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Microorganisms on surface culture of injection port of IV sets and its implication to infection control

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Abstract. Nosocomial infection is a disease caused by a pathogenic agent that is acquired during a patient's hospitalization or treatment inside another health care facility. The said infection can be caused by microorganisms. These microorganisms may already be present in the patient's body or may come from the environment, contaminated hospital equipment; An intravenous (IV) set used during IV therapy is one example of the possible materials containing these microorganisms. The main purpose of this study is to determine the presence of microorganisms on injections ports of IV sets before and after disinfection when administering IV medications in the patients admitted to the medicine wards of Hospital X and Y. Presence of microorganisms despite disinfection may pose risk to patients through the entry of bacteria upon injection through the port. Thirty swab samples were obtained from each hospital. Swab samples were then isolated on nutrient agar plates. Hospital Y samples yielded no bacterial isolates whereas all 30 samples in Hospital X showed bacterial isolates. Swab samples underwent gram-staining to distinguish between gram-positive and gram-negative bacteria. *Streptococcus* species and *Staphylococcus* species which are classified as gram-positive bacteria were among the bacterial species identified before and after disinfection and were found on all the samples obtained from Hospital X. Based on the findings of this study, adherence to infection control procedures were not well established to reduce or eliminate microorganisms on injection ports in Hospital X that may cause Nosocomial infections. In line with these, it is highly recommended that proper infection control and maintenance procedures should be strictly enforced to reduce, if not eliminate the microorganisms on injection port which are possible causes of Nosocomial infections and may threaten the patients' health.

Keywords: Nosocomial infection, IV injection ports, *Staphylococcus* sp., *Streptococcus* sp., Infection control

Introduction

A hospital represents a special environment with preventive, curative and rehabilitative functions. However, there are incidences wherein infection is acquired within the hospital premises. These are called nosocomial infections, or hospital-acquired infection which may occur within 48 hours of hospital admission, 3 days of discharge or 30 days of an operation (Dave, J. et al., 2005). This nosocomial infection is a major public health problem throughout the world, occurring among 7-12% of the hospitalized patients globally with more than 1.4 million people suffering from the infectious complications acquired in the hospital. About 90% of nosocomial infections are caused by bacterial strains of Pseudomonas aeruginosa, Staphylococcus aureus, Escherichia coli, Klebsiella pneumonia, and Proteus species (Jain, A. et al., 2007). These microorganisms often dwell in both moist and dry environments and could thrive at various levels of oxygenation with a strong ability to survive on inert materials such as those used for patient care (De Ocampo, H. et al., 2008). An intravenous (IV) set is one example of those possible materials containing them.

Intravenous therapy makes use of an IV set, consisting of IV containers, tubings, and dressings (Kozier,B. et al 2008). The injection port of an IV set is attached to the IV tubing, and it is where the medications are injected leading to the veins. Entrance of microorganisms into the vein will pose a risk of nosocomial infection to the client. When microorganisms gain access through the administration set, the intravascular catheter, or an injection port, it can lead to bloodstream infections (Maki, D. et al., 2006). Moreover, routine care is done to prevent these complications. Some of these are hand hygiene and dressing. Dressings should also be changed routinely every 48 hours. When injecting medications through the injection port, it is disinfected first with an antiseptic solution, either a 70% alcohol or chlorhexidine. Although certain infection control standards are implemented, serious violations of infection control standards have been found in the vast majority of hospitals in many parts of the world (De Ocampo, H. et al., 2008). Having knowledge and awareness of the possible existence of these microorganisms on the injection port of IV lines and their complications, prompted the investigators to conduct this study to be able to find ways on how to reduce the risks these microorganisms impose to our clients and more importantly, sanitation protocols would be strictly imposed and followed by all hospital staff and personnel as well as the admitted patients.

Materials and Methods

This study employed a Descriptive research design. It aimed to identify microorganisms present in the injection port of IV sets attached to patients upon admission. Culture from the injection ports was subjected for a test to obtain the description of the morphological characteristics of the microorganisms. There were six (6) specific phases in this study namely, Preparation of Media, Collection of Samples, Isolation, Purification and Maintenance of Bacterial Isolates from IV injection ports, Cellular Characterization on Cell Shape and Cell Arrangement, Culture and Identification, and Morphological Test. Collection of samples from the injection ports of IV sets was done to patients admitted for 24 hours or more but not exceeding 4 days at the Medicine wards of Hospital X and Hospital Y of Iligan City. The sampling date was determined randomly, that happened prior to the giving of medications and after disinfection of the injection ports during administration of IV medications.

Before going to the sampling site, test tubes covered with cotton plugs and filled with 3-ml nutrient broth were labeled accordingly and kept in vertical position during transport to the sampling site to prevent the broth from being tilted to the edge of the tube and be contaminated. They were then kept inside an ice bucket, submerged in ice and wrapped in sterile plastic, still in vertical position. Each sample was swabbed with a wet sterile cotton applicator (previously soaked in sterile water), observing aseptic technique to eliminate unnecessary contaminants. After every swabbing, the swabbed cotton applicator was put into its respective sterile test tube, dipping it into the 5-ml nutrient broth. The tube was then submerged into the ice to inhibit further proliferation of bacteria. The tubes with the swabs were incubated for 24 hours in room temperature, then transported carefully back to the laboratory for the bacteria to be grown, cultured, observed, and identified.

Results and Discussion

Thirty samples were collected from two hospitals; fifteen samples were collected before administration of IV medications, and another fifteen were collected after administration of IV medications.

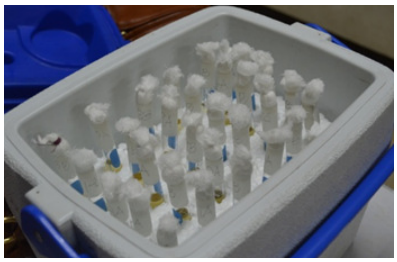

Figure 1. Swabbed Samples from the IV ports

All thirty samples from Hospital X and Hospital Y were collected then streaked in the petri plates. Samples from Hospital X yielded colonies, whereas in Hospital Y yielded no bacterial colonies for all thirty samples.

Table 1. Number of petri plates that yielded bacterial colonies from IV ports of IV sets in the Medicine Wards of Hospital X and Hospital Y.

	Hospital X	**Hospital Y**
Bacterial colonies	**30**	**0**

Colony Characteristics on Nutrient Agar

Since Hospital X showed the positive result on the presence of microorganisms, partial identification of the colony forming units (CFU) was determined.

Based on the morphological characteristics through visual/ocular observations, results have shown that there are two (2) dominant bacterial colonies present in the IV ports. These results were summarized in Table 2.

Table 2. Colonial morphology of bacterial colonies isolated from IV ports of IV sets in the Medicine Wards in Hospital X in Iligan City.

Colony	No. of Nutrient Agar Plate Samples		Colony Morphology on Nutrient Agar				
	Before disinfection	After disinfection	Shape	Edge	Elevation	Surface	Color
A	7	7	Round	Entire	Convex	Shiny	Yellow
B	8	8	Round	Entire	Raised	Shiny	White

Identification of Microorganisms by Gram Staining

The bacterial isolates were subjected to Gram staining in order to classify bacteria on the basis of their Gram reaction. Gram staining reaction will be differentiated by the color of bacterial cells in which the gram negative will appear pink while those that are gram positive will appear purple (Bruckner, 2008, as cited by Baguio *et al.*, 2012).

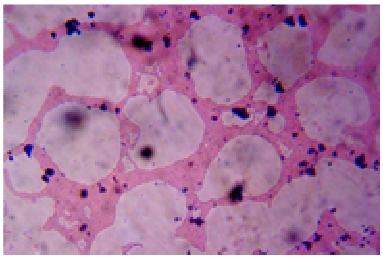

Figure 2. Colony A.*Staphylococcus* sp.

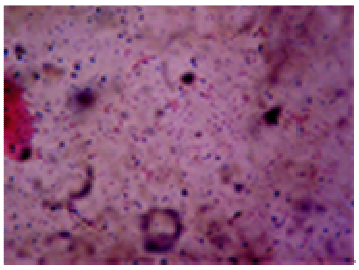

Figure 3. Colony B.*Streptococcus* sp.

Figure 2 is from the Gram stain of the bacterial Colony A. The colony structure showed a grapelike clusters and staph arrangement. The colony is a gram-positive cocci because it retain the violet stain. Thus, the bacteria shown in the figure is a *Staphylococcus* sp. Figure 3 is from the Gram stain of the Colony B. The colony structure showed a diplococcus arrangement. The colony is a gram-positive cocci because it retains the violet stain. Thus, the bacteria shown in the figure is a general characteristic of *Streptococcus* sp.

Table 3. Gram Staining results of the samples from IV ports of IV sets in the Medicine Wards in Hospital X in Iligan City.

Colony	Number of Nutrient Agar Plate Samples		Gram Staining	BACTERIAL GENUS
	Before disinfection	After disinfection		
A	7	7	(+) cocci in clusters	*Staphylococcus* sp.
B	8	8	(+) cocci in chains	*Streptococcus* sp.

The above table showed the answer of the second objective of this study, which is to identify microorganisms before and after disinfection when administering IV medications. *Staphylococcus* sp. is among the pathogens found on the injection ports of IV set. This is a major concern for the healthcare team since this is considered the most serious Gram-positive pathogen. It produces many toxins that contribute to the bacterium's pathogenicity by increasing its ability to invade the body or damage tissue (Tortora, G. *et al*., 2001). It is a frequent cause of both hospital acquired pneumonia and community-acquired pneumonia (Haessler, S. and Brown, 2009).

Streptococcus sp.*,* another pathogen identified on the injection ports of IV sets, is currently the leading cause of invasive bacterial disease in children and the elderly, making it also a concern in the health care profession (Todar, K. 2008).These microorganisms can cause pneumonia, paranasal sinusitis and otitis media, or meningitis, which is usually secondary to one of the former infections.

The results implied that the infection control procedures of hospital X were not effective and not well established since there were still microorganisms present after infection control procedures have been observed in administering IV medications. This complements the study of Maki, D. *et al.*2006 suggesting that a perfunctory swab of a needleless membranous septum with alcohol to disinfect it before insertion of a needle may not reliably prevent entry of microorganisms through the device as evidenced by their results in which, of the 30 connectors accessed after conventional disinfection with 70% alcohol, 20 (67%) showed transmission of microorganisms (442-25,000 colony-forming units). In contrast, of the 60 connectors cultured after application of the novel antiseptic cap, only 1 (1.6%) showed any transmission of microorganisms.

Conclusions

Gram staining morphological test was used in this study to classify bacteria on the basis of their forms, sizes, cellular morphologies, and based on the aforementioned test,the study have foud out that the possible identified microorganisms on the surface culture of injection ports of IV sets were *Staphylococcus species* and *Streptococcus species*. It is higlhy recommended to follow – up this study utilizing more Biochemical tests such as Catalse test

in order to differentiate between *Staphylococcus* and *Streptococcus* genera. Coagualse test could also be employed to differentiate *Staphylococcus aureus* and other *Staphyloccoci.* Having knowledge and awareness of the existence of these microorganisms on the injection port of IV lines and their complications, the healthcare team will be able to find ways on how to reduce the risks that these microorganisms might pose to our clients and more importantly, sanitation protocols would be strictly imposed and followed by all hospital staff and personnel.

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References:

Aspden, P. (2007, July 26). Failure to Cap IV Tubings and Disinfecting IV Ports Place Patients at Risk for Infection. Institute for Safe Medication Practice. Retrieved May 18,2012 from http://www.ismp.org/newsletters/acutecare/articles/20070726.asp

Baguio, B., Gemelo, A., Vega, E. ''Detection of Potential Pneumonia-Causing Bacteria Found in Nebulizers in Iligan City Hospitals: Some Implications on Infection Control.'' Unpublished thesis, MSU-IIT, Iligan City, 2012.

Bhatt, S. K., Patel, D. A., Patel, K. B., Shah, H. S. (2011). Surveillance of Hospital Acquired Infection in Surgical Wards in Tertiary Care Centre Ahmedabad, Gujarat. National Journal of Community Medicine, 2(3), 340-345.

Dave, J., Inweregbu, K., Pittard, A. (2005). Nosocomial Infections. Continuing education in Anesthesia, Critical Care & Pain, 5(1), 14-17.

De Ocampo, H., Flores, A., & Galacio, A. ''Microbial Air Quality of Gregorio T. Lluch Memorial Hospital.'' Unpublished thesis, MSU-IIT, Iligan City, 2008.

Haessler, S., & Brown, R. (2009). Pneumonia Caused by Staphylococcus areus. Current Respiratory Medicine Reviews, 5(1), 62-67.

Jain, A., & Singh, K. (2007). Recent Advances in the Management of Nosocomial Infections. JK Science Review Article, 9(1), 1-8.

Kozier, B., Erb, G., Berman, A., & Snyder, S. (2008). Fundamentals of nursing: concepts process and practice. 8th ed. New Jersey: Pearson Education Inc.

Maki, D., & Menyhay, S. (2006). Disinfection of Needleless Catheter Connectors and Active Ports with Alcohol Ports May Not Prevent Microbial Entry: The Promise of a Novel Antiseptic-Barrier Cap. Infection Control and Hospital Epidemiology, 27(1), 1-5.

Todar, K. (2008). Nutrition and Growth of Bacteria. Todar's Online Textbook of Bacteriology. Retrieved May 18, 2012 from ttp://textbookofbacteriology.net/kt_toc.html

Tortora, G. J., Funke, B., Case, C. (2001). Microbiology: an introduction. Singapore: Pearson Education Asia Pte. Ltd.