

GERDY'S SAFE ZONE IN THE KENYAN POPULATION: A CADAVERIC STUDY

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ABSTRACT

Background: The Common Peroneal Nerve (CPN) is a branch of the sciatic nerve, which is almost subcutaneous in its course around the fibula. This means it is a structure that is at risk when performing procedures around the proximal fibula and tibia. This study was done to determine a safe zone in which procedures can be performed without injuring it.

Objective: To determine the extent of Gerdy's safe zone in the Kenyan population.

Design: This was an anatomical descriptive cross-sectional study.

Methods: The study was carried out at the human anatomy laboratory, Moi University. Dissection was done on forty three right sided formalin fixed limbs. Right sided lower limbs were chosen because they were more in number than the left sided lower limbs thus satisfying requirements of study population.

Results: Forty three right sided lower limbs (32 male, 11 female) were dissected. The nerve was seen to define an arc like trajectory around Gerdy's tubercle, with a mean radius of 57.6 ± 5 mm.

Conclusion: In this population, Gerdy's safe zone (radius of 57.6 ± 5 mm) is most likely to be free of the common peroneal nerve and its branches and thus can be marked preoperatively before carrying out procedures in the proximal tibia.

Key words: Gerdy's tubercle, Gerdy's safe zone, Tibia

INTRODUCTION

The common peroneal nerve is one of the branches of the sciatic nerve. It innervates the muscles in the anterolateral compartment of the leg (1-3). Due to its being almost subcutaneous around the proximal fibula, it is at risk when it comes to performing percutaneous procedures and surgical procedures around the proximal fibula and tibia. Most studies done on the common peroneal nerve have been centered on the course of the nerve around the fibula bone (4–10). The authors came across three studies that explored the relationship of the common peroneal nerve to Gerdy's tubercle on the tibia (11–13). Gerdy's tubercle was described as a prominence on the lateral aspect of the proximal tibia (14). The researchers carried out this study in accordance with the Kenyan Human anatomy act (15). Surgical approaches in this region should be within the safe zone (4,10–13). This study was done to describe the relationship of the nerve to Gerdy's tubercle on the tibia in the Kenyan population.

MATERIALS AND METHODS

The study was carried out in Moi University Human Anatomy Laboratory (MUHAL) following approval by the Institutional Research and Ethics Committee (IREC) and Human Anatomy Department. As per the Human anatomy act (15), forty three (32 male, 11 female) formalin fixed limbs which satisfied inclusion criteria (neither signs of gross pathology nor surgical instrumentation) were obtained. Right sided limbs were chosen since a larger number of them met the inclusion criteria of the study. Dissection of the lower limbs was carried out via lateral approach as described by some authors (13,20). The CPN nerve was identified and its distance from Gerdy's tubercle was measured at three points as described by some authors (13):

dI- distance from Gerdy's tubercle to the CPN at the back of the head of the fibula

dIII- distance from Gerdy's tubercle to the starting point of the superficial branch of the CPN

dIII- Distance from Gerdy’s tubercle to the anterior recurrent genicular branch of the common peroneal nerve

All the above distances are demonstrated in Figure 1.

Figure 1

Measurement of *dI*, *dII* and *dIII* as per Rubel et al. (13)

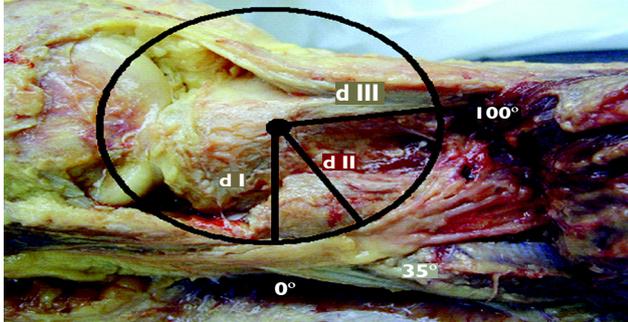


Figure 2

Measuring *dI*- distance from Gerdy’s tubercle to the common peroneal nerve at the back of the head of the fibula

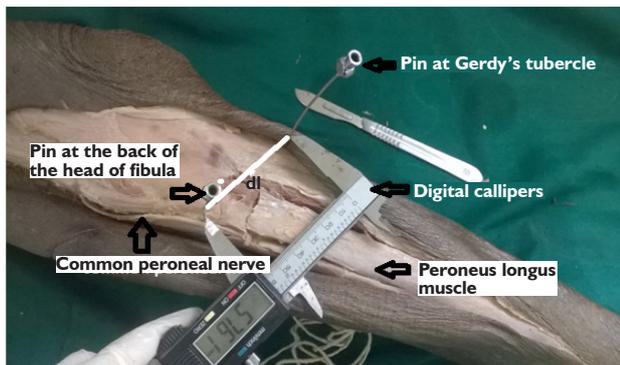
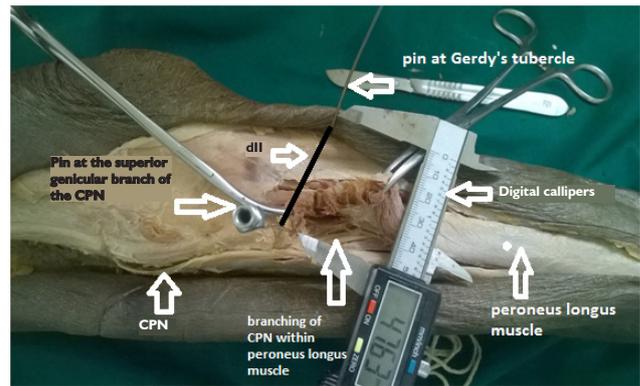


Figure 3

Measuring *dII*- from Gerdy’s tubercle to the superior genicular branch of the common peroneal nerve



Data collected was recorded onto data sheets and fed into a restricted access electronic database. Photographs of dissection specimens were taken. Analysis of data was done using STATA version 13 SE. Data was summarized into means and medians then presented in tables.

RESULTS

The common peroneal nerve was noted to run laterally along the medial aspect of the biceps femoris muscle over the lateral condyle of the femur. It then ran downwards behind the head of fibula, before twisting around the fibular neck and piercing the peroneus longus muscle and dividing into its branches in the substance of the muscle. Measurements were taken from Gerdy’s tubercle to the nerve at three points as summarized in Table 1. However, there was no statistical significance in variables *dI*- *dIII* ($p>0.005$).

Table 1
Summary of statistics for *dI*, *dII*, *dIII* and *MT*

Variable	N	Mean(±SD)[mm]	Median(IQR)[mm]	Min[mm]	Max[mm]	Shapiro-Wilk test	
						W	P-value
<i>dI</i>	43	57.5 (±5.1)	58 (54,62)	48	68	0.970	0.325
<i>dII</i>	43	53.1 (±6.3)	54 (47,58)	39	63	0.970	0.338
<i>dIII</i>	43	49 (±8.5)	49 (44,53)	30	65	0.984	0.838

Total mean of *dI*, *dII*, *dIII*=57.6 mm (± 5)

n-Number of limbs; Min- Minimum; Max-Maximum; SD- Standard deviation; IQR- Interquartile range

dI-Distance from Gerdy’s tubercle to the common peroneal nerve behind head of fibula

dII-Distance from Gerdy’s tubercle to the starting point of the superficial genicular (lateral) branch of common peroneal nerve

dIII-Distance from Gerdy’s tubercle to anterior recurrent genicular branch of the common peroneal nerve

*All distances measured in mm

The distances were compared between the genders and summarized in Table 2.

Table 2*Summary of statistics for dI, dII, dIII between the genders*

Variable	Female (n=11)	Male (n=32)	P-value
dI (mean)	56.82(±5.07) mm	58.03(±5.15) mm	0.504*
dII (mean)	51.55(±6.34) mm	53.64(±6.38) mm	0.352*
dIII (mean)	50.60(±5.81) mm	48.50(±9.28) mm	0.505*

*Comparison of means using t-test

mm- millimeters; n-number of limbs

dI-Distance from Gerdy's tubercle to the common peroneal nerve behind head of fibula*dII*-Distance from Gerdy's tubercle to the starting point of the superficial genicular (lateral) branch of common peroneal nerve*dIII*-Distance from Gerdy's tubercle to anterior recurrent genicular branch of the common peroneal nerveThe findings between the genders were found to be statistically insignificant ($p>0.005$).

DISCUSSION

Most studies that have been done on the Common Peroneal Nerve (CPN) have been in relation to the fibulas as aforementioned (4–10). With regards to the fibula, in this study, the common peroneal nerve coursed on the lateral condyle of the femur. It then traversed the back of the head of the fibula and curved around the fibular neck. The nerve then branched in the substance of the peroneus longus muscle with the exception of four limbs where it branched outside the peroneus longus muscle. This was in agreement with the course described in standard textbooks of anatomy (1-3).

This study set out to study the common peroneal nerve in relation to Gerdy's tubercle in the Kenyan population. Rubel *et al.* (13) conducted a study on the course of the CPN in relation to Gerdy's tubercle on the tibia to determine a safe zone where there is no risk to the common peroneal nerve as one does procedures on the proximal tibia. The nerve was noted to take an almost arc-like trajectory in relation to this tubercle, enclosing circular area. Previous studies (11–13) demonstrated no nerves in this region, hence why it is a safe zone, considered safe for orthopaedic procedures.

In this study, *dI* distance 1- (Gerdy's tubercle to the CPN at the back of the head of the fibula) had a mean measurement of 57.5mm (±5.1) and a median measurement of 58mm (IQR54, 62). This mean and median measurements were not in agreement with what was documented by several authors (11–13). With regards to *dII*, (distance from Gerdy's tubercle to the starting point of the superficial branch of the CPN): since the superficial branch emerges just anterior to the lateral aspect of the fibula the dimensions in this study were not any different. The measurements for *dII* in

this study were a mean measurement of 53.1mm (±6.3) and a median measurement of 54mm (IQR47, 58). This differed with previous studies done on Caucasian populations as documented by several authors (11-13). Regarding *dIII* (distance from Gerdy's tubercle to the anterior recurrent genicular branch), mean measurements were 49mm (±8.5), with a median of 49mm (IQR44, 53). This was not in agreement with studies previously done on Caucasian populations (11-13).

With regards to the different findings in the genders, the researchers also did not come across studies that compared specifically the dimensions *dI- dIII* of CPN in men and women, and as such were unable to compare findings with other populations. In this study, the *dI- dIII* were statistically not significant ($p>0.005$) as seen in Tables 1 and 2. To the knowledge of the researchers, there were no studies done on Africans to compare the findings with during this study.

In this study, *dI* readings were higher (56.8 for females and 58mm for males) when compared to those in a study by Rubel *et al.* (13) (average radius of 45mm). The most plausible explanation deduced for higher readings for *dI* in this study was that *dI* was more of a bony measurement and previous studies have found that African bones have larger dimensions.

Putman *et al.* (18) conducted a study in African and Caucasian women where they investigated skeletal microarchitecture and strength in the radii of tibias of the participants. They found that African Americans had denser and larger bones when compared to the Caucasian women. Mahfouz *et al.* (19) conducted a study on the three dimensional morphology of the knee. The team studied femoral (distal) and proximal tibia dimensions in Africans, Caucasians and Asians of both genders. They found that males had larger

dimensions of both bones as compared to females. This might be the reason why the *dI* measurements in this population were larger in males when compared to females. Based on the above two studies (18,19) it might be reasonable to speculate that the values gotten in this study were due to Africans having larger dimensions for bones.

When the researchers studied the values of the means gotten in this MUHAL study, for *dI - dIII* it was noted that they also seem to plot an arc like course for the nerve around the Gerdy's tubercle, despite the values being larger than the previous three studies by several authors (11–13). In this regard, the nerve in this Kenyan population defines an arc like course around the tubercle, hence this finding is in agreement with the ones in the previous three quoted studies, and it is only that the measurements are greater.

CONCLUSIONS AND RECOMMENDATIONS

In this population, the common peroneal nerve followed the standard course with regards to the fibula as described in standard anatomy texts.

Gerdy's safe zone in this population has a larger radius (57.6±5mm) which should factor into preoperative planning for surgeries (percutaneous and arthroscopic) in the proximal tibia and fibula.

More studies should be done in other African populations for better comparison of the findings.

More studies should be done on gender differences in the Gerdy's safe zone in different populations.

DISCLOSURE STATEMENT

The study was not funded. As such the principal author and co-authors do not benefit directly from it.

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