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RESEARCH ARTICLE

A Study Of Nutrient Foramen In Long Bones Of Inferior Extremity In Human Being

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Abstract

The nutrient foramina are cavities that conduct the nutrient arteries and the peripheral nerves on the shaft of long bones. Long bones receive most of the interosseous blood supply from the nutrient arteries, and sometimes through the periosteal vessels. Nutrient arteries play an important role in nutrition and growth of the bones particularly during its growth period in the embryo and fetus as well as during early phases of ossification. Total one hundred eleven long bones of lower limb i.e.thirty seven each of the Femur,Tibia& Fibula was taken from Department of Anatomy, Pt.J.N.M.Medical College ,Raipur & was studied for the location ,direction,number of Nutrient foramen.& It was found that most of the long bones follow the dictum "Towards the elbow I go,away from the knee I flee". & the Direction of nutrient foramen is opposite to growing end i.e .towards the knee. double nutrient foramen was found in most cases of Femur.the Nutrient foramen in Femur was found in Upper 1/3rd &middle 1/3rd in most of the cases .The nutrient foramen in Tibia was mostly found in Upper 1/3rd & some in middle1/3rd.In Fibula the nutrient foramina in some cases found in upper1/3rd & in most of the cases found in middle 1/3rd .This Anatomical study of nutrient foramina in shaft of long bones is of paramount importance in medico-legal aspect and also important in surgical procedures like bone grafting and microsurgical bone transplantation

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INTRODUCTION

Nutrient foramen is the largest foramen on the shaft of long bones through which nutrient artery for that bone passes. Berard^[1] was the first to correlate the direction of the canal with the ossification and growth of the bone. Humphrey^[8] was working on the direction and obliquity of nutrient canals postulated periosteal slipping theory, the canal finally directed away from the growing end. Harris^[6] has stated that the position of nutrient foramina is constant during the growth of long bone. Lutken^[12] has stated that position of nutrient foramina is variable & typical position of nutrient foramina can be determined after a study on human bones.Aim of the present study is to find out the direction of nutrient foramina with reference to the growing ends of the bone ,number of nutrient foramen present , common position of nutrient foramen

MATERIAL & METHODS

For this study,Total 111 long bones of lower limb (37 Femur,37 Tibia,37 Fibula) were taken From the Department of Anatomy,Pt.J.N.M.Medical College, Raipur The bones for examination were washed properly & dried. Each bone was examined in detail for the number, position & direction of nutrient foramina. The nutrient foramen was identified by the presence of a well marked groove and raised edge at the commencement of the canal. The

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Dean

exact position of the nutrient foramina was made out whether it was present on the upper or middle or lower one third of the bone.. The total length of long bones and distance of nutrient foramen from the upper end also measured. Sliding caliper and Osteometric board, magnifying glass were used for measuring these parameters.

RESULTS

Table-1

of various parameters of long bones

| | Total length(in cm) | Distance of N.F from upper end (in cm) | Distance of N.F from lower end(in cm) |
|--------|---------------------|--|---------------------------------------|
| Femur | 43.6 | 15.25 | 28.4 |
| Tibia | 37.2 | 12.4 | 24.74 |
| Fibula | 36.35 | 15.3 | 21.05 |

Table .1 shows length of different long bones.The mean length of Femur ,Tibia ,Fibula are 43.6,37.2,36.35 respectively.The distance of Nutrient foramen from upper end are 15.25,12.4,15.3 respectively.

Table 2: showing percentage of incidence of nutrient foramina in long bones

| | one nutrient foramina(%) | Two nutrient foramina(%) | Three nutrient foramina(%) |
|--------|--------------------------|--------------------------|----------------------------|
| Femur | 27.02 | 59.4 | 13.51 |
| Tibia | 83.7 | 16.2 | 0 |
| Fibula | 81.08 | 18.91 | 0 |

Table 2 shows that number of nutrient foramina in long bones were variable. Most of the bones having only one nutrient foramen, except Femur.Presence of two nutrient foramina were observed in femur in 59.4% cases i.e in 22 femur.& three nutrient foramen is seen in 13.51% cases i.e in 5 femur. In Tibia 16.2% cases,i.e in 6 tibia two nutrient foramen found. & in Fibula 18.91% cases i.e.7 fibula two nutrient foramen were found.three nutrient foramen was not found in tibia & fibula.

Table 3: showing the position of nutrient foramina in segment of long bones

| | Upper 1/3rd | Middle 1/3rd | Lower 1/3rd |
|--------|-------------|--------------|-------------|
| Femur | 17 | 19 | 1 |
| Tibia | 34 | 3 | 0 |
| Fibula | 10 | 27 | 0 |

In Table III ,For locating the position of nutrient foramina the bones were divided in to 3 segments upper 1/3rd,middle 1/3rd,lower 1/3rd In Femur nutrient foramina was found in middle 1/3rd in 19 bones,in 17 bones it was found in upper 1/3rd.In Tibia nutrient foramina was found in upper 1/3rd in 34 cases & in 3 cases it was found in middle 1/3rd .no nutrient foramen was found in lower 1/3rd . In Fibula nutrient foramina is found at the upper 1/3rd in 10 cases.,in middle 1/3rd in 27 cases & not found in lower 1/3rd

DISCUSSION

In embryonic period all the nutrient arteries course caudally. This is true in hemodynamic point of view to force the blood from cephalic to caudal side. This agrees with adult rules "towards the knee and away from elbow". This is said to be due to unequal growth of the ends of the long bones. The arrangement of diaphyseal nutrient foramen in long bones usually follows a definite pattern. Position is constant and seen on flexor surfaces.^[17]

The direction of nutrient foramina in human long bones is directed away from the growing end. This is due to one end of long bone is growing faster than the other end. In many tetra pods, there is variation in the directions of nutrient foramina, but in mammals and birds Hughes pointed out that Anomalous canal are frequent.^[7]

The blood supply of femur has been studied thoroughly by Luxor Kuliga and Turk^[13], blood supply of femur and humerus has been investigated by Lutken^[12], Laing^[10] and Carroll^[2]. Nutrient foramina of radius and ulna have been studied by Shullman^[18]. Longia GS et al^[11].stated that the vascular theory offers the best explanation of all reported anomalies as well as the normal fashioning of nutrient canals.

Location of nutrient foramen in different segments of long bones:

Femur: In femur the position of the nutrient foramina showed much variability. Mysorkar quoted higher number of nutrient foramina in 3rd and 4th segment which corresponds to upper 1/3rd & middle 1/3rd. In present study it is

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prevalent in upper 1/3rd & middle 1/3rd segments. The Tibia: tibia showed most consistency in position of nutrient foramina. It was constantly present in the 1st segment (upper 1/3rd) of the shaft and more commonly on vertical line and less commonly lateral to the vertical line. The present study correlates with the study of Mysorkar. Fibula: fibula showed presence of nutrient foramina in 2nd segment (middle 1/3rd) and on the medial crest of the bone. The present study correlates with study of Mysorkar

Direction of nutrient canal:

Direction and obliquity of nutrient canal shows the general pattern i.e Towards the knee, The direction of nutrient foramina in human long bones is directed away from the growing end. This is due to one end of long bone is growing faster than the other end^[15]. All the upwardly directed foramina were situated much below the middle of the shaft of the bone. There was no change in the obliquity of the canal when the foramina were situated in the centre of the bone compared to when they were nearer the ends.

Percentage of nutrient foramen in long bones:

Presence of two nutrient foramina were observed in femur in 59.4% cases i.e in 22 femur. & three nutrient foramen is seen in 13.51% cases i.e in 5 femur. In Tibia 16.2% cases, i.e in 6 tibia two nutrient foramen found. & in Fibula 18.91% cases i.e. 7 fibula two nutrient foramen were found. three nutrient foramen was not found in tibia & fibula.

CONCLUSION

Total one hundred eleven long bones of upper limb i.e. thirty seven each of the Femur, Tibia, Fibula was taken from Department of Anatomy, Pt. J.N.M. Medical College, Raipur & was studied for the location, direction, number of Nutrient foramen. & It was found that most of the long bones follow the dictum "Towards the elbow I go, away from the knee I flee". & the Direction of nutrient foramen is opposite to growing end i.e. towards the knee. double nutrient foramen was found in most cases of Femur. the Nutrient foramen in Femur was found in Upper 1/3rd & middle 1/3rd in most of the cases. The nutrient foramen in Tibia was mostly found in Upper 1/3rd & some in middle 1/3rd. In Fibula the nutrient foramina in some cases found in upper 1/3rd & in most of the cases found in middle 1/3rd. This anatomical study of nutrient foramina in shaft of long bones is of paramount importance in medico-legal aspect and also important in surgical procedures like bone grafting and microsurgical bone transplantation

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