Hemodynamic changes as noted in our study could potentially produce deleterious effects in the critically ill. Although the present study group had no obvious adverse effects from the decrease in SVR and MAP, large fluctuations in these values could be dangerous in select groups of patients, such as those with coronary artery disease, carotid stenosis, or renal vascular disease. Further, hemodynamically unstable patients (who were excluded from this study) might be at high risk for complications. It should be noted that the present study involved an elderly population and that the changes observed might be age related.

In summary, we have shown that iv cimetidine given as a slow infusion over 2 min produces a transient but significant decrease in MAP. The mechanism for this effect appears to be direct vasodilation. Cimetidine administration should be included in the differential diagnosis of unexplained hypotension in the ICU or anesthetized patient. Further studies are warranted to identify which patients are at greatest risk for such a reaction and the pharmacologic mechanism of action.

REFERENCES


An Unusual Cause of Patient Movement during Anesthesia

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Surgery involving the use of the microscope requires that the patient remain motionless. We describe an episode of intraoperative patient movement resulting from unusual cause.

REPORT OF A CASE

An 18-year-old man weighing 65 kg was to have emergency surgical removal of a bullet fragment that had penetrated the cornea of his right eye and lodged behind the lens. The patient was in excellent health; was taking no medications; had no history of any significant disease, allergies, or prior operations; and had no family history of anesthetic difficulties. His arterial blood pressure was 120/80 mm Hg with a heart rate of 88 beats/min, and no premedication was given. After breathing 100% oxygen, thiopental 350 mg and pancuronium 6 mg were given iv, after which his trachea was intubated without evidence of moving or coughing. Anesthesia was maintained with 40% oxygen and 60% nitrous oxide, to which 2% enflurane was added. Ventilation was controlled with a tidal volume of 700 ml and a rate of 12 times per minute. The rectal temperature remained at 36.4°C, although arterial blood pressure did not change but heart rate gradually increased to 120 beats/min over the next hour. At this point, the surgeon noted that the patient appeared to be bucking. Close observation revealed that the patient was in fact moving in a reciprocating manner in a cephalad-caudal direction at a rate of approximately 2.0 Hz. The movement was very slight and probably would not have been noticed if the microscope had not been in use at the time. Although the peripheral nerve stimulator indicated about a 75% depression in twitch height, 6 mg of d-tubocurarine was administered with resultant elimination of muscular response to electrical stimulation, but the patient continued to move.

It was then noted that the patient's heart rate was exactly the same rate at which the movements were occurring. When propranolol 0.5 mg was administered iv for the purpose of decreasing heart rate, it decreased to 110 beats/min and the movements stopped. The patient remained immobile for the remaining 1½ h of the operation. When the enflurane and nitrous oxide were discontinued and the patient

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began to awaken at the end of surgery, his heart rate gradually increased. When it reached 120 beats/min, the previously described movement resumed, only this time with a greater magnitude but otherwise equal in character and direction to the original movement. The heart rate continued to increase, and by the time it reached 128 beats/min, movement had ceased. The patient had an otherwise uneventful recovery from anesthesia and surgery.

**DISCUSSION**

Movement occurs for a variety of well-known reasons during surgery, including—but not limited to—light anesthesia, insufficient muscle relaxation, patient respiratory effort and cardiac function, mechanical ventilation, direct electrocautery stimulation of tissue, and operating room personnel pushing directly on the operating table or patient.

Although our patient had been paralyzed with pancuronium, results of neuromuscular blockade monitoring indicated that his musculature could have contracted in a weak manner. Thus, if the patient had begun to shiver, or the administration of 2% enflurane had stimulated seizure activity, such activity could have been demonstrated through very weak muscular contractions (electroencephalographic monitoring had not been used). Therefore, when complete paralysis did not eliminate this movement, we searched for more obscure causes of movement.

Ballistocardiography is a technique of cardiac examination that measures movements of the body caused by the ballistic forces of cardiac contraction, ejection of blood, and deceleration of blood in the great vessels. These minute movements of the body resulting from the regular acceleration and deceleration of heart muscle and blood in various directions are graphically recorded from movement of an extremely low-friction tabletop, which is free to roll or float on a hard subsurface, and upon which the cardiac patient is placed for examination. Most of this movement is in the longitudinal (cephalad-caudal) axis.

In our case, this particular patient and the slight flexibility of the operating room table mount combined to produce an object that, if acted upon by a physical force along its longitudinal axis, would oscillate along this longitudinal axis at a natural frequency of 2.0 Hz, much like one side of a giant low-frequency tuning fork. Just as a tuning fork's natural frequency is determined by the weight of the arm and the elasticity of its material, so too the natural frequency of movement of our patient and table was determined by the weight of the patient and table and the elasticity of the table's mount. When the heart rate was equal or close to this natural frequency, ballistocardiographic forces of cardiac contraction would keep this resonant system in motion. However, when the heart rate increased or decreased, the ballistocardiographic forces were no longer in harmony with the natural frequency of the tabletop and patient and the movement would stop. An alternate method of disrupting this resonant system would have been to add or remove weight from the table, thereby changing its natural frequency and disrupting its resonance with the patient's heart rate.

After propranolol was administered to change the heart rate and contractility, the harmonic relationship was disrupted and the movement stopped. When the enflurane was removed and its cardiovascular depressant effect diminished, not only did the patient and the tabletop begin moving as they did earlier when the heart rate was 120 beats/min, but they moved more forcefully, a fact that is not surprising if the movement was due to myocardial and hemodynamic activity, since these now more powerful forces of recoil and deceleration were able to cause a greater magnitude of excursion of the patient and table against the elasticity of the table's mount.

In summary, we feel that patient movement due to ballistocardiographic forces represents an unusual clinical phenomenon that must be considered when immobilizing a patient for microsurgery and that changing the heart rate represents a logical method of eliminating such movement.

**REFERENCES**