Does total intravenous anaesthesia increase the risk of awareness?

Total intravenous anaesthesia (TIVA) with propofol given by repeated boluses, manual infusion or target controlled infusion is associated with a low incidence of postoperative nausea and vomiting. It is also useful in certain types of surgery, e.g. when administration of volatile anaesthetics is difficult. One reason for reluctance to use TIVA is the belief that the incidence of awareness under anaesthesia is greater than with volatile anaesthetic agents.

TIVA increases risk of awareness

There is more variability in the plasma concentration of propofol than volatile agents, as propofol has greater pharmacokinetic and pharmacodynamic variability. Propofol dosing should be calculated according to the patient's lean body mass; estimation of this weight is a potential source of error.

Concentrations of an intravenous agent cannot be continuously monitored in each patient. Target controlled infusions can only estimate the effector site concentration from a nomogram based on the patient's weight. This contrasts with volatile agents, where the end tidal concentration of anaesthetic agent (ETAA) is routinely monitored and can be compared with minimum alveolar concentrations (MAC) for that agent.

Failure of delivery of the anaesthetic agent is unlikely with volatile agents, as interruption of ventilation should trigger apnoea or ventilator failure alarms, and a minimum ETAA alarm can be set on most anaesthetic machines. With TIVA, a tissued cannula or disconnected line can easily go unnoticed.

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TIVA does not increase risk of awareness

No randomized controlled study has compared the incidence of awareness between TIVA and inhalational anaesthesia but it seems to be similar in comparable prospective studies, despite the arguments above. Nordström et al (1997) prospectively studied 1000 patients anaesthetized with TIVA. Patients were premedicated and anaesthetized with a manual infusion of propofol and alfentanil based on age and lean body mass, given muscle relaxants and ventilated with a mixture of air and oxygen. The incidence of explicit recall was 0.2%.

Sandin et al's (2000) prospective study subjected patients to a structured interview in the recovery unit, and at 1–3 days and 7–14 days postoperatively. This study recruited 11 785 patients, but only 288 (2.4%) were anaesthetized with TIVA. The incidence of explicit recall was 0.19%; no cases of awareness were reported in patients anaesthetized with TIVA.

In Nordström's trial, the first 500 patients answered two questionnaires early in the postoperative period. One patient subsequently reported awareness with severe posttraumatic neurosis but this was only identified 4 days postoperatively, after a period of complete amnesia for intraoperative events. As a result, the second 500 patients answered a further questionnaire at 7 days. The incidence of awareness may have been underestimated in the first 500 patients.

The B-aware trial of 2463 patients at high risk of awareness included 1055 patients anaesthetized with TIVA, and there was no significant difference in use of TIVA in the bispectral index (BIS) and control groups (P=0.553) (Myles et al, 2004). The BIS group had 0.16% explicit recall compared to 0.88% in the control group (P=0.022). The study did not look at the specific incidence of awareness in the TIVA group, but found that the infusion target was significantly lower in the BIS group, suggesting that anaesthetists infuse more propofol than required to prevent awareness when BIS is not used.

Although measurement of ETAA is best practice when using volatile agents, MAC is a surrogate measure. It is an ED50 (effective dose at which 50% of patients do not move in response to a standard stimulus) for patient movement, and this response does not equate to explicit recall but is the result of spinal reflexes. MAC is the same in decerebrate and intact rats (Rampil et al, 1993). It also does not allow for premedication, patient age or physiological factors. ETAA monitoring has not been shown to reduce awareness. Sandin et al (2000) found no difference in incidence of explicit recall whether ETAA was used or not.

Conclusions

There is no objective evidence that TIVA increases the risk of awareness. The endpoints used to determine depth of anaesthesia may be more important than the type of anaesthetic administered. **BJHM**

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