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Anatomic variations

A further morphological study of the persistent median artery in neonatal cadavers*

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Summary: Persistent median artery was studied in 60 upper limbs of 30 neonatal cadavers. It was found in 12 (20%) specimens while partial atrophy in the distal part of the median artery was detected in 9 (15%) specimens. These findings correlated well with those of other series including the authors' previous study which covered both adults and neonates. There was no significant difference statistically between the authors' current and previous studies ($p>0,05$). Therefore both studies were combined. The incidence of persistent median artery in this enlarged series (100 specimens) was 17%. This rate of persistent median artery was higher than those of most other published series. We believe this may be due to evolutionary and racial trends; the neonatal origin of our specimens would be another differing factor. Partial atrophy of the median artery, and the different incidences in neonates and adults raised the possibility that the median artery regresses at a later age, possibly during perinatal and early infancy period.

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Une étude morphologique complémentaire sur l'artère médiane persistante sur des enfants morts-nés

Résumé : La persistance de l'a. médiane a été recherchée sur 60 membres supérieurs provenant de 30 cadavres de nouveau-nés. Elle a été trouvée sur 12 pièces (20 % des cas) tandis qu'une atrophie localisée de la partie distale de l'a. médiane était détectée sur 9 pièces (15 %). Ces constatations ont une bonne corrélation avec celles d'autres séries, y compris l'étude antérieure des auteurs portant à la fois sur des adultes et des nouveau-nés. Il n'y avait pas de différence statistiquement significative entre l'étude rapportée ici et la précédente ($p>0,05$). C'est pourquoi les deux études ont été rassemblées. La fréquence de la persistance d'une a. médiane dans cette étude élargie (100 cas) a été de 17 %. Ce taux d'a. médiane persistante est plus élevé que celui de la plupart des autres séries publiées. Nous pensons qu'il peut être lié à des facteurs évolutifs et ethniques ; l'origine néonatale de nos observations a pu être un autre facteur différentiel. L'atrophie partielle de l'a. médiane et la différence de fréquence chez le nouveau-né par rapport à l'adulte proviennent de la possibilité qu'a l'a. médiane de régresser à un stade plus tardif, peut-être durant la période périnatale ou dans la première enfance.

Key words: Persistent median artery–Neonatal cadaver

The median a. is a relatively common anatomical variant [2, 5, 11, 14, 25, 30] and its presence should be taken into consideration in clinical practice, especially in neonatal surgery, for several reasons: It may cause symptoms of the carpal tunnel syndrome [2-3, 8-10, 14, 15, 17, 21, 31]; it may supply the hand in radial or ulnar artery injuries, or it may be used as graft artery elsewhere in the body [14, 21].

In a recent study, in 20 neonatal cadavers we have found a persistent median a. (PMA) with an incidence of 12.5% [19]. Compared with previously published studies, this incidence is remarkably high and, considering most other studies were performed on adult cadavers, this difference lead to several questions including whether these findings reflect racial and/or evolutionary differences of PMA incidence between different populations, or whether the results reflect developmental differences between adults and neonates.

In this study we have extended our previous study to cover more dissections including histologic investigations.

Material and methods

Sixty upper limbs out of 30 neonatal cadavers (18 males, 12 females) were obtained from the collection of the Anatomy Department of Ondokuzmayis University. All cadavers were

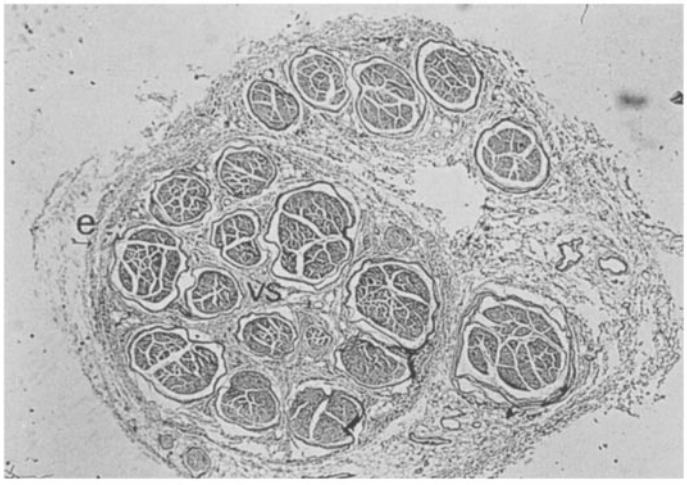

Fig. 1
Cross section of the median neurovascular bundle of the forearm immediately above the flexor retinaculum from a neonatal cadaver without a macroscopically identifiable median a. X25. Van Gieson, *e:* epineurium, *Vs:* vasa nervorum

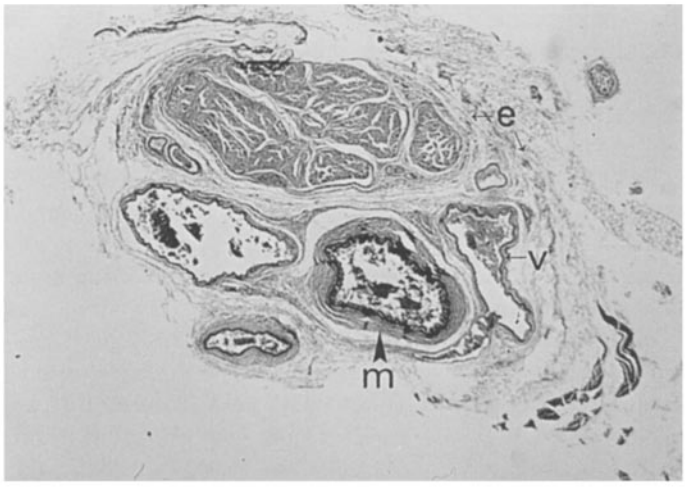

Fig. 2
Cross section of the median neuravascular bundle in the forearm immediately above the flexor retinaculum from a neonatal cadaver without a macroscopically identifiable median a. X25. Van Gieson, *Vs:* vasa nervorum, *e:* epineurium, *m:* median a., *v:* venae comitantes

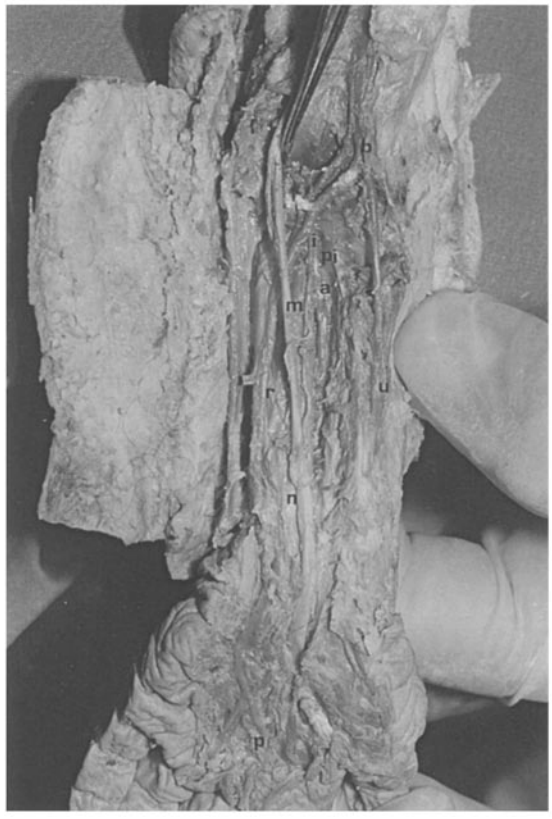

Fig. 3
Progressive atrophy in the distal part of the left median a. arising from anterior interosseous a. in a neonatal cadaver. The median n. has been reflected laterally to reveal partial atrophy of the median a. *m:* median a., *n:* median n., *u:* ulnar a., *r:* radial a., *i:* common interosseous a., *b:* brachial a., *a:* anterior interosseous a., *pi:* posterior interosseous a., *p:* superficial palmar arch

previously fixed in 10% formalin and all upper limbs were dissected under a microscope (Carl Zeiss Opmi 99) from the distal upper arm to the metacarpophalangeal joints. The brachial a. and median n. were identified at the proximal one third of the forearms as well as the ulnar, radial and common interosseous aa.

The presence of the PMA was anatomically investigated along the course of the median n. For an artery to be considered as PMA it had to meet the following criteria:

1- Very close situation to venae comitantes,

2- Join to the superficial palmar arch and blood supply the structures of the hand.

The relationship between the PMA and the median n. was evaluated histologically. Sections for light microscopy were taken through the median neurovascular bundle of the forearm from immediately above the flexor retinaculum since this was the level at which the smallest diameter of the artery most frequently occured. 0.3-0.4 mm long segments of the neurovascular bundle were embedded in paraffin and stained with Haematoxylin-Eosin and Van Gieson. Only arteries lying next to the median n. but outside of the epineurium were identified as a median a. (Figs. 1, 2). Data were analyzed statistically using x2 test.

Results

The frequency of the PMA was found to be 20% (7 in males, 5 in females). There was no significant difference between males and females ($p>0.05$). Out of 30 neonatal cadavers in which both forearms were available, the artery was present bilaterally in 4 cases (13.3%), unilaterally in 4 cases (13.3%) and was bilaterally absent in 22 cases (73.4%). This gives a frequency of 26.6% per individual.

Eight arose from the ulnar a. and 4 from the common interosseous a. In all cases, radial and ulnar aa. were present. PMAs descended to the wrist on the lateral side of the median n. on the volar aspect of the forearm and, by joining the superficial palmar arch, supplied digits of the hand.

In a total of 9 (15%), the median a. became atrophic in the distal part of the forearm (Fig. 3). In these cases, in the proximal half of the forearm, the median a. ran in close association with the median n. bilaterally in 5 cases, and unilaterally in 4 cases. 7 of these arteries arose from the ulnar a., 5 from common interosseous a., while in two cases, they arose from the anterior interosseous a. (Fig. 3).

Discussion

The incidence of PMA have been reported to range from 1.5 to 27.2% [1, 7, 16, 18, 23-24, 28]. These eight reports are included in Table 1. All of the previously published series have been carried out in adult cadavers and they have not included neonatal specimens. A previous study which included the neonatal period had been performed by us and the incidence of the PMA had been found to be 12.5% [19]. In the same study the PMA could not be shown on adult material.

In the present study the incidence of the PMA in neonatal cadavers is not different from our previous series (12.5% in 40 forearms versus 20% in 60 forearms; x2=0.50; p>0.05). The lack of statistically significant differences between the results for both series, allows us to calculate a combined frequency for the entire material. Thus in a total of 100 forearms, 17 (17%) PMAs were detected. 13 (26%) of all individuals possessed either unilateral or bilateral PMA. These figures show that the PMA cannot be considered as a relatively rare variant.

Table 1. Incidences of persistent median a. according to various authors

%	Authors	Case (Nb)
8	Adachi (1928)	200
4.43	Mc Cormack (1953)	750
8.33	Misra (1955)	66
9.9	Coleman and Anson (1961)	650
3	Kenesi,Alexandre et Aaron (1967)	33
2.2	Janevski (1982)	750
1.5	Srivastava (1990)	134
27.2	Henneberg and George(1992)	158

Our incidences are higher than most other published series [7, 16, 21, 23, 24, 28] except Henneberg's one [13]. The difference cannot be explained by diagnostic criteria since we have used stringent morphologic and histologic criteria for the identification of PMA. The differences are possibly caused by racial and/or evolutionary trends in different studied populations. The neonatal origin of our specimens would be another differing factor.

In contrast with Henneberg [13] who reported a PMA incidence of 27.2% in adult specimens, our previous study failed to detect PMA in 35 adult cadavers, but a similar incidence is found in neonates [19]. Additionally, during routine dissection of a 42-year-old male cadaver, a well developed PMA that arose from the ulnar a. was found bilaterally and entered the carpal canal along an additional flexor muscle to the index finger [20]. This difference needs to be explained.

A well developed median a. is a constant feature in the embryo [6, 21, 26, 27]. It is generally accepted that the median a. regresses after the eighth week of intrauterine life and is referred to as arteria commitans nervi mediani [4, 12, 22, 29, 32]. Therefore, one would not expect to find different PMA incidences in neonatal and adult populations. However, our findings are contradictory. In the present study, partial atrophy in the distal part of the median a. was detected in 9 cases (15%) and, together with the differences in adult and neonatal incidences, it raises the possibility that the median a. can regress at a much later stage, possibly during the perinatal period and early infancy.

In conclusion, PMA was detected with a high incidence in neonatal cadavers. Differences between adult and neonatal incidences make it clear that further neonatal and pediatric series should be evaluated to understand the developmental patterns of the median a.

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