MANAGEMENT OF POST-CRANIOTOMY PAIN: past, present & future?

NEUROSIG QUEENSTOWN 2013

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Introduction

• Overview of Analgesia in Craniotomy
  • Past, Present & Future
    • PCA, Scalp Blocks, “other analgesics”

• Audit of post-craniotomy analgesia
  • What works in Christchurch

• Conclusions
The Past: Post-operative pain in Neurosurgery

- Traditionally held views:
  - Not too much of a problem
  - IM Codeine/Morphine has been the mainstay of Rx
  - Concerns re sedation v neurological assessment
  - ?effect of opioids on
    - CO$_2$/CBF
    - Miosis
    - PONV
    - Respiratory depression
The Past: Post-operative pain in Neurosurgery

- “There is no post-op pain because movement does not increase tension in tissues of the operative site”
  - Geevarghese KP 1977

- It has traditionally been taught that…….“Pain accompanying intracranial surgery is minimal and when present dangerous to treat”
  - Gottschalk A
Dunbar PJ et al. *Craniotomy procedures are associated with less analgesic requirements than other surgical procedures.* AA. 1999

- Retrospective Chart review (300 notes)
  - Intra-op opioid + PACU pain
    - Intracranial
    - MaxFax
    - Lumbar laminectomies
  - Intracranial procedures had $\frac{1}{2}$ the intra-op opioid (fentanyl) and $\frac{1}{3}$ post-op morphine
    - $\frac{1}{2}$ had no post-op pain
  - Intracranial procedures had lower pain scores
Dunbar PJ et al. **Craniotomy procedures are associated with less analgesic requirements than other surgical procedures.** AA. 1999

- But…….
  - Fentanyl based anaesthetic (mean 514ug)
  - PACU only
Stoneham & Walters 1995. *Post-operative analgesia for craniotomy patients: current attitudes among neuroanaesthetists*

- Survey 183 neuroanaesthetists (110 [60.1%] response)
  - 97% IM Codeine
  - 3% would consider morphine use post-op

- 56% “*post op analgesia inadequate*”

- 37 elective patients
  - 60% “complained” of pain
    - *Pulsating/pounding/heavy/stabbing*
    - 1\(^{st}\) 12 hours worst
    - \(\frac{2}{3}\) “moderate-severe”

> “pain management after neurosurgery is an important, although neglected, clinical problem”
Gottschalk et al 2007: *Prospective evaluation of pain and analgesic use following major elective intracranial surgery*

- 178 patients – craniotomy
  - 69% have moderate – severe pain on D1
  - 48% D2
  - Dissatisfaction with analgesia associated with elevated pain levels

“most patients have moderate – severe pain for the first 2 days after surgery that is often inadequately treated”
Roberts GC 2005. *Post-craniotomy analgesia: current practices in British neurosurgical centres*

- **Background:**
  - "many patients experiencing moderate-severe pain post-operatively"

- **Survey:**
  - 33 neurosurgical centres in UK (70% response)
    - 78% use Codeine only
    - 30% NSAID

- "10 years after Stoneham & Walters post-craniotomy analgesic practices do not appear to have progressed or developed”
- “there is a need for properly structured and methodologically robust studies to investigate the efficacy, safety and appropriateness of morphine PCA in post craniotomy patients”
So…….”post craniotomy pain remains a real headache”   Talke 2005

- Studies are difficult to interpret:
  - Differing intra-op anaesthetics + opioid regimes
    - role of fentanyl v remi
  - PACU pain management protocols
  - Subjectivities of pain assessments
  - Lack of power to evaluate side effects

- Incidence and severity of post craniotomy pain significant and most patients do not get good pain relief
  - poor pain management
  - deliberate use of small doses of opioids

- “immediate need for good clinical studies to improve pain management”
Morad AH et al 2009: *Efficacy of iv PCA after supratentorial intracranial surgery: a prospective RCT*

- 79 patients (GA + scalp block)
  - Randomised:
    - PRN 25-50ug fentanyl Q30min
    - PCA 0.5ug/kg fentanyl Q15min

- Results:
  - PCA group:
    - Lower pain scores
    - More Fentanyl (44 v 23 ug/hr........16 hrs)
    - No adverse events/assessment issues (but NOT powered for safety)
  - ?400 patients required
<table>
<thead>
<tr>
<th></th>
<th>No PCA</th>
<th>PCA</th>
</tr>
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<tbody>
<tr>
<td>mean overall intraop fentanyl dose (µg)</td>
<td>514 ± 310</td>
<td>506 ± 170</td>
</tr>
<tr>
<td>mean intraop fentanyl dose (µg/kg)</td>
<td>6.82 ± 3.98</td>
<td>6.83 ± 2.49</td>
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<tr>
<td>mean midazolam dose (mg)</td>
<td>0.429 ± 0.948</td>
<td>0.103 ± 0.409</td>
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<tr>
<td>dexamethasone</td>
<td>31 (89)</td>
<td>24 (83)</td>
</tr>
<tr>
<td>initial pain score (0-10)</td>
<td>3.62 ± 2.11</td>
<td>2.53 ± 1.96</td>
</tr>
<tr>
<td>mean pain score (0-10)§</td>
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<tr>
<td>mean fentanyl use (µg/hr)§</td>
<td>23.6 ± 23.7</td>
<td>44.1 ± 34.5</td>
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<tr>
<td>mean fentanyl use by weight (µg/kg/hr)§</td>
<td>0.321 ± 0.320</td>
<td>0.558 ± 0.376</td>
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**Postop events**

- nausea or vomiting: 16 (46) vs. 20 (69)
- pruritus: 2 (6) vs. 5 (17)
- uncontrolled pain: 2 (6) vs. 0 (0)
- uncontrolled nausea/vomiting: 0 (0) vs. 1 (3)
- excessive sedation/respiratory depression: 0 (0) vs. 0 (0)
- neurological deterioration: 1 (3) vs. 2 (7)

- 80 patients randomised
  - 65 completed the study:
    - 31 PCA Fentanyl
    - 34 PRN Fentanyl
      - 1:1 or 1:2 nursing (ie ICU)
      - Continuous electronic monitoring
  - Results PCA group:
    - Increased Fentanyl use
    - Better pain scores
      - ½ incidence of “severe pain” (>6/10)
      - 0% incidence of safety related adverse events [CI 0-9.2%]
Is PCA safe?

Changes in PaCO2 [kPa] after craniotomy

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<td>1 h</td>
<td>0.16 (0.53), [-0.90-1.5]</td>
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<td>4 h</td>
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<td>-0.13 (0.57), [-0.9-1.2]</td>
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Is PCA safe?
Respiration monitoring

• APSF recommendation
• CO\textsubscript{2} monitoring impractical
• Masimo RRa “listens” for airflow in the trachea
• Well tolerated by patients
• Nurses love it!
Scalp Blocks

• 1st described by Pinosky 1996

• Regional anesthesia to nerves innervating the scalp:
  • Supra-orbital & Supra-trochlear ($V_1$)
  • Auriculo-temporal ($V_2$)
  • Post-auricular branches of the Greater Auricular Nerves
  • Occipital nerves
Anaesthesia’s easiest block?
Studies

- Haemodynamic stability to pins
  - Pinosky 1996

- Prolonged analgesia >48hrs (VAS scores)
  - Nguyen 2001

- “Equivalent” transitional analgesia to 0.1mg/kg morphine
  - Ayoub 2006

- Evaluate current evidence about analgesia after craniotomy
- 9 suitable RCTs
  - 519 patients in total looked at 4 modalities
    - Scalp infiltration
    - Scalp nerve block
    - Parecoxib
    - PCA
- Best evidence for scalp LA
Audit: *Post craniotomy analgesia at Christchurch Hospital*

- Predominately 2 anaesthetists involved
- 2 main anaesthetic “techniques”
  - Intra-operative Remifentanil + Morphine
  - Intra-operative Fentanyl + Scalp Blocks
- All patients had:
  - Nurse-administered iv Morphine increments available in PACU
  - LA wound infiltration (at start of craniotomy)
  - Adequate Paracetamol
Results:

Post-Craniotomy Analgesia

- 54 Supratentorial Craniotomies
  - 13 Case Notes Lost
  - 38 Case notes reviewed
  - 3 patients not analysed
  - Post op ICU ventilated
- 12 Scalp Blocks Group SC
- 26 Remi + Morphine Group RM
PACU ANALGESIA

Group No Block/Remi
- 6 (23%) patients had no pain
- 7 (27%) patients had “negative” comments about pain.
- Morphine 0 [9]-17mg
  - Mean 3.26mg
- 1 patient required naloxone infusion

Group Scalp Block
- 9 (75%) patients had no pain
- 1 patient required 3 mg morphine
- 1 patient required single dose (60mg) codeine
Neuro HDU ANALGESIA
1st 24 Hours

Group No Block/Remi
- 15 (58%) required Morphine
  - Dose 7.5-100mg
- 9 (35%) required Codeine PO₄
  - Dose 60-240mg
- Tramadol in 2 patients
- 6 (23%) patients no opioid analgesia

Group Scalp Block
- 2 (16%) patients required Morphine
- 3 (25%) required Codeine PO₄
- Oxynorm in 1 patient
- 7 (58%) patients no opioid analgesia
AUDIT SUMMARY

- Retrospective audit of 2 intra-operative analgesic techniques:
  - Remifentanil & Morphine
  - Fentanyl & Scalp Blocks

- Scalp Blocks:
  - 75% have no pain in PACU (v 23%)
  - 58% require no opioid in 1st 24 hours (v 23%)
Explanations?

- Scalp blocks
  - Audit results broadly consistent with studies

- Remifentanil v Fentanyl
  - Revolutionised neuroanaesthesia practice
    - Control haemodynamics with opioids & still wake the patient up!!!
  - Use has "revealed" problems not seen with other opioids……………..OIH
Opioid-induced Hyperalgesia (OIH)

- Paradoxical sensitisation to pain induced by opioids
- Albutt 1870:
  - “does morphia encourage the very pain it pretends to relieve?”
  - “reliance on morphia only ended in that curious state of perpetuated pain”
- Needs to be differentiated from inadequate Rx and “acute tolerance”
  - Progressive lack of response to a drug which can be overcome with increasing doses
- OIH occurs with remi @ 0.1ug/kg/min >4hrs
“Anti-analgesia”

- “Complex neurobiology and likely to involve more than one system!”

- OIH has some features of both acute tolerance & sensitisation
  - Pre and post-synaptic changes
  - Central, spinal cord & peripheral neuroplastic changes
    - NMDA receptor system
      - ?role of gabapentin & ketamine
      - ?Internalisation of µ receptors
    - Genetics

GE Navigator

- Models:
  - Anaesthetic agents
  - Analgesia
  - Muscle relaxation

- Manual/Automatic inputs

- Allows “easy” fentanyl infusions
  - Target Ce 2-2.2ng/ml
Other analgesics

- iv Paracetamol
  - Post-op discectomy/laminectomy
    - 40 patients randomised to iv paracetamol/placebo
      - Pain scores lower
      - PONV lower
      - Better “subjective” assessment of pain management
      - Morphine consumption same
  - *Improves “quality” of analgesia*

Other analgesics

- Parecoxib:
  - 100 patients randomised to parecoxib v placebo
  - PCA morphine/iv paracetamol/scalp LA
- No differences (out to 24 hrs) in:
  - Morphine use
    - Trend to reduced morphine requirement in PACU
      - 53% v 70% required morphine
  - Median morphine use at 24hrs equivalent
- Pain intensity
- PONV

Williams DL et al. Effect of iv parecoxib on post-craniotomy pain. BJA 2011
Other analgesics

- **Tramadol**
  - 50 patients randomised to 100mg Tramadol BD v “standard” (paracetamol/oxycodone)
  - Reduced:
    - LOS (4 v 3 days)
    - Pain scores
    - Rescue morphine
    - Less total analgesia at lower overall cost

So what do I do?

- Unilateral scalp block
- Intraoperative Fentanyl infusion (550-800ug)
- 1g iv Paracetamol Q6H 1st 24 hrs
- Post-op Fentanyl/Droperidol PCA
- Neuro HDU +/- RRa monitoring (Posterior fossa)
- NSAIDs (Ibuprofen 400mg TDS @ 36hrs)
- Tramadol or Gabapentin for “problem” patients