

## ELASTOSIS OF THE PANCREAS

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The pathologic changes of the elastic fibres have been studied mainly in the wall of the vessels. The elastic fibres of other tissues were thoroughly investigated by *Melnikow—Raswedenkow*. According to this author the lungs, spleen, intestines, diaphragm and the tongue, being in constant motion, are particularly well endowed with elastic fibres. The pancreas, liver, and other parenchymatous organs, as well as organs of newborn infants contain but few elastic fibres.

Under certain pathological conditions the elastic substance will take part in inflammatory processes, but its increase is chiefly connected with circulatory changes. Chronic venous congestion in the spleen, liver or kidneys, leads to formation of elastic tissue, which presumably promotes to restore the disturbed circulation. According to *Melnikow—Raswedenkow*, the role of elastic tissue consists in protecting specific tissues and ensuring their regular function.

*Baló* and *Róna* have found that in different organs, such as the heart, lungs, pleura, kidneys and other viscera elastosis may develop. Amongst the aetiological factors of elastosis, an increase of pressure plays an important role, though inflammatory processes and developmental anomalies may also be involved. The origin, respectively the dissolution and formation of elastic fibres have been studied by *Baló* and *Banga*, according to whom the enzyme elastase plays a prominent role in the disappearance and increase of elastic fibres. *Baló* and *Róna* suppose that the elastic substance dissolved from the aorta and major arteries may be impregnated into other tissues. *Törő* considers the changes of the milieu as fundamental in the production of elastosis, whereas the experiments of *Krompecher* point to the importance of cellular activity of the elastoblasts.

*Baló*, *Róna* and *Lábas* have stated that the hyperplasia of elastic lamellae, or lamellar elastosis of the renal arterioles is a characteristic alteration in essential hypertony and chronic nephritis.

### Experiments

In the course of a study on the histology of the pancreas some of the sections were stained with Weigert's resorcin-fuchsin. With this technique, we found



in some specimens an important amount of elastic substance accumulated around the smallest and the medium sized ducts, and within their walls (Fig. 1), where the elastic substance forms undulating fibres or coarse granules. Starting from this observation, we have made a study of the pancreas of 100 subjects of different age deceased of various cause. It was endeavoured to ascertain some correlation between elastosis, i. e. the increase in amount of the elastic substance within the excretory ducts and the original disease. It could be established in the first place that no accumulation of elastic substance occurs around the pancreatic ducts of infants or of children under 10 years of age. The quantity of elastic substance contained within the walls of the ducts shows a slight increase with age, but a significant increase of elastic substance within the pancreas is by no means a constant phenomenon in advanced age.

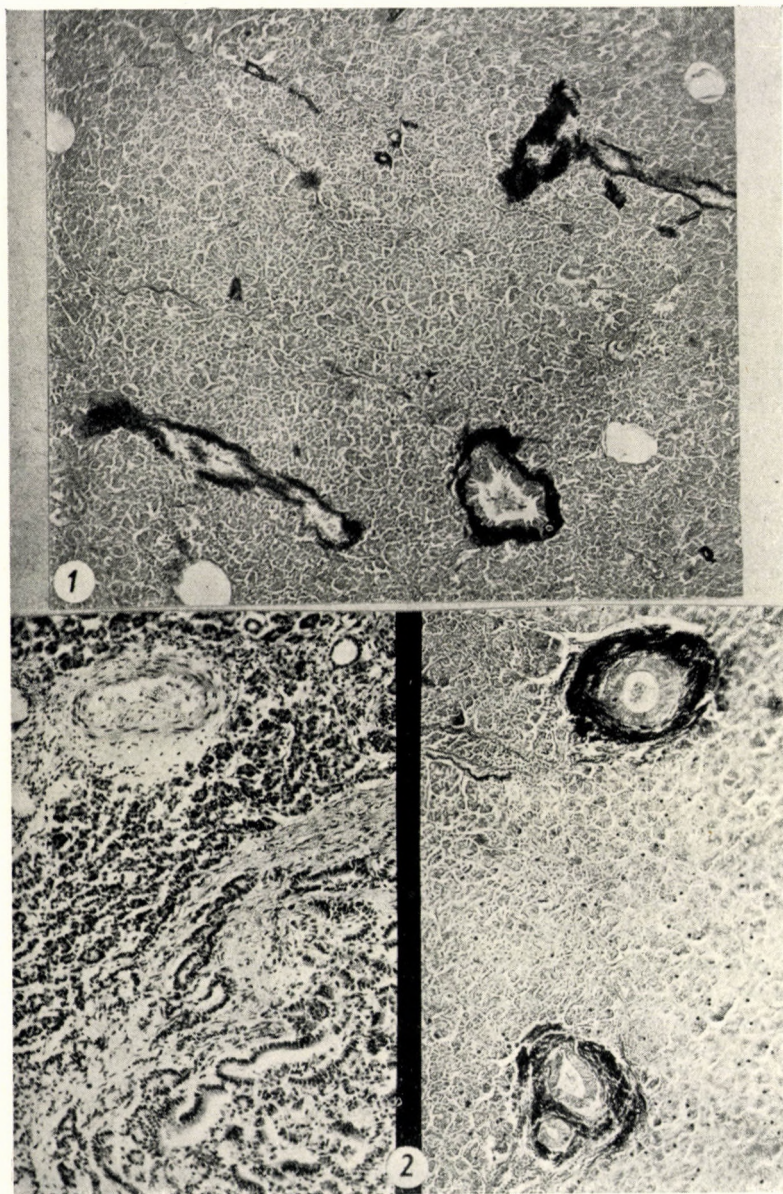
We have marked the amount of elastic fibres found around or in the wall of the small and medium-sized pancreatic ducts with from 1 to 4 crosses. Elastosis has been found severest in the groups marked with 3 and 4 crosses. In 36 of the 100 pancreases, i. e. 36 per cent studied we found this grave change. In 64 cases there was no, or hardly any, elastic substance around the pancreatic ducts.

From the 36 cases presenting distinct elastosis the following conclusions could be drawn.

1. In the cases marked with 3 or 4 crosses, the increase in amount of elastic substance around the pancreatic ducts was associated in 11 instances with congestion of cardiac origin and in 3 cases with grave hepatic cirrhosis and consequent portal stagnation. Among the 100 cases examined there were 5 of pancreatic carcinoma. Four of the tumours were located in the head of the pancreas, with distinct peripheral elastosis of the small and medium-sized ducts. Elastosis was absent in the fifth case, where lesions originated in the tail of the pancreas. In one instance, a common duct obstruction of long standing, caused by a gall-stone, gave rise to grave elastosis. The last case within this group, that of a male subject 66 years of age (A. D. No. 460/951) was forwarded after cholecystectomy for autopsy with a diagnosis of jaundice, cholelithiasis, intestinal obstruction, myodegeneration and haemorrhagic pancreatitis. In the course of the intervention, an egg-sized calculus was extracted and the biliary ducts sonded. Autopsy revealed thrombosis in the portal and splenic veins, accompanied by advanced arteriosclerosis, acute necrotic pancreatitis and jaundice. Histology of the pancreas revealed basal cell metaplasia and marked papillomatosis of the pancreatic ducts. The obstruction of the pancreatic ducts had evidently led to stagnation of the pancreatic juice. Elastosis around the small and medium-sized pancreatic ducts can be seen on Fig. 2.

2. The most advanced cases of elastosis were associated with arteriosclerosis, in 8 cases with hypertension (Fig. 3).





*Fig. 1.* Elastosis within the walls of medium-sized and small pancreatic ducts. (Male, 50 years of age. Autopsy Diary No. 417/950. Weigert's resorcin-fuchsin stain)

*Fig. 2.* Left, papillomatosis of pancreatic ducts (Haematoxylin-eosin stain). Right, elastosis of small ducts. (Weigert's resorcin-fuchsin stain)



3. In pancreases in which marked elastosis was present around the ducts, the caudal area was the one chiefly affected. Elastosis occurred mainly in the small and medium-sized ducts. Major ducts were not involved, even when their wall was considerably thickened. Among the 36 cases of advanced elastosis, 19 showed grave pancreatic lipomatosis.

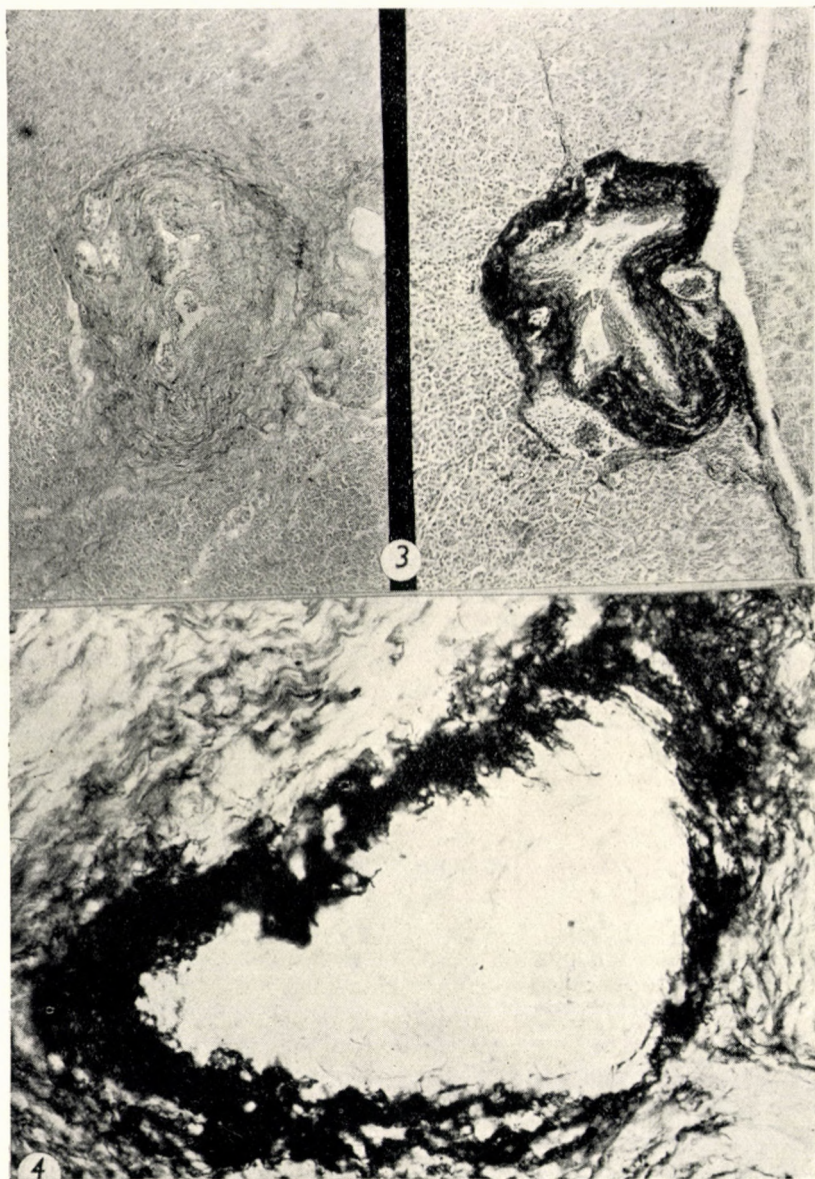
### Discussion

*Opie*, and later *Archibald*, studied the role of Oddi's sphincter in different diseases, pointing out that calculi or a neurogenic spasm could bring about a dysfunction of the sphincter, in which case pressure within the pancreatic ducts is increased. *Myers* and *Keefer*, as well as *Richman* and *Colp*, found a spasm of Oddi's sphincter in duodenitis of congestive origin, or following heavy drinking or eating. In such cases Vater's papilla becomes oedematous, inhibiting the flow of both bile and pancreatic juice. *Baló* and *Ballon*, as well as *Rich* and *Duff*, have made epithelial metaplasia responsible for the stagnation of pancreatic juice. In the well-known syndrome of retractile stenotising Odditis (*del Valle*, 1925) the scarred Vater's papilla inhibits the flow of pancreatic juice and the consequential digestive failure leads to steatorrhoea.

There is a similarity between the vascular changes occurring in hypertension (*Baló*, *Róna* and *Lábas*) and those observed by us in the elastosis of ducts. Elastosis around the pancreatic ducts marked with 3 or 4 crosses was mostly found in subjects who had died of heart failure, cirrhosis, tumour of the head of the pancreas, or who had suffered from cholelithiasis. As it is known from the experiments of *Opie*, and *Myers* and *Richman* and others, in cardiac or portal congestion Vater's papilla becomes constricted and the pressure within the ducts increase. The same mechanism acts in tumours of the head of the pancreas, in cholelithiasis, or when the lumen of the ducts is constricted by basal cell metaplasia or papillomatosis. The increased intraductal pressure cannot fail to involve the wall of the small and medium-sized ducts, a fact which accounts for the thickening and elastosis of the walls.

*Ssobolew* (1902), ligating the Wirsungian duct in the dog, observed that in some of the cases there followed an increase in amount of the elastic substance around the small ducts. *Lázár*, from the 1st Dept. of Surgery of Budapest University Medical School, performed partial and complete ligatures of the pancreatic duct in dogs and kindly gave us access to his material. We could observe that total ligation was followed by atrophy of the pancreatic parenchyma but no elastosis. Partial ligation in five cases resulted, however, in a significant increase in the amount of elastic substance around the pancreatic ducts (Fig. 4). In these cases the elastic fibres did not show the delicate wavy pattern recognized in human elastosis, though a close resemblance was evident.





*Fig. 3.* Right, elastosis of pancreatic ducts in a female subject of 51 years, with arteriosclerosis. (A. D. No. 156/949.) Left, control. (Male subject, 47 years. A. D. No. 376/950. Weigert's resorcin-fuchsin stain)

*Fig. 4.* Increased amount of elastic substance around the pancreatic ducts of a dog after artificial constriction of the Wirsungian duct. (Weigert's resorcin-fuchsin stain)



It is probable, that in experimental elastosis it is also the increased pressure which is responsible for the increase in the amount of elastic fibres. The quantity of elastic substance accumulating in the small pancreatic ducts may possibly raise the elasticity of their wall.

Elastosis of the pancreas is frequently associated with arteriosclerosis. This fact confirms the view of *Baló* and *Róna*, who consider the mobilized elastic substance of the great vessels as the source of endogenous elastin.

It was observed that elastosis of the pancreatic ducts is often associated with pancreatic lipomatosis. The finding may be explained with *Baló's* theory, that focal necroses are responsible for pancreatic lipomatosis. When the intra-pancreatic pressure rises, the enzymes pass through the walls of the ducts into the parenchyma, which they digest. With time, fatty tissue occupies the necrotic areas.

*Kokas*, *Földes* and *Banga* have demonstrated that pancreatic juice contains elastase. The latter is operative not only in the dissimilation of elastic fibres, but also in their production.

#### Summary

Examination of the pancreas of 100 subjects died with various diseases revealed in 36 cases elastosis, i. e. an increase in the amount of elastic substance around the small and medium-sized pancreatic ducts. A rise in intra-pancreatic pressure may account for the development of elastosis, which is frequently associated with arteriosclerosis. Elastosis of the excretory ducts may be associated with lipomatosis.

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## ЭЛАСТОЗ В ПОДЖЕЛУДОЧНОЙ ЖЕЛЕЗЕ

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## Резюме

Мы исследовали поджелудочную железу у 100 больных, погибших вследствие разных заболеваний. Среди этих случаев мы нашли в 36 случаях выраженное размножение эластического вещества вокруг мелких и средних выводных протоков железы («эластоз»).

В 64 остальных случаях эластоз панкреатических протоков или совсем не наблюдалось или же эластоз являлся только весьма незначительным. Самым тяжелым эластозом сопровождались застойный дуоденит, рак головной части поджелудочной железы, камня желчного хода и папилломатоз панкреатических ходов.

Мы нашли подобные изменения у собак после частичной перевязки Вирсунгянова протока поджелудочной железы. Известно, что в таких случаях давление внутри ходов поджелудочной железы увеличивается, и это увеличение давления является причиной возникновения эластога поджелудочной железы.

Эластоз главного выводного протока поджелудочной железы часто сопровождается артериосклерозом. Эластоз выводных протоков может осложняться липоматозом поджелудочной железы.