

From the Histological Department (Head: Professor MARTIN WRETE), University of Uppsala, Sweden

Elastic Tissue Contents of the Medial Layer of the Cerebral Arteries Differences between young and adult individuals

By

OVE HASSLER

With 3 Figures in the Text

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A considerable amount of elastic tissue is to be found in the medial layer of the aorta and of the large elastic arteries. The media of the muscular arteries also contains some elastic tissue in the form of fine elastic fibres. It is generally known that in this respect the cerebral arteries constitute an exception, since they have no elastic tissue in their medial layer (WOLFF 1948, and others).

Material and methods

The material examined comprised the large cerebral arteries from 158 individuals. Seventy-nine were aged 10 years or less; the remaining 79 were selected arbitrarily from those over 10 who, from a macroscopic inspection showed no advanced atheromatous changes. The arteries were taken within 36 hours post-mortem. Fixation was performed by prolonged injection under slight pressure of formalin into the carotids and vertebrals. Segments roughly one mm. long were excised from the right and left internal carotids, the right and left anterior cerebral arteries, the right and left middle cerebral arteries and the basilar artery. The segments were embedded in paraffin. Each segment was then cut into transverse sections, 10 μ . thick. They were stained with an elastin stain (aldehyde-fuchsin, resorcin-fuchsin, orcein, or orcein-fractions no. 4 and 5 of BROLIN and HASSLER) in association with picrofuchsin or eosin. Nuclear stains (iron haematoxylin, Harris' haematoxylin, nuclear-fast-red) were used in preliminary experiments but were abandoned since they increased the time required to count the elastic fibrils. From each arterial segment two sections were taken at random from those not including a branching point. The elastic fibres were counted within 10 arbitrarily selected portions of the media in each section. Each portion consisted of the volume of media included in a ring placed in the focal plane of the eye-piece when the microscope tube was lowered and raised over the section. A divided part of a fibril was counted as a whole fibril.

Results

As shown in Figs. 1 and 3, many more elastic fibrils per unit volume of arterial media were observed in the young children than in the adults. Moreover there seemed to be even more fibrils per unit volume in the children aged $1/12$ —2 years than in the new born. The fibrils seemed to be a little longer and coarser in the adults than in the new born.

Rather more fibrils were found in the internal carotids and the basilar artery than in the anterior cerebral and the middle cerebral arteries. The distribution of fibrils over different arteries did not change with increasing age (cf. Fig. 2).

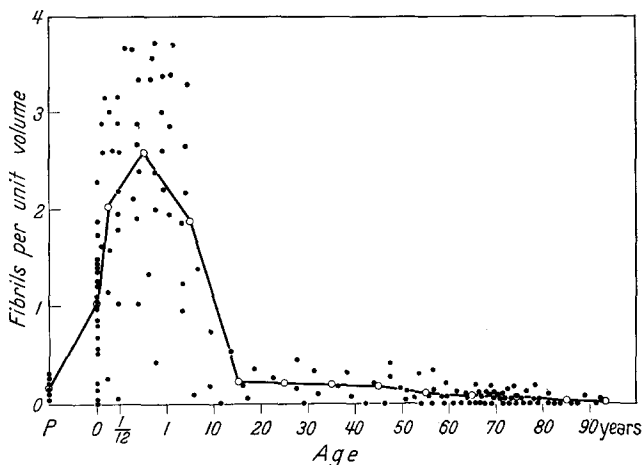


Fig. 1. Diagram showing the mean number of elastic fibrils per unit volume of the tunica media of the cerebral arteries of individuals at different ages (*p* prematures)

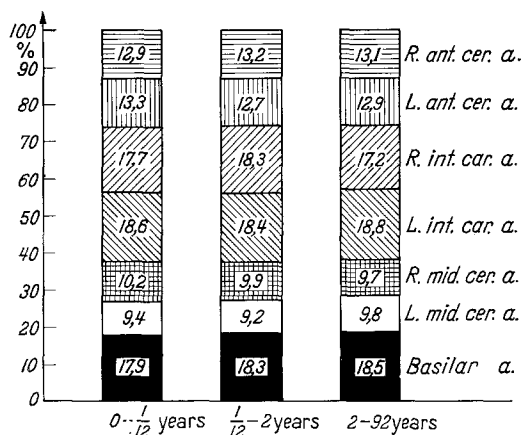


Fig. 2. Distribution of the elastic fibrils over various arterial groups at different ages, expressed as a percentage of the total number of fibrils observed in each age group. *R. ant. cer. a.* right anterior cerebral artery. *L. ant. cer. a.* left anterior cerebral artery. *R. int. car. a.* right internal carotid artery. *R. mid. cer. a.* right middle cerebral artery

Elastic fibrils were consistently scarce in the media over physiological intima cushions.

Discussion

BINSWANGER and SCHAXEL (1917) have previously made observations concerning the elastin contents of the cerebral arteries at different ages. They did no quantitative work, and their statements were based on a general impression obtained from sections. Their findings regarding the new born and old individuals are in accordance with the author's. They indicate, however, that a high content of elastic fibres is to be found in

the media of middle aged individuals; this is not in agreement with the present results.

GOERTTLER (1953) has pointed out that in the new born the cerebral arteries have a thicker media. There is therefore a closer resemblance between these and the other arteries of the body than between the cerebral and other body arteries of the adult. The author's findings of increased contents of elastic fibres in the media of the arteries of the new born are also in accordance with such a

resemblance. If, in addition, the media is proportionately thicker in the children, then the total content of elastic fibrils is increased more, relative to the calibre of the arteries, than might be deduced from figures 2 and 3. GOERTTLER assumed

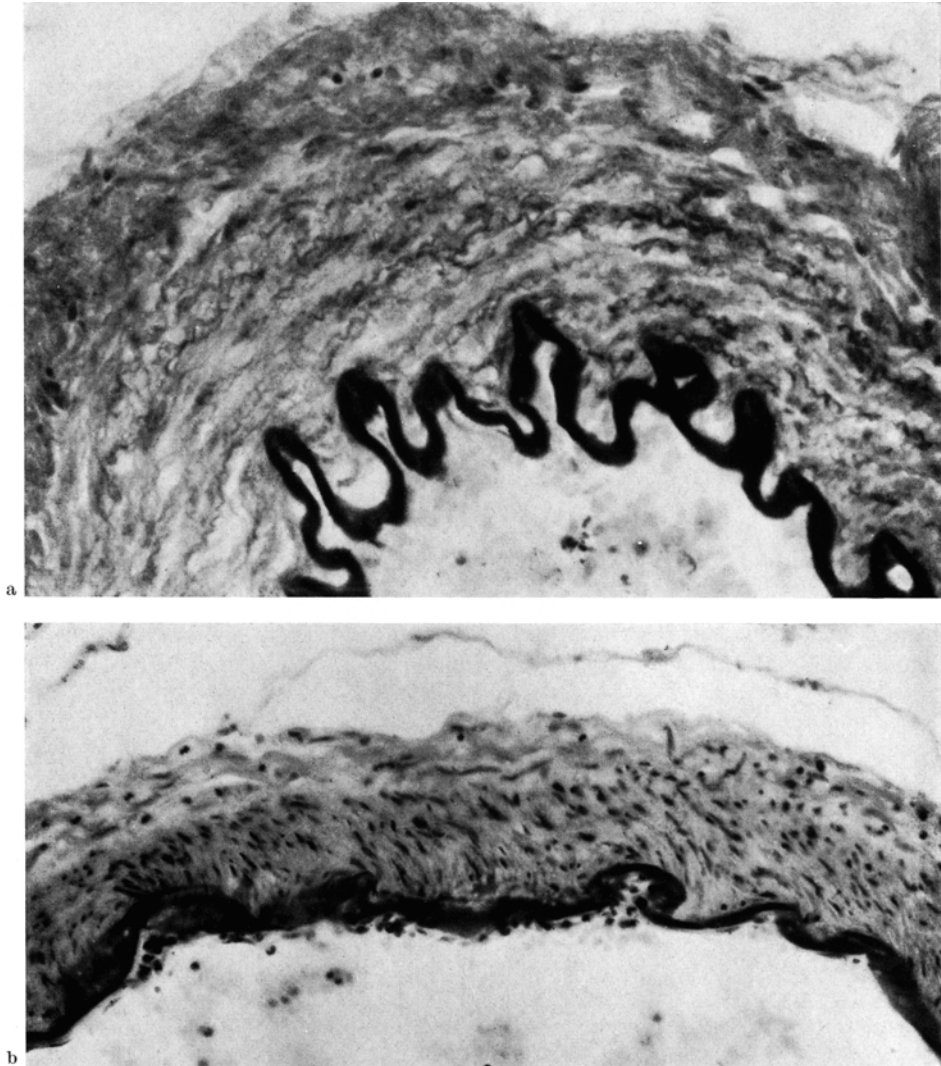


Fig. 3a and b. Sections through cerebral artery from a) a 3-month-old boy, b) a 47-year-old man. The difference in contents of elastic fibrils is apparent. (a aldehyde-fuchsin and picrofuchsin, $\times 300$; b aldehyde-fuchsin and van Gieson, $\times 190$)

that the thin media of the adult individual arose from changes in the intracranial pressure conditions which occur after the sutures have grown together. The differences observed in the present investigation between the elastic tissue contents of the media in young children and adults may also be connected with differences in the intracranial pressure conditions following coalescence of the sutures.

WOLFF (1937, 1948) and ASK-UPMARK (1944) have pointed out that the cerebral arteries in adults have a lamellar structure, with all the elastic tissue concentrated into one layer (the internal elastic lamella) and all muscle into another layer (the media). The present findings show this lamellar arrangement to be less pronounced in the new born. If, as WOLFF assumes, such an arrangement has a pulse-damping effect, this effect can be expected to be lower in the new-borns than in the adults.

The decrease in the adult individual of the contents of elastic tissue in the media of the cerebral arteries may have some significance as regards the development of a special type of atheromatosis in these arteries. It is known that in many cases the cerebral arteries are not affected simultaneously with other arteries of the body (BOYD 1952, and others).

Summary

In contrast to previous reports, a high content of elastic fibrils in the media of the cerebral arteries was found in children relative to that in the middle-aged individuals examined. The highest contents were found in subjects between 1 month and 2 years of age. More elastic fibrils were found per volume of media in the internal carotid and basilar artery than in the middle cerebral artery.

Zusammenfassung

Im Gegensatz zu früheren Untersuchungen konnte der Verfasser in den Gehirnarterien von Kindern vermehrt elastische Fasern nachweisen gegenüber den Gehirnarterien von Erwachsenen. Die meisten elastischen Fasern wurden bei 1 Monat bis 2 Jahre alten Kindern nachgewiesen. In der A. carotis interna und basilaris waren pro Volumeneinheit mehr elastische Fasern zu finden als in der A. cerebri media.

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Dozent Dr. O. HASSLER, Histologiska institutionen,
 Uppsala Universitet, V. Ågatan 26, Uppsala, Sverige