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Occupational Exposure to Anesthetics of Medical Personnel in operating Room Area

中文摘要

台灣有近萬人從事麻醉相關工作，部分醫院在施行全身麻醉時，仍是使用笑氣合併其他鹵化麻醉劑。多數研究都指出，長期暴露於麻醉廢氣，可能與自發性流產、早產、新生兒低出生體重及不孕等生殖危害有關。近十年間國內並無同時偵測手術房區域笑氣與鹵化麻醉劑濃度的研究，而國內的手術房環境是否有過高之麻醉廢氣暴露值得關切。因此，本研究嘗試利用新開發之方法，現場採集手術房區域樣本，利用氣相層析質譜儀（GC- MS）同時分析空氣中之笑氣與鹵化麻醉劑，並討論影響醫院手術房區域麻醉廢氣濃度之因素。

研究對象包括台北市兩家醫學中心及一家區域醫院，採樣區域包括手術房、恢復室及污走道。結果顯示，Sevoflurane 爲使用最多之揮發性鹵化麻醉劑，環境濃度亦最高，各醫院均有高於 NIOSH 對於單一鹵化麻醉劑暴露建議值 (2ppm) 的情形；醫學中心笑氣濃度之中位數爲 1.87 ppm，然區域醫院雖極少使用笑氣，環境中位數濃度高達 120.85 ppm，有管路或開關閥洩漏之可能性。此外，拔管時會造成較大量麻醉氣體的逸散，除了使醫護人員有較高的短時間暴露外，若通風換氣率不足，也會使手術房之麻醉廢氣濃度累積。兒童麻醉較成人麻醉有較高的麻醉廢氣逸散，宜加強注意通風換氣率。恢復室的麻醉氣體濃度與留觀之病人數、通風換氣率有關，如果無法減少留觀病人密度，則應提高通風換氣率。

鑑於麻醉廢氣的潛在危害與洩漏可能性，建議醫院應定期檢點麻醉氣體供應設備，並定期監測環境濃度。本研究使用之採樣分析法因可同時測定多種麻醉氣體，十分適合作爲手術房區域環境濃度測定方法。

英文摘要

There are nearly ten thousand health care personnel engaged in anaesthetizing work in Taiwan. However, some hospitals still use laughing gas combining with halogenate anesthetics for general anesthesia. Many studies have found that long-term exposure to anesthetic gases is associated with spontaneous abortion, premature delivery, low birth weight, and involuntary infertility. Whether the concentrations of waste anesthetic gases are too high in operating rooms is therefore of concern. Nonetheless, during the past decade, no study has been conducted in Taiwan to evaluate the health risk of using laughing gas and halogenate anesthetics concurrently. Thus, we implemented a study to examine the factors associated with the concentrations of waste anesthetic gases in hospital operating rooms, using a newly developed sampling and analyzing method.

We studied two medical centers and one regional hospital in Taipei. The sampling areas included the operation rooms, recovery rooms and polluted corridors. The results showed that sevoflurane was the most prevalent volatility halogenate anesthetics and had the highest concentration at sampling areas. All study hospitals exceeded the exposure limit for halogenate anesthetics (2ppm) recommended by NIOSH (National Institute for Occupational Safety and Health) .The median level of N2O at the two medical centers was 1.87 ppm. Although regional hospitals seldom use N2O, its concentration was very high (median 120.85 ppm) . This is likely to result from leakage of pipelines or switch valves. Anesthetic gases may also escape during the removal of endotracheal tubes, causing, short-term high exposure to medical personnel. Anesthetic gases accumulate with insufficient ventilation, too. The process of paediatric anesthesia released more waste anesthetic gases than of adult anesthesia, so the ventilation rate should be adjusted accordingly. The concentrations of anesthetic gases in the recovery rooms were related to the number of patients and the ventilation rate. If the density of patients can not be decreased, the ventilation rate must increase to compensate more pollution sources.

In view of the potential health risks of the waste anesthetic gases, hospitals should examine the supply equipment and monitor the environmental levels regularly. The sampling/analyzing method developed and validated in this study can quantify several anesthesia gases simultaneously. It will be an appropriate method to be applied in future studies.