Use of neonatal intensive care unit as a safe place for neonatal surgery

Antonio W D Gavilanes, Erik Heineman, Marcel J H M Herpers, Carlos E Blanco

Abstract

Aim—To evaluate the advantages, disadvantages, and short term morbidity and mortality of major surgical interventions performed in the neonatal intensive care unit.

Methods—A retrospective case review of 45 neonates was performed from April 1991 to September 1995. The characteristics of the patients were: gestational age 29 (SD 4) weeks (range 24 to 41 weeks); birthweight 1305 (870) g (range 540 to 4040 g); presurgical weight 1430 (895) g (range 550 to 4370 g); postconceptional age at surgery 31 (4) weeks (26 to 47 weeks). The indications for surgery were: ligation of patent ductus arteriosus (n=16); insertion of a subcutaneous ventricular catheter reservoir for hydrocephalus (n=14); repair of congenital diaphragmatic hernia (n=2); open lung biopsy (n=1); and laparotomies (because of necrotising enterocolitis, anorectal malformations, and intestinal obstructions) (n=12). The management of these neonates at laparotomy was: bowel resection with stomas (n=8) and stomas (n=4). A specially designed area was used to perform surgery.

Results—Local or systemic infection associated with surgery was not seen and no perioperative mortality was related to the surgical procedure.

Conclusions—The neonatal intensive care unit is suitable for major surgery during the neonatal period and no special area is needed to perform complication free surgery.

Arch Dis Child 1997;76:F51–F53

Keywords: neonatal surgery; neonatal intensive care; perioperative mortality.

In the past decade, improvements in the treatment of neonates within the neonatal intensive care unit have resulted in increased survival, particularly in extremely low birthweight infants. Furthermore, the need for surgery—for example, patent ductus arteriosus, necrotising enterocolitis, and posthaemorrhagic hydrocephalus—on very small premature infants has also increased.

In most neonatal centres neonatal surgical interventions, with the exception of the operative closure of the patent ductus arteriosus, are usually performed in the operating theatre, not in the unit. This means that transportation, extra manipulation, and a change of ventilator are all required, as well as interrupting the care of an unstable infant. The reason for this policy is based on the major concern that a neonatal intensive care unit does not provide a clean operating area, and so predisposes to a higher risk of surgical and postoperative infection. However, since April 1991, all major neonatal surgery on critically ill infants has been performed in our neonatal intensive care unit, without moving the patients.

This report is an evaluation of the advantages, disadvantages, and short term morbidity and mortality of major surgical interventions performed in our unit over the past four years.

Methods

Data from 45 infants who underwent surgical interventions in the unit between April 1991 and September 1995 were collected retrospectively. Surgery was performed in the unit when the patients were clinically unstable, on mechanical ventilation, or weighed 2000 g or less.

Surgical placement of central lines and extracorporeal membrane oxygenation cannulations and decannulations, which are routinely performed in the unit, were excluded from the assessment.

The unit has 13 intensive care beds, each one with an available area of 9 m².

Infants with an unstable thermoregulation were operated on inside their closed incubators; infants with stable control of body temperature were placed on an open incubator, but were not moved from their place.

Wall partitions isolated the operation site. The staff working in the unit wore cap and mask, but only the operating team wore surgical clothes. Regular activities in the unit were not suspended (radiography, ultrasonography, blood samples, etc.). Parents of other patients were allowed into the unit to visit their infants.

When the patient was not mechanically ventilated preoperatively, endotracheal intubation was performed by the paediatric resident or the neonatologist. Monitoring of the patient included: pulse oximetry, invasive or non-invasive blood pressure monitoring; electrocardiography; measurement of heart and respiratory rate and core temperature. Vascular access was assured before surgery. Infants were not premedicated, while intravenous anaesthetics in combination with non-depolarising muscle relaxants were used. Induction of anaesthesia was obtained using intravenous fentanyl 10 mcg/kg/bolus and paralysis was obtained using intravenous pancuronium or vecuronium 0.10 or 0.15 mg/kg/bolus. Titration of anaesthetics, fluid, and blood replacement were indicated by the neonatologist and...
The third death was an asphyxiated premature infant born after 29 weeks of pregnancy, weighing 650 g. His mother, a recipient of a kidney transplantation, had received prednisone, azathioprine, and cyclosporine. The patent ductus arteriosus was ligated one day after birth due to hypotension and oliguria. He remained in shock in spite of maximal treatment and died one day later after treatment had been stopped.

Discussion
Our results have shown that the neonatal intensive care unit is a safe place in which to perform surgical procedures, even on extremely sick and unstable infants, as no infection or other complications related to the surgical procedures occurred within the first 72 hours of the procedures.

The multidisciplinary medical team that managed the patients within the unit was, with the exception of the anaesthetic nurse, the same team that would have managed them in the operating theatre. The function of the anaesthetic nurse was transferred to a unit nurse, thus saving anaesthetic nursing time.
Neonatal intensive care unit as a safe place for neonatal surgery

The question of whether the neonatal intensive care unit is a better location than the operating theatre for performing major surgery cannot be answered by this study, in the absence of a random allocation of the infants to one or other location. However, we have confirmed that neonatal surgery can be performed in the neonatal intensive care unit.

There are no available data from randomised studies that compare the neonatal intensive care unit and the operating theatre for performing neonatal surgery. The only non-randomised, retrospective study which compared both locations was performed by Finer et al. The authors performed surgery in a specially designated area of the unit. Furthermore, the patient characteristics and the various conditions requiring surgery within the operating theatre and the unit groups were not the same.

This study dispels the concern that the neonatal intensive care unit cannot be a clean operating area, and shows that it is possible to perform major surgical procedures on critically ill infants there without complications.

We thank Dr J E Bunt for his help collecting the data.


Commentary

The suggestion that surgery can be performed in the neonatal intensive care unit may come as a shock to many neonatologists. But on closer inspection, the concept has considerable appeal. Transfer from the unit to the operating theatre within the same hospital will involve four major moves into and out of a transport incubator, and transfer between hospitals is even more hazardous. The risks of extubation, hypothermia and equipment and monitoring disconnection could all be reduced by performing surgery in the neonatal intensive care unit, and the need to discontinue vital treatment during transfer—for example, nitric oxide—could be avoided. Continuity of care by neonatal medical and nursing staff would be a great asset, not only to the patient, but also to the paediatric anaesthetist who may be unfamiliar with the patient’s ventilatory and circulatory idiosyncrasies.

Balanced against this are the considerable challenges posed by performing surgery in such an environment. The authors of this paper are particularly concerned to show that there was no increase in the rate of infection as a result of surgery in the unit—something they have not actually been able to prove, given the small sample size and lack of control group—but this may not be the most important risk factor. Major neonatal surgery is always a considerable technical challenge. Vital factors include accessibility, lighting, the immediate availability of the surgical equipment required to cope with the unexpected, and an experienced theatre team. The prospect of undertaking a difficult intestinal anastomosis on a 900 g infant in an incubator (with the light reflecting off the surface), with restricted access and in a stooped position is bad enough, but if that infant then required reintubation while the abdomen was still open...There would be a temptation to undertake the minimal amount of surgery possible, such as enterostomies in cases of necrotising enterocolitis, when under more controlled conditions, definitive surgery might be possible and subsequent surgery thus avoided. Other factors not addressed by the authors include restrictions on the use of diathermy and of inhaled anaesthetic agents in the neonatal intensive care unit.

However, the concepts raised by this study should not be dismissed out of hand. There may well be specific occasions where surgery in the unit will be the most appropriate option—for example, the very sick, very low birthweight baby with necrotising enterocolitis—but this should be considered only in exceptional circumstances. Such surgery should still be undertaken by specialist paediatric surgeons, and in major centres where the perioperative management can be undertaken by doctors and nurses with appropriate training and experience of neonates coming to surgery. A better outcome for these very sick infants is more likely to be achieved by an improvement in neonatal transport services, by centralisation of their management, and by the provision of dedicated neonatal operating theatres within the neonatal intensive care unit area.

DAVID BURGE

Wessex Centre for Paediatric Surgery
Southampton General Hospital
Southampton SO16 6YD
Use of neonatal intensive care unit as a safe place for neonatal surgery

Antonio W D Gavilanes, Erik Heineman, Marcel J H M Herpers and Carlos E Blanco

Arch Dis Child Fetal Neonatal Ed 1997 76: F51-F53
doi: 10.1136/fn.76.1.F51

Updated information and services can be found at:
http://fn.bmj.com/content/76/1/F51

These include:

References
This article cites 4 articles, 0 of which you can access for free at:
http://fn.bmj.com/content/76/1/F51#BIBL

Email alerting service
Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Topic Collections
Articles on similar topics can be found in the following collections
- Epidemiologic studies (929)
- Pathology (68)
- Clinical diagnostic tests (720)
- Congenital heart disease (152)
- Hydrocephalus (19)
- Oesophagus (51)
- Radiology (692)
- Surgery (69)
- Surgical diagnostic tests (65)

Notes

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/