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SCIENTIFIC ARTICLE

# Effect of nitrous oxide on fentanyl consumption in burned patients undergoing dressing change

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**KEYWORDS**
Pain;
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**Abstract**
*Background and objectives:* Thermal injuries and injured areas management are important causes of pain in burned patients, requiring that these patients are constantly undergoing general anesthesia for dressing change. Nitrous oxide ($N_2O$) has analgesic and sedative properties; it is easy to use and widely available. Thus, the aim of this study was to evaluate the analgesic effect of $N_2O$ combined with fentanyl in burned patients during dressing change.
*Method:* After approval by the institutional Ethics Committee, 15 adult burned patients requiring daily dressing change were evaluated. Patient analgesia was controlled with fentanyl 0.0005% administered by intravenous pump infusion on-demand. Randomly, in one of the days a mixture of 65% $N_2O$ in oxygen ($O_2$) was associated via mask, with a flow of 10 L/min ($N_2O$ group) and on the other day only $O_2$ under the same flow (control group).
*Results:* No significant pain reduction was seen in $N_2O$ group compared to control group. VAS score before dressing change was 4.07 and 3.4, respectively, in $N_2O$ and control groups. Regarding pain at the end of the dressing, patients in $N_2O$ group reported pain severity of 2.8; while the control group reported 2.87. There was no significant difference in fentanyl consumption in both groups.
*Conclusions:* The association of $N_2O$ was not effective in reducing opioid consumption during dressing changes.


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**PALAVRAS-CHAVE**
Dor;
Óxido nitroso;
*Burns*;
Desbridamento

**Efeito do óxido nitroso sobre o consumo de fentanil em pacientes queimados submetidos à troca de curativo**

**Resumo**
*Justificativa e objetivos:* Os ferimentos térmicos e a manipulação das áreas lesadas são causas importantes de dor em pacientes vítimas de queimaduras, necessitando que estes pacientes sejam constantemente submetidos a anestesias gerais para a troca do curativo. O óxido nitroso ($N_2O$) tem propriedades analgésicas e sedativas, sendo capaz de fácil utilização e de ampla disponibilidade. Com isto, objetivou-se avaliar o efeito analgésico da administração de $N_2O$ associado ao fentanil em pacientes queimados, durante a troca de curativo.
*Método:* Após aprovação pela comissão de ética institucional, foram avaliados 15 pacientes adultos, vítimas de queimaduras com necessidade de troca diária de curativo. A analgesia do paciente foi controlada pelo uso de fentanil 0,0005% administrado por bomba de infusão sob demanda, intravenosa. De maneira aleatória, em um dos dias foi associada mistura de $N_2O$ a 65% em oxigênio ($O_2$) sob máscara com fluxo de 10 L/min (grupo $N_2O$) e no outro dia apenas $O_2$ sob o mesmo fluxo (grupo controle).
*Resultados:* Não se observou diminuição significativa da dor no grupo $N_2O$ em relação ao grupo controle. A dor na EAV antes da troca do curativo foi de 4,07 e 3,4; respectivamente nos grupos $N_2O$ e controle. Quanto à dor ao término da troca de curativo, os pacientes do grupo $N_2O$ referiram dor intensidade 2,8; enquanto no grupo controle foi de 2,87. Não houve diferença significativa de consumo de fentanil em ambos os grupos.
*Conclusões:* A associação de $N_2O$ não foi eficaz na redução no consumo de opióides durante a troca de curativos.


## Introduction

One of the biggest problems faced in caring for burn patients is the need for frequent dressings, as the burning is a major cause of pain even without its manipulation. Therefore, these patients undergo general anesthesia every other day, or even daily, with long post-anesthetic recovery and prolonged fasting.[1,2] The consequences of this process may be malnutrition and delayed healing. Furthermore, the drugs used in general anesthesia often cause nausea and vomiting in sensitive patients. Development of dependence and tolerance to anesthetic drugs may also occur.[3]

Thus, there is interest in studying analgesia and sedation methods for dressing changes in burn patients, allowing rapid induction and recovery of the patients, with low incidence of side effects, at a reduced cost, which could be easy, efficient, and known by medical professionals, enabling better pain control at the most critical moment.[4]

Nitrous oxide ($N_2O$) has analgesic and sedative properties known for over 150 years and it is still used in general anesthesia, potentiating other intravenous and inhaled anesthetic agents.[5,6] Its use in small procedures outside the operating room is also widespread in the medical and dental practice, and it is satisfactory in most cases, with mild and controllable side effects with the agent discontinuation.[7–11]

The objective of this study was to evaluate the analgesic effect of 65% nitrous oxide associated with fentanyl in burn patients during dressing changes.

## Materials and methods

After obtaining the institutional Ethics Committee approval and written informed consent of all participants, 15 burn patients, aged between 18 and 60 years, ASA I and II, admitted to the specialized unit for burn treatment at the Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo (HCFMUSP), requiring daily dressing change were evaluated.

Exclusion criteria were patients with burns in the airways, face or cervical region compromising the proper management and air mask coupling; history of significant side effects (e.g., significant agitation or prolonged nausea and vomiting) with $N_2O$ inhalation, those with severe or uncontrollable side effects, confused or poorly collaborative, with psychiatric disorders that prevent participation in the study, $SpO_2 < 90\%$, and pregnant.

Patients underwent sedation with 0.0005% fentanyl solution administered intravenously by patient-controlled analgesia (PCA) in loading dose (1 mcg $kg^{-1}$) and, if with more severe pain, bolus of 30 mcg on-demand at 5 min intervals during dressing change carried out in the bed by the nursing staff on two occasions. The use of PCA pump was previously explained to the patient, with the demand bolus triggered by the patient or investigator physician. In one of the days, a mixture of 65% $N_2O$ and oxygen ($O_2$) under mask with flow rate of 10 L $min^{-1}$ ($N_2O$ group) was associated, and the next day only $O_2$ under the same flow (control group), provided by a portable Takaoka dental anesthesia device.