Vecuronium and Danger of Vagal Induced Cardiac Arrest during Laparotomy: A Case Report and Literature Review

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Vecuronium bromide, a relatively new nondepolarizing neuromuscular blocker, is frequently cited as a good option for muscular relaxation, since it provides good neuromuscular block and is free from cardiovascular activity[1]. However, bradycardia[2] and even cardiac arrest[3] were reported after its use. We report herein a case of a healthy woman who developed asystole a few minutes after the administration of vecuronium and made complete recovery after resuscitation.

Case Report

A 53-year-old Caucasian woman was admitted to our hospital for elective transabdominal hysterectomy. She denied previous chronic diseases and both the physical and the laboratory examinations were normal.

After premedication with meperidine 1 $mg \cdot kg^{-1}$ and promethazine 0.5 $mg \cdot kg^{-1}$ administered 30 min before the scheduled surgery time, anesthesia was induced by the intravenous administration of sodium thiopentone 4 $mg \cdot kg^{-1}$ and 0.1 mg of fetanyl. Following sleep induction, as indicated by at least two of the listed criteria: a) Centralized eyeballs; b) Absent eyelash reflex; c) Reduced jaw tone[4], vecuronium 0.1 $mg \cdot kg^{-1}$ was adnimistered for facilitation of endotracheal intubation. The patient was carefully ventilated through a face mask, and after two minetes, when the neuromuscular monitor device (Relaxograph™, Datex Instrumentarium Corp., Helsinki, Finland) showed appropriate muscular relaxation, an 8 mm I.D. endotracheal tube was uneventfully inserted through her mouth into the trachea. Tube position was asserted by bilateral listening of breath sounds and the tube was fixed at place by adhesive tape.

Controlled ventilation was then initiated (Ventimeter® Controller II, Air Shields Vickers, Hatboro, PA 19040, USA) with a tidal volume of 10 $ml \cdot kg^{-1}$ and a frequency set to maintain an end tidal CO_2 of 35 mmHg. Anesthesia was maintained with a mixture of N_2O 4 $l \cdot min^{-1}$, O_2 $l \cdot min^{-1}$ and isofulurane 1.5%.

Heart rate, blood pressure, hemoglobin saturation (Sa_{O_2}), esophageal temperature and expiratory CO_2 were monitored continuously by the Cardiocap™ (Datex Instrumentarium Corp., Helsinki, Finland). For oxygen concentration monitoring, the oxygen

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monitor 143 (Medix LTD, Rehovot, Israel) was attached to the inspiratory limb of the anesthetic circuit.

After induction, the blood pressure decreased from 140/90 to 110/75 mmHg and the pulse rate from 90 to 75 beats·min^{-1}, whereas the Sa_{O_2} remained 99%. The skin and fascia incision was performed without detected changes in the cardiorespiratory parameters, but after opening the peritoneum, during insertion of peritoneal retractors and traction on the wound edges, a sudden profound bradycardia, rapidly followed by cardiac arrest occurred. At this moment, no evidences of hypoxemia (Sa_{O_2}=99%) or CO_2 abnormalities (end tidal CO_2=35 mmHg) were observed in the monitor apparatus.

Prompt institution of CPR, ventilation of the lungs with 100% oxygen and intravenous administration of 1 mg atropine, caused return of normal sinus rhythm and blood pressure 15 seconds thereafter.

The surgery continued uneventfully and the postoperative course was without complicatoins. The patient was discharged to her home on the 4th postoperative day without evidences of cardiovascular or neurological deficits. During her hospital stay serial CPK isoenzimes measurements and ECG recording showed no signs of myocardial infraction.

Discussion

Vecuronium is a monoquaternary homologue of pancuronium with a relatively short nondepolarizing muscle relaxant activity and apparently devoid of significant cardiovascular changes when administered in clinical doses[1,5,6]. Nevertheless, vecuronium can induce bradycardia[7–9] and some cases of cardiac arrest after its use were related in the literature[3,10,11]. The reasons for this reduciton in heart rate are poorly understood[12]. Cozanitis[8] and Miller[13] suggest that vecuronium per se is devoid of intrinsic bradycardic activity. They postulate that because of the lack of vagolytic activity of this neuromuscular agent any vagal mediated bradycardia caused by drugs (fentanyl for example) or by surgical stimuli (such this from peritoneal traction) can easily occur. In contrast, Inoue and colleagues[13] as well as Salmenpera and co-workers[14] suggested that vecuronium possesses an intrinsic bradycardic activity. Whatever the cause is, its incidence appears to be low if the anesthetic technique and the surgery are free from vagal activity[15]. Moreover, vagolytic preanesthetic medication apparently protects from this undesirable effect[7].

Gravlee and colleages[17] had demonstrate that the association of vecuronium with fentanyl caused a significant decrease in heart rate and cardiac index, although those changes were more evident with sufentanil than with fentanyl. Since the combination of pancuronium with fentanyl provided the greatest overall hemodynamic and electrocardiographic stability, those authors recommend the use of this association in cardiac surgical patients.

In our case, fentanyl which is known to have a strong vagal activity[16] was administered at the begining of the anesthesia. Furthermore, cardiac arrest occurred during peritoneal traction, which could cause an additional vagal stimulation. As described above, since vecuronium lacks vagolytic activity or has an intrinsic bradycardic action, the vagal stimulus could be strong enough to induce cardiac arrest.

Since vecuronium induced cardiac arrest was previously described one can wonder about the value of this report. However, vecuronium is becoming increasingly popular and most reports postulate that it is safe and free from adverse cardiovascular activity, which can lead many anesthetists

to use it with an exaggerate sense of security. Therefore, it is our intention to remind our readers that the association of vecuronium and fentanyl together with the surgical stimuli can induce a potential lethal complication: cardiac arrest.

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References

1. Booij LHDJ, Edwards RP, Sohn YJ, et al: Cardiovascular and neuromuscular effects of ORG NC45, pancuronium, metocurine and d-tubocurarine in dogs. Anesth Analg 59:26–30, 1980
2. May JR: Vecuronium and bradycardia. Anaesthesia 40:410, 1985
3. Kirkwood I, Duckworth RA: An unusual case of sinus arrest. Br J Anaesth 55:1273, 1983
4. Lombard TP, Couper JL: Propofol or methohexitone for induction of anaesthesia for minor gynaecological procedures. South Afr Med J 72:843–845, 1987
5. Robertson EN, Booij LHDJ, Fragen RJ, et al: Clinical comparison of atracurium and vecuronium (ORG NC45). Br J Anaesth 55:125–129, 1983
6. Gallo Ja, Cork RC, Puchi P: Comparison of effects of atracurium and vecuronium in cardiac surgical patients. Anesth Analg 67:61–65, 1988
7. Cozanitis DA, Pouttu J, Rosenberg PH: Bradycardia associated with the use of vecuronium. A comparative study with pancuronium with and without glycopyrronium. Anaesthesia 42:192–194, 1987
8. Cozanitis DA, Erkola O: A clinical study into the possible intrinsic bradycardia activity of vecuronium. Anaesthesia 44:648–650, 1989
9. Caldwell JE, Braidwood JM, Simpson S: Vecuronium bromide in anaesthisia for laparoscopic sterelization. Br J Anaesth 57:765–769, 1985
10. Starr NJ, Sethna DH, Estafanous FG: Bradycardia and asystole following the rapid administration of sufentanil with vecuronium. Anesthesiology 64:521–523, 1986
11. Pollok AJP: Cardiac arrest immediately after vecuronium. Br J Anaesth 58:936–937, 1986
12. Miller RD: Vecuronium. Seminar in Anesth 3:312–318, 1984
13. Inoue K, El-Banayosy A, Stolarsky L, et al: Vecuronium induced bradycardia following induction of anaesthesia with etomidate or thiopentone with or without fentanyl. Br J Anaesth 60:10–13, 1988
14. Salmenpera M, Peltola K, Takkunen O, et al: Cardiovascular effects of pancuronium and vecuronium during high-dose fentanyl anesthesia. Anesth Analg 62:1059–1064, 1983
15. Cozanitis DA, Lindgren L, Rosenberg PH: Bradycardia in patients receiving atracurium or vecuronium in conditions of low vagal stimulation. Anaesthesia 44:303–305, 1989
16. Reitan JA, Stengert KB, Wymore ML, et al: Central vagal control of fentanyl-induced bradycardia during halothane anesthesia. Anesth Analg 57:31–36, 1978
17. Gravlee PG, Ramsey FM, Roy RC, et al: Rapid administration of a narcotic and neuromuscular blocker: A hemodynamic comparison Anesth Analg 67:39–47, 1988