

**SURVEILLANCE OF BACTERIAL CONTAMINATION OF ANESTHESIA MACHINE AND PERIPHERAL INTRAVENOUS CANNULA DURING GENERAL ANESTHESIA**Ch. Srinivas Rao<sup>1</sup>, C. Siva Kalyani<sup>2</sup>, N. S. Sudhakar<sup>3</sup>**HOW TO CITE THIS ARTICLE:**

Ch. Srinivas Rao, C. Siva Kalyani, N. S. Sudhakar. "Surveillance of Bacterial Contamination of Anesthesia Machine and Peripheral Intravenous Cannula during General Anesthesia". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 06, January 19; Page: 933-940, DOI: 10.14260/jemds/2015/133

**ABSTRACT: BACKGROUND:** Given the expanding role of the anesthesiologist as the "total perioperative physician," the increasing number of invasive procedures performed by anesthesiologists, and the increase in the prevalence of emerging diseases, stringent attention to infection control practices is paramount. **AIM:** To find out the bacterial contamination of anesthesia machine and internal lumen of the injection port of peripheral intravenous cannula, and evaluation of its risk factors during general anesthesia procedures. **MATERIALS AND METHODS:** 50 general anaesthesia procedures were selected randomly after the approval of ethics committee and informed consent from the patient. Samples were taken for bacterial culture on 2 sites in anesthesia machine (Adjustable pressure limiting valve {APL} and agent concentration dial of inhaled anesthetics{AD}) and internal lumen of the injection port of peripheral intravenous cannula before starting and after completion of procedures. Bacteria and colony count were identified according to standard laboratory methods. **RESULTS:** Adjustable pressure limiting valve area was contaminated with bacteria in 12% (6/50) before starting procedure and 34% (17/50) after completion of procedures. Agent concentration dial of inhaled anesthetic site was contaminated with bacteria in 10% (5/50) before starting procedure and 28% (14/50) after completion of procedures. Bacterial contamination occurred in the internal lumen of the injection port of peripheral intravenous cannula in 16% (8/50) during general anesthesia. Isolated bacteria in anesthesia machine and peripheral intra venous cannula sites are STAPHYLO COCCI, STREPTOCOCCI, MICRO COCCI, ENTERO COCCI, E.COLI, and PSEUDOMONAS. **CONCLUSION:** Bacterial contamination is significantly associated with procedure order in a day (bacterial contamination rate is increased from first procedure to fifth procedure in a day. It is significantly associated with surgical specialty highest in general surgery and lowest in orthopedic surgeries. Also, it is not associated with age, sex, physical class of patient and duration of procedure.

**KEYWORDS:** Bacterial contamination, Adjustable pressure limiting valve, Agent concentration dial of inhaled anesthetics, Intravenous cannula.

**INTRODUCTION:** For several reasons, the intra-operative environment serves as a risk factor for the development of hospital acquired infections. This, combined with evidence that general anesthesia is associated with immune suppression, suggests that anesthetic practice as a whole may also be linked to the development of hospital-acquired infections. The intraoperative environment includes both aerosolized particles and healthcare tools used within the anesthesia work area. This is associated with the development of nosocomial infections.

There is a high probability of patient contamination during the practice of anesthesia due to rapid patient care combined with frequent contact with potential sources of bacterial transmission.

## ORIGINAL ARTICLE

---

**AIM & OBJECTIVES:** Find out the bacterial contamination of anesthesia machine and internal lumen of the injection port of peripheral intravenous cannula, and evaluation of its risk factors during general anesthesia procedures.

1. To identify the incidence of bacterial contamination in the anesthesia machine during general anesthesia practice.
2. To identify the incidence of bacterial contamination in the internal lumen of the injection port of peripheral intravenous cannula during general anesthesia practice.
3. Risk evaluation of the following factors in bacterial contamination of anesthesia machine and peripheral intravenous cannula during general anesthesia practice. Surgical procedure, duration, age, gender and physical status of patients (ASA Grede), and procedure order in a day were noted.

### **MATERIALS AND METHODS:**

1. **TYPE OF STUDY:** Randomized, prospective, non-blinded and comparative study.
2. **STUDY AREA:** Operation theatres in tertiary care hospitals, Vishakapatnam, Andhrapradesh. Approval was obtained from the institutional review board for the protection of human subjects following expedited review with a waiver for informed patient consent.
3. **STUDY POPULATION:** Samples were taken for bacterial culture on 2 sites in anesthesia machine (Adjustable pressure limiting valve and agent concentration dial of inhaled anesthetics) and internal lumen of the injection port of peripheral intravenous cannula before starting and after completion of procedures.

### **INCLUSION CRITERIA:**

1. All age groups of patients,
2. Both male and female patients,
4. All physical classes of patients,
5. All surgical specialties,
6. Only elective procedures.

### **EXCLUSION CRITERIA:**

1. Emergency procedures,
2. Patients already having peripheral intravenous cannula.

4. **SAMPLE SIZE AND SAMPLE TECHNIQUE:** 50 General anesthesia procedures were selected randomly for study. These are either first, second, third, fourth or fifth procedure of a day.

Each patient received a sterile peripheral intravenous cannula in preoperative holding area. Culture of internal lumen of the injection port of peripheral intravenous cannula immediately after removal from packing is invariably negative, After completion of general anesthesia procedure cultures were taken in the internal lumen of the injection port of peripheral intravenous cannula. Isolation of bacteria indicates contamination of peripheral intravenous cannula during general anesthesia practice.

## ORIGINAL ARTICLE

---

The adjustable pressure-limiting valve complex and agent concentration dial of inhaled anesthetics were disinfected with the quaternary ammonium disinfectant (Dimension III) solution before starting anesthesia. Baseline cultures were then obtained from these sites at procedure beginning and once again after completion of randomly selected procedure.

Isolation of bacteria before starting of the procedure indicates ineffective decontamination of anesthesia machine. Isolation of bacteria after completion of procedure indicates bacterial contamination during general anesthesia practice.

### 5. DATA COLLECTION TECHNIQUE AND TOOLS:

#### 1. Sampling of internal lumen of the injection port of Peripheral Intravenous cannula:

Samples obtained for bacterial culture by using sterile polyester fiber tipped applicator swabs moistened with sterile transport medium (BactiSwab) was inserted into the internal surfaces of the injection port of peripheral intravenous cannula and rotated 360° several times to culture. Each swab then inoculated and cultured on nutrient agar and MacConkey agar medium with a zigzag pattern and swab rotation.

2. **Sampling of the 2 sites on Anesthesia machine:** Samples were taken for bacterial culture before starting and after completion of procedure in anesthesia machine (Adjustable pressure limiting valve and agent concentration dial of inhaled anesthetics). Samples obtained by using sterile polyester fiber tipped applicator swabs moistened with sterile transport medium (BactiSwab) to roll several times over the selected areas followed by culturing on nutrient agar and MacConkey agar medium with a zigzag pattern and swab rotation.

#### 3. Bacterial cultures conditions:

All MacConkey agar and nutrient agar were incubated at 35°C for 48 h, and microorganisms were quantified according to colonies per surface area sampled (CPSS) and bacterial organisms were identified according standard laboratory methods.

#### 4. TOOLS:

1. Peripheral intra venous cannula of selected patient
2. Sterile polyester fiber tipped swabs for sample collection and transport
3. Culture media Nutrient agar and MacConkey agar
4. Adjustable pressure limiting valve and agent concentration dial of Anesthesia machine.
5. Microscope for identification of bacteria and colony count.
6. Microsoft office excel worksheet and Microsoft word.

### THE OUTCOMES WERE:

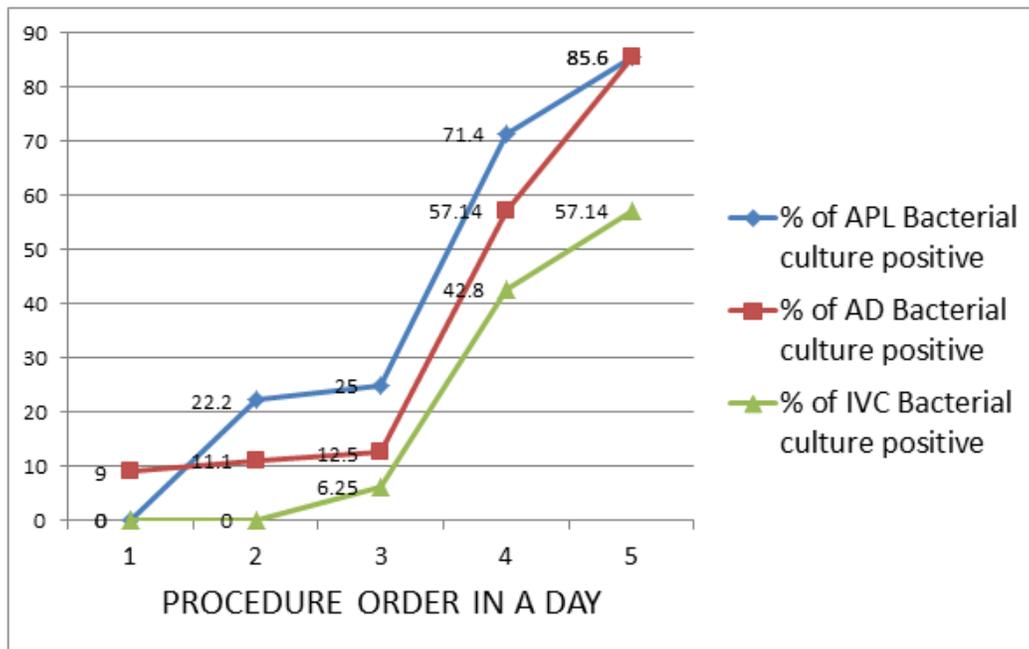
- (1) Number of positive cultures in adjustable pressure limiting valve, agent concentration dial of inhaled anesthetics and internal lumen of the injection port of peripheral intra venous cannula.
- (2) Bacteria identification and Colonies per surface area sampled (CPSS) in positive cultures.

## ORIGINAL ARTICLE

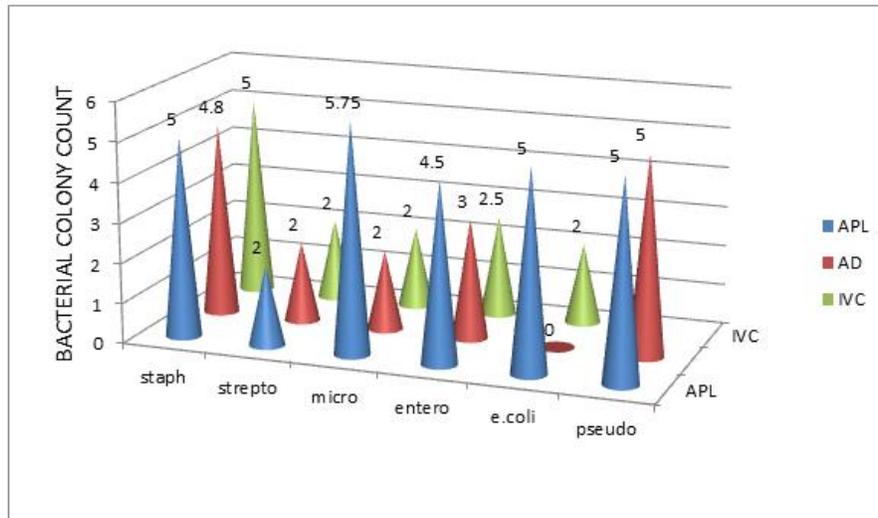
**STATISTICAL METHODS:** Data were collected, tabulated, coded and analyzed. Numerical variables were presented as mean and standard deviations (SD) while categorical variables were presented as frequency and percent. For the numerical variables; correlation coefficient was used whenever appropriate. For the categorical variables; Chi-square test was used. A difference with P value <0.05 was considered statistically significant. Microsoft word and excel have been used to generate graphs and tables etc.

### RESULTS:

- Adjustable pressure limiting valve area was contaminated with bacteria in 12% (6/50) before starting procedure and 34% (17/50) after completion of procedures.
- Agent concentration dial of inhaled anesthetic site was contaminated with bacteria in 10% (5/50) before starting procedure and 28% (14/50) after completion of procedures.
- Bacterial contamination occurred in the internal lumen of the injection port of peripheral intravenous cannula in 16% (8/50) during general anesthesia.
- Bacterial contamination peripheral intravenous cannula was significantly associated with procedure order in a day. Contamination rate was increasing from first procedure to fifth procedure.  $r = 0.95$ ;  $p < 0.05$ , it is statistically significant.
- Bacterial contamination of anesthesia machine was increased from first procedure to fifth procedure.  $r = 0.98$ ;  $p < 0.05$  for APL valve site,  $r = 0.94$ ;  $p < 0.05$  for AD site, it is statistically significant.



**GRAPH 1: Distribution of bacterial culture positives after completion of procedure according to procedure order in a day**



**GRAPH 2: Mean of isolated bacterial colony count in APL, AD and IVC sites after completion of procedures**

- Bacterial contamination of anesthesia machine and peripheral intravenous cannula during general anesthesia practice was not associated with age, gender, ASA physical status of patient and duration of procedure.
- Bacterial contamination is highest in GENERAL SURGERY and lowest in ORTHOPEDIC surgeries. Adjustable pressure limiting valve site contamination has not occurred in orthopedic surgeries. peripheral intravenous cannulas has not contaminated in orthopedic and neuro surgical procedures
- Isolated bacteria in anesthesia machine and peripheral intra venous cannula sites are STAPHYLO COCCI, STREPTOCOCCI, MICRO COCCI, ENTERO COCCI, E.COLI, and PSEUDOMONAS.

**DISCUSSION:** In this study we evaluated the incidence of bacterial contamination of anesthesia machine and peripheral intravenous cannula, and risk factors like age, gender, surgery duration, physical status, surgical specialty of patients and procedure order in a day during general anesthesia practice.

During the study period, total 50 general anesthesia procedures were enrolled. Patients underwent a variety of surgical procedures, including E.N.T (28%), General surgery (26%), Orthopedic surgery (10%), Plastic surgery (14%), Obstetrics and gynecology (8%), urology (10%), and neuro surgery (4%).

In adjustable pressure limiting valve site 12% (6/50) culture samples were positive for bacteria at procedure beginning and 34% (17/50) culture samples were positive for bacteria at the end of procedure.

In agent dial site 10% (5/50) culture samples were positive at procedure beginning and 28% (14/50) culture samples were positive at the end of procedure.

**RANDY W. LOFTUS et al:** Hand contamination of anesthesia providers is an important risk factor for intraoperative bacterial transmission: [www.anesthesia-analgesia.org](http://www.anesthesia-analgesia.org) January 2011. Volume 112.

## ORIGINAL ARTICLE

Number 1, shows “overall bacterial transmission to the intraoperative environment occurred in 146/164 (89%) of cases”.<sup>1</sup>

D.N.A TAGOE et al; potential source of transmission of hospital acquired infection in the volta regional hospital in GHANA<sup>2</sup> shoes “The theatre had the most pathogenic bacteria isolates of 7 of 9 (77.8%)”.<sup>2</sup>

Study name	% of bacterial contamination of intra-operative area.
Surveillance of bacterial contamination of anesthesia machine and peripheral intravenous cannula during general anesthesia practice.	34%
Loftus RW, Koff MD: Transmission of pathogenic bacterial organisms in the anesthesia work area. <sup>1</sup> Anesthesiology 2008; 109: 399–407.	89%
D.N.A TAGOE et al; potential source of transmission of hospital acquired infection in the volta regional hospital in GHANA <sup>2</sup> . Ghana medical journal March 2011, volume 45, number1.	77.8%

**TABLE 1: COMPARATIVE RESULTS OF BACTERIAL CONTAMINATION OF INTRAOPERATIVE ENVIRONMENT IN DIFFERENT STUDIES**

In peripheral Intra venous cannula 8 of 50 (16%) culture samples were positive for bacteria at the end of procedure.

Study name	% of Bacterial contamination of peripheral intravenous cannula.
Surveillance of bacterial contamination of anesthesia machine and peripheral intravenous cannula during general anesthesia practice.	16%
Loftus RW, Koff MD Transmission of pathogenic bacterial organisms in the anesthesia work area. Anesthesiology 2008; 109: 399–407.	32%
Koff MD, Loftus RW, Reduction in intraoperative bacterial contamination of peripheral intravenous tubing through the use of a novel device. Anesthesiology 2009; 110: 978–85.	32.8%

**TABLE 2: COMPARATIVE RESULTS OF BACTERIAL CONTAMINATION OF PERIPHERAL INTRAVENOUS CANNULAS IN DIFFERENT STUDIES**

## ORIGINAL ARTICLE

---

This indicates bacterial contamination in anesthesia machine and peripheral intra venous cannula occurred during general anesthesia practice.

In this study bacterial contamination is significantly associated with procedure order in a day (bacterial contamination rate is increased from first procedure to fifth procedure in a day).

And bacterial contamination is significantly associated with surgical specialty highest in general surgery and lowest in orthopedic surgeries.

Bacterial contamination is not associated with age, sex, physical class of patient and duration of procedure.

One of the main factors for bacterial transmission to anesthesia machine is hand contamination of anesthesia providers, a study on hand contamination was koff MD, Loftus RW, Burchman CC, et al. Reduction in intraoperative bacterial contamination of peripheral intravenous tubing through the use of a novel device. *Anesthesiology* 2009; 110 (5): 978-895,<sup>3</sup> in this study anesthesia providers were given a hand sanitation device to be worn and used in addition to typical wall mounted dispensers. Contamination of the anesthesia work area and patient IV tubing dropped dramatically.

Overall, hospitalized patients are becoming more vulnerable to these infections because of aging and aggressive medical and surgical interventions. Evidence suggests that more emphasis should be placed on identification of modifiable risk factors and implementation of strategies designed to reduce transmission of infectious organisms.

Three main techniques are important to prevent infection transmission from the provider to the patient and anesthesia machine. These include aseptic practice, proper hand hygiene and appropriate barrier techniques as recommended by the centers for disease control and prevention. Universally agreed infection control measures are basic hygiene standards, including hand hygiene, patient isolation, appropriate glove and gown usage, care of equipment, and standards for environmental cleanliness.<sup>4-6</sup>

**LIMITATIONS WERE:** Antibiotic sensitivity for bacteria was not done because of cost constringent. Follow up of the patients with bacteria contaminated peripheral intravenous cannula for assessment of morbidity and mortality was not done. Sample size is small, 50 procedures.

**CONCLUSION:** There is a chance of bacterial contamination of anesthesia machine and peripheral intravenous cannula during general anesthesia practice.

Bacterial contamination will be associated with procedure order in a day, may not be associated with age, gender, surgical specialty and physical status of patients and duration of procedure. It will be reduced by maintaining strict aseptic precautions during general anesthesia.

### BIBLIOGRAPHY:

1. RANDY W. LOFTUS et all: Hand contamination of anesthesia providers is an important risk factor for intraoperative bacterial transmission: [www.anesthesia-analgesia.org](http://www.anesthesia-analgesia.org) January 2011.volume112.number1.
2. D.N.A TAGOE et all; POTENTIAL SOURCE OF TRANSMISSION OF HOSPITAL ACQUIRED INFECTION IN THE VOLTA REGIONAL HOSPITAL IN GHANA, Ghana medical general, volume 45, number 1, march 2011;

## ORIGINAL ARTICLE

3. Was koff MD, Loftus RW, Burchman CC, et al. Reduction in intraoperative bacterial contamination of peripheral intravenous tubing through the use of a novel device. *Anesthesiology* 2009; 110 (5): 978-895.
4. Wenzel RP (ed) (1993) *Prevention and control of nosocomial infections*, 2nd edn. Williams and Wilkins, Baltimore, USA.
5. Ayliffe GAJ, Fraiese A, Geddes A, Mitchell K (1998) *Control of hospital infection; a practical handbook*, 4th edn. Arnold, London.
6. Ward V, Wilson J, Taylor L et al (1997) *Preventing hospital-acquired infection: clinical guidelines*, vol 42. Public Health Laboratory Service, London.

### **AUTHORS:**

1. Ch. Srinivas Rao
2. C. Siva Kalyani
3. N. S. Sudhakar

### **PARTICULARS OF CONTRIBUTORS:**

1. Assistant Professor, Department of Anaesthesiology, Andhra Medical College, Visakhapatnam.
2. Assistant Professor, Department of Microbiology, Andhra Medical College, Visakhapatnam.

3. Consultant Anaesthesiologist, Department of Anaesthesiology, Manipal Hospitals, Visakhapatnam.

### **NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:**

Dr. Ch. Srinivas Rao,  
Flat No. 4G, Rednam Alcazar,  
Jail Road, Visakhapatnam.  
E-mail: srinivasrao719@gmail.com

Date of Submission: 09/01/2015.  
Date of Peer Review: 10/01/2015.  
Date of Acceptance: 12/01/2015.  
Date of Publishing: 16/01/2015.