KETAMINE AND AGENESIS OF THE CORPUS CALLOSUM

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SUMMARY

Ketamine did not provide adequate anaesthesia for pneumoencephalography in a 10-week-old child with agenesis of the corpus callosum. Associated neurological defects are the most likely reason for this failure.

Agenesis of the corpus callosum is a rare condition which may not be associated with any detectable neurological deficit. When a deficit does occur it is frequently related to the severity of associated brain anomalies (Harcourt-Webster and Rack, 1965). When agenesis of the corpus callosum is suspected in infancy pneumoencephalography is recommended for definitive diagnosis and general anaesthesia is usually required. The anaesthetic technique used for this procedure is rarely mentioned in published case reports. This communication describes the use of ketamine for pneumoencephalography in a 10-week-old child with suspected agenesis of the corpus callosum.

CASE REPORT

The baby was born with the aid of forceps at 36 weeks gestation and weighed 2600 g. He was the sixth child in an apparently normal family. Initial progress was uneventful until, at 5 weeks, he was admitted to hospital for investigation of vomiting; an abnormal increase in head size was noted. A ventriculogram suggested agenesis of the corpus callosum with hydrocephalus and a prosencephalic cyst of the right cerebral hemisphere. Pneumoencephalography under general anaesthesia was performed at the age of 10 weeks (weight 3990 g).

Premedication was with atropine 0.1 mg i.m. During the procedure, heart rate and ventilation were monitored with a precordial stethoscope and arterial pressure was measured with an infant pressure cuff and anaeroid manometer. Within 2 min of the injection of ketamine 50 mg i.m. (10.3 mg kg\(^{-1}\)) the muscles became rigid and the child exhibited extended limbs and opisthotonos. Arterial pressure, pulse and skin colour remained normal, but breathing became irregular. The rigidity decreased over the next few minutes and regular breathing was resumed. The baby was strapped into a modified infant seat and positioned for lumbar puncture. Over the next 30 min, while air was being injected for pneumoencephalography, a further 35 mg of ketamine (5-mg increments) was administered i.v. because of continued withdrawal movements in response to the insertion and positioning of the lumbar puncture needle. Because of persisting muscle stiffness, diazepam 0.5 mg was given i.v. over 3 min in an attempt to smooth the progress of the anaesthetic. Some muscle relaxation resulted, but the major effect was depression of breathing—a slowing of rate with deep jerky inspiratory efforts. Normal respiratory rhythm resumed within 10 min. Over the last hour of the procedure while x-rays were being obtained, a further 15 mg of ketamine was required (5-mg increments) and, during this time, the baby opened his eyes twice.

The investigation lasted 1 h 45 min and, except for respiratory rhythm, other signs were normal. Despite the large dose of ketamine (50 mg i.m. and 50 mg i.v.) the baby’s eyes were open before leaving for the recovery area and there were no complications after anaesthesia. Ten days later, a repeat ventriculogram showed a significant increase in the size of the ventricles. A ventriculo-peritoneal shunt was performed under general anaesthesia with nitrous oxide, oxygen, halothane, tubocurarine and controlled ventilation; there were no problems during or after operation.

DISCUSSION

Ketamine is usually described as a "dissociative anaesthetic" because it produces e.g. changes suggesting dissociation of the cortex from the limbic system (Corssen, Miyasaka and Domino, 1968). However, more recent evidence does not entirely...
support this concept (Kayama and Iwama, 1972; Morse and Cave-Smith, 1974). Since Morse and Cave-Smith had successfully used ketamine to anaesthetize an infant with no cerebral cortex, it was decided to use ketamine on this occasion.

Although the procedure was performed successfully by an experienced radiologist, the anaesthetic was not ideal. Bizarre and uncontrolled neuromuscular activity in infants less than 6 months of age have been described with ketamine (Corssen, Miyasaka and Domino, 1968; Dillon, 1971; Szappanyos, Gemperle and Rifat, 1971). On the other hand, similar neuromuscular reactions have been observed in patients with pre-existing neurological deficiencies (Drury and Clark, 1970; Dillon, 1971). In this baby, opisthotonos and muscular stiffness could be described as a bizarre and uncontrolled reaction which did not respond to diazepam or to further increments of ketamine, a finding in agreement with the results of other work on normal infants (Szappanyos, Gemperle and Rifat, 1971). Conversely, the withdrawal movements initiated by stimulation from the lumbar puncture needle were well co-ordinated and suggested failure to achieve adequate analgesia. The reasons for the failure of ketamine are not clear.

While ketamine is usually described as a mild respiratory stimulant, large doses may cause depression of breathing. In this case respiratory depression occurred only following the administration of diazepam. This emphasizes the unpredictability of diazepam respiratory depression (Buskop, Price and Molner, 1967; Hunter, 1967) in the presence of other anaesthetic agents.

A high mortality rate is associated with agenesis of the corpus callosum when the symptoms present in infancy (Slager, Kelly and Wagner, 1957; Shapira and Cohen, 1973). This is the result of other severe congenital defects affecting many systems (Slager, Kelly and Wagner, 1957). There is frequently clinical evidence of a diffuse neurological deficit (Carpenter and Druckenmiller, 1953) and the abnormal brain development leads to a reorganization of neural pathways linking the cortex and limbic system (Ettlinger et al., 1972). The pneumoencephalogram confirmed the absence of the corpus callosum and this may have contributed to the relative failure of ketamine anaesthesia. However, it is likely that other associated anomalies, including a cystic lesion of the right cerebral hemisphere and hydrocephalus, played a significant part by further disrupting normal neural pathways. It would appear that if, as a result of fundamental neural reorganization, abnormal pathways link the cortex and limbic system, ketamine may not provide adequate analgesia.

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REFERENCES


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RESUME

La ketamine n'a pas provoque l'anesthesie appropriee lors d'une pneumoencephalographie chez un enfant age de 10 semaines, atteint d'une agenese du corps calleux. Il est vraisemblable que la raison de cet echec provienne d'anomalies neurologiques associees.

La quetamina no proveyó una anestesia adecuada para la neumoencefalografía de un niño de 10 semanas con agenesia del cuerpo calloso. Los defectos neurológicos asociados constituyeron muy probablemente la causa de esta deficiencia.