Regional anaesthesia for surgical treatment of inguinal hernia in preterm babies

Preterm infants requiring general anaesthesia in the first few months of life have a higher incidence of postoperative complications than term infants.[1] Thus it has been recommended that elective surgery should be postponed in these infants until they are no longer at risk of developing these problems.[2] However, the optimal timing of surgery remains difficult to determine and it depends very much on the individual infant's perinatal history, maturity, and the presence of other illnesses.[3]

Inguinal hernia is a common surgical condition in this group,[4] occurring in up to one third infants of birth weight <1000 g.[5] Early surgical repair has been recommended as delay may result in incarceration of the hernia, bowel ischaemia, and gonadal infarction.[6]

The dilemma posed by the need for early surgery coupled with the risks of general anaesthesia may be resolved by the use of a regional anaesthetic technique in the awake infant.

Preterm infants and general anaesthesia

Respiratory problems are the most serious complications occurring in former preterm infants after general anaesthesia. The reported incidence of apnoea varies from 18%[1] to 37%[7] depending on the indication for surgery, the general health of the infant, and the method used to identify apnoea. In a prospective study, using pneumography, Welborn *et al* found that 37% of healthy former preterm infants undergoing inguinal hernia repair developed periodic breathing postoperatively.[8] In a later study of a similar group, eight out of 11 preterm infants had episodes of prolonged apnoea in the postoperative period.[9] Kurth and LeBard found that 24% of preterm infants had apnoea after inguinal herniotomy.[10] The majority of apnoeas are self limiting or respond to simple manual stimulation, but ventilatory support postoperatively may be required.[11] The risk of developing apnoea is inversely related to the postconceptional age being more common in infants with a postconceptional age <44–46 weeks,[7 8 10] but has been reported in older infants[7] and may be related to anaemia.[12] It cannot be predicted reliably by a previous history of apnoea or by preoperative pneumography.[10]

The pathogenesis of postoperative apnoea is multifactorial and involves an abnormality of central respiratory control and airway obstruction.[10] The majority occur in the immediate postoperative period, which may reflect the depressant effects of low concentrations of general anaesthetic agents on respiratory drive[13] and the residual effects of muscle relaxants on upper airway tone.[14] However, the mechanism of late onset apnoea occurring 2–12 hours after surgery is unclear and may be related to the respiratory depressant effect of high levels of endorphins.[15]

Although Welborn *et al* have demonstrated that caffeine 10 mg/kg, administered at induction of anaesthesia, diminishes the incidence of postoperative apnoea,[16] these infants are still at risk from the respiratory complications of intubation and ventilation.[17] Furthermore, it is our impression, and this has also been observed in other centres,[18] that infants with bronchopulmonary dysplasia who develop any of these problems, and who need ventilation postoperatively, are difficult to wean and suffer a setback in their overall recovery.

Spinal anaesthesia

In view of the problems associated with general anaesthesia Abajian *et al*[19] proposed the use of spinal anaesthesia for former preterm infants requiring inguinal herniotomy and the technique is now widely accepted.[20–22] It involves subarachnoid injection of local anaesthetic through a small (25 gauge) lumbar puncture needle inserted at the L4–L5 or L5–SI interspace. Hyperbaric bupivacaine 0·5% or hyperbaric tetracaine 1% are the most commonly used drugs for spinal anaesthesia. There is no reliable method of estimating the extent of sensory loss in these patients but adequate blockade is usually heralded by the rapid onset of flaccid paralysis of the lower limbs after administration of the drug. In infants, unlike adults, cardiovascular stability is usually maintained and may be due to immaturity of the sympathetic nervous system.[23] When spinal anaesthesia is established the infants either sleep or are easily placated with a soother and surgery can proceed. Since 1987 we have used it for inguinal surgery in these babies and find it satisfactory in the majority of patients. However, spinal anaesthesia is of short duration in infants, due possibly to differences in cerebrospinal fluid dynamics and in our experience is only suitable for procedures lasting less than 60 minutes. If surgery is unduly prolonged it may be necessary to supplement the anaesthesia with intravenous sedation, which increases the risk of apnoea.[22]

Although several studies have demonstrated the potential safety of spinal anaesthesia,[19–22] monitoring is required for an appropriate period after surgery as the risk of apnoea is still present in these infants.[24 25]

The advantages of spinal anaesthesia are that it causes minimal physiological disturbance, avoids the risks of general anaesthesia, and allows prompt return to preoperative feeding schedules.

Caudal epidural anaesthesia

Caudal epidural anaesthesia is widely used in paediatric practice as a supplement to general anaesthesia and for postoperative pain relief. Recently, it has been advocated as the sole anaesthetic technique in the awake premature infant needing inguinal surgery.[26–28] It involves puncture of the sacrococcygeal ligament and injection of local anaesthetic, usually bupivacaine 0·25% with 1:200 000 adrenaline, into the caudal space with onset of surgical anaesthesia within 20 minutes. Hazards inherent in the technique itself include the risk of dural puncture with subarchnoid injection of a large volume of local anaesthetic, and inadvertent intravenous injection. In our experience it is a useful alternative to spinal anaesthesia, is longer lasting, and provides postoperative analgesia.

Recommendations

Preterm infants needing inguinal herniotomy pose many problems for paediatric anaesthetists. The aim is to provide satisfactory surgical conditions with adequate anaesthesia while causing minimal physiological disturbance and rapid recovery to the preanaesthetic status. The complications associated with general anaesthesia are well recognised and an unsupplemented regional anaesthetic technique seems to be closest to the ideal. However these procedures are not without hazard, and may be associated

with serious complications. Therefore, vigilance by the anaesthetist is required during these procedures and throughout the operative period.

If the inguinal hernia is reducible, it is our practice, in common with other centres,[6] to defer surgery until the overall condition of the infant is stable. Herniotomy is usually performed before discharge from the neonatal intensive care unit. If an infant, who has already been discharged home, develops a hernia, surgery is performed within 24 hours and the infant is admitted to hospital for overnight monitoring.

It must be emphasised that, irrespective of the anaesthetic technique used, all infants with a postconceptional age <44–46 weeks should have apnoea monitoring for 12 hours postoperatively.[3] It is our practice to use similar monitoring in infants with a postconceptional age <60 weeks, and we do not consider them suitable for day surgery. As these infants represent a high risk it would seem prudent to refer them for management by paediatric anaesthetists and paediatric surgeons. Surgery should be performed in a centre capable of providing adequate postoperative care and if necessary postoperative ventilation.

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