

Intraoperative awareness — comparison of its incidence in women undergoing general anaesthesia for Caesarean section and for gynaecological procedures

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Abstract

Background. Intraoperative awareness (IA) is diagnosed when patients can recall their surroundings or an event related to the surgery that occurred while they were under general anaesthesia. The female gender and Caesarean section are considered to be contributing factors. The aim of the present study was to analyse the frequency of IA in patients undergoing general anaesthesia either for Caesarean section or gynaecological procedures.

Methods. ASA I and II women were included into the study. Patients were randomly allocated to 4 groups: A, B and C included patients qualified for elective gynaecological surgery, and group D comprised Caesarean section patients. Premedication was not given. Group A received total intravenous anaesthesia with TCI, and groups B, C and D received balanced anaesthesia. The depth of anaesthesia was monitored with an AEP monitor. Blinded structured interviews were conducted 2 hours after anaesthesia and on postoperative days 7 and 30.

Results. 337 patients were enrolled into the study. 45 patients reported diverse sensations connected to the anaesthesia (Group A — 7 patients, B — 9 patients, C — 2 patients, D — 28 patients). There were mainly dream sensations, but IA was present in 3 cases. In all of the cases, IA was recognised during the first interview. One episode of awareness appeared in group B, and the other two appeared in group D. One Caesarean section was complicated by intraoperative haemorrhage.

The patient from group B had similar sensations during previous anaesthesia. Two women enrolled in the study reported awareness in the past, which did not occur this time.

Conclusion. Awareness during general anaesthesia occurs occasionally. The frequency of occurrence in a group of patients undergoing general anaesthesia for uncomplicated Caesarean section is not higher than for other procedures. The anaesthesia for Caesarean section, as well as for other procedures, may be accompanied by pleasant dreams.

Key words: anaesthesia, general, intraoperative awareness; surgery, Caesarean section; surgery, gynaecology

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One of the primary objectives of general anaesthesia is to induce sleep. Failed attempts result in intra- and post-anaesthesia suffering of patients [1].

Since the introduction of general anaesthesia, intraoperative awareness has been defined as a recall of events that occur during anaesthesia. Recall can be overt (evoked spontaneously) or latent (evoked by special psychological tests) [2]. Awareness can include the feeling of muscle relaxation, awareness of the presence of the endotracheal

tube, pain or pressure, and recollections of conversations in the operating room.

The factors believed to predispose to this phenomenon include female gender [3], young age [2, 3], smoking, severe obesity [2], and lack of premedication [4]. A Caesarean section belongs to the procedures associated with the highest incidence of awareness [4].

The aim of the study was to compare the incidence of intraoperative awareness in female patients undergoing

general anaesthesia for gynaecological procedures and for Caesarean sections.

METHODS

The study design was approved by the Bioethics Committee of the Medical University of Lublin. ASA I and II female patients were enrolled in the study and randomly allocated to 4 groups according to the type of general anaesthesia performed. Groups A and B consisted of patients anaesthetised for elective gynaecological procedures, group C consisted of those undergoing anaesthesia for short gynaecological procedures, and group D consisted of Caesarean section patients. Patients were not pharmacologically premedicated.

In group A, patients underwent total intravenous anaesthesia with target controlled infusion (TCI) using cisatracurium (0.1 mg kg^{-1}) and continuous infusion of remifentanyl in incremental doses until reaching the plasma concentration of 8.5 ng mL^{-1} , which was followed by infusion of propofol to provide the desirable plasma concentration of $8 \mu\text{g mL}^{-1}$. TCI anaesthesia was maintained with continuous infusion of remifentanyl and propofol administered in pre-set doses of $3\text{--}6 \text{ ng mL}^{-1}$ and $2\text{--}4 \mu\text{g mL}^{-1}$, respectively. In the remaining groups, combined general anaesthesia was used: group B — thiopentone (5 mg kg^{-1}), fentanyl ($3\text{--}5 \mu\text{g kg}^{-1}$), cisatracurium (0.1 mg kg^{-1}) and sevoflurane ($1\text{--}2 \text{ vol}\%$); group C — propofol (2 mg kg^{-1}), fentanyl ($3\text{--}5 \mu\text{g kg}^{-1}$) and sevoflurane ($1\text{--}2 \text{ vol}\%$); group D — thiopentone (5 mg kg^{-1}), suxamethonium (1 mg kg^{-1}), fentanyl ($3\text{--}5 \mu\text{g kg}^{-1}$) and cisatracurium (0.05 mg kg^{-1}) administered immediately after the foetus extraction. All of the patients received a mixture of N_2O and O_2 ; F_2O_2 was maintained at the level of 0.33.

Basic vital functions and sleep depth were monitored by measuring auditory evoked potentials with the AEP monitor (Danmeter, Denmark); the A-line auditory evoked potential index was kept within the range of 15–25.

Awareness was detected using a questionnaire designed by the authors, which contains 22 questions assessing the recall of patients during anaesthesia regarding pain, dreams, and tactile and auditory sensations (annex). Patients were surveyed three times: 2 h after anaesthesia and on post-anaesthesia days 7 and 30 (by phone). Postoperative surveys were conducted by a person not involved in anaesthesia.

Data were analysed using Statistica 10.0 (StatSoft, Tulsa, USA). Variables concerning characteristics of groups were presented as a mean and standard deviation. Data on intra-operative sensations were presented in the numerical form and as percentages. Because the equal variance assumption was not fulfilled, univariate analysis of variance was applied using the non-parametric Kruskal-Wallis test; when significant differences were found, analysis was continued with multiple comparisons of ranks. Statistical significance was assumed at $P < 0.05$.

RESULTS

The study included 337 patients. Data regarding the age and body weight of patients, duration of surgery and anaesthesia in individual groups are summarised in Table 1. Group D patients were significantly younger and their body weight was higher compared to patients in the remaining groups. In group D, the duration of surgery and anaesthesia was shorter than in groups A and B.

All anaesthetic procedures were uneventful. Various sensations during anaesthesia were reported by 46 women. In most cases, the sensations were connected with dreams. However, in 3 cases, the descriptions of intraoperative events suggested intraoperative awareness; no significant inter-group differences in their incidence were observed (Table 2).

The feeling of “the presence of a tube in the throat” and “sore throat” at the onset of anaesthesia was reported by one patient in group B, who also experienced unpleasant unidentified dreams. The same patient admitted having similar sensations during an anaesthetic procedure several years earlier.

One patient from group D described pain and pressure experienced during surgery and the feeling of the presence of an endotracheal tube in the throat; moreover, she could not move. She recalled the moment of incision of the abdominal integuments accompanied by pain sensations, and the time when the baby was extracted was associated with pain and severe pressure. She heard the voices of the operating room personnel during the extraction of her baby, yet she could not remember the exact words or define what they were discussing. The memories covered the period of

Table 1. Characteristics of groups (means \pm SD)

Parameter	Group A	Group B	Group C	Group D
Number of patients	51	95	16	175
Age (years)	$48 \pm 10^*$	$44 \pm 12^*$	$50 \pm 15^*$	31 ± 6
Body weight (kg)	$68.6 \pm 12.4^*$	$66.8 \pm 11.0^*$	$73.4 \pm 15.3^\dagger$	76.7 ± 12.3
Duration of surgery (min)	$42.7 \pm 22.8^\ddagger$	$43.1 \pm 21.8^\S$	29.2 ± 13.6	33 ± 16.6
Duration of anaesthesia (min)	$59.5 \pm 23.8^*$	$60.1 \pm 22.4^*$	39.6 ± 13.4	41.6 ± 17.5

* $P < 0.001$ compared to group D, $^\dagger P = 0.002$ compared to group D, $^\S P = 0.003$ compared to group D, $^\ddagger P = 0.008$ compared to group D

Table 2. Intraoperative sensations experienced by patients

Sensations	Group A (n = 51)	Group B (n = 95)	Group C (n = 16)	Group D (n = 175)	P
Pleasant dreams	1 (1.96%)	5 (5.26%)	2 (12.5%)	13 (7.43%)	0.251
Unidentified dreams	6 (11.76%)	1 (1.05%)	0 (0%)	10 (5.71%)	0.061
Unpleasant dreams	0 (0%)	2 (2.1%)	0 (0%)	3 (1.71%)	0.702
Awareness	0 (0%)	1 (1.05%)	0 (0%)	2 (1.14%)	0.824

surgery shortly after the induction of anaesthesia until the baby was extracted; later, there was no recall.

Another patient reported intraoperative sensations of touch and pressure, which she did not interpret as pain, and the feeling of the presence of an endotracheal tube. She was able to recall conversations in the operating room, e.g., she remembered the words “the professor entered the Caesarean section room”. However, she did not remember the moment of extracting the baby; her memories pertained to the post-delivery period and were associated with an episode of intraoperative haemorrhage.

In all three patients, awareness during general anaesthesia was already confirmed during the first examination 2 hours after surgery. Phone conversations carried out on post-anaesthesia days 7 and 30 did not demonstrate that the events evolved towards post-traumatic stress syndrome.

Two patients described awareness during their previous anaesthetic procedures, which did not reoccur.

DISCUSSION

Our results confirm the opinion that intraoperative awareness develops rarely and is more commonly experienced in patients undergoing general anaesthesia for Caesarean section. The specificity of this procedure favours the use of shallow anaesthesia to limit the adverse effects of anaesthesia on a baby delivered by Caesarean section. In cases of Caesarean sections complicated by intraoperative haemorrhage, shallow anaesthesia can be an important element in resuscitation management due to haemodynamic instability of patients [2]. Analysis of our results revealed the involvement of both of these circumstances as causes of intraoperative awareness. A noteworthy result was that a vast majority of the Caesarean section patients did not remember the period of anaesthesia, or their anaesthesia-related memories were pleasant dreams. Recall of dreams subsided with time elapsing from the completion of anaesthesia [5].

Awareness can develop at suitable doses of anaesthetics in patients with higher requirements for anaesthetics, i.e., patients using opioids on a long-term basis, alcohol abusers [2] and those with genetic resistance to anaesthetics (e.g., with increased requirements for volatile anaesthetics, which is observed in red-heads with mutations of the

melanocortin-1 receptor) [6]. The types of sensations are evaluated with the 5-degree Michigan awareness classification [7, 8].

Patients with intraoperative recall characterise this episode in different ways, ranging from a lack of satisfaction with anaesthesia to severe mental trauma. The occurrence of recall can be a source of stress, anxiety, nightmares, and insomnia, and recall can lead to post-traumatic stress syndrome [1, 9].

Another noteworthy observation from our study was that, in our subjects, intraoperative recall and other intraoperative sensations were most commonly observed during combined general anaesthesia for Caesarean sections and gynaecological procedures with thiopentone used for induction. In groups receiving propofol, the only sensations were neutral or pleasant dreams. This observation is likely to suggest stronger amnesic effects of propofol compared to thiopentone.

Studies from other centres disclosed that total intravenous anaesthesia is associated with a higher incidence of awareness than combined anaesthesia with halogen volatile anaesthetics [4, 8, 10], which is attributed to the lack of possible monitoring of serum concentrations of intravenous anaesthetics and to population variability of response to propofol. However, our findings suggest that awareness can develop during combined anaesthesia with sevoflurane but not during total intravenous anaesthesia. This observation is likely to be associated with pre-set target concentrations of an anaesthetic instead of its manually adjusted doses used during infusions.

It should be noted that, in one case, intraoperative awareness was also experienced during the previous procedure, which may indicate that some individuals are predisposed to such a phenomenon. Nonetheless, the examples of the other two patients show that awareness in the past does not mean that it will occur during subsequent anaesthetic procedures.

CONCLUSIONS

1. Awareness is observed incidentally in patients undergoing general anaesthesia.
2. The incidence of awareness episodes in patients undergoing anaesthesia for uncomplicated Caesarean sec-

tions is comparable to that in patients anaesthetised for gynaecological procedures.

3. Anaesthesia for Caesarean section can be accompanied by pleasant sensations of a dream-like nature, which are similar to those in anaesthesia for other procedures.
4. Awareness during one anaesthetic procedure does not predicts occurrence during subsequent procedures.

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ANNEX

QUESTIONNAIRE FOR ASSESSMENT OF INTRAOPERATIVE AWARENESS

GENERAL QUESTIONS

How do you feel?			
Have you been troubled by anything?	Yes	No	I don't know
Do you feel any pain?	Yes	No	I don't know
Pain scale			
Numerical scale			
Are you cold?	Yes	No	I don't know
Do you know that you are in hospital?	Yes	No	I don't know
Do you know that you are in the recovery room?	Yes	No	I don't know
Do you know that the surgery has been completed?	Yes	No	I don't know

DETAILED QUESTIONS

1. Do you remember the way to the operating room and initial preparations for surgery?	Yes	No	I don't	
2. Do you remember the end of surgery?	Yes	No	I don't	
3. Do you remember sleeping during surgery and anaesthesia?	Yes	No	I don't	
4. Do you remember when you fell asleep? (enquire further)				
5. Did you dream during anaesthesia?		Yes	No	
6. What dreams did you have? (enquire further)	Pleasant	Unpleasant	Unidentified	I don't remember the dreams
7. Did you feel any pain during anaesthesia?	Yes	No	I don't know	
8. Were you able to breathe?	Yes	No	I don't know	
9. Do you remember anything from the period of surgery?	Yes	No	I don't know	
10. What do you remember from the period of surgery? (enquire further)				
11. Did you hear anything during surgery?	Yes	No	I don't know	
12. What did you hear during surgery? (ask further about noises, conversations, voices, etc.)				
13. Did you feel anything during surgery?	Yes	No	I don't know	
14. What did you feel during surgery? (ask further about touch, pain, skin incision, pressure, presence of something in the mouth, throat, etc.)				
15. Are you satisfied with anaesthesia?	Yes	No	I don't know	
16. Would you choose a similar kind of anaesthesia, if needed?	Yes	No	I don't know	