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## Response to "Rate-adaptive Cardiac Pacing: Implications of Environmental Noise during Craniotomy"

*To the Editor:*—Thank you for allowing Pacesetter the opportunity to review the manuscript by Schwartzberg *et al.*<sup>1</sup> The report describes an interesting phenomenon wherein the ventricular paced rate accelerated during the use of craniotomy drilling.

Although the authors focused on the inference that the vibration associated with the craniotomy drill caused acceleration of the paced rate *via* the activity sensor, there is a second potential explanation that is more likely. If one carefully examines the top tracing in their figure 1, atrial and ventricular bipolar pacing stimuli are present. It is reasonable to presume that the same monitoring leads were used throughout the procedure, and in support of this, the morphology of the pacemaker-evoked QRS complex is identical on both dual lead recordings for this figure. When the bottom tracing is carefully examined, there is ventricular pacing at the programmed maximum tracking rate. Increase in the ventricular rate may be a result of either electrical signals sensed on the atrial channel or sensor drive. However, if it were sensor drive, one would expect to see atrial and ventricular output pulses, and only a ventricular output pulse can be identified. As such, I believe that the pacemaker was actually tracking signals sensed on the atrial channel. If this is the case, disabling the sensor by programming to the DDD mode would not have eliminated this response.

A potential means of differentiating sensor drive from atrial tracking as the cause of the intermittently rapid rhythm would be the rapidity with which the paced rhythm returned to the base rate on cessation of craniotomy drilling. If the increase in rate were a result of the sensor drive, there should be a gradual decrease in the rate from the high rate to the base rate in accord with the programmed recovery time. If the increase in rate was a result of oversensing of electrical signals generated by the craniotomy drill, the return to base rate would occur within one or two cycles on cessation of drilling. However, neither information concerning these programmed parameters of the pacemaker nor continuous rhythm strips recorded on the cessation of craniotomy drilling are included in the manuscript.

Although the authors focus on the possibility that the vibration induced by the craniotomy drill caused the acceleration in the paced and hence heart rate, this may not be the case. However, their final recommendation that the sensor be disabled during any surgical procedure is entirely appropriate and applicable to all rate-modulated pacemakers.

Although the focus of the article is on the drill-induced vibration and presumed increase in the paced rate under sensor drive, another point should be made. The description of the electrocautery set-up with the grounding plate positioned on the right thigh suggests that monopolar cautery was used. This means that the current flow from the electrocautery unit to the grounding plate will encompass the pacing system. This may cause a multiplicity of potential problems for the patient and the pacing system that were alluded to in the discussion. Some additional references are cited below.<sup>2-4</sup> In the case of head and neck surgery in a patient with a permanent pacemaker, my routine recommendation is to use bipolar cautery rather than monopolar cautery.

I would like to applaud the authors for not inducing asynchronous function by placing a magnet over the pacemaker during either the administration of electrocautery or drilling because this has sometimes been associated with inducing other problems with the implanted system.

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