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Tunica Media of Aorta and Pulmonary Trunk in Relation to Internal Calibres in Transposition of Great Arteries, in Aortic and Pulmonary Atresia and in Normal Hearts

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Summary. In a post mortem material of 17 cases of transposition of the great arteries (TGA) from patients with an age range from birth to two years and ten months after birth, the internal calibres of the great arteries and the ostia of the heart proved to be the same as in normal hearts. Furthermore, the media of the ascending aorta and pulmonary trunk showed no adaptation to the abnormal circulatory conditions in 15 cases of TGA with an age range from birth up to $5^1/_2$ months: in both great arteries the thickness of the tunica media and the packing density of its elastic fibres were the same as in normal hearts. However, adaptation of the tunica media of the pulmonary trunk to the abnormal circulatory conditions: increased media thickness, was found in the two remaining cases, older than 12 months.

In 7 cases of pulmonary atresia (age from 1 day to 12 months) and in 9 cases of aortic atresia (age from 2 days to 37 days) the following observations were made. Vessels with reduced or absent function (ascending aorta in aortic atresia and pulmonary trunk in pulmonary atresia) showed a markedly different structure. In aortic atresia the internal calibre and thickness of the media of the ascending aorta were markedly reduced, whereas the packing density of the elastic fibres of the media remained the same as in normal hearts. In pulmonary atresia the pulmonary trunk showed large variations in internal calibre, whereas both media thickness and the packing density of its elastic fibres remained the same as in normal hearts. When the markedly enlarged single functional vessels (the pulmonary trunk in aortic atresia and the ascending aorta in pulmonary atresia) were compared no significant differences between their internal calibre, media thickness and the packing density of the elastic fibres were found indicating similar

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adaptation to the abnormal but comparable functional load of acting as sole arterial trunk.

Key words: Media – Calibres – Aorta – Pulmonary trunk.

Introduction

We have previously measured the internal calibres of the ostia and great arteries in normal cardiovascular organs and in an abnormal material of cases with aortic and pulmonary atresia in order to determine the effects of extreme alterations of normal blood flow (van Meurs and Klein, 1974; van Meurs et al., 1977). In this study we have investigated the calibres of the great arteries and of the ostia of the heart in another condition of abnormal blood flow i.e. transposition of the great arteries.

During normal growth and under certain abnormal conditions the tunica media of the great arteries undergoes structural changes (Heath et al., 1959; Heath and Edwards, 1960; Saldaña and Arias, 1963; Yamakawa et al., 1966). We therefore also investigated the relation between changes of the internal calibres of the great arteries and structural changes of the tunica media (changes in thickness and packing density of the elastic fibres) of these vessels in aortic and pulmonary atresia and transposition of the great arteries. Normal hearts provided reference material.

Material and Methods

The post mortem material was put at our disposal by the department of pathology of the Erasmus University Rotterdam. It consisted of specimens of hearts with great arteries attached, which will be referred to as hearts, and of lungs.

a) Hearts with Transposition of the Great Arteries (TGA). This group consisted of 17 hearts from patients with an age range from 14 h after birth to 34 months and was subdivided as follows: Group I – Two cases of TGA with ventricular septal defect (VSD) and open ductus arteriosus (DA), age: in both cases 1 month; Group II – One case of TGA with a large VSD and closed DA, age: 15 months; Group III – Eleven cases of TGA without septal defect and with an open DA, age range: 4 h to $5^1/_2$ months; Group IV – Three cases of TGA without VSD and with a closed DA, age range: 13 days to 34 months (Tables 1, 2); Operations are mentioned in Table 2.

b) Aortic Atresia. Nine hearts with atresia of the left ventricular orifice and/or aortic ostium and rudimentary left ventricle derived from patients with an age range from 2 days to 5 weeks (Table 1). No operations were carried out.

c) Pulmonary Atresia. Seven hearts with atresia of the right ventricular orifice and/or pulmonary ostium and rudimentary right ventricle, derived from patients with an age range from 1 day to 12 months (Table 1). In case 1 and 6 a Waterston-shunt operation was carried out several days before death. In the other cases no operations were performed.

d) Normal Hearts. This control material consisted of 53 specimens derived from infants and children with an age range from 27 weeks of gestation up to 15 years after birth. It was divided into two groups: Group I – 34 hearts with an open DA, age range: from 27 weeks of gestation to 2 months and 8 days after birth; Group II – 19 hearts with a closed DA, age range: from $2^1/_2$ days after birth to 15 years.

Table 1. Synopsis of data on internal diameters of aortic and pulmonary ostia, ascending aorta, pulmonary trunk and ductus arteriosus, thickness in µm and packing density of its elastic fibres in % of tunica media of ascending aorta and pulmonary trunk (See 'observations')

Case	Body length (cm)	Age after birth		Internal diameter (mm)		Media asc. aorta		Internal diameter (mm)		Media pulm. trunk		Diameter (mm) DA
		m	d	Aortic ostium	Asc. aorta	Thickn.	Pack. dens. el. fibres	Pulm. ostium	Pulm. trunk	Thickn.	Pack. dens. el. fibres	
Transposition of the great arteries												
Group I (VSD and open DA)												
1	46	–	28	6.5	7	403	32	7	8.5	426	28	4.5
2	57	–	28	7.5	8	684	25	7	7	449	25	2
Group II (VSD and closed DA)												
3	74	15	–	9	9.5	734	30	12	13	1,053	30	0
Group III (without VSD and open DA)												
4	?	–	1	6.5	7	596	18	7	7	481	18	4
5	47	–	1	7	7.5	621	22	7.5	8	426	28	1
6	49	–	1	6	6.5	514	18	6	7	594	19	2
7	49	–	13	7	7	583	22	7	7	718	23	2
8	52	–	1	6	6	575	20	6	6	561	22	2
9	52	–	8	6	6.5	528	25	6	6.5	546	26	2
10	52	–	11	6	6	519	33	7	7	441	31	2
11	56	1	21	8.5	9	527	24	9	10	524	24	3
12	56	1	15	9	9	558	19	12	12	389	19	2
13	58	–	1	7.5	8	356	29	7.5	8	508	22	4
14	64	5	15	8.5	9	712	26	8.5	10	601	20	1
Group IV (without VSD and closed DA)												
15	54	–	13	7	7.5	501	33	7	7	354	31	0
16	59	3	–	9.5	10	808	21	11.5	12	613	20	0
17	105	34	–	11	12	566	31	14	15	824	16	0
Aortic atresia												
1	50	–	3	0	1	168	23	8	8	404	30	4
2	50	–	4	0	2	358	21	8	8	467	23	4
3	50	–	7	0	1	292	16	11	11	494	23	5.5
4	51	–	3	0	2	335	24	10	10	578	28	4
5	51	–	3	0	1.5	600	17	11	11	913	34	5
6	52	–	2	0	2	386	25	9	9	377	23	4
7	52	1	7	0	3	390	24	10	10	523	27	7
8	52	–	10	0	1	235	17	12	12	514	24	5
9	54	–	3	0	2	374	22	10	11	413	28	7
Pulmonary atresia												
1	47	–	13	8	9	686	19	0	5	500	19	2
2	51	–	16	11	11	630	22	0	4	322	19	3
3	52	–	1	10	11	440	28	0	6	347	24	3
4	?	–	1	10	11	550	28	0	3	513	26	4
5	54	–	13	10	10	689	21	0	9.5	605	20	4
6	60	7	15	12	14	550	21	0	8	285	15	3
7	61	12	–	12	12	642	26	0	7	278	16	2

Abbreviations: mat., mature; prem., premature; ? incomplete data; DA, ductus arteriosus; VSD, ventricular septal defect.

Table 2. Transposition of the great arteries. Synopsis of data on internal diameters of ductus arteriosus, ventricular and atrial septal defect; operative procedures, systolic and diastolic blood pressures

Case	Age		Procedures	Syst/Diast pressure (mmHg)			Diameter (mm) post mortem			Pulmonary vasc. disease
	m	d		LV	TrP	RV	DA	VSD	ASD	Grade
1		28					4.5	4	11	–
2		2	Rashkind	68/0		67/0				–
		21	Blalock-Hanlon				2	2	12	
3	$2^1/_2$		Catheterisation	65/0	45/28	60/0				1
	3		Blalock-Hanlon							
	13		Catheterisation		55/18		0	9	12	
4		1					4	0	6	1
5		1					1	0	6	–
6		1					2	0	6	–
7		2	Rashkind	35/0		64/4				–
		9	Blalock-Hanlon				2	0	8	
8		1					2	0	4	–
9		8	Rashkind	17/5			2	0	10	–
10		9	Rashkind	50/10		80/12				–
		10	Blalock-Hanlon				2	0	5	
11	1	21	Rashkind				3	0	7	–
12	1	2	Rashkind	75/4		108/4	2	0	11	–
13		1	Rashkind	30/0		35/0	4	0	7	–
14		7	Rashkind	65/10		75/10				1
	5	6	Blalock-Hanlon				1	0	12	
15		12	Rashkind	52/0		82/0	0	0	9	2
16		16	Rashkind	72/15		78/14	0	0	8	2
17	1		Blalock-Hanlon	40/5		80/19	0	0	16	–

Abbreviations: LV, left ventricle; TrP, pulmonary trunk; RV, right ventricle; DA, ductus arteriosus; VSD, ventricular septal defect; ASD, atrial septal defect

In this material the internal diameters of the aortic and pulmonary ostia, ascending aorta, aortic arch, pulmonary trunk and pulmonary arteries were measured within 24 h after death and before fixation with a 4% formaldehyde solution with the aid of calibrated probes and were compared with body length as a parameter of development. This method, its reliability, and part of the material have been described previously (van Meurs and Klein, 1974; van Meurs et al., 1977). Moreover, for purposes of comparing the vascular diameters in cases varying in age, the following calculations were carried out. In normal hearts and in TGA the squared values of the various diameters measured were expressed as a percentage of the sum total of the squared values of the diameter of the aortic and pulmonary ostia ($Ao^2+Po^2=100\%$). In the material with aortic and pulmonary atresia the squared values of the diameters were expressed as a percentage of the squared diameter of the functional outflow ostium ($Ao^2=100\%$ or $Po^2=100\%$). The changes of these relative cross-sectional areas along the course of the great arteries will be represented graphically and will be called aortic and pulmonary curves (van Meurs and Klein, 1974 and this paper).

In addition to these measurements the thickness of the media of the ascending aorta and the pulmonary trunk and the condition of their elastic fibre component were determined. Transverse rings, located 1 to 2 cm above the ostia, were taken out of the formaldehyde fixed arteries without distention or inflation, 7 µm transverse sections were stained with haematoxylin and eosin or with the Van Gieson's method. The mean thickness of the media was calculated from 20 determinations equally distributed over the circumference of the vessel. The packing density of the elastic fibres, i.e., the percentage of the cross-sectional area of the media occupied by elastic fibres, was calculated from 20 determinations by the method of point counting as described by Weibel and Elias (1967).

A pilot study on ten normal and four pathologic cases showed that the elastic fibres were equally distributed over the total area occupied by the media.

Formaldehyde fixed material from the lungs of the TGA cases was examined for the presence of pulmonary vascular disease accompanying pulmonary hypertension, as described by Heath et al. (1958), Heath and Edwards (1958) and by Wagenvoort et al. (1964, 1968).

The statistical analysis of the results was carried out using Student's *t*-test. A difference was considered as significant if the two-tailed probability was < 0.05. Correlations and confidence intervals were calculated following Sachs (1973).

Observations

1. Internal Diameters of Aorta and Pulmonary Trunk

a) Transposition of the Great Arteries. In TGA correlations calculated between body length and internal diameters of the aortic and pulmonary ostium, and of the ascending aorta and pulmonary trunk did not differ significantly from those previously calculated for normal hearts (van Meurs et al., 1977). Accordingly, the graphic representation of the cross-sectional areas of the great arteries in the largest group, the cases without ventricular septal defect (VSD) and

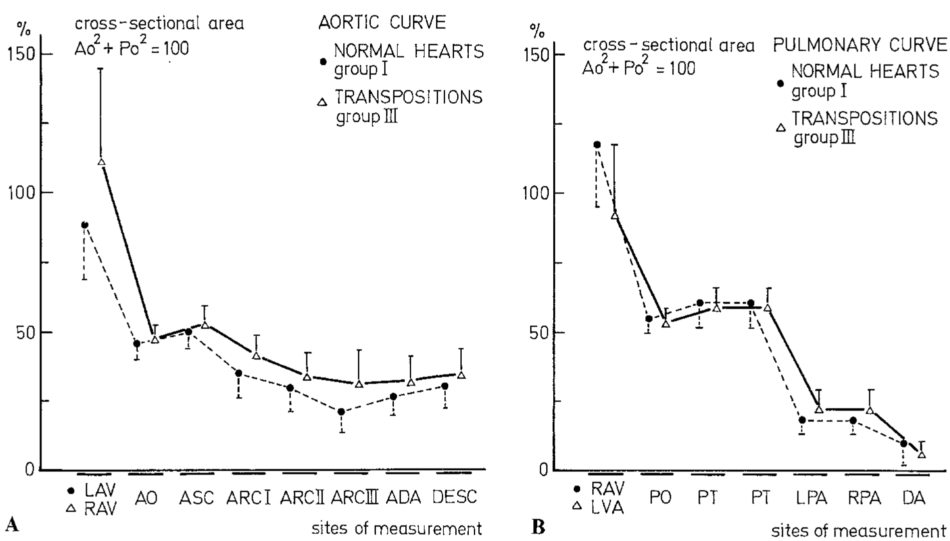
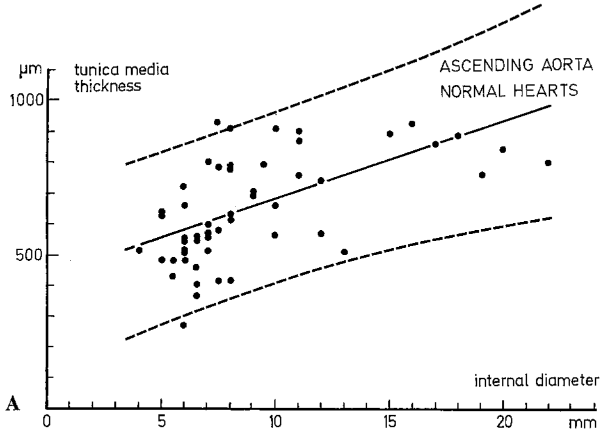


Fig. 1A and B. Relative cross-sectional areas (mean ± standard deviation) of cardiac orifices and great vessels of 11 cases of transposition of great arteries without ventricular septal defect and with open ductus arteriosus, Group III (uninterrupted line). The reference material of 34 normal hearts with open ductus, Group I, is included (interrupted line). Abbreviations: *RAV*, right atrioventricular ostium; *PO*, pulmonary ostium; *PT*, pulmonary trunk; *LPA*, left pulmonary artery; *RPA*, right pulmonary artery; *DA*, ductus arteriosus; *LAV*, left atrioventricular ostium; *AO*, aortic ostium; *ASC*, ascending aorta; *ARC I*, aortic arch between brachiocephalic and left carotid artery; *ARC II*, aortic arch between left carotid artery and left subclavian; *ARC III*, aortic isthmus between left subclavian artery and ductus arteriosus; *ADA*, aorta at connexion with ductus arteriosus; *DESC*, descending aorta



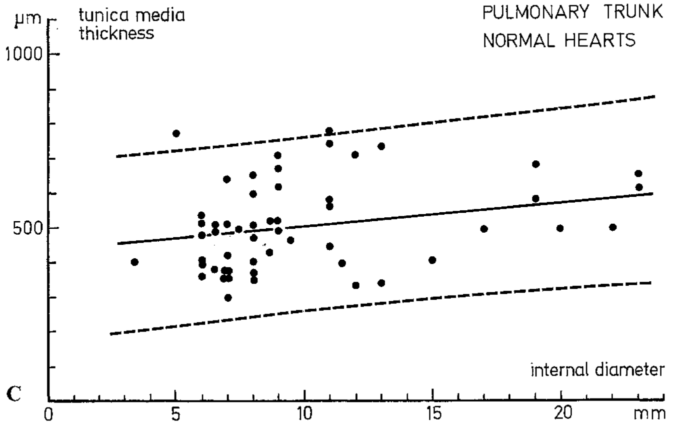
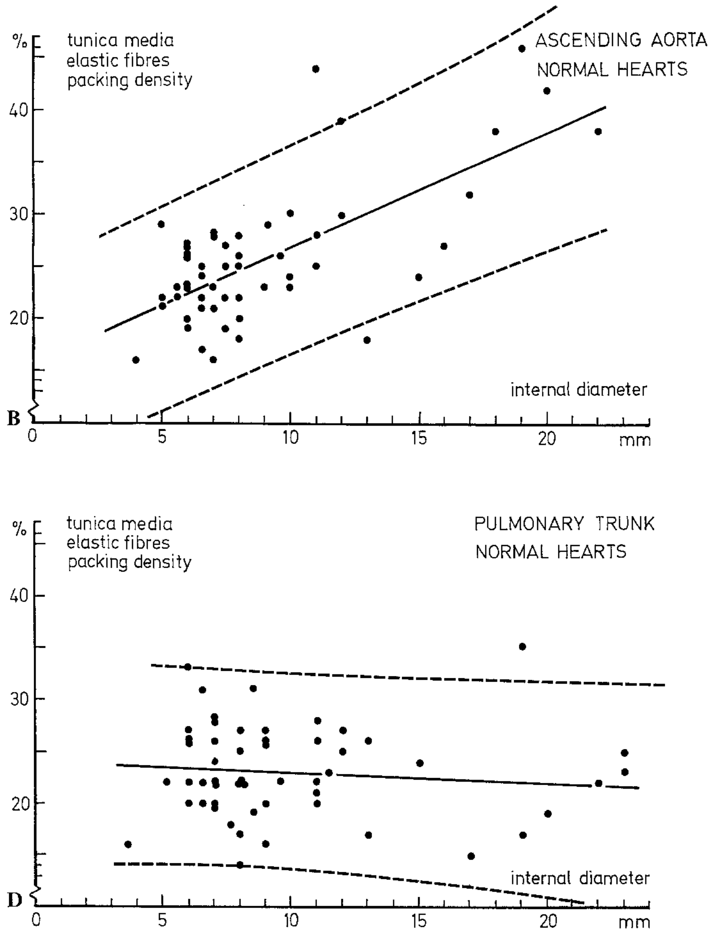


Fig. 2. A Correlation between thickness of tunica media and internal diameter of ascending aorta in all 53 cases of normal hearts; interrupted lines indicate 95% confidence interval. **B** Correlation between packing density of elastic fibres of tunica media and internal diameter of ascending aorta in all 53 cases of normal hearts; interrupted lines indicate 95% confidence interval. **C** Correlation between thickness of tunica media and internal diameter of pulmonary trunk in all 53 cases of normal hearts; interrupted lines indicate 95% confidence interval. **D** Correlation between packing density of elastic fibres of tunica media and internal diameter of pulmonary trunk in all 53 cases of normal hearts; interrupted lines indicate 95% confidence interval

with an open ductus (Group III of TGA, Tables 1, 2) yielded the same results as the comparable group of normal hearts, those with an open ductus (Fig. 1). The aortic and pulmonary curves of the other much smaller groups of TGA, were all similar to those of the normal hearts with an open ductus shown in Fig. 1 and to the curves of the normal hearts with a closed ductus.

b) Aortic and Pulmonary Atresia and Normal Hearts. We will use the diameters and cross-sectional areas of the great arteries and the ductuses of the hearts described previously (van Meurs and Klein 1974; van Meurs et al., 1977).



II. Tunica Media of the Ascending Aorta and Pulmonary Trunk: Thickness and Packing Density of Its Elastic Fibres and Their Relation to the Internal Diameters of These Arteries

a) Normal Hearts. In the 53 normal hearts the age related differences in internal diameters of the ascending aorta of 4 to 22 mm were accompanied by parallel differences in the thickness of the media from 270 to 930 µm and by parallel differences in the packing density of the elastic fibres from 16 to 46% (Fig. 2A, B). Similarly, the differences in internal diameters of the pulmonary trunk from 3.5 to 23 mm were accompanied by differences in the thickness of the media from 290 to 780 µm, while the packing density of the elastic fibres varied from 15 to 35% (Fig. 2C, D). However, otherwise than in the aorta the values for vascular diameters and those for the media characteristics were not closely related in the pulmonary trunk.

b) Transposition of the Great Arteries. The 15 cases of patients dying within $5^1/_2$ months after birth showed in the ascending aorta and pulmonary trunk

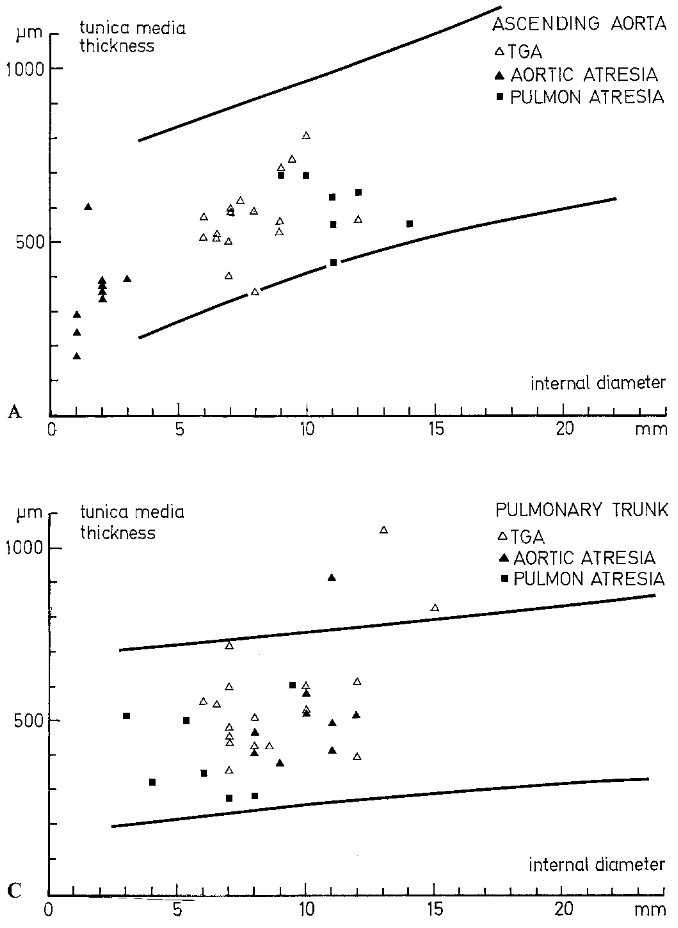
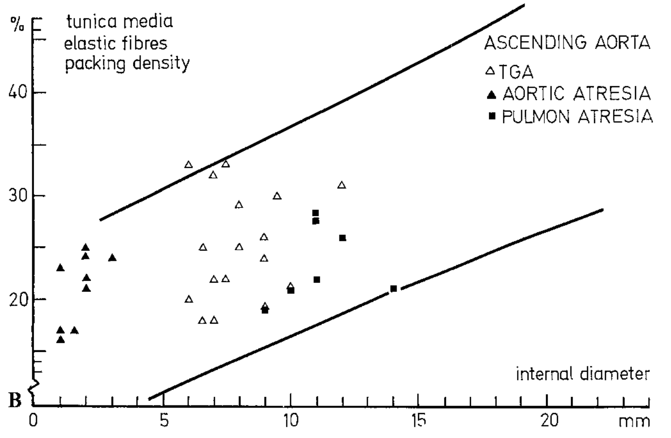
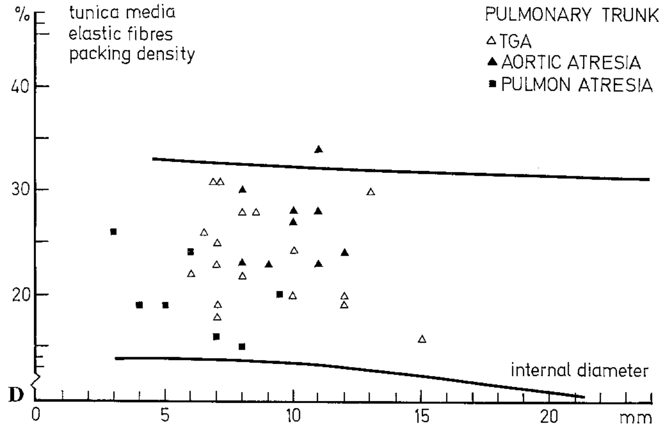


Fig. 3. A Correlation between thickness of tunica media and internal diameter of ascending aorta in all 17 cases of transposition of great arteries (*TGA*), in 9 cases of aortic atresia and in 7 cases of pulmonary atresia. Lines indicate 95% confidence interval for normal hearts. **B** Correlation between packing density of elastic fibres of tunica media and internal diameter of ascending aorta in all 17 cases of TGA, in 9 cases of aortic atresia and in 7 cases of pulmonary atresia. Lines indicate 95% confidence interval for normal hearts. **C** Correlation between thickness of tunica media and internal diameter of pulmonary trunk in all 17 cases of TGA, in 9 cases of aortic atresia and in 7 cases of pulmonary atresia. Lines indicate 95% confidence interval for normal hearts. **D** Correlation between packing density of elastic fibres of tunica media and internal diameter of pulmonary trunk in all 17 cases of TGA, in 9 cases of aortic atresia and in 7 cases of pulmonary atresia. Lines indicate 95% confidence interval for normal hearts

no deviations from the normal condition in media characteristics. This could be demonstrated by relating the data on media structure to the age-related diameters of the vessels and by comparing the values obtained with the corresponding values for normal hearts up to the age of six months (Fig. 3A–D). The values for these TGA cases were within the 95% confidence interval for the normal hearts. The presence or absence of a VSD and of an open DA





appeared without influence on the similarity of the media structure in TGA and in the normal condition.

However, in the oldest patients, age 15 months and 34 months, the pulmonary trunk showed a media structure different from that in normal hearts, its thickness being, in both cases, greater than in normal children with similarly sized pulmonary trunks (Table 1, Fig. 3C, values in upper right hand corner).

c) Aortic Atresia. Figure 3A–D similarly show the data on media structure obtained in aortic and pulmonary atresia in their relation to the diameters of the corresponding vessels. However, since in contrast to TGA the vascular diameters are highly abnormal in the atresia material other ways of comparing the abnormal material with the normal controls will also be used.

In the nine hearts with aortic atresia, all derived from patients dying within 5 weeks, the thickness of the media (160–600 μm) of the very small ascending aorta, internal diameter of 1 to 3 mm, was significantly smaller than the value in normal hearts at birth (270–700 μm) which had a mean internal diameter of the aorta of 6 mm. However, the packing density of the elastic fibres showed the same variation (16–25%) as in normal hearts at birth (19–27%).

The thickness of the media of the exceptionally large pulmonary trunk, internal diameter of 8 to 12 mm, was between 380 and 910 μm, a value consistent with that for a normal pulmonary trunk of the same calibre (320–780 μm) and with that for the pulmonary trunk of normal hearts at birth (350–650 μm), mean internal diameter of 7 mm. The packing density of the elastic fibres (23–34%), was significantly higher than in normal cases with a similar internal diameter (16–31%) and also higher than in pulmonary trunks of normal hearts at birth (20–28%).

d) Pulmonary Atresia. In the seven hearts with pulmonary atresia, all derived from patients dying within 1 year, the thickness of the media of the ascending aorta was significantly below that in normal hearts with a similar internal diameter of the ascending aorta of 9 to 14 mm (400–690 versus 550–900 μm), but had the same thickness as in normal hearts at birth (400–690 versus 270–700 μm). The packing density of the elastic fibres of the ascending aorta was the same as in normal hearts with a similar diameter (22–26% versus 23–30%) and also the same as in normal hearts at birth (22–26 versus 20–28%).

The thickness of the media of the pulmonary trunk was normal when compared with vessels with a similar internal diameter of 3 to 9.5 mm (300–500 versus 350–800 μm) and also was the same as in normal hearts at birth (300–500 versus 350–650 μm). The packing density of the elastic fibres of the pulmonary trunk was the same as in normal hearts with a similar internal diameter of 3 to 9.5 mm (15–26 versus 15–33%) and the same as in normal hearts at birth (15–26 versus 20–28%) (Fig. 3A–D).

In comparing the pulmonary trunk in aortic atresia with the ascending aorta in pulmonary atresia it has been previously shown that the internal calibres of these vessels were of the same size (van Meurs and Klein, 1974). The present data on the tunica media of these vessels show that in these much enlarged vessels the thickness of the media and the packing density of its elastic fibres were the same (media thickness: 400–900 in aortic atresia versus 400–690 μm in pulmonary atresia; packing density: 23–34 in aortic atresia versus 22–26% in pulmonary atresia; Fig 3A and 3C and of 3B and 3D).

III. Transposition of the Great Arteries and Pulmonary Vascular Disease

Pulmonary vascular disease was found in 5 of the total number of 17 cases of TGA (Table 2). Two of these 5 patients were younger than 2 weeks. The other 3 patients were older than 3 months. The systolic blood pressure in the left ventricle was in the 11 TGA cases for which such measurements were available between 17 and 75 mmHg, but ranged from 52 to 72 mmHg in the 4 out of the 5 cases with pulmonary vascular disease (Table 2).

Discussion

This paper is based on the assumption that internal vascular diameters as measured in our unfixed post mortem material reflect the in vivo conditions (van Meurs et al., 1977). No significant differences in diameter were found between the measurements of the vessels both unfixed and after fixation (van Meurs and Klein, 1974). To make comparisons possible of data on vascular calibre, media thickness and packing density of its elastic fibres the hearts and great vessels were not only always fixed in the same way but the sections were also always prepared in the same way (see Material and Methods). However, one should keep in mind that if another way of fixation is chosen or if the measurements of the media characteristics of the vessles would have been made in the unfixed state slightly different values would have been found. However, this does not detract from the reliability of our conclusions which are based on comparisons, not on absolute values.

Normal Hearts. In normal hearts we noticed in the ascending aorta in the period from birth to 15 years a doubling of the thickness of the media and of the packing density of the elastic fibres, parallelling a nearly fourfold increase of the internal diameter. In the pulmonary trunk there were no significant changes in thickness or packing density of the elastic fibres of the media accompanying the age-related increase of the internal diameter. This may be related to the smaller blood pressure in the pulmonary trunk than in the aorta under normal circulatory conditions.

Transposition of the Great Arteries. In TGA the circulatory condition does not deviate from normal before birth. After birth, however, such deviations do develop (Berthrong et al., 1955; Rowe and James, 1957; Adams and Lind, 1957; Rudolph et al., 1961; Emmanouilides et al., 1964; Haworth and Reid, 1976; Riggs et al., 1977). In normal infants pulmonary arterial pressure falls to values below 16 mmHg but in infants with TGA the arterial pressure in the pulmonary trunk, now supplying the systemic circulation, does not always show such a fall. Blood flow through the lungs may also be greater than normal in TGA (Ferencz, 1966; Tynan, 1972). Graham et al. (1971) showed that in TGA the function of the left ventricle, which now supplies the lungs, becomes abnormal after the age of six months: left ventricle end diastolic volume and systolic output exceed the normal values of the left ventricle. In cases of TGA with a ventricular septal defect these values are even higher. Pulmonary vascular disease, which is considered to be a sign of chronic severe pulmonary hypertension, is according to Edwards and Edwards (1978) not observed before the age of 12 months in cases of TGA with and without VSD.

Our morphological data strongly suggest that morphological adaptations to abnormal functional conditions may require considerable time to develop. In the 11 hearts with TGA from children younger than 28 days and in the 4 hearts with TGA with an age range from $1^1/_2$ to $5^1/_2$ months no abnormalities of vascular size or of media structure were found. However, this was the case in the two oldest cases (no's 3 and 17, Tables 1, 2), aged 15 and 34 months respectively. Here, in the pulmonary trunk the thickness of the media was in both cases greater than in normal children of the same age. In case 3, aged 15 months, with a large VSD and closed DA, pulmonary hypertension (55/18 mmHg) was found two months before death. Only a mild degree of pulmonary vascular disease was found at autopsy. In case 17, aged 34 months, with an intact ventricular septum and closed DA, no pulmonary vascular disease was found. Pulmonary arterial pressure was not recorded in this child.

Aortic and Pulmonary Atresia. The increase in blood flow in the pulmonary trunk in aortic atresia which is already present during foetal life, is accompanied by doubling of the cross-sectional area of the pulmonary ostium in combination with a comparable increase in size of the pulmonary trunk (van Meurs and Klein, 1974). The present study indicates that the increase in size of this vessel is accompanied by a marked increase of the volume of the media, since it maintains in the enlarged vessel its normal thickness in combination with a higher packing density of its elastic fibres. The comparable adaptation of the aorta in pulmonary atresia appeared at first to be less pronounced. The doubling in size of the aorta was accompanied by changes in the media which did not give it a thickness equal to that of a normal aorta of the same size and the packing density of its elastic fibres did not exceed that normally present. However, comparing the pulmonary trunk in aortic atresia with the aorta in pulmonary atresia there is not only a similarity of the cross-sectional areas of both vessels but there is also similarity of the thickness of the media and of the packing density of its elastic fibres. Probably, when the aorta develops into a sole arterial trunk its changes in media characteristics are less pronounced than those of the pulmonary trunk under similar functional conditions, since in the aorta these changes start from a morphological condition closer to the end-result of the adaptation.

The aorta in aortic atresia which still supplies the coronary arteries and the completely afunctional pulmonary trunk in pulmonary atresia, showed dissimilar changes. In aortic atresia the thickness of the media of the aorta was reduced, whereas the packing density of the elastic fibres remained unchanged. In pulmonary atresia both variables remained unchanged in the pulmonary trunk. Therefore, the adaptation of aorta and pulmonary trunk to abnormally low and to absent blood flow seems to differ markedly. This difference in adaptation to reduced function may be explained in the same way as the difference between aorta and pulmonary trunk in their responses to increased function: the structure of normal pulmonary trunk may be closer to the end-result of adaptation in reduced function.

In conclusion we can compare the adaptations of the internal calibres of the great arteries and of their tunica media to conditions of primarily abnormal arterio-ventriculo connexion (TGA) and of primarily abnormal blood flow (aortic and pulmonary atresia). Alterations in internal calibre and/or structure of the tunica media of the aorta or pulmonary trunk were only found in the two oldest TGA cases, i.e., in the pulmonary trunk of the cases who reached the age of 15 and 34 months. The question arises whether these changes were due to the increased pulmonary arterial pressure or to the abnormal arterioventriculo connexion as such. In contrast to the observations on TGA, marked adaptations of the structure of the tunica media of the aorta and pulmonary trunk were found in cases of aortic and pulmonary atresia, of which the majority was not older than 16 days, indicating that such abnormalities do not require a period of postnatal life for their development. Therefore, if, in TGA, adaptations of the tunica media of the pulmonary trunk are due only to the abnormal arterioventriculo connexion, alterations in the structure of the tunica media of the pulmonary trunk should have been present in the young cases of TGA. However, this was not the case. Probably the absence of alterations in the media structure in the great arteries in the majority of TGA cases – in contrast to the presence of such alterations in the atresia cases – is due to a much earlier, already prenatal, exposure of the great arteries to abnormal circulatory conditions in the atresia cases.

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