Proximal Atrioventricular Bundle, Atrioventricular Node, and Distal Atrioventricular Bundle Are Distinct Anatomic Structures With Unique Histological Characteristics and Innervation

To the Editor:

Your readers need to be aware that the situation concerning the disposition of the atrioventricular conduction tissues is not quite as described by Racker and Kadish.1 First, Racker and Kadish1 addressed the arrangement in the dog, a fact that is not mentioned in either the title or the abstract. This must be emphasized because, despite similarities, there are also differences between the dog and the human with regard to the disposition of the atrioventricular conduction tissues.2 This aspect received attention from Tawara3 on page 150 of his monograph.

Second and perhaps more important, Racker and Kadish1 claim that their findings are in agreement with the original publication of Tawara.4 They go so far as to state that only recently have Tawara’s observations been confirmed,5 suggesting that his initial observations were at variance with all who have studied the system since his original work. This is incorrect. Neither in his original pilot work3 nor in his much more extensive monograph4 did Tawara describe the atrioventricular node as being insulated within the central fibrous body, which is the major thrust of the recent revision. The “atrial bundle” to which Tawara refers in his first work is described in the more substantial publication as an atrial extension from the node, or “knoten.” To avoid misunderstanding, the crucial passage from Tawara’s monograph3 where he is describing the dog heart (page 137) follows: Die vordere Forsetzung des Knoten bildet den Kammerabschnitt des Verbindungsbündels. Wie schon oben erwähnt, ist der Übergang zwischen dem Vorhofs- und dem Kamerabschnitte ein ganz allmählicher. Ich setze die Grenze dort, wo dieses System das Septum fibrosum atrioventriculare durchbricht, weil einerseits diese Stelle anatomisch leicht zu bestimmen ist, und ferner, weil beim Schafe dieses System gerade an dieser Stelle histologisch die schon erwähnte, merkwürdige Umgestaltung zeigt.

We translate this as follows: The forward continuation of the node forms the ventricular part of the connecting bundle. As already described, the transition between the atrial and ventricular segment is relatively gradual. I make the border at the place where the system penetrates the atrioventricular fibrous septum because this place is easily determined anatomically and because, at this place in the sheep, the system shows remarkable histological change.

Thus, there is no substance whatsoever in the claim made by Racker and Kadish1 that, unlike all those who have studied the topic since Tawara, they have been the only ones who properly understood his writings. In fact, it is they who have misunderstood the original work.

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Response

Becker and Anderson claim in their letter that “readers need to be aware that the situation concerning the disposition of the atrioventricular conduction tissues is not quite as described by Racker and Kadish.” However, this is not supported by their comments.

First, the disposition of the conduction tissues was not the topic of our article. Instead, we not only demonstrated and confirmed the disposition of the atrioventricular bridge tissues described by Tawara1 in our 1989 and 1999 reports (quoted in the Introduction and Discussion), but also demonstrated seminal characteristics distinguishing their morphology, myocytes, and innervation in 3 orthogonal section planes.

Second, contrary to what is stated regarding species differences, Tawara makes clear that mammals share the same landmarks for the conduction tissues in The Conduction System of Mammal Hearts: An Anatomic Histologic Study of the Atrioventricular Bundle and the Purkinje Fibers (Figures A-B, page 192).2

Third, regarding intervening studies, we rightly claimed the initial demonstration of Tawara’s bridge, as described only in his article, “Topography and Histology of Bridging Fibers [bruckenfasern]: Contribution to the Study of the Importance of Purkinje Fibers,”1 because the atrial bundle “originating from the entry of the coronary sinus and elevated edge valvula thebesii” (page 72)1 had not been shown before. Unfortunately, Tawara’s article contained no illustrations; his monograph3 contained sketches of histological sections that do not include the coronary sinus ostium or the elevated entry edge and drawings of the conduction system on whole hearts that do not extend to the coronary sinus or the elevated edge. In addition, anatomic features of the proximal atrioventricular bundle and gross heart landmarks, which are clearly apparent in transverse sections, are not found or delineated in the histological data from intervening studies, which were all based on transverse sections.

Fourth, Tawara’s “interwoven Knoten” (page 75)1 is depicted by him as located in the central fibrous body in the dog (Plate 120, Figure 3).2 It has also been demonstrated in the human heart by James3 and in the rabbit heart by Anderson et al,4 who termed it the closed node. Later, Becker et al5 termed Tawara’s node the penetrating bundle, which is what it is called today. Our serial sections confirmed that only one node resides in the region of the atrioventricular junction and that it is within the central fibrous body.

Finally, the passages from Tawara’s monograph for the atrial (proximal atrioventricular) and ventricular (distal atrioventricular) bundles are correctly quoted. However, in Tawara’s words, the atrial bundle “moves backward and the second [ventricular or distal atrioventricular] bundle moves forward from the node” (page 75).1 Thus, there is no discrepancy between our findings and those of Tawara.


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