The Prevalence of Bacterial Contamination on the Anesthetic Machine in Zawia Education al Hospital

Ghada Algeblaue & Lubna Abdalrahman
Dept. of Anesthesia& Intensive care units
Zawia University

Abstract

Background: *The anesthesia machines have been inconclusively concerned as a source of hospital- acquired respiratory infections. The anesthesia machines that have a bacterial contamination and their potential hazard for pulmonary infection and cross-infection among anesthetized patients have been an infection control issue since the 1950s.* ***AIM:*** *to detect and analyze the prevalence of bacterial contamination in different parts of the anesthetic machine in both sterile and non-sterile situations at a major hospital named Zawia Education Hospital.* ***MATERIAL AND METHOD:*** *120 samples (75/120 sterile, 45/120 nonsterile) were swabbed from four anesthetic machines using*

sterile bacterial swabs and aseptic technique, samples were collected by swabbing different parts of the anesthetic machines such as the mask, circular inside patient and circular inside the machine. ***RESULTS:*** *54.66% of the sterilized samples were positive and 48.88% of the non-sterilized samples were positive. The results showed different types of pathogenic bacteria which are Staphylococcus (different types), E .COLi, Pseudomonas aeruginosa, Proteus spp, Diphtheria, Micrococcus, Non lactose ferments –ve Bacilli, Non lactose ferments +E,coli and Klebsiella.* ***CONCLUSION:*** *From these findings, the anesthetic machines do appear to have pathogenic bacteria. This research supports tha idea that the present methodology of cleaning and sterilization of the anesthesia machine at this facility is not effective.*

KEYWORDS: *Anesthesia machines, Bacterial contamination, Sterile and non-sterile samples, Zawia Education Hospital.*

1.Introduction

The anesthetic machine main purpose is to provide assisted or controlled ventilation to the patient, provide oxygen, deliver precise amounts of anesthetic agent, remove carbon dioxide (CO2). It consists of many components such as gas source- compressed oxygen, pressure regulator, flow meter, vaporizer, patient breathing circuit, waste gas scavenger systems , inhalation breathing tube, re-breathing bag, pressure relief valve, anesthetic induction chamber and mask.

Hospital- acquired respiratory infections are major sources of morbidity and mortality among hospitalized patients. These infections arise during hospitalization as a complication of another illness[12]. Hospital- acquired respiratory infections are reputed to extend

hospitalization an average of 4 days per infection, and nearly 4% of all infections resulted in death[13]. The rates of hospital- acquired respiratory infections for most hospitals in the United States are estimated to range between 3% and 5%. Many different factors can affect the transmition of infections prior, during , and after patient surgical operation[15,16]. Different studies have confirmed that the anesthetic machine equipment can play an important role in transmitting infections to the patient during and after a surgical operation[6,11]. Some bacteria's go out of patient's during an anesthesia and cause contamination of the machine respiratory system[1,8]. The best way to prevent such contamination is by using some equipment once only. For instance, the trachea tube, hose pipes, air way and other rubber parts that are used during anesthesia should be used once and to be changed for each individual patient[2,7]. There are various types of organisms that can be transmitted from the patient into the anesthetic machine including virus, fungus, *Bacillus*, and bacteria[8,14]. Therefore, washing, sterilizing and disinfecting various parts of the anesthetic machine is necessary and vital in preventing the contamination and reducing the hazard[4,8].

Aim and Objectives

To determine the availability of the bacterial contamination of the anesthetic machines in the hospital operation rooms. Also, to identify the type of bacteria that has been grown on different parts of the anesthetic machine. Finally, to evaluate the effectiveness of sterilization.

Materials and Methods

This study was achieved by sampling of anesthetic machines in four operation rooms in Zawia Education Hospital. One hundred twenty

samples were collected from the four operation rooms . Seventy five samples have been collected in sterilizer situation before using the machine in an operation surgery rooms, and forty five samples were collected in non sterile situation (Figure 1) which is after using the anesthetic machine in the operation rooms .All of collected samples were taken from anesthesia's equipments in eight different parts from four operation rooms. The parts of the anesthetic machine that the samples were collected from are: mask, filter, circular inside patient, circular inside the machine , reservoir bag, laryngoscope, monitor and machine surface.

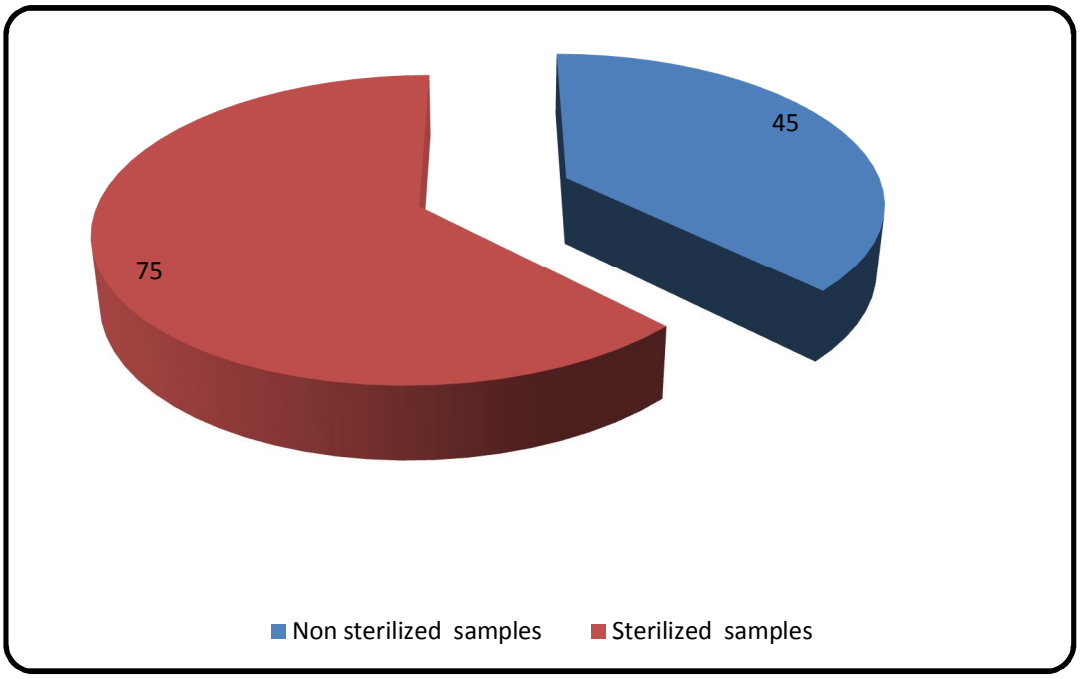

Figure 1: Classification of the collected samples (120 sample), sterilized and non sterilized samples

The samples were collected in random days before and after the usage of the machine in the operation rooms to investigate whether these equipments have contamination or not. The samples were taken by

sterilized swab from the chosen equipments in the anesthetic machine before and after sterilization. After the collection process, the samples then transported immediately to the laboratory which is located inside Zawia Hospital. The samples were rinsed with 2 to 3 ml of enrichment broth to allow the microbes to grow in aerobic and anaerobic environments. The enrichment was incubated at 37° C for 24 hours. Later, all plates were streaked to blood agar (BA) and MacConkey agar (MA), then incubated at 37°C for 24 hours.

Results and Discussion

Seventy five samples were collected from the anesthetic machine in sterile situation, the results showed that 41 samples out of 75 samples were positive which represent 54.67% and 34 samples were negative (45.33%). Forty five samples were collected from the anesthetic machine in non-sterile situation, 22 samples were positive (48.89%) and 23 samples were negative (51.11%). Figures 2 , 3 & 4 describe the previous results. Tables one and two describe the type of bacteria that were found in the positive sample in both cases (sterile and non- sterile). Also, they show the recurrence for each bacterial type. Potentially pathogenic bacteria such as Staphylococcus aureus was found in the face mask. Pseudomonas aeruginosa, Acinetobacter baumannii, Proteus spp, Non lactose ferments +E,coli, Non lactose ferments –ve Bacilli, and E .coli, were found in the surface of machine.. The specific sites that had the most contamination were the surfaces that most commonly touched by the anaesthetist during induction of anaesthesia – the ventilator bag, the monitor of the machine, and the surface table. This is consistent with the hypothesis that the anesthetist's hands are the main route of transmission of contaminants, and that the patient's oropharynx is the most likely

source. The concern about the use of a contaminated anesthetic machine is that it is obligatory for the anesthetist's hands to go from the patient's airway to the anesthetic machine and back again without time to change gloves or wash hands. Therefore hand washing and gloves cannot protect a patient from pathogens present on the anesthetic machine.

The results of this study raise old questions concerning the origin of the bacteria, the risk they might cause in terms of cross-contamination within patients, and the consequences for infection control. Let's assume that the patient is the source of the contamination, we would postulate a leakage of the bacterial filters which are routinely disposed between each patient or a possible health-care workers non-compliance with established standards. The contamination also could be caused by the handling and the storage of re-processed internal BCS (Breathing Service System) [16] . Indeed, the on-site observation of the BCS and ABM's (Anesthetic Breathing Machine) re-processing showed a number of potential moments supporting this possibility. Pre-processed components of the ABM were left unprotected air-dry after machine-based cleaning and disinfection. The reassembled BCSs was then wrapped in clean green fabric, and stored on a cupboard in a storage room until their next use. Looking closer at the bacterial species recovered further strengthens the hypothesis of contamination during re-processing the BCSs. More than half of the bacteria belonged to the normal microbial flora of human skin. The presence of Escherichia coli, a typical representative of intestinal human flora, which was found in one BCS, can be explained by low compliance to hand hygiene[12]. Aerobe spore forming Gram-positive bacteria are ubiquitous in the air. Neisseria species, non-diphtheiroid Corynebacteria and viridans Streptococci are commonly found in the human pharyngeal region and could represent oral contamination through

speaking and non-wearing of face masks during wrapping and handling. So, as patients under general anesthesia are much more sensitive to bacterial contamination and growing bacteria's such as Staphylococcus aureus and Pseudomonas aeruginosa, it is suggested that washing surgical room equipment with 10% cetrimide-c as a disinfectant solution is not enough for contamination prevention[3,9]. A stronger disinfectant solutions with standard viscosity should be used instead.

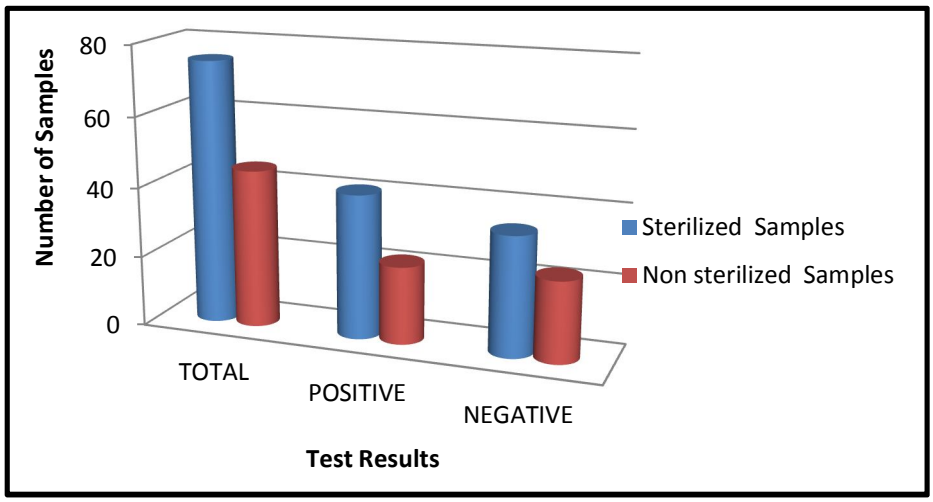

Figure 2: The test results of the sterilized and non sterilized samples

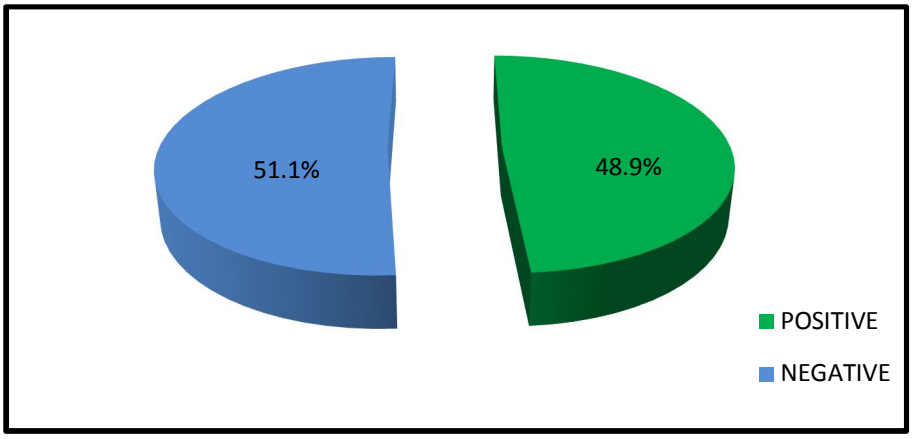

Figure 3: The percentage of negative and positive for the non-sterilized samples

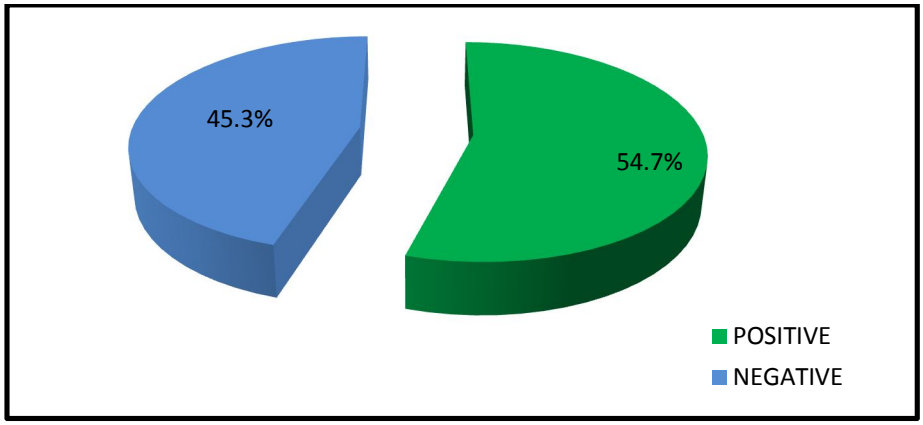

Figure 4: The percentage of negative and positive for the non-sterilized samples

Table 1: The type of bacteria that were found in the positive sterilized samples

Type of Bacteria	Times of contamination through sample after sterilization (before surgical operations)
Staphylococcus auras	4
Coagulase-negative staphylococcus	5
Staphylococcus hemolytic	3
Staphylococcus mix	2
Diphtheria +(CNS) Staphylococcus	5
Pseudomonas aeruginosa	1
Proteus spp	1
Diphtheria + Acinetobacter baumannii	1
Micrococcus	3
E .COLi	1
Non lactose ferments –ve Bacilli	2
Non lactose ferments +E,coli	1
Diphtheria +hemolytic	1
Diphtheria	11
No growth	34
Total	75

Table 2: The type of bacteria that were found in the positive non-sterilized samples

Type of Bacteria	Times of contamination through Non sterilized samples (after surgical operations)
Staphylococcus auras	1
Coagulase-negative staphylococcus	8
Staphylococcus hemolytic	3
Staphylococcus mix	4
Diphtheria	4
Diphtheria +Staphylococcus	1
Klebsiella	1
No growth	23
Total	45

Conclusion

It can be concluded from This study that potentially pathogenic bacteria are present on anesthetic machines, and by using a simple and easy intervention, the colonization of anesthetic equipment with pathogens can be significantly reduced. Although methodological difficulties in demonstrating the efficacy of infection control measures have limited the quality of evidence in this field, there is widespread acceptance of the need to prevent the spread of potential pathogens between patients through fastidious hygiene and isolation of infected patients. Also, it can be concluded from this study that the contamination is exist in both situations : sterilization or non-sterilization. 54.67% of the samples in sterile situation were positive and the percentage of the positive samples in non sterile situation was 48.89%.

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