Technical Report

Transducer offset by electrocautery resulting in erroneous blood pressure measurement

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During a coronary artery bypass operation arterial blood pressure measured with a Bentley Trantec model 800 transducer increased erroneously while continuous electrocautery was being used. This phenomenon has occurred infrequently, with fictitious hypotension being observed in one patient. To reproduce the problem of pressure offset during electrosurgery a bench test demonstrated that with peak to peak voltage of 20 volts from the electrosurgical unit, three of seven Bentley transducers had offsets as much as ± 50 mmHg. It is important for anaesthetists to determine if electrosurgery units are functioning before treating apparent pressure drifts.

The electrocautery electrosurgical device may be associated with several problems during the course of anaesthesia and surgery, including thermal injury, explosion, ventricular fibrillation, deactivation and reprogramming of implanted pacemakers and interference with EKG monitoring.¹⁻⁶ We report our experience with high frequency radio electrocautery producing errors in transducer measurement of arterial blood pressure.

Key words

EQUIPMENT: pressure transducer, electrocautery.

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Case report

During a coronary artery bypass operation, radial arterial blood pressure was noted to have suddenly increased with skin incision, prior to sternotomy, while continuous electrocautery (cutting current) was being used. This hypertension (from 125 mmHg systolic to 160 mmHg systolic) was treated with isoflurane. However, it was noted that with cessation of electrosurgery the blood pressure returned to normal. Isoflurane was discontinued but with the onset of electrocautery an upward shift in the baseline was observed (Figure 1). The electrosurgical device was a radio frequency generator, Valleylab Model SSE2, the transducer a Bentley Trantec Model 800, and the monitor a Tektronix 414.

Since this initial episode we have been on the alert for its reoccurrence and have found the transducer offset to occur during approximately five per cent of cases when this system is utilized. Another example is seen in Figure 1 (lower trace). In this second patient who had an intra-aortic balloon pump inserted, there was an increase in arterial pressure with additional change in waveform when electrosurgery was used. One case was observed where there was a downward shift of the pressure with electrosurgery resulting in fictitious hypotension.

Test procedures

To reproduce the problems of pressure offset during electrosurgery a bench test setup was made in a manner similar to that previously described.⁷ The test setup was connected according to the diagram

FIGURE 1 (Top panel) Increase in arterial blood pressure due to electrocautery. Arterial pressure in mmHg. Arrow indicates onset of electrocautery. (Bottom panel) Increase in arterial blood pressure due to electrocautery in a patient with an intra-aortic balloon pump. Arterial blood pressure in mmHg. Arrow indicates onset of electrocautery.

FIGURE 2 Diagram of laboratory test setup (See text).

in Figure 2. The system was flushed with normal saline and purged of all air bubbles. Both clamps were set to block the tubing and pressure was applied to the system by the inflation of a mercury monometer inflation bulb. With the electrosurgical unit in the "cut" mode, the output was gradually increased from 0 to 100 volts peak to peak, measured on the oscilloscope connected to a needle inserted in the injection site. This simulated the patient electrical connection during the operating room procedure. The electrosurgical unit, oscilloscope and monitor were all referenced to a common ground point.

Seven Bentley Trantec model 800 transducers were tested with two different Tektronix 414 monitors. In addition, Meditrace 1000 and disposable Gould and Norton transducers were tested. Electrosurgical units tested were the Electromedical Systems model 130201 and the Valleylab model SSE2.

As the output from the electrosurgical units was increased beyond 20 volts peak to peak (in cut mode) an offset in the pressure shown on the monitor started to appear. At 10 volts the offset was as much as ± 50 mmHg on the Tektronix monitor with three of the Bentley transducers. This offset was not demonstrable with the Meditrace 1000, the Gould or the Norton transducers.

Discussion

There was no obvious explanation why some of the transducers were sensitive to electrosurgical units and others were not. Continuity and calibration checks were made on all transducers and no appreciable differences were found. Thus there was no implication of specific equipment failure causing the offset.

It is important to realize that the pressure offset phenomenon exists with some Bentley Trantec transducers and may exist with other models not tested. Anaesthetists should determine if electrosurgical units are active before treating pressure drifts observed during surgery.

References

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Résumé

Lors d'un pontage aortocoronarien la pression artérielle mesurée par un transducteur Bentley Trantec model 800 augmenta d'une façon erronée lors de l'utilisation de l'électrocautère. Ce phénomène est survenu à quelques occasions avec une hypotension fictive observée chez un des patients. Afin de reproduire le problème de débancement de la pression lors de l'utilisation de l'électrocautère un test de laboratoire a démontré que pour un voltage de 20 volts "peak to peak" de l'électrocautère, trois des sept transducteurs Bentley ont montré un débancement de pression de ± 50 mmHg. Il est important que les anesthésistes s'assurent que l'électrocautère n'est pas en fonction avant de traiter les variations de pression.