REVIEW OF THE LITERATURE ON THE USE OF
THE PENTHOX INHALER IN PREHOSPITAL PAIN
MANAGEMENT

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ABSTRACT

Ambulance staff can provide Penthrox inhaler, an instant pain medication, in pre-hospital services (paramedics or ambulance nurses). In the medical world, Penthrox inhaler is a Methoxyflurane single-use inhaler that has been in use for more than 40 years. Penthrox Inhaler's potential for trauma pain treatment, as well as its advantages and side effects, have been studied in international publications. This study's goal was to identify these findings and determine if Penthrox Inhaler is safe for pre-hospital trauma pain management. The PICO approach, a sort of systematic literature review, is employed in this study. Patient: I'm in a lot of pain. Using a Penthrox Inhaler as an aid, There is none. Pain alleviation is the end result. The name for it is analgesia. Low Dose Methoxyflurane exhibited a substantial impact in cases of trauma pain when administered. When compared to other medications, Low Dose Methoxyflurane was administered to the patient more quickly. A VAS score of 42.8% said it was extremely fulfilling, and a score of 67.3 percent said it was satisfying. Gas medicine adverse effects might include neprotoxicity and a decrease in the patient's capacity to tolerate the medication. Before administering Methoxyflurane to patients, check that the patient's oxygen saturation level is over 90% and that the maximum dosage administered in the span of two hours is 6 ml. While providing Penthrox to patients, ambulance staff can be safe with an exposure time of 8 hours.

Keywords: A VAS score, Penthrane, Patients, Penthrox

1. Introduction

Patients who report significant traumatic pain following an event, such as a traffic accident, industrial accident, or even a household disaster, must be examined for their acuity level using the Visual Analogue Scale (VAS).

In the absence of immediate intervention, severe pain may cause stress, increased catecholamine levels, vasoconstriction, impaired tissue perfusion and oxygen pressure in tissues, hyperglycemia, lipolysis and protein catabolism; a disrupted wound healing process; an increased risk of wound infection; and decreased cytotoxic T lymphocyte and reduced phagocytes activities. Single-use Penthrox inhaler containing Methoxyflurane, a non-narcotic analgesic that is administered by inhalation may be administered by ambulance staff in pre-hospital care to alleviate acute trauma pain. It has been used in Australia and New Zealand for pain treatment for more than 40 years (Porter, et al. 2018). Methoxyflurane has been used in the UK ambulance service since 1915 to treat
moderate to severe pain in situations of trauma or injury. Methoxyflurane is also widely used on the continent of Europe. Fluorinated hydrocarbon anaesthetic methoxyflurane was initially manufactured by the business Abbott Laboratories under the brand name.

![Penthrox Inhaler Unit](image)

Penthroxy in the early 1960s, Since 1970, About Laboratories has created Methoxyflurane in a single-use inhaler container, which may be used by patients for pain management, particularly in situations of minor and obstetric surgery. Using low-dose methoxyflurane in trauma patients with severe acute pain and for medical operations on conscious patients has been allowed by Canadian regulators. It is a non-narcotic analgesic medication that is commonly used to alleviate severe pain caused by musculoskeletal damage (Hartshorn, & Middleton, 2019). Easy to use, Penthorx inhaler is very helpful in the process of promptly addressing pain in the Ambulance Helicopter service. Methoxyflurane doses of up to two and a half millilitres each can be administered by the patient, as long as he or she is closely monitored by a physician. Penthrox's inhaler may be seen in image number one (Abebe, et al. 2021). To use the Penthrox inhaler, place the inhaler tube into the cavity and spin it until the Methoxyflurane material fills the space. Penthrox Inhaler Low-dose (3 ml) is easy to administer, but it also eliminates pain more quickly than injections of analgesics. In comparison to Tramadol injection, which is an analgesic medicine administered intramuscularly, Penthrox Inhaler inhalation has a quicker impact on pain reduction.

II. Background

Fluorinated hydrocarbon methoxyflurane (the active component in Penthrox) was first licenced as an inhalation nephrotoxic agent in 1962; it was voluntarily removed off the market in 2001 after complaints of nephrotoxicity caused it to fall out of favour. In the 1970s, a self-administered methoxyflurane inhalator called the Analgizer was promoted as an analgesic at lower dosages. While the Analgizer was withdrawn, methoxyflurane autoinhalers have been extensively used in Australia since 1975, are first line for moderate-to-severe analgesia in several Australian ambulance services, and are recommended by the Australian and New Zealand College of Anaesthetists pain management guidelines. It has only lately become popular in Europe due to the approval of Penthrox, a methoxyflurane autoinhaler sold by Mundipharma in Europe and jjj in the UK. So many research have been carried out in the previous six years as a result. Methoxyflurane, like other anaesthetics, has a mysterious mechanism of action.
Methoxyflurane inhalation has been argued to reduce oligoanalgesia in the ER since it has less hurdles to administration than other drugs, such as nitrous oxide or opioids (Fabbri, *et al.* 2020). Despite pain accounting for 75–80 percent of all emergency room visits, two-thirds of patients in large-scale European trials did not obtain any analgesics.

![Workflow: Pentrox Inhaler](image)

Methoxyflurane has been shown in other trials to provide faster pain relief than the current standard of treatment when administered at the same time. (Dißmann *et al.* 2018) Evidence suggests that it might give a more steady, safe and simple method of pain treatment in pre-hospital or austere settings.

According to critics, there is not enough of an advantage to warrant its adoption over current practises. Activated charcoal filters can reduce the incidence of occupational illness for healthcare personnel (especially in confined pre-hospital environments), however there are still issues. Nephrotoxicity associated with anaesthetic dosages was originally thought to extend to analgesic doses, however this does not appear to be the case now.

Morphine and Entonox are effective substitutes for inhaled methoxyflurane (inhaled nitrous oxide). While morphine is widely accepted as the gold standard for pain management, it can lead to dependence and respiratory depression, thus it must be monitored (Lim, *et al.* 2021). Furthermore, data shows that this results in modest initial dosages and lengthy periods of insufficient analgesia. In the emergency room, Entonox equipment is cumbersome, delaying its use and making it ineffective pre-hospitaly.

When it comes to acute trauma, inhaled methoxyflurane may be a better analgesic than normal therapy in terms of patient outcomes.

**III. The Purpose of the Study**

Pre-hospital trauma pain treatment with Pentrox Inhaler was examined in this study to determine the advantages and adverse effects of using Pentrox Inhaler based on published worldwide research on the potential of utilising Pentrox Inhaler for that purpose.

**IV. Method**

Pain treatment with Pentrox Inhaler in pre-hospital care is studied using the PICO method.

**Problem/patient**

The patient is in excruciating discomfort.
Keywords
Pain or trauma and/or hospitalisation are appropriate keywords.

Penthrox Inhaler
1. How Effective Is It in Treating Post-Traumatic Stress Disorder Pain?
2. How can Penthrox Inhaler help in trauma pain management?
3. Penthrox Inhaler's side effects in the treatment of trauma pain are:
4. The Ambulance Staff's Penthrox Inhaler Level while providing the drug is safe?

V. Literature Research
Pre-hospital care pain treatment with Penthrox inhalation was researched by finding all relevant foreign papers (Fabbri, et al. 2021). Research published in worldwide journals such as PubMed, Wiley, Springer, and Google Scholar, together with a search technique based on the PICO approach, provides the foundation for this electronic database (patient, intervention, comparison and outcome).

VI. Result and Discussion
Pain management with Penthrox Inhaler
The difficulty of injecting patients, especially those who refuse to take oral drugs due to nausea and vomiting, is a typical challenge in the management of pain in the emergency room and pre-hospital. As a result of the lack of authorization of ambulance staff to deliver pain medication injections, penthrox inhaler is the preferred method of administering pain medicine to trauma victims. It has been used in Australia for more than 40 years to treat severe pain in pre-hospital settings as well as emergency rooms (Allison, et al. 2021). Penthroxinhaler is a Methoxyflurane trademarked anaesthetic. While Penthrox inhaler includes 3 ml per unit package of Methoxyflurane or in terms of the low-dose medication Methoxyflurane, which may be used up to 6 ml in the treatment of trauma pain, when breathed for 25-30 minutes, can offer analgesic action. Both adults and children can benefit from the Penthrox inhaler as an alternate treatment for trauma pain and in minor surgical operations or other medical procedures.

Benefit of Penthrox Inhaler
In comparison to conventional analgesics (mean 29.9 minutes with an SD 35.5 minute) in situations of trauma pain, the administration of Low Dose Methoxyflurane demonstrated a very substantial benefit, as observed by the length of pain relief (mean 38.1 minutes with SD 34.7 minutes). In comparison to other drugs (mean 39.2 with SD 43 minutes), patients received Low Dose Methoxyflurane faster (mean 21.7 minutes with an SD 24.2 minutes). When measuring traumatic pain, we used the VAS (Visual analogue Scale) model, which can be used in the ER to assess the quality of pain (Liu, et al. 2021). The VAS value for pain reduction with LDM was described as extremely pleasing by 42.8% and satisfactory by 67.3%, whereas the VAS level with morphine injection indicated very pleasant by 18.1% and a satisfactory level of 22.8%
Side effect of Penthrox Inhaler

Tolerability by the patient and nephrotoxicity are two of the most common adverse effects of employing gas medicines. Depending on the dosage and duration of administration, nephrotoxicity might develop. Fluoride levels in serum are between 0.006 and 0.026 micro mol/l whereas those in blood range from 3 millilitres to 6 millilitres while using the Penthrox inhaler. The safe dose for this medication is 3 ml, which can be repeated three times in 0.3 hours (Porter et al., 2018). Inhalation of Penthrox inhaler can be safe for up to 2 hours, but if given for 2.5 to 3 hours, it can cause sub-clinical toxicity; if given for more than 5 hours, it can cause toxic levels in the bloodstream. The level of tolerability of drug use can be expressed by patients in terms of side effects. At lower oxygen saturations, several patients had minor headaches and mild somnolence after receiving 3ml of Penthrox inhaler vial. The stench of rotting fruit is a common complaint from certain patients. Numbness, exhilaration, lightheadedness and hallucinations were reported by 18.1 percent of the participants (Porter, et al. 2018). Drowsiness and mild hallucinations were reported by 25.7 percent of patients who received Penthrox inhaler, and the maximum dose of 6ml, which may be administered for two hours, was shown to minimise the adverse effects of Methoxyflurane administration.

**Penthrox Inhaler Exposure Level to the Ambulance Staff**

A police officer who administers a narcotic in gas form is unquestionably putting himself at risk. Methoxyflurane gas exposure was 0.23 PPM in a room without cold air conditioning for 8 hours, whereas in a closed room, it was 1.5 PPM, the median of 0.017 (0.008-0.736) PPM, and the maximum exposure limit for Methoxyflurane gas is 15 PPM.. Methoxyflurane may be used safely by ambulance staff for 8 hours a day in the treatment of trauma pain, according to this study.

**VII. Conclusion**

Penthrox inhalers, as opposed to injections, are a simple and rapid solution to common pain management issues in the ER and pre-hospital setting, especially when the patient refuses to take oral medicine or is receiving...
intravenous administration (Abebe, et al. 2021). As a faster and longer-acting analgesic than conventional treatments for acute pain, inhaling the Penthrox inhaler for 25-30 minutes can offer an analgesic effect. An inhaler containing 3 ml of Penthrox per package, which is safe to use and may be delivered by paramedics, is available. In order to minimise any potential adverse effects, patients should have an oxygen saturation level of at least 90% before receiving the Penthrox inhaler (Allison, et al. 2021). Penthrox inhaler has a maximum dose of 6 ml administered every 2 hours for situations of trauma pain. Ambulance workers are not exposed to fatal quantities of Methoxyflurane gas when using Penthrox inhaler for 8 hours of patient care.

VIII. Suggestion
Pentrox inhalers should be studied in clinical trials by the Food and Drug Supervisory Agency and the Ministry of Health for patients of Asian descent, particularly Indonesians, and permission should be granted for paramedics (or ambulance nurses) to use Pentrox inhalers in trauma pain cases without a doctor's prescription. This is especially important for Indonesians.
References


