Case report

Use of an ultrasonic scalpel in the open-heart reoperation of a patient with pacemaker

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Abstract

Electrocautery has a potential risk of serious pacemaker dysfunction in patients with implanted pacemaker. Here we present the safe and efficient use of ultrasonic scalpel (Harmonic scalpel) for the first time in a patient with implanted pacemaker undergoing open-heart reoperation. © 2002 Elsevier Science B.V. All rights reserved.

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1. Introduction

Electrocautery, the most common tissue cutting and coagulating technique currently used for the preparation of patients for open-heart surgery, has a potential risk of serious pacemaker dysfunction in patients with implanted pacemaker [1]. An alternative to the currently used technique for dissection of paced patient may be offered by ultrasonic scalpel (US). Here we present efficient use of US for the first time in a patient with implanted pacemaker undergoing open-heart reoperation.

2. Case report

A 57-year-old male patient who underwent transvenous pacemaker implantation (Model: Medtronic Prodigy SR 8162, Pacing Mode: VVIR) in 1988 for total A-V block and aortic valve replacement in 1991 (St. Jude 23 mm) for aortic insufficiency was admitted to our clinic because of paravalvular leakage. Preoperative pacemaker measurements were recorded (Table 1). Usage of US (Ultracision Harmonic Scalpel Inc; Smithfield, RI, USA and 5 mm blunt hook blade dissector-DH085) was planned for all steps of the operation. The patient was taken on an elective surgery on November 2001. After midline skin incision, subcutaneous tissues, muscle and overlying fascia were opened by using US at level V for better cutting performance. Level of US was decreased to level III if better coagulation is necessary. Touching the old sternal steel wires did not create injury to the dissecting hook. Sternum was opened with the oscillating saw. Substernal and pericardial adhesions, front surface of the heart, apical and retro cardiac area were separated with the help of the US at level V. Neither laceration nor perforation occurred during the dissection with the US. No abnormal rhythms or ECG interferences were detected during the procedure. Aorto-caval cannulation was done and cardiopulmonary bypass instituted. Prosthetic aortic valve was replaced with a new one in a conventional manner. After the neutralisation of Heparin, control of bleeding was provided with the US at level III. The sternum was rewired. Postoperative pacemaker measurements show no damage to the pulse generator, or changes in the capture threshold (Table 1). Bleeding was noted at the rate of 200 cm³/24 h and no transfusion was required postoperatively. The patient was discharged on postoperative day 7.

3. Discussion

Electrocautery may inhibit or trigger the pacemaker in demand modes, damage the pacing system or possibly cause the unit to go into its Automatic Safety Reversion mode in patients with pacemaker during the surgery and can also cause thermal damage to the heart through the lead electrode [1,2]. Even if current precautionary guidelines are followed [3], the number and distance of pacemaker electrodes are important factors for the ability of a pacemaker to pick up electromagnetic interference.
produced by electrocautery. Unipolar leads, as in this case, need much more caution during surgery. The distance between the anode and the cathode electrodes are quite small in bipolar leads (both are contained within the tip of the lead), while it is much greater in pacemakers employing unipolar leads because the anode is the metal case surrounding the pulse generator and the cathode is the tip of the lead. So bipolar leads are much more resistant to the conducted electromagnetic interference than the unipolar leads.

Other precautions advised are concerned with whether it is possible to place the pacemaker in a triggered or asynchronous mode. It is also important to have the programming device in the operating room. When the electrocautery or US as in this case is not in use, the ECG should be checked for arrhythmia or alterations in pacemaker function. If the device appears to have been inappropriately reprogrammed by electromagnetic interference, it is advisable to take the time to return the device to the mode selected before continuing the procedure. It seems that these precautions may be of lesser value when the US is used.

The US (Harmonic Scalpel) is an alternative to unipolar electrocautery during surgical procedures, in patients with pacemakers, where this scalpel provided adequate hemostasis without the adverse consequences of electromagnetic interference in different laparoscopic or open-heart surgery cases [4–6]. Ultrasonic energy of the US denatures tissue protein into a sticky coagulum that seals blood vessels and bleeding tissues. The US has a two-cutting mechanism. Primary mechanism for cutting is longitudinal vibration of the blade tip at 55,500 times/s over an excursion of 5–10 μm. Mechanical cutting enables the scalpel to incise high-protein-density and collagen-rich tissues such as muscle, peritoneum and fibrous connective tissue. A second cutting mechanism is cavitation tissue plane dissection which facilitates dissection between planes of tissue and helps protect adjacent vital structures [7]. There is no report about harmful effect of the US to the pacemaker or to the patient. We observed that cutting and coagulating is slower than the electrocautery as a disadvantage.

Although pacemakers are engineered to be more resistant to the electromagnetic interference, the protection is by no means complete. The effects of electromagnetic interference are highly variable and rarely reproducible. US is an alternative coagulating and cutting device in open-heart reoperations of cases with pacemaker and provides adequate hemostasis and does not bear the risk of pacemaker dysfunction. We believe that US can be used safely for all electronic device dependent patients.

References