

PREVALENCE OF UPPER LIMB LENGTH DISCREPANCY AMONG ASYMPTOMATIC POPULATION OF MEDICAL STUDENTS IN NEPAL: A DESCRIPTIVE CROSS SECTIONAL STUDY

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ABSTRACT

INTRODUCTION

Upper limb length discrepancy are frequently documented in various anatomical orthopedics and anthropometric journals. Proper idea about discrepancy is pivotal prior to any limb lengthening surgery. The aim of the study is to find out the prevalence of upper limb length discrepancy among asymptomatic population in medical students of Nepal.

MATERIAL AND METHODS

A descriptive cross-sectional study was carried out at the department of anatomy in Universal College of Medical Sciences, Bhairahawa, Nepal from September 2021 to November 2022 after ethical clearance from the same institution (IRC UCMS, Ref: UCMS/IRC/079/21). Full and segmental length of upper limb was taken, recorded with help of flexible tape. Reference points for these measurements were bony landmarks as approved in the Integrative Measurement Protocol Morphological and Behavioral Research in Human and non-human primates version 1.0 were used. Convenient sampling method was used Data was analyzed using Microsoft Excel 2016. Point estimate at 95% Confidence Interval was calculated along with frequency and percentage.

RESULTS

Out of two hundred fifty seven participants 141 were male and 116 were female. Total upper limb length of male is 74.17 ± 4.79 cm and female is 71.92 ± 4.81 cm. Total upper limb length discrepancy maximum was observed 3 cm .In our study it was observed that wrist has maximum discrepancy between right and left limb followed by arm and fore arm.

CONCLUSION

The present study shows the prevalence of upper limb length discrepancy in asymptomatic Nepalese population.

KEYWORDS

Upper limb, Discrepancy, Prevalence.

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INTRODUCTION

Limb development starts towards the end of fourth week of intrauterine life. Upper limb bud develops opposite to the caudal cervical segments and lower limb bud forms opposite the lumbar and upper sacral segments. At the apex of each limb bud the ectodermal ridge thickens to form an apical ectodermal ridge (AER).¹ For the proximal-distal axis, the apical ectodermal ridge stimulates the production of FGFs in the underlying distal mesoderm. As the limb elongate mesenchymal models of the bones are formed by cellular aggregations. Chondrification center appears by 5th week.² Osteogenesis of long bones begins in 7th week, except carpal bones which occur after birth. The upper limb rotates laterally through 90 degree on their longitudinal axis.²

Human body has never been bilaterally symmetrical and limbs are no exception to it. Even though upper limb length discrepancy is a rare occurrence, length discrepancy showed both aesthetic problem as well as functional problems.³ Patients may suffer from impaired activities of daily living, difficulty performing in sports or decreased self-image.⁴ Additionally, detail knowledge of prevalence of upper limb length discrepancy in our population will help surgeons to plan limb lengthening surgery.

The study is undertaken to know the prevalence of upper limb length discrepancy in asymptomatic population in a medical students of Nepal.

MATERIAL AND METHODS

An Institutional based descriptive cross-sectional study design was employed to assess the upper limb length discrepancy in students of Universal College of Medical Science. Study was conducted among medical students (MBBS, BDS) of UCMS over the period of 3rd August 2021 to 2nd Sept 2021. Simple convenient sampling method was done among students of UCMS. Inclusion and exclusion criteria were students with no neurological or musculoskeletal disorder, with no history of fractures, trauma, any congenital anomalies and students who were willing to participate in study. The UCMS-IRC reviewed and approved and provided ethical clearance for conducting the research. (UCMS/IRC/082/21). Total two hundred fifty seven (257) students participate in the present study. Minimum size was estimated using the following formula:

$$n = Z^2 \times p \times q / e^2 = (1.96)^2 \times 0.5 \times (1-0.5) / (0.07)^2 = 196$$

Where, Z = 1.96 for confidence interval at 95%

p = prevalence, 50%q = 1-pe = margin of error, 7%

All the collected data were entered into Microsoft excel and exported to SPSS version 22 for analysis. Simple frequency tables have been used to analyze data related to the study. Characteristics of the sample were categorized using mean and standard deviation.

A non-elastic fiber tape graduated in centimeters and meters (tape), Marker pen was used. Reference points for these measurements were bony landmarks as approved in the Integrative Measurement Protocol Morphological and Behavioral Research in Human and non- human primates version 1.0 were used.⁵ All the measurements was done in anatomical position. The landmarks of various measurements were as follows:

1. Total length of upper limb: Measurement is taken from most superior lateral point of acromion process (acromial landmark) to the lower and lateral border of styloid process of radius (radial landmark).

2. Segmental measurement: Arm length: Measurement is taken from acromial landmark to the posterior surface of olecranon process of ulna. Forearm length; measurement in taken from the head of radius (upper radial landmark) to the most distal point of the styloid process of radius (or styloid). Hand length; measurement is taken from styloid process at base of thumb to the tip of middle finger.

RESULTS

Results are shown in table as follows:

Table 1. Showing total length and segmental length of upper limb

Parameters	Total upper limb right	Arm	Forearm	Wrist	Total upper limb left	Arm	Forearm	Wrist
Mean	73.15	34.09	25.67	18.83	72.98	33.96	26.26	18.77
Standard deviation	4.92	2.96	2.32	1.43	4.95	3.037	13.02	1.34
Minimum	61.80	24.50	20.50	15.50	62.00	25.00	20.00	14.50
Maximum	85.00	42.50	30.50	22.00	84.50	40.50	227.00	22.00

Table 2. Showing gender difference in total and segmental limb length in right and left limb

Parameters	Male (Mean ± sd)	Female (Mean ± sd)	Mean difference	p-value
Total upper limb right	74.17 ± 4.79	71.92 ± 4.81	2.24	< 0.001
Arm	34.60 ± 2.92	33.47 ± 2.90	1.13	0.002
Forearm	25.99 ± 2.27	25.32 ± 2.33	0.67	0.021
Wrist	19.04 ± 1.43	18.57 ± 1.39	0.46	0.009
Total upper limb Left	73.98 ± 4.92	71.76 ± 4.73	2.21	< 0.001
Arm	34.59 ± 3.06	33.19 ± 2.84	1.40	< 0.001
Forearm	25.67 ± 2.40	26.98 ± 1.92	1.31*	0.467
Wrist	18.90 ± 1.35	18.61 ± 1.32	0.29	0.082

Table 3. Showing difference in mean value and p between male right and left limb. Male and Male right and left

Parameters	Right (Mean ± sd)	Left (Mean ± sd)	Mean difference	p-value
Total upper limb	74.17±4.79	73.98±4.92	0.186	< 0.001
Arm	34.60±2.92	34.60±3.05	0.004	< 0.001
Forearm	25.99±2.27	25.67±2.40	0.318	< 0.001
Wrist	19.04±1.43	18.91±1.35	0.136	< 0.001

Table 4. Showing difference in mean value and p between female right and left limb. Female and Female right and left

Parameters	Right (Mean ± sd)	Left (Mean ± sd)	Mean difference	p-value
Total upper limb	71.92±4.81	71.76±4.73	0.161	< 0.001
Arm	33.47±2.90	33.19± 2.84	0.284	< 0.001
Forearm	25.32± 2.33	26.98±19.21	0.660	0.095
Wrist	18.58± 1.39	18.61± 1.32	0.034	< 0.001

Length of Upper right Limb in male 74.17 and Length of Upper right Limb in female 71.92

Length of upper left limb in male 73.98 and length of upper right limb in female 71.76

Mean differences in length of upper right limb in male and

length of upper limb in female 2.24

Mean differences in length of upper left limb in male and length of upper left limb in female 2.21

Length of upper right limb in male 74.17 and length of upper left limb in male 73.98

Mean differences in length of upper right limb in male and length of upper left limb in male 0.18

Length of upper right limb in female 71.92 and length of upper left limb in female 71.76

Mean differences in length of upper right limb in female and length of upper left limb in female 0.16

DISCUSSION

In our study with sample size of (n= 257) the mean total length of upper limb is 73.15 ± 4.92 cm in right and 72.98 ± 4.95 cm. The maximum length observed is 85.0 cm in right limb and 84.50 cm in left limb. The minimum length observed is 61.80 cm and 62.0 cm in right and left limb respectively. This is similar to the study done by Kharbat AF at al⁶ where right upper limb was longer than the left. R W sanders stated that left-handed subjects have higher and larger left elbows than right-handed subjects.⁷

Gender wise difference between total upper limb is 2.24 cm and 2.21 cm in right and left limb with *p* value less than 0.001 for both side which was similar to the same type of study done by MA khan et al⁸ where the differences of maximum length of humerus were statistically significant between both the genders (*p*<0.001). The mean total length of upper right limb in male 74.17 cm and length of upper left limb in male 73.98 cm. Mean differences in length of upper right limb in male and length of upper left limb in male is 0.18 cm. The mean total length of upper right limb in female 71.92 cm and length of upper left limb in female 71.76 cm. Mean differences in length of upper right limb in female and length of upper left limb in female is 0.16 cm. In contrast to this Auerbach BM et al stated that upper limb bones demonstrate a systematic right-bias in all dimensions.⁹ They also mentioned females have more asymmetric and right-biased upper limb maximum lengths which was not seen in our study. On contrary to that in a study done in Indian population by Singhal S it was mentioned that the difference in measurements of the right and left sides was insignificant.¹⁰

A CT based study for radius and ulna (forearm) was done in a 132 cadavers of Korean population from 2004 to 2020 by Hong E et al suggested no statistically significant differences in whole bone parameters including length, volume, bowing or twisting in the bilateral forearm bones whereas in shape analysis they stated there was asymmetry between bilateral forearm bones.¹¹ In another study done by Edmond T et al in a pediatric population also suggested no significant differences were found between right and left extremities.¹²

In our study total difference in mean length of upper limb between male and female is 2.4 cm which is similar to (2.75 cm) in a study done by Pietak A et al.¹³ In their study they further stated human limb bone lengths and volumes follow fundamental and highly conserved mathematical relationships, which may contribute to our understanding of normal and disordered growth, stature estimation, and biomechanics. Lutfy J et al even set ratios to calculate preamputation limb length.¹⁴

CONCLUSION

In conclusion, this investigation highlights the presence of upper limb length discrepancy (uLLD) among the asymptomatic population, with its importance in clinical practice. While asymptomatic uLLD may not directly cause functional impairments, its potential impact on biomechanics and musculoskeletal disorders. Clinicians should remain vigilant in assessing uLLD, particularly in contexts where precise upper limb function is crucial. Further research is needed to clarify upper limb length discrepancy in Nepalese population facilitating the development of tailored management strategies to optimize upper limb function and mitigate potential complications in affected individuals.

CONFLICT OF INTEREST

None

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