Macedonian Veterinary Review 27, 1/2 p.59-62 (1998)
UDC: 599.824-141.3

EXTRAOSAL, PERIOSTAL AND INTRAOSAL ARTERIAL VASCULARIZATION OF THE HUMERUS IN SMALL GREEN MONKEY (Cercopithecus aethiopis sabeus)

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The main nutritive opening is always distally oriented with respect to humerus from the medial side. The nutritive channel, the extension of this opening is distally oriented. Proximal epiphysis of the humerus are supplied blood by branches of A.circumflexa humeri cranialis and A.circumflexa humeri caudalis. Corpus humeri received blood supply from A.principalis humeri, that a branch of A.brachialis or in certain cases A.ulnaris. Blood supply for distal epiphysis comes from A.collateralis ulnaris proximalis and A.collateralis ulnaris distalis. Rami periostales originate from humerus muscle branches that vascularize muscles in scapulo-humeral region and from nutritive branches prior the entry to the Foramen nutricium.

Key words: humerus, vascularization, small green monkey

INTRODUCTION

Skeletal system is widely studied because different disorders of traumatic or nontraumatic origin, appears on bone. In order to understanding bone malformation it is necessary to know detailed vascularization patterns. Numerous authors provided informations of vascularization of humans and some animals (Guilland, 1953; Brooks, 1958; Barlow, 1959; Pagano et al.,1959; Kato, 1970; Kogovcek, 1980; Joji},1965). There are lacks data on angiology related to arterial vascularization of the small green monkey. From this point view, this research was aimed to present extraoseal, periosteal and intraoseal vascularization of the humerus in this animal by means of different approaches.

MATERIAL AND METHODS

For the study of the spatial distribution of nutritive openings we examined 20 humeri. Six humeri were prepared as osteological preparations and the remains 14 were injected with minium-stained gelatin or India ink. Extraoseal and intraoseal arterial vascularization of the humerus was studied by injecting blood vessels (A.subclavia or A.axillaris) with gelatin stained with India ink, ratio 1:1.

RESULT AND DISCUSSION

Topography of the nutritive openings of the humerus

The humerus of the small green monkey is characterized by Foramen nutricium principale and a larger number of smaller openings visible only with magnifying glass.

Foramen nutricium principale is located on the distal third diaphysis on the medial side. The opening leads through bone compacta and nutritive channel ends by opening directed to bone marrow (Fig.2A). In front of nutritive openings, on the body of humerus, shallow or deeper sulcus can be observed. The shape of nutritive opening is oval.

On the proximal part of the humerus several nutritive openings are located on the neck of the humerus at the level of joint capsule. The lateral sides of Tuberculum majus and Tuberculum minus contains a single large nutritive openings (Fig.2B).

On the distal part of the humerus nutritive openings are located on Epicondylus medialis and Epicondylus lateralis and in Fossa radialis (Fig.2B).

Extraosal and intraosal arterial vascularization of humerus

Proximal epiphysis of humerus receives its blood supply through branches of A.circumflexa humeri cranialis (Fig.2C) and A.circumflexa humeri caudalis . A.circumflexa humeri cranialis is a blood vessel that branches of A.brachialis. It runs cranially covered by M.biceps brachii and after the flow of 10-12 mm it divides into Ramus ascendes and Ramus descendes. Ramus ascendes (Fig.2C) is a branch that running proximally towards Tuberculum majus humeri, enters through a large nutritive opening and vascularize this bone nodule. Another bone branch Tuberculum minus humeri and Collum humeri vascularize the arterial branch of A.brachialis.

Diaphysis humeri receives blood supply from A.nutricia principalis humeri (Fig.3 C; Fig 3 D). This artery is a branch of A. brachialis, although it may be a branch of A.ulnaris, A.radialis and A.collateralis ulnaris proximalis. It branches into Pars extraossealis (part that is out of bone), Pars intramuralis (part that penetrates bone compacta) and pars intraossalis (part that located in the bone marrow). One branch enters nutritive opening located in Fossa radialis and further branches in this part of the bone. Pars extraossalis of A.nutricia principalis humeri has 10-12 mm in length. It is positioned proximally with several periostal branches. pars intramuralis is a log as nutritive channel, 3-5 mm. Pars intraossalis has 3-4 mm in length and separates into two terminal branches: Ramus ascendens and ramus descendens. ramus ascendens runs proximally in a spiral manner. After 5-10 mm it separates into 5 to 6 narrower branches. Out of these branches, numerous smaller branches penetrate the bone marrow in the form of fine network. Ramus descendes, after spiral run of 5-10 mm separates into two to three branches and creating dense network in the bone marrow. terminal branches Ramus ascendens and ramus descendens spread up to epiphysis. The applied method of analysis did not reveal any anastomoses between blood vessels of diaphysis and epiphysis.

Distal epiphysis is supplied by blood from A.collateralis ulnaris proximalis and A.collateralis ulnaris distalis. They represent branches of A.ulnaris. A.collateralis ulnaris proximalis runs caudoventrally just over the medial side of the distal part of humerus and yields several periostal branches for the periost and also providing branches for muscles of that region. The second blood vessel runs over the lateral side of the humerus towards epicondylus lateralis in which it enter with several branches.

Periostal arterial vascularization of monkey humerus

Periostal arterial blood vessels originate from larger or smaller blood vessels that supply blood for surrounding muscles and humerus. These blood vessels yield branches that generate in, the periost, very dense branches network nearly invisible by naked eye. Out of this periostal network run out numerous nutritive branches that enter bone compacta through nutritive openings located on this surface.

FIGURES:

***Figure 1**. The small green monkey*

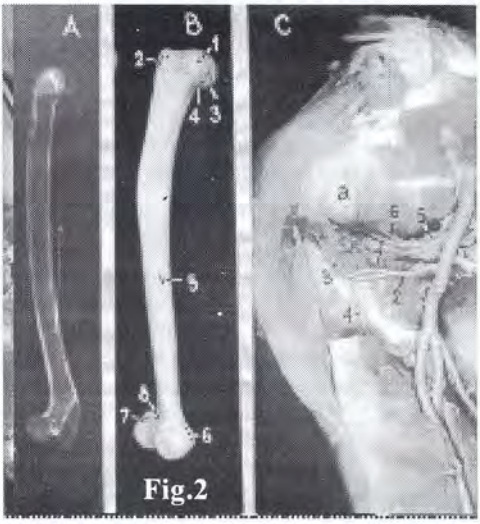

***Figure 2**. A- Nutritive openings in monkey humeri; B- Nutritive openings and blood vessels of the proximal part of humerus.*
B_1- nutritive opening on the Tuberculum majus; B_2- nutritive opening on the Tuberculum majus; B_3- Caput humeri; B_4- nutritive opening on the Collum humeri; B_5- Foramen nutricium principale; B_6- nutritive opening on the epicondylus medialis humeri; B_7- nutritive opening on the epicondylus lateralis humeri; B_8- nutritive opening on the Fossa radialis.
C_a- Tuberculum minus humeri; C_1- A.bracialis; C_2- A.circumflexa humeri cranialis; C_3- Ramus ascendes; C_4- Ramus descendes; C_5- A. circumflexa humeri caudalis; C_6- A.nutricia proximalis humeri; C_7- The branch of the blood vessel for Tuberculum minus humeri.

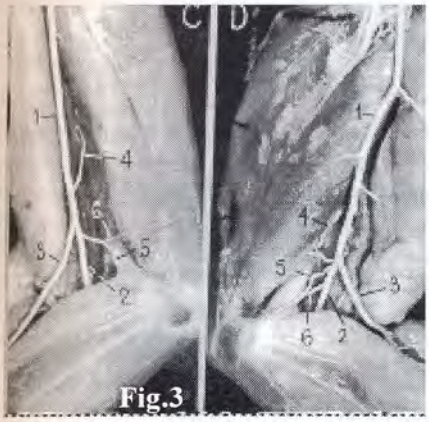

***Figure 3.** Arterial vascularization of the diaphysis and distal part of the humerus (C,D).*
1-A.brachialis; 2- A.radialis; 3- A. ulnaris; 4- A.nutricia principalis humeri; 5- A. collateralis ulnaris proximalis; 6- A.collateralis ulnaris distalis.

CONCLUSION

The report presents topography of nutritive openings, direction of the spread of the main nutritive channel as well as extraosal and intraosal arterial vascularization diaphysis and epiphysis of the humerus.

The main nutritive opening is always distally oriented with respect to humerus from the medial side. The nutritive channel, the extension of this opening is distally oriented. Proximal epiphysis of the humerus are supplied blood by branches of A.circumflexa humeri cranialis and A.circumflexa humeri caudalis. Corpus humeri received blood supply from A.principalis humeri, that a branch of A.brachialis or in certain cases A.ulnaris. Blood supply for distal epiphysis comes from A.collateralis ulnaris proximalis and A.collateralis ulnaris distalis. Rami periostales originate from humerus muscle branches that vascularize muscles in scapulo-humeral region and from nutritive branches prior the entry to the Foramen nutricium.

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ЕКСТРАКОСКЕНА, ПЕРИКОСКЕНА И ИНТРАКОСКЕНА АРТЕРИЈАЛНА ВАСКУЛАРИЗАЦИЈА НА ХУМЕРУСОТ НА МАЛИОТ ЗЕЛЕН МАЈМУН (Cercopithecus aethopis sabeus)

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Главниот нутритивен отвор е секогаш дистално ориентиран во однос на хумерусот од медијалната страна. Нутритивниот канал, кој е продолжението на овој отвор, е дистално ориентиран. Проксималните епифизи на хумерусот се снабдуваат со крв од гранките на A. circumflexa humeri cranialis и A. circumflexa humeri caudalis. Corpus humeri се снабдува со крв од A. principalis humeri, потоа од гранка на A. brachialis или во одредени случаи преку A.ulnaris. Дисталните епифизи се снабдеваат со крв од A. collateralis ulnaris proximalis и A. collateralis ulnaris distalis. Rami periostales потекнуваат од гранките во хумерусот кои потоа ги васкуларизираат мускулите во скапуло- хумералниот предел и од нутритивните гранки пред самиот влез во Foramen nutricium.

Клучни зборови: *хумерус, васкуларизација, мал зелен мајмун.*