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Total Intravenous Anesthesia/Target-Controlled Infusion and Auditory-Evoked Potentials in Day Surgery Mammoplasty

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Abstract. Total intravenous anesthesia and the new parameter for administering the most recent drugs, target-controlled infusion, as well as the introduction of new short half-life molecules that do not accumulate have made anesthesia in day surgery safer. In this study, the use of auditory-evoked potentials monitoring made it possible to determine the target plasma concentration of propofol that induces a narcosis sufficiently deep and strictly necessary for effectiveness, thus minimizing the anesthesiologic risk linked to the use and the dosing of the drug, reducing the hospitalization time, and decreasing the side effects for patients undergoing day surgery mammoplasty.

Key words: Auditory evoked potentials—Day surgery—Mammoplasty—Plastic surgery—Target controlled infusion—Total intravenous anesthesia

Total intravenous anesthesia has been used successfully in many surgical branches because of the recently introduced new short half-life molecules with no accumulation effects [7]. Furthermore, the new parameters for administration of the most recent drugs, target-controlled infusion, have made day surgery operations with the patient under anesthesia safer [2,5,8].

The aim of this study was to verify, through monitoring of auditory-evoked potentials (AEP) [4,5], the propofol plasma concentration target capable of inducing a level of narcosis sufficiently deep and strictly necessary for effectiveness, thus minimizing the anesthesiologic risk linked to the use and the dosing of the drug while reducing hospitalization time and side effects [4,9].

Auditory-evoked potentials (AEP) use auditory stimuli to evaluate the level of cerebral activity. They have been used both in studies on learning and memory processes and in research on the evaluation of the anesthesia level.

To evaluate the depth of anesthesia, midlatency AEP (MLAEP) recorded 10 to 100 min after auditory stimulation has been primarily used because it has shown limited intra- and interindividual variability. The AEP A-line monitor generates an index derived from the analysis of MLAEP waveforms. Once this monitor has acquired the baseline signal, thanks to sophisticated filtering systems, it can extract in a short time (only 6s) the MLAEP signal, whose changes during anesthesia are represented by an index, the A-line ARX Index (scale of 0 to 100), which reflects the hypnotic state of the individual.

The aim of this study was to control, by means of the aforementioned monitoring, the propofol plasma concentration sufficient to provoke a narcosis status for each individual patient, avoiding the risk of awareness and reducing side effects (caused by uselessly high drug doses) and hospitalization time. All this becomes even more important in plastic cosmetic surgery, in which day surgery and short convalescence times are particularly significant, because postanesthesia recovery and anesthetic metabolism may become limiting factors.

Materials and Methods

After written informed consent, 42 American Society of Anesthesiology (ASA) classes 1 and 2 patients

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Table 1. Anesthesiologic protocol

	Group A	Group B
Premedication	Atropina 0.01 mg/kg IM Midazolam 0.07 mg/kg IM	Atropina 0.01 mg/kg IM Midazolam 0.07 mg/kg IM
Induction	Remifentanil (50 /ml) 0.25 μg/kg/min IV Propofol (target 4 μg /ml) Cis-atracurium 0.20 mg/kg IV	Remifentanil (50 /ml) 0.25 μg/kg/min IV Propofol (target 4 μg /ml) Cis-atracurium 0.20 mg/kg IV
	O_2-Air Remifentanil (50 μg /ml) 0.25 μg /kg/min IV Cis-atracurium (boli) 0.04 mg/kg IV, at 25% of the TOF	O_2-Air Remifentanil (50 μg /ml) 0.25 μg /kg/min IV Cis-atracurium (boli) 0.04 mg/kg IV, at 25% of the TOF
	Propofol Target 4 μg /ml	Propofol Target = value ≤ 20 AEP

IM, intramuscular; IV, intravenous; TOF, ; AEP, auditory-evoked potentials.

(average age, 32 ± 4 years; average body weight, 62 ± 7 kg) who had undergone augmentation mammoplasty with submuscular implantation of mammary prosthesis (8 patients) and reductive mammoplasty due to gigantomastia of medium gravity were studied. The average length of surgery was 72 ± 4 min for augmentation mammoplasty and 158 ± 23 min for reduction mammoplasty.

Patients with allergies or intolerances to even one of the drugs included in this study were excluded. According to the waiting list position, the patients were divided into two groups of 21 each: group A and group B. The two groups were homogeneous for age, weight, ASA class, and type of operation.

The following anesthesiologic protocol was used for all the patients:

- Premedication about 45 min before surgery with intramuscular (IM) atropine 0.01 mg/kg and intravenous (IV) midazolam 0.07 mg/kg
- Induction with a remifentanil (50 μg/ml) dose of 0.25 μg/kg/min IV
- Maintenance with air and O_2, a remifentanil (50 μg/ml) dose of 0.25 μg/kg/min IV, and cis-atracurium (boli) 0.04 mg/kg IV at 25% of train of four (TOF). The propofol was administered with a target of 4 μg/ml for the group A patients and a target of AEP values at 20 or less for the group B patients (Table 1).

The anesthesiologic protocol is shown in Table 1. Intraoperative monitoring involved the following: systolic pressure (SAP), dyastolic pressure (DAP), mean arterial pressure, electrocardiogram in derivation II (II der.), cardiac frequency (CF), oxygen saturation, end-tidal carbon dioxide, temperature corporeal (CT), hourly diuresis. The narcosis level of the group B patients was measured through the evaluation of AEP (ALARIS AEP monitor, ALARIS, Florence, Italy).

Table 2. Examined parameters

	Group A (min)[a]	Group B (min)
Spontaneous respiration	9 ± 2	4 ± 1
Extubation	13 ± 2	6 ± 1
Eye opening time	15 ± 1	7 ± 2
Carrying out simple commands	16 ± 2	9 ± 1

[a] $p < 0.05$.

Table 3. Side effects

	Group A Patients (%)	Group B Patients (%)
Nausea	5 (24)	2 (9)
Vomiting	3 (14)	2 (9)
Shivering	2 (9)	2 (9)

Neuromuscular monitoring was performed by the TOF watch. [3,6].

After the interruption of propofol administration, at the end of the operation, the following parameters were examined: spontaneous respiration, extubation time, eye-opening time, performance of simple orders, time of discharge from the recovery room, and presence of postoperative nausea, vomiting, shivering [1,6].

Student's *t*-test was used for statistical analysis. All *p* values less than 0.05 were considered significant. Data are expressed as means ± standard deviation.

Results

Good hemodynamic stability was achieved for all the patients. Table 2 presents the examined parameters and Table 3. presents the side effects. No episodes of awareness were reported by the patients in the post-operative period. The plasma concentration target of propofol in group B was 2.4 to 2.9 μg /ml.

Conclusions

The monitoring of AEPs to assess the level of narcosis enabled achievement of the expected objectives: significantly more rapid awakening than in the control group, earlier discharge, and the reduction of propofol dosing, tailor made according to individual characteristics.

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