Analgesia Nociception Index application in a patient with situs inversus totalis

Dear Editor,

The Analgesia Nociception Index (ANI) monitors parasympathetic activity and has been demonstrated to have an advantage over standard clinical practice during general anaesthesia (GA) and for detecting nociceptive stimulation during surgery.[1,2] Here, we present a case of situs inversus totalis monitored with ANI, and the values of ANI conflict with the haemodynamics during surgery.

A 63-year-old woman with a body mass index of 24 kg/m^2 was scheduled for debulking surgery for ovarian cancer. She had no other systemic diseases except for congenital situs inversus totalis, which was identified through a routine chest X-ray examination, and it was also observed during the preoperative computed tomography examination for abdominal tumour assessment on this occasion. The standard monitoring system included electrocardiogram (ECG), noninvasive and invasive arterial blood pressure monitoring, pulse oximetry and capnography. Due to dextrocardia, the conventional left leg electrode in the ECG setup was replaced with the right leg electrode positioned on the right hypochondrium. In addition, the bispectral index (BIS™; Covidien Inc, Boulder, CO, USA) and ANI (Physiodoloris®; MDoloris Medical Systems, Loos, France) were utilised during GA. GA was initiated using a combination of propofol target-controlled infusion (TCI) with an effect-site concentration (Ce) of 3.5 μg/ml, remifentanil TCI with a Ce of 3.0 ng/ml, 60 mg of lidocaine, 60 mg of rocuronium and 5 mg of dexamethasone. A bilateral

transversus abdominis plane (TAP) block with 1% lidocaine and 0.35% ropivacaine (40 ml) under sonography was performed before the skin incision. Following GA induction, ANI values of 100 were obtained from ECG waveforms by two sensors, with a large sensor positioned on her left upper chest below the clavicle and a small round sensor attached to the right hypochondrium. Consequently, we adjusted remifentanil Ce to 0 ng/ml. As the surgical procedure commenced, remifentanil was titrated to a Ce of 1.0 ng/ml to address incisional pain. Initially, we had confidence in the efficacy of the TAP block. However, systolic blood pressure reached 200 mmHg as the operation progressed, and instant ANI (ANIi) remained at 100. To address this, we repositioned the large sensor to the right upper chest (with the small sensor over the left hypochondrium), resulting in an instantaneous drop in ANIi to 54. Subsequently, remifentanil was adjusted to a Ce of 3.0 ng/ml, reducing the heart rate and blood pressure [Table 1]. Simultaneously, ANIi values demonstrated a surge increase to 100. As the surgery progressed, we adjusted the Ce of remifentanil from 3.0 to 1.0 ng/ml based on ANI values and haemodynamic parameters. The patient was transferred to the postanaesthesia care unit with ANI values ranging from 95 to 97, which were compared by two ANI machines (with a large sensor positioned over the left and right upper chest) [Figure 1] and a Numeric Rating Scale (ranging from 0 to 10, where 0 indicates 'no pain' and 10 signifies the 'worst pain imaginable') score of 0. Details of perioperative haemodynamics, ANI values and Ce of propofol and remifentanil are provided in Table 1.

In this case, the ANI values recorded while the sensor was placed across the heart conflicted with the hyperdynamic status. Therefore, ANI may not fully encapsulate the complexity of pain perception, as it predominantly evaluates autonomic responses.[3] The primary benefit observed in this case was the ability of ANI to guide the titration of remifentanil despite the anatomical challenges posed by situs inversus totalis. The initial high ANI values led to adjustments in anaesthetic management, potentially improving patient safety and comfort. However, ANI should not replace comprehensive clinical judgement and should be combined with other monitoring methods to ensure accurate pain assessment and management.[4] ANI is a valuable tool for assessing pain responses during anaesthesia,[5] but adjustments and considerations are necessary due to the reversed anatomical orientation in patients with situs inversus totalis. The outcome of using ANI in such cases remains unclear. ANI should not substitute the comprehensive clinical judgement of anaesthesia providers. Anaesthesiologists should

Table 1: Perioperative haemodynamics, ANI values, Ce of propofol and medication

Time (min)	Events	ANI_i	ANI_m	HR (bpm)	SBP (mmHg)	Propofol (Ce)	Remifentanil (Ce)
0	Preparation	100	100	80	92	0	0
10		100	100	75	90	0	0
20	Induction	100	100	70	86	3.5	1.0
30		100	100	80	80	2.0	1.0
40		100	100	99	95	2.0	1.0
50	Incision	100	100	85	140	2.2	1.0
60		92	100	90	153	2.4	1.0
70		100	100	77	176	3.0	1.0
75	Change ANI electrodes	54	82	75	202	3.0	1.0
80		69	57	74	182	3.0	3.0
90		95	80	65	125	2.5	2.5
100		100	96	67	113	2.0	1.5
110		60	75	70	140	2.2	1.5
120		74	70	70	145	2.2	1.0
130		85	73	69	144	2.2	1.0
140		64	71	70	132	2.2	1.0
150		37	48	71	128	2.2	2.0
160		52	43	70	160	2.2	1.5
170		66	60	71	158	2.2	1.5
180	End of surgery	68	66	72	156	1.5	1.0
190	Emergence	72	70	73	160	0.7	1.0
200	PACU	80	75	76	180		

ANI=Analgesia Nociception Index, ANI_i=instant-Analgesia Nociception Index, ANI_m=mean-Analgesia Nociception Index, Ce=effect-site concentration, HR=heart rate, PACU=postanaesthesia care unit, SBP=systolic blood pressure

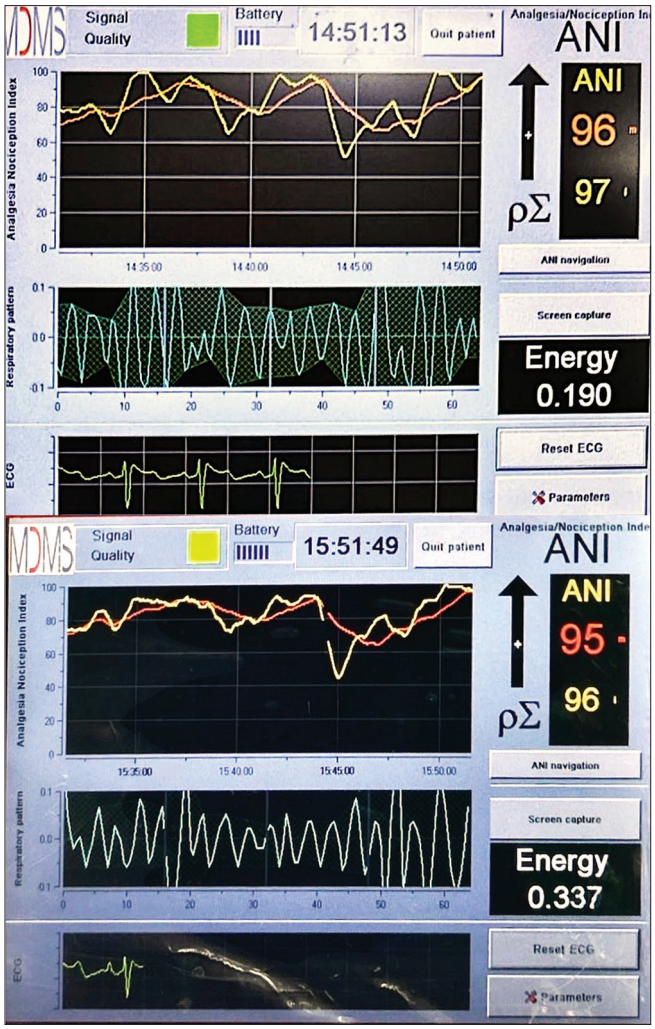

Figure 1: Comparison of two ANI machines in the PACU: one with a large sensor on the left upper chest and a small round sensor on the right hypochondrium (upper part) and another with the reverse configuration (lower part). ANI = Analgesia Nociception Index, PACU = postanaesthesia care unit

integrate haemodynamics and interpret cardiac structural abnormalities with care during anaesthesia.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient consented to her images and other clinical information to be reported in the journal. The patient understands that her name and initials will not be published and due efforts will be made to conceal her identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

ORCID

Ying-Tzu Chen: https://orcid.org/0000-0003-1178-6507
Chia-Yu Lin: https://orcid.org/0000-0002-5140-6153
Zhi-Fu Wu: https://orcid.org/0000-0001-6376-9085

Ying-Tzu Chen[1], Chia-Yu Lin[1], Zhi-Fu Wu[1,2,3]

[1]Department of Anaesthesiology, Kaohsiung Medical University Hospital, [2]Department of Anaesthesiology, Faculty of Medicine, College of Medicine, Kaohsiung Medical University, Kaohsiung, [3]Department of Anaesthesiology, Tri-Service General Hospital and National Defense Medical Centre, Taipei, Taiwan

Address for correspondence:
Dr. Zhi-Fu Wu,
Department of Anaesthesiology, Kaohsiung Medical University Hospital, Kaohsiung Medical University, No. 100, Tzyou 1st Rd., Sanmin Dist., Kaohsiung City 80756, Taiwan.
E-mail: aneswu@gmail.com

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