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Identification of Staphylococcus Aureus and Profile of Oxacillin Resistance in Hospital Environmental Ants

Melissa Costa Martins[1], José Dionísio de Paula Júnior[2]

[1]Department of Pharmacy, Foundation President Antônio Carlos - FUPAC, Ubá, Minas Gerais, Brazil

[2]Department of Post-Graduate Degree in Forestry Science, Federal University of Viçosa (UFV), Viçosa, Minas Gerais, Brazil

Email address:
melissamartins11@yahoo.com.br (M. C. Martins), dionisiodepaula@yahoo.com.br (J. D. de P. Júnior)

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Abstract: The objective of the research is to identify the presence of *Staphylococcus aureus* in hospital ants and describe its resistance profile relative to oxacillin. Methods: This is an analytical cross with temporality. The research scenario consisted of a charity hospital and later the microbiology laboratory of the Faculty President Antonio Carlos. The sample consists of five ants explored each sector, namely ICU and Surgical Center, totaling 10 ants. Results: Of the total samples, 7 (70%) ants grew *Staphylococcus aureus* and 3 (30%) did not. Of the samples collected in each sector 3 (60%) in the ICC, and 4 (80%), surgical center, showed growth of *Staphylococcus aureus*. These strains of *S. aureus* found 100% sensitivity showed a profile of oxacillin-resistant. Conclusion: It is concluded from the results obtained in the present study that ants allocated in hospitals may carry *Staphylococcus aureus*. As well as this bacterial species can exhibit antibiotic resistance, as shown *Staphylococcus aureus* and oxacillin resistant.

Keywords: Ants, Vectors, Infection, Resistance

1. Introduction

The high incidence of Hospital Infection is considered a major concern in health care. According to the Ministry of Health, Infection concept is how the acquired after admission of the patient and which manifests itself during or after hospitalization, relating it to the hospital or medical procedures. In Brazil and in the world to Infection is considered a critical problem, and may be related to the emergence of social and economic problems [1, 2].

Hospital-acquired infections can also be related to factors intrinsic to the host, the patient case, or environmental factors. This occurrence may be undesirable due to health conditions or the presence of pathogens vectors [3].

Arthropods, such as cockroaches, flies and ants, and rodents, being adapted to adverse environmental conditions, are among the principal vectors of microorganisms in the hospital environment [4].

Ants are among the synanthropic insects that have adapted to live with the man. They belong to the order Hymenoptera, family Formicidae. They are among the animals that are best adapted to the urban environment. In Brazil are already cataloged more than 2,000 species of ants, and worldwide approximately 18,000 species [5, 6].

They can contribute to cycling of nutrients, soil aeration, pollination, seed dispersal some plants and also participate in the food chain. However, in another study says that 20 to 30 species that occur in Brazil are considered urban pests [7].

Ants are insects endowed with great mobility, some species arrive to go up to three centimeters per second. For adapt in various environments, they are found in domestic, wild and hospital environments. These come to these sites through attractive and may be food and sweetened medicines, among others. Therefore, it can be predicted that the ants act as carriers in the microorganism [8].

The presence of ants in hospitals can be influenced by the architectural structure, proximity to residential, packaging some medications that can bring nests of ants to the internal environment, the movement of large numbers of people with clothes and objects that may contain nests ants, food and use of sugars in certain treatments, which can function as attractive [8].

The ant fauna in Brazilian hospitals as well as rich is

composed of exotic species. The presence of pathogenic bacteria-carrying ants are common in critical wards, hosting patients physically challenged and compromised immunity, such as infectious diseases, burn patients and emergency. These patients are more susceptible to contamination, which could prolong hospitalization or even cause death [9, 10].

In relation to a lifting of the ant fauna in Brazil hospitals, it was observed that insects carry these pathogenic microorganisms and can be resistant to these antibiotics (Moreira et al., 2005). Some of the most commonly found genera of pathogenic bacteria are Staphylococcus, Enterococcus and Pseudomonas. This results in a potential risk that the AI mobility of large capacity within these environments ants [3, 11].

Staphylococcus despite being a member of the normal skin microbiota and various parts of the body, nasal cavity and oropharynx, can also be found in different organs are responsible for infection. Among the species there are those opportunists who are associated with nosocomial infections. Staphylococcus according to the production of the enzyme coagulase are divided into S. aureus, when positive and negative when, belong to the group of coagulase-negative staphylococci [12, 13].

Staphylococcus aureus are responsible for high morbidity and mortality among nosocomial infection, accounting for over 30% of these infections. This bacterium has become important when they began to emerge the first hospital infection outbreaks in the 70s both life-threatening diseases such as endocarditis and toxic shock syndrome, the light conditions can be caused by S. aureus. But it had knowledge of the same due to the appearance of the first strains of Staphylococcus Aureus Resistant to Methicillin, in the 60's [14, 15].

In Brazil, the Staphylococcus aureus strains isolated in hospitals of the country from 26.6 to 71% corresponds to the in Staphylococcus Aureus Resistant to Methicillin. Since the introduction of methicillin in clinical use, such resistant strains have been identified [15, 16].

The injury resistance of S. aureus oxacillin occurs also because they are resistant to all beta-lactam antibiotics such as penicillins, cephalosporins, carbapenems and several other classes of antimicrobials, hampering the therapeutic options for the patient, the prescription restricting [1, 11].

The work is justified by the high probability of being carriers in the ants of microorganisms in hospitals consequently possible cause of nosocomial infection in hospitalized patients, especially patients in closed sectors to be the most likely to acquire this infection.

The relevance of this work is to know the potential for transmission of microorganisms by ants seeking to provide knowledge about this fact. Thus, it is important to carry out a microbiological analysis of ants present in hospitals for confirmation of a possible contamination which may cause damage to health.

The objective of the research is to identify the presence of Staphylococcus aureus in hospital ants and describe their resistance profile compared to oxacillin.

2. Methods

It is an analytic study with cross temporality. The survey was conducted in the period from 01/03/2013 to 31/10/2013. The setting of the study was composed of a philanthropic hospital in the city of Uba, Minas Gerais, Brazil and then the microbiology laboratory of the Faculty President Antônio Carlos (FUPAC). The material was collected by the academic undergraduate degree in Pharmacy.

The study comprises a qualitative research with nominal variables related to the presence of bacteria of the species Staphylococcus aureus in a hospital environment captured ants and then its resistance profile Oxacillin the antibiotic.

The method of ants was included that were within each sterile vial capture. But the exclusion method were the ants that had killed and ants were around the trap bottles.

It was made clear to the institution of the research, data collection, ensuring confidentiality and commitment of the dissemination of results. The survey obeyed all search criteria on human subjects according to Resolution 196/96 of the National Health Council and approved by the Ethics Committee via Platform Brazil with the proposing institution FUPAC. The analysis of the survey data was performed using descriptive statistics, by Microsoft Excel® 2010.

For sample selection, capturing ants in sterile vials was performed traps containing 50% glucose solution sterile inside [4]. These bottles were placed in specific locations of the sectors surveyed, the Operating Room and Intensive Care Unit. Samples were taken for seven consecutive days, the flasks remained in the sectors for 10 hours. Placed after cleaning the sectors and removed before the next cleaning.

Afterward, the vials were sealed with sterile and packaged in an insulated box lid being transported to the laboratory with the FUPAC estimated time up to 20 minutes. five ants were collected from each investigated sector, with a total of 10 ants.

For laboratory analysis was prepared BHI broth (brain heart infusion). It was added to each 10 mL test tube BHI broth. Then ants were collected separately and sterile forceps were removed one by a sterile vial and dipped in the test tubes separately. After 24h were incubated at 35°C. Between the tubes showing growth, seeding was carried out by exhaustion in Petri dishes containing sterile Mannitol Agar, which is a selective medium for the growth of the desired bacteria in this study, Staphylococcus aureus. The plates were incubated in bacteriological oven for 24h at 35°C [17].

The test consisted of adding catalase onto a microscope slide, one drop of hydrogen peroxide (3% hydrogen peroxide) and a sample of the bacterium. Then, they were considered positive in this test the crops that have demonstrated a rapid and sustained production of gas bubbles or effervescence [18].

The coagulase test consisted of a mixture in a test tube containing nutrient agar in 0.5 ml of rabbit plasma and an isolated colony. After homogenization in the test tube, this was incubated at 35°C. The result of the test was interpreted as positive due to clot formation at 2h, 6h and 24h of

incubation [18].

To check the sensitivity profile of Staphylococcus aureus to oxacillin, the recommended criteria were followed by the Clinical and Laboratory Standards Institute - CLSI [19].

A 24-hour suspension of the microorganism standardized to an equivalent turbidity of 0.5 McFarland scale, medium was seeded confluent on the surface of plates containing Agar Mueller Hinton. For this seeding was used sterile swab. Then we applied an impregnated disk with about 1μg oxacillin inoculum and incubated at 35°C for 24 hours. After incubation, it was observed the presence or absence of inhibition zone in accordance with the diameter of the haloes second CLSI [19].

3. Results

10 were captured ants, five per sector investigated. Of all the samples, 7 (70%) grew ants and 3 Staphylococcus aureus (30%) had no. Of the samples in each sector 3 (60%), the ICU, and 4 (80%), in the operating room showed growth for Staphylococcus aureus, as shown in Table 1.

Table 1. *Presence of Staphylococcus aureus in ants hospital sector.*

Sector	Presence of S. aureus N	%	Absence of S. aureusn	%
CTI	03 ants	60.0	02 ants	40.0
Surgery Center	04 ants	80.0	01 ant	10.0

Of the samples that showed bacterial growth of Staphylococcus aures strains were isolated, and then checked as its susceptibility profile to the antibiotic methicillin. The sensitivity profile was confirmed following the protocols CLSI [19]. This protocol consists of resistant strains present inhibition halo ≤ 10mm. Of these 100% strains isolated were resistant to methicillin, shown in Table 2.

Table 2. *Evaluation of resistance to antibiotic profile Oxacillin.*

Sector	*S. aureus* n (strains)	Resistance%
CTI	3 samples	100.0
Surgery Center	4 samples	100.0

4. Discussion

Insects such as ants run over the various surfaces and is thus considered important role of vectors in bacterial propagation fact described by conducted a study on multidrug resistant bacteria isolated from hospital ants and also in this study [17].

Ants are excellent candidates for in-hospital pathogenic vectors, because the type of activity developed by these and how often are found in hospitals. And also because up to 30% of the adult population of a colony to exercise at the same time outside activities to the nest, back and forth of the colony, walking long distances [20].

The fact that ants are conveyed to microorganisms may involve the transmission of diseases, and an increased rate and severity of nosocomial infections [8].

Which could explain the adhesion and survival of microorganisms in the body of an ant are factors related to its exoskeleton as the occurrence of the greeting, the number, distribution and quality of the exocrine glands, cuticle sculpture. It is still unknown details on the microbial flora of the ants, but as in many animals, it is believed that the colonization of microorganisms can occur on the surface of your body. The author also points out that in humans plus there is the normal microbial flora, there is also the transient flora, which changes according to the environment in which they live. From this fact, it is likely that with ants occur the same [20].

One explanation for this may be due ants, for example, urban share the same environment as humans, and therefore have their natural microflora altered by selective pressure caused by microorganisms associated with humans, as Staphylococcus aureus, coagulase-negative, Streptococcus spp., Bacillus spp., enteric bacilli [20].

In this study there was growth of Staphylococcus aureus served by ant 70% of the sample, similar to the study, which was found 60% of the sample being carriers in the microorganisms [17].

Staphylococcus aureus is considered one of the most important pathogens associated with nosocomial infections. These microorganisms can cause nosocomial septicemia, most frequently affecting patients intubated and subjected to vacuum [20].

In study of Ants as mechanical vectors of microorganisms in the School Hospital of the Federal University of Triangulo Mineiro reported that 54.5% had microorganisms conveyed by ants and according to the literature, 50 of bacteria that are pathogenic grew. In the present study, it was expected a significant result as the carriers in the ants being bacteria, a result also demonstrated [21].

It has been observed in other studies also a significant presence of ant microorganism as a carrier, in some localities reaching 98.4% of the ants were found infected [20].

In the study, bacteria carried by ants in the hospital, the evaluated sites, 80% had the presence of ants, only in the operating room and ICU that insects were found, which differs from this study because the evaluated sites, operating room and ICU, obtained the total sample and expected a growth of Staphylococcus aureus significant [8].

In this study, from ants found in Staphylococcus aureus, antibiotic susceptibility was done to test their resistance to methicillin, and as a result obtained 100% of resistant strains.

Evaluate the resistance of Staphylococcus sp. as vancomycin was found 100% resistant sample and that most of coagulase-negative Staphylococcus strains were resistant to antibiotics in routine hospital use. The same also reports that there is an increase and incidence of coagulase-negative Staphylococcus strains resistant to oxacillin in hospitals [17].

In another study in which 90 were evaluated coagulase-negative Staphylococcus strains obtained 49% penicillin-resistant, methicillin-resistant 24.5%, 23.6% resistant to ampicillin and resistant to 13.6% gentamicin [21].

There are reports also of Staphylococcus negative coagulase-resistant to erythromycin. Strains of

Staphylococcus, 4 S. haemolyticus, 100% were resistant to erythromycin, gentamicin, penicillin G, oxacillin and 75% [17].

Other bacterial species such as Acinetobacter, Streptococcus, Gamella, Klebsiella and E. faecalis were isolated from hospital environment ants, and to evaluate the resistance to these antibiotics, met multiresistant strains [8].

5. Conclusion

It is concluded from the results obtained in this study in the hospital allocated ants may carry Staphylococcus aureus. As well as this bacterial species may exhibit resistance to antibiotics, such as Staphylococcus aureus was shown to be resistant to methicillin.

This occurrence can contribute to the rise of nosocomial infections, since these resistant strains may spread to various hospital locations. Fit new studies to correlate ants in the hospital and the cause of hospital infections.

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