

Despertar Intraoperatório (Awareness): Caso Clínico

Raising Awareness on Awareness: Case Report

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Resumo

O despertar intraoperatório é uma complicação rara mas real da anestesia geral, com uma incidência estimada em 1-2 casos por 1000 anestésias gerais. Apresentamos um destes casos, em que uma paciente do sexo feminino, 63 anos de idade, com neoplasia maligna da mama e proposta para mastectomia unilateral, excisão de gânglio sentinela e colocação de expansor, apresentou despertar intraoperatório.

Este caso levou-nos a realizar uma busca sistemática pelos factores que contribuíram para esta complicação (*root cause analysis*), algo em que os sistemas de colheita automática de dados no perioperatório se revelaram particularmente importantes.

Note-se que a causa de um episódio de *awareness* deve sempre ser pesquisada, não apenas do ponto de vista dos cuidados ao paciente mas também para evitar casos subsequentes em outros indivíduos, uma vez que podem ser descobertos erros sistemáticos ou disfunções insuspeitas do equipamento utilizado.

Palavras-chave: Análise de Causa Fundamental; Anestesia Geral; Despertar Intraoperatório; Complicações Intraoperatórias; Monitorização Intraoperatória

Abstract

Awareness is a rare though important complication of general anaesthesia that still occurs in the present, with an estimated incidence of 1-2:1000 general anaesthetics. We present the case of a 63-year-old female patient with breast cancer presenting for unilateral mastectomy, sentinel lymph node excision and placement of short-term tissue expander under general anaesthesia, who experienced intraoperative awareness.

We set out to perform a root cause analysis in search of contributing factors in this particular case, acknowledging the importance of automatic data collection systems in this type of investigation.

A systematic search for the underlying cause should always be performed, as its importance extends not only to the patient directly involved but also to subsequent cases, given that potentially repeatable errors or unsuspected equipment malfunction may be unveiled.

Keywords: Anesthesia, General; Intraoperative Awareness; Intraoperative Complications; Monitoring, Intraoperative; Root Cause Analysis

INTRODUCTION

With an estimated incidence of 1-2 cases for every 1000 surgeries under general anaesthesia,¹ awareness is a particularly dreaded complication for both patients and anaesthesiologists. The basic underlying mechanism is an imbalance between the depressant effects of anaesthetic agents and the stimulating effects of surgical aggression, predisposing to superficialization and, eventually, explicit recall. While considerable effort has been channeled into understanding and preventing this complication, human error or equipment malfunction is still often involved,²⁻⁴ which means there is significant margin for improvement in terms of preventative efforts. Special attention is paramount at every step of patient management if we are to stop its occurrence.¹

CASE REPORT

A 63-year-old female patient diagnosed with invasive carcinoma of the right breast was scheduled for unilateral mastectomy, sentinel lymph node excision and placement of a short-term tissue expander, under general anaesthesia.

As comorbidities she had type 2 diabetes mellitus, arterial hypertension, obesity, depression and generalized anxiety disorder, and had been operated on twice before with no history of complications (for uterine dilation and curettage). Her daily medications included a benzodiazepine (she took lorazepam for over 30 years), mianserine, irbesartan, indapamide, metformin, vildagliptin and simvastatin.

Physical examination was unremarkable except for obesity and some stigmata pointing to a possible difficult airway,

namely a Mallampati class III, thyromental distance 4.5 cm and a short, thick neck.

On the day of surgery patient and equipment checklists were completed, difficult airway material made readily available, the patient was monitored and induction performed with administration of midazolam 2.5 mg, fentanyl 0.15 mg and propofol 200 mg (patient weight: 90 kg). The neuromuscular blocker was withheld pending laryngoscopy, which evidenced a Cormack-Lehane class IV, even with the BURP manoeuvre (two attempts). Help was called, and because the patient was easy to ventilate with bag-mask (non-emergency pathway⁵), an alternative approach to the airway was used – videolaryngoscopy – successfully. Securing the airway took approximately 9 minutes, during which additional 150 mg propofol were administered to maintain appropriate anaesthetic depth. After endotracheal intubation atracurium was administered and a balanced general anaesthesia maintained (halogenated agent: desflurane).

At 0:37 minutes, concurrent with skin incision, there was an important adrenergic response (Fig. 1), leading to administration of additional opioid and an increase in the halogenated agent with consequent return of vital signs to pre-anaesthetic levels. The remainder of the surgery proceeded uneventfully, but once the patient was extubated, oriented and communicating, she told us she remembered feeling pain for a few seconds during skin incision. We applied the modified Brice questionnaire^{6,7} and confirmed intraoperative awareness had indeed occurred. From that moment onwards we had two main concerns: on the one hand, addressing the patient's immediate needs and optimizing care; on the other, finding a satisfactory explanation for the occurrence of this sentinel event.

DISCUSSION

PATIENT MANAGEMENT

Awareness has the potential for devastating psychological consequences on the patient, especially when associated with intraoperative pain¹ – in which case post-traumatic stress disorder (PTSD) can occur in up to 70%.⁸ Patients with explicit recall can feel abandoned and isolated, often believing there is no one they can talk to about the occurrence because either others won't believe it or will judge them as ungrateful.⁹ This contributes to a feeling of helplessness that should be ameliorated by the anaesthesiologist.

It is critical to never try and deny what happened. Naturally one must differentiate between true awareness episodes and perioperative dreams or recollection of events during intended superficialization (like at the end of surgery when the patient is being extubated), and in this regard an objective conversation with application of the aforementioned modified Brice questionnaire^{6,7} is instrumental in separating

the two. However, if and when recall of intraoperative events is confirmed, any attempt at denying it will only isolate the patient further, worsening his/her psychological outcome.¹ In the case we described, we visited the patient daily during her hospital stay, and had frank talks with her explaining what had happened and what could be made to prevent it in subsequent surgeries.

Initially she did develop insomnia and nightmares, dreaming that she was being attacked and bitten by an unknown animal while unable to move and fend for herself – likely representing the immobility and pain experienced intraoperatively. This could signal the onset of PTSD,¹⁰ but the patient persistently refused specialized psychological counselling. With continued support from all healthcare professionals, however, such dreams soon subsided, still during hospital stay, and on follow-up post-discharge contacts we could confirm that she had returned to her usual routine, exhibiting none of these or other lasting symptoms. A few months later she was operated on again (for breast reconstruction), and was understandably anxious and fearful about anaesthesia. We advised her to always tell her anaesthesiologists what had happened, as a past history of awareness is regarded as a risk factor for new episodes,¹ and during the new surgery she was monitored with a BIS index monitor, which remained below 60 throughout the intervention. There were no complications.

ROOT CAUSE ANALYSIS⁹

As mentioned, this sentinel event sparked a search for causes underlying this awareness episode.

We know from the ASA Closed Claims Database and Anesthesia Awareness Registry¹¹ that in 37% of awareness cases human error is the main contributing factor, with equipment malfunction responsible for an additional 28%. In the remainder 35%, a cause cannot usually be identified – leading some authors to postulate that not all cases of awareness can be prevented.^{7,10} In a minority of these “orphan” cases pharmacogenomic variability causing altered sensitivity to the administered drugs may be involved, but such truly is a small subset and should not be assumed as a default explanation without a serious effort to rule out more common causes.

With such in mind, we set out to perform a root cause analysis, reviewing all steps of intraoperative patient management using the Ishikawa (or fishbone) diagram.¹² We specifically looked at aspects such as *methods* (organization), *manpower* (people), *machinery*, *material*, *measurements* and *environment*.

Organizationally (*methods* aspect), appropriate checklists had been followed prior to beginning the case, and were properly filled. Necessary *materials* were also readily available, and all *machines* passed the regular tests. Also,

no *environment* or *measurement* problems were apparent, leaving us to analyse possible changes in *manpower* – which is to say, face the possibility of *human error*.

We began by confirming that the different medications remaining in the syringes were present in the amounts expected after consulting the registers, and that there had been no vial swaps. The presence of an adequate amount of desflurane in the vaporizer throughout the case was also confirmed. There had been no disconnections in intravenous lines that might imply administered drugs had not reached the patient, nor were these lines kinked intraoperatively, as their functioning status was regularly checked by us.

We then set out to analyse anaesthetic choices. We could have elected to use an anaesthetic depth monitor, but the truth is that these are still not *routinely* indicated for clinical use by international guidelines,⁴ though they should be considered in patients with significant risk factors – and, accordingly, have been used in subsequent interventions on the same individual.

Possible risk factors in our patient included chronic benzodiazepine use, a history of depression and generalized anxiety disorder and some stigmata pointing to a possible difficult airway. Considering their existence and also the fact that she was anxious, with fear and anxiety appearing to have a priming effect on memory formation,¹³ we administered a preoperative dose of 2.5 mg of midazolam, aiming to take advantage of the amnestic effects of the drug – though clearly such effect was not prolonged enough in this case. Chronic medication with other benzodiazepines may arguably have decreased the patient's sensitivity to the drug's effects.

A difficult airway is considered a risk factor for awareness¹³ mainly because it is relatively easy for the anaesthesiologist to become so focused in the difficulty to intubate and/or ventilate that a longer than anticipated period to secure the airway is not always accompanied by additional doses of anaesthetic. Such did not occur in our patient, who received 150 mg of propofol in addition to the induction dose to maintain unconsciousness during this period.

Regarding intraoperative clues to the possibility of an awareness episode occurring, clinical markers usually include elevated blood pressure and heart rate, diaphoresis and lacrimation. Still, their absence should not be considered as overly reassuring, particularly when there is concurrent medication with beta-blockers (for the first two) or anticholinergics (which prevent diaphoresis).¹ Spontaneous patient movement and/or ventilator dissynchrony are also possible markers of superficialization, usually still at a sufficiently deep level of consciousness to prevent explicit recall.¹ However, since the advent of neuromuscular blockers movement as a useful clinical monitoring tool has been difficult to use,⁴ so much so that these medications are

now considered a risk factor for intraoperative awareness. In our patient signs of adrenergic activation concurrent with the first incision (Fig. 1) led to an intentional deepening of anaesthesia, with further opioid administration and an increase in the dose of the halogenated agent (also increasing the fresh gas flow to allow for a faster rise in the $et_{desflurane}$). However, the patient still superficialized enough to feel and remember pain for a few seconds during that period. Because a neuromuscular blocker had been administered, movement as a clinical sign was made impossible to detect. Given that the dose of drugs administered abided to clinical guidelines, did this particular patient simply need more, or was there something else involved?

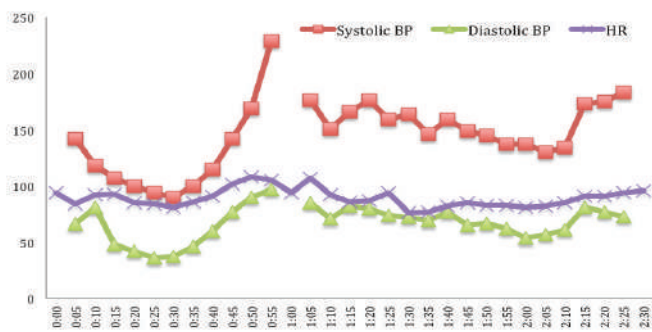


Figure 1. Evolution of systolic arterial blood pressure, diastolic arterial blood pressure and heart rate since first monitoring the patient in the operating room.

BEYOND A SUPERFICIAL ANALYSIS: THE IMPORTANCE OF AUTOMATIC DATA COLLECTION SYSTEMS

Thus far a cause for intraoperative awareness still had not been uncovered, which was worrisome. However, at the operating room where this occurred there was an automatic data collection system available, which recorded both vital signs and ventilatory data. We readily retrieved this information and set out to analyse the numbers critically. What we found was that after an initial upstroke, the $et_{desflurane}$ not only did not go past 3%, as from 25 minutes onwards it actually plummeted until reaching 0%, by 35 minutes. Consequently, when at 37 minutes, after positioning and disinfection of the patient, the first incision was made, there was no halogenated agent in the breathing circuit, and consequently superficialization occurred (Fig. 2) – accompanied by the aforementioned signs of adrenergic activation concurrent with the awareness episode. The manipulation of the vaporizer to increase the set inspired desflurane concentration at this point seems to have returned it to a functioning state, because the expired concentration quickly rose and remained within intended values until the end of the case.

Appropriate alarms for the $et_{desflurane}$ were not set, leading to the lack of recognition of this malfunction. It should

be emphasized that the BAG-RECALL trial proved their effectiveness in the prevention of intraoperative awareness,⁸ and as such they should be used routinely.

Further supporting evidence for vaporizer malfunction came from the fact that in later surgeries performed at the same operating room a considerable difference was later found between set and expired values for desflurane. Appropriate corrective actions were taken by sending the vaporizer for repair, most likely preventing the occurrence of new cases in additional patients.

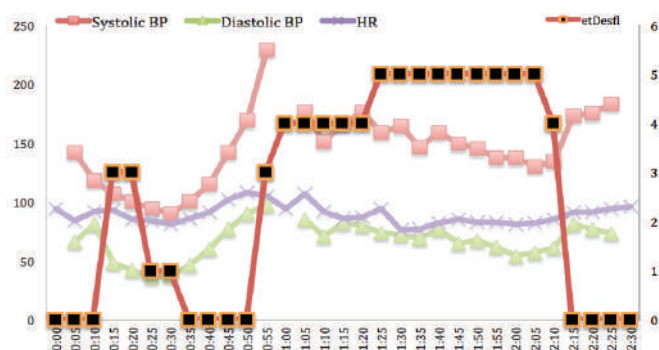


Figure 2. Superimposition of et_{desflurane} data on Figure 1.

CONCLUSION

Perhaps not all cases of intraoperative awareness can be prevented, but the fact that human error or equipment malfunction is involved in the majority of them means there is a vast room for improvement.

Considering the potentially devastating psychological consequences of this complication, much effort has been devoted to the development of anaesthetic depth monitors, but it should be mentioned that *the most effective anti-awareness mechanism is likely to be an ever-vigilant anaesthesiologist*, alert to the problem and observant of every step of patient treatment.

If awareness does occur, it is important not only to optimize patient management but also to investigate its causes, which can have important repercussions not only for the affected patient but also for subsequent ones, as happened in the case reported. In this regard, automatic data collection systems may prove to be particularly powerful tools, helping to uncover causes otherwise easily missed.

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Proteção de Pessoas e Animais: Os autores declaram que os procedimentos seguidos estavam de acordo com os regulamentos estabelecidos pelos responsáveis da comissão de investigação clínica e ética e de acordo com a declaração de Helsínquia da associação médica mundial.

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