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Evaluation of CE Angle of Wiberg for the functional outcome in various Hip Pathologies: A prospective study

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Introduction

CE Angle of Wiberg

Hip joint is a ball and socket variety of synovial joint. The head of femur forms more than half a sphere, sphericity of head of femur is very important aspect in function and biomechanics of hip joint.

Biomechanically, a round head act as a fulcrum. The factors influencing both the magnitude and the direction of the compressive forces acting on the femoral head are 1) The position of the center of gravity; 2) The abductor lever arm, which is a function of the neck-shaft angle; and 3) The magnitude of body weight. Shortening of the abductor lever arm through coxa valga or excessive femoral anteversion will result in increased abductor demand and therefore increased joint loading. If the lever arm is so shortened that the muscles are overpowered, then either a gluteus medius lurch (the center of gravity is brought laterally over the supporting hip) or a pelvic tilt (Trendelenberg gait) will occur.

Aspheric head leads to weak abductor lever arm, and the sphericity has to be corrected or abductor lever arm is to be corrected, for deciding upon this we need to see the CE angle of Wiberg.

The CE angle of Wiberg is an excellent method of studying the development of hip joint in radiograms.[1]It is simple and unlike other measurements, **Bruckl et al (1972)**[2] showed that only a few lines to be drawn on the radiogram.[1]

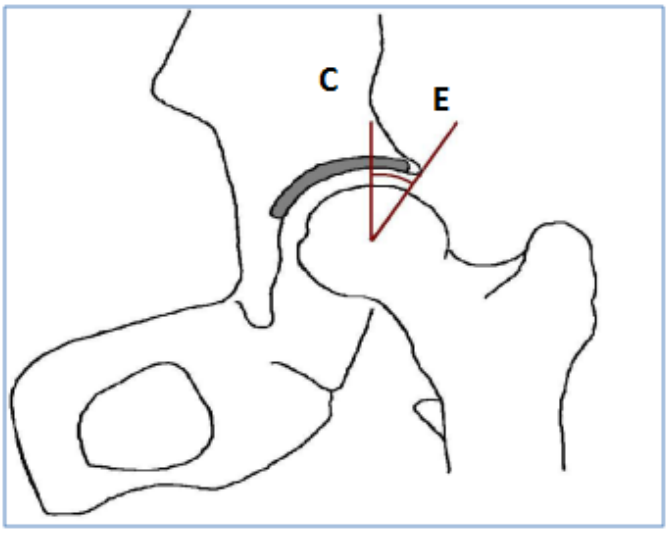

Fig. 1: Showing CE angle of Wiberg

The center edge angle (CE) was introduced by **Wiberg in 1939** as a measure of acetabular development and high degree of displacement of femoral head. It has been employed almost exclusively in relation to developmental dysplasia of hip previously called as congenital dislocation of hip and CE angle here distinguishes normal and so called dysplastic hips. **Wiberg (1939)**[3] stated that values over 25^0 were normal in adults and values between 20^0 and 25^0 were uncertain. This has been confirmed in other investigations. **Severin(1941)**[4], **Wiberg (1944)(1953)**[5,6], **Davis W (1970)**[7], **Fredensborg (1976).**[1] In children under 15 years of age, 20^0 or more

should be considered as normal with a range of 15^0 to 20^0.[1]

By noting the CE angle we are able to decide upon the further management of the affected Hip. In this study, we are going to assess the CE angle of Wiberg, in various aspheric hip conditions and formulate a protocol for further management of these Hip pathologies.

Materials and Method

Outcome in Various Hip Pathologies" in the Department of Orthopaedics, Pt. B.D.Sharma PGIMS, Rohtak during the period of 15 months from March 2017 to May 2018. A total of 28 patients (35 hips) with hip pathologies who fulfilled all the inclusion criteria and none of the exclusion criteria were enrolled in the present study.

Study Design: Prospective, observational study.

Sample Size: A total of 28 patients (35 hips) with hip pathologies were enrolled.

Total 36 patients of non-traumatic pathological hip pain had reported to us. And out of which only 35 hips of 28 patients who fulfilled our inclusion criteria and none of the exclusion criteria were enrolled in the study.

Inclusion Criteria

1. Patients with hip pathologies with age more than 5 years
2. Patients of both the genders
3. Patients with hip pathologies like CAM and/or Pincer type of Femoroacetabular impingement, Acetabular retroversion, Perthes like deformity, Osteoarthritis Hip, Avascular necrosis of femoral head, Developmental dysplasia of hip
4. Patients who are doubtful for hip preservation or salvage procedure
5. Patients willing to provide their voluntary written informed consent

Exclusion Criteria

1. Patients with congenital hip pathologies.
2. Patients not providing their voluntary informed written consent

Methodology

The patients were examined in OPD and after examination were sent for radiographs. Which were done under supervision. Plain upright Antero-posterior Pelvis views were obtained with legs positioned in neutral abduction-adduction along the functional axis. The x-ray beam was centered two finger breadths above the symphysis pubis in the vertical midline with a source to film distance of 120 cm in all cases.

All the 28 patients with plain upright AP pelvis, their radiographs were obtained with the neutral rotation of femurs. When measuring the lateral center edge angle the pelvic obliquity is adjusted.

Lateral center edge angle is formed by line perpendicular to the tilt of the pelvis and through the center of femoral head, for correct measurement draw a right angled line through the inferior aspect of the obturator foramina and the center of the femoral head and a line from the center of the femoral head to the lateral aspect congruent sourcil. **Sourcil** is the lateral acetabular border at the lateral margin of the dense zone of acetabular roof.

Measurements on Radiographs

The center of femoral head was determined with a spherical template on digital radiographs by placing the radius of the template congruent with the aspect of head contained by the acetabulum while ignoring the increasing lateral and anterior radius associated with CAM type femoroacetabular impingement deformities.

AP radiographs were corrected for leg- length inequality or obliquity by determining the vertical bases on a plane perpendicular to a line through the ischial tuberosities, tear drops or inferior border of the obturator foramina depending on which was more symmetric and assessable. The CE angle was formed by the intersection of vertical

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line through the center of the femoral head with the line extending to the lateral edge of the sourcil. In addition, a note was made on the presence of coxa profunda, Protrusio and a retroverted acetabulum. Coxa profunda was identified when the floor of the acetabulum was on or medial to the ilio-ischial line.[8] Protrusio was identified when the femoral head was on or medial to the ilio-ischial line.[8] Acetabular retroversion was identified when a crossover sign was present. The crossover sign was present when the anterior wall of the acetabulum crossed the posterior wall of the acetabulum.[9]

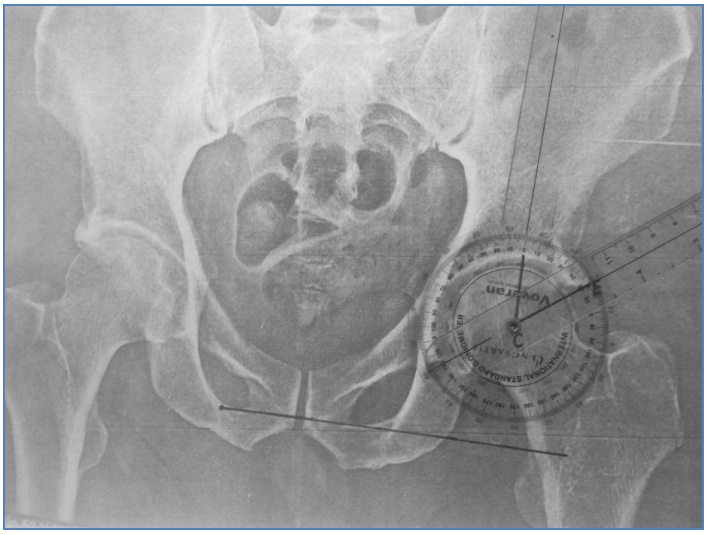

Fig.2 : Method of Measurement of CE Angle by Goniometer

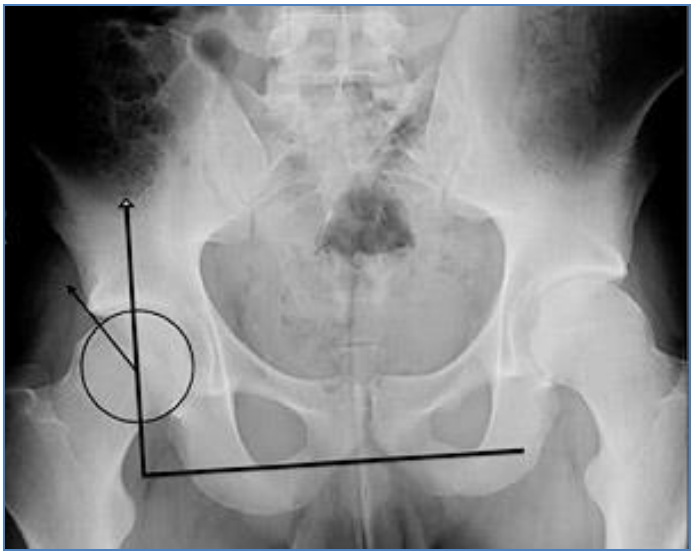

Fig.3: Measurement of CE Angle on the X-ray Mose Template

On the next follow-up, the X-rays were repeated, but were blinded and randomized from the examiner and presented as a fresh case, after one week cases were examined by other colleague x-rays are repeated in same manner and then after measurements these cases were matched with the previous X-ray readings. Both the x-rays are discussed in our clinical meetings of our institute for decision making according to the CE angle of the patient.

Result and Discussion

1. In present series our aim is to assess the Center Edge angle of Wiberg in various hip pathologies reported to us in a short duration of time viz. FAI, OA Hip, Osteonecrosis of Femoral head and Perthes' Disease.
2. The mean age of males were 40.86 ± 20.44 years and females were 42.71±12.04 years.
3. In all the hip pathologies Male preponderance was seen. Distribution amongst male : female was 75% : 25%
4. In all 28 cases (35 hips), Unilateral : Bilateral distribution was 75% : 25%
5. In our study we found a spectrum of variations in CE angle in all hip pathologies. Femoroacetabular impingement was the most common encountered hip pathology in our study.
6. The Mean CEA and SD in the hip pathologies were-

Femoroacetabular impingement :$32.67^0 \pm 11.67^0$

Osteoarthritis hip : $40.42^0 \pm 10.54^0$

Avascular necrosis of femoral head: $36.64^0 \pm 16.50^0$

Perthes' disease :$13.67^0 \pm 4.04^0$

7. If the CEA falls $\leq 20^0$ or $\geq 50^0$, total hip arthroplasty was contemplated in all hip pathologies except Perthes' Disease.
8. In Femoroacetabular impingement as the CE angle increases surgical management was contemplated.

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9. In Osteonecrosis of Femoral Head inspite of normal CE angle surgical management for hip salvage had been done.

10.In all the cases where there is involvement of Protrusio acetabulii whether the CE angle was normal, Total hip arthroplasty was contemplated.

11.Our potential limitation of study was the limited sample size, and short duration of time to assess the variation in CE angle in those patients where non-operative or Hip salvage procedure was done.

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