INTRODUCTION

Since the introduction of "balanced anesthesia" with the liberal use of opioid analgesics and neuromuscular blockers, the assessment of anesthetic depth has become a difficult problem. Recently the availability of compact spectral EEG monitors has enhanced our ability to gauge the depth of anesthesia in clinical settings. The EEG-bispectral index (BIS) is a processed EEG monitor that has been validated as a measure of the hypnotic effect of anesthetic drugs.[1-3] It is generally accepted that a BIS index below 60 indicates adequate hypnosis. The present study evaluated the BIS changes associated with midazolam plus ketamine anesthesia.

MATERIAL AND METHOD

The EEG-BIS monitor has been adopted as one of the standard anesthesia monitors in our hospital since last year. After informed consent was obtained, 20 healthy adult female patients of ASA I and II physical status without a history of cardiovascular or neurologic disease who were scheduled for elective gynecologic surgery were enrolled in this study.

No medication was allowed within 12 h prior to surgery, and no premedication was given to any patient. Upon arrival at the operating room, the patient was placed on the usual monitors including a precordial stethoscope, continuous ECG, peripheral pulse oximeter, non-invasive blood pressure, and nasopharyngeal temperature monitors. After cleansing the skin with degreaser, electrodes (Zip Prep, Aspect Medical System, Natick, MA, USA) were applied at Fp1, Fp2, A1, A2 (international 10-20 system) and ground to the monitor bipolar channels. The high- and low-frequency filter settings were 30 and 2 Hz, respectively, and the electrode impedance was < 10 k ohms. A microprocessor-based EEG monitor (model A-2000, Aspect Medical System) was used to continuously display the real-time EEG and the bispectral index (BIS) with scale of 0 to 100. In addition, display of signal quality index (SQI) and electromyography (EMG) were also recorded.

After baseline vital signs were recorded, 4 consecutive readings of BIS at 30 s intervals were taken to establish the baseline value while the patient was fully awake. Patients were then given an intravenous dose of midazolam 0.05 mg/kg, and BIS values were recorded for 3 min at 30 s intervals. Then patients were given ketamine 1.5 mg/kg I.V., and BIS recordings were made for 5 min after ketamine while consciousness was assessed through verbal commands and the lid reflex. At the end of 5 min, rocuronium 0.6 mg/kg I.V. was administered over 10 s, and BIS readings were recorded at 30 s intervals for 90 s. Then endotracheal intubation was performed, and the BIS index was recorded for 1 min after intubation and continuously after administration of sevoflurane at 1.5 MAC in 3 L/min of nitrous oxide and 2 L/min oxygen. Vital signs were continuously monitored every 2 min and the BIS index every minute, and were recorded until the patient was awake and extubated. The patient was ventilated mechanically to maintain an end-tidal carbon dioxide concentration of 32 to 35 mmHg, and body temperature was maintained at 35-37 with thermoblanket. Intermittent bolus doses of atracurium were given to maintain muscle relaxation, and any residual neuromuscular blocking was reversed with neostigmine-atropine before extubation.

In addition to the assessment of Aldrete score, all patients were asked specifically about any recall, hallucinations, dysphoria, euphoria, or awareness under anesthesia in the Post Anesthesia Recovery Unit.

All data are reported as the mean value SD. Demographic data, BP, HR, and BIS index were compared between the 2 groups using Student *t*-test. BP, HR, and BIS index at each time point were compared with the baseline within the group with repeated measurements of ANOVA. A *P* value of less than 0.05 was considered statistically significant.

RESULTS

The demographic data of the patients are listed in Table 1. SQI was always above 80% on all the readings of BIS, and EMG values were between 25 and 30 db with no significant changes before or after the administration of the induction agents.

As shown in Table 2, the mean value of BIS during