Table 1. Demographic Data of Patients

No. of patients	N = 20
Sex	Female
Age (yr.)	45 ± 10.5
Weight (kg)	59 ± 9
Height (cm)	158 ± 6.5
Physical status	ASA I: II = 11: 9

Value are expressed as the mean ± standard deviation (SD).

Table 3. BIS Value in Anesthesia Emergence

	Time after sevoflurane discontinued (min)				
	0	5	10	15	20
BIS Index	52 ± 8	63 ± 11	77 ± 14	89 ± 10*	96 ± 2**

Values are expressed as the mean ± S.D.
BIS = bispectral index.
* $p < 0.05$ when compared to the baseline.
** $p < 0.01$ when compared to the baseline.

the awake basal state was 92 with a range of 87-98, and it gradually decreased to 83 at 3 min after the administration of Midazolam; all patients were tranquil but readily rousable. After ketamine administration, all patients drifted into an anesthetized dissociate state with loss of lid reflex and no response to verbal stimulus within 2 min, at which time the mean value of the BIS index was 86, and it increased to 90, 95, and 96 at the 3rd, 4th, and 5th minutes, respectively ($p < 0.05$ when compared to baseline value) (Table 2). However upon administration of sevoflurane, the mean BIS index value gradually decreased to below 60 within 6 min and remained below that value throughout surgery. After sevoflurane was turned off, all patients awakened within 15 min with BIS above 70 ($p < 0.05$ when compared to the baseline value) as shown in Table 3. No patient manifested facial grimace, myoclonus or choreiform movement. The administration of the muscle relaxant, rocuronium, and the act of intubation did not alter the BIS index significantly. No patient had recall, delirium, hallucination or awareness under anesthesia when questioned in the recovery room. There were increase of mean blood pressure (MAP) by 15% and heart rate by 18% after the administration of ketamine which, however, were not clinically significant, and all returned to normal after the use of inhalation agents (Table 2).

DISCUSSION

Until recently, anesthesiologists in clinical practice had to rely on a number of indirect, non-specific signs, namely hemodynamic, respiratory, muscular, and autonomic changes, to monitor the depth of anesthesia. However, these measures do not indicate the adequacy of anesthesia in a reliable manner especially with the use of muscle relaxants and potent opiods which can easily render the patient non-moving with analgesia and yet fully wake during surgery. Awareness during general anesthesia is becoming a notable problem with reported incidence of 0.2%-1.1%.[5-8] Electroencephalography (EEG) monitoring which monitors central nervous activities has been shown to be a much more reliable measurement of the anesthetic depth. However, the standard EEG machine is not suitable for perioperative use due to its size and technical complexity. With the introduction of technology for compressing, simplifying, and displaying processed EEG signals into clinical medicine, an EEG-bispectral index

Table 2. BIS Index and Hemodynamic Values on Anesthesia Induction before and after Anesthetics

Time	Basal	After midazolam			After ketamine					After rocuronium	After sevoflurane						
		1	2	3 min	1	2	3	4	5 min		1	2	3	4	5	6	10 min
BIS	92±3	89±4	87±5	83±7	83±7	86±6	90±5	95±3	96±2	97±2	97±1	95±2	85±5	79±6	75±9*	58±16*	52±3*
HR	75±10	76±11	77±10	77±9	79±11	84±14	86±10*	87±9*	86±9*	78±13	94±12*	95±10*	91±9*	88±9	88±8	80±12	72±11
MAP	101±6	106±10	101±14	107±14	107±14	108±10	119±13*	120±12*	118±9	115±14	126±10*	116±8*	110±9	108±7	106±7	96±12	91±9

Values are expressed as the mean ± S.D.
BIS = bispectral index, HR = heart rate, MAP = mean arterial pressure.
*$p < 0.05$ when compared to the baselin