Journal of Clinical Anesthesia (2016) **35**, 560–563

ELSEVIER

Journal of Clinical Anesthesia

Original Contribution

Atropine and glycopyrrolate do not support bacterial growth—safety and economic considerations☆,☆☆

Balazs Ittzes MD[a,1], Zsolt Weiling MD[b,1], Istvan Zoard Batai MD[a], Monika Kerenyi MD, PhD[a], Istvan Batai MD, PhD[b,*]

[a]*Department of Medical Microbiology, University of Pecs, Pecs, Hungary, Szigeti u. 12. H-7624*
[b]*Department of Anaesthesia and Intensive Care, University of Pecs, Pecs, Hungary, Rakoczi u. 2. H-7623*

Received 17 April 2015; revised 1 September 2016; accepted 13 September 2016

Keywords:
Atropine;
Bactericidal;
Glycopyrrolate;
Hospital finance

Abstract
Study objective: Evaluation of bacterial growth in atropine and glycopyrrolate.
Design: Laboratory investigation.
Subjects and measurements: Standard microbiological methods were used to evaluate the impact of atropine and glycopyrrolate on the growth of *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Escherichia coli*. Bacterial count was checked at 0, 1, 2, 3, 4, 6, and 24 hours.
Main results: Atropine or glycopyrrolate did not support the growth of the above bacteria at any examined time at room temperature. Glycopyrrolate killed all of the examined strains ($P < .05$), whereas in atropine, only the clinical isolates of *Staphylococcus* and *Acinetobacter* were killed ($P < .05$).
Conclusions: Drawing up atropine or glycopyrrolate at the beginning of the operating list and use within 24 hours if needed are a safe practice and do not pose infection hazard. We can also reduce hospital costs if we do not throw away these unused syringes following each case.

1. Introduction

Safety is an important issue in anesthesia. We may draw up atropine, glycopyrrolate, or other emergency medications before the first case and use it later. The contamination rate of intravenous drugs may be as high as 18% during preparation [1]. Intravenous medication may support or inhibit bacterial growth [2]. Bacteria surviving in drugs used in anesthesia practice may cause severe bloodstream infection [3].

On the other hand, loaded but unadministered drugs contribute to waste. Drugs that do not support bacterial growth if contaminated may be kept for a later use and may improve departmental finance.

In this study, we examined the impact of atropine and glycopyrrolate on bacterial growth. We hypothesized that these medications alter bacterial growth.

☆ Financial support: University of Pecs, Pecs, Hungary. Grant AOK KA-34039/10-03 and AOK KA-34039/10-13.
☆☆ No external funding and no competing interests declared.
* Corresponding author. Tel.: +36 302770599.
E-mail addresses: bittzes@hotmail.com (B. Ittzes), wdr@mailbox.hu (Z. Weiling), istvanzbatai@gmail.com (I.Z. Batai), kerenyim@hotmail.com (M. Kerenyi), ibatai@gmail.com (I. Batai).
[1] Balazs Ittzes and Zsolt Weiling equally contributed to the article.

http://dx.doi.org/10.1016/j.jclinane.2016.09.011
0952-8180/

2. Materials and methods

The examined preparations were Atropine Sulfate Injection BP (atropine sulfate; B Braun Melsungen AG, Berlin, Germany) 600 μg mL^{-1} and Robinul (glycopyrronium bromide; Anpharm, Croydon, UK) 200 μg mL^{-1}.

The growth of *Staphylococcus aureus* (American Type Culture Collection [ATCC] 23923), *Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 27853), clinical isolates of metallo-beta-lactamase producing *P aeruginosa*, methicillin-resistant *S aureus* (MRSA), extended spectrum beta-lactamase producing (ESBL) *E coli*, and multidrug-resistant *Acinetobacter baumannii* (MDRA) was investigated in the above medications.

Mueller-Hinton (MH) broth was inoculated with each organism and incubated overnight at 37°C. The cultures were diluted to a density of 0.5 McFarland units with sterile nonbacteriostatic saline 0.9%. Each bacterium solution was further diluted with sterile saline 0.9% to give an initial concentration of 10^3 colony forming units (cfu)/mL in the tested medications and controls. All diluted suspensions were vortexed for 1 minute between each aliquot removal. Five vials of each tested drug and controls were inoculated. After inoculation, the culture vials were kept at room temperature (20°C). Each vial was vortexed for 5 minutes, and a 10-μL sample was then removed and plated on MH agar at the following times after inoculation: 0, 1, 2, 3, 4, 6, and 24 hours. The plates were then incubated at 37°C for 24 and 48 hours, and the cfu numbers were counted. The method is described in details elsewhere [4]. MH broth controls were also applied. A sterility control check for atropine and glycopyrrolate was also performed by plating a sample of each medication on MH agar plates and incubating for 24 and 48 hours at 37°C.

Statistical analysis was performed by using analysis of variance. Individual comparisons between group means were made by using the Scheffé test. $P < .05$ was regarded as significant.

3. Results

Each bacterium grew in MH broth. There was no growth from the tested ampoules.

In glycopyrronium bromide, the cfu of MRSA significantly decreased after 2 hours, whereas the cfu of all other strains significantly decreased after 1 hour ($P < .05$) (Fig. 1).

In atropine sulfate, the cfu of *S aureus*, *E coli*, ESBL, and *P aeruginosa* strains did not change significantly. On the other hand, the cfu of MRSA decreased significantly following 2 hours and those of the MDRA strain after 3 hours ($P < .05$). Both strains were killed by the end of the experiment ($P < .05$) (Fig. 2).

4. Discussion

Our results suggest that atropine and glycopyrrolate do not support the growth of the investigated *S aureus*, *E coli*, *P aeruginosa*, and *A baumannii* strains at room temperature, whereas atropine killed the MRSA and MDRA strains. These microbes are responsible for most of the intravascular catheter-related bacterial bloodstream infections. [5].

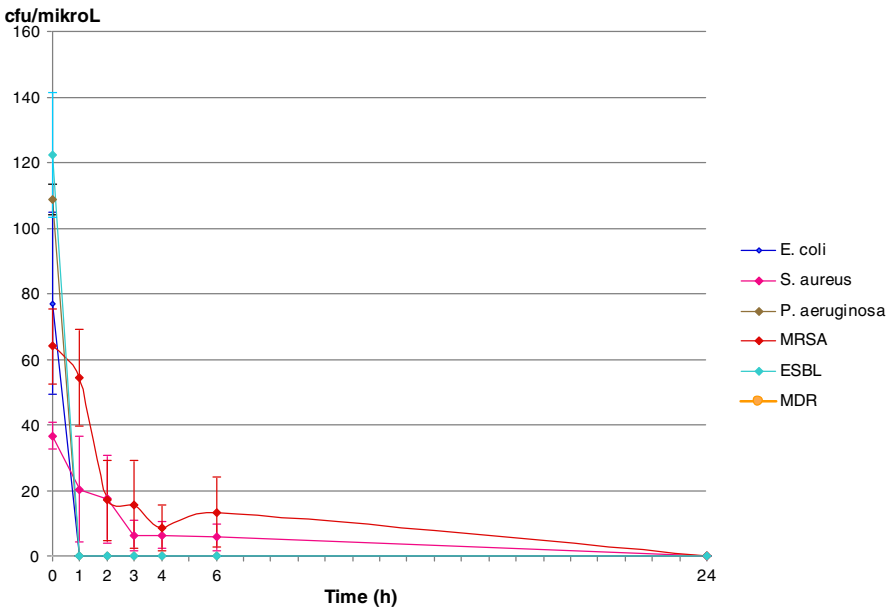

Fig. 1 Bacterial growth in glycopyrronium bromide 200 μg mL^{-1} at room temperature. The cfu of all investigated strains decreased significantly. Values are mean (SD).