TO EVALUATE THE CHANGES IN HIP JOINT RELATED TO LOWER LIMB DOMINANCE AND ITS ASSOCIATION WITH HIP DISLOCATION

NIAZ MOHAMMAD, MAQBOOL ILAHI, QAISAR ZAMAN

1. Department of Anatomy, Khyber Girls Medical College, Peshawar Pakistan.

ABSTRACT

BACKGROUND: The stability of a joint depends on the arrangement of the articular surfaces. The failure of acetabulum to deepen along with associated relaxed capsule can be a causative factor leading to congenital dislocation of hip in babies. The right traumatic hip dislocation is less uncommon as compared to left side in adults.

OBJECTIVE: To correlate the majority of right-footed population with the bony parameters of hip joint bilaterally and to find out its association with left congenital and right acquired traumatic dislocation of hip.

MATERIAL AND METHODS: As the right footed people are considerably more (90%) than the left footed and this study work was correlated with the bones collected from cadavers in Anatomy department of KGMC Peshawar from January 2014 to December 2014. We included 14 pairs of femurs, 14 pairs of hip bones in this study to see the structural differences when dominant hip joint is compared with non-dominant hip joints. The measurements were performed with the help of vernier caliper.

RESULTS: The mean horizontal diameter of right (dominant) and left acetabulum was 50.14±0.69 mm and 52.35±0.65mm. The mean horizontal depth of right and left acetabulum was 22.21±0.82mm and 25.25±0.52mm. The horizontal diameter of right and left femur was 46.42±0.62mm and 43.85±01mm. The thickness of femoral head was 26.71±01mm on right (dominant) side but this thickness was 29.17±01mm on left side.

CONCLUSION: The left acetabulum was having a significant larger diameter in adult, allowing the smaller left femoral head to fit snugly which can be correlated with the more common left congenital dislocation hip. On the other hand, in adults, the left acetabulum is deeper, allowing the thicker left head of femur as an adjustment for weight bearing function while the larger rightfemoral head fit into a comparatively shallow socket. This may be a factor to improve mobility at the cost of stability; as right traumatic dislocationhip is less uncommon as compared to left side.

KEY WORDS: Hip joint, Ball and socket joint, Dominant lower limb, Right footedness, Left footedness, Congenital dislocation hip, Traumatic dislocation hip.

INTRODUCTION

The hip joint is a ball and socket joint¹. The stability of this largest² joint depends on the arrangement of the articular surface. The failure of acetabulum to deepen along with associated relaxed capsule can be a causative factor leading to congenital dislocation of hip³ in newborn babies. Brandler and Paracchini reported that handedness establish body asymmetry during development⁴. In about 90 percent of people the left hemisphere is dominant but in 96 percent of individuals speech is controlled by left hemisphere. Thus in most adult the left hemisphere is dominant which controls the right side of the body including limbs⁵. In cerebral palsy bilateral hip dislocation is a common complication in children⁶. It can be correlated with the joints of dominant limb which may develop earlier as compared to left side and start earlier movements which further expedite the process of development and make it less prone to dislocation. That is why left hip is dislocated more often than the right⁷ which can be presumed that limb dominance⁸,⁹ might play
some role in early development of a joint. Young et al\textsuperscript{10} reported asymmetry in the femoral head and Vandenbussche suggested that it would be better to design a cup for arthroplasty according to the side of acetabulum which may require different implants for right or left side\textsuperscript{11}. Negrete et al also reported a strong trend in females tearing their left anterior cruciate ligament more frequently as compared to right anterior cruciate ligament which may be the result of limb asymmetry\textsuperscript{12}.

The congenital hip dysplasia which may be a localized fault in embryonic development\textsuperscript{13} may also be associated with other conditions like osteoarthritis in later life\textsuperscript{14}. Keeping in view the existence of a considerable bilateral asymmetry between the two limbs\textsuperscript{15} the objective of this study was to compare the bony parameters of hip joints like transverse diameter and thickness of articular surface of femoral head along with transverse diameter and depth of acetabulum in the cadaveric bones bilaterally which were correlated with congenital and acquired dislocation of hip.

**MATERIAL AND METHODS**

This study work was carried out in Anatomy department of Khyber Girls Medical College Peshawar from January 2014 to December 2014. The hip joint of right limb was compared with left with help of measuring different parameters in bones achieved from cadavers at Anatomy Department Khyber Girls Medical College Peshawar. We included 14 pairs of femurs and 14 pairs of hip bones for this study. The measurements were performed with the help of vernier caliper.

The horizontal diameter and horizontal depth of acetabulum were measured along with horizontal diameter and thickness of articular surface of posterior quadrant of head of femur bilaterally. Total data was entered in SPSS version 20. All the data were assessed through Student's t-test to test any significant difference observed in bones of right and left hip joints and these findings were analyzed for conclusion. Student's t-test was applied for all quantitative data. A p-value of $\leq 0.05$ was taken significant.

**RESULTS**

The mean horizontal diameter of right acetabulum and left acetabulum was $50.14\pm0.69$ mm and $52.35\pm0.65$ mm. The mean horizontal depth of right and left acetabulum was $22.21\pm0.82$ mm and $25.25\pm0.52$ mm. The mean horizontal diameter of right and left femur was $46.42\pm0.62$ mm and $43.85\pm0.01$ mm. The mean thickness of femoral head was $26.71\pm01$ mm on right (dominant) side but this thickness was $29.17\pm01$ mm on left side.

**Table 1: Comparison of bony parameters of right Hip and left Hip joint**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Bone</th>
<th>Parameters</th>
<th>Right MEAN $\pm$ SE</th>
<th>Left MEAN $\pm$ SE</th>
<th>P. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Acetabulum</td>
<td>Horizontal diameter (mm)</td>
<td>50.14$\pm$0.69</td>
<td>52.35$\pm$0.65</td>
<td>0.03*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Horizontal depth (mm)</td>
<td>22.21$\pm$0.82</td>
<td>25.25$\pm$0.52</td>
<td>0.05*</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>14</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Femur</td>
<td>Horizontal diameterhead (mm)</td>
<td>46.42$\pm$0.62</td>
<td>43.85$\pm$01</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thickness articular surface (mm)</td>
<td>26.71$\pm$01</td>
<td>29.17$\pm$01</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>14</td>
<td>14</td>
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</tr>
</tbody>
</table>

**KEY:** N = Number of specimens SE = Standard error of mean * = Statistically significant

**DISCUSSION**

The mean horizontal diameter of right acetabulum (50mm) was significantly (p=0.03) less than the diameter of left acetabulum (52 mm) which may reflect a wider diameter of left acetabulum in newborn as well, making these babies more prone to congenital dislocation hip. Varodompu et al reported the average acetabular diameter to be 52 mm\textsuperscript{16}. A study in human fetuses demonstrated a strong relationship between femoral head and
acetabular diameter who noted that in some joints the femoral head diameter exceeded the acetabular diameter\textsuperscript{17} which might remain under developed for a longer time and provide a good explanation for congenital dislocation of hip. The mean horizontal depth of right acetabulum (22 mm) was significantly (p=0.05) less than left acetabulum (25mm). This may be due to more weight bearing function performed by left hip joint during different movements (kicking the ball etc.) of right dominant limb apart from walking. In other study the fetal acetabular depth was shown to be the slowest-growing structure which may be an explanation for congenital dislocation hip\textsuperscript{17}. The Saikia et al also reported a similar (2.5cm) depth of acetabulum\textsuperscript{18}.

The horizontal diameter of right femur (46.4 mm) was more (p=0.06) than that of left femur (44mm) which shows that right hip is more adjusted to different sort of activities associated with lesser acetabular depth providing a good platform for a wide range of movements. This study was in accordance with the study of Saegnipanthkul and Techasatien who reported the mean coronal diameter of femoral head to be 45.25mm\textsuperscript{19}.

The thickness of femoral head (27mm) was less (p=0.13) on right side as compared with left (29 mm) side which was not increased with increase in femoral head diameter. This shallow head of right femur could be correlated with shallow depth of right acetabulum which may be adapted well to more mobility as compared to left side which supports the idea that joint growth is mechanically regulated\textsuperscript{20}. It could be correlated with the study of Dwyer et al who reported that the traumatic hip dislocation is more common on the right than on the left side \textsuperscript{21}.

**CONCLUSION**

The left acetabulum was having a significant larger diameter in adult, allowing the smaller left femoral head to fit snugly into a comparatively larger acetabular cavity, which can be correlated to the more common left congenital dislocation hip. On the other hand the left acetabulum is deeper allowing the longer left femoral head as an adjustment for weight bearing function while the larger right femoral head (presumed dominant) fit into a comparatively shallow socket of acetabulum. This may improve mobility at the cost of stability, as the right traumatic hip dislocation is less uncommon as compared to left side in adults.

**REFERENCES**


CORRESPONDENCE ADDRESS
Name: Dr. Niaz Mohammad
Department of Anatomy
Khyber Girls Medical College,
Peshawar-Pakistan.
Cell: 0300-5979766
Email: dr.niaz303@gmail.com