

## ESTUDO MORFOLÓGICO DO SEGMENTO INICIAL DA ARTÉRIA MESENTÉRICA SUPERIOR, EM DIFERENTES IDADES

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**RESUMO:** Este trabalho consta do estudo da constituição e das modificações sofridas pelo segmento inicial da artéria mesentérica superior, com a idade. O material foi obtido de 15 cadáveres, reunidos em 3 grupos etários: A, de 1 dia a 1 ano; B, de 6 a 8 anos e C, de 27 a 40 anos. As peças anatômicas foram submetidas a tratamento histológico. A túnica adventícia da artéria mesentérica apresentava redução de espessura, quando comparavam-se os grupos A, B e C, ao mesmo tempo que seus feixes de fibras colágenas tornavam-se mais espessos e menos ondulados. O contingente de lâminas e feixes de fibras elásticas maduras nos grupos B e C era menor que no grupo A, sendo verificada refusão nos feixes de fibras oxitalânicas e elaunínicas, no grupo C. No grupo A, tanto na túnica média quanto na região subendotelial predominavam feixes de fibras musculares, ocorrendo gradativo aumento de fibras colágenas nos grupos B e C. Os feixes de fibras elásticas maduras eram escassos nesta túnica, nos 3 grupos estudados, enquanto os feixes de fibras oxitalânicas e elaunínicas estavam presentes em menor quantidade no grupo A que nos grupos B e C. Na túnica íntima, foram encontrados espessamentos regionalizados nos 3 grupos, sendo estes constituídos por grupamentos celulares e elementos fibrosos. Nestas regiões, a lâmina elástica interna delaminava-se, estes espessamentos tornavam-se maiores com o progredir da idade. Discute-se que o aumento de fibras colágenas, oxitalânicas e elaunínicas da túnica média, juntamente com os espessamentos da túnica íntima e o aumento do colágeno subendotelial reduzem a distensibilidade do segmento inicial desse vaso.

**PALAVRAS-CHAVE:** artéria mesentérica superior; envelhecimento; tecidos fibrosos.

## MORPHOLOGICAL STUDY OF THE INITIAL SEGMENT OF THE SUPERIOR MESENTERIC ARTERY IN DIFFERENT AGES

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**ABSTRACT:** This work is concerned with the study of the composition and modifications occurring on the initial segment of the superior mesenteric artery with age. The material was obtained from 15 corpses, divided in three groups: A, from one day to one year; B, from six to eight years, and C, from 27 to 40 years. The anatomical pieces were subject to histological treatment. The tunica adventitia of the mesenteric artery presented decreased in thickness when groups A, B and C were compared, while its bundles of collagen fibers grew thicker and less wavy. The amount of layers and bundles of mature elastic fibers on groups B and C was smaller than on group A, a decrease on the bundles of oxytalanic and elauninic fibers being observed on group C. On group A, both on the tunica media and the subendothelial region bundles of muscular fibers predominated, occurring a gradual increase of collagen fibers on groups B and C. Bundles of mature elastic fibers were scarce in this tunica on the groups studied, while bundles of oxytalanic and elauninic fibers were present in lesser amounts on group A than on groups B and C. On the tunica intima, regional thickenings were found on all the groups, which were composed of cellular clusters and fibrous elements. On these regions the inner elastic layer was delaminated, and these thickenings grew larger with aging. It is discussed that the increase of collagen, oxytalanic and elauninic fibers on the tunica media, as well as the thickenings of the tunica intima and the increase of the subendothelial collagen decrease the distensibility of the initial segment of this vessel.

**KEY WORDS:** aging; fibrous tissues; superior mesenteric artery.

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### Introduction

The superior mesenteric artery has a large and important territory of irrigation, requiring walls which adapt to the modifications of its diameter, so as to control blood flow according to the different functional moments in which the intestines are. Changes of its constituents can lead to physiological or physiopathological modifications, which will be reflected on the organs supplied for it. According to GROSS & FITES (1977), atheromas of the superior mesenteric artery are generally located on its first two or three centimeters. The existence of thickenings on the tunic intima and the fact that these become increasingly larger as a function of aging, along with alterations of the inner elastic layer, suggest that these sites could develop atherosclerosis. This supposition is supported by WILENS (1951), DUMONT *et al.* (1961) and VELICAN & VELICAN (1983). These alterations together with the increase of collagen tissue tend to decrease the distensibility of this vessel's initial segment. On the literature searched, we have found few works concerning the composition of the superior mesenteric artery, the compositional aspects of its wall are found in generalized form, along with arteries of similar diameter. This fact prompted us to investigate the compositional aspects of the initial segment of the superior mesenteric artery in different age groups, with the purpose of obtaining data for the understanding of the morphological alterations that arise with aging.

### Material and Methods

Fifteen anatomical pieces of corpses of Brazilian subjects were used, obtained of the Institute Verification Obit of São Paulo, whose ages ranged from one day to 40 years; pieces included the first centimeter of the superior mesenteric artery.

The material was distributed in three age groups, group A from one day to one year, group B from six to eight years and group C from 27 to 40 years.

After being removed the pieces were fixed in 10% formaline for 48 hours, then subject to histological treatment and 25-micrometers transverse serial sectioning. Next the sections were stained alternately and in sequence by the methods of Azan (to evidence collagen and muscular fibers), Hematoxilín-Eosin (to evidence

cells), Verhoeff (to evidence mature elastic fibers) and Weigert with previous oxidation in potassium permanganate (to evidence mature, oxytalanic and elauninic elastic fibers).

### Results

#### Group A: from one day to one year

The tunic adventitia was much thicker than the tunica media. Its bundles of collagen fibers were thin and wavy, while on the tunic media and subendothelial region they were thin and in smaller amounts, with the muscular tissue predominating (figure 1A).

The bundles of mature, oxytalanic and elauninic elastic fibers of the adventitia were evidenced in large amounts, being in largest quantities on the more internal extracts of this tunic. On the tunic media, oxytalanic and elauninic fibers were evidenced in amounts (figure 1B) larger than those of mature elastic fibers (figure 1C).

The tunic intima was composed by a wavy inner elastic layer, and in some regions small thickenings were found, where the inner elastic layer delaminated itself (figure 1D).

#### Group B: from six to eight years

The tunic adventitia was thicker than the media, but the bundles of collagen fibers of which it was composed were thicker and less wavy than on group A. On the tunic media and subendothelial regions, a larger amount of bundles of collagen fibers was observed (figure 2A).

The bundles of mature elastic fibers of the adventitia were present in smaller amounts than on group A, forming well-defined layers on the internal third of this tunic (figure 2B). The bundles of oxytalanic and elauninic fibers showed distribution similar to that on group A. On the tunic media the bundles of these latter fibers were more abundant than those of mature elastic fibers (figure 2C).

The thickenings of the tunic intima were restricted to some regions, where the inner elastic layer was duplicated, forming two layers between which collagen, elastic and muscular fibers were observed (figure 2D).

#### Group C: from 27 to 40 years

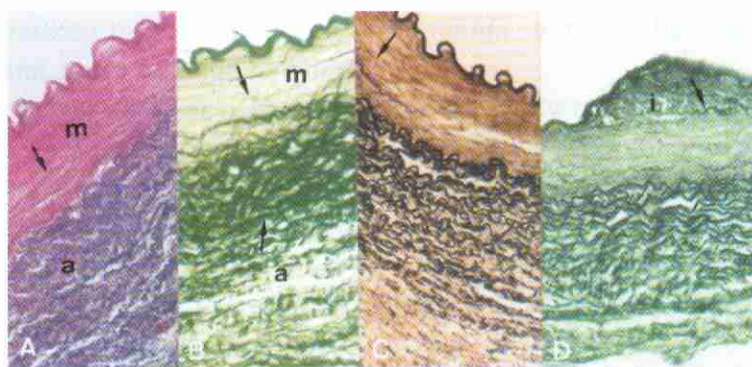
The width of the tunicae adventitia and media were almost equal, with thicker and less wavy collagen fibers, as compared with groups A

and B, being present on the tunic adventitia. On the tunic media and subendothelial region the bundles of collagen fibers were present in larger amounts than on the previous groups (figure 3A).

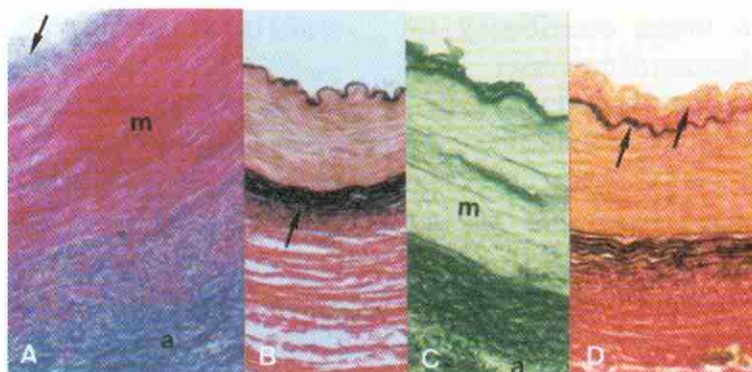
The bundles of mature elastic fibers were less abundant on the tunic adventitia in comparison with groups A and B. Similarly to the observations on groups A and B, decreased quantities of mature elastic fibers were found on

elauninic fibers were present in smaller amounts on the tunic adventitia, but in quantities comparable to those on the tunic media of group B (figure 3C).

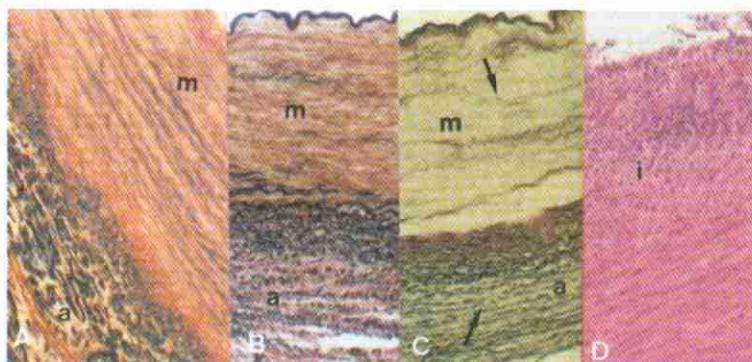
The thickenings of the tunic intima were found more frequently, in some cases extending for the whole vascular circumference. On this region it was observed a greater cellular proliferation than on groups A and B (figure 3D).



**FIGURE 1** - Group A. **A**, transverse section of the initial segment of the superior mesenteric artery, evidencing bundles of collagen fibers (blue) on the tunicae adventitia (a) and media (m). Muscular tissue (arrow). Azan 125X, blue filter. **B**, bundles of mature, oxytalanic and elauninic elastic fibers (arrow) on the tunicae adventitia (a) and media (m). Weigert 125X, green filter. **C**, staining by the method of Verhoeff evidencing bundles of mature elastic fibers on the tunic media (arrow). 125X, blue filter. **D**, thickening of the tunic intima (i) and delamination of the inner elastic layer (arrow). Oxidized Weigert 125X, green filter.



**FIGURE 2** - Group B. **A**, transverse section of the superior mesenteric artery evidencing bundles of collagen fibers (blue) on the tunicae adventitia (a) and media (m) and subendothelial regions (arrow). Azan 125X, blue filter. **B**, bundles of mature elastic fibers forming layers on the tunic adventitia (arrow). Verhoeff 75X, blue filter. **C**, bundles of oxytalanic and elauninic fibers (black) on the tunicae adventitia (a) and media (m). Oxidized Weigert 125X, green filter. **D**, duplication of the inner elastic membrane (arrows). Verhoeff 125X, blue filter.



**FIGURE 3** - Group C. **A**, transverse section of the superior mesenteric artery evidencing bundles of collagen fibers (blue) on the tunicae adventitia (a) and media (m). Azan 75X. **B**, staining by the method of Verhoeff evidencing bundles of mature elastic fibers (black) on the tunicae adventitia (a) and media (m). 75X, blue filter. **C**, oxytalanic and elauninic fibers (arrow) on the tunicae adventitia (a) and media (m). Oxidized Weigert 75X, blue and green filters. **D**, thickening of the tunic intima with cellular proliferation (i). HE 125X, blue filter.

### Discussion

On the individuals from groups A and B the tunic adventitia was much thicker than the tunic media; BLOOM & FAWCETT (1977) observed this feature when describing muscular arteries.

The tunic adventitia was altered with aging, a decrease on its thickness being observed in relation to the tunic media. The bundles of collagen fibers became thicker and less wavy, a characteristic not described by the authors consulted.

The bundles of elastic fibers of the tunic adventitia were modified in amount and affinity for the stains, an aspect also described by BARGMANN (1968). Group A exhibited larger quantity of mature elastic fibers on the more internal extracts, while groups B and C had fewer of these fibers.

Oxytalanic and elauninic fibers were present in greater proportions on groups A and B, in comparison with group C, while a gradual increase of collagen fibers occurred. HAMILTON (1982) and LEHNINGER (1993) describe the resistance of collagen fibers, contributing to restrain an excessive dilatation of the vessel.

Another fact that contributes to the lesser elasticity of the arterial wall is the reduction with aging of the bundles of mature elastic fibers and elastic layers, which are responsible for the greatest capacity of distension.

When comparing the tunic media on the three groups studied, it was observed a gradual increase of collagen fibers and a decrease on the bundles of muscular fibers, similar observation were described by BOGLIOLO (1994). On the individuals from groups A and B the muscular fibers represented the predominant element on this tunic, agreeing with BENDITT & GOWN (1980) and COTRAN *et al.* (1996), while on group C the bundles of collagen and muscular fibers were found in similar proportions; this fibrous replacement caused by aging was also described by SCHORNAGEL (1956). Consequently this vessel tends to become rigid and to reduce its flux-controlling capacity.

On the tunic media the bundles of mature elastic fibers were few on the three groups studied, while oxytalanic and elauninic fibers increased in density on group A, equaling on

groups B and C. The oxytalanic and elauninic fibers possess function of mechanical resistance greater than of elasticity (GAWLIK, 1965 and COTTA PEREIRA *et al.*, 1975), and their increase together with the increase of collagen fibers, add up to make the vascular wall less distensible (SNELL, 1985).

The bundles of collagen fibers of the subendothelial region increase gradually as a function of age, WILENS (1951).

It was also verified early and progressive thickenings of the tunic intima as a function of age, a fact also observed in different arteries by FABRE *et al.* (1968), JÄGER *et al.* (1982) and SNELL (1985). We believe that the increase on the thickness of the tunic intima limits the elasticity of the tunic media especially because of the richness of collagen fibers that arise with aging on the subendothelial region.

The delamination of the inner elastic layer along with the proliferation of muscular, collagen and elastic fibers are aspects also described in different arteries by SCHORNAGEL (1956); MOON (1957); NEUFELD *et al.* (1962); FABRE *et al.* (1968) and LAFAYETTE (1984).

The existence of thickenings of the tunic intima on the initial segment of the superior mesenteric artery and the fact that these become gradually larger as a function of age, are suggestive that on these sites atherosclerosis can develop. This supposition is reinforced by WILENS (1951) when reporting that the thickenings of the tunic intima are diffuse and more pronounced in arteries which normally develop atherosclerosis; by GROSS & FITES (1977) when describing that the atheromas of the superior mesenteric artery are generally located on its first two or three centimeters and by VELICAN & VELICAN (1980) when stating that the thickenings of the tunic intima are located on the major sites for histogenesis of atheroma plaques.

### Conclusion

We conclude that the appearance of early thickenings of the tunic intima and the fact that these become progressively larger with aging, along with the increase of collagen tissue, oxytalanic and elauninic fibers on the tunic media, as well as the increase of collagen tissue on the

subendothelial region, contribute to decrease the distensibility of the initial segment of the superior mesenteric artery.

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