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Update

A prospective video-based observational and analytical approach to evaluate management during brain tumour surgery at a university hospital

Approche ergonomique pour l'analyse de la gestion des incidents au bloc opératoire

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ABSTRACT

The operating room (OR) is a high-risk complex setting, where patient safety relies on the coordinated efforts of multiple team members. However, little attention has been paid to evaluating the strategies employed by OR practitioners to prevent and correct incidents that inevitably occur during surgery. Therefore, we were prompted to investigate human factor (HF) engineering methods that have been used in an innovative way in order to systematically observe and analyze the management of incidents in the neurosurgical OR of a French university hospital. A technical case report illustrates our approach that associates the following procedures: the recording of OR team member activities and behaviour by video cameras and direct observation of a HF researcher, with the description and the explicit demonstration of safety related procedures in self- and cross-confrontation interviews of OR team members. This technical report emphasizes complementary aspects of clinical performance related to safety skills. Moreover, individual and team performances rely on complementary abilities that associate practical knowledge, skills, and attitudes, which are engaged at various degrees to prevent and manage incidents. This report also enlightens new quality-improvement opportunities as well as further objectives for future studies.

Mots clés :
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RÉSUMÉ

Le bloc opératoire est un environnement complexe, où la sécurité du patient repose sur les efforts coordonnés de tous les membres de l'équipe chirurgicale. Néanmoins, les stratégies déployées par ces professionnels pour prévenir et corriger les incidents, qui surviennent inévitablement, ont jusqu'à présent été peu étudiées. Nous décrivons une méthode ergonomique originale, utilisée pour observer et analyser la gestion des « erreurs » au bloc de neurochirurgie. Nous avons choisi, pour exemple illustratif, le cas d'une patiente de 70 ans, opérée d'une tumeur cérébrale. L'activité et les comportements des membres de l'équipe chirurgicale ont été observés par un chercheur en ergonomie, et enregistrés par des caméras vidéo HD. Les erreurs commises ont été recensées et catégorisées : 66 % étaient purement liées à la performance clinique ; 33 % impliquaient (au moins partiellement) la communication ou la gestion organisationnelle. Les actions associées à la sécurité du patient ont, par suite, été explicitées et analysées au cours d'entretiens personnalisés, au cours desquels les professionnels du bloc ont fait 86 références aux procédures en cours et à la check-list. Ils se sont appuyés sur des compétences complémentaires pour gérer les erreurs : les connaissances pratiques (citées 25 fois), les compétences techniques (citées 21 fois), le savoir être (cité 8 fois). Nous avons détaillé une méthode innovante d'analyse des erreurs au bloc opératoire ; les diverses compétences mises en œuvre dans la gestion de ces erreurs ont été explicitées

Abbreviations: OR, operating room; ICU, intensive care unit; D2, two days after the operation.

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Success is not final, failure is not fatal: it is the courage to continue that counts

Sir Winston Churchill

1. Introduction

Previous epidemiological studies from several industrialized countries (e.g., US [1,2] and Western Europe [3–6]) have shown that:

- approximately 3% to 4% of hospitalized patients suffer a serious adverse event;
- surgical adverse events account for 48% of all adverse events;
- almost half to two-thirds of these adverse events are preventable.

Consequently, patient safety has received increased attention. It is now accepted that the operating room (OR) is an inherently high-risk environment and improving patient safety often involves the coordinated efforts of multiple members of the healthcare team. Nevertheless, little attention has been paid to these strategies adopted to manage risks among health professionals. In a prescient and seminal paper published in 1994, Leape [7] argued that if healthcare providers were to succeed in reducing errors in hospital care, they would need to fundamentally change the way they think about errors. The author subsequently stated that the solutions to the problem of medical error would not primarily lie within medicine, but in the discipline of human factors and ergonomics (HF&E). Indeed, HF&E is a multidisciplinary field incorporating contributions from psychology, engineering, industrial design, graphic design, statistics, operations research and anthropometry. In essence it is the study of designing equipment and devices that fit the human body and its cognitive abilities. HF&E provide prospective data in collective and qualitative analysis methods, which have been used in elite sports [8] and high-risk industries (e.g., commercial aviation, nuclear safety, aerospace) to study team performance. To obtain a better understanding of patient safety practice in the OR, we attempted to systematically describe the management of incidents by the OR team as observed in their natural setting, and then interpreted by these care providers (i.e. surgeons, anaesthesiologists, nurses) in a video-based self- and cross-confrontation interviews. Our aim was to perform a qualitative analysis of events/errors, in order to identify the root causes and understand how they may be harmful to the patient. In the present report, we describe the methodology developed for further prospective studies, providing one illustrated case.

2. Technical case illustration

2.1. Research setting

The present observational and analytical pilot research study was conducted in the OR of Toulouse university hospital in the department of neurosurgery, according to the principles of the declaration of Helsinki. Because it was an observational quality-improvement case study with no change in our current clinical practice, neither approval of the ethics committee nor informed consent was required according to French law. The experiment was reviewed by the Communication Board of our institution, then presented and clearly explained to the OR senior management and OR staff in advance. A representative sample of OR team members consented to participate to the study. All participants had been previously informed of the quality-improvement and educational purpose of the study, and gave their written informed consent to be filmed.

2.2. Operation profile

A routine elective case of brain tumour surgery was chosen for the following reasons: craniotomy for a brain tumour is a common neurosurgical procedure that is regularly performed in the department; it requires classic microsurgical technical skills [9]; its indications have been well defined in literature as well as its complications [10].

A 70-year-old woman was operated on for a right frontal meningioma of the skull convexity. Her basic preoperative complaint was headaches. The patient's ASA score was 2. The surgical team was composed of the following care providers: a staff surgeon, a chief resident surgeon, a resident surgeon, a staff anaesthesiologist, a resident anaesthesiologist, a scrub nurse, a circulating nurse, and an nurse anaesthetist. Staff doctors and nurses were all entirely familiar with the surgical procedure with the exception of one nurse, who was less trained in neurosurgery. All team members, except the residents, were permanent members of the neurosurgical department.

The anaesthesia was induced with sufentanyl and propofol. Curare was administered to facilitate the tracheal intubation. The patient received standard monitoring that included invasive and non-invasive arterial blood pressure, continuous electrocardiogram, pulse oximetry, oesophageal temperature, urine output, and end-tidal CO^2 as well as anaesthetic concentrations. The anaesthesia was maintained with a propofol infusion during the procedure that consisted of a right frontal craniotomy (performed by the chief resident) and extra-axial tumour resection (performed by the staff neurosurgeon).

After the operation, the patient was transferred to the neurosurgical ICU as standard procedure. Pathological report suggested a WHO-grade-2 atypical meningioma. A transient confusion was observed at D1 (one day after surgery), which was partly attributed to steroids and opioids. The patient was able to walk 2 days after the operation, and was rapidly discharged following a normal neurological examination. Postoperative CT revealed a parenchymal hypo-density at the surgical site, and a contralateral subdural collection. At D19, the patient was admitted for headaches and confusion and was operated on for a left sided subdural haematoma, which alleviated the symptoms.

2.3. Data collection and analysis

The study was performed according to the HF&E approach (Serious Game Research Network), and the researcher (JFC) trained to analyze professional behaviours of healthcare workers in the OR.

Firstly, the HF&E researcher prospectively collected observational data, which consisted of digital recordings obtained from 3 digital video cameras, placed to record team member behaviour and activities, supplemented with direct observations using ethnographic field note methods [11]. A working group composed of a staff neurosurgeon, a staff anaesthesiologist, and the HF&E researcher analyzed the video-recordings and field notes. They recorded a total of 18 failures, which were characterized according to a standardized terminology and classification schema [12], including their type and cause (Table 1). Major as well as minor incidents were analyzed (e.g., major incident that prolongs hospitalization, and/or leads to additional and not planned diagnostic procedure(s) or treatment(s); also the patient is often physically injured) [4].

Overall, 66% of these failures were basically related to clinical performance, whereas 33% involved communication or patient management, at least partially. Technical skills were the root cause of nearly 90% of the failures that occurred during the pre-intervention phase and 45% (4/9) of the failures during the intervention phase, whereas communication failures represented