An Autopsy based unaided Eye Study of Lambdoid Suture of Skull– the Science of Forensic Estimation of Age

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ABSTRACT

Background: The criminal investigation starts at crime scene and ends in the laboratory. The most vital of which is mortuary where the postmortem examination of the deceased is carried out to answer the questions of interest in that investigatory menu.

Aim: Unaided eye estimation of age from the lambdoid suture of skull on autopsy.

Methods: The subjects under study were taken from mortuary of the department of Forensic Medicine and Toxicology in the King Edward Medical University Lahore during the year 2016. The targeted population for study was the draining are of the mortuary of King Edward Medical College having designated police station. A pretested questionnaire was used to collect the calculated sample among the research population as a research method. A non-probability convenient consecutive sampling technique was applied to collect the data. The comparative descriptive study design was utilized to analyze the results.

Results: The study revealed that among the targeted population a higher percentage more than third of the sample size were adolescents of age between 21 – 30 years being 35% followed by elderlies of age between 41 – 50 years amount to 20%. The research depicted that age can be determined from degree of closure of lambdoid suture in the dead body on the autopsy table with closure taking place earlier in males as compared to that of females.

Conclusion: This study concludes that it is possible to estimate age from the degree of lambdoid suture closure of the deceased skull vault during the postmortem examination.

Keywords: Age, Lambdoid, Suture, Autopsy, Cranial, Post-mortem Examination, Skull

INTRODUCTION

The science of Forensic Medicine is given the prime responsibility to constitute the individuality of the unknown in face of mass disasters or any single individual with not known identity. The identity is required in each and every discipline irrespective of its nature being civil or criminal case. This identity then than paves the ways to probe the investigations in a specific direction and hence resolving the questions of intricate nature. Age is the first parameter to be determined in the this complex web of establishing one identity. Age estimation, beside other responsibility of legal nature of criminal spheres, is also required for regular societal norms like that of schooling, identification cards, seeking jobs and voting rights. In the face of difficult situations and unavailability of normal physiological parameters the age is generally determined either from the bony skeleton or otherwise of the human body parameters.

The age from the physiological parameters is depicted through the general development in height and weight along with pubertal changes in terms of menarche and thelarche etc. The pathological changes can be catastrophic of eye produced as a factor of aging. As long as the dead body brought for postmortem examination is fresh and no sign of ensuing decomposition the determination of age, from these parameters, poses no difficulty. But the problem arises when the cases of deceased are brought with moderate to advanced stage of decomposition whereas sometime even totally skeletonized remains are brought for investigation. Skeletal remains are the hardest part of the human body and so are resistant to general decomposition changes and hence after the normal physiological changes of the soft tissue the bones help better for determination of identity including age. The teeth up to 6 – 12 years, the long bones up to 30 years and after 30 years the cranial sutures can help age estimation in case of decomposition or mutilated bodies. The ossification centers of the long bones, the sternal rib ends and the degree of ossification of the cranial sutures from inwards to outwards help in age estimation on the autopsy type. The naked eye examination after 30 years of age and especially in decomposed dead bodies the cranial vault suture are the only

Received on 07-07-2022

Accepted on 16-11-2022

DOI: https://doi.org/10.53350/pjmhs20221612206

MATERIAL AND METHODS

The study was carried out at the mortuary of the Forensic Medicine department of King Edward Medical University during the year 2016. The study participants are included through a predesigned and pretested questionnaire incorporating Acsádi- Nemeskéri score i.e. a method of scoring the lambdoid suture designed by two great scientists of their time. G. Acsádi, and J. Nemeskéri were renowned archaeologists, writers and researcher of late twentieth century who devised a method of estimating the age from the cranial suture is commonly referred as Acsádi- Nemeskéri scale.
After approval of the Institutional Review Board (IRB) all the cases with skull abnormalities, fractured skull and with age less than 20 or more than 70 were excluded in order to ensure the desired age range and any factor compromising lambdoid suture naked eye examination. Similarly the deceased objects with given age bracket as mentioned above and normal skull contours. The standard autopsy protocol for dissection of the scalp and skull for proper exposure of the lambdoid suture.

The sample size of 90 dead bodies were selected through a non-probability consecutive purposive sampling technique. A descriptive comparative cross-sectional study design was applied to infer the results and observation in order to determine the age of the deceased on the autopsy table during the postmortem examination in cases of unclaimed or unidentified dead bodies.

The Acşádi- Nemeskéri score for degree of closure of the lambdoid suture for its three parts as L1, L2 and L3 was applied to assess closure stage from 0, 1, 2, 3, to 4 being observed as open, with incipient closure, with closure in progress, advanced closure and completely closed. The exercise was executed both for ectracranial closure as well as endocranial closure from outside and inside the skull cavity respectively of the lambdoid suture. The Acşádi- Nemeskéri scoring scale is schematically presented as below

0= open. There is still little space left between edges of adjoining bones.
1=incipient closure. Clearly visible as a continuous often zigzagging line.
2=closure in progress. Line thinner, less zigzags, interrupted by complete Closure.
3=advanced closure. Only pits indicate where the suture is located (almost complete closure)
4= closed. Even location cannot be recognized.

RESULTS

Age versus gender distribution: For the purpose of convenience table 1 shows the subjects under study were classified into 5 categories of each expanding over a decade. The each categories contained the number of subjects and their gender is elaborated in the same table. The 21 – 30 years age bracket contained at total of 32 subjects with 10 having male gender and 22 as females. There were 15 cases in the age span of 31 – 40 years containing 08 males while 07 were females. There were 10 males with 08 females making a total of 18 subjects in the age range of 41 – 50 years. The age scale 51 – 60 years was represented by 14 subject with contribution of 08 males and just 06 females. A total of 11 cases in the age group of 61 – 70 years comprised of 09 males and 02 females. The category of age 21 – 30 years encompassed 35.5% with female preponderance more than 50% of the said category, the 31 – 40 years contained 16.7%, the 41 – 50 years comprised of 20% almost equal contribution of both the gender in the middle 3 age groups. The last group of age span 61 – 70 years accommodated 12.2% with almost all of male genders. However the overall composition of gender proportions was equal.

The Lambdoid Suture Stages and Estimated Age: The age was estimated by the stage of the closure of the Lambdoid Suture through Acşádi- Nemeskéri score as described in the methodology section from 0 as open to 4 as completely closed. The suture was divided into 3 equal halves as L1, L2 and L3. Those of the ectracranial surface was labelled as ‘Ecto’ as prefix and for the endocranial surface the prefix of ‘Endo’ was labelled. The table 02 shows the degree of suture closure in 45 males and table 03 shows the same for equal number of females.

In table 2 complete closure of the lambdoid suture endocranial subsections as Endo-L1, Endo-L2 and Endo-L3 whereas on the ectracranial surface Ecto-L1 was observed as completely closed in the age group of 61 to 70 years. The rest of the subsections were all above the advanced closure and just short of complete closure which also may be regarded as completely closed in the age range 61 -70 years. Within the age scale of 51 – 60 years the Endo-L1 subsection was observed as completely closed. Endo-L2 subsection in 41 – 50 years age group was observed as having advanced closure, subsection Ecto-L3 depicted closure in progress in 31-40 years of age and subsection Endo-L3 in age bracket of 21-30 years showed incipient closure. Among the females the subsections Ecto – L1, Endo – L1, Endo – L2 and Endo – L3 among ages 61 – 70 years showed complete closure whereas in subsections of Ecto – L2 Endo – L2 and Ecto – L3 there was advanced closure in age ranges 51 – 60 years of age and subsection Ecto – L1 41 – 50 years exhibited advanced closure as well. Incipient closure was observed in subsection of n Ecto – L2 in the age of 31 – 40 years.

Among both the genders when combined in there was complete closure in all the subsections of the Lambdoid Suture in the age group 61 – 70 years endocranially and sparing Ecto-L2 there was complete closure in all the subsections ectocranially as well.

Table 1: The age groups versus gender distribution

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Male (n=45)</th>
<th>Female (n=45)</th>
<th>Total (n=90)</th>
<th>Valid %</th>
<th>age</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 to 30 years</td>
<td>10</td>
<td>22</td>
<td>32</td>
<td>35.5</td>
<td></td>
</tr>
<tr>
<td>31 to 40 Years</td>
<td>08</td>
<td>07</td>
<td>15</td>
<td>16.7</td>
<td>20</td>
</tr>
<tr>
<td>41 to 50 Years</td>
<td>10</td>
<td>08</td>
<td>18</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>51 to 60 Years</td>
<td>08</td>
<td>06</td>
<td>14</td>
<td>15.6</td>
<td></td>
</tr>
<tr>
<td>61 to 70 Years</td>
<td>09</td>
<td>02</td>
<td>11</td>
<td>12.2%</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: The lambdoid suture closure stage in males (n=45)

<table>
<thead>
<tr>
<th>Age group</th>
<th>n</th>
<th>Ecto-L1 Mean ± SD</th>
<th>Ecto-L2 Mean ± SD</th>
<th>Ecto-L3 Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-30 Years</td>
<td>10</td>
<td>0.90±0.316</td>
<td>1.30±0.483</td>
<td>0.10±0.316</td>
</tr>
<tr>
<td>31-40 Years</td>
<td>08</td>
<td>1.86±0.641</td>
<td>2.36±0.518</td>
<td>1.25±0.483</td>
</tr>
<tr>
<td>41-50 Years</td>
<td>10</td>
<td>3.30±0.675</td>
<td>3.35±0.527</td>
<td>2.30±0.483</td>
</tr>
<tr>
<td>51-60 Years</td>
<td>08</td>
<td>3.88±0.354</td>
<td>4.00±0.000</td>
<td>3.82±0.518</td>
</tr>
<tr>
<td>61-70 Years</td>
<td>09</td>
<td>4.00±0.000</td>
<td>4.00±0.000</td>
<td>3.56±0.527</td>
</tr>
</tbody>
</table>

Table 3: The lambdoid suture closure progress in females (n=45)

<table>
<thead>
<tr>
<th>Age group</th>
<th>n</th>
<th>Ecto-L1 Mean ± SD</th>
<th>Ecto-L2 Mean ± SD</th>
<th>Ecto-L3 Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-30 Years</td>
<td>22</td>
<td>0.95±0.486</td>
<td>1.59±0.734</td>
<td>0.41±0.503</td>
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<tr>
<td>31-40 Years</td>
<td>7</td>
<td>1.86±0.690</td>
<td>1.86±0.378</td>
<td>1.00±0.000</td>
</tr>
<tr>
<td>41-50 Years</td>
<td>8</td>
<td>3.00±0.535</td>
<td>3.63±0.518</td>
<td>2.50±0.926</td>
</tr>
<tr>
<td>51-60 Years</td>
<td>6</td>
<td>3.17±0.408</td>
<td>3.67±0.516</td>
<td>3.00±0.000</td>
</tr>
<tr>
<td>61-70 Years</td>
<td>2</td>
<td>4.00±0.000</td>
<td>4.00±0.000</td>
<td>3.50±0.707</td>
</tr>
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</table>
DISCUSSION

The results inferred from the study were promising for estimation of age from the degree of lambdoid suture closure. The study focussed for determination of age from the lambdoid suture only and it was confirmed that the suture closure starts occurring in late thirties, progressed during forties and fifties while it was near completion in the sixties. It started closing from the endocranial surface of the skull. i.e. the inner surface of the cranial vault. It has already been an established fact all the bony skeleton grows, fuse and ossify first in females than in males applicable to all the long bones and other bones part of the skeleton except the sutures of the cranial vault. When the process of ossification closes to the closure of the cranial suture the gender disparity becomes evident being reciprocal that of the fact as described above. The closure of the cranial suture, the one i.e. lambdoid suture studes in the current article shows the closure in females is earlier as compared to that of males, when analysed at the specific age of the genders.

The study revealed that closure of the lambdoid suture kept progressing with advancing age. The closure was more marked endocranially than ectocranial closure. Significant progress in terms of closure was observed relatively in older age groups as already established in existing research. The prominent age was after 40 years and complete closure in entire lambdoid suture in 61 to 70 years age bracket.

Gender disparity was also analysed in the lambdoid suture closure pattern. It has already been an established fact all the bony skeleton grows, fuse and ossify first in females than in males applicable to all the long bones and other bones part of the skeleton except the sutures of the cranial vault. Gender disparity becomes evident being reciprocal that of the fact as described above. The closure of the cranial suture, the one i.e. lambdoid suture studies in the current article shows the closure in females is earlier as compared to that of males, when analysed at the specific age of both the genders.

A close examination of the lambdoid suture pattern observed at the specific age of both the genders. The study concluded that the lambdoid suture starts closing from inner surface and then turns out to the outer surface. The lambdoid suture closure takes place earlier in females than in males like all other sutures of the skull.

Conflict of interest: Noting to declare

REFERENCES
