**Abstract.** – Anaesthesia awareness (AA) is postoperative recall of events experienced under general anaesthesia. Most frequently patients remember an auditory perception, the feeling of motor function lost, pain, helplessness, anxiety, panic, impending death. The prevalence of awareness in nonobstetric and noncardiac surgical cases is 0.1%-0.2%. The prevalence is higher in cardiac surgery, obstetric and major trauma cases. According to the results of many studies light anaesthesia is the most common cause of the AA. Posttraumatic stress disorder appears in 33%-56% of patients who experienced awareness during general anaesthesia. Extreme awareness experiences are very uncommon, but traumatic and can have lasting effects on patients. Several brain-function monitors based on the processed electroencephalogram or evoked potentials have been developed to assess anaesthetic depth. Measures to prevent awareness include avoidance of light anaesthesia, gaining more knowledge about patient anaesthetic requirements and development of methods to detect consciousness during anaesthesia.

Key Words:
Anaesthesia general, Anaesthesia depth, Complications awareness, Explicit recall.

**Introduction**

Anaesthesia awareness (AA) is postoperative recall of events experienced under general anaesthesia. This term refers to the situation when we cannot assume, on the basis of usual clinical signs (such as blood pressure increase, heart rate frequency, muscular contractions, lacrimation, etc.), that anaesthesia is not of adequate depth. After operation patient could remember some or all events during the surgery and it is possible that he didn’t feel anything or might have felt moderate or intense pain or pressure if the analgesics dose hadn’t been adequate.

It is believed that awareness occurs as a result of auditory and verbal stimuli that are registered by brain cortex during the anaesthesia of apparently adequate depth. *Explicit awareness* means that patients are able to express their memories postoperatively. It occurs spontaneously or after being provoked by some questions or a postoperative event shortly after operation. With *implicit awareness* patients are not able to express their memories postoperatively and are not aware of them, but there are changes in performance or behavior that can be proved by hypnosis, specific tests and other methods. In 1985, Bennett carried out a double-blind study of implicit awareness, in which he randomized 33 patients to either suggestion or control group. Suggestion group patients were called by their names while they were under anaesthesia and asked to pull their ear postoperatively. They received nitrous oxide, halothane or enflurane. After the operation none of the patients could recall the suggestion but the patients who had received the message intraoperatively were recorded to pull their ears more frequently than patients in the control group.

**What do Patients Most often Remember?**

Most frequently they remember an auditory perception (voices 66%, noises 17%), the feeling of motor function lost (not being able to breath 48%, sensation of paralysis 17%), pain (38%), feelings of helplessness, anxiety, panic, impending death, or catastrophe (34%)\(^5\). Depending of what part of the operation they remember, the pain can come from intubation, incision or the following surgical procedure.

**When do Patients Become Aware?**

Sandin et al.\(^6\) performed one of the largest study on this topic which included 11785 pa-
tients. They identified 18 cases of awareness and one case of inadvertent muscle blockade that had occurred before unconsciousness. Prevalence of awareness was 0.18% in cases in which neuromuscular blocking drugs were used, and 0.1% in the absence of such drugs. Results showed that 39% of patients awareness was identified already in post-anaesthesia care unit (PACU), in 33% of the patients between the 1st and the 3rd day after the operation and in 27% of the patients awareness was detected on the 7th day after the operation and anaesthesia. Significant percentage of patients report awareness at PACU but they negate it during the following checks and vice versa. The detection of awareness depends on the interview technique, timing of the interview and structure of the interview. Therefore, it is necessary to check the patients who are suspected of being aware under anaesthesia minimum three times, in three different time intervals.

**Frequency**

The prevalence of awareness in nonobstetric and noncardiac surgical cases is 0.1%-0.2%. In a study from Australia, Myles et al. reported a frequency of awareness of 0.10%; it was the highest risk factor for patient dissatisfaction after anaesthesia. However, in certain patient groups, such those undergoing anesthesia for cardiac, emergency trauma, obstetric surgery or bronchoscopy, an increased risk for awareness and recall has been reported. The prevalence in cardiac surgery ranges from 1.1-1.5%, in obstetric cases (0.4%) and major trauma cases (11-43%).

Studies that have been performed recently show that awareness is more common in children than in adults, which causes a real problem. There are several reasons for that: it is believed that the children up to third year don’t have explicit memory completely developed, so they are not able to express their memories. Besides, the EEG is changing during the children’s growth, so there is some data showing that the methods for monitoring awareness such as bispectral index (BIS) and entropy, are less reliable in children younger than one year old ones.

The frequency of AA is not high, but we shouldn’t forget the great number of various interventions that are performed under general anesthesia all over the world every day. At issue here is a significant number of AA cases. We should have in mind that the presence of awareness under general anesthesia falls within the range of responsibilities of an anesthesiologist, thus a case of AA can turn into a law suit case against an anesthesiologist.

**Risk Factors**

Regarding the different kinds of surgical interventions, awareness is more frequent at major traumas that are followed by hypovolemia and hypotension, cardiac surgeries, C-sections, at intervention that are carried out at night, in operation of patient who undergo general anaesthesia for the first time. regarding the sex and age as risk factors, results are very different. So, in the study which included 3843 patients in Finland, awareness was identified only in female patients, with incidence of awareness of 0.07% in outpatients and 0.13% in inpatients. On the other side, an American study on 177468 patients showed that the prevalence of awareness was two times higher in male patients of an older age.

The Table I shows the major and minor criteria of awareness frequency during general anaesthesia. The patient with the higher risk for aware-

<table>
<thead>
<tr>
<th>Major criteria</th>
<th>Minor criteria</th>
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<tr>
<td>Preoperative long-term use of anticonvulsant agents, opiates, benzodiazepines, or cocaine</td>
<td>Use of beta-blockers</td>
</tr>
<tr>
<td>Heavy alcohol intake</td>
<td>Chronic obstructive pulmonary disease (COPD)</td>
</tr>
<tr>
<td>History of anaesthesia awareness and/or history of difficult intubation</td>
<td>Obesity BMI &gt; 30</td>
</tr>
<tr>
<td>ASA physical status class 4 or class 5</td>
<td>Smoking two or more packs of cigarettes per day</td>
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<tr>
<td>Cardiac ejection fraction (EF) &lt; 40%</td>
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<tr>
<td>Aortic stenosis</td>
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<td>Pulmonary hypertension</td>
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Table I. Major and minor criteria of awareness incidence during general anaesthesia.
In particular, according to the results of the research carried out in Spain with 4001 patients included, the prevalence of awareness in elective surgery was 0.6%. The patients were divided into three groups on the basis of anaesthetic technique: the prevalence of awareness was significantly higher in patients where inhalation anaesthetics halogen-containing were not used, the prevalence was 1% for TIVA propofol anaesthesia (which means 1% out of all patients who got TIVA were aware), 0.59% for balanced anaesthesia, 5% for O₂/N₂O\(^1\).
venous anaesthesia, since it is not presently possible to monitor the blood concentrations of anaesthetic agents28. We can conclude that the clinical monitoring of patients is an irreplaceable and necessary procedure in interpretation of the results coming with modern monitoring.

**How to Avoid Anesthesia Awareness?**

(Table III)

We should preoperatively consider if there is a higher risk for anaesthesia awareness and inform selected patients of the possibility of intraoperative awareness. The American Society of Anesthesiologists (ASA) has published guidelines recommended that stringent efforts must be made to prevent AA1.

We should consider premedication with amnestic agents. The results of some studies show that the application of benzodiazepines reduces the incidence of awareness10,29. There was no difference in the frequency of awareness and recall in respect to premedication, according to the results of Sandin et al. study6. This observation seems to agree with the suggestion of a minor role of benzodiazepine premedication in protection from awareness and recall during anaesthesia6,16. Any firm conclusion about the effect of benzodiazepines on the frequency of awareness and recall should be drawn cautiously, because the timing of the administration in relation to the operation is not standardized, and the duration of surgery varied considerably.

Consultants who participated in ASA Practice advisory for intraoperative awareness strongly agree that functioning of anaesthesia delivery systems (e.g., vaporizers, infusion pumps, fresh gas flow, intravenous lines) should be checked to reduce the risk of intraoperative awareness. Monitoring of the concentrations of inspired and expired gases and inhalation agents; and general vigilance should eliminate cases caused by inadequate anaesthetic delivery1,2. In high risk situations, monitoring of depth of anaesthesia is justified. Use of such monitoring may also be advisable in patients in whom clinical signs of light anaesthesia may be masked (concurrent β-blockers, diabetes).

Awareness during anaesthesia is uncommon, but well described adverse outcome that may result in serious emotional injury and post-traumatic stress disorder. A properly trained anaesthetist, administering anaesthesia according to knowledge of pharmacology and patient and surgical characteristics, assisted by clinical signs and monitoring, can minimize the risk of awareness. Measures to prevent awareness include avoidance of light anesthesia, gaining more knowledge about anaesthetic requirements of patients and development of methods to detect consciousness during anesthesia.

**References**


Awareness during general anaesthesia – implications of explicit intraoperative recall


