neurobiological effects in the neonate.⁸ At term the vascularity of the epidural space is increased, thus enhancing the possibility of systemic drug absorption. Epinephrine (1:200,000) is commonly employed to decrease systemic absorption. However, it should be noted that resultant plasma concentrations of epinephrine may be sufficient to produce peripheral vasodilation through beta-adrenergic stimulation.

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What is the place of bupivacaine in obstetric epidural analgesia?

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Bupivacaine is the most widely used local anaesthetic in obstetric anaesthesia because of its properties of long duration of action, weak motor block in analgesic concentrations, and greater safety for mother and foetus. Bupivacaine was reputed to be safer for the foetus and neonate because: the low umbilical blood/maternal vein ratio suggested reduced placental transfer of drug; the drug was reported to have a short half-life in the neonate (60-90 min); and there was an absence of neurobehavioural effects. However, none of these advantages has stood the test of time.¹⁻³ Additionally, unpublished case histories suggest that bupivacaine induced seizures without depression of the maternal cardiovascular system may result in foetal asphyxia and poor outcome, presumably from uterine hyperactivity and/or uterine artery spasm.

Bupivacaine may occasionally have a slow, unpredictable spread of analgesic effect (30-40 min), result in spotty analgesia, regress in 60-90 min, or progress to higher spinal segments after an established block. Use of epinephrine in obstetrics is controversial, despite the fact that there are no clinical studies demonstrating any adverse neonatal effects.^{4,5} In the author's experience, the efficacy of bupivacaine can be improved by the use of a 50/50 mixture of 0.5 per cent bupivacaine and one per cent lidocaine or mepivacaine with epinephrine; a 10-12 ml dose of this mixture provides fast, reliable onset and longer duration of labour pain relief and facilitates perineal anaesthesia.

Bupivacaine 0.75 per cent, in a dose of 18-20 ml, was often used for Caesarean section but reports of cardiac arrest with this concentration and dose resulted in a warning against its use in

obstetrics by the Food and Drug Administration (United States),* Health Protection Branch of the Department of National Health and Welfare (Canada) and the drug manufacturers.† Bupivacaine-induced cardiac arrest has usually been fatal despite prolonged cardiopulmonary resuscitation (CPR). Such prolonged resuscitation (30 min), has a poor prognosis, although complete recovery has been reported with CPR for 15 to 20 min.⁶⁻⁸ Cardiac massage produced some perfusion of the uterus (a nonvital organ), as evidenced by foetal survival for 15–30 min before delivery.‡

Bupivacaine 0.5 per cent 20–30 ml provides more reliable and safer anaesthesia for Caesarean section than bupivacaine 0.75 per cent since a higher dermatome level can be obtained with lower dosage. However, except for a lower incidence of hypotension and longer postoperative pain relief, bupivacaine affords no advantages for Caesarean section compared to other local anaesthetics: the use of bupivacaine is associated with a slower spread of surgical analgesia,^{9,10} longer recovery room time,¹¹ and may result in sudden cardiovascular collapse.‡

Enhanced cardiovascular toxicity of the longer acting amide local anaesthetics (bupivacaine and etidocaine) compared with that of the shorter acting (lidocaine),¹² while controversial, has become more accepted as a result of animal studies directed toward specific aetiology and therapy. Experiments in the awake ewe model demonstrated that: bupivacaine is more cardiotoxic than lidocaine; acidosis and hypoxia, even when promptly corrected, make a critical difference in the cardiotoxicity of bupivacaine but not that of lidocaine; and prolonged CPR (30 min) was unsuccessful with bupivacaine induced cardiotoxicity because of prolonged electromechanical dissociation.^{13,14}

Lidocaine blocks sodium channels in a fast-in, fast-out fashion (FIFO) and has little cardiac block-

ing action at normal heart rates.§ Bupivacaine blocks sodium channels in a fast-in, slow-out fashion (FISO) and, compared to lidocaine at equipotent concentrations, is about four times more effective than lidocaine in depressing cardiac conduction over the range of physiological heart rates.¹⁵ Furthermore, a small amount of diastolic depolarisation (secondary to seizure-induced hypoxia and acidosis) would be expected to markedly increase bupivacaine's depressant effect on cardiac conduction. Resuscitation may require large doses of epinephrine to reverse conduction block, possibly by hyperpolarising the membrane.^{16,17}

Physicians can neither predict nor identify with laboratory testing individuals with unusual susceptibility to bupivacaine toxicity; the incidence may be 1/20,000 to 1/100,000. The dose of bupivacaine causing cardiovascular collapse in obstetric patients may be unusually small (75 mg).‡ While the risks appear to be considerably less with bupivacaine 0.5 per cent compared to that with 0.75 per cent, it would be prudent to consider the use of other local anaesthetics or to use 0.5 per cent bupivacaine with epinephrine for surgical procedures and to inject it slowly (1–2 min), and incrementally (20–30 mg every 2–3 min).

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The rational use of bupivacaine in obstetric epidural anaesthesia

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In August, 1983, Canadian anaesthetists were advised by the Drugs Directorate of the Health Protection Branch of the Department of National Health and Welfare, Ottawa, in conjunction with the drug company, Winthrop Laboratories, that bupivacaine 0.75 per cent was no longer recommended for use in obstetric analgesia and anaesthesia.* This advisory resulted from American reports of cardiac arrest in patients receiving this concentration of the drug.†‡ Since then, two Canadian publications have commented on the advice concerning bupivacaine,§ and recommended techniques for the safe use of the drug. However, despite reports about its possible cardiotoxicity, bupivacaine remains the preferred local anaesthetic agent in obstetric anaesthesia and has three major uses.

Epidural analgesia in labour

Continuous epidural analgesia (intermittent injection)

Since epidural drug dose requirements are reduced

*Blair I. New recommendations about bupivacaine (Letter). Winthrop Laboratories. 29 August, 1983.

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