Original Article

Comparison of Adequacy of Anaesthesia (AoA) monitors with CONOX® monitor regarding sevoflurane consumption during routine general anaesthesia: A randomised clinical trial

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ABSTRACT

Background and Aims: Adequacy of Anaesthesia (AoA) and CONOX® are combined monitors that assess levels of anaesthesia and analgesia and give a comprehensive score. No studies have measured and compared the total consumption of inhaled anaesthetic agents while using these monitors. We designed a study to compare AoA and CONOX in terms of sevoflurane usage, fentanyl usage and recovery from the effects of anaesthesia. **Methods:** A randomised trial was conducted in 58 patients. Group A ($n = 31$) patients were monitored with AoA, and Group C ($n = 27$) patients were monitored with CONOX. Sevoflurane was titrated to maintain a state entropy value of 40–60 in AoA and a Quantium consciousness index (qCON) value of 40–60 in CONOX. Similarly, fentanyl was titrated with bolus doses of 0.5 μg/kg to maintain a surgical pleth index value of 40–60 in AoA and Quantium noxious index (qNOX) value of 40–60 in CONOX. Intraoperative awareness was assessed postoperatively using a modified Brice questionnaire. The *t*-test or Chi-square test was used to compare the parameters between the groups. **Results:** Mean sevoflurane consumption was similar between AoA and CONOX groups [13.2 (standard deviation {SD}: 3.9) (95% confidence interval {CI}:11.8, 14.5) versus 14.4 (SD: 3.7) (95% CI: 13.0, 15.7) ml/h] ($P = 0.236$). Fentanyl usage was higher in the AoA group compared to the CONOX group [146.2 (SD: 34.28) (95% CI: 134.13, 158.26) versus 128.2 (SD: 26.7) (95% CI: 118.12, 138.27) μg] ($P = 0.031$). The emergence time and haemodynamic instability events were similar between AoA and CONOX. **Conclusion:** Both AoA and CONOX measure anaesthetic depth similarly. However, interpreting qNOX values requires caution, as the patient's consciousness status influences them.

Keywords: Adequacy of Anaesthesia, anaesthetics, fentanyl, general, inhalation, qCON, qNOX, Quantium consciousness index, sevoflurane, surgical pleth index

INTRODUCTION

The depth of anaesthesia refers to the level of central nervous system depression and responsiveness to surgical stimulus. Monitors using electroencephalography (EEG) derived data, such as bispectral index (BIS), Entropy, and Narcotrend, have been subjected to various trials and have proved their efficacy.[1,2] These neurophysiological monitoring methods for the depth of anaesthesia have reduced intraoperative awareness, reduced anaesthetic agent usage and improved recovery from anaesthesia.[3–5] These monitors are associated with better haemodynamic stability. Conventionally, intraoperative analgesia was assessed just like depth of anaesthesia by clinical haemodynamic parameters. Various monitors quantify nociception, such as surgical pleth index (SPI) and Quantium

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noxious index (qNOX). These monitors assess the plethysmographic amplitude variability and EEG derived data, respectively. These monitors have been shown to significantly reduce the amount of analgesic agents used, and analgesic consumption is better titrated.[6–8]

Some monitors assess both the depth of anaesthesia and the level of analgesia and give a comprehensive score that would help balance the anaesthesia better, namely CONOX® (Quantium Medicals S.L.U, Barcelona, Spain) (non-invasive depth of anaesthesia monitor) and Adequacy of Anaesthesia (AoA) (GE Healthcare, Chicago, IL, USA). We assume that these monitors have similar efficacy in predicting the depth of anaesthesia. However, no studies have measured the total consumption of inhaled anaesthetic agents and compared them with each other while using these two monitors.

In this study, we aimed to compare the two monitors regarding the amount of sevoflurane consumed (primary outcome) while maintaining adequate depth of anaesthesia and analgesia. We hypothesised that sevoflurane consumption would be comparable in both groups. The total fentanyl consumed and recovery from the effects, along with haemodynamic parameters (secondary outcomes), were also compared.

METHODS

This randomised clinical trial was conducted in a tertiary care hospital from March 2020 to March 2022 and followed the standards of the Helsinki Declaration of 2013 and Good Clinical Practice guidelines. The institute ethics committee provided ethical approval for this study (vide approval number JIP/IEC/2019/485, dated 30/01/2020). The study was registered in the Clinical Trials Registry-India (vide registration number CTRI/2020/11/028864, www.ctri.nic.in). Informed written consent was obtained from patients before they participated in the study and also for using their data for educational and research purposes.

Patients aged 18–60, with American Society of Anesthesiologists (ASA) physical status I and II, scheduled for elective surgeries (mainly breast and ear, nose and throat surgeries) lasting 2–5 h under general anaesthesia with an tracheal tube, were included. Patients undergoing regional anaesthesia or laparoscopic surgeries were excluded.

Patients were assigned to either Group A (monitored with AoA) or Group C (monitored with CONOX) in the preoperative holding area using computer-generated simple randomisation sequences, and allocation concealment was ensured using sequentially numbered, opaque, sealed envelopes. Standard preoperative medications and instructions were given. Our study used the Datex Ohmeda Aisys CS2 (GE Healthcare, Chicago, IL, USA) anaesthesia workstation. This workstation calculates the total amount of anaesthetic gases utilised by the machine and divides them into the amount of liquid consumed. Before induction of anaesthesia, in addition to standard monitors, AoA (GE Healthcare, Chicago, IL, USA) electrodes (Entropy) were applied to patients assigned to Group A and CONOX electrodes were applied to the patients belonging to Group C. Both groups were monitored with a train-of-four (TOF) ratio for adequacy of neuromuscular blockade. All baseline parameters were recorded. After adequate preoxygenation with 6 l/min of oxygen, anaesthesia was induced with intravenous (IV) fentanyl 2 μg/kg, propofol 2 mg/kg, vecuronium 0.1 mg/kg. Patients were manually ventilated with a bag and mask for 5 min with sevoflurane 1% in oxygen to maintain either state entropy (SE) of 40–60 (Group A) or 40–60 of Quantium consciousness index (qCON) (Group C). During tracheal intubation, gas flows were paused. After tracheal intubation, the lungs were ventilated with a tidal volume of 6–8 ml/kg, and the respiratory rate was adjusted to obtain an end-tidal carbon dioxide concentration of 35–40 mmHg. A fresh gas flow of 2 L was set to deliver oxygen mixed in the air to maintain a fraction of inspired oxygen of 40%. Sevoflurane was titrated to maintain a value of 40–60 of SE in the AoA group and qCON in Group C. Delivery of sevoflurane was adjusted using end-tidal control with a 0.3% increase or decrease in target end-tidal concentration of sevoflurane at a time. The anaesthesia provider was blinded to the minimum alveolar concentration values. IV fentanyl 0.5 μg/kg boluses was administered to maintain a value of 40–60 of SPI in Group A and qNOX in Group C. IV vecuronium 0.01 mg/kg was administered when the TOF monitors elicited two responses. If the patient's blood pressure fell more than 20% from the baseline while maintaining the depth of 40–60 in either CONOX or AoA and SPI and qNOX of 40–60, other causes of hypotension were ruled out. An IV fluid bolus of 5–10 ml/kg and/or one dose of IV mephentermine 3 mg was administered and recorded. If blood pressure or heart rate rose above

20% of baseline and anaesthetic depth was within the acceptable range, after ruling out other causes, a beta-blocker (IV labetalol 2 mg increments) or a vasodilator (IV nitroglycerin 10 μg) was administered. The treating anaesthesiologist was allowed to decide whether or not to administer more or less anaesthetic agents according to the clinical scenario, and these were recorded. Sevoflurane was switched off at the start of skin closure in both groups, and fresh gas flows increased to 6 l/min at the end of skin closure. Residual neuromuscular blockade was reversed when the patient started taking spontaneous breaths or the TOF count was 3 or more. Mechanical ventilation continued until spontaneous respiration began, followed by assisted manual ventilation. A verbal command ('open your eyes') was given every 1 min. The trachea was extubated after obtaining a satisfactory response from the patient, a TOF ratio higher than 0.9 and a sustained head lift for 5 s. Recovery time (eye opening on verbal commands and orientation to time, place and person) was assessed at 1-min intervals. The time from skin closure (sevoflurane stop point) to extubation was considered the emergence time and was recorded.

An independent observer recorded intraoperative data from the study population, including total sevoflurane used (primary outcome) and secondary outcomes such as IV fentanyl consumption, recovery and emergence times for either group. After 24 h, patients were assessed for intraoperative awareness using a modified Brice questionnaire. Patients were observed in the post-anaesthesia care unit.

Based on a previous study,[5] the sevoflurane consumed using Entropy monitoring showed a standard deviation (SD) of 1.5 ml/h. Considering a difference of less than 1 ml/h for sevoflurane consumption as a non-inferiority while titrated using both the monitors, for a significance of 0.05 and power of 90%, a sample of 78 patients was required (39 in each group), using Open Source Epidemiologic Statistics for Public Health (OpenEpi) software (www.OpenEpi.com). Considering dropouts, 90 patients were to be enroled. However, a sample size of 56 (28 in each group) was finally proposed to be included as we had restricted elective admissions during the coronavirus disease 2019 (COVID-19) pandemic. This sample size gave us a power of 80%. Statistical Package for the Social Sciences statistics software version 21.0 (IBM Corp, Armonk, NY, USA) was used to analyse the data. Data with a normal distribution (such as age, heart rate, pulse oximetry, blood pressure) were compared using the Student's *t*-test and presented as mean with SD and 95% confidence intervals (CIs). Nominal data (gender, ASA class) were compared using the Chi-square test. The outcomes (amount of sevoflurane, fentanyl consumption and the emergence time) were compared between the two groups using Student's *t*-test. The incidence of intraoperative awareness between the groups was compared using the Chi-square test. A *P* value less than 0.05 was considered significant.

RESULTS

A total of 66 patients were screened, of whom 58 patients, 31 in Group A (AoA) and 27 in Group C (CONOX), were included in the study. Eight patients were excluded as the surgeries were postponed due to a lack of operation theatre time [Figure 1]. Demographics and the duration and type of surgery were similar between the groups [Table 1].

Sevoflurane consumption was not significantly different between groups A and C ($P = 0.236$). There was a significant more consumption of IV fentanyl in Group A compared to Group C ($P < 0.001$). There was no statistically significant difference in emergence time between groups A and C ($P = 0.214$). Incidence of possible associated intraoperative awareness was also comparable between the groups (3% in Group A versus 7.4% in Group C) [Table 2]. The haemodynamic parameters and use of vasoactive drugs were comparable in both groups.

Baseline SE and qCON values were statistically similar ($P > 0.05$), but preinduction SPI values were significantly lower than the preinduction qNOX values ($P < 0.05$) [Figures 2 and 3]. Intraoperative haemodynamic events like episodes of hypertension, tachycardia and hypotension were similar between the groups ($P > 0.05$). The total amount of blood loss and fluid administration were comparable in both groups ($P > 0.05$).

DISCUSSION

We undertook this study to assess and compare the difference in anaesthetic (sevoflurane) and analgesic (fentanyl) consumption under anaesthesia using the combined monitors, namely CONOX (Quantium Medicals S.L.U, Spain) and AoA (GE Healthcare, Chicago, IL, USA) monitors. We found no difference in sevoflurane usage between the groups, but significantly more IV fentanyl was used in the AoA group.

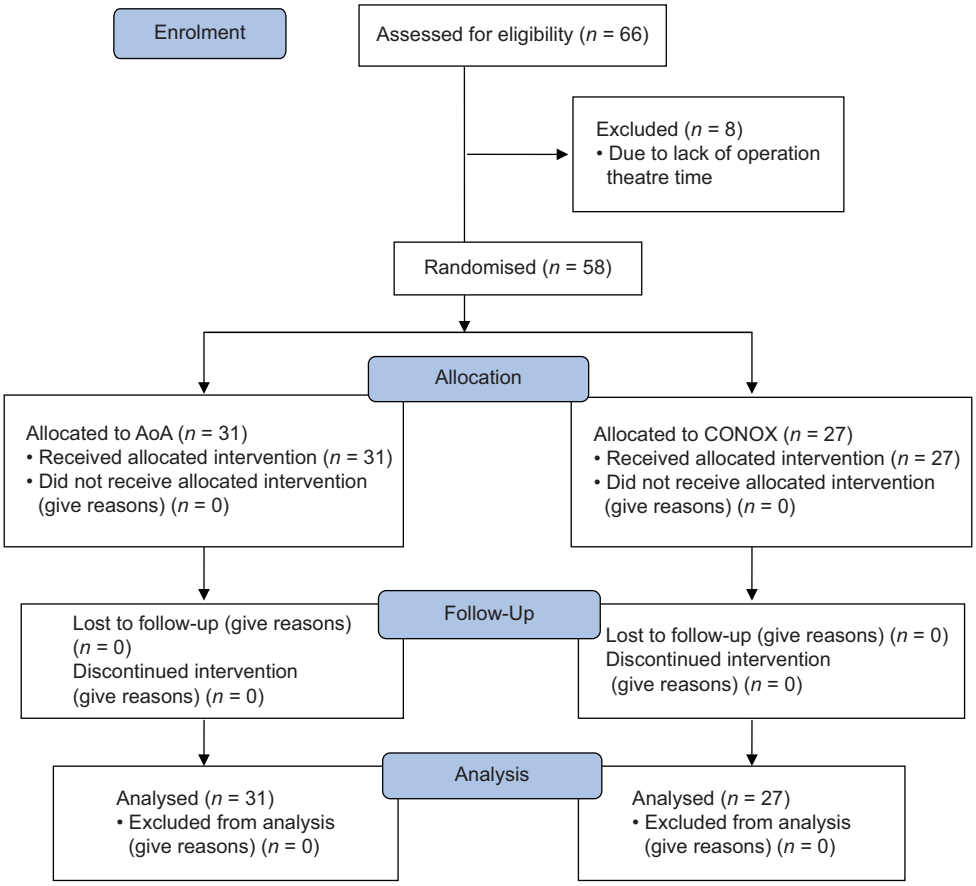

Figure 1: Consolidated Standards of Reporting Trials flow diagram. AoA = Adequacy of Anaesthesia

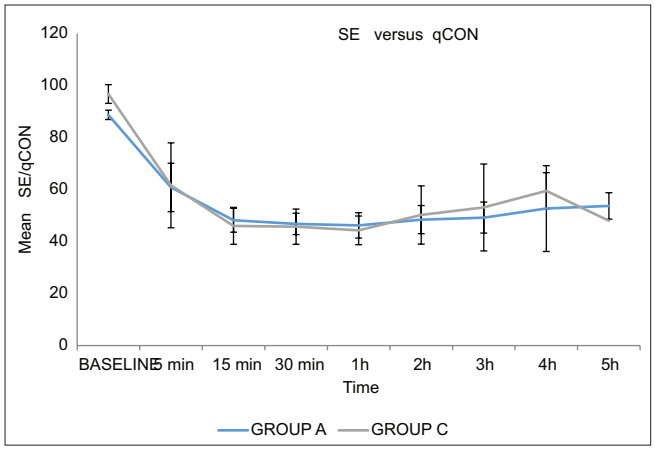

Figure 2: Values of state entropy using AoA monitor (Group A) and qCON using CONOX monitor (Group C) during various time points (Group A- AoA, Group C- CONOX). All values were statistically insignificant. AoA = Adequacy of Anaesthesia, qCON = Quantium consciousness index, SE = state entropy

The AoA monitor uses spectral entropy (SE and response entropy) from processed EEG and frontal electromyography variables to monitor the state of the brain during general anaesthesia. The recommended range is 40–60 for an adequate surgical anaesthetic plane.[5] The study by El Hor *et al*.[5] showed entropy-guided mean sevoflurane consumption of 3.8 (SD: 1.5) ml/h using a Dräger Zeus auto control ventilator, which delivered a metabolic flow during wash-in and steady state. We used a flow of 2 l/min after tracheal intubation, which could account for the higher sevoflurane usage in our study. Studies using entropy-guided sevoflurane anaesthesia have shown varying amounts of sevoflurane consumption, though all have reported reduced consumption.[4,5,9] Using an entropy monitor during propofol anaesthesia has shown a reduction in propofol consumption compared to standard monitoring.[10–12] In the CONOX monitor, qCON was developed using four EEG spectral ratios and burst suppression. qCON and qNOX are based on different frequency widths fed into adaptive neuro-fuzzy inference systems to give output on a 0–99 scale. There are studies done under propofol anaesthesia wherein the depth of anaesthesia was monitored using qCON versus standard monitoring, and a significant decrease in agent consumption was found.[13] Two studies validated qCON by comparing it with BIS and found them to have a comparable efficacy in predicting loss of consciousness while

using propofol.[14,15] There are no studies on sevoflurane use with CONOX monitor.

SPI in the AoA monitor is used to monitor pain. It uses a multivariate index derived from the sum of normalised pulse beat and photoplethysmographic waveform obtained from the patient's pulse using special probes and modules to values of 0–100. A level of less than 50 is usually recommended for an adequate depth of analgesia.

In our study, the total mean fentanyl consumption was 146.2 (SD: 34.28) µg in the AoA group for a mean duration of 3 h. Some studies have shown a reduction in fentanyl consumption while using SPI compared to standard monitoring,[6,7] while others have shown an increase in comparable amounts.[8,16,17]

qNOX, like qCON, was also developed using four EEG spectral ratios. qNOX uses four frequency widths that are different from qCON. The derivation of qCON and qNOX values is interlinked, such that when qCON values go below a particular range, it is assumed that qNOX values also drop. The recommended qNOX value at which patients are unlikely to respond to noxious stimuli was 40–60.[13,18,19]

Studies have shown a reduction in fentanyl consumption while using a qNOX monitor compared to a standard monitor.[13,18] One study reported that total mean intraoperative fentanyl usage was 215.5 (SD: 32.3) µg in the CONOX group and 249 (SD: 54.6) µg in the control group ($P < 0.05$) throughout 1–3 h.[13] Three studies have shown that qNOX can reliably predict nociception during remifentanil propofol anaesthesia.[14,18,19]

Table 1: Demographic characteristics and intraoperative variables

Variables	Group A (*n*=31)	Group C (*n*=27)	*P*
Age (years)	45.87 (9.6)	42.2 (12.9)	0.220
Weight (kg)	57.5 (11.59)	60.4 (10.3)	0.328
ASA PS I/II	22/9	19/8	0.929
Gender- male/female	10/21	11/16	0.217
Duration of surgery (h)	2.98 (0.7)	2.8 (0.8)	0.364
Blood loss in ml	190.96 (118.3)	178.5 (84.8)	0.651
Fluids (ml/h)	374.6 (85.23)	364.1 (83.9)	0.639
Type of surgeries			0.273
BCS	3	0	
Caldwell Luc	0	1	
Endoscopic debridement	0	4	
FESS	1	2	
Hemithyroidectomy	2	2	
Mastoid exploration	5	3	
MRM	17	10	
Myringoplasty	0	1	
Partial maxillectomy	0	1	
Simple mastectomy	1	1	
Superficial parotidectomy	1	0	
Total thyroidectomy	0	1	
WLE of carcinoma tongue	1	1	
Total	31	27	

Data expressed as mean (standard deviation) or numbers. Group A- AoA, Group C- CONOX. AoA=Adequacy of Anaesthesia, ASA-PS=American Society of Anaesthesiologists-Physical Status, BCS=breast conserving surgery, FESS=functional endoscopic sinus Surgery, MRM=modified radical mastectomy, WLE=wide local excision

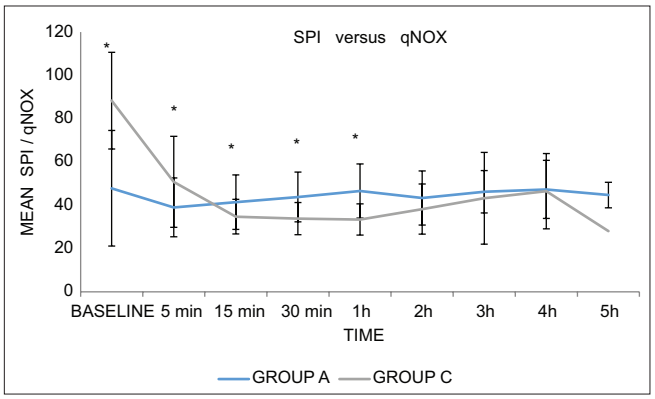

Figure 3: Mean values of SPI using AoA (Group A) and qNOX using CONOX monitor (Group C) during various time points (Group A- AoA, Group C- CONOX). **P* value less than 0.05. AoA = Adequacy of Anaesthesia, SPI = surgical plethysmographic index. qNOX = Quantium noxious index

Table 2: Studied parameters

Variables	Group A (*n*=31)	Group C (*n*=27)	*P*
Sevoflurane consumption (ml/h), Mean (SD) (95% CI)	13.2 (3.9) (11.8, 14.5)	14.4 (3.7) (13.0, 15.7)	0.236
Total fentanyl used (µg), Mean (SD) (95% CI)	146.2 (34.28) (134.13, 158.26)	128.2 (26.7) (118.12, 138.27)	0.031
Intraoperative fentanyl used per kg (µg/kg), Mean (SD) (95% CI)	2.58 (0.6) (2.36, 2.79)	2.12 (0.27) (2.01, 2.22)	<0.001
Emergence time (min), Mean (SD) (95% CI)	11.25 (2.38) (10.41, 12.08)	10.7 (2.4) (9.79, 11.60)	0.385
Possible associated intraoperative awareness- yes/no, *n* (%)	1 (3)/30 (97)	2 (7.4)/25 (92.6)	0.161

Data expressed as mean (SD) (95% CI) or numbers (percentage). Group A- AoA, Group C- CONOX. AoA=Adequacy of Anaesthesia, CI=confidence interval, SD=standard deviation

In our study, qCON and SE were comparable throughout the anaesthesia; qNOX and SPI were comparable except in the beginning, where qNOX was higher [Figure 3]. Higher baseline values in qNOX are probably due to using an EEG-based algorithm to calculate its value, which may be higher in the awake state (baseline).

The requirement of fentanyl was also lesser in the qNOX group during the surgery due to the same reason that qNOX values might be influenced by a low qCON value during deeper levels of anaesthesia. While using a CONOX monitor, the depth of anaesthesia (qCON) and nociception measurement (qNOX) are from EEG waves. Hence, we hypothesise that values of qNOX could be influenced by anaesthetic agents, which would have led to the actual changes in EEG. However, while using AoA, the nociception component is derived from plethysmography (SPI) and hence is not influenced by the anaesthetic agent and the EEG obtained afterwards. This could probably explain the use of a more significant amount of fentanyl in the AoA group, despite having similar haemodynamics, to reduce the SPI values.

In our study, the time to emergence in both groups was comparable. Various studies showed a significantly lower emergence time while monitoring depth with entropy than with conventional monitoring.[3,7,20,21] However, no studies using CONOX have evaluated the emergence time.

Our study did not find a significant difference in intraoperative awareness between the groups. Three patients reported that they had recollections of vague dreams during the perioperative period. This is classified in several studies as possible associated awareness and not as definitive awareness. These three patients were followed up, and the test was repeated after 30 days. They were found to have normal higher mental functions without recollection of awareness. Various studies have shown no difference in intraoperative awareness between the entropy-monitored and the conventionally monitored groups.[4,9,11–13,22]

Limitations include the fact that we could not include more patients in the study due to COVID pandemic restrictions on admitting elective cases; however, the sample size was calculated to have a power of 80%. We did not record the use of postoperative analgesics, which could have given a better idea about the level of intraoperative analgesia.

CONCLUSION

Both AoA and CONOX monitors are similarly efficient in monitoring the depth of anaesthesia. We did not find a difference in sevoflurane usage, intraoperative awareness or haemodynamics between the groups. However, analgesia monitoring by qNOX might differ from SPI, as we found significantly higher fentanyl use in the AoA group. Further studies are needed to validate this finding about qNOX.

Study data availability

De-identified data may be requested with reasonable justification from the authors (email to the corresponding author) and shall be shared after approval as per the authors' institutional policy

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Conflicts of interest

There are no conflicts of interest.

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REFERENCES

1. Balci C, Karabekir H, Kahraman F, Sivaci R. Comparison of entropy and bispectral Index during propofol and fentanyl sedation in monitored anaesthesia care. J Int Med Res 2009;37:1336–42.
2. Sargin M, Uluer MS, Şimşek B. The effect of bispectral index monitoring on cognitive performance following sedation for outpatient colonoscopy: A randomized controlled trial. Sao Paulo Med J 2019;137:305–11.
3. Choi SR, Lim YH, Lee SC, Lee JH, Chung CJ. Spectral entropy monitoring allowed lower sevoflurane concentration and faster recovery in children. Acta Anaesthesiol Scand 2010;54:859–62.
4. Dinu AR, Rogobete AF, Popovici SE, Bedreag OH, Papurica M, Dumbuleu CM, *et al*. Impact of General Anesthesia Guided by State Entropy (SE) and Response Entropy (RE) on perioperative stability in elective laparoscopic cholecystectomy patients—A prospective observational randomized monocentric study. Entropy 2020;22:356. doi: 10.3390/e22030356
5. El Hor T, Van Der Linden P, De Hert S, Mélot C, Bidgoli J. Impact of entropy monitoring on volatile anesthetic uptake. Anesthesiology 2013;118:868–73.
6. Cotae AM, Ţigliş M, Cobilinschi C, Băetu AE, Iacob DM, Grinţescu IM. The impact of monitoring depth of anesthesia

and nociception on postoperative cognitive function in adult multiple trauma patients. Medicina 2021;57:408. doi: 10.3390/medicina57050408
7. Guo J, Zhu W, Shi Q, Bao F, Xu J. Effect of surgical pleth index-guided analgesia versus conventional analgesia techniques on fentanyl consumption under multimodal analgesia in laparoscopic cholecystectomy: A prospective, randomized and controlled study. BMC Anesthesiol 2021;21:167. doi: 10.1186/s12871-021-01366-x
8. Jain N, Gera A, Sharma B, Sood J, Chugh P. Comparison of Surgical Pleth Index-guided analgesia using fentanyl versus conventional analgesia technique in laparoscopic cholecystectomy. Minerva Anestesiol 2019;85:358–65.
9. Wu SC, Wang PC, Liao WT, Shih TH, Chang KA, Lin KC, *et al*. Use of spectral entropy monitoring in reducing the quantity of sevoflurane as sole inhalational anesthetic and in decreasing the need for antihypertensive drugs in total knee replacement surgery. Acta Anaesthesiol Taiwan 2008;46:106–11.
10. Elgebaly A, El Mourad M, Fathy S. The role of entropy monitoring in reducing propofol requirements during open heart surgeries. A prospective randomized study. Ann Card Anaesth 2020;23:272. doi: 10.4103/aca.ACA_184_18
11. Gruenewald M, Harju J, Preckel B, Molnár Z, Yli-Hankala A, Rosskopf F, *et al*. Comparison of adequacy of anaesthesia monitoring with standard clinical practice monitoring during routine general anaesthesia: An international, multicentre, single-blinded randomised controlled trial. Eur J Anaesthesiol 2021;38:73–81.
12. Vakkuri A, Yli-Hankala A, Sandin R, Mustola S, Høymork S, Nyblom S, *et al*. Spectral entropy monitoring is associated with reduced propofol use and faster emergence in propofol–nitrous oxide–alfentanil anesthesia. Anesthesiology 2005;103:274–9.
13. Toar BJ, Suarjaya IPP, Hartawan IU, Senapathi TGA. The use of CONOX as a guide to the general anesthesia on laparotomy patients compared with standard clinical care – A pilot study. Neurologico Spinale Medico Chirurgico 2021;4:51–4.
14. Jensen EW, Valencia JF, López A, Anglada T, Agustí M, Ramos Y, *et al*. Monitoring hypnotic effect and nociception with two EEG-derived indices, qCON and qNOX, during general anaesthesia: Monitoring anaesthesia with qCON and qNOX. Acta Anaesthesiol Scand 2014;58:933–41.
15. Jensen EW. New findings and trends for depth of anesthesia monitoring. Korean J Anesthesiol 2018;71:343–4.
16. Bonhomme V, Uutela K, Hans G, Maquoi I, Born JD, Brichant JF, *et al*. Comparison of the Surgical Pleth Index™ with haemodynamic variables to assess nociception–anti-nociception balance during general anaesthesia. Br J Anaesth 2011;106:101–11.
17. Won YJ, Oh SK, Lim BG, Kim YS, Lee DY, Lee JH. Effect of surgical pleth index-guided remifentanil administration on perioperative outcomes in elderly patients: A prospective randomized controlled trial. BMC Anesthesiol 2023;23:57. doi: 10.1186/s12871-023-02011-5
18. Fontanet J, Gambus P, Jospin M, Vallverdú M, Gabarrón E. Comparison of the qNOX and ANI indices of nociception during propofol and remifentanil anaesthesia. Paper presented at: 8th European Study Group on Cardiovascular Oscillations meeting, Fai della Paganella, Trento, Italy, May 25-28, 2014.
19. Melia U, Gabarron E, Agustí M, Souto N, Pineda P, Fontanet J, *et al*. Comparison of the qCON and qNOX indices for the assessment of unconsciousness level and noxious stimulation response during surgery. J Clin Monit Comput 2017;31:1273–81.
20. Sudhakaran R, Makkar J, Jain D, Wig J, Chabra R. Comparison of bispectral index and end-tidal anaesthetic concentration monitoring on recovery profile of desflurane in patients undergoing lumbar spine surgery. Indian J Anaesth 2018;62:516-23.
21. Goyal K, Nileshwar A, Budania L, Gaude Y, Mathew S, Vaidya S. Evaluation of effect of entropy monitoring on isoflurane consumption and recovery from anesthesia. J Anaesthesiol Clin Pharmacol 2017;33:529-33.
22. Talawar P, Chhabra A, Trikha A, Arora MK, Chandralekha. Entropy monitoring decreases isoflurane concentration and recovery time in pediatric day care surgery -A randomized controlled trial. Pediatr Anesth 2010;20:1105–10.