Biochemical Alterations during Tetany

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Although tetanic manifestations of hypocalcemia may be relatively common in patients of the pediatric age group and in adults with acute hypoparathyroidism, their spontaneous occurrence during general anesthesia in patients without previously known abnormalities of calcium metabolism is rare. In fact, tetany was notably absent in critically ill patients with persistently low ionized calcium levels.1,2

In the case report presented below, we documented the changes in plasma ionized calcium concentration ([Ca++] ) occurring with tetany in a patient both during anesthesia with spontaneous ventilation and in the awake state during controlled ventilation.

REPORT OF A CASE

A 43-year-old woman was admitted to the hospital for removal of a hemangioma on the right side of the face. The history was unremarkable, and the patient denied the use of drugs and symptoms of abnormalities of calcium metabolism; specifically, there had not been symptoms of tetany in the past. Premedication consisted of diazepam, 10 mg, given orally. Anesthesia was induced by infusion of thiopental (175 mg, iv), and intubation of the trachea was performed following iv administration of succinylcholine. Anesthesia was maintained by spontaneous inhalation of halothane (1–1.5 per cent) in an oxygen–nitrous oxide (40:60) mixture, with occasional manual assistance. Approximately 90 min following onset of the procedure, when minute ventilation was considered adequate, tetanic position of both hands appeared. The wrists were flexed to a right angle and the fingers were flexed at the metacarpo-phalangeal joints. All digits were extended at the interphalangeal joints. The fingers and thumb were in adducted position. Chvostek's sign was readily elicited. Arterial blood pressure was 125/80 torr, pulse rate 84 beats/min, and respiratory rate 28/min. Laboratory analysis of a specimen of arterial blood withdrawn at this time revealed PaO2 131 torr, PaCO2 29 torr, pH 7.48, and ionized calcium concentration ([Ca++] ) 0.66 mm. Calcium chloride (5 mg/kg) was administered intravenously over a 3-min period and the tetanic manifestations disappeared. The surgical procedure was completed and administration of anesthetic drugs discontinued. Postoperative recovery was uncomplicated. Three days later, after informed consent had been obtained, a 21-gauge thin-walled needle was advanced into the left radial artery for blood sampling. An intravenous infusion of 5 per cent dextrose in water was started and a blood pressure cuff applied. The patient, fully awake and alert, was then hyper-

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ventilated manually via face mask (room air) for a 30-min period, after which tetanic manifestations in both hands appeared. Chvostek's sign was readily elicited. Spontaneous ventilation was then allowed to occur, initially with occasional assistance. Arterial blood samples were withdrawn and the patient tested for both Chvostek's sign and Trouseau's sign, prior to onset and upon cessation of hyperventilation, and at 5-min intervals until 15 min and 30 min following onset of spontaneous ventilation.

As shown in table 1, tetanic manifestations were associated with decreased [Ca++], increased pH, and decreased PaCO2. The decrease in [Ca++] was more pronounced during anesthesia, despite a smaller pH change when compared with the period of hyperventilation in the awake state, [Ca++] gradually returned to the control level and both Trouseau's and Chvostek's signs could not be elicited 30 min following cessation of hyperventilation. Blood gases, pH, and ionized calcium concentration were measured using appropriate electrodes at 37 C (Radiometer* electrodes with PHM 72 digital meter and Orion* S-S 20 calcium-selective electrode system, respectively).

DISCUSSION

Our case report demonstrates that tetany may be associated with ionized hypocalcemia, alkalosis, or both. We found that symptoms of tetany were present over a relatively wide range of ionized calcium values. In our patient, tetany first appeared spontaneously during surgical anesthesia with halothane when [Ca++] was substantially below normal (1.12 ± 0.03 mm).3 The reason for this degree of hypocalcemia is not immediately apparent, although a slightly decreased PaCO2 and increased pH may have been among the contributing factors. However, similar blood-gas values and pH may be regularly recorded during anesthesia in other patients without symptoms of tetany. Total calcium concentration measurement was not available for our patient. However, such information would not have added much to our observation, since a substantial decrease in the ionized moiety can occur without a change in total calcium concentration.4 The electrocardiogram was monitored with oscilloscopic display, limiting our ability to determine corrected values of the Q–T interval (Q–OTc and Q–Te). If a direct-writing electrocardiograph had been available, estimation of directional changes in [Ca++] might have been possible by evaluation of the duration of Q–T intervals. However, in view of recent data from this laboratory,4 precise determination of [Ca++] status requires direct laboratory analysis.

Edmondson and co-workers5 found, in the experi-
mental animal, that hypocalcemia and alkalosis in the extracellular fluid acted synergistically in the etiology of tetany. Previous data from this laboratory \(^a\) are in agreement with results of these investigators, who pointed out that the magnitude of reduction in [Ca\(^{++}\)] due to alkalosis \textit{per se} is relatively small, and that alkalosis-induced tetany cannot be explained by the hypocalcemic effect of alkalosis alone. They \(^a\) also found that hypocalcemia in combination with alkalosis consistently induced tetany, whereas either condition alone did not.

In our patient, arterial blood pressure was well-maintained throughout the hypocalcemic episode. Alterations in both ventricular and peripheral vascular function can occur with hypocalcemia. \(^6\) When tetany appeared in our patient during anesthesia, calcium chloride was administered, and tetanic manifestations disappeared. In view of the relatively small [Ca\(^{++}\)] change that occurred with tetany in the awake state, calcium replacement therapy was not considered necessary.

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### References


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**Cardiorespiratory and Cranial-nerve Sequelae of Surgical Procedures Involving the Posterior Fossa**

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Surgical procedures in the region of the posterior fossa are attended by a variety of potential complications. Certain of these—venous air embolism, for example—are relatively common, and have received investigative attention. Other less frequent complications have received less attention. The following case report illustrates some problems that may attend neurosurgical procedures involving the posterior fossa.

### Report of a Case

An 18-year-old male patient was scheduled for posterior-fossa exploration for a cerebellar mass lesion with associated hydro-