INFORMATIONAL ARTICLE

EXPOSURE TO SURGICAL SMOKE: HOW TO PROTECT YOURSELF?

EXPOSIÇÃO À FUMAÇA CIRÚRGICA: COMO SE PROTEGER?

EXPOSICIÓN AL HUMO QUIRÚRGICO: ¿CÓMO PROTEGERSE?

Jéssica Ribeiro Aranha¹ , Patrícia Aroni² , Evelin Daiane Gabriel Pinhatti³ , Renata Perfeito Ribeiro⁴

ABSTRACT

Objective: to report the use of respiratory protection equipment by workers exposed to inhalation of surgical smoke. **Method:** this is a descriptive, informative study, based on publications relevant to the use of respiratory protective equipment used by workers exposed to surgical smoke. A bibliographic search of scientific articles that addressed the topic was carried out in the following databases: MEDLINE, Web of Science, Sci-Versi Scopus and LILACS. **Results:** it was registered that N95 masks filter particles larger than 0.3 microns; therefore, not all substances are retained with their use, since the chemical compounds present in surgical smoke measure from 0.1 to 0.5 microns. Thus, it is assessed that the recommendation for the use of the common surgical mask by workers exposed to surgical smoke is not safe. It is noteworthy, however, that there are recommendations for its use in the face of this exposure. **Conclusion:** it is necessary, with the exposure of workers to the chemical components present in the surgical smoke produced by the electrocautery, the recommendation and implementation of the use of the N95 mask, vacuum cleaners for surgical smoke and room exhaust fans. **Descriptors:** Electrocoagulation; Protective Devices; Health Personnel; Occupational Health; Smoke; Occupational Exposure.

RESUMO

Objetivo: relatar o uso do equipamento para proteção respiratória por trabalhadores expostos à inalação da fumaça cirúrgica. **Método:** trata-se de um estudo descritivo, do tipo informativo, com base em publicações pertinentes ao uso de equipamentos de proteção respiratória utilizados pelos trabalhadores expostos à fumaça cirúrgica. Realizou-se uma busca bibliográfica de artigos científicos que abordassem o tema nas seguintes bases de dados: MEDLINE, Web of Science, Sci-Versi Scopus e LILACS. **Resultados:** registrou-se que as máscaras N95 filtram partículas maiores que 0,3 microns, portanto, nem todas as substâncias são retidas com o seu uso, já que os compostos químicos presentes na fumaça cirúrgica medem de 0,1 a 0,5 microns. Avalia-se, dessa forma, que a recomendação do uso da máscara cirúrgica comum pelos trabalhadores expostos à fumaça cirúrgica não é segura. Ressalta-se, porém, que existem recomendações para o seu uso diante dessa exposição. **Conclusão:** fazem-se necessárias, com a exposição dos trabalhadores aos componentes químicos presentes na fumaça cirúrgica produzida pelo eletrocautério, a recomendação e a implementação do uso da máscara N95, aspiradores próprios para a fumaça cirúrgica e exaustores de ambiente. **Descritores:** Eletrocoagulação; Equipamentos de Proteção; Pessoal de Saúde; Saúde do Trabalhador; Fumaça; Exposição Ocupacional.

RESUMEN

Objetivo: informar sobre el uso de equipos de protección respiratoria por parte de los trabajadores expuestos a la inhalación de humo quirúrgico. **Método:** este es un estudio descriptivo e informativo, basado en publicaciones relevantes para el uso de equipos de protección respiratoria utilizados por trabajadores expuestos al humo quirúrgico. Se realizó una búsqueda bibliográfica de artículos científicos que abordaron el tema en las siguientes bases de datos: MEDLINE, Web of Science, Sci-Versi Scopus y LILACS. **Resultados:** se registró que las máscaras N95 filtran partículas de más de 0.3 micras, por lo tanto, no todas las sustancias se retienen con su uso, ya que los compuestos químicos presentes en el humo quirúrgico miden de 0.1 a 0.5 micras. Por lo tanto, se evalúa que la recomendación para el uso de la máscara quirúrgica común por parte de los trabajadores expuestos al humo quirúrgico no es segura. Cabe señalar, sin embargo, que hay recomendaciones para su uso ante esta exposición. **Conclusión:** con la exposición de los trabajadores a los componentes químicos presentes en el humo quirúrgico producido por electrocauterio, es necesario recomendar e implementar el uso de la máscara N95, aspiradoras para humo quirúrgico y extractores de aire. **Descriptor:** Electrocoagulación; Equipos de Seguridad; Personal de Salud; Salud Laboral; Humo; Exposición Profesional.

^{1,2,3,4}State University of Londrina/UEL. Londrina (PR), Brazil. ¹ <http://orcid.org/0000-0003-0204-8414> ² <http://orcid.org/0000-0001-5092-2714> ³ <http://orcid.org/0000-0002-7626-805X> ⁴ <http://orcid.org/0000-0002-7821-9980>

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INTRODUCTION

It is known that, in various work environments, there is exposure to various occupational risks, such as biological, physical, chemical and ergonomic¹, and among these environments, hospitals stand out. It is noted, in this place, specifically, in the operating room, a concern about the chemical risk that permeates workers, especially those exposed to surgical smoke. It is observed that this smoke is produced by electrocautery, a device widely used in surgical procedures, which, with the aid of electric current, performs the cutting and coagulation of various tissues.²

Surgical smoke is formed by water vapor, chemical compounds,³⁻⁴ viruses, bacteria and blood cell material,⁵ which, when inhaled, cause respiratory tract infections in exposed workers.⁶

It has been described in studies, given the routine use of electrocautery in the various surgical procedures, that workers exposed to surgical smoke smell an unpleasant odor⁷, in addition to presenting several signs and symptoms, such as foreign body sensation in the throat, nausea, burning in the pharynx, nasal congestion, irritation of the nasal mucosa and oral cavity, sneezing,² headache, eye irritation,⁴ vomiting, weakness and dizziness.⁸

Among the chemical compounds present in the smoke of the electrocautery, polycyclic aromatic hydrocarbons (PAH),⁹⁻¹⁰ volatile organic compounds (VOCs),¹¹ carbon monoxide (CO),³ toluene,¹² benzene, formaldehyde, acrolein and hydrogen cyanide.⁸ It is understood that these compounds measure from 0.1 to 0.5 microns and have cytotoxic and mutagenic effects, being harmful to the health of those who inhale them.¹³

In view of this issue, it appears that some preventive measures must be implemented: the use of exhaust fans in the operating room; vacuum cleaners for the removal of surgical smoke and the use of the N95 mask by exposed workers.¹⁴

OBJECTIVE

- To report the use of respiratory protection equipment by workers exposed to surgical smoke inhalation.

METHOD

This is a quantitative, descriptive, informative study, based on publications relevant to the use of respiratory protective equipment used by workers exposed to surgical smoke.

A bibliographic search of scientific articles that addressed the topic was carried out in the following databases: MEDLINE, Web of Science, Sci-Versi Scopus and LILACS, using DeCS descriptors such as: Health Personnel OR Personal

Protective Equipment OR Masks OR Respiratory Protection Devices OR Smoke AND (N95 AND Surgical Mask) and MeSH descriptors as: Health Personnel OR Respiratory Protective Devices OR Masks OR Smoke AND (N95 AND Surgical Mask) in search of articles.

Surgical Mask

It is known that surgical masks are conventionally used by workers in operating rooms, but, contrary to what is believed, these masks do not offer sufficient protection against surgical smoke, as they do not prevent the inhalation of toxic gases, aerosols and resulting chemical components of tissue coagulation. This equipment has been developed to protect the patient from infections¹⁵ and workers from being contaminated with body fluids during surgical procedures.^{14,16}

N95 Mask

It appears that this mask is responsible for filtering particles larger than 0.3 microns,¹⁶ therefore, not all substances are retained with their use, as the chemical compounds present in surgical smoke measure from 0.1 to 0.5 microns.¹⁶

It is emphasized that international organizations, such as the Association of Perioperative Registered Nurses (AORN), incorporate and reinforce the use of the N95 mask as a preventive measure in reducing exposure to chemical risks from surgical smoke, because, among the masks offered by hospital institutions, it retains a large amount of chemical particles that are in the air during the use of electrocautery.¹⁴

Exhausts in the operating room

The exhaust fans present in the operating rooms promote the capture of surgical smoke, that is, during the surgical procedure this smoke is removed to an area far from the team, where it can be filtered. This smoke passes through a filter so that it can return to the environment. These exhaust fans are connected to filters that have activated carbon in their composition, which will absorb the chemicals that are present in surgical smoke. These filters are called ULPA (Ultra Low Penetration Air) and removes 99.9995% of the chemical components that measure 0.12 microns or more, thus preventing the worker from being exposed to these carcinogenic and mutagenic chemical compounds for the human body.^{19,20}

DISCUSSION

It is noticed, in the practice of several health institutions, the mandatory use of the common surgical mask by workers inside the operating room, even if they are exposed to surgical smoke. It is pointed out that this conduct reflects the need for studies on the risks pertaining to the operating room and the dissemination of studies

carried out, which demonstrate the risks of occupational diseases to which these workers are exposed when they are in environments with the presence of surgical smoke using the surgical mask.

It is said that the N95 mask received its nomenclature from the United States of America (USA), as it has a filter that retains 95% of the particles present in the air. It is noteworthy that, in Brazil, the equipment is equivalent to the PPF2 mask (filtering semi-facial part), since both have the same level of protection.¹

It is emphasized that international organizations, such as the Association of Perioperative Registers Nurses (AORN), incorporate and reinforce the use of the N95 mask as a preventive measure in reducing exposure to the chemical risks of surgical smoke, because, among the masks offered by hospital institutions, this retains a large amount of chemical particles that are in the air during the use of electrocautery.¹⁴

The National Institute for Occupational Safety and Health (NIOSH) recommends the use of ventilation techniques, such as the installation and use of exhaust fans in the operating room, to control the presence of chemical compounds in the air from the use of electrocautery.¹⁸

It is signaled, in order to be effective in reducing surgical smoke in the environment, that it is necessary to use ventilation with approximately 20 air changes per hour, in order to capture the chemical components of this smoke.¹⁸

It is noticed that this study has as a limitation the scarcity of publications in relation to the effectiveness of respiratory protective equipment in the retention of chemical components present in surgical smoke during the use of electrocautery.

Studies are needed to elucidate the most adequate protection in relation to the effectiveness in retaining the chemical components of 0.1 to 5 microns generated by electrocautery, in order to protect the exposed worker, since these substances are seen in the literature as being harmful to the health of those who inhale them in the workplace, as they contain mutagenic and carcinogenic properties.

CONCLUSION

In view of the great exposure of surgical center workers to the chemical components of surgical smoke produced by electrocautery, it is suggested that the N95 mask be used in the surgical environment, which filters 95% of these chemical components in the air, and the installation of room exhaust fans and vacuum cleaners for surgical smoke, minimizing the risks related to the constant inhalation of this smoke in the various

surgical procedures and preserving the occupational health of the surgical team.

It is noteworthy, however, that this mask, although currently the most suitable, does not filter some particles that can influence the occupational health of exposed workers.

In addition, there is a need to develop studies with stronger scientific evidence, to scientifically clarify, to workers exposed to surgical smoke and managers, which type of protective equipment, individual or collective, should be used during practice the use of electrocautery.

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Corresponding author

Jéssica Ribeiro Aranha

Email: jessica_aranha10@hotmail.com

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