



Peri-operative intensive care



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ABSTRACT

All good intensive care requires attention to detail of the routine elements of care. These include staffing and monitoring, drug prescription and administration, feeding and fluid balance, analgesia and sedation, organ support and reducing the risk of healthcare-associated infection. Doing this well requires an understanding of the relevant physiology and an awareness of the limited evidence base. Detailed protocols and implementation checklist are valuable in ensuring that these minimum standards are met. However, peri-operative care is not all predictable and amenable to protocolization. This is especially true following separation of conjoined twins. Despite the sophisticated imaging and multi-disciplinary planning that precede elective separation, the acute physiological changes in each twin cannot always be predicted reliably. In this article, we review briefly each element of peri-operative care and how this might vary in conjoined twins.

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Peri-operative intensive care of conjoined twins

Almost all conjoined twins will require intensive care treatment. In many cases, they will require a period of initial stabilisation and assessment in ICU, most will have a lengthy post-operative ICU course and many will be relatively frequent attenders in the early years depending on their co-morbidities.

It is prudent to involve the intensive care team in the initial prenatal stage for several reasons. Firstly, it allows the sharing of information about malformations and planning for their potential clinical course. Secondly, ICU involvement is useful in prenatal counselling when treatment options and their consequences can be discussed. This may unveil ethical dilemmas that can be processed appropriately. Thirdly, it allows the parents to have an organised prenatal ICU visit to help prepare and familiarise themselves with the environment and staff.

Stable pre-operative period

Many conjoined twins are surprisingly stable in the initial postnatal period. Where possible, it is best to allow them find their own equilibrium, as their postnatal physiological changes occur particularly as the respective pulmonary and systemic vascular resistances adjust to extra-uterine life. In this scenario, ICU allows for monitoring, basic nursing care and the performing

of diagnostic procedures. Invasive monitoring is only performed if clinically indicated. Initial assessment includes basic blood tests, plain films and ultrasound and an early CT/MRI where possible if emergency separation is anticipated. As previously discussed, if stability can be established, it is aimed to postpone elective separation until at least 3–6 months of life.

ICU nursing care

Nursing care of conjoined twins has unique challenges in the ICU environment. It requires two nursing teams to allow separate but simultaneous care be given to each patient. Our practise is to colour code the patients—red and blue. They can be identified by colour-coded patient hats, with all monitoring, medication and intravenous lines clearly identified by colour ([Figure 1](#)).

Drug prescription and administration

Pharmacokinetics and pharmacodynamics are inconsistent in conjoined twins. Cross circulation can alter volumes of distribution and result in unpredictable metabolism and drug responses. In general, more cross circulation is usually seen in thoracopagus and craniopagus types.¹ Our practise is to calculate each patient's weight as the combined weight divided by two for symmetrical twins, or an estimated proportion if asymmetrical. Drugs are prescribed for each twin according to their assigned weight and administered individually. We find this offers the best opportunity

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Fig. 1. Thoraco-omphalopagus twins anesthetized immediately prior to separation.

for even distribution of metabolism regardless of the extent of vascular connection. Close observation of drug levels and renal and hepatic function is required, and appropriate adjustments should be made for any impairment. Zero tolerance prescribing and daily error feedback is part of our routine care to minimise drug errors.²

Feeding/fluids

Early nutrition has been shown to reduce mortality in intensive care patients.³ We aim to start enteral feeding on conjoined twins where possible, with consideration given to the risk of gut ischaemia in individual cases. Simultaneous filling of both stomachs is inadvisable in thoraco-omphalopagus twins, as it may result in respiratory distress. Conjoined twins are often found to have different growth rates and body composition prior to separation. A case study demonstrated a difference in resting energy expenditure of twins that normalises after separation, lending itself to the hypothesis that a twin might provide nutrients to the other.⁴ When the gastrointestinal tract cannot be used to meet estimated fluid and caloric requirements, TPN should be provided.⁵ Thought should be given to the sparing of central vascular access as far as possible in the pre-operative period, with tunneled catheters or vascular ports preferable for long-term access.

Monitoring of fluid balance is important and may require catheterisation for accuracy in the acute setting depending on the anatomy. If there is sharing of the renal systems, renal function should be monitored closely. If there is a shared urethral orifice, renal ultrasound should be performed to ensure no obstructive hydronephrosis occurs. If urinary outflow is combined, urinary output should be divided between both twins for fluid balance calculations.

If maintenance fluids are required in the short term, our practise is to prescribe according to individual estimated body weight and administer individually to each twin. Both intravenous fluid composition and quantity of infusion should be adjusted according to clinical status on an evolving basis.⁶ Multiple observational studies demonstrate a strong, independent association with increasing fluid accumulation and poor outcome in children in intensive care, although no causative effect has been found.^{7–9} In general, we aim for a neutral fluid balance in stable conjoined twins on maintenance intravenous fluids.

Unstable pre-operative period

The emergency stabilisation of conjoined twins follows the same principles of ABC as all patients, with specific consideration made for anticipated challenges. The overarching aim is to attain a period of stability and growth. In rare cases, this cannot be achieved and emergency separation may be undertaken if the anatomical configuration enables such.

Airway

Intubation problems in conjoined twins should be anticipated, with the anatomical arrangement providing unique challenges. Unsurprisingly, it has been demonstrated that emergency intubation times are much longer, and hence early planning and preparation for this scenario is prudent.

Both patients should be prepared for intubation and ventilation, with separate personnel for each twin. After simultaneous pre-oxygenation, the twin who is most in need of respiratory support should be intubated first, with the patients optimally positioned for this laryngoscopy. The patients should then be repositioned to the optimal position for laryngoscopy of the other twin, mindful of the risk of accidental extubation during repositioning.¹⁰ If intravenous induction agents are being used, it is important to be aware that the drug effect is unpredictable unless cross circulation is fully delineated. On occasion, the effect may occur in the other twin first, regardless of the site of administration and the vascular connexions. If a lengthy period of intubation is anticipated (i.e., > 6–8 weeks) tracheostomy should be considered as per all patients.

Breathing/ventilation

The respiratory mechanics of conjoined twins, particularly thoraco-omphalopagus, also require special consideration. Anatomically, their bony thoracic cavities are often smaller and/or joined, and the diaphragms may or may not be united. The overall anatomy can restrict positioning, which predisposes to atelectasis and respiratory tract infections. Physiologically, they usually have two independent respiratory centres driving independent respiratory rhythms. In patients whose chests are united, paradoxical movements are often observed.¹¹ In some cases, minor disturbances can cause this asynchronous breathing to conflict with a deleterious effect on gas exchange.

The decision to provide mechanical ventilator support is a clinical one. In some cases, it is reasonable to trial a period of non-invasive ventilation, although this is less likely to be of benefit if asynchronous “quarrelling” is problematic. It is also worth considering if the mechanical effect of air accumulation in the stomach is likely to be of detriment. In increasing respiratory failure, early intubation and ventilation can be beneficial in avoiding hypoxia. For positive pressure ventilation, our practise is to aim for PEEP 4–8 cm H₂O, tidal volume: 5–7 ml/kg and FiO₂ < 0.6. A strategy of permissive hypercapnia is used if clinically

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