

VENOUS WALL ULTRASTRUCTURE IN GENERALIZED VENOMEGALY

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SUMMARY

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The ultrastructure of the v. colica sinistra in a case of generalized vasomegaly in man was examined. Elastic material was found in three forms: as a lightly osmiophil amorphous material bordering on myocytes, as a highly osmiophil elastic membrane, and as highly osmiophil slim elastic fibres of different orientation in the tunica media and adventitia. The slightly osmiophil elastic material is assumed to be newly formed by pinocytotic activity of the myocytes. The highly osmiophil elastic material indicates its impairment. No typical atherosclerotic changes were found in the examined vein. Based on a comparison with previous findings in the case of vasomegaly of the a. mesenterica inferior, the authors conclude that the venomegaly phenomenon is connected with degenerative changes in the elastic material of the vessel wall.

Key words: Venomegaly — Ultrastructure — Elastic material

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INTRODUCTION

Arteriomegaly was described for the first time in two patients by Leriche in 1942 and 1943 (see 18). This interesting clinical entity was later given attention by other investigators but only from the clinical aspect (1, 4—6, 9, 10—12, 18—20).

This phenomenon has been shown to appear already in children (2, 8). It was indicated that the basic defect is probably due to a congenital abnormality of the elastic tissue in arteries. In our previous publication (14) we showed a morphological picture of elastic material characterized by its high osmiophilia typical of degenerative changes in an elastic material (7). It was shown, at the same time, that arteriomegaly substantially differs from atherosclerosis. Typical atherosclerotic changes were found neither in the tunica intima nor in the tunica media. As a result, it can be reasonably concluded that arteriomegaly is not caused by atherosclerotic lesions (14).

Venomegaly has not been described in the literature to date. This is probably due to the fact it does not occur very frequently as well as to the difficulties connected with obtaining human tissue for an electron microscopic examination.

MATERIAL AND METHODS

A 75-year-old male patient was treated at the Department of Angiology of S. Camillo General Hospital in Rome with claudication on the left side. Obliteration of the a. iliaca communis sinistra of the relevant side was found and an aneurysm of the aorta abdominalis was detected on follow-up. The patient was later operated on. During the operation, generalized vasomegaly was found.

The tissue for an electron microscopic examination was recovered from the v. colica sinistra during the operation. Fixation was performed by immersing small tissue blocks in 2.5 % glutaraldehyde in 0.05 M cacodylate buffer (pH 7.2) for 2 hours and post-fixed in 2 % osmium tetroxide in the same cacodylate buffer. The material was then dehydrated with acetone. After embedding it in EPON, the material was cut using an LKB ultratome. Semithin sections were stained with toluidine blue and examined in a light microscope. Ultrathin sections were contrasted using standard technique by uranylacetate and lead citrate (17). No specific contrasting methods for elastic tissue were used. The ultrathin sections were examined and photographed by a Tesla BS 500 electron microscope.

RESULTS

1. Tunica intima (Fig. 1)

The tunica intima consists in the group of medium-sized veins of only a single layer of endothelial cells. The layer was damaged while preparing the material. A relatively thick elastic membrane with irregular side thickening was found in the place of the membrana elastica interna. This membrane is well visible in the semithin as well as in the ultrathin sections; it is disrupted at several sites. A remarkable feature of the membrane is its very high osmiophilia: both the amorphous elastin and the elastic microfibrils are highly osmiophil. Its thickness is about 1.7 μm .

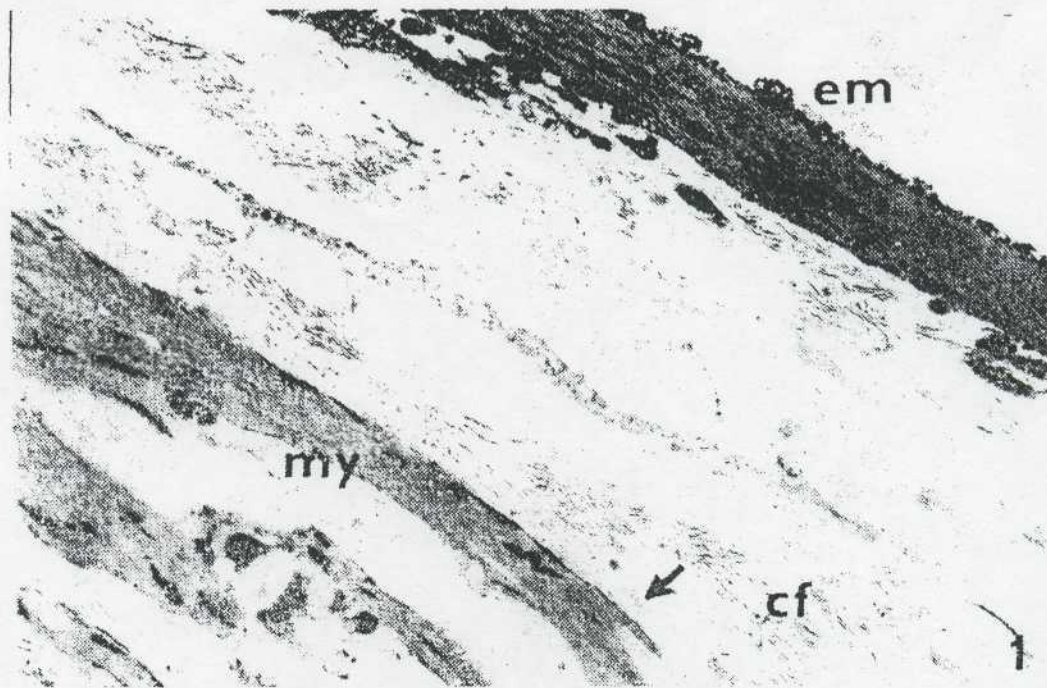


Fig. 1. A cross section through the wall of the v. colica sinistra. A highly osmiophil membrana elastica occurs in the site of the membrana elastica interna. cf — collagenous microfibrils, em — elastic membrane, my — myocyte. — — light elastic material. X 6,500.

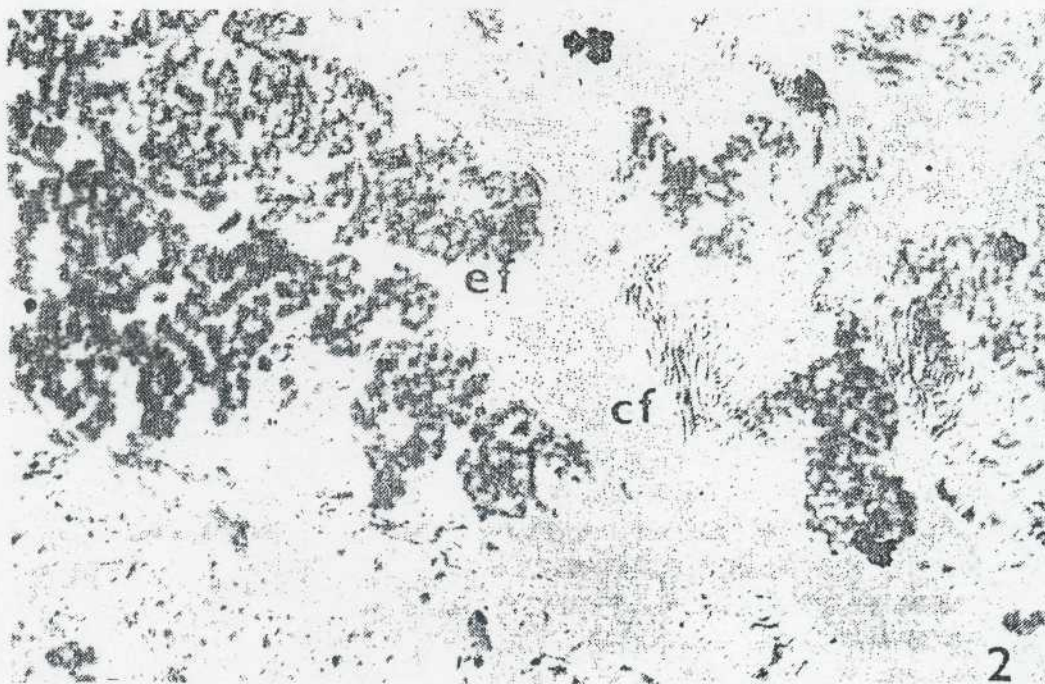


Fig. 2. The tunica media of the v. colica sinistra. A cross section. cf — collagenous microfibrils, ef — elastic fibers. X 19,500.

2. Tunica media (Figs. 2, 3, 4)

The myocytes of the tunica media, in this group of veins limited in number, are oriented in parallel to the cross section of the vein. Among the myocytes, there are relatively wide spaces filled with collagenous microfibrils and elastic material. The myocyte plasma is electron light with no major morphological changes. The myocytes exhibit only low pinocytotic activity. In some places the surface of the myocytes borders on layers of the amorphous light elastic material.

In the spaces among the myocytes there are numerous collagenous microfibrils. We found them mostly in cross or oblique sections, an indication they are arranged in parallel to the course of the vein. These collagenous microfibrils are about 28 nm thick. They are intermingled with highly osmiophil thin elastic fibres running in parallel or transversely to myocytes. The thickness of these fibres is about 0.1 μm .

3. Tunica adventitia (Fig. 4)

The tunica adventitia in veins is very thick. The myocytes in this layer are arranged in parallel to the course of the vein: so they are found cross sectioned. Again, the cytoplasm of myocytes is free of any signs of atherosclerotic lesions and shows no signs of degeneration. There is no marked pinocytotic activity. Among the myocytes there are numerous collagenous microfibrils and highly osmiophil elastic material in the form of thin fibres of different orientation. Another lightly osmiophil amorphous elastic material is located in the vicinity of myocytes.

As to our findings, the elastic material occurs in the studied *v. colica sinistra* in three forms:

1. As a slightly osmiophil amorphous material bordering on myocytes in the tunica media and adventitia.
2. In the place of the *membrana elastica interna* there occurs a thick highly osmiophil elastic membrane with well visible elastic microfibrils.
3. Highly osmiophil elastic slim fibres are present among the myocytes of the tunica media and tunica adventitia; these fibres are of different orientation.

DISCUSSION

To date, venomegaly has not been described in the literature making it impossible to compare our results with other data. Attention was paid only to arteriomegaly which could be connected with a presumed high pressure in arteries and with its mechanical influence. In experiments it was indeed, as a rule, a high mechanical pressure which led to the disruption of elastic membranes [see, e.g. Meyer and Henschel (15) — experimentally achieved arterial tortuosity]. Nyström (16) found, in the cases of intracranial aneurysms,

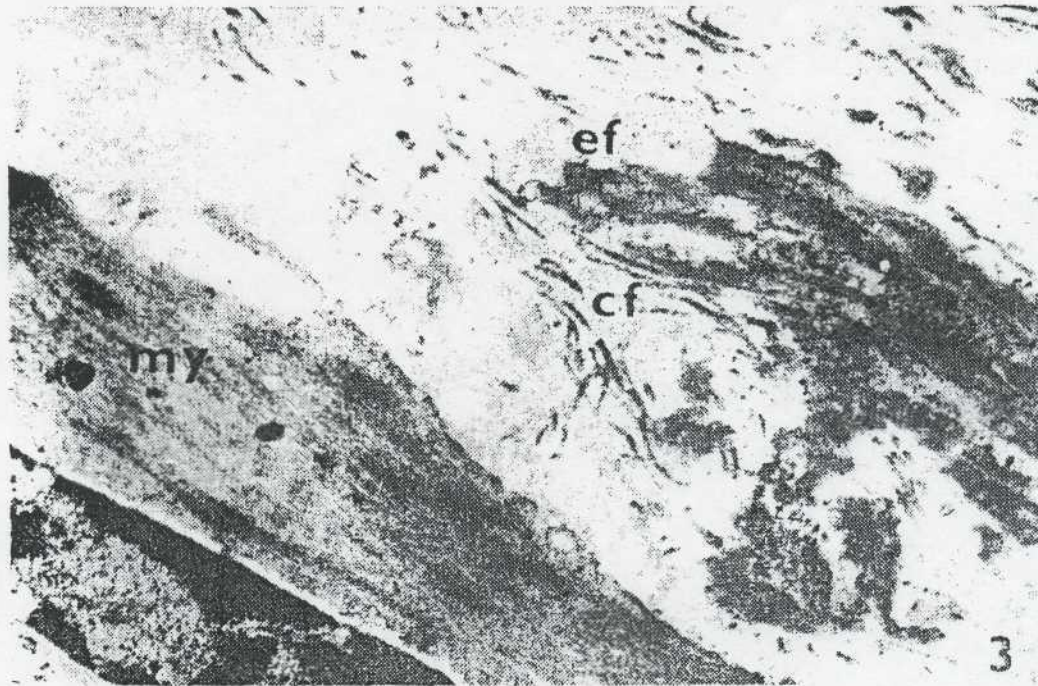


Fig. 3. The tunica media of the v. colica sinistra. A cross section. cf — collagenous microfibrils, ef — elastic fibers, my — myocyte. X 27,000.



Fig. 4. Transition of the tunica media and adventitia. A cross section through the v. colica sinistra wall, cf — collagenous microfibrils, ef — elastic fibers. X 35,000.

a highly osmiophil membrana elastica interna and an amorphous electron dense elastic material in the vicinity of the rupture. The occurrence of arteriomegaly in children suggests a congenital abnormality of the elastic tissue in arteries in these cases (2, 8). All these findings indicate that in cases of vasomegaly attention should also focus on the structure of veins.

A distinct feature of the examined patient was his generalized vasomegaly. As to the v. colica sinistra wall we can compare our findings only with those of arteriomegaly of the a. mesenterica inferior described in our previous paper (18). On the whole the findings in both vessels of the same case are very similar. The elastic material occurs in the form of highly osmiophil elastic fibres (membranes). Besides, slightly osmiophil elastic material, produced by the pinocytotic vesicles of myocytes was found, bordering on myocytes or lying among them. This pinocytotic activity is much greater in the a. mesenterica inferior myocytes. The light amorphous elastic material probably represents newly formed elastin. The high osmiophilia of elastic fibres among myocytes indicates degeneration (elastic material degradation — 3, 7, 21). The difference as to the membrana elastica interna in the a. mesenterica inferior and v. colica sinistra is at present not possible to explain. Examination of a greater number of vessels in cases of vasomegaly will be necessary.

Similarly as in the case of arteriomegaly described (18) no typical changes reported in atherosclerosis were found in the examined v. colica sinistra (for comparison see, e.g., 14). Atherosclerosis is therefore not a cause of vasomegaly.

Based on the described ultrastructural examination of the v. colica sinistra wall and comparison with the findings in arteriomegaly of the a. mesenterica inferior we can conclude that in the case of venomegaly, similar changes of elastic material were found characterized by its high osmiophilia. We can therefore assume that pathologic changes in elastic material may be one of the causes of vasodilatation.

ZUSAMMENFASSUNG: Bei einem Kranken mit generalisierter Vasomegalie wurde die Wandultrastruktur der V. colica sinistra untersucht. Das elastische Material trat in dreifacher Form vor: als leicht osmiophiles amorfes Material am Myozytenrand, als stark osmiophile elastische Membrane, und als stark osmiophile schmale elastische Fasern, verschiedentlich angeordnet in der Tunica media und Adventitia. Über dem schwach osmiophilen elastischen Material nimmt man an, dass es durch die pinozytische Aktivität neuformiert wird. Das stark osmiophile elastische Material deutet eine Störung der pinozytischen Aktivität an. In der untersuchten Vene wurden keine typischen atherosklerotischen Veränderungen gefunden. Nach Vergleich mit dem Befund einer Vasomegalie der A. mesenterica inferior bei demselben Patienten kommen die Autoren zum Schluss, dass die Venomegalie mit degenerativen Veränderungen des elastischen Materials in der Gefässwand zusammenhängt.

R É S U M É : Chez un malade avec vasomégalie généralisée, on a examiné l'ultrastructure de la paroi de v. colica sinistra. Le matériau élastique était présent sous trois formes: comme matériau légèrement osmiophile au bord des myocytes, comme membrane élastique hautement osmiophile et comme minces fibres élastiques hautement osmiophiles, d'arrangement divers dans la tunica media et adventitia. Quant au matériau faiblement osmiophile, on est d'avis qu'il est nouvellement formé par l'activité pinocytotique des myocytes. Le matériau élastique hautement osmiophile témoigne d'une perturbation de l'activité pinocytotique. Dans la veine examinée n'ont pas été constatés des changements athérosclérotiques typiques. S'appuyant sur la comparaison avec les constatations de vasomégalie dans a. mesenterica inferior chez le même malade, les auteurs arrivent à la conclusion que la veinomégalie est en rapport avec les changements dégénératifs du matériau élastique dans la paroi vasculaire.

РЕЗЮМЕ: У больного с генерализированной вазомегалией исследовали ультраструктуру стенки v. colica sinistra. Эластический материал встречался в тройной форме: как слегка осмиофильный аморфный материал по краям миоцитов; как высоко осмиофильная эластическая мембрана и как высоко осмиофильные эластические волокна с различным расположением в tunica media и адвентициальной оболочке. О слегка осмиофильном эластическом материале предполагается, что он создается вследствие пиноцитотической активности миоцитов. Высоко осмиофильный эластический материал свидетельствует о нарушении пиноцитотической активности. В исследованной вене не обнаружили типичных атеросклеротических изменений. На основе сравнения с анализами вазомегалии a. mesenterica inferior у того же больного авторы приходят к заключению, что веномегалия связана с дегенеративными изменениями эластического материала в сосудистой стенке.

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