Original Article

Ulnar variance in normal Nepalese population

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ABSTRACT

Background and Objectives: There are many factors that influence the ulnar variance such as age, sex, genetic factors, gross elbow pathology, gripping of the hand, rotation of the forearm and positioning of the elbow. There are several pathologies of the wrist in which ulnar variance play a role. We lack study in Nepalese population regarding the influence of age and sex on ulnar variance. The primary objective of this study was to determine the mean ulnar variance in normal Nepalese population and to assess age and sex difference.

Material and Methods: This prospective study was conducted in Janaki Medical College and Teaching Hospital from July 2020 to March 2021. Total 120 patients were included in the study. Ulnar variance was measured by using the method of perpendiculars.

Results: The mean value of ulnar variance was 0.73±1.62 in our population. In our study, thirty two (26.7%) had neutral ulnar variance, twenty two (18.3%) had negative ulnar variance and sixty six (55%) had positive ulnar variance.

Conclusion: There was statistically significant difference in ulnar variance between male and female population ($p<0.05$). Females had higher ulnar variance than male population. There was more positive ulnar variance with higher age group ($p<0.05$).

Keywords: Age, Sex, Ulnar Variance , Male , Female , Positive

INTRODUCTION

The relative length of the ulna compared to the radius, or ulnar variance, appears to be an important element in wrist pathology. The length is determined by age, genetic factors, load (as in gymnasts) and gross elbow pathology. The negative ulnar variance or short ulna has been associated with Kienbock's disease, avascular necrosis of the scaphoid and scapholunate dissociations. On the contrary, a long ulna (positive ulnar variance) is harmful for the ulnar compartment of the wrist as it causes degeneration and perforation of the triangular fibrocartilage complex (TFCC) and cartilaginous wear of the carpal bones (ulnar impaction syndrome) [1]. There are many factors that influence the ulnar variance such as age, sex and ethnic group [2]. Positioning of the elbow, rotation of the forearm and gripping of the hand also influence the measurement of ulnar variance [3]. The relationship between age , sex and ulnar variance have been studied by many authors with varying results. There are many studies which showed ulnar variance increases with age. Hadi et al. studied that there was a statistically significant difference in the ulnar variance between the male and female

subjects of the Indonesian population [4]. There is study done by Chen et al [5] which revealed aging does not affect ulnar variance. In the study done by Nakamura et al age and sex both had influence on ulnar variance and that it was lower in males than in females [6]. However, there was no significant correlations between the ulnar variance measurements and a patient's age, gender, race, or handedness in a study done by Freedman et al [7].

There are different methods for measuring the ulnar variance [8], with the most popular methods being the project-a-line technique, method of concentric circles, and method of perpendiculars. Among these the method of perpendiculars was most reliable for both inter observer and intra observer reliability [9, 10]. The aim of this study is to determine the influence of age and sex on ulnar variance in normal Nepalese population.

MATERIALS AND METHODS

This was a prospective observational study carried out in Department of Orthopaedics and Trauma Surgery, Janaki Medical College and Teaching Hospital (JMCTH), Janakpur, Nepal from July 2020 to March 2021.. Patients in age group 18-67 years presenting to Department of Orthopaedics and Trauma Surgery, JMCTH with wrist complaints but normal bony architecture were considered for the study. Only true anteroposterior and lateral radiographs of the wrist were used in the study.

The measurements were made on wrist radiographs of the patients by using scale, goniometer and values were recorded. The measurements were corrected for roentgenographic magnification. All patients fulfilling the inclusion criteria were requested for the informed consent and those giving the informed consent were included in the study. The inclusion criteria included patients aged 18-67 years with a history of wrist related complaints. The exclusion criteria included wrists with open physeal plates, history of surgery for disorders related to the wrist joint, history of growth disorders and systemic bone disease, evidence of congenital anomalies of the wrist, evidence of severe arthritic changes of the wrist. We included 120 patients in our study. Posteroanterior roentgenograms (figure 1) were made with the wrist and forearm in a neutral position, the elbow in 90 degree of flexion and the shoulder in 90 degree of abduction. The x ray tube was aligned vertical to the radial styloid, 100 cms from the top of the table.

The lateral view (figure 2) was obtained with elbow flexed to 90° and adducted against the trunk. The measurements were made on wrist radiographs of the patients by using scale, goniometer and values were recorded. Only true postero-anterior and lateral radiographs of the wrist were used in the study. The measurements were corrected for roentgenographic magnification. The measurements of ulnar variance was taken by the methods as shown in figure 3.

Figure 1: Postero-anterior view. The cental beam is aligned vertical over radial styloid 100 cm from the film [1].

Figure 2: Lateral view. The central beam is aligned vertical over radial styloid, 100 cm from the film [1]

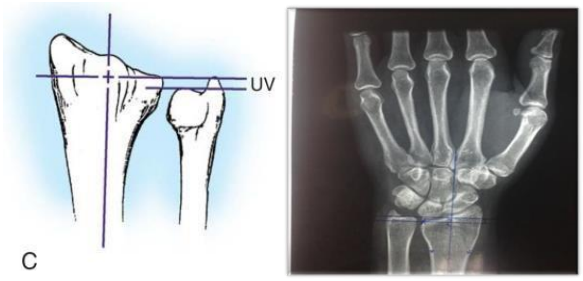


Fig 3: Measurement of ulnar variance

RESULTS

There were 120 subjects for the study which consisted of 50 (41.7%) males and 70 (58.3%) females.

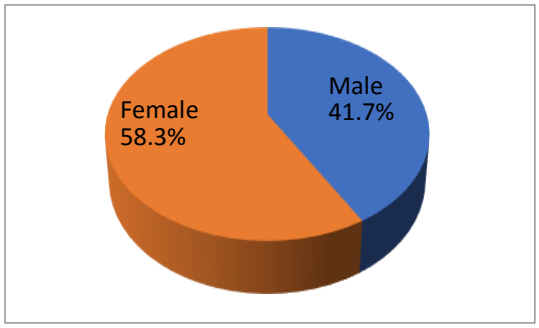


Figure 4: Distribution based on patient gender

Age groups were classified as (18-27 years, 28-37 years, 38-47 years, 48-57 years, 58-67 years).

The age wise distribution of 120 patients is shown in table 1.

The highest number of patients were from 48-57 years (28.3%) and lowest number of patients (20%) were from age group of 58-67 years. The mean value of ulnar variance was 0.73±1.62 mm in our population.

Table 1: Distribution of study subjects according to age group

Age Group	Frequency	Percent
18-27	22	18.3
28-37	21	17.5
38-47	23	19.2
48-57	34	28.3
58-67	20	16.7
Total	120	100

The mean ulnar variance of male was 0.360 ± 1.75 mm whereas that of female was 1.00 ± 1.48 mm which is statistically significant.

There was a significant difference in ulnar variance according to age ($p<0.05$). Ulnar variance was less in younger patients and gradually became more positive with increasing age. In our study, thirty two patients (26.7%) had neutral ulnar variance, twenty two (18.3%) had negative ulnar variance and sixty six (55%) had positive ulnar variance.

DISCUSSION

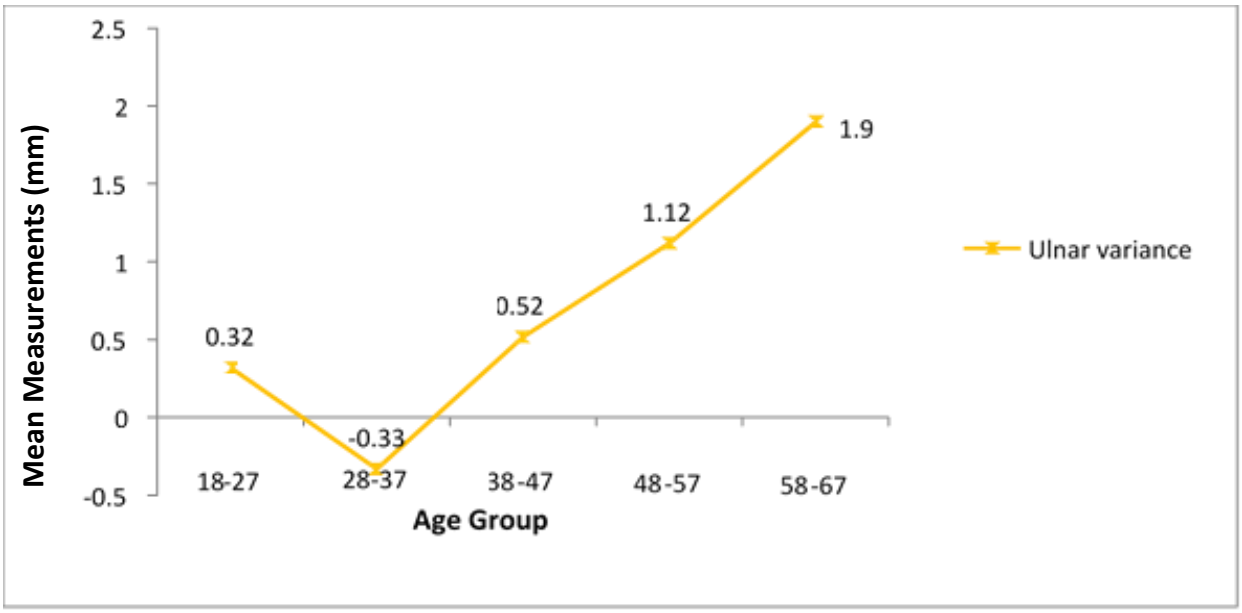
In this study we measured the distal radius morphometry in 120 individuals consisting of 50(42%) males and 70(58%) females. Number of female patients presenting to our

Table 2: Distribution of Ulnar Variance according to gender

Parameter	Male (n= 50)	Female (n=70)	t-value	p-value
Ulnar Variance	0.360 ± 1.75 mm	1.00 ± 1.48 mm	-2.162	0.033

Table 3: Distribution of Ulnar Variance according to age group

Parameter	Age Group					F-value ANOVA test	p-value
	18-27 yrs	28-37 yrs	38-47 yrs	48-57yrs	58-67 yrs		
Ulnar Variance	0. 32± 1.46 mm	-0.33± 1.71 mm	0.52± 1.67 mm	1.12± 1.47 mm	1.90± 0.91 mm	6.941	**0.000**



clinic for symptomatic wrist pain are more than male patients as females are mostly involved in house hold activities which make them prone to overuse injury of the wrist. The age group was 18-67 years with the mean age 43 ± 14.21 years. In our study, there were maximum number of patients in the age group of more than 40 years as repetitive trauma is acquired over time for overuse injury to present as wrist pain. There were 90 right wrists (66%) and 30 left wrists (34%) as right wrist being dominant side in our study.

Schuind FA et al [11] method of posterio-anterior roentgen graphic measurements of the wrist in 120 adults were used to determine the normal dimensions and variations according to age and sex. In his study there were 56 males and 64 females with mean age group of 44±5.9 years. There were 98 right wrists and 22 left wrists which is comparable to our study as right wrists being the dominant wrist. Similar study was carried out by Chan CYW et al [12] in Malaysian population. The study included 77 radiographs of the wrist with 13 females (16.9%) and 64 (83.1%) males with mean age of 30.7±11.5 years. Their sample size was smaller as compared to our study. They took into account racial distribution in their study which was not included in our study. There was male predominant in their study as compared to our study.

In our study the mean ulnar variance was 0.73±1.62 mm. The mean ulnar variance of male was 0.360 ± 1.75mm whereas that of female was 1.00 ± 1.48mm which was statistically significant ($p<0.05$). The mean ulnar variance changed with age having a more positive value in the upper age group. The mean

ulnar variance of 18-27 yrs age group was 0.32±1.46mm, 28-37 yrs age group was 0.33 ±1.71mm, 38- 47yrs age group was 0.52±1.67mm, 48-57 yrs age group was 1.12±1.47mm, and 58-67yrs age group was 1.90±0.91mm. The differences were statistically significant ($p<0.05$). This finding is similar to the study done by Sanderson et al [1] who found statistically significant difference in relation to ulnar variance and age. They studied ulnar variance in 1023 normal wrists taken in standardized fashion. Tanaka et al [13] found ulnar variance to be smaller in men than in women which was similar to our study and noted a progressive increase of ulnar variance with increasing age. The length of the ulna is not constant during the lifetime, when compared with that of the radius [14], and ulnar variance is thought to change depending on the age, genetics, loading, and wrist and elbow pathologies [2].

Sanderson et al [1] found the mean ulnar variance of 0.6±1.2mm which was similar to our study. Our study differed from Schuind et al [11] who found no significant difference in ulnar variance with respect to age and sex. Chan CYW et al [12] reported in their study the mean ulnar variance of -0.1±1.31mm in Malaysian population which was different from our study. The difference could be due to predominant male population in their study. Mishra et al [15] observed a positive ulnar variance of 0.66 ±2.46mm in their study of the Indian population. Hadi et al [4] observed a statistically significant difference in the ulnar variance between the male and female subjects of the Indonesian population which is similar to our finding. Gelberman RH et al [16] established that Whites commonly have negative ulnar variance and are more susceptible to suffer from Kienbock's disease Because of the different results in the literature comparing the ulnar variance according to age, race, and gender it becomes quite obvious to study the results in Nepalese population as done in our study.

CONCLUSIONS

There was statistically significant difference in ulnar variance between male and female population ($p<0.05$). Females had higher ulnar variance than male population. There was more positive ulnar variance in higher age group ($p<0.05$).

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CONFLICT OF INTEREST: *None*

SOURCE OF SUPPORT: *None*

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