His bundle lead placement: Is His bundle captured?

Ronpichai Chokesuwattanaskul, MD[1], Krit Jongnarangsin, MD[1]

[1]Division of Cardiac Electrophysiology, University of Michigan Health Care, Ann Arbor, Michigan, USA

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Corresponding author: Krit Jongnarangsin, MD

University of Michigan Health Care

1500 E Medical Center Dr., Ann Arbor, MI 48109

Tel: 734-936-4000

Email: kritj@med.umich.edu

Case

A 59-year-old female underwent a dual-chamber pacemaker implantation for intermittent complete heart block. A baseline electrocardiogram showed normal sinus rhythm with first degree AV block and right bundle branch block. ackAn intracardiac electrogram from the His bundle lead demonstrated Atrial-His (AH) and His-ventricular (HV) intervals were 186 and 110 milliseconds (ms), respectively. Pacing was performed from the His bundle lead with a decremental pacing output to assess for the His bundle capture threshold (Figure 1). However, there were no significant QRS morphology changes during the pacing. Is the His bundle captured?

Commentary.

Figure 2 shows paced ventricular complexes during pacing from the His bundle lead with a decremental pacing output at a sweep speed of 50 mm/second. These complexes are either nonselective His bundle capture which is the fusion between the His bundle conduction and local myocardial tissue capture or pure local myocardial capture since there is no isoelectric interval between pacing stimulus and QRS. Nonselective His bundle capture is usually differentiated from pure local myocardial capture by a narrower QRS complex when there is a change in QRS morphology during pacing with a higher pacing output. (1) However, there are no significant changes in QRS morphology in all paced ventricular complexes to allow the differentiation between His bundle capture and loss of His capture. A sharp potential is noted following the 3rd, 4th and 5th ventricular electrogram (arrow) on the His bundle lead channel when the pacing output was decreased to 1.2V @ 1.0ms and is absent on the 1st and 2nd complexes when the pacing output was higher at 1.4V @ 1.0ms. This potential represents a retrograde His bundle activation from ventricular depolarization when the His bundle is not captured. It is absent on the 1st and 2nd complexes because the His bundle is captured and refractory for retrograde activation. Retrograde His potential which is usually buried within the ventricular electrogram is easier to see in this patient because it is much later due to delayed retrograde infra-Hisian conduction. Based upon the absence and presence of

retrograde His bundle activation, nonselective His bundle capture can be determined on the 1st and 2nd paced complexes and local myocardial capture without His capture on the 3rd, 4th and 5th paced complexes. The unchanged QRS morphology with His capture and loss of His capture in this patient is due to a significantly prolonged infra-Hisian conduction with an HV interval of 110 ms which allows the majority of the ventricular myocardial tissue to depolarize before the conduction from the His bundle to exit Purkinje fibers. Therefore, QRS morphology is not different between His and loss of His capture. This change was reproducible when the pacing output was decreased to 1.2V @ 1.0ms. The change in stimulation to His interval has been described in paraHisian pacing maneuver (2) which is a useful pacing maneuver in electrophysiological studies to differentiate retrograde septal accessory pathway conduction from retrograde AV node conduction.

In summary, His bundle capture might be difficult to recognize using a change in paced QRS morphology when the infra-Hisian conduction is significantly prolonged. Retrograde His bundle activation may be helpful to differentiate nonselective His bundle capture from pure local myocardial capture in patients with significantly prolonged HV interval. However, the benefit of His bundle capture in these patients is unknown.

References

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Figure legend

Figure 1: Decremental pacing output from the His Bundle lead

Figure 2: Retrograde His potential (arrow)