

# Fine tuning depth of anaesthesia: important impact on quality of care or merely waste of cost associated to EEG-electrodes

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Day surgery is becoming increasingly popular and more and more patients and surgical procedures are nowadays managed as day cases. Enhanced recovery and early discharge has a number of beneficial effects. Shortening hospital stay reduces most certainly the risk for nosocomial infections. Early ambulation and alimentionation has without doubt beneficial effects on the homeostasis and reduces the risk for thromboembolic complications. But are all patients suitable for day surgery? Some may argue that the elderly may have a problem with early discharge and the demand for self-care already short after end of surgery and anaesthesia. Surgery and anaesthesia exert comparatively greater adverse effects on the elderly than on the younger brain, manifest by the higher prevalence of postoperative delirium and cognitive dysfunction. Strom et al [1] recently raised the question; *Should general anaesthesia be avoided in the elderly?* Efforts should without doubt be put on optimising the perioperative care of the elderly patient.

The enhanced recovery logistics has also been shown to reduce the risk for cognitive side effects [2]. The combination of a fast-track set-up with multimodal opioid-sparing analgesia has been shown by the Kehlet group in Copenhagen [3] to eliminate the occurrence of delirium after elective arthroplasty in elderly patients. They suggest that fast-track methodology may reduce the incidence of postoperative cognitive decline after surgery [4]. Whether day surgery per se protect the elderly from deterioration in cognitive performance as compared in hospital care has been suggested in one of the studies by the ISPOC group [5]. It seems obvious that effort should be made to avoid prolonged hospital stay in the elderly at risk patient for postoperative cognitive side effects; postoperative delirium (PD) and postoperative cognitive dysfunction (POCD).

The use of EEG-based depth-of-anaesthesia monitors in order to titrate anaesthetic depth, administration of anaesthetic has been shown to improve, facilitate emergence. Wong et al [6] showed already in 2002 that titration of isoflurane using the BIS index decreased utilization of isoflurane and contributed to faster emergence of elderly patients undergoing elective knee or hip replacement surgery. White et al [7] showed that compared with standard anaesthesia monitoring practice, adjunctive use of auditory evoked potential and BIS monitoring can improve titration of desflurane during general anaesthesia, leading to an improved recovery profile after ambulatory surgery. Liu [8] conducted a meta-analysis about the use of EEG bispectral index during ambulatory surgery in 2004 and concluded that the use of BIS monitoring modestly reduced anaesthetic consumption, risk of nausea and vomiting, and recovery room time. The beneficial effects from the use of EEG-based depth of anaesthesia monitoring on early recovery and anaesthetic consumption has also been supported

in the meta-analysis by Punjasawadwong et al [9] published in 2007 and the systematic review by Shepherd et al [10] published in 2013.

There is a strengthened interest for the use of EEG-based depth-of-anaesthesia monitors for titration of anaesthesia delivery in its possibility to reduce the risk for neurocognitive side effects such as delirium and cognitive dysfunction in at risk patients. Radtke et al [11] from Berlin published in 2013 a study showing that intraoperative neuro-monitoring was associated with a lower incidence of delirium, possibly by reducing extreme low BIS values. They suggest that in high-risk surgical patients e.g. the elderly, this may give the anaesthesiologist a possibility to influence one precipitating factor in the complex genesis of delirium. Jildenstål et al showed that AEP monitoring allows dose reduction of anaesthetic agents, leading to better cardiovascular stability and decreased requirements for intra-operative fluids and vasopressors. They also found a lower number of patients with cognitive decline at 24-hours [12] and that IL-6 increase [13] was less pronounced in the AEP titrated group of patients following minor ophthalmic surgery. There is also a recent study although in major surgery still suggesting obvious clinically important benefits associated to EEG-based titration of anaesthesia delivery in the elderly. Chan et al we tested in a randomized controlled trial, the effect of BIS monitoring on POCD in 921 elderly patients undergoing major non cardiac surgery. Patients were randomly assigned to receive either BIS-guided anaesthesia or routine care. The BIS group had anaesthesia adjusted to maintain a BIS value between 40 and 60 during maintenance of anaesthesia. Routine care group had BIS measured but not revealed to attending anaesthesiologists. Anaesthesia was adjusted according to traditional clinical signs and hemodynamic parameters. A neuropsychology battery of tests was administered before and at 1 week and 3 months after surgery. Results were compared with matched control patients who did not have surgery during the same period. Delirium was measured using the confusion assessment method criteria. The median (interquartile range) BIS values during the maintenance period of anaesthesia were significantly lower in the control group, 36 (31 to 49), compared with the BIS-guided group, 53 (48 to 57),  $P < 0.001$ . BIS-guided anaesthesia reduced the drug consumption similar to previous studies; the propofol delivery by 21% and that for volatile anaesthetics by 30%. There were fewer patients with delirium in the BIS group compared with routine care (15.6% vs. 24.1%,  $P = 0.01$ ). Although cognitive performance was similar between groups at 1 week after surgery, patients in the BIS group had a lower rate of POCD at 3 months compared with routine care (10.2% vs. 14.7%; adjusted odds ratio 0.67; 95% confidence interval, 0.32-0.98;  $P = 0.025$ ). Whether the choice of main anaesthetic has any

clinical significant impact on the risk for cognitive side effects is still not adequately studied. We do await the results from the Italian PINOCCHIO [14] study. The potential organ protecting properties of halogenated inhaled anaesthetics needs further studies [15,16]. There is also a most recent Cochrane meta-analysis around the regional anaesthesia and outcome [17]. The results are hard to interpolate for the day surgery practice, the authors merely conclude; *Compared with general anaesthesia, a central neuraxial block may reduce the zero to 30-day mortality for patients undergoing surgery with intermediate to high cardiac risk (level of evidence, moderate). Further research is required.*

It seems reasonable to conclude that day surgery, shortening the hospital stay, is reasonably of value for the elderly patients requiring surgery. Titration of anaesthetic delivery by the use of an EEG-based depth-of-anaesthesia monitor seems to have the potential to further improve the management of the elderly at risk for cognitive side effect patient. The choice of main anaesthetic and anaesthetic technique needs further studies. The elderly most however have adequate support and supervision; escort during transfer back home and adequate support during first postoperative days while in the home environment.

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