

USE OF NITROUS OXIDE IN PAEDIATRIC EMERGENCIES

Marta Rodríguez Solano. Nurse specialist in paediatric nursing. Master in integration in care and clinical problem solving in nursing. University Expert in Pediatric Care for Nursing. University Expert in Neonatal Care for Nursing.

Lourdes Rodríguez Solano. FEA in anaesthesiology, resuscitation and pain therapy. Subspecialized in pain therapy. University expert in Pain.

Abstract: Pain is defined by the International Association for the Study of Pain (IASP) as "an unpleasant sensory and emotional experience associated with, or similar to that associated with, actual or potential tissue injury" (Vidal Fuentes, 2020). It is vital to control pain before performing techniques that involve this painful experience, as well as the awareness of all health professionals to apply the different resources and respect the action times of effect. Thus it has been demonstrated that the use of nitrous oxide (N₂O) is an optimal alternative to mitigate painful effects with few adverse effects recorded, these being mostly mild and known. It is well accepted by parents, who would again accept the use of the gas in future procedures (Capapé, 2008).

Keywords: pain, nitrous oxide, emergency department

UTILIZACIÓN DEL ÓXIDO NITROSO EN LAS URGENCIAS DE PEDIATRÍA

Resumen: El dolor es definido por la International Association for the Study of Pain (IASP) como "una experiencia sensorial y emocional desagradable asociada, o similar a la asociada, a una lesión tisular real o potencial" (Vidal Fuentes, 2020). Es vital controlar el dolor ante la realización de técnicas que suponen esa experiencia dolorosa, así como la concienciación de todos los profesionales sanitarios para aplicar los diferentes recursos y respetar los tiempos de acción de efecto. Así se ha demostrado que la utilización del óxido nitroso (N₂O) es una óptima alternativa para mitigar efectos dolorosos con escasos efectos adversos registrados, siendo éstos en su mayoría leves y conocidos. Presenta una buena aceptación por parte de los padres, que aceptarían de nuevo el uso del gas en futuros procedimientos (Capapé, 2008).

Palabras clave: dolor, óxido nitroso, urgencias

USO DE ÓXIDO NITROSO EM EMERGÊNCIAS PEDIÁTRICAS

Resumo: A dor é definida pela Associação Internacional para o Estudo da Dor (IASP) como "uma experiência sensorial e emocional desagradável associada a, ou semelhante à associada a, lesão tecidual real ou potencial" (Vidal Fuentes, 2020). É vital controlar a dor antes de realizar técnicas que envolvam esta dolorosa experiência, assim como a consciência de todos os profissionais de saúde para aplicar os diferentes recursos e respeitar os tempos de ação de efeito. Foi demonstrado que o uso de óxido nitroso (N₂O) é uma óptima alternativa para mitigar os efeitos dolorosos com poucos efeitos adversos registrados, a maioria dos quais são suaves e conhecidos. É bem aceito pelos pais, que aceitariam novamente o uso do gás em procedimentos futuros (Capapé, 2008).

USE OF NITROUS OXIDE IN PAEDIATRIC EMERGENCIES

Palavras-chave: dor, óxido nítrico, departamento de emergência

USE OF NITROUS OXIDE IN PAEDIATRIC EMERGENCIES

METHODOLOGY

A bibliographic search was carried out in the main databases such as Pubmed, Scielo, Cochrane and Google Scholar, without time criteria. We selected articles in both Spanish and English. In addition, different publications of the Spanish Society of Paediatric Emergency Medicine (SEUP), the Spanish Association of Paediatrics (AEPED) and the NCBI were consulted.

IMPORTANCE OF THE ISSUE

Generally we always pay attention to the pain produced by the disease itself or its sequelae, but we do not always pay attention to the pain produced by the different invasive diagnostic or therapeutic methods. Sometimes the processes become more painful due to the level of stress felt by the child, as well as the repetition of certain techniques, often underestimating the pain produced by the different invasive diagnostic or therapeutic methods (Huang & Johnson, 2016).

EVIDENCE SUMMARY: MANAGEMENT

Nitrous oxide is a gas, which in concentrations of 50% or less together with another 50% of oxygen, is used as an anaesthetic and anxiolytic; it also has a certain amnesic capacity. Thus its effects are achieved without reaching the loss of consciousness.

It begins its action after 3-5 minutes of use and its recovery is usually immediate after its withdrawal. It is therefore a good alternative for use against techniques that generate pain, although we must bear in mind that its administration is not without risk (Cortés et al., 2009). Although we must take into account that its administration is not without risk, so it should be administered by qualified personnel who know how to act against the adverse effects that may occur (Olsen et al., 2019).

To administer it, the patient will breathe in the usual way through a face mask through which we will administer the gas. The administration should be withdrawn if the patient is found to be too drowsy. Keep the patient monitored with the pulse oximeter during the whole process.

On withdrawal, recovery is practically instantaneous, although we can administer 100% oxygen for 3-5 minutes afterwards to ensure complete withdrawal of nitrous oxide and thus avoid some adverse effects such as headache, lethargy and nausea.

Many authors show that these adverse effects are less with a gas utilization of 50% (Capapé, 2008).

APPLICATIONS

There are numerous painful procedures in which we can use it to reduce the patient's anxiety and pain. Some of them would be: reduction of dislocations, fracture manipulation, wound healing, burns or wounds that require sutures, extraction of foreign bodies, lumbar puncture and in general any invasive activity (Capapé, 2008).

USE OF NITROUS OXIDE IN PAEDIATRIC EMERGENCIES

CONTRAINDICATIONS

Any technique, however slight it may be, involves some risks and contraindications that must be taken into account. That is why it is important for the personnel who administer it to be aware of these risks and contraindications.

N₂O has a low solubility in the blood, although according to studies, it is 35 times more soluble than nitrogen (the main component of the air we breathe). Consequently, when we inhale N₂O it diffuses more rapidly through the air spaces than nitrogen does. This means that in some circumstances the rapid expansion can produce a detrimental effect by increasing pressure.

The effects of increased pressure and lung expansion depend on the pressure of nitrous oxide, the amount of blood flow entering the air cavity, and the duration of exposure. fails to expand the thorax, reposition the head before giving the next ventilation (Huang & Johnson, 2016).

Some of the contraindications are (Capapé, 2008):

- Intrathoracic injury.
- Airway obstruction, acute respiratory infection, pneumonia, pulmonary edema, pulmonary hypertension (increased pulmonary vascular resistances).
- COPD, emphysema, cystic fibrosis (Huang & Johnson, 2016).
- Pneumothorax (an increase in volume has been demonstrated after use), pneumoperitoneum (Huang & Johnson, 2016).
- Head trauma with intracranial hypertension.
- Altered level of consciousness.
- Gas embolism.
- Sinusitis.
- Submersion accident.
- Abdominal gas distention, intestinal ileus.
- Patients with ASA III-IV.
- Facial trauma involving the mask area.
- Patients dependent on oxygen therapy.
- Patients who received gases such as SF₆, C₃F₈, C₂F₆, for at least 3 months afterwards.
- Pregnant.

ADVERSE EFFECTS

Although generally well tolerated, some adverse effects have been described such as euphoria, agitation, headache, paresthesias, vertigo, nausea, vomiting, hallucinations, somnolence... They usually disappear within a few minutes after discontinuation of administration (Olsen et al., 2019). Other effects such as oversedation, desaturation, apnea, bradycardia have been related to co-administration with benzodiazepines and opioids and the age of the patient (less than 2 years) (Pedersen et al., 2013).

In prolonged exposures and at high doses, neurological disorders of the myeloneuropathic type or megaloblastic anaemias with leukopenia may appear (Capapé, 2008).

BIBLIOGRAPHIC REFERENCES

Capapé, S. (2008). Sedation in the emergency department for techniques and procedures with nitrous oxide. *Anales de Pediatría Continuada*, 6(4), 231-235.

[https://doi.org/10.1016/S1696-2818\(08\)75638-5](https://doi.org/10.1016/S1696-2818(08)75638-5)

Cortés, B. G., Zache, S. C., Benito, F. J., Maya, J. L., Santervas, Y. F., Cubells, C. L., Ayestarán, O.

S., Concepción, M., Llanas, M. E. M., & Casanova, F. J. T. (2009). *NITROUS OXIDE: EFFECTIVENESS AND SAFETY IN THE PERFORMANCE OF PAINFUL PROCEDURES IN PEDIATRIC EMERGENCY DEPARTMENTS*. 19.

Huang, C., & Johnson, N. (2016). Nitrous Oxide, From the Operating Room to the Emergency Department. *Current Emergency and Hospital Medicine Reports*, 4, 11-18.

<https://doi.org/10.1007/s40138-016-0092-3>. <https://doi.org/10.1007/s40138-016-0092-3>

Olsen, A., Iversen, C., & Størdal, K. (2019). Use of nitrous oxide in children. *Tidsskrift for Den Norske Laegeforening: Tidsskrift for Praktisk Medicin, Ny Raekke*, 139(12).

<https://doi.org/10.4045/tidsskr.18.0338>

Pedersen, R. S., Bayat, A., Steen, N. P., & Jacobsson, M.-L. B. (2013). Nitrous oxide provides safe and effective analgesia for minor paediatric procedures-A systematic review.

Danish Medical Journal, 60(6), A4627.

Vidal Fuentes, J. (2020). Updated version of the IASP definition of pain: A step forward or a step back. *Journal of the Spanish Pain Society*.

<https://doi.org/10.20986/resed.2020.3839/2020>