

## *Editorial*

---

# Postcraniotomy pain remains a real headache!

It is still a common belief that patients undergoing craniotomy experience minimal pain in the postoperative period. However, this old dogma is not substantiated by good scientific data. On the contrary, many clinical studies indicate that postoperative pain management after intracranial surgery is poor and is associated with unsatisfactory pain relief [1–3]. A major problem is that postoperative pain management of craniotomy patients has not been well studied, and healthcare providers lack good evidence-based guidelines to provide appropriate postoperative analgesia for neurosurgical patients.

Few studies have focused specifically on the incidence and severity of postoperative pain in patients after intracranial surgery. In 1995 Stoneham and Walters sent a postal questionnaire to members of the Neuroanaesthesia Society of Great Britain and Ireland regarding postoperative neurosurgical analgesia [4]. They reported that over half of the 110 respondents thought that analgesia was inadequate. A year later the same investigators reported that 84% of patients who had an elective craniotomy and had their postoperative pain treated with codeine complained of moderate to severe postoperative pain at some time during the first 24 h after surgery [2]. Similarly, in a pilot study De Benedittis and colleagues found that over 60% of patients who had neurosurgery, had postoperative pain and two third of those patients reported moderate to severe pain [1]. They also reported that postoperative pain occurred most frequently during the first 48 h after surgery with the maximum incidence occurring at 12 h after surgery. Consistent with the results of De Benedittis and colleagues, Leslie and colleagues recently reported that cranial surgery patients experience moderate to severe pain on the first and second postoperative days [5]. Thus, several prospective but small studies have documented a high incidence of moderate to severe postcraniotomy pain.

Additional data on postcraniotomy pain comes from studies where pain assessment was a secondary endpoint in the evaluation of drugs. One of these studies demonstrated that a relatively weak nonopioid analgesic (paracetamol) was insufficient to treat postcraniotomy pain when a short-acting opioid (remifentanyl) was used intraoperatively [3]. Indeed the pain control was so bad that enrollment to this study group was stopped after the first six patients experienced significant postoperative pain. Only one study, a retrospective chart review, reported that craniotomy patients have minimal postoperative pain [6]. The craniotomy patients in this study received over 500 µg of fentanyl intraoperatively and pain data was collected for only 90 min postoperatively. Another way to interpret these data is that intraoperative use of a moderate amount of an opioid, fentanyl, is sufficient to provide significant analgesia for craniotomy patients for the first 90 min after surgery. This interpretation is in agreement with the results of Gelb and colleagues who reported that the incidence of severe postoperative pain is only 11% when moderate amounts of fentanyl was administered intraoperatively but the incidence more than doubled to 24% when patients received a shorter-acting opioid, remifentanyl, followed by a small dose of morphine [7].

Several studies have reported that the location of surgery (infratentorial vs. supratentorial) does not have an effect on the incidence and severity of postoperative pain, while a few have found site to be of importance [1,2,8,9]. It is likely that the amount of pain is more related to the amount of muscle damage than the surgical location relative to the tentorium. Thus a supratentorial craniotomy that involves resection of temporalis muscle or an infratentorial one that involves splitting the posterior cervical muscles is much more painful than other supratentorial or infratentorial approaches that do not involve the muscles.

The study of postcraniotomy pain is challenging because of several confounding variables including the use of differing intraoperative anaesthetics/opioids, lack of standardized postoperative pain management protocols, subjectivity of the pain assessment techniques and the patients' neurological status. Most

---

Correspondence to: Pekka O. Talke, Department of Anesthesia and Perioperative Care, University of California, 521 Parnassus Ave., San Francisco, CA 94143, USA. E-mail: talkep@ucsf.edu

Accepted for publication March 2005 EJA 3145

studies have excluded aphasic patients or those whose poor neurological status makes the use of standard visual analogue scale (VAS) scoring systems difficult. However, it is vitally important that we carefully differentiate those who have no pain from those who cannot communicate their pain by 'usual' means. For the latter we have an obligation to develop and evaluate appropriate tools to assess their postoperative pain.

A few investigators have studied the effect of local anaesthetics and analgesics on postcraniotomy pain. Infiltrating the scalp with either bupivacaine or ropivacaine decreases pain after craniotomy [10,11]. The analgesic effect appears to be long acting because infiltration prior to incision in some studies reduces postoperative pain and therefore may be working through pre-emptive analgesic mechanisms [11]. Although infiltrating the scalp with local anaesthetics reduces postoperative pain, it does not reduce the need for postoperative pain medications because the effect at best only lasts through the first few postoperative hours.

Studies of postcraniotomy use of analgesics show that potent opioids (codeine, morphine and oxycodone) provide better pain relief than weaker analgesics such as tramadol, paracetamol or ketoprofen [9,12]. Morphine and codeine appear to have similar efficacies if appropriately dosed to accommodate the greater variability in individual response with codeine [13,14]. Surprisingly, some are still administering analgesics intramuscularly (i.m.); a route that compared to intravenous (i.v.) administration is associated with a slower onset, a more variable absorption and pain on injection [4,7,9,13,14]. None of the studies evaluating different analgesics for postcraniotomy pain have been sufficiently large to have the power to assess the side effects of the analgesics. This is unfortunate because the potential side effect profile of opioids has been the deterrent to their routine use to adequately treat postcraniotomy pain.

Use of morphine to treat postcraniotomy pain has been limited because of its potential to produce miosis, sedation, nausea and respiratory depression. However, in the published studies none of these effects have been reported to be of clinical significance in postcraniotomy patients suggesting that in the current care settings, its use is relatively safe. On the other hand, there are no good clinical studies that have evaluated the safety of i.v. morphine when used in quantities that provide adequate postcraniotomy pain control.

Roberts in the current issue of the *European Journal of Anaesthesiology* addresses many of these issues [15]. The responses to her analgesia questionnaire point out that codeine is still the most commonly used analgesic after intracranial surgery in Great Britain and that it is often administered i.m. Her results also

show that formal pain assessment (the fifth vital sign) is not done routinely. So what has changed since Stoneham published their questionnaire results almost 10 yr ago? Not much. Thus, Roberts' results point out the urgent need for evidence-based pain management data for craniotomy patients, the need to better educate all care givers on pain management techniques, the importance of routine pain assessment and the potential need to standardize postcraniotomy pain management once appropriate data is available. Although the questionnaire by Roberts serves a purpose in assessing current practices in British neurosurgical centres as seen through the eyes of nursing staff, future surveys should include the views of other caregivers and patients.

From the current article by Roberts and the literature, it is clear that several studies should be conducted to improve the safety and efficacy of postcraniotomy pain management. Prospective, well-controlled clinical studies are needed to test the hypothesis that craniotomy patients can be provided with adequate postoperative analgesia without significant analgesic-induced side effects. In addition to studying (patient controlled) morphine and codeine, multi-modal approaches using combinations of opioids, local anaesthetics, nonsteroidal anti-inflammatory agents and alpha-2 adrenoceptor agonists should be studied. The studies need to control for intraoperative use of anaesthetics and analgesics. Pain should be assessed for a minimum of 12 h after surgery and preferably for 48 h. The methods of assessing severity of pain need to be detailed enough to include pain intensity at the time of assessment as well as the worst pain experienced since the last assessment, and the method of reporting pain data should include details on the distribution of data (outliers) in addition to the usual descriptive statistics. Pain assessment techniques should be developed and validated for patients with altered neurologic status and finally, studies need to be adequately powered to test the hypothesis.

In summary, the literature demonstrates that the incidence and severity of postcraniotomy pain can be significant and more importantly, that most patients do not get satisfactory postoperative pain relief. This may be a reflection of either poor postoperative pain management or a deliberate use of small doses of opioids in fear of potential opioid-mediated side effects. The adverse effects of postoperative pain and stress have been demonstrated while clinically significant and substantiated opioid-induced side effects have not been reported. Thus, there is a significant, immediate need for good clinical studies to improve pain management of postcraniotomy patients. In the interim we recommend that each unit carefully evaluate its current pain management practices, that i.v.

drugs be used in preference to i.m. and that the most potent appropriate analgesics be used.

P. O. Talke, A. W. Gelb  
 Department of Anaesthesia  
 and Perioperative Care  
 University of California  
 San Francisco, CA, USA

## References

- De Benedittis G, Lorenzetti A, Migliore M, Spagnoli D, Tiberio F, Villani RM. Postoperative pain in neurosurgery: a pilot study in brain surgery. *Neurosurgery* 1996; **38**: 466–469.
- Quiney N, Cooper R, Stoneham M, Walters F. Pain after craniotomy. A time for reappraisal? *Br J Neurosurg* 1996; **10**: 295–299.
- Verchere E, Grenier B, Mesli A, Siao D, Sesay M, Maurette P. Postoperative pain management after supratentorial craniotomy. *J Neurosurg Anaesthesiol* 2002; **14**: 96–101.
- Stoneham MD, Walters FJ. Post-operative analgesia for craniotomy patients: current attitudes among neuroanaesthetists. *Eur J Anaesthesiol* 1995; **12**: 571–575.
- Leslie K, Troedel S, Irwin K, *et al.* Quality of recovery from anesthesia in neurosurgical patients. *Anesthesiology* 2003; **99**: 1158–1165.
- Dunbar PJ, Visco E, Lam AM. Craniotomy procedures are associated with less analgesic requirements than other surgical procedures. *Anesth Analg* 1999; **88**: 335–340.
- Gelb AW, Salevsky F, Chung F, *et al.* Remifentanyl with morphine transitional analgesia shortens neurological recovery compared to fentanyl for supratentorial craniotomy. *Can J Anaesth* 2003; **50**: 946–952.
- Irefin SA, Schubert A, Bloomfield EL, DeBoer GE, Mascha EJ, Ebrahim ZY. The effect of craniotomy location on postoperative pain and nausea. *J Anesth* 2003; **17**: 227–231.
- Jeffrey HM, Charlton P, Mellor DJ, Moss E, Vucevic M. Analgesia after intracranial surgery: a double-blind, prospective comparison of codeine and tramadol. *Br J Anaesth* 1999; **83**: 245–249.
- Bloomfield EL, Schubert A, Secic M, Barnett G, Shutway F, Ebrahim ZY. The influence of scalp infiltration with bupivacaine on hemodynamics and postoperative pain in adult patients undergoing craniotomy. *Anesth Analg* 1998; **87**: 579–582.
- Nguyen A, Girard F, Boudreault D, *et al.* Scalp nerve blocks decrease the severity of pain after craniotomy. *Anesth Analg* 2001; **93**: 1272–1276.
- Tanskanen P, Kytta J, Randell T. Patient-controlled analgesia with oxycodone in the treatment of postcraniotomy pain. *Acta Anaesthesiol Scand* 1999; **43**: 42–45.
- Goldsack C, Scuplak SM, Smith M. A double-blind comparison of codeine and morphine for postoperative analgesia following intracranial surgery. *Anaesthesia* 1996; **51**: 1029–1032.
- Stoneham MD, Cooper R, Quiney NF, Walters FJ. Pain following craniotomy: a preliminary study comparing PCA morphine with intramuscular codeine phosphate. *Anaesthesia* 1996; **51**: 1176–1178.
- Roberts GC. Post-craniotomy analgesia: current practices in British neurosurgical centres – a survey of post-craniotomy analgesic practices. *Eur J Anaesthesiol* 2005; **22**: 328–332.