Case report

Anaesthetic management of total craniopagus twins for magnetic resonance imaging and cerebral angiography

A. Parameswari*, M. Vakamudi, V. Raghupathy and R. Siddhartha

Department of Anesthesiology, Critical Care and Pain Medicine, Sri Ramachandra Medical College and Research Institute, Sri Ramachandra University, No.1, Ramachandra Nagar, Porur, Chennai 600 116, Tamil Nadu, India

* Corresponding author. E-mail: reetharun@gmail.com

Key points

- Craniopagus twins are rare but present unique anaesthetic challenges.
- Careful preoperative planning is required.
- Access to/control of both airways can be difficult.
- Crossover between the two circulations has physiological and pharmacological effects.

We describe the anaesthetic management of 4-yr-old total craniopagus twins for radiological investigations. There are some unique anaesthetic problems associated with this condition. These include cross-circulation between the twins that results in induction of both the twins after the administration of i.v. induction agent to one twin and difficulty in mask ventilating both the twins simultaneously due to the angle between the heads; different arterial pressures in the two children complicate pharmacological management and underline the importance of physiological measures to control arterial pressure. Adequate preparation and teamwork is the keystone to the management of these patients.

Keywords: airway, complications; complications, hypotension; complications, hypoxia; radiology

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Craniopagus twins are an uncommon type of conjoined twins with an incidence of one in 2.5 million live births and this represents 2–6% of all conjoined twins.1 The management of these twins for general anaesthesia poses considerable challenges. Before separation can be done, radiographic assessment of organ function and the extent of cross-circulation between the twins have to be evaluated in detail. Cerebral angiography provides invaluable information on the cerebral vascular architecture. We report our anaesthetic management of these twins for magnetic resonance imaging (MRI) and biplane cerebral angiography.

Case description

Four-year-old craniopagus twins X and Y were admitted to our hospital for radiological investigations. Their developmental milestones were normal. Baby X was a hypertensive. Their combined weight at admission was 23 kg (Y 12.5 kg and X 10.5 kg). The twins were joined at the parietal, temporal, and occipital region of their skulls and were facing 90° apart, putting them in the total vertical III craniopagus category. There were no apparent neurological abnormalities on examination, with normal reflexes, good motility, and tone in all limbs. The hypertensive twin X was more active than twin Y. On examination, twin X had a heart rate of 118 beats min⁻¹ and an arterial pressure of 170/90 mm Hg, whereas twin Y had a heart rate of 108 beats min⁻¹ and a pressure of 90/50 mm Hg. Chest X-ray and ECG were normal for both the twins. Echocardiography revealed that twin X had a closed ventricular septal defect with trivial mitral and tricuspid regurgitation. The children underwent the procedure after discussion with the surgeon, the interventional neuroradiologist, and the paediatric cardiologist.

A detailed anaesthetic plan was charted on the day before the procedure. We planned to manage the MRI using i.m. ketamine and the cerebral angiography in the interventional neuroradiology suite under general anaesthesia with tracheal intubation.

For the MRI, ketamine 5 mg kg⁻¹ with glycopyrrolate 0.01 mg kg⁻¹ was given as i.m. injection to both the twins in the gluteal muscle in the holding area. An i.v. line was secured using a 22 G cannula, one for each child. Ampicillin 1200 mg was given i.v. for infective endocarditis prophylaxis as two divided doses of 600 mg for each twin, 30 min before moving to the MRI suite. Supplemental oxygen was given by a face mask. Heart rate, oxygen saturation, and arterial pressure were monitored continuously using two monitors in the MRI suite. The arterial pressure of twin Y ranged from 90/60 to 110/70 mm Hg, whereas that of twin X ranged from 170/90 to 200/100 mm Hg, heart rates were stable at 110–120 beats min⁻¹, and their oxygen saturation was 100% throughout. I.V. ketamine and midazolam were given for the maintenance of anaesthesia. The total dose of i.v. ketamine required during the procedure was...
greater in twin Y compared with twin X. At the end of the procedure, the children were conscious, breathing spontaneously and haemodynamically stable, and were shifted to the interventional radiology suite with oxygen by a face mask, with monitoring of ECG, arterial pressure, and oxygen saturation.

The cerebral angiography was done in an interventional radiology suite which had been prepared earlier. Our plan was to use a single anaesthetic machine with two breathing circuits (Jackson Rees modification of Ayre's T Piece with extended tubing) attached to the common gas outlet as a ‘Y’ connection. The twins were monitored on two separate monitors for ECG, non-invasive arterial pressure, and pulse oximetry. They were pre-oxygenated simultaneously by two different anaesthetists, using the two different breathing circuits.

Our plan was to induce the hypertensive twin X first, as we believed that the cause of hypertension was the shunting of blood from the other twin. Inducing this child first would minimize the crossover of anaesthetic drugs administered i.v. into the other twin. Induction of anaesthesia was with thiopental 5 mg kg$^{-1}$, fentanyl 2$\mu$g kg$^{-1}$, and vecuronium 0.1 mg kg$^{-1}$. However, immediately after induction of twin X, twin Y also became unconscious, stopped breathing, and started desaturating. We immediately mask ventilated twin Y which was very difficult as we were also ventilating twin X and the two heads were at right angles to each other. The oxygen saturation in twin Y decreased to 66% and then increased and was then maintained at 100%. During this episode, the heart rate in twin Y also decreased from 110 to 80 beats min$^{-1}$, and came back to 110 once the saturation started increasing. Twin X was then intubated with a 5 mm uncuffed tracheal tube. This was done while the airway was maintained for twin Y by mask ventilation. After that, we gave vecuronium 0.1 mg kg$^{-1}$ to twin Y and secured the airway with a 4.5 mm uncuffed tracheal tube. Auscultation and capnography confirmed correct placement in both twins. Anaesthesia was maintained with oxygen 3 litre min$^{-1}$, nitrous oxide 5 litre min$^{-1}$, and sevoflurane 1%. Higher fresh gas flows were used as both the children were ventilated from one anaesthetic machine using two breathing circuits.

After induction, the arterial pressure in twin X was 201/110 mm Hg and 88/55 mm Hg in twin Y. Increasing sevoflurane to 2% reduced the arterial pressure of the hypertensive twin to 180/90 mm Hg, but the pressure of twin Y decreased to 80/40 mm Hg. Instead of using pharmacological control of arterial pressure, we thought we could use physiological control. We placed a pillow of 7 cm thickness under twin X, so that she was lying at a higher level than twin Y (Fig. 1). We thought that this would shunt the blood from the hypertensive twin and also decrease the gravity-dependent shunting of blood from the hypotensive to the hypertensive twin. After doing this, the arterial pressure stabilized at 150/90 mm Hg in twin X and at 100/60 mm Hg in twin Y. Their heart rates remained stable at 100–110 beats min$^{-1}$. Twin Y required a higher drug dosage of fentanyl and vecuronium intraoperatively than twin X.

The angiogram was done using retrograde Seldinger's technique and a 5 F femoral arterial sheath was introduced. The predominant cerebral venous drainage of Y was through the left transverse sigmoid system, draining out through the left internal jugular vein, and through the circular venous sinus into the transverse–sigmoid–jugular system of twin X, bilaterally. A significant portion of the venous drainage of X was shunted into the left transverse sinus of twin Y. There was also significant crossover of the external carotid artery territory of X and Y. At the end of the procedure, the neuromuscular block was reversed and the tracheas were extubated. The twins were shifted to the ward, after 1 h of observation in the post-anaesthesia care unit. The twins were discharged on the second postoperative day.

Discussion

Conjoining occurs because of incomplete fission of a single embryo. Craniopagus can be classified as partial or complete, depending on the extent of union between the two twins. The anaesthetic management of these patients of the total variety is unique and challenging for several reasons. The position of the head and neck of our twins was such that it was difficult to obtain ideal intubating

![Fig 1 A pillow of 7 cm height was placed under the hypertensive twin as a means of physiological control of arterial pressure.](https://academic.oup.com/bja/article-abstract/105/3/368/251295/369)
conditions. Crossover of circulation occurred between the twins such that induction of one twin resulted in effects being seen in the other twin as well. Although the hypertensive twin X was receiving blood from Y, which was probably responsible for the lower arterial pressures in Y, there was in fact a shunting from one twin to the other which explains the sequence of events we observed. Management of arterial pressure was another issue to deal with. One twin was hypertensive and the other had a lower pressure. Pharmacological treatment of the hypertension in one twin could be disastrous for the other twin with low normal arterial pressure because of the circulatory crossover. To avoid this, we resorted to physiological methods of lowering arterial pressure by using gravity to influence the shunting of blood. This has been done in a previous case reported for separation of craniopagus twins.2

This case emphasizes the unique challenges faced in managing this rare congenital anomaly and the necessity to plan in advance the anaesthetic management and the essentiality of team work. Surgical separation of these twins would be an even greater challenge.3 4

Conflict of interest
None declared.

References
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