

Pollution In Operation Theatre

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Citation

P Raju. *Pollution In Operation Theatre*. The Internet Journal of Anesthesiology. 2005 Volume 10 Number 2.

Abstract

It is an overview of various causes leading to pollution inside an Operation Theatre with the possible solutions. It depicts the historical aspect as well as the present day situation.

Written as an essay for West Zone Conference, Indian Society of Anaesthesiologists, 19 – 21 September 2003, Kolhapur, India.

ESSAY

“.... I experienced an extensive inflammation of the gum, accompanied with great pain, which destroyed the power of repose and of consistent action. On the day when the inflammation was most troublesome, I breathed three large doses of Nitrous Oxide. The pain diminished after first four or five respirations....” These famous words of Sir Humphry Davy (1800) probably represent its first ever recorded use for anaesthetics purpose in humans.

“A Rag and a Bottle” made administration of Ether / Chloroform (Inhalational Anaesthetics) simpler, but Pollution was the price paid for that simplicity. Current researches in Anaesthesia and Analgesia (1922) described the death of Edward Costain, an Anaesthetist as “A martyr to his skill who paid with his life for his humane work.” Kirschner (1925) supported while Werthmann (1948) noted the chronic Ether intoxication.

Kelling (1918) developed one of the first equipment for control of Operation Theatre pollution. Perthes (1925) developed a more sophisticated variant. Weiloch (1925) and Holscher (1928) gave their variants too. Werthmann's (1948) “Artificial Climate” was a more efficient and practical concept.

Vaismann's (1967) report caused an awakening. It explained adverse working conditions and associated health hazards. So this became an obvious world wide interest and concern, which we were quite oblivious to, till sometime ago.

So many surveys and studies on theatre pollution have shown it could be an alarming health hazard. Adverse effects

can occur especially in female anaesthesiologists, like increased rates of abortion, infertility, congenital abnormality in unborn foetus. General health could be at stake. It can manifest as headache, irritability, lack of concentration, nausea, pruritus, fatigue, depression. Even liver and renal disorders, neurological abnormalities and cervical cancer were found to be associated. It has been suggested it might affect the skill of the theatre personnel. It can cause significant decrements in various perceptual and cognitive skills. Moreover, it is not ethical to put the surgeons and paramedical staff at risk. Ultraviolet and Ionising radiation, propellants, defatting agents, volatile by-products of surgical cement also contribute to such pollution. Hence, theatre pollution is of great concern.

Correlation between blood tests, urinalysis and atmospheric levels have been tried to prove the hazardous effects of these gases, especially during a prolonged exposure. To combat these hazards, NIOSH (National Institute For Occupational Safety and Health, 1977) recommended standard criteria for the limit of gas levels in theatre's atmosphere.

- Halogenated agent alone – 2ppm.
- Nitrous Oxide – 25ppm.
- Halogenated agent and Nitrous Oxide together – Agent (0.5ppm), N₂O (25ppm).

Without any argument, I can confidently say the safest option is to remove these waste gases before they are released into the theatre atmosphere. Obviously, Scavenging Systems are the best practical way to combat theatre pollution. Scavenging is appropriately defined as “The collection and subsequent removal of vented gases from the operating chamber.” It minimizes the pollution to the

maximum. One should not remember, hazards such as extension of Anaesthesia circuit to the ultimate disposal site, obstruction anywhere leading to barotrauma cannot be neglected. Other measures in the form of reducing the spillage of gases into the theatre atmosphere can be achieved by control of leaks from anaesthesia system, performing an ideal induction and suction techniques. Furthermore, room air ventilating systems play an important role in which a non re-circulating air conditioning system through which the spilled gases are recovered and vented out is ideal, but very expensive. Lesser the concentration of inhalational agents used, lesser the pollution such as in the closed circuits using low fresh gas flows. For both ecological and economical reasons, the use of newer inhalational anaesthetics, with low tissue solubility and low anaesthetic potency, can be justified by using low flow or minimum flow techniques. Usage of Sevoflurane / Desflurane and air for Halothane and Nitrous Oxide in the latest machines reduce pollution to a certain extent.

A reasonably new concept, where a ventilator attached to a circle system with a Zeolite reflector placed in between decreases documented Isoflurane consumption. Performing surgeries under regional and local blocks, Total Intravenous Anaesthesia (TIVA) offer a definite advantage in creating pollution free environment in the theatre. Traps and Filters are used to capture waste gases and absorb the pollutants and efficient air filters are capable of filtering out anaesthetic drugs. Also, at the present times, surveys can be best carried out using adsorption tubes of diffusion dosimeter and a portable infrared spectrometer for background N₂O concentrations.

Last but not the least is Noise Pollution. It is well documented that noise is stressful, eliciting changes in Autonomic Nervous System, impairing the mental faculties leading to decreased work performance and increased anxiety respectively. Noisiest time is during the preparation

period. A decibel level of 10 – 40 represents relative quiet, 40 – 80 is moderately loud and 100 – 130 is uncomfortable. At 160, the tympanic membrane gives way. The sources are the health personnel, machines and that incessant conversation, moving equipment here and there, suction machines, monitor and their sensitive alarms. Intercoms and ventilators add to the chaos. Even air-conditioning systems, opening packages, dropping the surgical instruments into the bowl play their part in this orchestra. Effects could be seen on endocrine system in the form of activation of pituitary adrenal axis, cardiovascular system in the form of increasing blood pressure, auditory apparatus, sleep and finally, mental function.

A better acoustic designing and maintenance of equipment together with an increased awareness of staff towards this vital factor of work environment may decrease noise pollution. A department of sound has been suggested in limiting this hazard where they take care of monitoring and controlling the noise and provides centre of music therapy.

38 long years have elapsed since Vaismann's survey. Unanswered questions yet remain. Future studies must answer them considering the seriousness of the problem and the mortality of the issue. Nevertheless, a better awareness, improved techniques, machines and skill make it less alarming than it was before.

A point to be noted: The whole essay was written in context to the set up in the developing countries and it may not be right when compared to the present day situation in developed countries.

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References

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