Common Arterial Trunk With Atrioventricular Septal Defect: New Observations Pertinent to Repair

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Background. **The coexistence of abnormalities in both atrioventricular and ventriculoarterial junctions occasionally represents a formidable challenge to the surgeon. The association of common arterial trunk with atrioventricular septal defect is such an example. To date, only two reports have described successful operative outcome. This paucity of success might reflect the anatomical complexity that could prevent favorable results.**

Methods. **We reviewed six specimens with common arterial trunk and atrioventricular septal defect, focusing on how to establish a nonobstructed connection between the left ventricle and the truncal valve.**

Results. **In all cases, the common trunk arose exclusively from the right ventricle, and the only exit from the left ventricle was the ventricular component of the septal deficiency. In particular, the preferential route was limited to a space below the superior bridging leaflet that did not have any tendinous cords inserting onto the ventricular crest, in contrast to the inferior bridging leaflets that were always tethered to the crest with many short cords. Accordingly, the size of potential left ventricular outflow depended on the shape of the anterosuperior margin of the ventricular crest below the superior bridging leaflet. The potential outflow was narrower than the truncal valvar area in all hearts but one having extensive anterosuperior excavation of the ventricular crest, suggesting the necessity of septal enlargement had anatomical repair been attempted during life.**

Conclusions. **Owing to the unique ventriculoarterial connection, the surgeon, considering anatomical repair, needs to pay attention to the anterosuperior margin of the ventricular scoop, which determines the adequacy of left ventricular outflow size.**

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The surgical management of common arterial trunk and atrioventricular septal defect (AVSD) as an isolated lesion has improved steadily, leading to a remarkable decrease in operative mortality in recent years [1–3]. Nevertheless, a combination of the two anomalies, albeit rare, still represents a significant surgical challenge. Only two reports have described favorable outcomes after surgical repair of this lesion [4, 5], and many more cases were reported in autopsy studies [6–14]. The cardiac anatomy of these two lesions have been well investigated previously, but only as separate entities [6, 15–21]. We therefore investigated hearts with this particular combination of anomalies with the aim to identify morphologic features that could complicate anatomical repair.

Material and Methods

This study has been approved by our Institutional Ethics Committee. From the cardiac specimen archives of the Royal Brompton Hospital, United Kingdom, and Leiden University Medical Center, Netherlands, we identified 6 hearts with common arterial trunk in the setting of a biventricular atrioventricular connection through a common atrioventricular valve; 4 had the usual atrial arrangement (situs solitus), and the other 2 had isomeric arrangement of the right atrial appendages. Although 4 hearts (3 with usual atrial arrangement and 1 with right isomerism) had more or less balanced ventricles and were deemed suitable for biventricular repair in view of ventricular cavity size, the right heart was dominant in the remaining 2 (namely, unbalanced AVSD). Although the latter 2 hearts would not have been suitable for anatomical repair, we opted to include these specimens for reference. We carried out morphologic investigations on these specimens, particularly focusing on how to establish a nonobstructed connection between the left ventricle and the truncal valve as a key component of anatomical repair.

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Table 1. Morphologic Features of Cases

Case No.	Atrial Arrangement	Atrioventricular Connection	Ventricular Topology	Relationship With Ventricular Crest SBL	IBL	Truncal-SBL Continuity	AV Valvar Orifice(s)	Level of Intracardiac Shunting	Origin of Truncal Valve	Excavation of Ventricular Scoop
1	Usual	Balanced AVSD	Right-hand	No attachment	Short cords	Continuous	Common	Atrial & ventricular	Only from RV	Minimal
2	Usual	Balanced AVSD	Right-hand	No attachment	Short cords	Separate	Separate	Only ventricular	Only from RV	Moderate
3	Right isomerism	Balanced AVSD	Right-hand	Only tip attached	Adherent	Continuous	Common	Only ventricular	Only from RV	Moderate
4	Usual	Balanced AVSD	Right-hand	No attachment	Short cords	Continuous	Common	Atrial & ventricular	Only from RV	Extensive
5	Usual	Unbalanced AVSD	Right-hand	No attachment	Short cords	Continuous	Common	Atrial & ventricular	Only from RV	Moderate
6	Right isomerism	Unbalanced AVSD	Right-hand	No attachment	Short cords	Continuous	Common	Atrial & ventricular	Only from RV	Minimal

AVSD = atrioventricular septal defect; IBL = inferior bridging leaflet; RV = right ventricle; SBL = superior bridging leaflet.

Results

Ventriculoarterial Junction

Among 4 hearts with the usual atrial arrangement, 2 had the pulmonary trunk arising from the common arterial trunk (so-called type 1 according to the Collet and Edward classification [20]), whereas the other 2 had separate and adjacent pulmonary orifices (type 2). By contrast, both hearts with right isomerism had separate and remote pulmonary orifices (type 3). In 2 hearts, the pulmonary orifice was located immediately above the sinotubular junction and left aspect of the circumference of the common trunk. Apart from 1 heart in which the aortic arch had been removed, the aortic arch was left-sided and not obstructed in the remaining. All the hearts had a two-coronary arterial system, and there were no major branches that crossed right ventricular outlet where a ventriculotomy would be made during surgical repair. The most striking finding was that all 6 hearts had the common trunk originating exclusively from the right ventricle, irrespective of the mode of pulmonary origin (Table 1).

Atrioventricular Junction

All the hearts had a common atrioventricular junction guarded by a basically five-leaflet configured atrioventricular valve. In 5 hearts, the superior bridging leaflet extended well into the right ventricle, resulting in a diminutive anterosuperior leaflet. In the remaining heart, the superior bridging leaflet was less extensive, and there were two separate papillary muscles supporting a well-developed anterosuperior leaflet. In all 6 hearts, the superior bridging leaflet did not have any tendinous cords (chordae tendinae) inserting onto the crest of the ventricular septum and could be lifted upward freely toward the level of the atrioventricular junction, restrained only by cordal attachments to papillary muscles in the ventricles. In 1 of the 6 hearts, however, the tip of the leaflet was attached directly to the crest, but the leaflet body was still free from the septum. By contrast, the inferior bridging leaflet was always, albeit to greater or lesser degree, tethered to the ventricular crest with many short cords. In particular, the inferior leaflet was almost adherent to the septal surface, leading to minimal potential for shunting below the inferior leaflet in 1 heart. In another heart, both bridging leaflets were completely attached to the underside of the atrial septum, resulting in intracardiac shunting being only at the ventricular level. In this particular heart, the anticipated location of the atrioventricular node was less displaced inferoposteriorly from the apex of the triangle of Koch [19].

All the hearts had an additional atrial communication at the floor of the oval fossa. In 1 heart, there were no pulmonary veins entering the left atrial chamber, which consisted of little more than a normal appendage. On the contrary, the right atrium was grossly dilated and received a large inferior caval vein and a right superior caval vein of normal size, suggesting the presence of an infracardiac type of totally anomalous pulmonary venous connection, but this could not be confirmed on the