Occupational hazards to anesthetists and their prevention

Safaa M. Helal[1], Ayman A. Rady[1], Alaa Eldin A. Aiad[1], Mahmoud A. Zahran[2].

[1]Anesthesia, Intensive Care and Pain Management Faculty of Medicine, Menoufyia University, Egypt.
[2]Shebein el-kom teaching hospital, Egypt
dr_safaahelal@yahoo.com

Abstract: Background and objectives: Newer developments and advancements in anesthesiology, surgical and medical fields have widened the functional scope of anesthesiologist thus increasing his professional responsibilities and obligations. While at workplace, anesthesiologist is exposed to a wide array of potential hazards that can be detrimental to his overall health. Numerous risks and safety concerns have been mentioned in this article, but the magnitude of challenges in anesthesiology practice are far greater than those cited and anticipated. This article is an attempt to bring a general awareness among anesthesia fraternity about the various health hazards associated with anesthesia practice. Also, a genuine attempt has been made to enumerate the various preventive methods and precautions that should be adopted to make practice of anesthesiology safe and smooth. **Content**: We present a classification of risk and its relationship to occupational diseases. Also, the various preventive precautions that should be adopted. **Conclusion**: 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.
[Safaa M. Helal, Ayman A. Rady, Alaa Eldin A. Aiad, Mahmoud A. Zahran **Occupational hazards to anesthetists and their prevention.** *J Am Sci* 2014;10(11):31-36]. (ISSN: 1545-1003). http://www.jofamericanscience.org. 5

Keywords: Anesthesiology, Occupational Diseases, Occupational Health, Risk.

Introduction:

In 1995, WHO gave the definition of occupational health which aimed at the promotion and maintenance of highest degree of physical, mental and social well being of workers in all occupation and placing workers in an occupational environment adapted to physiological and psychological capabilities and also protecting them from risks resulting from factors adverse to health.

Among many persons who have jobs that are vulnerable to occupational diseases, anesthesiologists are exposed to a number of health hazards that can be extremely harmful to professional and personal health as they expected to provide safe and smooth anesthesia services not only in the operation theatres and intensive care units, but also at various remote locations, pre interventional consultations, pain clinics, magnetic resonance imaging and radiology centers. Anesthesiologist is also an essential part of trauma and natural disaster management team. [(1)]

So, the hazards can be broadly classified into the following categories:

a) Biological hazards.
b) Chemical hazards.
c) Physical hazards.
d) Personal hazards.

a) Biological hazards:

In day to day practice anesthesiologists are exposed to numerous pathogens that include bacteria, viruses, etc. The incidence of such hazards varies from hospital to hospital and from country to country and results in clinically asymptomatic carrier state to overt fatal infection .[(2)]

Infective hepatitis:-

The risk of seroconversion rate increases manifold in infection with hepatitis B virus if the source patient is in the highly infective period, that is, hepatitis E antigen positive state. The 0.03 ml of infectious blood is sufficient to cause hepatitis B infection and the incidence is more with hollow needles than with solid needles especially in non immunized health care workers [(3)]

The complications and consequences after contracting HCV include chronic hepatitis in more than 80 % of exposed personals and among them 20% of the patients can develop hepatic cirrhosis after 10 – 15 years and 3 % can develop fatal hepatocellular carcinoma .[(4)]

Preventive measures and precautions:-

Anesthesiologists should ensure a complete immunization with Hepatitis B vaccine with booster at regular intervals of 5 years. In non immunized healthcare workers and also in whom no antibodies can be demonstrated should be treated with hepatitis B immunoglobulin along with three injections of hepatitis B vaccine. However, in case of hepatitis C infection, no vaccine available till date and nor the post exposure prophylaxis is of much significance. Simple measures such as wearing of protective clothing, gloves, masks, avoiding reinsertion of the needle into its cap, dressing of all abrasions and cuts, disposing of the contaminated material in meticulous

manner, sterilization of anesthesia equipment and apparatus are sufficient enough to prevent infection to a large extent.[5]

Acquired immunodeficiency syndrome virus:-

The prevalence of HIV in surgical patients and consequent risks to anesthesiologists has continuously increased though it still remains much lower than other viral infections. The exact incidence is difficult to ascertain for abraded and intact skin but studies have observed an incidence of 0.03% to 0.3% after percutaneous exposure to HIV infected blood and mucocutaneous exposure, respectively. The common source of infection being venous catheterization, neuroaxial anesthesia, punctures during intramuscular injections and withdrawal of blood sample, during laryngoscopy, intubation and extubation as well as during oral and tracheal suctioning.[6]

Preventive measures and precautions:-

The centers for disease control and prevention has laid down certain guidelines and should be followed in all form of anesthesiology practice to prevent any incidence of HIV infection. The recommended post exposure prophylaxis insists on immediate washing of the exposure site with plain water and soap. Antiviral drugs should be administrated within an hour and include tenofovir, emtricitabine, zidovudine, lamivudine, lopinavirand retonavir. The rapid HIV antibody test should be carried out if exposure < 2 h and test should be repeated at 6 and 12 weeks and thereafter at 6 months as source patients can be in the window period.

Tuberculosis TB:

The incidence and prevalence is much higher in developing nations as compared to the west and as such anesthesiologists in these countries are invariably exposed to surgical patients suffering from a clinically carrier state to sever symptomatic TB. The risks of contracting infection with mycobacterium increases during performance of various procedures in operation theatre such as laryngoscopy, intubation, broncoscopy, Ryle's tube insertion, oro pharyngeal suctioning, tracheal suctioning, use of open circuits (Bains and Jackson Rees) for mechanical ventilation , etc.[7]

Preventive measures and precautions:-

These risks can be minimized by using protective closing, wearing of masks and gloves during suctioning and other oral procedures. A possible or suspected exposure should be confirmed by a tuberculin test and if it is positive thus one should take drug therapy for TB as indicated. [8]

Swine flu:-

Many patients of swine flu got admitted in emergency surgical wards and the intensive care units at the peak of epidemic period. Besides a high probability of contracting infection from the potential source patient, anesthesiologist had to manage the compromised pulmonary function, hyper reactive airway, systemic hypotension and multi organ dysfunction of these patients. [9]

Preventive measures and precautions:-

Though only emergency surgeries are recommended in such patients still precautions have to be taken during such interventions especially in ICU during procedures such as suctioning, dressings, intubation, etc. The role of protective clothing and specially designed face masks (N95) is of immense significance in providing adequate protection. Closed loop circuits should be used to avoid contamination and infection of other operation theatre personals. In case of exposure, a 5 day course of oseltamiviris sufficient besides vaccination for swine flu virus.

b) Chemical hazards.

Allergic risks

Exposure to certain products increases the risk of diseases, such as latex allergy, as several materials commonly used by anesthesiologists have this component. Latex allergy is also associated with a history of atopy and allergy to certain foods such as bananas, kiwi fruits and avocado. Reaction may occur by three clinically distinct types: irritant contact dermatitis, Type IV delayed hypersensitivity and Type I immediate hypersensitivity mediated by IgE. Latex sensitivity varies from 12.5-20%, making anesthesiologists vulnerable to allergic reactions during their professional activity. This sensitivity may lead to physical disability to perform their work and exchange of medical field. [10]

Preventive measures and precautions:-

Special gloves are available that have minimal latex content.

Also, washing of the hand immediately after the use of gloves can prevent though cannot eliminate the incidence of allergy. [11]

Noxious pollutants from diathermy and laser use:-

The wearing of ordinary surgical face masks are not protective enough and exposes anesthesiologist to inhalation of toxic fumes, vapors and gases during the use of diathermy and laser. The size of pores in the surgical face mask cannot prevent inhalation of particles lesser than 0.5 μm in diameter where as the size of toxic fumes, vapors and gases during the use of diathermy and laser are less than 0.31 μm. Though no human studies have been published till date but data from various animal studies have been established that inhalation of such fumes can be carcinogenic and damaging to eyes and skin and can potentially cause renal, hepatic and central nervous system toxicity. [12]

Preventive measures and precautions:-

These problems can be overcome by the use of plenum, hepafilters, scavenging systems, wearing of protective eye glasses and the use of various suction equipments. [13]

Anesthetic gases:-

Nitrous oxide and various halogenated anesthetics such as halothane, isoflurane and enflurane have been implicated in various harmful biological effects after absorption through alveolar-capillary membrane. The exposure of anesthesiologist to inhalational anesthetics is higher as compared to other operation theatre personals and may even cross the limits of environmental tolerance. Once these lipid-soluble agents are metabolized into body, the more harmful effects are exerted by their metabolites that can potentially cause hepatic, renal, pulmonary toxicity and decreased psychomotor efficiency on chronic exposure. Though, issues have been raised from time to time about the teratogenic effects of the anesthetic gasses and the resultant congenital abnormalities in the newborn as well as a higher rate of spontaneous abortion among female anesthesiologists but nothing conclusive has been established as yet. [14]

Preventive measures and precautions:-

Various health agencies have provided a regulation for technical limit of nitrous oxide in operation theatre to a limit equal to 50 ppm but till date there are no limits set for halogenated anesthetics. Control of substances hazardous to health (COSHH) has established regulations about the permissible levels of these anesthetics in 1999. [15]

Fire and explosion hazards:-

Fires and explosion in operation theatres can cause severe form of burn injury and inhalational trauma to the pulmonary tissue. The oxygen enriched atmosphere of operation theatre along with presence of inflammable substances and ignition sources such as diathermy and lasers are potential factors that can cause fire or explosion in the operation theatre. [16]

Preventive measures and precautions:-

The present day safety equipments mandate the availability of fire extinguishers at specific places in the operation theatre that can decrease the said risks to a great extent. Good housekeeping, maintenance and discipline help prevent such mishaps. [17]

c) Physical hazards.

Radiation and nuclear hazards:-

Both the ionizing and non ionizing radiation has been implicated as the potential hazard to anesthesiologists at their work place. The anesthesiologist is exposed to radiation six times more than other personals during the neurointerventional angiographic procedures and the increasing use of C-arm in the orthopedic procedures exposes the anesthesiologists to beyond the recommended dose limit of radiation of 150 msv/yr and the cumulative effects of radiation affect entire body or cause localized damage to a certain area of the body such as cataract. These different sources of radiations may be threatening to the human body as a whole or may cause localized damage to certain area of the body, depending upon the extent and dosage of the irradiation. [18]

Preventive measures and precautions:-

The use of protective lead jackets and thyroid covering collars should be compulsory for all the personals. Badges and radiation dose measuring meter should be analyzed on monthly basis to calculate cumulative exposure to radiation. Also, keeping a distance from the patient as the patient is a potential source of scatter radiation. [19]

Radiology suite:-

Pediatric, non-cooperative and patient on mechanical ventilation require the services of anesthesiologists during radiologic diagnostic interventions either in the form of procedure sedation or general anesthesia. A major concern with anesthetists with cardiac problems involves the malfunctioning of aneurysm clips, pacemakers and prosthetic heart valves which can be potentially lethal in such patients. [20]

Preventive measures and precautions:-

Anesthesiologists with these implanted devices should refrain from entering such areas and should be vigilant when they take such patients for the requisite interventions. The vibrations and the acoustic noise can be equally harmful resulting in severe vertigo, nausea, vomiting and should be prevented with the use of special ear plugs.

The modern technology has provided various monitoring gadgets to help the anesthesiologist during the surgical procedure, but at the same time exposes him to various potential hazards of such electrical equipment. Though, there are no established reports but it is generally postulated that exposure to the electromagnetic fields of such monitoring gadgets can result in possible carcinomatous changes in brain, breast and hematopoietic system. These concerns definitely require large meta-analytical studies in the future. [21]

Orthopedic and soft tissue injuries:

Abrasions, lacerations and cut injuries from glass are common during the snapping of drug ampoules. One of the most common neglected aspect during administration of general and neuraxial anesthesia is the positioning of anesthesiologist. Though the exact incidence is not known but such wrong positioning during airway securing and administration of neuraxial anesthesia is harmful for back muscles and can potentially lead to disc

problems in certain high risk individuals. The introduction of laryngeal mask airway (LMA) has virtually eliminated the risk of first metacarpo-pharyngeal joint injury due to prolonged holding of the face mask during short duration anesthesia for day case procedures. [22]

Preventive measures and precautions:-

As far as possible, use of definite methods of airway securing with LMA in cases anesthesia is required for short duration. Positioning should be comfortable while administrating general anesthesia, neuraxial blockade or during laryngoscopy and intubation. [23]

d) Personal hazards.

Drug abuse and addiction:-

Substance abuse and dependence has acquired an important dimension in the present day anesthesiology practice. Multiple risk factors including individual susceptibility, long monotonous working hours, fatigable work shifts, personal problems in the family and marital discord, easy availability of the sedative and potent psychoactive drugs predispose the anesthesiologist to substance abuse that can prove harmful not only to himself but also can be devastating for the patient as well. The high propensity of anesthesia risk and the resultant catastrophic consequences along with increasing consumer awareness and litigation can put huge mental pressure on anesthesiologist that further predispose him to acquire the path of substance abuse. Data from various developed nations like US and UK indicate that general incidence of alcohol or drug abuse is estimated at 1 in 15 doctors. [24]

Preventive measures and precautions:-

Rehabilitation and resumption of professional duties require a lot of co operation from colleagues. The factors leading to present situation should be identified and an effort should be made with the help of psychologist to eliminate whatever are the possible causative factors. [25]

Stress and burnout:-

Stress is necessary evil as (optimal stress) levels are essential for enhanced performance whereas more than optimal stress can lead to poor decision making, decreased performance levels and discordial atmosphere at workplace and at home. Contributory factors to developing such a higher levels of stress included overwork, nature of duties especially night shifts, disturbances of natural sleep cycle, additional administrative responsibilities besides heavy clinical schedule, family problems, etc. Inexperienced trainee anesthesiologists are even more exposed to stress at work and run a greater risk of burnout. They sometimes experience very demanding situations and may feel lonely and inadequate at work. Such a situation can make anesthesia unattractive and may explain why some young doctors have been reluctant to choose it as a career. [26]

Effect of stress:-

Stressful working conditions can lead to three types of strains: physical (e.g., headaches or coronary heart disease), Behavioral (e.g., absenteeism or poor performance) and psychological (e.g., anxiety or depressed mood).Physical symptoms that may occur because of occupational stress include fatigue, headache, upset stomach, muscular aches and pains, chronic mild illness, sleep disturbances, and eating disorders. Psychological and behavioral problems that may develop include anxiety, irritability, alcohol and drug use, feeling powerless and low morale. If exposure to stressors in the workplace is prolonged, chronic health problems can occur including immune system dysfunction, high blood pressure and increase risk of stroke. [27]

Burnout is the end result of taking too much stress for a long time leading to mental and physical exhaustion and ultimately resulting in mental and physical breakdown and a tendency to commit suicide. [28]

Fatigue:-

Stress can lead to fatigue which can be mental, physical or emotional. It can significantly impair the ability of performing professional duties and can lead to poor sleep that result in lack of alertness and vigilance during performance of clinical skills. Difficult airway management, resuscitation procedures and interpretation of ECG all are affected as shown by study especially among the emergency physicians working in the night shifts. [29]

Fatigue can lead to impaired decision making, prolonged reaction time and can lead to power naps which can cause accidents while driving, also, metabolic consequences can occur including hypoglycemia, hypovolemia, ill health, gastritis, coronary artery disease and high propensity for drug abuse.[30]

Preventive measures and precautions (stress busting strategies):-

Numerous measures can be adopted to decrease and eliminate stress from the professional and personal lives:-

* Planning and developing newer strategies to cope up with anticipated stress.
* Maintaining a good discipline in daily schedules.
* Communicating and discussing all the niggling issues with either spouse or colleague or friends.
* Realization of inner self potential.
* Indulging in hobbies and relaxing during idle time.
* Inculcating a sense of optimism.

* Maintaining a good sleep pattern, regular exercise and good nutrition. [31]

The aging anesthesiologists:-

Important physiologic changes can impact an older anesthesiologist's ability to administer a safe anesthetic. Commonly observed physiological changes include impairments in hearing, vision, short term memory, and problem-solving abilities. Also, Intellectual quickness, learning, and reaction time all slow. These changes have the potential to limit the older anesthesiologist's ability to rapidly process information, assimilate and apply new knowledge, make complex decisions and initiate a proper response. Age related changes in the cardiovascular and musculoskeletal systems can make it more difficult for older anesthesiologists to sustain the long, demanding work shifts common in anesthetic practice. [32]

On the other hand, normal aging also contributes advantages, such as wisdom, judgment, and the experience acquired by a lifelong practice of the specialty. There is a strong positive correlation between experience and performance of many tasks required for administration of a safe anesthetic. [33]

Conclusion

Control of occupational hazards to which anesthesiologists are exposed daily is necessary to prevent the development of injury and/or disease often disabling.

The joint effort of anesthesiologists and hospital managers is of vital importance for the development of an appropriate workplace, with reduced risks to the good practice of anesthesiology, which contributes to decreased absenteeism, improved care provided to patients, and quality of life of anesthesiologists.

Correspondence author
Mahmoud abd-elmonem Zahran
Al mehalla el kobra, Gharbia
Email: zahranabomalek@yahoo.com

References:

1. Thomas I, Carter JA. Occupational hazards of anaesthesia. Contin Educ Anesth Crit care pain 2006;6:182-7.
2. Greene ES, Berry AJ, Arnold WP, Jagger J. percutaeous injuries in anaesthesia personnel. Anaes Analg 1996;83:273-8.
3. Jackson SH, Cheung EC, Hepatitis B and Hepatitis C: Occupational considerations for the anaesthesiologist. Anaesthesia Clin North America 2004;22:357-77.
4. Puro V , Petrosillo N ,Ippolito G , Jaggar J.Hepatitis C virus infection in health care workers . infec Control Hosp Epidemiol 1995;16:324-5.
5. Tom DJ, Gulevich SJ, Shapiro HM. Epidural blood patch in the HIV positive patient. Review of clinical experience. Anaesthesiology 1992;76:943-7.
6. Thomas I , Carter JA. Occupational hazards of anaesthesia. Contin Educ Anaesth Crit Care Pain 2006;6:182-7.
7. Menzies R, Fanning A, Yuan L, Fitzgerald M.Tuberculosis among health care workers. N Engl J Med 1995;332:92-8.
8. Nettleman MD, Fredricksom M, Good NL, Hunter SA.Tuberculosis control strategies: The cost of particulate respirators.Ann Intern Med1994;121:37-40.
9. Kaul T, Pawar M. Swine flu and anaesthesia. J Anaesth Clin Pharmacol 2009;25:399-402.
10. Batti MACSB - Allergy to latex, editorial. Rev Bras Anaesthesia. 2003;53:555-560.
11. Bajwa and Kaur: Risks and safety in anaesthesia practice 2012;167:230-68.
12. Sager PM, Meagher A, Sobczak S, Wolff BG. Chemical composition and potential hazards of electrocautry smoke. Br J Surg 1996;83:1792.
13. Sukhminder Jit Singh Bagwa, Jasbir Kaur. Risks and safety in anaesthesia practice 2012;167:230-68.
14. Rowland AS, Baired DD,Shore DL, Weinberg CR, Savitz DA, Wilcox AJ. Nitrous oxide spontaneous abortion in female dental assistants. Am J Epidemiol 1995;141:531-8.
15. Sukhminder Jit Singh Bagwa, Jasbir Kaur. Risks and safety in anaesthesia practice 2012;167:230-68.
16. Kalkman CJ, Romjin C, Van Rheineck Leyssius AT. Fire and explosion hazard during oxygen use in operating rooms. Ned Tijdschr Geneeskd 2008;152:1313-6.
17. Sukhminder Jit Singh Bagwa, Jasbir Kaur. Risks and safety in anaesthesia practice 2012;167:230-68.
18. Durack DP, Gardner AI, Trang A. Radiation exposure during anaesthetic practice. Anaesth Intensive Care 2006;34:216-7.
19. Young WL, Pile-Spellman J. Anaesthetic consideration for interventional neuroradiology. Anesthesiology 1994;80:427-56.
20. Jorgensen NH, Messick JM Jr, Gray J, Nugent M, Berquest TH. ASA monitoring standards and magnetic resonance imaging. Anaesth Analg 1994;79:1141-7.
21. Patteson SK, Chesney JT.Anaesthetic management for MRI: Problems and solutions. Anaesth Analg 1992;74:121-8.

22. The joint commission – sentinel event alert issue 49: Health care worker problems and patient safety. Occup heath.2012;85:67-79.
23. Sukhminder Jit Singh Bagwa, Jasbir Kaur. Risks and safety in anaesthesia practice 2012;167:230-68.
24. Berry CB, Crome IB, Plant M. Substance misuse among anaesthetists in the United kingdom and Ireland. Anaesthesia 2000;55:946-52.
25. Menk EJ, Baumgarten RK, Kingsley CP, Culling RD. Success of re-entry into anaesthesiology training programs by residents with a history of substance abuse. JAMA 2009;263:3060-2.
26. Nyseen AS, Hansez I. Stress and burnout in anaesthesia. Curr Opin anaesthesia 2008;21:406-11.
27. Ishikawa Baumgarten RK, Good NL, , *et al*. (2009). "Prospective Study on Occupational Stress and Risk of Stroke". Archives of Internal Medicine 169 (1): 56–61.
28. Malasch S, Schaufeli WB, Leiter MP. Job burnout. Annu Rev Psychol 2001;52:397-422.
29. Morris GP, Morris RW. Anaesthesia and fatigue. An analysis of the first 10 years of the Australian incident monitoring study 1987-1997. Anaesth Intensive care 2000;28:300-4.
30. Barger LK, Cade BE, Ayas NT. Extended work shifts and the risk of motor vehicle crashes among interns. N Engl J Med 2005;352:125-34.
31. Shidhaye R, Divekar D, Dhulkhed V, Goel G, Gupta A. Evaluation of stressors and coping strategies for stress in Indian anaesthesiologists. Indian J Anaesth 2011;155:193-8.
32. Travis KW, Mihevc NT, Orkin FK, Zeitlin GL: Age and anesthetic practice: a regional perspective. Journal of Clinical Anesthesia 1999;11: 175- 186.
33. Daniel Volquind, Airton Bagatini, Gabriela Massaro Carneiro Monteiro, Juliana Rech Londero, Giovani Dani Benvenutti. Occupational Hazards and Diseases Related to the Practice of Anesthesiology. Rev Bras Anestesiol. 2013;63(2):227-232.

9/23/2014