Right ventricular angiography in permanent pacemaker implantation and in management of cardiac perforations

Summary

This thesis focuses on the role of angiography as an imaging modality for implanting the lead in the mid-septum during permanent pacemaker implantation (PPI). It also discusses the utility of angiography in managing cardiac perforations. PPI is the only treatment option for symptomatic bradyarrhythmias, saving millions of lives worldwide. The most common indications for PPI are AV block and sick sinus syndrome, which can occur in patients with structurally normal hearts or with operated or unoperated congenital heart diseases (CHD). Cardiac perforation is a complication of PPI and electrophysiology procedures that can be life-threatening if unrecognized and not treated immediately.

The right ventricular apex (RVA) has traditionally been the preferred site for ventricular pacing due to the ease of lead implantation and long-term stability. However, studies have shown that chronic RVA pacing can be non-physiological and may impair left ventricular (LV) function in patients requiring a high percentage of right ventricle (RV) pacing (>40%). As a result, alternative right ventricular non-apical sites (RVNA), such as the right ventricular outflow tract (RVOT) and right ventricular mid-septum (RVMS), have been proposed. Right ventricular mid-septal-pacing (RVMS) has been proposed as the optimal site for RV pacing to prevent adverse events of RV pacing. However, the studies on RVMS pacing have been equivocal since one of the major drawbacks was the improper definition of the RVMS site. Implanting the ventricular lead in the mid-septal region is challenging in patients with abnormal anatomy and those with congenital heart disease (CHD).

The thesis explores the targeted placement of leads in RVMS in patients with structurally normal hearts and those with congenital heart disease. It emphasizes the importance of defining the RVMS area accurately and performing targeted lead delivery. Combined with computed tomography (CT), angiography is utilized to determine the RVMS anatomically and guide lead placement. A 5-segment grid is introduced as a reference for

routine RVMS cases, with angiography reserved for complex cases or to confirm placement accuracy.

Additionally, the thesis addresses the challenges of PPI in patients with various operated and unoperated CHD, including dextrocardia, a condition characterized by a right-sided heart orientation. Angiography plays a crucial role in avoiding lead implantation on the lateral wall of the venous ventricle, which can be detrimental in patients with dextrocardia. In this thesis, we discuss the role of angiography during PPI in patients with CHD, including dextrocardia, along with medium- and long-term outcomes. Furthermore, the thesis highlights the utility of angiography in managing cardiac perforations (CP) during electrophysiological procedures. Angiography helps confirm and localize CP and can assist in verifying the sealing of perforations. Overall, this research adds to the existing literature on the role of angiography in PPI.