A CASE OF ACUTE HYPERPYREXIA WITH VIOLENT SHIVERING IMMEDIATELY AFTER OPERATION UNDER EPIDURAL ANAESTHESIA SUPPLEMENTED BY NITROUS OXIDE

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Abstract

Acute rise of body temperature to 40° C triggered by violent shivering was observed immediately after operation under epidural anaesthesia supplemented by nitrous oxide in a 65-year-old male patient. Cooling was not effective until the patient was anaesthetized with thiopentone, diazepam, and triflupromazine to control the shivering.

KEY WORDS: COMPLICATIONS, postoperative shivering, hyperpyrexia; ANAESTHETICS, gases, nitrous oxide; ANAESTHETIC TECHNIQUES, epidural.

SINCE THE recognition of malignant hyperpyrexia as a clinical entity, rise of body temperature during and immediately after anaesthesia has engaged the attention of anaesthetists.^{1,2} Recently we have experienced an episode of acute hyperpyrexia triggered by violent shivering immediately after an operation under epidural anaesthesia supplemented by nitrous oxide.

CASE REPORT

A 65-year-old 45 kg male, with unremarkable family history, underwent partial resection of the urinary bladder and right ureter for neoplasm. Incidence of hyperpyrexia during or immediately after operation in his family or relatives was not known. Preoperative examinations were unremarkable except for left ventricular hypertrophy on E.C.G. (Table I).

Premedication consisted of intramuscular diazepam 8 mg and atropine sulphate 0.4 mg one hour before anaesthesia. On admission to the operating room, his blood pressure was 124/80 mmHg, heart rate 58 per minute, and body temperature 36.6° C. An intravenous drip infusion of lactated Ringer's solution was started. The epidural space was identified by the loss of resistance technique and an epidural catheter was introduced at L2,3 and advanced 4 cm caudad. The aspiration test was negative and the

positioning of the catheter was confirmed by administration of a test dose. Thereafter lidocaine 2 per cent was given in 100 mg increments to a total of 300 mg, and analgesia was obtained between T11 and L5. The trachea was intubated following intravenous thiopentone 200 mg, succinylcholine 40 mg and topical lidocaine. The usual fasciculations were observed following succinylcholine and relaxation of the jaw was satisfactory. The patient was given nitrous oxide 3.5 l/min and oxygen 1.5 l/min and the lungs were ventilated manually.

Lidocaine 1.5 per cent was used to a total dose of 1330 mg during the operation, which lasted five hours and three minutes. Ephedrine 4 mg was administered three times when the systolic blood pressure fell below 80 mmHg, and intravenous atropine sulphate 0.2 mg when the heart rate slowed to less than 50 beats per minute during anaesthesia. Warming by blanket (39° C) was started when the rectal temperature dropped to 36.0° C, but nevertheless it dropped further to 35.1° C during two hours in the course of the operation and was 36° C at the end of the

TABLE I
PREOPERATIVE EXAMINATIONS

	Blood pressure 120/60 mmHg		
	Pulse rate 72 beat/min		
	Body temperature 36.5° C		
RBC	450 × 10 ⁴ /mm ³	Total protein	61 g/l
GOT	14 U/l	GPT	21 U/l
BUN	6 mmol/l	CPK	73 I.U./l
E.C.G.	L.V.H.		

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TABLE II
ARTERIAL BLOOD GAS ANALYSIS

	Preoperative	End of Operation	Shivering (40° C)	After 7% NaHCO ₃ 60 ml i.v.
[H ⁺] ₂ mmol/l	41	40	57	44
PCO ₂ (kPa)	5.1	4.5	4.8	4.9
PO ₂ (kPa)	9.8	20.5	18.1	16.0
HCO ₃ ⁻ (mmol/l)	23.7	20.8	14.2	19.8
BE (mmol/l)	-0.4	-2.8	-11.4	-3.7

operation. Stored whole blood 600 ml was transfused during the operation.

The patient responded to verbal orders and was able to take deep breaths as soon as nitrous oxide had been discontinued; hence the tracheal tube was removed, and he was transferred to the recovery room.

On admission to the recovery room, blood pressure was 120/70 mmHg, heart rate 76 beats per minute and body temperature 36.0° C. The patient was alert and orientated without complaints of pain or chill (Figure 1). Fifteen minutes later he developed violent shivering and rise of body temperature followed. Within 50 minutes the rectal temperature had risen to 40° C, despite the intravenous administration of triflupromazine 15 mg, alcohol sponging, cooling blankets and the application of ice bags over the iliac, carotid and popliteal areas. Arterial blood gas analysis revealed metabolic acidosis, and 60 ml of sodium bicarbonate seven per cent was administered (Table II). At this point the decision was made to anaesthetize the patient to terminate the shivering. A total intravenous dose of thiopentone 400 mg, diazepam 20 mg and triflupromazine 45 mg succeeded in controlling the shivering and the rectal temperature fell to below 38° C within two hours. Cooling was continued until

the rectal temperature had dropped to 37.8° C. The patient was observed closely for another hour while the temperature remained stable, whereupon he was transferred to the intensive observation area of the ward. C.P.K. determined in the recovery room was 267 I.U./l.

A low grade fever (below 38° C) persisted for three days on the ward and then subsided. No further hyperpyrexia followed, and the postoperative course was uneventful.

DISCUSSION

Acute hyperpyrexia immediately after the operation has been reported recently as being caused by septicaemia,^{3,4} pheochromocytoma,⁴ malfunction of central thermo-regulatory mechanism following neurosurgery⁵ and by malignant hyperpyrexia (including suspected cases).⁶⁻¹¹ Our case was somewhat unique because the hyperpyrexia was triggered by an episode of violent shivering. This phenomenon has not been described, although hyperpyrexia with shaking chills was included in a couple of reports.^{3,7,10} Kumaya, *et al.*¹⁰ reported that a 51-year-old male who underwent an uneventful neurosurgical procedure under halothane anaesthesia developed severe shaking chills after extubation and the body temperature rose from 35.5° C to 41.5° C in 30 minutes. Ryan and Papper⁷ reported on a female patient who, following an otolaryngological operation under halothane anaesthesia, had a shaking chill after an episode of emergence delirium in the recovery room. The rectal temperature rose from 38.4° C to 40.3° C in two and a half hours despite the intravenous administration of chlorpromazine 25 mg, alcohol baths, cooling blankets and ice bags.

Shivering after epidural anaesthesia is relatively common with an incidence of 20 to 50 per cent.¹²⁻¹⁴ In comparison with patients being given one per cent halothane, patients who had received epidural anaesthesia were slow to re-

FIGURE 1 Course of anaesthesia.

warm in the recovery room despite a high incidence of shivering.¹⁴

The aetiology of shivering after epidural anaesthesia is unclear. Thauer and Simon¹⁵ claimed that shivering was a response to the effect of cold solution introduced into the epidural space on temperature sensors located in the spinal cord. However, Webb, James and Wheeler¹⁶ injected bupivacaine at 15° C, 20° C, and 37° C into the epidural space for obstetrical analgesia, and showed no difference in the incidence of shivering between the groups. Thus they came to the conclusion that the incidence of shivering was independent of the temperature of local anaesthetics injected into the epidural space.

Only a few cases of malignant hyperpyrexia have been reported following regional anaesthesia.^{11,17-19} Klimanek, Majewski and Walehick¹⁷ reported a case of malignant hyperpyrexia following lumbar epidural anaesthesia with lidocaine 300 mg and bupivacaine 50 mg. Muscle rigidity developed in the upper extremities and face with contractions and trismus. The body temperature rose to 41.5° C in 30 minutes despite intensive cooling. High temperatures following subarachnoid anaesthesia have been reported by Katz and Virich¹¹ by Katz¹⁸ and Wadhwa.¹⁹ On the basis of animal experiments, Kerr, Wingard and Gatt²⁰ have claimed that epidural anaesthesia with lidocaine prevents malignant hyperpyrexia.

Our patient was given thiopentone and succinylcholine for tracheal intubation, supplemented with nitrous oxide; thus it was not a pure epidural anaesthesia. Since the hyperpyrexia reaction developed six hours after the administration of succinylcholine which is a prime trigger of malignant hyperpyrexia a diagnosis of malignant hyperpyrexia could probably be excluded. The hyperpyrexia was probably caused by intense shivering from undetermined causes following epidural anaesthesia. In accordance with Pickering²¹ that "the most effective means of cooling a man is to give an anaesthetic," successful cooling was achieved only after administration of thiopentone, diazepam, and triflupromazine. In this kind of shivering-triggered hyperpyrexia, shivering must be controlled first, before effective cooling can be achieved.

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RÉSUMÉ

Un épisode subit d'hyperthermie à 40° C précédé et accompagné d'un violent frisson est survenu chez un patient de 61 ans immédiatement à la fin d'une intervention d'une durée de 6 heures (cystectomie et urétérectomie partielles). L'intervention avait été effectuée sous anesthésie péridurale supplémentée de protoxyde d'azote et d'oxygène. Le malade s'était éveillé en fin d'intervention et avait été extubé avant son transport en salle de réveil. Les mesures de refroidissement (matelas réfrigérant, sacs de glace, éponges d'alcool et trifluopromazine) se sont avérées inefficaces tant que le frisson a persisté; on a dû recourir à l'anesthésie générale (thiopental, diazepam, trifluopromazine) pour le contrôler. Dans des cas comme celui-ci, où l'hyperthermie est associée au frisson, il faut contrôler le frisson pour en arriver à refroidir le malade.