

Editorial Comment

Ventricular Septal Defects: How Shall We Describe, Name and Classify Them?*

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These are the interesting, important and difficult questions considered by Soto, Ceballos and Kirklin (1) in this issue of the Journal. In addition to congratulating these distinguished authors on their study, our task is also to provide perspective and some constructive suggestions.

Components of the Interventricular Septum

The four main anatomic components that make up the normal definitive interventricular septum are as follows (Fig. 1):

- 1) *The septum of the atrioventricular (AV) canal* (component 1).
- 2) *The muscular septum or ventricular sinus septum* (component 2).
- 3) *The septal band or proximal conal septum* (component 3).
- 4) *The parietal band or distal conal septum* (component 4)

We refer to these as the four *main* anatomic and developmental components of the definitive interventricular septum because, from the embryologic standpoint, there are many more components. The foregoing is an intentional simplification for diagnostic purposes.

Anatomic Types of Ventricular Septal Defect

Ventricular septal defects occur within, and between, these four main ventricular septal components:

1. Ventricular septal defects of the AV canal type. The septum of the AV canal is completely absent in the complete form of common AV canal, and the ventricular part of this

septum is absent in straddling tricuspid valve. Soto et al. (1) prefer to call these *inlet septal defects* (their Fig. 9 and 10). We prefer the designation AV canal type of ventricular septal defect because *inlet septal* defect has been used to describe defects of either component 1 or component 2, or both (Fig. 1). The ventricular inlet is composed of components 1 and 2 (Fig. 1), and the ventricular outlet consists of components 3 and 4 (Fig. 1). Consequently, ventricular septal defect of the AV canal type (component 1 only, Fig. 1) is more anatomically specific than is *inlet* septal defect (component 1 or 2, or both; Fig. 1).

This type of defect may also be called *AV septal defect*, with or without common AV canal (i.e., with or without cleft mitral valve and so forth). We avoid using the term *AV septal defect* alone, without other modifiers, because of its current connotation of common AV canal. *Ventricular septal defect of the AV canal type* fortunately does not have that connotation, making it a preferable term when common AV canal is not present.

2. Muscular ventricular septal defects. These are openings in the muscular ventricular septum, also known as the ventricular sinus septum. *Muscular defects*, which is what these defects have long been called, involve component 2 (Fig. 1). Mid-muscular defects are often located at the junction of components 2 and 3 (Fig. 1). From the right ventricular aspect, such apertures often are seen slightly above or somewhat below the septal band (component 3, Fig. 1A). From the left ventricular viewpoint, mid-muscular defects typically are found at the junction of the smooth (nontrabeculated) portion of the ventricular septum superiorly (component 3, Fig. 1B) and the finely trabeculated part of the ventricular septum inferiorly (component 2, Fig. 1B). Soto et al. (1) call such openings *muscular inlet* septal defects and *trabecular* defects (their Table 1). We agree that muscular defects may be in many different locations, a point of considerable surgical importance.

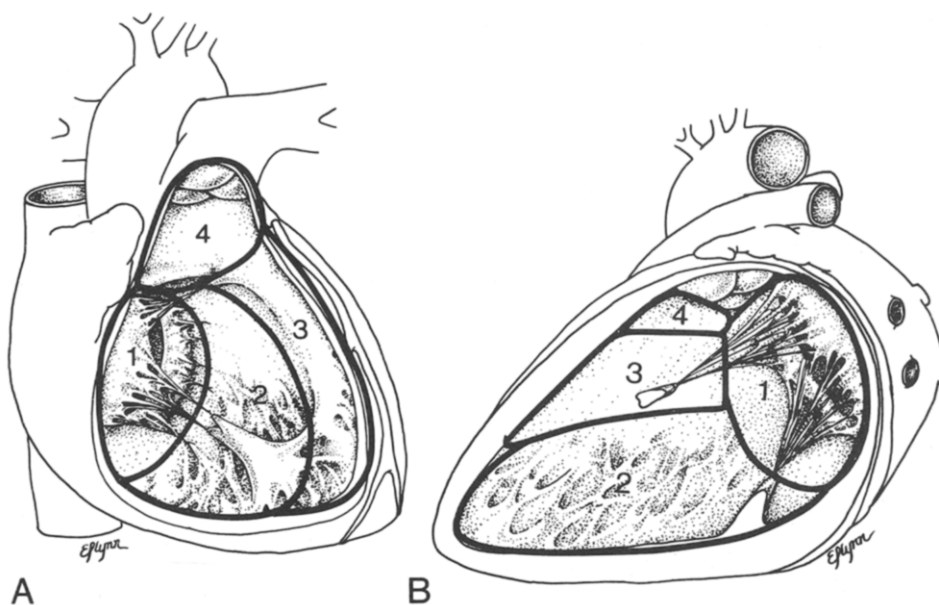
Regarding trabecular defects (1), it is noteworthy that muscular apertures close to the septal band (trabecula septomarginalis) typically do not involve this structure (component 3, Fig. 1A), but instead lie behind and to the left of the septal band. Trabecular ventricular septal defect should therefore be understood to mean a muscular defect close to the septal or moderator band but not necessarily of (or within) either of these structures. Because the septal band is a broad smooth structure (see Fig. 1 and 2 of Soto et al.), the "trabecular" septum is *not* trabeculated. The term "trabecular" septum comes from *trabecula septomarginalis*, the Latin term for the moderator band that runs from the septum (hence, *septo*) to the acute margin of the right ventricle (hence, *marginalis*). Ironically, although the "trabecular" septum (septal band) is not trabeculated (component 3, Fig.

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Figure 1. The four main anatomic and developmental components of the interventricular septum of the normal human heart, schematic presentation: **A**, morphologically right ventricle; **B**, morphologically left ventricle. Component 1 = septum of atrioventricular canal; component 2 = muscular ventricular septum, or sinus septum; component 3 = septal band (in A), or proximal conal septum; component 4 = parietal band (in A), or distal conal septum.



1A), the muscular (sinus) septum is trabeculated (component 2, Fig. 1A).

3. Conoventricular defects (2). These defects, lying between the conal septum (component 4, Fig. 1) and the ventricular septum (components 2 and 3, Fig. 1), are well shown photographically (their Fig. 3 to 5) (1). Conoventricular defects may be *membranous* when both the conal and the ventricular sinus septa are anatomically normal and when only the membranous septum (between the anterior and septal tricuspid leaflets) is defective.

However, most conoventricular defects are more than membranous. Typically, the conal septum is variably *hypoplastic* or *malaligned*, or both. *Malalignment conoventricular septal defects* may be associated with outflow tract obstruction, as in tetralogy of Fallot or interrupted aortic arch. Conoventricular defects may or may not be confluent with either AV valve or with either semilunar valve, or both.

For example, such defects may be described as *paratricsupid* (*para* = beside, in Greek) or as *juxtatricsupid* (*juxta* = beside, in Latin).

Unfortunately, Soto et al. (1) retain the erroneous term *perimembranous* (*peri* = around, in Greek). Conoventricular defects often are *paramembranous*—e.g., beside the membranous septum and confluent with it. But such defects are never *perimembranous*: they never surround the membranous septum on all sides. By analogy, the *parathyroid* gland—meaning *beside* the thyroid gland—is correct in meaning, whereas the *perithyroid* gland—meaning *around* the thyroid gland—would be absurd.

4. Conal septal defects result from a defect of, or within, component 4 (Fig. 1) (their Fig. 6 and 7) (1). Soto et al. call such openings *ventricular septal defects in the right ventricular outlet* (Table 1) (1). We prefer the conventional term *conal septal defect* because it is brief and generally understood.

Glossary of terms. Thus, we and Soto et al. (1) agree that there are four main anatomic types of ventricular septal defect. So that terminologic differences will not obscure our factual agreement, we have provided in Table 1 a brief glossary of terms and findings, based on their study (1).

Table 1. Glossary of Terms and Findings

Types of Ventricular Septal Defect (n = 76)				
Type	Our Terminology	Terminology of Soto et al. (1)	No. of Cases	Percent of Series
1	Atrioventricular canal type	Inlet septal defect	7	9
2	Muscular	Inlet septal defect	4	5 } 30
		Trabecular	19	
3	Conoventricular	Conoventricular	25	33
4	Conal septal	Right ventricular outlet	21	28

References

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