Depth of anaesthesia predicts post-operative pain at six weeks following wide local breast tissue excision and sentinel node biopsy

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Background

Some argue that light anaesthesia reduces post-operative mortality and morbidity (Monk, 2010). Others have argued that light anaesthesia may lead to post-operative psychological sequelae (Wang *et al.*, 2004). Studies using the isolated forearm technique have demonstrated that intraoperative consciousness sufficient to enable response to command (with post-operative amnesia) is much more common than unplanned intraoperative awareness with post-operative recall (Russell, 1993). *Does light anaesthesia with amnesia cause sensitisation of pain perception leading to elevated levels of post-operative pain?*

Material and methods

60 women (ASA 1 and 2) undergoing wide local excision of breast tissue and sentinel node biopsy recruited, **mean age 62.1** range 31 to 85. Anaesthetic technique: Propofol *induction* and Sevoflurane (1to1.5 MAC) in 50% nitrous oxide *maintenance* along with Atracurium. Depth of anaesthesia monitored using Bispectral Index (Covidien Vista Monitor 185-0151 & BISx 185-0145-AMS)(MW,PB). The anaesthetist delivering the anaesthetic blind to BIS index. The anaesthetist was told the patient was “light” if the BIS index exceeded 55, and also told the patient was “deep” if the BIS index fell below 30. Average BIS recorded for each minute throughout.

Pre-Op	2-3 days	6 weeks	3 months
STAI (state&trait)	STAI (state)	STAI (state)	STAI (state)
McGill Pain	McGill Pain	McGill Pain	McGill Pain
VAS pain	VAS pain	VAS pain	VAS pain
Pain Intensity	Pain Intensity	Pain Intensity	Pain Intensity
Pain LoC			

Results and discussion

21/60 patients exceeded a BIS of 60 at some point during their surgery, with one as high as 88. No patient had explicit post-operative recall. **Significant positive correlations were found between (1) the BIS index post induction, (2) during the five-minute epoch immediately following initial incision, and post-operative pain measures at six weeks** ($r=0.43$, $p=0.002$; $r=0.285$, $p=0.039$), but not at the other two time points. The patient sample was divided using a BIS cut-off of 50 creating “deep” and “light” groups. **An independent t-test demonstrated significant differences between these two groups on Present Pain Intensity** ($t=2.42$, $p=0.019$) and approached significance on the McGill Pain Questionnaire ($t=1.90$, $p=0.063$) and on the visual analogue scale ($t=1.83$, $p=0.073$) at six-week follow-up.

Scatterplot of VAS pain scores at 6 weeks against BIS during the 5-minute post incision epoch

Variable	Mean for correlated patients (N=26)	Mean for uncorrelated patients (N=23)	T-test significance
Age	59.3	67.1	0.010
STAI state	43.1	36.0	0.046
STAI trait	36.1	31.0	0.026
Overall mean BIS	40.0	43.9	0.008
MPQ pre-op	4.4	1.5	0.014

These results support the hypothesis that light anaesthesia may allow sensitisation to pain, specifically at 6 weeks post-operatively. How do we explain the absence of such a relationship at 2 days and 3 months? At 2 days, a variety of medical and surgical variables predominate in influencing pain perception, including analgesic dose, and so it is not surprising that more subtle psychological influences were masked. At 3 months most patients were pain-free and scoring minimally on pain measures (37/48), leaving little scope for significant correlation.

Conclusion

We found evidence of a positive relationship between intra-operative anaesthetic lightness and post-operative pain at six weeks following breast surgery in a cohort of 60 women. These findings, if replicated, suggest that routine depth of anaesthesia monitoring and responsive adjustment of anaesthetic dose may reduce post-operative pain. They also support the intriguing theory that intra-operative events and stimulation may be processed by the patient under light anaesthesia and have post-operative effects despite explicit amnesia.

References

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