

The Interventricular Septum as a Site for Implantation of Electrocardiac Devices - Clinical Implications of Topography and Variation in Position

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Abstract : Proper imaging of the interventricular septum during endocavitary lead implantation is essential for successful procedure. The interventricular septum is located oblique to the 3 main body planes and forms angles of $44.56^\circ \pm 7.81^\circ$, $45.44^\circ \pm 7.81^\circ$, 62.49° (IQR $58.84^\circ - 68.39^\circ$) with the sagittal, frontal and transverse planes, respectively. The optimal left anterior oblique (LAO) projection is to have the septum aligned along the radiation beam and will be obtained for an angle of $53.24^\circ \pm 9.08^\circ$, while the best visualization of the septal surface in the right anterior oblique (RAO) projection is obtained by using an angle of $45.44^\circ \pm 7.81^\circ$. In addition, the RAO angle ($p=0.003$) and the septal slope to the transverse plane ($p=0.002$) are larger in the male group, but the LAO angle ($p=0.003$) and the dihedral angle that the septum forms with the sagittal plane ($p=0.003$) are smaller, compared to the female group. Analyzing the optimal RAO angle in cross-sections lying at the level of the connections of the septum with the free wall of the right ventricle from the front and back, we obtain slightly smaller angle values, i.e. $41.11^\circ \pm 8.51^\circ$ and $43.94^\circ \pm 7.22^\circ$, respectively. As the septum is directed leftward in the apical region, the optimal RAO angle for this area decreases ($16.49^\circ \pm 7.07^\circ$) and does not show significant differences between the male and female groups ($p=0.23$). Within the right ventricular apex, there is a cavity formed by the apical segment of the interventricular septum and the free wall of the right ventricle with a depth of 12.35mm (IQR 11.07mm - 13.51mm). The length of the septum measured in longitudinal section, containing 4 heart cavities, is 73.03mm \pm 8.06mm. With the left ventricular septal wall formed by the interventricular septum in the apical region at a length of 10.06mm (IQR 8.86 - 11.07mm) already lies outside the right ventricle. Both mentioned lengths are significantly larger in the male group ($p<0.001$). For proper imaging of the septum from the right ventricular side, an oblique position of the visualization devices is necessary. Correct determination of the RAO and LAO angle during the procedure allows to improve the procedure performed, and possible modification of the visual field when moving in the anterior, posterior and apical directions of the septum will avoid complications. Overlooking the change in the direction of the interventricular septum in the apical region and a significant decrease in the RAO angle can result in implantation of the lead into the free wall of the right ventricle with less effective pacing and even complications such as wall perforation and cardiac tamponade. The demonstrated gender differences can also be helpful in setting the right projections. A necessary addition to the analysis will be a description of the area of the ventricular septum, which we are currently working on using autopsy material.

Keywords : anatomical variability, angle, electrocardiological procedure, interventricular septum

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