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CONTROLANDO ACINETOBACTER ENDÊMICO COM HIPOCLORITO DE SÓDIO

CONTROLLING ENDEMIC ACINETOBACTER BAUMANNII WITH SODIUM HYPOCHLORITE

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RESUMO

Objetivo: Avaliar a eficácia de hipoclorito 1% como um agente de desinfecção ambiental para controlar Acinetobacter em um hospital onde este microrganismo é endêmico. **Métodos:** Uma avaliação foi realizada em três diferentes períodos: 10 meses antes, durante 3 meses e 5 meses após a intervenção com a higienização do ambiente, usando hipoclorito de 1% em todas as unidades do hospital. Os dados sobre infecção (pneumonia, infecção do trato urinário e bacteremia) foram apresentados como número por 1000 pacientes-dia. **Resultados:** A taxa de infecção Acinetobacter eram 16,7 por 1000 pacientes-dia antes da intervenção, 5,1 por 1000 pacientes-dia durante a intervenção e 25,0 por 1000 pacientes-dia de cinco meses após a intervenção de hipoclorito. A intervenção hipoclorito resultou numa redução significativa na infecção por Acinetobacter em todos os sítios (urinária, bacteremia e pneumonia) (p <0,05). **Conclusão:** hipoclorito foi eficaz na redução temporária da taxa de Acinetobacter infecção.

Palavras-Chaves: Hipoclorito. Controle de Infecção. Infecção. Acinetobacter. Surto.

ABSTRACT

Objective: Evaluate the effectiveness of 1% hypochlorite as an environmental disinfection agent to control Acinetobacter infection in a hospital where this microorganism is endemic. **Methods:** An interventional prospective at three different periods: 10 months before, 3 months during and 5 months after intervention with environmental hygienization using 1% hypochlorite in all units of the hospital. The normal routine for infection control remained the same during the intervention. Data on infection (pneumonia, bacteremia and urinary tract infection) were presented as number per 1000 patient-days. **Results:** The rate of Acinetobacter infection were 16.7 per 1000 patient-days before intervention, 5.1 per 1000 patient-days during intervention and 25.0 per 1000 patient-days five months after hypochlorite intervention. The hypochlorite intervention resulted in a significant reduction in Acinetobacter infection, including all sites (urinary, bacteremia and pneumonia) (p < 0.05). **Conclusion:** Hypochlorite was effective in reducing the rate of Acinetobacter infection during the disinfection.

Keywords: Hypochlorite. Infection Control. Infection. Acinetobacter. Outbreak

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INTRODUCTION

In the last two decades, the incidence of infections caused by multi-drug resistant bacteria has increased at an alarming rate[1]. Acinetobacter baumannii has been recognized as the leading cause of infection in Brazilian hospitals, and the prevalence of colonization has increased around the world2. Acinetobacter infection has posed some challenges to physicians, including attributed mortality, few therapeutic options, unresponsiveness to available drugs and difficulty in defining infection and colonization[3,4].

Several approaches have been taken in attempts to control Acinetobacter infection. Successful measures have been described in controlling outbreaks3. However, controlling endemic Acinetobacter infection in hospital is very difficult. The existing approaches consist of environmental disinfection using potent products together with an intensive educational program that promotes hand hygiene and contact isolation with cohort, even with selective decontamination[1,3,5,6].

The aim of our study was to evaluate the effectiveness of environmental disinfection with 1% hypochlorite as an isolated measure to control endemic Acinetobacter infection and colonization in a hospital.

METHODS

Local

This study was performed in a 660-bed university hospital in Curitiba, a city in Southern Brazil. An observational prospective study was performed after establishment of a new hygienization environment routine using 1% hypochlorite. Quaternary ammonium compounds have been used for hygienization in our hospital. The normal routine to control infection remained the same during the hygiene modification. There were no other interventions, such as educational campaign, new orientation, hand hygiene orientation or other measures to modify the current routine protocol to control infection. The data were collected at three distinct phases during January 2008 to July 2009. The first phase was ten months prior to the routine modification. The second phase was three months during the hypochlorite application. The last phase was five months after the protocol. Active surveillance of colonization was not performed during the study (rectal, nasal or auxiliary swabs). Cultures from these sites were excluded from the study.

Protocol

The protocol for 1% hypochlorite application consisted cleaning of the following: 1) floor and walls; 2) beds; 3) tables and chairs; 4) windows and doors; 5) entire bathrooms. These places were cleaned daily. All units of the hospital were also included, such as surgical rooms where terminal decontamination with hypochlorite was used between each surgery, laboratory, all intensive care units, all beds in the entire hospital and the floor of administrative areas. In areas of intensive circulation, cleaning was performed at night. This dose of hypochlorite (1%) is approved by ANVISA (National Agency of Sanitary Vigilance).

Acinetobacter infection

The identification of Acinetobacter was performed using biochemical tests. Susceptibility test were performed as previously published in the Clinical and Laboratory Standards Institute (CLSI)[7]. Hospital infection was defined according to CDC (Centers for Disease Control and Prevention) criteria. The infection rate was determined by 1000 patient-days. We included ventilator-associated pneumonia, bloodstream infection and urinary tract infection for infection rate analysis. Surgical site infections and other infections were excluded due to the difficulty in differentiating between infection and colonization. A patient with positive Acinetobacter culture was only included once.

Fingerprinting of the isolates using the DiversiLab system

We included five samples of A. baumannii from different sites (two from blood culture and three from central venous catheter) of the patients from 2008 during the first 10 months before the intervention. Only five strains were stored in this period, and all of them were carbapenem resistant and showed the same susceptibility pattern.

The isolates were fingerprinted using the rep-PCR automated in the DiversiLab system (bioMèrieux). DNA was extracted from a bacterial suspension in physiologic saline and electrophoresed in 1.5% agarose and stained with Sybrsafe (Invitrogen). The fingerprinting of the isolates was performed using Acinetobacter Kit (DiversiLab). The samples were loaded in a chip and run using the Agilent 2100 Bioanalyzer (Agilent Technologies) as previous performed and described8.

Adverse effects

We analyzed the most common complaints of heath care workers using a questionnaire with objective answers at the end of the protocol to avoid behavioral modifications. The cleaning staff was not analyzed.

Statistical Analysis

Data about infection and colonization were expressed as number per 1000-patient-days and comparison along the time using non-parametric T test for the three phases.

RESULTS

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The total number of admissions per period of the study is described in Table 1. A total of 24,931 cultures from different sites were performed, excluding rectal, auxiliary and nasal cultures. From the cultures, 26.1% were positive, Acinetobacter spp. was identified in 560 (8.1% of total).

Table 1. Description of Acinetobacter infection and colonization during three periods of sodium hypochlorite hygienization

Characteristic	Period 1 Before Hypochlorite	Period 2 During Hypochlorite	Period 3 After Hypochlorite	P*
Admissions (total)	21726	5973	10114	
Monthly average	2173	1991	2023	
Number of culture				
Total	12470	5232	7229	
Positiives (%)	27,4	26,0	25,0	0,92
Acinetobacter /positives (%)	9,3	6,3	8,8	0,62
Acinetobacter infections (per 1000-patient-days)				
Total	16,7	5,1	25,0	<0.05
Urinary tract	4,3	1,1	12,0	<0.05
Ventilator associated pneumonia	8,1	4,0	6,5	<0.05
Bacteremia	4,6	1,1	3,4	<0.05
Acinetobacter colonization (per 1000-patient-days)				
Total	57,0	56,4	55,1	0,96

* p < 0,05 comparing the period 2 with periods 1 and 3. Periods 1 and 3 were similar

The total number of infections during the three periods is indicated in Table 1. During the first period, the rate of bloodstream infection was 4.6 per 1000 patient-days, the rate of urinary tract infection was 4.3 per 1000 patient-days and the rate of ventilator-associated pneumonia was 8.1 per 1000 ventilator-days. During the second period (during intervention), the rate of bloodstream infection was 1.1 per 1000 patient-days, the rate of urinary tract infection was 1.1 per 1000 patient-days and the rate of ventilator-associated pneumonia was 4.0 per 1000 ventilator-days. During the third period (after intervention), the rate of bloodstream infection was 3.4 per 1000 patient-days, the rate of urinary tract infection was 12.0 per 1000 patient-days and the rate of ventilator-associated pneumonia was 6.50 per 1000 ventilator-days. A comparison of infection types during all three phases is depicted in Figure 1. Intervention with hypochlorite showed a significant reduction in Acinetobacter infection of all types (urinary, bacteremia and pneumonia) (P < 0.05). However, during the third period after interruption of hypochlorite usage, the infection rate was similar to the first period, which was before intervention. The fingerprinting showed that the five samples tested were not similar (figure 2).

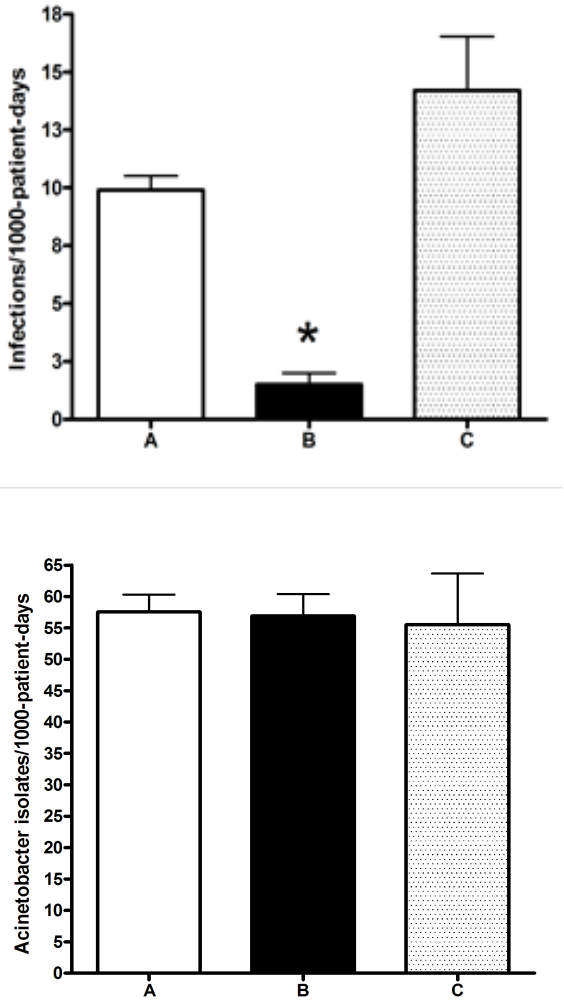

Figure 1. Acinetobacter infection rate before (A), during (B) and after (C) hypochlorite hygienization. * p < 0.05

Adverse effects

One-hundred ninety-seven healthcare workers were questioned for any signs or symptoms of discomfort during hypochlorite disinfection. The main complaints were conjunctival hyperemia (28.4%), followed by headache and

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smell (27.8 and 22.4%, respectively). All side effects are depicted in Table 2.

Table 2. Side effects in healthcare workers during environmental hygienization with sodium hypochlorite

Side effects (n=197)	n	
Healthcare worker without complaints	24	12,2%
Conjuntival hyperemia	56	28,4%
Headache	54	27,4%
Smell	45	22,8%
Cough	31	15,7%
Nasal discharge	24	12,2%
Dizzness	15	7,6%
Nasal hyperemia	11	5,6%
Dry mouth	4	2,0%
Malaise	3	1,5%
Dyspnea	3	1,5%
Other	7	3,6%

DISCUSSION

We demonstrated that an isolated intervention for environmental hygienization could reduce the rate of Acinetobacter infection. The effect of this intervention was significant but was not sustained for more than three months. The failure in sustained control of infection can be explained by several reasons. The first is that we employed an isolated measure to control infection, instead of including a cohort, continuous education about infection control and hand hygiene, orientation about ideal contact isolation to prevent infection or other programs. A second reason is the maintenance of colonized patients. Active surveillance of colonization was not performed. Patients colonized with Acinetobacter have prolonged hospitalization, several complications and invasive procedures (broncoscopy, endoscopy, curatives) and are subjected to radiological exams that require transportation. All of these conditions favor dissemination of Acinetobacter and persistence on objects and surfaces. Studies have demonstrated that Acinetobacter can survive on dry surfaces for more than three months[9,10]. In our institution, the polyclonal presence of Acinetobacter also contributes to the permanence in the environment, which is related to the endemic condition of this microorganism.

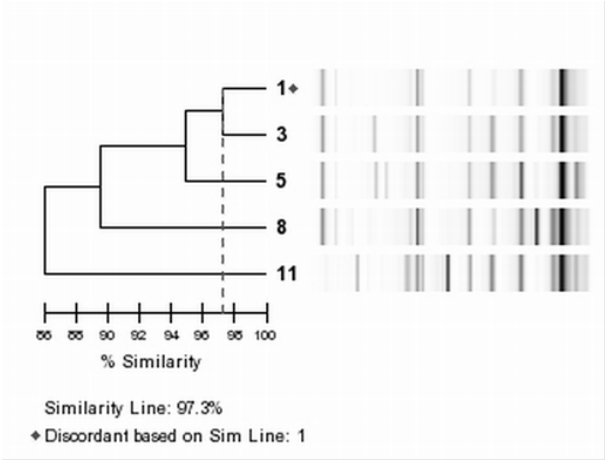

Figure 2. Dendogram of Acinetobacter strains isolated from patients with bacteremia. (3 and 5 - blood; 1,8 and 11 – catheter tip), showing the polyclonal pattern, suggesting the endemic characteristic in the institution.

A previous study showed a seasonal variance in Acinetobacter infection[10,11]. In our institution, we did not observe this tendency. We performed a retrospective analysis on the four years prior to this intervention and observed that the rate of infection was not affected by climate variance (data not shown). Observational studies suggested that environment plays a significant role for transmission of nosocomial pathogens, including Acinetobacter baumannii[11,12]. Nevertheless, unsanitary hands of healthcare workers are the main cause of transmission[12,13].

Our study supports current guidelines that recommend disinfection of surfaces in specific patient-care areas in order to reduce the risk of nosocomial pathogen transmission from surfaces[9,10]. The use of sodium hypochlorite for environmental cleaning has been demonstrated in several publications[13-16]. Other products have been tested for their effectiveness, including quaternary ammonium compound[13-16]. Apisarnthanarak et al. showed a lower level of Acinetobacter infection, which was sustained, during a year in intensive care units. These authors included other approaches as well as educational measures. Our study evaluated the isolated use of environmental disinfection, without other measures, and we also evaluated the entire hospital.

The use of the sodium hypochlorite had several adverse effects in the hygiene team as well as in patients and healthcare workers. Apisarnthanarak et al. discontinued the use of hypochlorite due to adverse effects, and we evaluated the major complaints. Conjunctival hyperemia was the most common side effect, but all healthcare workers exposed to hypochlorite reclaimed the modification in environmental disinfection. Furthermore, we did not observe any absences in healthcare workers during disinfection. We believe that

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sodium hypochlorite can be used as a measure periodically, but not as a normal routine. It should be more emphasized that potentially staff compliance to infection control procedures could have been influenced during the hypochlorite phase.

CONCLUSION

The conclusion of this study is that environment hygienization with hypochlorite is safe and effective in controlling endemic Acinetobacter infection. However, this isolated approach is not sustained and must be performed in conjunction with other measures of infection control. Adverse effects caused by hypochlorite usage are transitory and does not result in absenteeism of healthcare workers.

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