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Review Article

REVIEW ARTICLE

Intraoperative awareness: controversies and non-controversies

G. A. Mashour[1,*] and M. S. Avidan[2]

[1]University of Michigan Medical School, Ann Arbor, MI, USA, and [2]Washington University School of Medicine, St Louis, MO, USA

*Corresponding author. E-mail: gmashour@med.umich.edu

Abstract

Intraoperative awareness, with or without recall, continues to be a topic of clinical significance and neurobiological interest. In this article, we review evidence pertaining to the incidence, sequelae, and prevention of intraoperative awareness. We also asses which aspects of the complication are well understood (i.e. non-controversial) and which require further research for clarification (i.e. controversial).

Key words: anaesthesia, awareness, consciousness, post-traumatic stress disorder

Editor's key points

- Recent large prospective studies have addressed the incidence, detection, and prevention of awareness under general anaesthesia.
- While important controversies remain, a number of concepts regarding intraoperative awareness can be considered non-controversial.
- Controversies remain in both the aetiological and the neurobiological bases of awareness.

The unintended experience and memory of surgical or procedural events can be devastating for patients and remains a dynamic area of investigation. Intraoperative awareness, with or without explicit episodic recall, is relevant to patient safety, standards for intraoperative monitoring, and the search for the neural correlates of consciousness. The objective of this narrative review is to assess the state of the field by addressing key topics related to intraoperative awareness and to consider whether the evidence associated with these topics should be deemed controversial or non-controversial (see Figure 1 for summary).

Non-controversial: the modified Brice interview detects more instances of intraoperative awareness with explicit recall than alternative methods

Multiple prospective studies using the modified Brice interview[1] as the method of assessing intraoperative awareness with explicit recall have consistently found an incidence of approximately 1–2 per 1000[2–4] or higher.[5–10] In contrast, studies using instruments without specific questions pertaining to awareness (such as Pollard and colleagues),[11] quality assurance data (such as Mashour and colleagues)[12] or spontaneous reports [such as the recent National Audit Project (NAP) 5][13 14] have consistently found the incidence to be lower by an order of magnitude (Table 1).[11–14] It was unclear from these conflicting reports whether the differences in incidence resulted from disparities in patient population, anaesthetic technique, clinical severity, or method of detection. In an attempt to resolve the controversy across studies and study populations, Mashour and colleagues[15] compared the incidence of intraoperative awareness with explicit recall in a single population of surgical patients who received both a standard postoperative evaluation (without a structured interview intended to detect awareness) and a single modified

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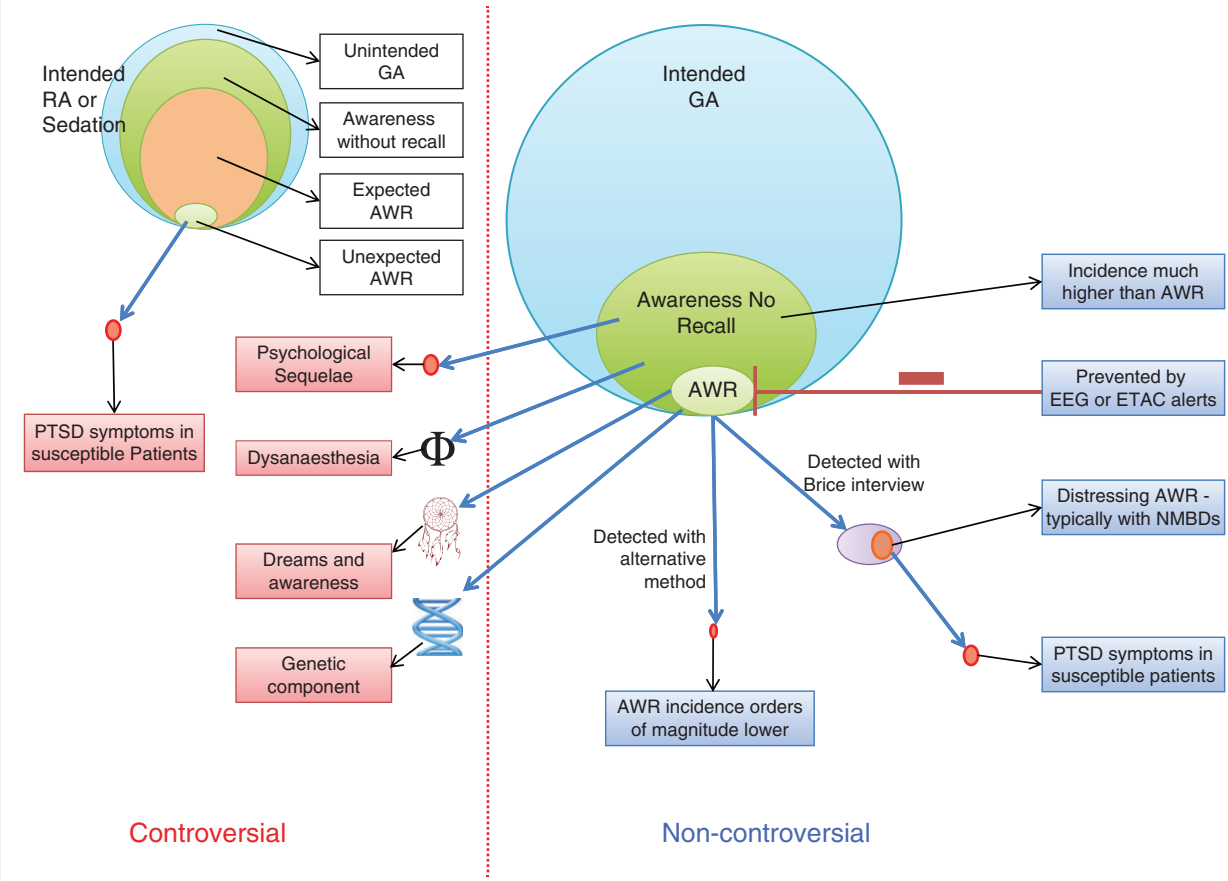

Fig 1 Controversial and non-controversial aspects of intraoperative awareness research and clinical practice. AWR, awareness with recall; EEG, electroencephalogram; ETAC, end-tidal anaesthetic concentration; GA, general anaesthesia; NMBD, neuromuscular blocking drugs; PTSD, post-traumatic stress disorder; RA, regional anaesthesia.

Brice interview at 30 days. The modified Brice interview detected 19 instances of definite intraoperative awareness with explicit recall in approximately 19 000 surgical patients.[15] Of these 19 instances, only three were detected independently based on spontaneous report.[15] Importantly, no instances were spontaneously reported that were not detected by the modified Brice interview. Although the modified Brice interview cannot be regarded as a 'gold-standard' psychometric test for awareness and memory, it has been associated consistently with a higher incidence compared with alternative methods. Thus, recent quality assurance initiatives that determined awareness incidences based on spontaneous reports[13 14] are likely to have underestimated the awareness incidence in the populations of interest, based on documented methodological limitations with this approach.[15 16]

Non-controversial: the incidence of awareness without explicit recall is higher than with recall

Consciousness and memory are dissociable cognitive processes, and the anaesthetic doses required for unconsciousness are higher than the doses required for amnesia. It is therefore not unexpected that a proportion of surgical patients receiving general anaesthesia could at times be both conscious and amnesic. Indeed, use of the isolated forearm technique (IFT) during intended general anaesthesia has revealed a high rate of response to command, the current standard for determining consciousness. For example, in a study of 113 patients by Tunstall and Sheikh,[17] 42% of patients responded to a command 2–5 min after what was presumed to be the induction of general anaesthesia. Importantly, none of the patients who responded had any explicit memory of the event. Remarkably, a study using the IFT found that 97% of patients had a positive response after skin incision; again, none of these patients had explicit recall of the episode.[18] Sanders and colleagues[19] summarize a number of studies using the IFT and demonstrate unequivocally that the incidence of awareness without explicit recall is significantly and consistently higher than the incidence of awareness with recall.

Non-controversial: intraoperative awareness with explicit recall can lead to post-traumatic stress disorder

The first case series of intraoperative awareness with explicit recall described a symptom constellation consistent with post-traumatic stress disorder (PTSD).[20] Since then, longitudinal evaluations of patients originally recruited for prospective observational or interventional awareness studies have revealed a notable incidence of PTSD.[21 22] However, closed claims studies[23] and the assessment of psychological consequences of past awareness events in patients returning to surgery[24] suggest that postawareness PTSD is not a