International Journal of Anatomy and Research,
Int J Anat Res 2016, Vol 4(1):2069-72. ISSN 2321-4287
DOI: http://dx.doi.org/10.16965/ijar.2016.144

Original Research Article

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

Manjunath CS *[1], Tejaswi Hiremarali Lokanathan [2].

*[1] Assistant Professor, Department of Anatomy, Hassan Institute of Medical Sciences, Sri Chamarajendra Hospital Campus, Hassan- 573201, Karnataka State, India.

[2] Assistant Professor, Department of Anatomy, Adichunchanagiri Institute of Medical Sciences, BG Nagara-571448, Nagamangala, Mandya, Karnataka State, India.

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.

Address for Correspondence: Dr. Manjunath CS, Assistant Professor, Department of Anatomy, Hassan Institute of Medical Sciences, Sri Chamarajendra Hospital Campus, Hassan- 573201, Karnataka State, India. Mobile no: +919481288323, **E-Mail:** csmanjunath41@gmail.com

Access this Article online

Quick Response code

DOI: 10.16965/ijar.2016.144

Web site: International Journal of Anatomy and Research
ISSN 2321-4287
www.ijmhr.org/ijar.htm

Received: 11 Feb 2016 Accepted: 03 Mar 2016
Peer Review: 11 Feb 2016 Published (O): 31 Mar 2016
Revised: None Published (P): 31 Mar 2016

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

third about 15% [15]. Although the clavicular-fractures are treated conservatively, there is an increase in the incidence of cases of non-union as well as displaced fractures with conservative treatment. Fixation of clavicular fractures have shown improved benefits over the conservative methods. The design of fixation devices depends largely on the anatomical characteristics of the clavicle [16].

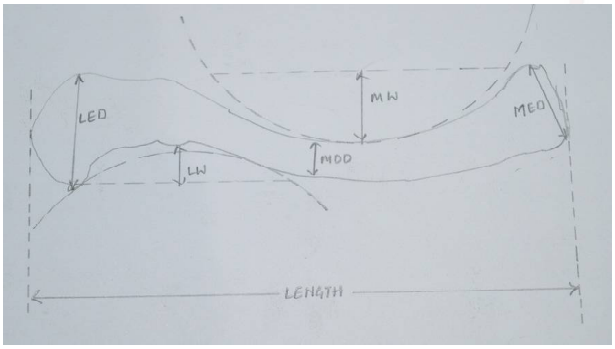
The objective of the present study was to provide the detailed morphological data of the clavicle, thus to help surgeons in planning for better management of clavicular fractures using fixation devices.

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.

Fig. 1: Measurement of length of the clavicle using digital sliding calipers

Fig. 2: Measurements of other morphological parameters of the clavicle



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).

Parameters	Side		P value
	Right	Left	
Length of the clavicle	142.62±8.18	144.65±9.86	>0.05
Lateral width	8.36±1.2	7.98±.87	>0.05
Medial width	13.54±3.12	14.89±4.26	>0.05
Lateral epiphyseal diameter	19.29±2.62	20.54±2.98	>0.05
Medial epiphyseal diameter	21.48±4.32	23.24±4.79	>0.05
Median diaphyseal diameter	8.52±2.48	9.59±2.87	>0.05
Lateral bending radius	31.74±4.12	32.69±4.79	>0.05
Medial bending radius	62.23±3.49	63.54±3.34	>0.05

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.

ACKNOWLEDGEMENTS

The authors are thankful to Dr.Prakash BS, Professor and Head, Department of Anatomy, Hassan Institute of Medical Sciences for his guidance and support during the research and first and second year MBBS students of Hassan Institute of Medical Sciences for providing the clavicle to carry out this study.

Conflicts of Interests: None

REFERENCES

[1]. Birch R. Shoulder girdle and arm. In: Gray's Anatomy. The Anatomical basis of clinical practice. 41st edition. Edited by Standring S. London: Churchill Livingstone Elsevier, 2016; 799.

[2]. Bernat A, Huysmans T, Van Glabbeek F, Sijbers J, Gielen J, Van Tongel A. The anatomy of the clavicle: a three-dimensional cadaveric study. Clin Anat 2014;27(5):712-23

[3]. Andermahr J, Jubel A, Elsner A, Prokop A, Tsikaras P, Jupiter J et al. Malunion of the clavicle causes significant glenoid malposition: A quantitative anatomic investigation. Surg Radiol Anat 2006;28:447-56.

[4]. Huang JI, Toogood P, Chen MR, Wiber JH, Cooperman DR. Clavicular anatomy and the applicability of precontoured paltes. J Bone Joint Surg AM 2007;89:2260-65.

[5]. Vanbeek C, Boselli KJ, Cadet ER, Ahmad CS, Lewine WN. Pre-contoured plating of the clavicle fractures: Decreased hardware related complications? Clin Orthop Relat Res 2011;469:3337-43.

[6]. Nowak J, Holgersson M, Larsson S. Can we predict long-term sequale after fractures of the clavicle based on the intial finding? A prospective study with nine to ten years' follow-up. J Shoulder Elbow Surg 2004;13:479-86.
[7]. Hillen RJ, Burger BJ, Poll RG, Van Dijk CN, Veeger DH. The effect of experimental shortening of the clavicle on shoulder kinematics. Clin Biomech 2012;27:777-81.
[8]. McCormick WF, Stewart JH, Greene H. Sexing of human clavicles using length band circumference measurements. Am J Foresnsic Med Pathol 1991;12:175-81.
[9]. Mays S, Steele J, Ford M. Directional asymmetry in the human clavicle. Int J Osteoarchaeol 1999;9:18-28.
[10]. Auerbach BM, Raxter MH. Patterns of clavicular bilateral asymmetry in relation to the humerus; Variations among humans. J Hum Evol 2008;54:663-74.
[11]. Danforth ME, Thompson A. An evaluation of determination of handedness using standard osteological measurements. J Forensic Sci 2008;53:771-81.
[12]. Kim W, McKee MD. Management of acute clavicle fractures. Orthop Clin North Am 2008;39(4):491-505.
[13]. Zlowodzki M, Zelle BA, Cole PA. Treatment of acute midshaft clavicle fractures:systematic review of 2144 fractures: on behalf of the Evidebce Based Orthopedic Trauma Working Group. J Orthop Trauma 2005;19(7):504-07.
[14]. Andersen K, Jensen PO, Lauritzen J. Treatment of clavicular fractures. Figure of eight bandage versus a simple sling. Acta Orthop SCand 1987;58:71-4.
[15]. Egol KA, Kovak KJ, Zuckerman JD. Handbook of fractures. 4th edition Philadelphia:Lippincott, Williams and Wilkins.p 141-149.
[16]. Walters J, Solomons C, Roche S. A morphometric study of the clavicle. SA orthop J 2010;9(3):47–52.
[17]. Kaur H, Harjeet, Sahni D, Jit I. Length and Curves of The Clavicle In Northwest Indians. J Anat Soc India 2002;51(2):199-209.
[18]. Mathieu PA, Marcheix PS, Hummel V, Valleix D, Mabit C. Anatomical study of the clavicle: endomedullary morphology. Surg Radiol Anat 2014;36:11-15.
[19]. Daruwalla Z, Courtis P, Fitzpatrick C, Fitzpatrick D, Mullet H. Anatomic variation of the clavicle: a novel 3-dimensional study. Clin Anat 2010;23:199-209.
[20]. Nalla S, Asvat R. Incidence of the coracoclavicular joint in South African populations. J Anat 1995; 186(Pt 3):645-9.
[21]. King PR, Scheepers S, Ikram A. Anatomy of the clavicle and its medullary canal: a computed tomographic study. Eur J Orthop Surg Traumatol 2014 Jan;24(1):37-42.
[22]. Jubel A, Andermahr J, Schiffer G, Rehm KE. Technique of intramedullary osteosynthesis of the clavicle with elastic titanium nails. Unfallchirurg 2002; 105(6): 511-16.
[23]. Chen YF, Wei HF, Zhang C et al. Retrospective comparison of titanium elastic nail (TEN) and reconstruction plate repair of displaced mid-shaft clavicular fractures: a randomized clinical trial. J Should Elb Surg 2010;19(6):495-501.

How to cite this article:

Manjunath CS, Tejaswi Hiremarali Lokanathan. ANATOMY OF THE CLAVICLE AND ITS APPLICABILITY IN MANAGEMENT OF CLAVICULAR FRACTURES. Int J Anat Res 2016;4(1):2069-2072.
DOI: 10.16965/ijar.2016.144