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Intra-operative Awareness

António Pais de Lacerda

Departamento de Medicina Intensiva, Hospital de Santa Maria, Centro Hospitalar Lisboa Norte, Lisboa (Portugal). Asignatura de "Medicina clínica: El médico, la Persona y el Enfermo", Facultad de Medicina de Lisboa (Portugal).

Correspondencia: António Pais de Lacerda, R. Prof. Carlos Teixeira, nº1-5ºC 1600-608 Lisboa (Portugal).

e-mail: aplac@armail.pt

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Summary

Awake is an American thriller, the *opera prima* of the young director Joby Harold, that addresses the problem of all those who maintain a state of awareness during a surgical intervention, which that allows them to feel (and afterwards recall) some of the episodes that occurred when they should have been sedated and pain-free (analgesics); that is, they have been poorly anaesthetized. Several factors are involved this situation, which, although rare, does occur. Physicians should be prepared to respond to the questions of individuals motivated by this type of film, in particular when the topic may generate cognitive dissociations with possible modifications in the behaviour of the patients, who possibly fear being subjected to surgery that is necessary for them.

Keywords: Intra-operative awareness, General anaesthesia, Depth of anaesthesia, Amnesia

You were on the other side of death
And I did not feel you
But you looked at me
And I did not see you
And you listened to me
And I didn't hear you
A shadow fled
From the other side of the night. Silence. The dawn broke.

José Bergamín, *Mañana**

When the America humorist Henry Louis Mencken (1880-156) wrote that "*To be in love is merely to be in a state of perpetual anesthesia — to mistake an ordinary young man for a Greek god or an ordinary young woman for a goddess*"[1], he was referring metaphorically to anaesthesia as a state of alteration of awareness in which vigilance persists.

However, this is not the aim of general anaesthesia, a situation in which through the effect of drugs the patient must remain unconscious and pain-free (without responding to painful stimuli), and in which it is hoped that the patient will be unable to recall phenomena that occurred during the surgical intervention. The degree of depth of the anaesthesia corresponds to a continuous depression of the central nervous system, with the consequent progressive decrease in response to stimuli.

Awareness is a state in which a person is able to process information coming from the external surroundings. This ability is evaluated through the observation of adequate responses to different stimuli (adequate movements in response to verbal commands or painful stimuli). This possibility of response may, however, be compromised both by the existence of neurological pathology and by the effect of a drug with a neuromuscular blockade action[2].

During general anaesthesia, physicians administer drugs, many of which cause amnesia (anterograde or retrograde) at concentrations lower than those necessary for the complete suppression of consciousness. Nevertheless, in some cases if the patient unexpectedly regains consciousness during surgery there may be a memory of some of the events that occurred during the intervention – and it is this phenomenon that is referred to as "intra-operative awareness" (IA) (excluding all possible memories of

* Varios autores. El crimen fue en Granada – Elegías a la muerte de García Lorca. Barcelona: Lumen; 2006

the moment of the induction of anaesthesia, waking and dreams).

Curiously, the work of Check and Levinson revealed that under hypnosis patients recalled many intra-operative events, especially those related to moments of "crisis"[3,4].

The advent of muscle relaxants in the 1940's created a new problem; it was no longer possible to evaluate the depth of anaesthesia through the failure to record motor responses since the patient would be incapacitated to perform movements while still awake.

In fact, it is currently not possible to guarantee that patients will remain unconscious during general anaesthesia, and explicit memories of sensory perceptions that occurred during the surgery may arise, even when methods able to measure the depth of anaesthesia are used [Bispectral Index Monitor (BIS), maintained between 40 and 60][5]. Our understanding of the individual responses of each patient to this complication is still limited. The number of documented cases of IA has increased, being 1% (5) in high-risk patients, although the number is much lower in the case of routine surgery (1-2-per 1000 patients operated)[6]. This number is possibly higher in paediatric surgery.

It is believed that this possibility is multifactorial and that it varies depending on the type of anaesthesia, the type of surgery, and the physiological circumstances of the patient in the pre-operative period[2]. Heart surgery (owing to the prior haemodynamic compromise or the reduced cardiac reserve too sensitive to anaesthetics) and caesarean sections (owing to the minimization of the levels of drugs that could affect the foetus) are the interventions posing greatest risk. Patients undergoing multiple trauma in accidents are also at higher risk, since they do not tolerate high doses of anaesthetics[2,7]. As individual factors that may condition the effect of anaesthetics, genetic variations must also be taken into account (contributing to different pharmacokinetics), together with a background of drug "abuse" or resistance stemming form habitual consumption (benzodiazepines, alcohol, cocaine…).

The memory of pain during surgery may have devastating psychological effects, especially the development of post-traumatic stress disorder and other psychological alterations, and in particular in the sphere of emotion[8] (mood swings, anxiety and panic attacks), with the later frequent onset of nightmares, flashbacks, and personality alterations, To avoid this post-operative recall of intra-operative events, modern anaesthesia has adopted preventive practices such as:

1. The administration of a benzodiazepine (affecting the formation of anterograde memory) in the pre-induction of anaesthesia;

2. Greater care in maintaining the patient asleep for long periods of time (induction with difficult intubations, for example);

3. An adequate maintenance of anaesthesia during surgery (more attention to the gas vaporizers, which may become depleted; surveillance of endovenous perfusions);

4. Adequate use of muscle relaxants, by assessing all the movements of the patient, even though such movements are considered "reflex", and

5. The use of brain function monitors may reduce the incidence of intra-operative awareness by about 80%, and these should be employed in patients whose pathology affords them a good chance of showing inter-operative awareness and in those who can only tolerate low doses of general anaesthetics.

Awake – The transplant surgery of de Clay Beresford

Clay Beresford: *Am I supposed to still hear you?*
In *Awake* (2007) by Joby Harold

Technical details

Title: *Awake*
Country: USA
Year: 2007
Director: Joby Harold
Music: Samuel Sim
Photography: Russell Carpenter
Film editor: Craig McKay
Screenwriter: Joby Harold
Cast: Hayden Christensen, Jessica Alba, Terrance Howard, Lena Olin, Christopher McDonald, Sam Robards, Arliss Howard, Fisher Stevens, Georgina Chapman, David Harbour, Steven Hinkle, Denis O'Hare, Charlie Hewson, Court Young, Joseph Costa, Poorna Jagannathan, Lee Wong, Kae Shimizu, Steven Rowe, Jeffrey Fierson, John C. Havens, Richard Thomsen, Joshua Rollins, Brenda

Schad, Sam Pitman and Ross Klavan.
Color: Color
Runtime: 84 minutes
Genre: Crime, thriller.
Producers: GreeneStreet Films, The Weinstein Company y Open City Films.
Synopsis: A young man receiving a heart transplant becomes horrifically aware that the anaesthesia has paralyzed hum but that he is fully conscious as regards sensitivity to pain.
http://www.imdb.com/title/tt0211933

Clay Beresford (Hayden Christensen), a young millionaire who has found much success in the sphere of high finances in New Cork (Figure 1), suffers from a heart condition related to a viral infection and his only possibility in the mid-to-long term is to undergo a heart transplant. His mother, Lilith Beresford (Lena Olin), who is overprotective and dominant in his life, finds out that he has been having an "impossible" romance with Sam Lockwood (Jessics Alba), his secretary, to whom Clay eventually gets married (Figure 2).

Suddenly, there is a message informing us that there is a histologically compatible heart available, and the time for the transplant is nigh (Figure 3). The title of the film, *Awake*, is illuminating. During the intervention the patient will be awake but paralyzed by curare-based drugs and will be unable to express his dramatic perceptions not only as regards the atmosphere in the operating theatre but above all as regards the pain inflicted by the scalpel. The operation is performed by Dr. Jack Harper (Terrance Howard) (Figure 4), who in his day saved him, became his friend, and was the best man at his wedding. His mother was always opposed to Dr. Harper performing the intervention since through a friend (Dr. Neyer (Arliss

Figure 1: Clay Beresford, the main character, is a successful young millionaire

Figure 2: Clay with his wife Sam

Howard) she had heard about a series of complaints concerning his poor practices.

Suddenly, in the operating theatre the anaesthetist is replaced by a colleague from another hospital. During the intervention a situation of "maintenance of awareness" arises. While Beresford is totally immobilized, in "off", and inaudible to those in the operating theatre, we learn of his terrifying experience (Figure 5).

Figure 3: Clay accompanied by his wife, Sam Lockwood, and his surgeon, Dr. Jack Harper, on the way to surgery

At this point the film passes from what would be, to a certain extent, a supernatural to a medical/psychological environment. The spectator realises that there is a plot to kill Beresford in the OR based on rejection of the transplanted organ, which was chosen especially for the purpose, and there is no alternative to save him. Meanwhile, Clay begins to realise that a plot has been hatched to kill him. In the hospital waiting room (Figure 6), Lilith discovers that Sam had worked at the hospital before becoming Clay's secretary. In fact her daughter-in-law belonged to Dr. Harper's team.

For Clay, the solution is to receive a new, compatible heart. His mother, who knows what is

Figure 4: The surgery was performed by Dr. Jack Harper

Figure 5: Clay undergoes the Herat transplant while still conscious

happening, commits suicide with an overdose. She finds herself in a post-mortem limbo that Clay does not wish to leave in order to return to the real world, where he would be an orphan, betrayed by the woman he loved.

Dr. Neyer, called in by the dying mother, resolves the transplant problem with a new team of surgeons, while the police apprehend the villains. After a brief regression to infancy and the perception that "he will always be better than his father", Clay decides to return to this world, in which the new transplant is successful.

Figure 6: Lilith, Clay's mother , in the hospital waiting room

From the philosophy of the cinema[9] to the viewing of a film

The cinema, presented as the seventh art, a synthesis or fusion between the spatial arts (architecture, sculpture, painting) and time (music, dancing, poetry), and as summarized by Ricciotto Canudo in "*Manifeste des sept arts*" (Paris, 28/03/1911), *is the art of life and not a simple illustration of something; neither is it a series of words commented and illustrated by images, or a series of pictures commented with words…. The cinema was created to be the total representation of Souls and Bodies, in a visual tale made of images, and painted with brushes of light.* In this way, an immaterial world of "art of life" occurs, not in the simple sense of reproduction but as a new proposal to manifest feelings that can be transmitted to the public: *Art is not the spectacle of a collection of real facts; it is the evocation of the feelings that surround those facts. It is not a question of photographic exteriors but of playing with light to obtain certain moods.*

It is in this sense of the expression of mood and feelings, borne by images, that "cinematographic language" is generated; creating a surreal life that is able to depict dreams and emotions.

A better definition of this "language" is that of Louis Delluc; the need to reproduce what is real, what is true in nature, in search of a concordant "photogenicity" of evaluative elements. Later, German Dulac was to define a cinema of essences, of pure emotion, in which *the most important aspect of the cinema is not the personage but the relativity of the images among one another and, as in other types of art, what really interests us is not the exterior fact but the interior emanation, a certain movement of things and people seen through a state of the soul.* The idea of the need to reproduce what is real starts to disappear, with Jean Epstein, to *what is specific about the cinema is that it must reflect the complete mobility, in time and in space, of images and sounds.*

How then can we amplify that state of the soul, or mood, that emotion, bringing the feelings of the characters seen on the screen to the spectators; creating an identical, empathic, feeling in them, and hence attaining a more stable and prolonged psychological effect?. The presentation of this "interiority" is developed by Epstein with the "interior monologue", thereby managing to add another dimension to what is real: that of the disorder of feelings, often in dissonance with the exterior discourse: "*It is clear that the topic itself can only excite, regardless of the way in which it is presented. But here it is a question of the way in which art*

allows the emotion of a topic or of an event to be realised up to the maximum degree of action"[10].

It is this overlay of sound –necessarily silent since the patient is curarized but aware- that connects the outside to the inside; the scenario of an operating theatre to the introspective invisible; surgical practice to feelings. The interior of the patient emerges to cause emotion in the spectator.

In a full-length film, it is narrative that helps us to understand previous circumstances and to gain a perspective of the future; the present –in this case the illness- is responsible for the temporal separation between the two, as occurs in the communication of a "formatted" case history among health professionals. However, whereas in the medical context each topic is discussed not only from the medical point of view but also from the ethical one, in the film that "case history", containing knowledge connected to emotions, may condition future behaviours in the spectator.

The problems of intra-operative awareness, and the issues –no less important- of medical failure and the ethical principles of the profession that arise in the film *Awake* are easily debatable both in the field of health and in that of the teaching of medicine. Nevertheless, when watching a film with "medical" contents it is possible to glimpse different situations, such as patient/family/physician relationships, medical professionalism, the relationships between partners, and event relationships between physicians and the community/society. *Aware* touches upon all these aspects and yet it leaves us with a feeling of sadness and falseness.

At a time when the public has become accustomed to seeing fairly credible medical situations in different TV series, it is normal for many people to understand that the situations depicted are somewhat distant from reality (in particular, the lack of ethics of the surgical team). However, in some people who are less perspicacious and more sensitive, an unrealistic fear may develop as regards the perspectives undergoing surgery: the pain and panic of Clay Beresford (and his inner monologue) will be seared into many peoples' minds.

When explaining the need for surgery and its risks, would any real surgeon place a patient on the operating table and show him or her a scalpel, describing its future trajectory on the patient's skin, where it will "cut like butter"? (Figure 7).

The idea of making a full-length film about this issue is interesting. However, in this first venture as a film maker Joby Harold overlooks the medical details of anaesthesia and surgery. In fact, Clay must be completely immobile because he has been given curare, which is not only apparent from the lack of facial and eye movements, in themselves sufficing to call the attention of any anaesthesiologist. The atmosphere in the operating room, with the dialogues heard there, is not realistic; the paucity of the members of the surgical team and the lack of asepsis, with so many comings and goings by the staff, are disconcerting, to say the least, and the sudden appearance of another transplantation team is not even worthy of comment (Figure 8).

Figure 7: The surgeon explains the intervention to Clay

When the film first appeared in Canadian cinemas, it was rapidly criticised by the Anaesthesiology Section of the Ontario Medical Association, who drew attention to its many blunders and considered that the kind of twisted information seen in the film could disturb proper medical education in patients as regards matters pertaining to their own health[11].

Thus, the issue of intra-operative awareness merely functions as an accessory to the overall development of the thriller.

The initial text of the film introduced the matter in a horrifying way: *Every year more than*

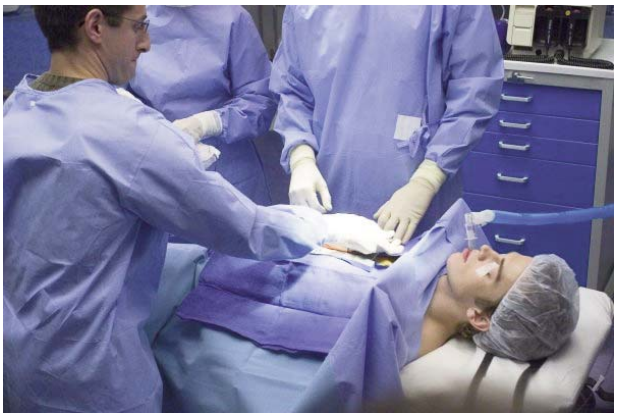


Figure 8: The operation and its atmosphere

21,000,000 patients are subjected to general anaesthesia. Most sleep calmly and remember nothing. However, 30,000 are not so lucky. They are not anaesthetized sufficiently and remain in a state known as intra-operative awareness. These people are completely paralyzed. They cannot even shout for help. They are conscious.

However, later, when we are really in the midst of the surgical intervention, nothing that happens in the operating room perceived by the patient will influence the development of future events. And, from the reality of the operating theatre, we pass rapidly to an imaginary register in the embodiment of peri-death limbic moments.

The initial dialogue of the film focuses on the problem of inter-operative awareness (Figure 9), suggesting that the author studied the topic and that the script will revolve around this issue. This, however, is pure fiction!

The 84 minutes of the film can be seen see simply within the context of a thriller (medical?) adorned with supernatural effects (extra-corporeal investigation), with more or less (un)expected events

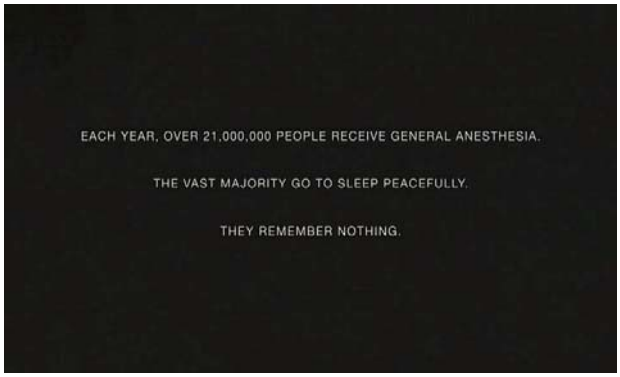


Figure 9: The first parts of the film focus on intra-operative awareness

that stimulate the attention of the patient, and no more.

What must be taught about intra-operative awareness?

A full-length film whose title points to a pathology or a medical issue, as well as raising doubts about the truth of what is shown, frequently generates doubts in patients who are in a similar situation. It is therefore important to clarify what is essential about intra-operative awareness based on current knowledge about the phenomenon.

1. There exists the possibility, although remote, that phenomena of recall about certain intra-operative events, sometimes pain, may occur in patients subjected to general anaesthesia. It is understood that when this occurs unexpectedly this perception of reality may be highly traumatic.

2. These cases are usually seen at the beginning or end of the anaesthesia, when the doses of sedating agent-anaesthesia are very low, although they may remain throughout the intervention: when they do happen, normally there is no pain but a sensation of pressure.

3. Higher risk interventions are those in which the patients are more unstable from the haemodynamic point of view, such as in cardiothoracic surgery or emergency C-sections. Intra-operative awareness cannot be completely prevented, above all as regards memory blockade.

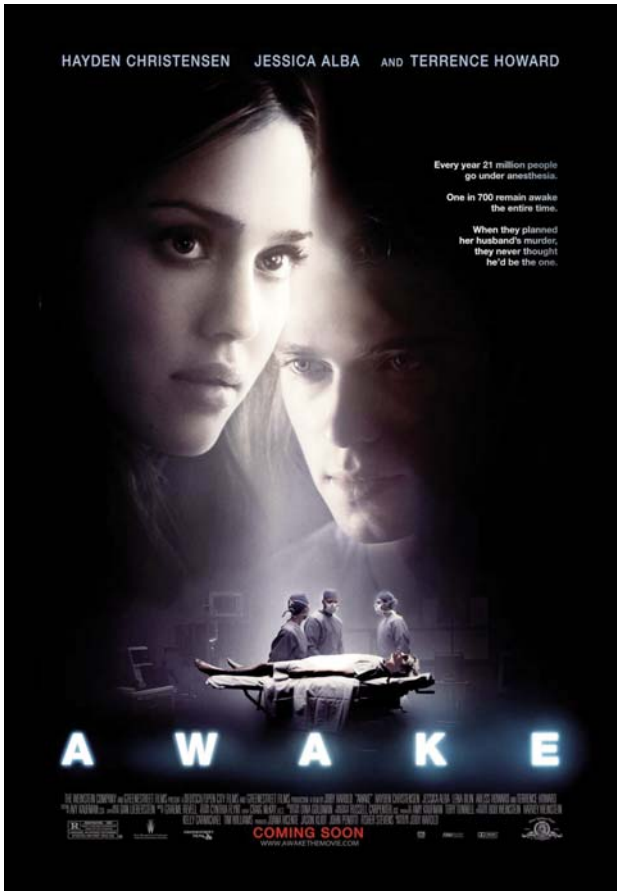
4. Anaesthesia has evolved in recent years in the sense of affording a greater protection of life and better patient comfort, although it is never possible to foresee individual response differences in patients. Some drugs may mask important signals used by the anaesthetist to assess the depth of anaesthesia. Nevertheless, it is never possible to rule out human error.

5. The existence of consultation with the anaesthetist prior to programmed surgery, in which the possible medication or drug consumption and doubts are clarified and discussed. Likewise, the immediate report of intra-operative awareness to the anaesthetist may help to reduce the traumatic stress brought about by this situation.

6. The most recently developed monitors for measuring the electrical activity of the brain during

anaesthesia do not directly quantify the level of awareness or memory, and their response is not uniform and depends on the type of patient and on the anaesthetics used. Although there are reports of intra-operative awareness in patients in which no alterations in haemodynamic parameters were recorded during surgery, nothing can replace the experience of an attentive anaesthetist, who must use information collected from his/her patient in an integrated way.

7. Not all "memories" after surgery actually correspond to the existence of intra-operative awareness. There may be a perception of prior scenarios or a recall of dreams during surgery.



American poster with the two protagonists in a scene from the film

8 The fear of being able to have some memory of the intervention carried out under general anaesthesia should never postpone life-preserving surgery.

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