Occupational Hazards Encountered by the Anesthesiologist - Status Update

Essay

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المخاطر المهنية التى يواجهها طبيب التخدير – آخر المستجدات

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List of Abbreviations

ACD	:	Anesthetic conserving device
ACPs	:	Anesthesia care providers
ACR	:	American College of Radiology
ALARA	:	As Low As Reasonably Achievable
APL	:	Adjustable Pressure Limiting
ASA	:	American Society of Anesthesiologists
CDC	:	Center for disease control & prevention
CFCs	:	Chloroflurocarbons
CLABSI	:	Central line associated blood stream infection
CRNAs	:	Certified Registered Nurse Anesthetists
CT	:	Computed Tomography
ECG	:	Electrocardiography
EMFs	:	Electromagnetic field
EPA	:	Environmental Protection Agency
GI	:	Gastrointestinal
HAIs	:	Healthcare associated infections
HBV	:	Hepatitis B virus
HIV	:	Human Immunodeficiency virus

IV	:	Intravenous
MRI	:	Magnetic Resonance Imaging
NIOSH	:	National institute for occupational safety and health
NMBDs	:	Neuromuscular Blocking Drugs
OR	:	Operating room
OSHA	:	Occupational Safety and Health Administration
PEP	:	Post exposure prophylaxis
Ppm	:	Part per million
SCE	:	Sister chromatid exchange
SSI	:	Surgical site infection
W/h	:	Watt per hour
WAGs	:	Waste anesthetic gases

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INTRODUCTION

Control of occupational hazards to which anesthesiologists are exposed daily is necessary in order to develop an appropriate workplace and minimize risks to the good practice of anesthesiology. This contributes to decrease absenteeism, improve patients' care and quality of life of anesthesiologists. ***(Volquind et al., 2013)***

There are several occupational hazards related to the practice of anesthesia. The toxicity of anesthesiologists gases and particularly of nitrous oxide was highlighted at the beginning of their use. Most toxic gases were abandoned and the application of collective protection measures (system of evacuation of anesthetic gas, ventilation of operating rooms, and use of closed circuit for anesthesia) made it possible to decrease considerably the risk related to inhalational anesthesia. Occupational blood exposure also decreases thanks to a better observance of safety rules and the use of protected material. The risk of latex allergy has decreased considerably with the substitution of latex by other material. The risk related to the exposure to ionizing radiations is better controlled because very strict regulations have been implemented. The operating room environment involves risks of electrification, fire and explosion. New risks have been identified: drug-addiction and the painfulness of work or burnout. Their frequency is difficult to evaluate but they can have serious consequences for the patients and the anesthesiologists. Their prevention relies on early tracking by the members of the team, the improvement of working conditions and a better professional recognition. ***(Mérat et al., 2008)***

Long term occupational exposure to trace concentrations of volatile anesthetics is thought to have adverse effects on the health of exposed personnel. In contrast with halothane; an agent likely to cause mutagenic effects and proven to be teratogenic; isoflurane and enflurane have not so far been proved to have adverse effects on the health of personnel exposed long term. Data on the newer agents sevoflurane and desflurane are limited. Since possible health hazards from long term exposure to inhalational anesthetics cannot yet be definitively excluded, many western countries have established limits for exposure. These usually range from 2 to 10 ppm as a time-weighted average over the time of exposure. A number of investigations have demonstrated that, in operating theatres with modern climate control and waste anesthetic gas scavenging systems, occupational exposure is unlikely to exceed threshold limits. However, occupational exposure from the use of volatile agents in operating theatres with poor air control; especially during bronchoscopy procedures in paediatric patients; remains a source of concern. This also holds true for both postanesthesia care units and intensive care units lacking proper air conditioning and waste gas scavengers. To minimize occupational exposure to volatile anesthetics, all measures must be taken to provide climate control and properly working scavenging devices, and ensure sufficient personal skill of the anesthetist, e.g. during inhalational mask induction. Furthermore, low-flow anesthesia should be used whenever possible. The sole use of intravenous drugs such as propofol instead of volatile agents, were this possible, would eliminate occupational exposure, but may result in environmental pollution by toxic metabolites (e.g. phenol). ***(Byhahn et al., 2001)***

Occupational exposure to a range of pathogens represents a serious risk to anesthetists. The risk of occupational infection with a blood-borne pathogen is proportional to three factors: (1) Number of exposures to infected blood or body fluids, (2) Prevalence of patients carrying the pathogen within an anesthesiologists practice and (3) Infectivity of a particular pathogen. Many exposures to blood-borne pathogens result from a failure to follow recommended procedures for the safe handling and disposal of contaminated ‘sharps’ or a failure to wear appropriate protective clothing and eyewear. ***(Thomas et al., 2006)***

Despite substantial advances in our understanding of addiction and the technology and therapeutic approaches used to fight this disease, addiction still remains a major issue in the anesthesia workplace, and outcomes have not appreciably changed. Although alcoholism and other forms of impairment, such as addiction to other substances and mental illness, impact anesthesiologists at rates similar to those in other professions, as recently as 2005, the drug of choice for anesthesiologists entering treatment was still an opioid. There exists a considerable association between chemical dependence and other psychopathology, and successful treatment for addiction is less likely when comorbid psychopathology is not treated. Individuals under evaluation or treatment for substance abuse should have an evaluation with subsequent management of comorbid psychiatric conditions. Participation in self-help groups is still considered a vital component in the therapy of the impaired physician, along with regular monitoring if the anesthesiologist wishes to attempt reentry into clinical practice. ***(Bryson et al., 2008)***

The use of monitors and electrical equipments continually exposes the anesthesiologist to electromagnetic fields. Adverse health effects resulting from this exposure are not well defined but there are reports that an increased risk of brain cancer, breast cancer and leukemia occurs in populations exposed to electromagnetic fields. While the potential health hazards and safe upper limits of exposure remain to be determined, anesthetists should aim to minimize their exposure. ***(Thomas et al., 2006)***

AIM OF THE WORK

This study is designed to understand the different occupational hazards related to the practice of anesthesiology and to discuss the possible preventive measures related to these risks.

CHAPTER 1

INHALATIONAL POLLUTION

Waste anesthetic gases are small amounts of volatile anesthetic gases that leak from the patient's anesthetic breathing circuit into the air of operating rooms during delivery of anesthesia. These gases may also be exhaled by patients recovering from anesthesia. Waste anesthetic gases include both nitrous oxide and halogenated anesthetics such as halothane, enflurane, isoflurane, desflurane, sevoflurane, and methoxyflurane. The halogenated anesthetics are often administered in combination with nitrous oxide. Nitrous oxide and some of the halogenated anesthetics may pose a hazard to hospital workers. ***(NIOSH, 2007)***

The use of gaseous anesthetics and vapours for narcosis in operating theatres means that inevitably some fraction of these is breathed by the operating room personnels . The amount will depend on the anesthetic method, the duration of the operation, and the condition of the equipment used for anesthesia and for overall ventilation. The greatest concentrations of anesthetics are found in the working zone of the anesthesiologist, then the surgeon and the scrub nurse. Until the middle of the 1960s there was little interest in air quality in operating theatres and the occupational effect of waste anesthetic agents on the operating room team. The situation has improved considerably since then and many studies have now been carried out. The inhalation of even low levels of these various compounds has been shown to have toxic effects. ***(Dobrovolsky, 2003)***

Even when scavenging and venting systems are in place, anesthesiologists may be exposed to these gases when leaks occur in the anesthetic breathing circuit (which may leak gas if the connectors, tubing, and valves are not maintained and tightly connected), when anesthetic gases escape during hookup and disconnection of the system, when anesthetic gas seeps over the lip of the patient’s mask or from endotracheal coupling (particularly if the mask is poorly fitted—for example, during pediatric anesthesia), during dental operations and during induction of anesthesia. ***(NIOSH, 2007)***

Sister chromatid exchange (SCE) analysis in peripheral blood lymphocytes is a well established technique aimed at evaluating human exposure to toxic agents. SCEs are interchanges between DNA replication products at apparently homologous loci. ***(Eroglu et al., 2006)***

The incidence of SCE in anesthesiologists exposed to waste anesthetic gases was significantly more frequent than that of