

Evaluation of Bacterial Contamination on Pre Hospital Ambulances in Qom University of Medical Sciences of Iran in 2015

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Background & Aims of the Study: When the issue of the quality of the patient's care is addressed, determination of infection degrees in reference to the quality of such cares has gained a high priority. Therefore, infections in ambulance equipment might play a significant role in reduction of the quality of the hospital cares. This study was conducted wishing to determine bacterial infection degrees in ambulances servicing in pre-hospital emergency medical services of Qom University of Medical Sciences, Iran.

Materials and Methods: In this analytical cross-sectional study, 132 sampling of the equipment's of 12 ambulances were done. Samples were stored on BHI broth as an amplifier for 24 hours. Then, they were introduced to blood agar and Eosin Methylene Blue (EMB) agar culture environments. After 24 hours, negative staphylococcus coagulase and bacillus were specified by different environments, solutions, diagnostic discs, gram staining, catalase test, oxidase test and coagulase test. Then data were analyzed by SPSS16.

Results: The results showed that the highest infection prevalence rate was observed in stretchers (12 samples, 100%) and the lowest in oxygenation moisturizers (1 sample, 8.4%). From infected equipment's, in addition, four instruments (37%) were mobile and eight of them (63%) were immobile.

Conclusion: Results indicated that an infection degree of the utensils and instruments which were used in ambulances employed servicing in the Qom Province Medical Emergency Response Center of Iran is high, that might have their roots in non-application of disinfectants for disinfecting ambulance surfaces and equipment. This is a mandatory for healthcare agents to utilize the protective covers, especially medical gloves.

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Background

Presently, World Health Organization (WHO) and its affiliates are integral parts of a social institute which is responsible for provision of full health services for the public as a center for training of health staff and other segments of the society. Keeping people healthy, especially

those individuals who deal with in hospitals and related centers, has a direct relationship with getting a proper insight into the factors giving rise to nosocomial infections (1). Since those centers are among important centers to deal with patients, so, nosocomial infections would be unavoidable in case of health and safety issues which are not taken into sufficient account. Having their roots in microorganisms

which exist in hospitals, nosocomial infections might infect individuals during their hospitalization (2). Such infections cast shadow on outcomes of the works by the best surgeons and incur economic losses through keeping occupied hospital beds for a long time, challenging one of the most significant objectives of the world health systems' macro policies, i.e., giving an access to the public for health facilities which are available in different countries. Seven to ten percent of hospitalized patients are affected by nosocomial infections, thereby remaining hospitalized for more than four to five days (3). During the last two decades, affection by such infections has been increased by 36 percent (4). In Iran, nosocomial infections have been reported to affect patients by more than 25 percent (5). Therefore, hospitals' and hospital-related systems' bacterial infections are among the issues which are relevant to hospital health. Bacterial infections in ambulances and other facilities might occur in different levels which are in contact with patients and medical staff (6).

In recent years, control of microorganisms at different levels of residential and industrial environments has been turned into a main concern. To deal with it, many surfaces impregnated with antimicrobials are employed in medical environments. In addition, those surfaces which are used in food industries, agriculture, construction and sewage should be able to diminish microbial loads (7). There are studies which have reported a transmission of bacteria from different levels. However, the role which is played by environmental surfaces in transmission of diseases has still remained as a scientific controversy, and few scientific findings are available on transmission of bacteria from environmental surfaces to hands and from hands to mouth (8).

Drops of water which are emitted from mouth and nose during sneezing, coughing and talking are referred to as nuclear droplets after the drops' cores are dried off. Given its size and weight, a drop's core could remain suspended

in the air for a longtime and cause a transmission of diseases (6). When they are deposited and located on different surfaces including facilities, blankets, etc., the droplets might cause a transmission of spore-like microorganisms. Moreover, the dusts with animal or human origins are important respecting spread of germs which might produce diseases and allergies; so, air conditioning systems are found to be inefficient in removal of particle contaminants (9-10). In the meantime, exceeding than 30 new infectious diseases have been identified in the world during the last decades and millions of people are currently affected by infectious agents. New organisms like cryptosporidium and new strains of *Escherichia coli* caused a wide range of pandemics with their chief transmission cause being direct and indirect contacts after water- and food-borne transmissions (11-13).

In Iran, Arami et al. conducted their study to determine hepatitis B contamination of surfaces and instruments in dental clinics. After relevant tests carried out in 96 sample locations, a HBV was identified. Researchers proposed a calcium-hypochlorite disinfection to reduce microbial contamination (14). In a study by Movahhedi et al. about the microbial contamination of the air of Imam Khomeini and ShahidZare hospitals of Sari, Iran, it was revealed that microbial contamination is existent at all departments of those hospitals, including the general surgery unit. Among observed microbial indices, staphylococcus, *pseudomonas aeruginosa* and gram-positive cocci were the most prevalent ones, respectively (15).

Salmanzadeh et al. in their study about 174 patients with nosocomial infections in Ahwaz, Iran, showed that infections are prevalent in most nosocomial departments such as Intensive Care Units, Orthopedics, Surgery, Gynecology and Obstetrics. Moreover, the highest degrees are related to SSI infections (16). The study by Saeidimehr et al on nosocomial infections in

Ahwaz Oil Company hospital demonstrated that the highest degree of nosocomial infections is found in Internal Medicine Units (46.55%) and the least in CCU (1.72%) (17).

In Iran, few studies have focused on determination of the microbial contamination of public surfaces. This is, therefore, a mandatory to conduct studies in this regard given necessity of the identification of potentially-infected surfaces and presentation of proper solutions aimed at maintaining individuals' health (18). The fact that there are numerous facilities in an ambulance, with some of which such as splints, cervical braces, long backboards, scopes, etc., having direct contacts with patients' bodies; and the reality is the patients and their caregivers are all transported in the limited space of an ambulance to the nearest hospital add to the necessity of conducting the present research in order to identify and investigate the microbial contaminations at emergency ambulances' surfaces and impact of disinfectants thereon. Most importantly, this study is preceded by no similar investigation executed as yet.

Aims of the study:

This study was conducted wishing to determine bacterial infection degrees in ambulances servicing in pre-hospital emergency medical services unit of the Qom University of Medical Sciences of Iran.

Materials & Methods

This research is a descriptive-analytical study which was carried out in 2015. A number of 132 ambulances from those servicing in the Qom Medical Emergency Response Center of Iran were examined for their bacterial infections on medical utensils and equipment. Required numbers of ambulance samples were calculated to be 12 with confidence margin being 95% and overall prevalence of positive cultures being 80% (19). In each ambulance, 11 sites were sampled and cultured. This number was chosen, using simple random method from the code allocated to each ambulance.

After the identification codes were assigned to each ambulance and the number of ambulances which were required for simple sampling method was calculated, eleven samples were specified. Pre-moistened sterile swabs were used to primarily check different places of each ambulance, including front door knobs, keys, steering wheel, stretchers, internal walls, scissors, bag valve masks, oxygenation moisturizers, drawer knobs, laryngoscopes and medical headsets.

Then samples were transferred to the Shahid Beheshti laboratory under standard conditions. They were exposed to Brain Heart Infusion Broth (BHI Broth) media for 24 hours at 37°C in order to permit bacteria, if any, to develop under this reinforcing environment. Then, samples were kept in blood agar and Eosin Methylene Blue (EMB) agar culture medium only to be intermittently studied for their bacterial development. In order to identify the type of the bacteria which had grown in these environments, complementary tests, different environments, solutions and diagnostic discs were applied; then, microbiological tests such as Gram staining, Catalase test, Oxidase test and Coagulase test as well as chemical methods like fermentation of sugars were taken. Laboratorial outcomes, information related to place, order of operation of sampling process and density of the disinfectant were all recorded.

Frequency tables and descriptive statistics such as mean and SD were employed to describe the data. T-Test was operated to analyze the data, using SPSS ver. 16. Level of significance was regarded to be less than 5%.

Results

This research was conducted on 32 samples of equipments in 12 ambulances servicing in the Qom emergency medical services unit, Iran. Statistical results showed that bacterial

contaminations over the ambulance utensils and equipments are categorized into two groups, staphylococcus coagulase and bacillus, the latter of which constituting a higher percentage of infections. In oxygenation moisturizers, for instance, the one hundred percent of infections were caused by bacillus. (Table 1)

From among the examined medical instruments, the highest infection prevalence rate was observed in stretchers (100%) and the lowest in oxygenation moisturizers (8.4%). From the infected equipments, in addition, four

instruments (37%) were mobile and eight of them (63%) were immobile.

Statistical results indicated that among the twelve examined ambulance parts, 66.6% of infections were observed in steering wheels, 50% in switches, 58.4% in front door knobs, 33.3% in laryngoscope blades, 100% in stretchers, 75% in rear internal walls, 8.4% in oxygenation moisturizers, 50% in drawer knobs, 33.3% in stethoscopes, 41.6% in bag valve masks and 41.6% in scissors (Table 2).

Table 1) determination of degree and type of ambulance utensils' infection rates

| Utensils and Equipment | Type of Bacteria | Percentage |
|--------------------------|--------------------------|------------|
| steering wheels | staphylococcus coagulase | 40% |
| | bacillus | 60% |
| switches | staphylococcus coagulase | 42.8% |
| | bacillus | 57.2% |
| front door knobs | staphylococcus coagulase | 37.5% |
| | bacillus | 62.5% |
| laryngoscope blades | staphylococcus coagulase | 40% |
| | bacillus | 60% |
| stretchers | staphylococcus coagulase | 35.7% |
| | bacillus | 64.3% |
| internal walls | staphylococcus coagulase | 45.4% |
| | bacillus | 54.6% |
| oxygenation moisturizers | bacillus | 100% |
| drawer knobs | staphylococcus coagulase | 71.4% |
| | bacillus | 28.6% |
| stethoscope | staphylococcus coagulase | 50% |
| | bacillus | 50% |
| bag valve masks | staphylococcus coagulase | 66.6% |
| | bacillus | 34.4% |
| scissors | staphylococcus coagulase | 60% |
| | bacillus | 40% |

Table 2) determination of frequency and percentage of ambulance utensils' infection rates

| utensils and equipment | percentage (frequency) |
|------------------------|-------------------------|
| steering wheels | 66.7(8)% |
| switches | 50(6)% |
| front door knobs | 58.4(7)% |
| laryngoscope blades | 33.3(4)% |
| stretchers | 100(12)% |
| internal walls | 75(9)% |
| oxygenation moisturize | 8.4(1)% |
| drawer knobs | 50(6)% |
| stethoscope | 33.3(4)% |
| bag valve masks | 41.6(5)% |
| scissors | 41.6(5)% |

Discussion

The most common infection over instruments and equipments was negative staphylococcus coagulase (53%). The result which is conformed to Jalalvandi's study which examined the infection of Kermanshah operating rooms, Iran, where the dominant microorganism was staphylococcus coagulase (72.6%) (20). Another study which was executed by Okon showed a negative staphylococcus coagulase which was found to be the most frequent microorganism isolated from different parts of operating rooms (21).

Since this bacterium is existent as a natural flora over the skin of people, especially healthcare agents, and as skin contacts are the origin of many infections, this is a mandatory for healthcare agents to utilize gloves during medical procedures and avoid direct contacts between hands, utensils and instruments. Use of disinfectants for reduction, and even total annihilation, of microorganisms which were available on ambulances' medical and non-medical equipments can help.

The most common infection of microorganisms in this study was found to be negative staphylococcus coagulase (53%), followed by bacillus (47%). Ekrami showed that gram-

negative staphylococcus has been the most prevalent cause of nosocomial infections on hospital equipment (22). According to Salman Zadeh, moreover, gram-negative staphylococcus with a prevalence of 23.9%, followed by bacillus with a prevalence of 21.05%, were the most causes of nosocomial infections (16). Unlike other studies, this research proved that immobile utensils carry the highest amount of infections, which is comparatively the highest in stretchers. This is due to the fact that stretchers have the highest degree if incontact with patients' bodies and are a subject to different infections carried through shoes, shirts and other belongings of patients.

The most contaminated places, in addition, were stretchers (100%), followed by ambulances' internal walls (75%), the fact which shows that ambulance surfaces are the most contaminated parts of an ambulance. In Jalalvandi's study, operating rooms' beds were found to be the third most contaminated places (19.2%) (20). According to Neil, the most contaminated samples are Surgical lights (23). Yavari, also, found that the highest frequency of contamination over operating rooms' utensils is related to patient beds (66.7%), preceded only by suction systems (24). These results are aligned with those obtained herein. This looks wholly logical due to the wide application of patient beds that have the highest contacts with patients' bodies, medical staff and other objects. Not only, in fact, microorganisms tend to lie over the frequently-used utensils, but also they are well prepared to position on horizontal surfaces.

Application of protective covers, especially medical gloves, by healthcare agents is necessary on account of the existence of several microorganisms on medical utensils, particularly staphylococcus coagulate. Such action could significantly reduce the infection degrees on medical instruments as it does well for the health of medical staff.

Results indicated that the lowest infection rates are related to oxygenation moisturizers, the

finding which is attributable to the fact that they are regularly washed after they are refilled. Also, oxygenation moisturizers' internal spaces are protected from microorganisms' access through getting screwed to oxygen manometer.

Conclusion

Results of this study showed that an infection degree of the utensils and instruments used in ambulances employed in the Qom Medical Emergency Response Center of Iran, is high (51.5%). This contamination level might be attributed to disapplication of disinfectants and making wrong use of them in sterilizing surfaces and equipment utilized in ambulances. Consequently, this seems compulsory to apply disinfectants in order to both assure health and safety of patients, hospital agents and reduce nosocomial infections.

Conduction of similar investigations aimed at examination of effectiveness and efficiency of disinfectants on which insufficient studies have been carried out appears to be indispensable. Because of the lack of sufficient studies on infections over emergency ambulances, similar studies on pre-hospital emergency medical ambulances appear to be required.

Footnotes

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Conflict of Interest:

The authors declared no conflict of interest.

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