Effect of Interelectrode Distance on the Bipolar Strength-Interval Relationship and Ventricular Effective Refractory Period in Humans

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Effect of Interlectrode Spacing **The purpose of this study was to compare the effects of interelectrode distances of 1 cm and 0.5 cm on the ventricular effective refractory period (VERP) and the strength-interval relationship during bipolar cathodal pacing. A quadripolar electrode catheter with an interelectrode spacing of 0.5 cm was positioned at the right ventricular apex in 30 subjects, and the VERP was measured in 2-msec steps at twice the late diastolic threshold using bipolar cathodal pacing, first with an electrode spacing of 1 cm, then 0.5 cm. With the technique used in this study, there was up to 4 msec of variability in the measured VERP. Therefore, a change in the VERP of at least 6 msec was required before concluding that the interelectrode distance had affected the measured VERP. In 15 subjects (group 1), the VERP was not affected by a change in electrode spacing; in nine subjects (group 2) the VERP was 6–10 msec longer with the 0.5 cm spacing than with the 1-cm spacing, and in six subjects (group 3) the VERP was 6–12 msec longer with the 1.0-cm spacing than with the 0.5-cm spacing. Determination of unipolar strength-interval curves in ten other subjects demonstrated that anodal curves can be distinguished from cathodal curves by the presence of an early diastolic dip and by the occurrence of the ascent of the curve at a longer extrastimulus coupling interval. These features were used as markers of an anodal contribution to the bipolar strength-interval curves in groups 1, 2, and 3. In subjects in whom there was a difference in the VERP with the two electrode spacings, an anodal contribution to the bipolar strength interval curve was always identifiable in the curve generated with the electrode spacing that had yielded the longer VERP. With the bipolar configuration that yielded the longer VERP, the unipolar stimulation threshold at the anode was always ≤ 1.6 mA and was always lower than the anodal threshold of the bipolar configuration that yielded the shorter VERP. In conclusion, the VERP may either lengthen or shorten by up to 10–12 msec when the interelectrode distance is changed from 1 to 0.5 cm during bipolar cathodal pacing. The effect of electrode spacing on the measured VERP is attributable to position-dependent effects on the unipolar anodal stimulation threshold. A lower anodal threshold may result in a greater degree of anodal contribution during bipolar pacing, manifest by the occurrence of the ascent of the strength-interval curve later in diastole and a corresponding increase in the VERP measured at a current strength of twice the late diastolic threshold.** *(J Cardiovasc Electrophysiol, Vol. I, pp. 103-115, April 1990)*

ventricular refractoriness, bipolar pacing, strength-interval curve

Introduction

In clinical cardiac electrophysiological studies, pacing conventionally is performed in bipolar fashion, with the distal electrode serving as the cathode and the proximal electrode as the anode. The distance between the two electrodes typically has been either 0.5 cm (Doherty, et al., 1984; Marchlinski, et al., 1987; Swerdlow, et al., 1987;

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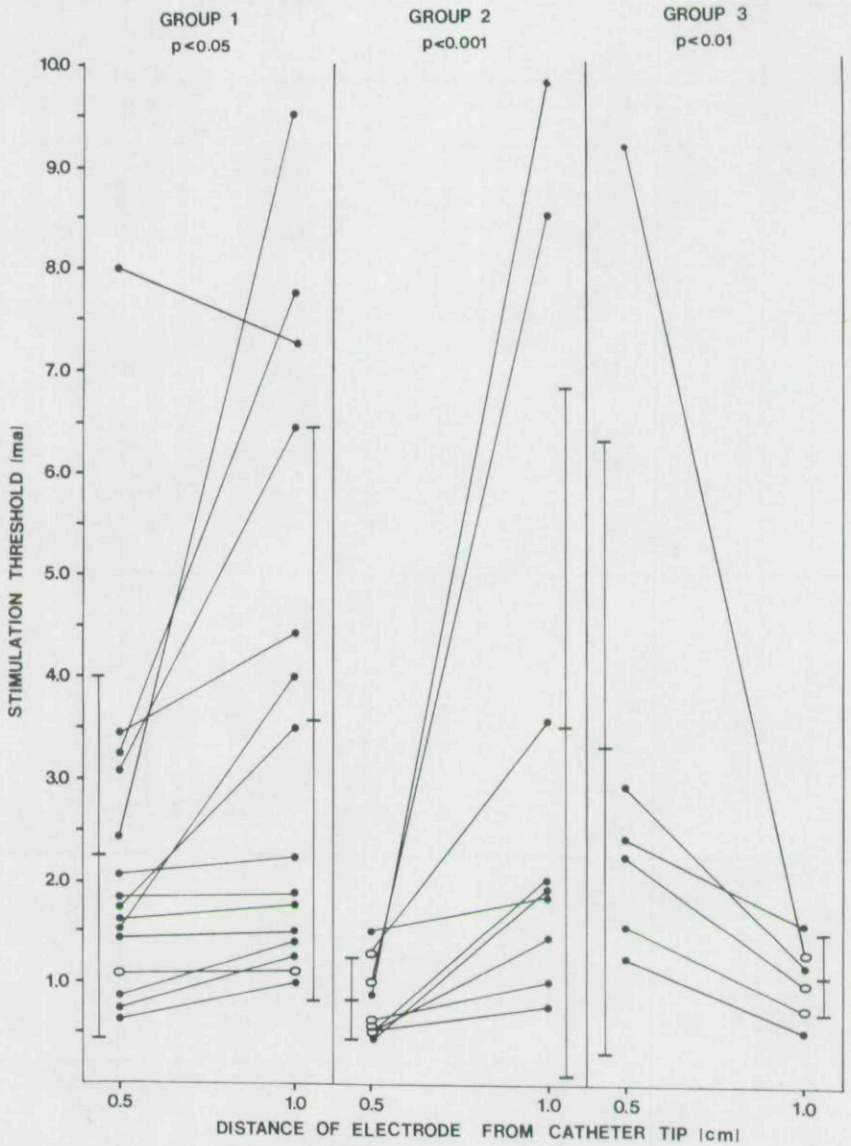

Figure 8. *The unipolar late diastolic stimulation thresholds measured at electrode 2 (0.5 cm from tip of catheter) and electrode 3 (1 cm from tip of catheter) in groups 1, 2, and 3. The mean ± standard deviation is indicted adjacent to the individual values. The open circles indicate the subjects in whom the bipolar strength-interval curve contained an early diastolic dip with either the 0.5-cm or 1-cm spacing.*

docardium during bipolar pacing might also influence the results of programmed ventricular stimulation remains to be determined.

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