ANALYSIS OF ULNAR VARIANCE DISTRIBUTION IN LOCAL ADULT ORTHOPAEDIC PATIENTS

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ABSTRACT

Objective: To document the distribution of ulnar variance in the adult outdoor patients of orthopaedic clinic in tertiary care hospital of Pakistan.

Study Design: Cross-sectional study.

Place and Duration of Study: Pakistan Naval Ship Shifa Hospital, Karachi Pakistan, from May 2016 to May 2017.

Methodology: From the outpatient clinic of orthopaedics, 243 individuals' wrist X-rays were taken after informed consent. X-rays were in postero-anterior view with neutral arm position. Ulnar variance was measured using the method of perpendiculars. Other relevant data included were gender, age, and dominant hand. The data were then analyzed using SPSS-22.

Results: There were 175 males and 68 females in the collected sample with the mean age of 36.29 ± 11.26 years. In our study, the mean ulnar variance was 0.424 ± 1.4 with positive ulnar variance at a higher frequency of 56% followed by negative ulnar variance at 32.9% and finally neutral ulnar variance at 11.1%.

Conclusion: In the outdoor adult orthopaedic patients of Pakistan Naval Ship Shifa hospital, positive ulnar variance predominates followed by negative ulnar variance and lastly neutral ulnar variance.

Keywords: Method of perpendiculars, Orthopaedic patients, Ulnar variance.

INTRODUCTION

Ulnar variance (UV) is a measure of the difference between the levels of the distal articulating surfaces of the ulna relative to the radius. When ulna is greater in length to radius it is termed as positive UV, whereas when it is less in length to the radius it is referred to as negative UV, and when ulna is equal in length to the radius then it is known as neutral UV[1]. The ideal force distribution across the wrist occurs in neutral UV with 80% load distributed to the radius and 20% to the ulna and this results in the prime function of the wrist joint[2]. Both positive and negative UV result in deranged mechanical load off and are related to various wrist pathologies[3-8].

UV determinants include, age, gender, grip, and ethnicity with positive UV more common in Asians and Blacks while negative UV more commonly found in Caucasians as published in previous studies[7,9,10].

The objective to determine the frequency of UV in local adult patients presenting in orthopaedic outpatient clinic in PNS Shifa hospital Karachi.

METHODOLOGY

The study was conducted in the Orthopaedic Unit of Pakistan Naval Ship (PNS) Shifa Hospital Karachi, from May 2016 to May 2017, which is a tertiary care

hospital. Non-probability convenience sampling was used to included wrist x-rays of patients visiting orthopaedic out-patient for consultation. Our sample size came to 243 and was calculated using the WHO sample size calculator keeping the confidence interval at 95%, a margin of error of 6% and using 35.3% negative UV from the study conducted in the normal adult population of Peshawar[9]. Our inclusion criteria was adults between the ages of 18-60 years. Our exclusion criteria was those suffering from arthritis and individuals with a history of trauma or surgery of same upper limb.

Patients presenting in orthopaedic outpatient clinic who fulfilled inclusion criteria were offered to participate in the study. Detailed history and clinical examination was done of those who consented and were then taken to radiology for radiographs.

In total 243 X-rays were obtained, after informed consent, based upon inclusion and exclusion criteria.

The wrist x-rays were in postero-anterior (PA) view with 90° abduction at the shoulder and 90° flexion at the elbow joint taken by tube-support x-ray machine, model number SMS-TS-2, manufactured by Eco Ray in May 2012 in Korea and measurements were done using a DICOM compatible software, the IMPAX orthopaedic tools, as provided by AGFA Healthcare.

Measurements were done using the method of perpendiculars. In this, a line is drawn through the longitudinal axis of the radius and a perpendicular is drawn that passes through the apex of the distal ulnar

aspect of the radius. A second perpendicular is then drawn across the apex of the distal cortical rim of the ulna and the distance between the two perpendiculars is the measured UV. The measurements were recorded and the data was later analyzed using Statistical Package for the Social Sciences (SPSS) version 22, and associations were determined using the chi-squared test, with a *p*-value <0.05 considered to be statistically significant.

RESULTS

In our sample 175 (72%) were males and 68 (28%) were females with a prominent male predominance with a ratio of 2.6:1. In total, 136 individuals exhibited positive UV, 80 individuals exhibited negative UV and 27 individuals exhibited neutral UV, with females exhibiting a positive ulnar variance predominance as compared to the males who had negative ulnar variance as the prevailing type (table-I).

The mean age was 36.3 ± 11.26 years and the mean UV observed was 0.424 ± 1.4mm with the lowest UV being at -3.7 and the highest at 5.70. Age stratification of our sample revealed negative UV to be found commonly in the 18-35 years age-group, the positive in the 36-50 years age-group, and neutral UV in the 51-60 years age-group (table-II).

We compared left vs right hand x-rays in our study as well, and found positive UV in dominance in both left and right hands (50.9% and 60.3% respectively) (table-III).

Table-I: Difference in ulnar variance in gender.

		Ulnar Variance			*p*-value
		Positive	Negative	Neutral	
Gender	Male	86 (49.1%)	68 (38.9%)	21 (12%)	0.002
	Female	50 (73.5%)	12 (17.7%)	6 (8.8%)	

Table-II: Difference in ulnar variance in different age groups.

		Ulnar variance			*p*-value
		Positive	Negative	Neutral	
Age Group	18-35	64 (52.9%)	45 (37.2%)	12 (9.9%)	
	36-50	54 (59.3%)	26 (28.6%)	11 (12.1%)	0.723
	51-60	18 (58.1%)	9 (29%)	4 (12.9%)	

Table-III: Difference in ulnar variance in left vs right hand.

		Ulnar variance			*p*-value
		Positive	Negative	Neutral	
X-ray Hand	Right	79 (60.3%)	39 (29.8)	13 (9.9%)	0.337
	Left	57 (50.9%)	41 (36.6%)	14 (12.5%)	

DISCUSSION

The mechanical load off across the wrist is ideal in neutral UV 2 and the deranged load off observed in both positive and negative UV has been implicated in various wrist pathologies ever since 1928 when Hulten associated negative UV as a predisposing factor to Keinbocks disease[1]. Negative UV is also associated with avascular necrosis of the scaphoid andscapholunate dissociations[5,7,10]. On the other end of the spectrum, a positive UV is linked with triangular fibrocartilaginous cartilage complex (TFCC) injury and ulnar impaction syndrome (the wearing of cartilage of carpal bones)[4,6]. In view of the evidence presented in the studies associating UV as a contributing agent to wrist pathologies, techniques such as ulnar or radius shorte-ning have been developed to neutralize the variance[14-17].

Many factors are known to affect UV including race, gender, age, and elbow pathologies[1,2,10,18] along with these, load and position of the wrist at the time of taking radiographs have been known to alter UV[18,19]. Thus, to have reliable and comparable results, radiographs for UV measurement in our study, were taken at 90° abduction of shoulder, and 90° flexion of elbow with the hand flat on the x-ray table. This PA view is a standard and has been documented to be both stable and reproducible, while also giving a good outline of the wrist[20,21]. To measure UV, the method of perpendiculars (figure) has been used as it has been shown to have more inter-observer and intra-observer reliability[20].

Figure: Method of perpendiculars.

This study population calculated, came to 243 and the mean age of subjects was 36.29 ± 11.26 years. The difference in gender population in our study (table-I) is owed to the fact that our study was based on convenient sampling and was conducted in a military hospital, where the patient inflow was mostly of serving and their families thus resulting in an increased inflow of male patients as compared to females.

Our mean UV came to 0.424 ± 1.4, due to a higher frequency of positive UV (136; 55.9%), followed by

negative UV (80; 32.9%) and then neutral UV (27; 11.11%). This is in accordance to various studies published which show that our population has a higher prevalence of positive UV[9,11]. A higher incidence of positive UV was found in our female subjects (73.5%) relative to our male subjects (49.1%) (table-I). This finding was found to be statistically significant (*p*-value =0.002), and is corroborated by researchers documenting similar findings[1,10,19,22]. However various studies have also been published that support no statistically significant association between gender[23,24].

With age-wise stratification (table-II) of our findings, it was observed that positive UV predominated the 36-50 years age group while negative was predominatly found in the 18-35 years age group and neutral UV was most common in the 51-60 years age group. We however did not find any statistically significant association with age and UV (*p*-value=0.723). Previously documented studies support the finding that age has no effect on UV[22,25].

We also documented UV with respect to the hand radiographed (table-III). It was observed that positive UV dominated both left (50.9%) and right (60.3%) hands followed by negative UV (L:36.6; R: 29.8) and then neutral UV (L: 12.5; R:9.9). No statistical correlation was found between right vs left hand UV (*p*-value =0.337) as too observed by Freedman[25].

Our findings must be viewed keeping in mind that our study population was a convenient sampling and although that is unlikely to produce bias in the measurement of UV, the resultant discrepancy in the difference between the male and female population may have affected our finding of a positive relation between gender and UV. So, further researches with equal gender frequencies are recommended. Wrist grip and position are known to play a part in the measurement of UV. And while position of the wrist was maintained in the standard neutral position, grip was not taken in account for in this study. Also, measurements were taken by a single observer, so further studies may be done with more than one observer to increase the reliability of the measurements.

CONCLUSION

In our local orthopaedic patients there was predominance of positive UV, followed by negative UV, and neutral UV was the lowest in prevalence. There was an association between gender and UV, however, further studies are needed with equal male to female distribution and more than one observer for measure-

ments to support these findings in our local population.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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