

CARDIAC CONDUCTION SYSTEM

Indications for Procedure: Unexplained arrhythmia, sinus node dysfunction (sick sinus syndrome, tachy-brady syndrome, sinus bradycardia, sinus pause), atrioventricular block, repaired congenital defects of the atrioventricular septum, history of conduction ablation procedures, sudden death in an otherwise healthy individual, history of syncope, sudden death during physical activity, drowning in a swimmer, falls.

Equipment: Scalpel, scissors, forceps.

Overview:

Dissection of the cardiac conduction system involves the examination of two different structures: the sinoatrial (SA) node and the atrioventricular (AV) node. Each structure is composed of specialized cardiomyocytes and insulated from the surrounding myocardium by thin bands of collagen. Trichrome staining is recommended to help delineate the structures histologically.

Atrioventricular Node

The AV node, as the name implies, lies along the tricuspid annulus between the right atrium and ventricle. It is bounded by an imaginary triangle (of “Koch”) whose base is the tricuspid annulus, with the coronary sinus ostium comprising the left side, and an imaginary line connecting the roof of the coronary sinus (the superior insertion point of the “Thebesian” valve of the coronary sinus) to the center of the atrioventricular septum (part of the membranous septum and “central fibrous body”) the right.

Procedure:

1. Identify the location of the AV node by defining the three sides of Koch’s triangle. The atrioventricular septum can be best appreciated by (a) placing the thumb over the right atrial portion, and then (b) pinching this part of the septum with the index finger from within in the left ventricular outflow tract (LVOT). (*Figure 1*)

2. Using a scalpel and working from the opened right atrial side, incise an approximately 3 x 4 cm block of tissue that encompasses this triangle. The tricuspid annulus should be in the center of the block, and the block should include about 1 cm of ventricular septum and right atrial wall on either side of the annulus. The coronary sinus ostium marks the right border of the block, and the left border should be just beyond the atrioventricular septum (so it is entirely included). The undersurface of the block will contain a portion of aortic and mitral valves, with the aortic-mitral fibrous continuity. Attachments to these valves can be trimmed with scissors once the block is excised. (*Figure 2*)
3. Using a scalpel, cut serial sections 2 to 3 mm thick perpendicular to the axis of the tricuspid annulus. Place them in order in 2 to 3 tissue cassettes (2 pieces per cassette). (*Figure 3*)
4. The AV nodal tissue is not usually apparent grossly but histologically can be seen as a discrete group of small cardiomyocytes with associated interstitial collagen surrounding the AV nodal artery. Dilated lymphatics can frequently be seen nearby as well. The AV node consists of a more compact portion toward the coronary sinus ostium, then the main body of the node, followed by a progressive narrowing to form the His bundle. The right bundle branch is a thin cord-like structure running in the direction of the tricuspid valve. It is much smaller than the left bundle branch and may require several levels of section through the paraffin block to be seen. The left bundle branch is much more broad and splays along almost the whole surface of the leftward ventricular septum. (*Figure 4*)

