in suggested that CT FNA-angle measurement method is more reliable and used in CT hip studies with confidence (Ginja *et al*., 2007). The femoral neck anteversion angle (FNA-angle) is an important factor for hip stability and normal walking related to multifactoral result of evolution, heredity, fetal development, intrauterine position, and the   mechanical forces. As of we know an abnormal FNA sometimes associated with many clinical problems ranging from harmless in toeing gait analysis. Particularly, in this early childhood osteoarthritis of the hip and the knee in the adults. In most cases were associated with minor functional problems in children during growth and development. So, child must be examined carefully and an accurate diagnosis needs to be established. The most important part If abnormal femoral neck anteversion produces severe functional disability, derivational osteotomy should be done, but delayed until late childhood (Gulan *et al*., 2000). Children for spontaneous regression of femoral neck ante version (FNA) angle The FNA was measured using ultrasound techniques also. Mean FNA angle in the first group was 24 degrees, and it decreased during examined period for average 1 degree per year. The medial and lateral rotation in the extended hip correlate with FNA angle as well as differences between medical and lateral rotation examination percentage of children with intoeing gait decreased from 12.8% to 1% (Matovinović *et al*., 1998). Most of new method for measuring femoral neck anteversion (FNA) that are required   only one lateral radiograph of the knee. In addition to routine radiographs of the hip for evaluation of total hip replacement. For compare the proposed method with FNA measurement by means of 3D CT

and MRI. Femoral specimens, radiographic examinations of the hip and knee, in three different rotational positions, and one CT examination were made. Te measurements of FNA were compared with patients with total hip replacements, measurements from routine radiographic examinations of the hip and knee and from CT examinations were compared successfully. The adequate accuracy and reproducibility of the FNA measurements produced by this proposed new method were be calculated.

Accuracy and reproducibility were 2 degree and 2 degree for the proposed method in the femoral specimen study, and accuracy was 4 degree in the hip patient. So, our proposed method had a minor flaw that caused almost solely by differences in knee size at inward rotation of the femur. Hence FNA measurement be made from a routine radiographic examination of the hip and a lateral view of the knee. This MRI method achieves an acceptable level of accuracy and reproducibility hving 80% results observed (Hermann and Egund, 1998). Elite ballet dancer (EBD) has greater-than-average turnout, or external rotation, in the hip. Anatomic constraints, such as the angle of version of the femoral neck. At the same time the femoral neck ante version (FNA) had angle limit. The amount of external rotation or turnout in the hip determine whether dancers who have better-than-average turnout and have lower-than-average FNA angles. But elite female dancers from three major American ballet companies were   study   concluded   that   the   average femoral neck anteversion angle (FNA-angle) in select group of dancers is similar to that of the general population. As of none of the dancers in this study had severe femoral neck ante version (Bauman *et al*., 1994).

FNA recent advances and future prospective

Now for this reason being what could be the best possibilities. Should we get together with both the sister branch (radiology, nuclear magnetic resonance imaging or nucleramedicine) as well to establish to develop the new concept and resolve this problem or to time pass in our hands. So here we encouraging and exploring the reality of the genuine problem of FNA. We also observed education and socio economical conditions and status among patients results not associated with this study.

Conclusion

Although, age, gender, degree of dislocation, concentric reduction or not, the development degree of femoral head before reduction and proximal femoral shape are the major factors influencing acetabular development. MRI is now openly recommended as an appropriate technique for measurement of the FNA in DDH, and this approach could replace 3D CT. MRI delivers no ionizing radiation and offers a better display of soft tissue amongst children with FNA-angel.

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Conflict of Interest: Nil

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