

SURGERY OF THE VASCULAR SYSTEM.*

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I. LIGATION OF THE DUCTUS ARTERIOSUS.

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THAT I may be allowed to bring this suggestion for a new operation before your Society, I ask on the basis that it has not been hastily conceived. On the contrary, long ago I demonstrated its technical possibility on the cadaver of newborn children, and felt that it was justifiable on the living. At various times I have tried to inspire the pediatric specialist with my views, but in vain. Now, in view of the recent advances in cardiac surgery, for much of which we are indebted to the surgeons of this city, I will venture to place my ideas before you, asking that you do not dismiss them hastily.

Nineteen years ago I saw a healthy girl baby that, soon after birth, exhibited symptoms of some cardiac lesion, out of keeping with the general appearance of perfect health and development. On severe exertion, such as straining at stool, it would become cyanotic, and the cardiac beat would cease. At times the child would apparently die, only to recover as soon as the heart was stimulated with electricity. In a few weeks atelectasis developed for which I tried artificial expansion of the lungs under negative pressure in a pneumatic cab-

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inet. This met with only temporary success. Auscultation at this time revealed a cardiac murmur with the pulmonary rales, but cyanosis was not a marked feature. After death, which took place without œdema or marked cyanosis, examination showed an open ductus arteriosus lying easily within reach behind the sternum, without any other defect or lesion except a dilated right ventricle. The simplicity of the remedy was so striking that I at once made further dissections, and satisfied myself that it would be possible to ligate the duct provided a diagnosis could be made beforehand. In regard to making a diagnosis, however, my pediatric advisers were not reassuring. In the hope that it may be possible to detect such a lesion in time to allow surgical interference, I would urge those skilled in the diagnosis of infantile lesions to lend their aid.

To attempt to disentangle the confusion of signs that attach to the various congenital lesions of the heart would be folly. Only faint light can be gained from authorities like Vierordt and others.

In the new-born the duct of Botalli is a little over 5mm. in diameter and 10-15mm. long. The length increases generally up to the time of obliteration which normally is complete by the twentieth day. Thus there must be an early period in the infant's life when the patency of the duct cannot be considered as pathological. It seems as though auscultatory signs during this period would throw some light on those which we should expect when the persistence of the duct forms a pathological factor. Townsend, however, examined 100 new-born babies during the first three days of life with this in view, but was unable to hear anything distinctive.

The causes for a persistent duct are not known. It may be due to some histological variation in the circular fibres, or to an absence of the inflammatory reaction that normally obtains. Very rarely is there an aneurysmal condition, or is the duct so short that a direct intercommunication between the aorta and the pulmonary artery exists. The cases collected by Vierordt do not number a hundred, but that must be quite far from a correct estimate. It is not at all necessary that other

congenital anomalies coëxist with the anomaly under consideration. Most writers find hypertrophy and dilatation of the heart, and the pulmonary artery may exceed the aorta in diameter. In typical cases the foramen ovale is closed, but not because of the theoretical reason that an open duct is dependent on a foramen that has closed prematurely.

In typical cases cyanosis is wanting. One finds rather an anemia or later a waxy appearance. Cyanosis is less characteristic of this than of other serious cardiac malformations. In late life it may be present, however. Cardiac dullness is increased laterally, and there may be projection and pulsation of the dullness, leftwards, in the upper costal spaces. This projection is visible by X-ray. The pulse shows little change though Franck considers that there is a fall with inspiration and a rise with expiration. We may find true attacks of suffocation, and bleeding from the mucous membranes as in other serious malformations. A loud systolic whir conducted into the cervical vessels may be heard, but as a matter of fact there are no definite auscultatory signs established as yet.

Of 26 cases recently collected about half lived to puberty, but it seems as though this must be an unduly large proportion owing to the lack of autopsies in infants. Death follows from atelectasis, general œdema, pleural exudate, pneumonia, endocarditis, etc.

Among the cardiac anomalies to be differentiated is, first of all, an open foramen ovale. The distinguishing signs are not well determined and it is useless to take up the question here. In open ventricular septa, in congenital pulmonary stenosis, in persistent truncus arteriosus, where the patient dies as a rule shortly after birth, we must expect marked cyanosis. Congenital aortic-pulmonary communication and stenosis of the various ostia are so rare that they may be disregarded.

Why should we consider surgical interference in cases of open ductus arteriosus? Because in spite of the fact that some cases may live to puberty, the chances of which must be small, we have the one cardiac-valvular lesion which is, relatively speaking, superficial. Furthermore the anomalous vessel is of

good size, its ligation must be followed by instant and permanent restoration to a normal function of the lungs and arteries, and it can be reached by a short surgical route.

The operation I would propose, as demonstrated on the cadaver, is as follows. Under ether, which I prefer to chloroform in any case involving collapse of the lung, the sternum can be easily split along its centre or a little to the right, opposite the second costal cartilage. This is easily done with a knife. The sternal halves are then retracted, ample room for working being obtained. The right pleural cavity will probably be opened but the left one will not. Judging from analogous cases in surgery, this should not be serious, but if necessary the physiologist's apparatus for maintaining artificial respiration could be employed. I hardly believe that it would be needed. After retracting the thymus upward, the pericardium is exposed. Its reflection lies so high on the large vessels that the ductus to all intents and purposes is intrapericardial. In the upper angle the aorta will be seen on the patient's right and the pulmonary artery on the left. By following close to the aorta toward the under surface of the arch the ductus, as large as the aorta itself, will be seen as the first vessel to the left pointing upward and a little to the right. Both pulmonary branches lie too far posteriorly to be seen, and by keeping close to the aorta the main pulmonary trunk will escape injury. On pushing through the tissues by blunt dissection the ductus, theoretically, should be easily surrounded with a ligature. It is a question whether or not simply crushing it would not accomplish as much, and in case of necessity, I believe that it would be worth trying. After closing the anterior pericardial wound the sternum can be sutured or not and the skin closed.

Would it be justifiable to subject a child to this risk without knowledge of the exact lesion? In a case with beginning atelectasis or other evidences of impending death from circulatory disturbances, with a reasonable basis for believing that the duct were open, it seems as though such an operation would be justifiable. I doubt if it would materially hasten a fatal issue in case the diagnosis were not confirmed.