Clinical Reports

Repeat ketamine anaesthesia of a child for radiotherapy in the prone position

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Sixteen ketamine anaesthetics over an eight-week period for a course of postoperative radiotherapy following removal of a medulloblastoma in an 18-month-old child are described. On each occasion the child was in the prone position with a tight fitting shell covering the head, trunk and arms. The problems of repeated anaesthetics, isolation of the child in one room from the anaesthetist in another, and psychological upset to the mother and child are discussed. Ketamine was chosen because with this agent the patient usually maintains a clear airway, even in unusual postures. It was used successfully by both the intramuscular and rectal routes, thus avoiding repeated venepuncture and intubation. Post-anaesthetic nausea was a problem, but tolerance to ketamine and psychological emergence phenomena did not occur.

Key words:

RADIOTHERAPY: young child; POSITION: prone;
ANAESTHETICS, INTRAVENOUS: Ketamine,
repeated use.

The purpose of radiotherapy after surgical removal of a cerebellar medulloblastoma is to eradicate tumour cells which may be present in the spinal axis of the cerebrum and cerebrospinal fluid. To ensure accurate treatment it is necessary to place the patient prone, in a position which must be precisely reproduced each day. One method of facilitating this is to make a plaster cast of the head, trunk and arms of the patient and, from this, a plastic shell which snugly fits the contours of the patient (Figure 1). Accurate fit is vitally important because the shell not only functions as a patient positioning device but also carries the treatment markings necessary to direct the radiation beams to the target areas at each treatment session. For daily treatments the patient only needs to lie still for three periods of approximately one minute each. However, even one minute may be too long for a young child to lie still, and thus some form of sedation or general anaesthesia may need to be given. Also, the making of the plaster cast requires a degree of cooperation which, in some cases, may not be possible unless the child is fully anaesthetised.

This paper presents a case report of an 18-month-old child who required 16 ketamine anaesthetics over a period of eight weeks.

Case history

An 18-month-old girl, weighing 12.5 kg, presented for outpatient radiotherapy after posterior fossa craniotomy for excision of a medulloblastoma. A total dose of 3,000 rads to the whole cerebrum and spinal axis was prescribed, plus an extra 2,000 rads to the posterior fossa. These were to be delivered by

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FIGURE 1 Anaesthetised patient under moulded plastic shell. This closely covers the head, trunk and arms and is clamped in position during each treatment.

a six million electron volt linear accelerator in 25 daily treatments over a period of approximately five weeks, after preparation of the individualised plastic shell. Apart from a wound haematoma and a resolving upper respiratory infection, the child had no abnormal physical signs. For the making of the plaster cast, sedation with promethazine, chlorpromazine and meperidine was tried on three occasions. Each time the child fell asleep in her mother's arms but woke and struggled as soon as any attempt was made to place her in the prone position. On the first attempt, at 0800 hours, the child had been given promethazine 17 mg, chlorpromazine 17 mg and meperidine 22.5 mg intramuscularly so that she would lie still during the making of the plaster cast. This she would not do and at 0950, pentobarbitone 20 mg intramuscularly was given. A further unsuccessful attempt was made to place her in the prone position. At 1215 hours a second dose of the sedative cocktail was given: promethazine 2.5 mg, chlorpromazine 2.5 mg and meperidine 10 mg intramuscularly. Again, the child woke up and fought when placed prone, although when the procedure was finally abandoned she slept for nearly six hours.

The following morning sedation was tried again, for the third time, with promethazine 5 mg, chlorpromazine 5 mg and meperidine 15 mg intramuscularly at 0905 hours with similar lack of success. By the end of this third attempt there had been considerable psychological upset, not only to the mother and child, but to the radiotherapy nurses and

staff; the Department of Anaesthesia was asked to provide assistance. At 1600 hours one of us (JRM) arrived to be greeted by grateful radiotherapy staff and an extremely anxious mother. So far she had seen three failures with sedation and the preliminary work of making the cast had still not been started. She was allowed to stay and, during subsequent treatment sessions, her anxiety diminished and she became friendly and co-operative.

With full anaesthetic equipment available in case of problems, ketamine 125 mg with atropine 0.2 mg was injected intramuscularly into the left thigh; satisfactory anaesthesia occurred within three minutes. The child was placed in the prone position for about 15 minutes while the plaster cast was applied and allowed to set. During this time the only visible parts of the child were the lips and nose, from below, and the legs. The rest of the body was encased in opaque white plaster, like the shell shown in Figure 1. Monitoring consisted of a precordial stethoscope and observation of the colour of the lips, legs and feet. The child was then transferred, still anaesthetised, to another location in the building, for computerised axial tomography. A "Butterfly" needle was placed in one of only two small veins for infusion of renograffin for the scan and was also used for one dose of intravenous ketamine 12.5 mg. During repositioning of the child, this needle was dislodged and a second intramuscular dose of ketamine 60 mg was given. Anaesthetic time was 75 minutes.

Six days later, anaesthesia was repeated using a similar technique during fitting and final adjustment of the plastic shell. Immediately following this 20-minute procedure, the child was transported, still in the prone position and with the plastic shell in place, to another room for treatment planning on a radiation therapy simulator. No airway problems were encountered on either of these two occasions.

Thirty daily outpatient radiotherapy treatments, with the child prone and securely held by the plastic shell, were planned using ketamine as the sole anaesthetic agent. During the first week there was some nausea and vomiting for up to four hours after treatment, always after she had recovered full consciousness. The radiotherapist suggested that the child's head might satisfactorily be immobilized in the shell without anaesthesia, even if she could still wriggle her hips and spine. Thus the fractionation of treatment to the spine could be changed so

FIGURE 2 Ketamine doses and routes of administration during the eight week period.

that general anaesthesia was only required for twice-weekly spinal radiations for the remainder of the course of treatment. This was done and vomiting did not occur after radiation alone. Dimenhydrinate suppositories were used for premedication in six subsequent treatments but, although they reduced the nausea, they also increased somnolence and so were discontinued. Other antinauseants such as hyoscine would probably have had the same advantage and disadvantage.

When a haematoma developed at the site of injection in the child's thigh, rectal ketamine was used for six treatments. This was done partly to avoid risk of haematoma at another injection site and partly in the hope that the absence of a needle would be more acceptable to the child. Onset of anaesthesia took between five and ten minutes and was not as reliable as the intramuscular route; recovery was slower with marked restlessness. The dose on the first occasion was $12 \text{ mg} \cdot \text{kg}^{-1}$ and

subsequent doses were higher, and on two occasions (two weeks apart), were supplemented by an intramuscular injection. When the thigh haematoma resolved the intramuscular route was used again with excellent results. The dose requirement did not increase and for the final treatments ketamine $8 \text{ mg} \cdot \text{kg}^{-1}$ was adequate with onset of action in less than two minutes. Sixteen anaesthetics were given over a period of eight weeks. Doses and routes of administration are shown in Figure 2.

Approximately 15 minutes of anaesthetic time was required to allow irradiation of the three fields. Before and after each radiation, monitoring was by visual observation, EKG and precordial stethoscope. During the three short periods of radiation, about 60 seconds each, when all personnel had to leave the treatment room, the child and EKG monitor were observed by closed circuit television.

As the child's mother became familiar with the

anaesthetic technique and staff she became much less anxious. On most days she held her little girl when the ketamine was given and carried her around the room until it took effect. She watched the treatment and went with the nurse to the Recovery Room.

Discussion

Repeat anaesthetics at short intervals in small children pose special problems. The shorter the interval and the larger the number of anaesthetics required, the greater is the concern for finding the most appropriate technique. This must be practical, safe and, preferably, simple. In this particular case there was the added concern of the prone position with the child's head held immobile in the plastic shell, plus the absence of the anaesthetist from the room during the short periods of actual treatment. Other anaesthetic techniques were considered. Experience with another child, undergoing treatment for retinoblastoma in the supine position, using rectal thiopentone 10 per cent had been unsatisfactory. That solution, presumably because of its alkalinity, caused a distressing proctitis and the child was unable to retain the solution after the first three days and intramuscular or intravenous ketamine was used instead. In the present case there was also the concern that, using a barbiturate without an endotracheal tube, the child's airway might become obstructed while she was fixed under the plastic shell in the prone position.

Anaesthetic techniques involving daily intubation would be safe for the actual procedure but might produce laryngitis and tracheitis from the inevitable repeated minor trauma. Sore throat would be a serious complication as this child was an outpatient and nutrition by the oral route was important. Reluctance to swallow might necessitate admission to hospital for intravenous fluids. Despite her post-ketamine nausea, this child's nutrition and general condition were satisfactory. For inhalational inductions, halothane would be the agent of choice for most anaesthetists; however, although hepatitis following repeated exposure to halothane in children is extremely rare,¹ the possibility must be considered. Alternatively, repeated venepuncture for a nitrous oxide-relaxant technique in an 18-month-old child might eventually tax even the most skilled anaesthetist.

Experience with ketamine in difficult situations

has been uniformly good.²⁻⁴ While ketamine is not the perfect anaesthetic agent, it is difficult to imagine any other technique or agent which would not cause more problems in these particular circumstances. Phillips² reported on its use in Fiji in relatively primitive conditions. In a series of 714 patients, there were four deaths; however, all deaths occurred in the postoperative period and were clearly related to the severe illness of those patients. Spoerel³ described his satisfactory experience with ketamine in dental anaesthesia for Eskimo children, many of whom had probably not been fasting. He reported a 41 per cent incidence of vomiting in the unmedicated patients but, as in our case, it occurred late in the recovery period when the children were responsive and able to sit up. In a report⁴ on the Moorgate Tube Disaster in London, England, in 1975, a 19-year-old patient is described who was trapped by the left foot in one of the coaches in the dark blind-ended tunnel. After 12 hours of effort it proved impossible to free her, and the rescue team therefore decided to perform an above-ankle amputation. This was done under ketamine anaesthesia with the patient vertical. The operation was performed in semi-darkness with the surgeon underneath the patient. It is doubtful whether, in that situation, any other technique would have been as safe or even practical.

Rectal administration of ketamine was first described by Saint Maurice⁵ for induction of anaesthesia in frightened children. In our child, the rectal route was just as upsetting as the intramuscular injection and had the disadvantage of slower induction and recovery. The only other problem was nausea and vomiting. Each morning the child was fasted and ketamine was given between 0930 hours and 1000 hours; she was alert and walking between 1100 and 1200 hours, but nausea and vomiting prevented eating or drinking until mid-afternoon. It was because of the nausea and the reduced fluid and caloric intake that the general anaesthetics for treatment of the spine were reduced to two per week. On the other days there were no side effects from the radiotherapy alone. Occasional questioning of the mother reassured us that there was no psychological upset or strange behaviour that she could attribute to the anaesthetic. Tolerance to ketamine, which has been described with its use both intramuscularly⁶ and rectally,⁷ did not occur in the case described.

Unusual problems may sometimes be solved by somewhat unorthodox methods. It is very unusual for any anaesthetic to be given to a child in the prone position without at least an intravenous infusion, endotracheal tube and, probably, controlled ventilation. However, for the series of radiotherapy treatments described, ketamine alone, by either the intramuscular or rectal route, although not ideal, was safe and satisfactory.

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Résumé

A la suite de la résection d'un médulloblastome chez un enfant de 18 mois, on a dû procéder à 18 séances de radiothérapie sous anesthésie générale. Pour chaque séance, l'enfant était maintenu en position ventrale, immobilisé dans une coquille rigide qui recouvrait la tête, le tronc et les bras. Ce travail présente la technique anesthésique utilisée.

On a choisi d'employer la kétamine car cet agent garde habituellement les voies aériennes ouvertes même en position inhabituelle. On l'a employée par voie musculaire et rectale évitant ainsi les ponctions veineuses répétées et l'intubation. Au réveil, les nausées constituaient un problème agaçant mais on n'a pas vu survenir de tolérance à la kétamine ou de cauchemar ou hallucination au réveil.

En discussion, on aborde le problème que représentent les anesthésies répétées, l'isolement de l'enfant loin de l'anesthésiste et l'impact psychologique sur la mère et l'enfant de ces événements répétés.