INTRODUCTION

The bony skeleton of the head is termed skull. Skull composed of cranial vault and base. Cranial vault is known as Calvaria. Cranial vault is the superior view of skull (Norma Verticalis). Calvarium consists of frontal, parietal, temporal and occipital bones. The skull's main function is to protect the brain. It is comprised of 22 bones, eight of which form the neurocranium and are connected by synarthrodial joints called sutures. Most of these cranial bones are categorized as flat bones and can be identified by their layered bone structure where a cancellous bone layer, called diploe, is sandwiched between two layers of dense cortical bone (cortex). The skull's main function is to protect the brain. It is comprised of 22 bones, eight of which form the neurocranium and are connected by synarthrodial joints called sutures. Most of these cranial bones are categorized as flat bones and can be identified by their layered bone structure where a cancellous bone layer, called diploe, is sandwiched between two layers of dense cortical bone (cortex). These bones develop from membranous ossification. Thus, these bones are called membrane bone. Membranous bones are widely used in bone grafting because of greater acceptability in donor. To evaluate donor site, firstly surgeons should assess the thickness of bone in Calvarium with help of Computerized tomography (CT) scan. For selection of screw for fixation, knowledge about calvarial thickness is essential. We can prevent the risk of penetrating cranial cavity due to screw fixation by knowing the calvarial thickness. Total thickness of calvarial bones includes outer table, diploe and inner table. Diploe is made up of spongy bone. Outer and inner table made up of compact bone. There are a few literatures regarding imaging assisted measurement of calvarial thickness among Nepalese population. This study was aimed to measure the thickness of Calvaria and to observe the variation in thickness in between them.

METHODS

The data was collected from Department of Radiology Chitwan Medical College Teaching Hospital, Bharatpur-13, Chitwan. from October 2022 A.D. to November 2022 A.D. Ethical approval was taken from IRC No. CMC-IRC/079/080-067 Ethical approval was taken from IRC No. CMC-IRC/079/080-067. Patient of age 15 to 50 years with normal CT finding were included in the study. Patient with chronic hydrocephalus, hyperparathyroidism, acromegaly, osteopetrosis, brain tumor, fibrous dysplasia, metastases were excluded.
The calvarial thickness were measured during routine 3-D MDCT (Siemens Somatom definition AS 128 slice MDCT Siemens GmBH, Germany with syngo.via version VB 20A MPR with 3D reconstruction). Scans were obtained with collimation: 128 x 0.6 mm scan time: 5.0 s scan length: 116 mm rotation time: 1.0 s tube settings: 120 kV, 380 eff. mAs CTDIvol: 54.08 mGy DLP: 916 mGy cm eff. dose:1.92 mSv. Using the axial view of brain CT, the thickness of frontal bone was measured in midpoint of coronal suture and nasion, the occipital bone midway between right mastoid bone and internal occipital protuberance while parietal bone was measured in parietal eminence and recorded in millimeter. All these measurements were presented as frequency distribution table and diagram. Data were entered and analyzed in Epidata and SPSS respectively.

RESULTS

Hundred calvarial thickness is measured by using computerized tomography scan. Thickness of frontal bone; parietal bone and occipital bone ranges from 0.37 mm to 0.97 mm with mean value 0.6991±0.311 mm; 0.36 mm to 0.99 mm with mean 0.6772±0.15058 mm and 0.30 to 0.95 mm with mean 0.68±0.15236 mm respectively as shown in table 1.

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Occipital bone</th>
<th>Parietal bone</th>
<th>Frontal bone</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.68±0.15236</td>
<td>0.6772±0.15058</td>
<td>0.6991±0.311</td>
<td></td>
</tr>
</tbody>
</table>

No significant correlation between thickness of frontal, parietal and occipital bone is observed using Pearson coefficient as shown in table 2.

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Correlations (Pearson coefficient)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frontal</td>
</tr>
<tr>
<td>Frontal bone</td>
<td>-</td>
</tr>
<tr>
<td>Parietal bone</td>
<td>0.663</td>
</tr>
<tr>
<td>Occipital bone</td>
<td>0.469</td>
</tr>
</tbody>
</table>

DISCUSSION

The present study deals with the measurement of thickness of frontal, parietal and occipital bone, and comparison between them. The present study shows that the findings were in proximity or similar to previous research.

Lillie et al. showed the results of study conducted was different from present study due to the age group involved of specified gender and greater sample size. Bhattarai M showed in the conducted study that mean thickness of parietal and occipital bone were inconsistent with present study due to numerous points considered while measuring the thickness; more sample size and all individual above 20 years were considered as candidate. Farzana et al. showed in their study that variations were observed with present study because of the difference in age group (18-73 years) of both gender, 1 6 slice CT scan used, and consecutive patient regarded as participant.

Weber et al. conducted a comparative study on 12 fossils skull of homo erectus OH 9 in Tanzania. The findings were different from present study due to difference in species of human being and smaller sample size. Ross MD et al. investigated skull thickness of black and white races and found that white women have the thickest and white men the thinnest skulls. Both the observations were contrasting to our result.

Boer et al. investigated on 1097 autopsied sample showed that findings are different from present study due to difference in sample size, age group (0-100) and duration of study (2011-2014).

Sabanciogullari et al. performed MRI based study on 220 head showed that the findings were indifferent from recent study due to different measuring instrument, abundant sample size and different analytical software version used SPSS 16.

Thulung et al. studied 100 samples of 15 to 50 years age group showed that the findings were consistent with the present study due to same sample size; sample population and similar research methodology.

Kulathunga et al. studied on 100 autopsied showed proximity with the present study due to similar geographical location, topography and environmental condition.

Baral et al. conducted a CT scan-based study on 100 samples over 20 years age showed that thickness of frontal and parietal were in close consistency with present study. But occipital thickness was inconsistent with the present study due the sample age being over 20 years of age.

Shah et al. concluded from their study that frontal and parietal thickness was similar. Despite of same geography, topography, ethnicity and races, occipital thickness differs from present study due to difference in duration of study and sample size.

Skrzat et al. concluded from a study on 10 dried skulls that variations in thickness in all calvarial bone was observed. Zwirner et al. performed a site dependent load deformation behaviors method (using three points bending techniques) revealed that the thickness was in close relation to each other despite of different method of measurement. Alkhatheeb mentioned in his cephalometric radiographic study that the thickness of parietal bone is greater followed by occipital and then frontal bone.

Marsh et al. determined findings from study of 219 skulls of age group (15 to 60 years) using proportional grid to the skull vault showed the variations in frontal, parietal and occipital thickness.

Smith et al. conducted a cephalometric radiogram of 111 skulls 120000 years remains of Jordan and Israel showed variations in between frontal, parietal and occipital thickness in comparison to present study due to racial geographic variation and different method of measurement being used.
CONCLUSION

The slight variation of calvarial thickness of frontal, parietal and occipital bone is observed. No significant correlation between thickness of frontal parietal and occipital bone is found.

ACKNOWLEDGEMENT

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CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

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