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Publicação Oficial da Sociedade Brasileira de Anestesiologia  
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## SCIENTIFIC ARTICLE

# The antimicrobial activity of ephedrine and admixture of ephedrine and propofol: an in vitro study

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Received 3 June 2016; accepted 20 June 2017

### KEYWORDS

Ephedrine;  
Propofol;  
Antimicrobial

### Abstract

**Introduction:** Propofol and Ephedrine are commonly used during anesthesia maintenance, the former as a hypnotic agent and the later as a vasopressor. The addition of propofol to ephedrine or administration of ephedrine before propofol injection is useful for decreasing or preventing propofol related hemodynamic changes and vascular pain. This in vitro study evaluated the antibacterial effect on common hospital-acquired infection pathogens of ephedrine alone or combined with propofol.

**Material and method:** The study was performed in two stages. In the first, the Minimum Inhibitory Concentration of propofol and ephedrine alone and combined was calculated for *Escherichia coli*, *Enterococcus faecium*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and a clinical isolate of *Acinetobacter* spp. at 0, 6, 12 and 24 h, using the microdilution method. In the second stage, the same drugs and combination were used to determine their effect on bacterial growth. Bacterial solutions were prepared at 0.5 MacFarland in sterile 0.9% physiological saline and diluted at 1/100 concentration. Colony numbers were measured as colony forming units mL<sup>-1</sup> at 0, 2, 4, 6, 8, 10 and 12th hours.

**Results:** Ephedrine either alone or combined with propofol did not have an antimicrobial effect on *Escherichia coli*, *Enterococcus faecium*, or *Pseudomonas aeruginosa* and this was similar to propofol. However, ephedrine alone and combined with propofol was found to have an antimicrobial effect on *Staphylococcus aureus* and *Acinetobacter* species at 512 mcg mL<sup>-1</sup> concentration and significantly decreased bacterial growth rate.

**Conclusion:** Ephedrine has an antimicrobial activity on *Staphylococcus aureus* and *Acinetobacter* species which were frequently encountered pathogens as a cause of nosocomial infections.

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<http://dx.doi.org/10.1016/j.bjane.2017.06.004>

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Please cite this article in press as: Tulgar S, et al. The antimicrobial activity of ephedrine and admixture of ephedrine and propofol: an in vitro study. Rev Bras Anesthesiol. 2017. <http://dx.doi.org/10.1016/j.bjane.2017.06.004>

## PALAVRAS-CHAVE

Efedrina;  
Propofol;  
Antimicrobiano

## A atividade antimicrobiana de efedrina e da combinação de efedrina e propofol: um estudo *in vitro*

### Resumo

**Introdução:** Propofol e efedrina são fármacos comumente usados durante a manutenção da anestesia, o primeiro como agente hipnótico e o segundo como vasopressor. A adição de propofol à efedrina ou a administração de efedrina antes da injeção de propofol é útil para diminuir ou prevenir alterações hemodinâmicas e dor vascular relacionadas ao propofol. Este estudo *in vitro* avaliou o efeito antibacteriano de efedrina, isolada ou em combinação com propofol, em patógenos comuns implicados em infecção hospitalar.

**Material e método:** O estudo foi realizado em duas etapas. Na primeira, a concentração inibitória mínima (CIM) de propofol e de efedrina isolada e em combinação foi calculada para *Escherichia coli*, *Enterococcus faecium*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* e um isolado clínico de *Acinetobacter spp* às 0, 6, 12 e 24 horas, usando o método de microdiluição. Na segunda etapa, os mesmos fármacos e a combinação foram utilizados para determinar seus efeitos no crescimento bacteriano. As soluções bacterianas foram preparadas em soro fisiológico a 0,9% em 0,5 McFarland e diluídas a uma concentração de 1/100. Os números das colônias foram medidos como cfu.mL<sup>-1</sup> às 0, 2, 4, 6, 8, 10 e 12 horas.

**Resultados:** Efedrina isolada ou em combinação com propofol não apresentou efeito antimicrobiano sobre *E. coli*, *E. faecium* ou *P. aeruginosa*, um resultado semelhante ao de propofol. Porém, efedrina isolada e em combinação com propofol apresentou efeito antimicrobiano sobre *Staphylococcus aureus* e *Acinetobacter spp*, em concentração de 512 mcg.mL<sup>-1</sup>, e redução significativa da taxa de crescimento bacteriano.

**Conclusão:** Efedrina tem atividade antimicrobiana em *S. aureus* e *Acinetobacter spp*, que são patógenos frequentemente identificados como causa de infecções nosocomiais.

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## Introduction

Propofol a commonly used hypnotic agent for the induction and maintenance of anesthesia is known to be a microbial growth-promoting agent that is prone to contamination, due to its lipid emulsion structure.<sup>1,2</sup> Despite awareness of the potential of contaminated propofol, sepsis and endotoxemia are still observed, sometimes even causing mortality.<sup>3-5</sup> Several agents have been used in combination with propofol to decrease its risk of contamination, including lidocaine that is also helpful in reducing the pain observed during administration.<sup>2,6-8</sup> Propofol is, of course, not the only source of bacterial contamination in operating rooms and intensive care units, and several medications and devices can lead to the complications of bacterial contamination, including sepsis.

Ephedrine is a commonly used vasopressor agent that has been used for several purposes in anesthesia practices.<sup>9,10</sup> Studies have demonstrated that the addition of propofol as an admixture to ephedrine or administration of ephedrine before propofol injection is useful for decreasing or preventing propofol related hemodynamic changes and propofol related vascular pain.<sup>11-13</sup> A recently published study reported that ephedrine had an antimicrobial effect on *Escherichia coli* at certain concentrations.<sup>14</sup> We are unaware of any similar studies.

This *in vitro* study was performed to evaluate the antibacterial effect on common hospital-acquired infection pathogens of ephedrine alone or combined with propofol.

## Material and method

### Drugs and microorganisms

Ephedrine (Efedrin Hidroklorür ampul 0.05 g mL<sup>-1</sup>, Biosel, Türkiye) and 1% propofol (Propofol 1% Fresenius, Türkiye) was used in this study. The study was designed with two stages. In the first stage, the Minimum Inhibitory Concentrations (MIC) of ephedrine and propofol separately and combined were determined using the broth microdilution method according to the procedures outlined by the Clinical and Laboratory Standards Institute (CLSI).<sup>15</sup> In the second stage, the effect on growth rate of organisms found to be affected by these drugs was measured. *Staphylococcus aureus* ATCC 25923, *E. coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853, *Enterococcus faecium* RSKK 01.016 and a clinical isolate of a multidrug resistant *Acinetobacter spp.* were used as control microorganisms. These strains of bacteria were obtained from American Type Culture Collection, USA (ATCC) and Refik Saydam National Type Culture, Collection, Turkey (RSKK).

### Determination of MIC

**Step 1: Preparation of drug mixtures:** Aseptic drug mixtures for Ephedrine (E), Propofol (P) and mixture of Ephedrine and Propofol (E+P) were prepared separately in 0.9% sterile physiologic saline with final concentrations of 512 µg mL<sup>-1</sup>, 256 µg mL<sup>-1</sup>, 128 µg mL<sup>-1</sup>, 64 µg mL<sup>-1</sup>,

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