ANATOMY OF THE CLAVICLE AND ITS APPLICABILITY IN MANAGEMENT OF CLAVICULAR FRACTURES

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ABSTRACT

Background: Fractures of the clavicle are relatively common and recently the most preferred mode of management is often surgical as it is associated with lesser chances of displaced fractures and non-union. Intramedullary nailing is one such method of fixation of clavicular fractures. Intramedullary nailing requires detailed knowledge about the anatomy of the clavicle.

Materials and Methods: Eighty dry, adult, human clavicles were studied using digital sliding calipers. Parameters like length, medial and lateral width, medial, lateral epiphyseal and medial diaphyseal diameters, medial and lateral bending radius were measured. Statistical analysis was done using SPSS software.

Results: Right clavicles were shorter than the left clavicle. The median diaphyseal diameter was significantly smaller than the medial and lateral epiphyseal diameter signifying the narrowness of the region.

Conclusion: Success of the intramedullary nailing in clavicular fracture management depends largely of the morphology of the endomedullary canal and narrowness of the median diaphyseal region and the total length of the clavicle should be kept in mind while attempting the procedure.

KEY WORDS: Adult, Arm Injuries, Clavicle, Epiphyses, Intramedullary Fracture Fixation.

INTRODUCTION

The clavicle is a “crank shaped cantilever that carries the scapula and transmits part of weight of the upper limb to the axial skeleton” [1]. It serves as the sole structure which connects the axial skeleton to the shoulder girdle [2]. Morphology of the clavicle has been a subject of interest for researchers since long time. Clavicular morphology has been studied extensively by Orthopedic Surgeons for better management of clavicular fractures [3-7]. Anatomic and Forensic experts have studied clavicle to explain development, gender and age related differences [8-11].

Clavicular fractures occur very commonly and account for 2-10% of all fractures and 44-66% of fractures around the shoulder [12-14]. Fracture of middle third accounts for 80-85% of all fractures of the clavicle, fractures of the medial third account for 5% and fractures of the lateral...
MATERIALS AND METHODS

In this study, 80 dry, human clavicles collected from the first and second year MBBS students and the department of Anatomy of the Hassan Institute of Medical Sciences, Hassan, India were used for data collection. 50 clavicles were from right side and 30 were left clavicles. Age and gender was not known. Clavicle with broken ends and any other deformities were excluded from the study.

All measurements were done by the same operator. Digital sliding calipers was used to take all measurements (Figure 1). We measured the following parameters (Figure 2),

1. Length of the clavicle
2. Lateral width (LW)
3. Medial width (MW)
4. Lateral epiphyseal diameter (LED)
5. Medial epiphyseal diameter (MED)
6. Median diaphyseal diameter (MDD)
7. Lateral bending radius (LR)
8. Medial bending radius (MR)

The data were entered into an excel sheet and were organized into subgroup base on the side of the clavicle. Statistical analysis was done using SPSS version 20 for windows 8.1. Comparison of quantitative variables was done using student’s t test. P value of d”0.05 was considered significant.

RESULTS

Table 1: Anatomical measurements of clavicle (in millimeters).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Side</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of the clavicle</td>
<td>Right</td>
<td>142.62±8.18</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>144.65±9.86</td>
</tr>
<tr>
<td>Lateral width</td>
<td></td>
<td>8.36±1.2</td>
</tr>
<tr>
<td>Medial width</td>
<td></td>
<td>13.54±3.12</td>
</tr>
<tr>
<td>Lateral epiphyseal diameter</td>
<td></td>
<td>19.29±2.62</td>
</tr>
<tr>
<td>Medial epiphyseal diameter</td>
<td></td>
<td>21.48±4.32</td>
</tr>
<tr>
<td>Median diaphyseal diameter</td>
<td></td>
<td>8.52±2.48</td>
</tr>
<tr>
<td>Lateral bending radius</td>
<td></td>
<td>31.74±4.12</td>
</tr>
<tr>
<td>Medial bending radius</td>
<td></td>
<td>62.23±3.49</td>
</tr>
</tbody>
</table>

Right clavicles were slightly shorter than the left. Lateral width of the clavicle was less than the medial width and the difference was statistically significant (pd”0.05). Medial epiphyseal diameter was more than the lateral epiphyseal diameter. The median diaphyseal diameter was the least of all the diameters. Medial bending radius was considerably more than the lateral bending radius. The side difference between all the parameters were statistically not significant (p > 0.05).
DISCUSSION

The study describes the anatomy of the dry, human clavicles of unknown sex, age and gender. Evaluation and comparison of data obtained in the present study showed similarities as well as differences when compared with previous studies.

In the present study, mean length of the right clavicle was 142.62 mm and left clavicle was 144.65 mm. Length of the clavicle was less when compared with previous studies done on dry clavicles, both in Indian and European population [17,18]. However, mean length of the clavicle in the present study was similar to the mean length obtained in studies done by Huang et al [8], Daruwalla et al [19] and Nalla et al [20]. In the present study the right clavicle was relatively shorter. The difference in the length of the clavicle was difficult to explain as the details of the age, gender and handedness of the bones were unavailable. Factors such as handedness and relative workload will affect the length of the clavicle.

Median diaphyseal diameter was significantly less than the medial and lateral epiphyseal diameter justifying the fact that the middle third of the clavicle indeed is the narrowest region of the clavicle. Because of this anatomy fractures occur more commonly in this region. Too much smaller median diaphyseal diameter means further smaller endomedullary canal and hence it may be a contraindication for intramedullary nailing as a treatment for mid-shaft fractures of the clavicle [21].

Conventionally clavicular fractures are being treated by conservative methods. Various authors have demonstrated the superiority of surgical method over the conservative management in clavicular fractures management [12,22,23]. Intramedullary approach preserves periosteal blood supply and hence has lesser chance of non-union [18]. Hence knowledge of detailed anatomy of the clavicle becomes essential in surgical management of clavicular fractures.

Limitations of the study: Endomedullary morphology could not studied due to financial constraints. Detailed measurements of the endomedullary morphology using computed tomography will yield accurate dimensions of the canal and hence can help in deciding about the size of the nails that can be employed in intramedullary fixation of the clavicle. One more limitation of the study was, the age, sex and handedness of the clavicles were not known. If data regarding the above factors are available or if the study can be done in live patients or cadavers using computed tomography accurate results can be obtained, as well as age, gender and handedness related difference can also be studied.

CONCLUSION

The study shows that the anatomy of the clavicle is suitable for surgical management or intramedullary fixation. Narrowness of the bone, especially, in the mid shaft region should be kept in mind while attempting intramedullary nailing as passing intramedullary device into these narrow canals will be difficult or even impossible.

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Conflicts of Interests: None

REFERENCES


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