



Infection Control and Preventive Strategies in ICU

An Essay

Submitted for Partial Fulfillment of Master Degree In Intensive Care Medicine

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Abbreviations

- ve	negative
+ ve	Positive
AGNB	Aerobic Gram Negative Bacilli
APIC	Association for Professionals in Infection Control
BAL	Broncho-Alveolar Lavage
BSI	BloodStream Infection
CA BSI	Community Acquired BloodStream Infection
CA-ASB	Catheter –Associated Asymptomatic Bacteriuria
CAP	Community Acquired Pneumonia
CA-UTI	Catheter Associated – Urinary Tract Infection
CDC	Centers for Disease Control and Prevention
CFU	Colony Forming Units
CIRCO	Critical Illness Related Carriage in Overgrowth
CRBSI	Catheter Related BloodStream Infection
CSF	CerebroSpinal Fluid
CT	Computerized Tomography
CXR	Chest X-Ray
DTP	Differential Time to Positivity
ETT	EndoTracheal Tube
HAI	Healthcare Associated Infection
HAP	Hospital Acquired Pneumonia
HBV	Hepatitis B Virus
HCAP	HealthCare- Associated Pneumonia
HCV	Hepatitis C virus
HCWs	Health Care Workers
HELICS	Hospitals in Europe Link for Infection Control through Surveillance
HEPA	High Efficacy Particulate Air
HICPAC	Healthcare Infection Control Practices Advisory Committee
HIV	Human Immunodeficiency Virus
HPF	High Power Field
ICU	Intensive Care Unit
IL	InterLeukin
IPI	Intrinsic Pathogenicity Index
MRSA	Methicillin Resistant Staphylococcus Aureus
PBS	Protected Brush Speciment
PICC	Peripherally Inserted Central Catheter
PICU	Paediatric Intensive Care Unit
PPE	Personal Protective Equipment

PPM	Potentially Pathogenic Microorganism
PTA	Polymyxin E, Tobramycin, Amphotericin B
RTI	Respiratory Tract Infection
SARS	Severe Acute Respiratory Syndrome
SDD	Selective Decontamination of Digestive tract
SHEA	Society of Healthcare of Epidemiology of America
SIRS	Systemic Inflammatory Response
SOD	Selective Oropharyngeal Decontamination
SSI	Surgical Site Infection
TNF	Tumour Necrosis Factor
TTP	Time To be Positive
US	United States
UTI	Urinary Tract Infection
VAP	Ventilator-Associated Pneumonia
VAT	Ventilator-Associated Tracheobronchitis
VRE	Vancomycin Resistant Enterococci
Vs	Versus
WHO	World Health Organization

Introduction



Introduction

Healthcare – associated infection (HAI), according to World health organization, (WHO), is defined as “an infection occurring in a patient in a hospital or other health facility in whom the infection was not present or incubating at the time of admission. This includes infections acquired in hospital but appearing after discharge, and also occupational infections among staff of the facility **(Ducel, Fabry and Nicolle, 2002)**).

The prevalence of HAIs generally exceeds 25% in intensive care units (ICUs) worldwide. Although ICU beds account for only 5 % of all hospital beds and care for less than 10 % of patients admitted, ICU – acquired HAIs account for more than 20 % of all HAIs **(Landelle, Pittet, 2016)**).

The risk factors of HAIs in ICU include the length of stay in ICU, frequent use of invasive devices required to support the organ systems and to monitor the haemodynamics (nosocomial pneumonia, bloodstream infection, and urinary tract infection are strongly correlated to device use), severity of patient’s illness, increased age, renal replacement therapy, and presence of comorbidities (e.g. diabetes mellitus, chronic obstructive pulmonary disease, cancer, HIV infection, and immunosuppression). **(Gandra& Ellison, 2018)**).

There are four major types of HAIs, all related to invasive or surgical procedures. They include, catheter – associated urinary tract infection (CAUTI), ventilator- associated pneumonia (VAP), surgical site infection (SSI) and catheter – related bloodstream infection (CR – BSI) **(Unahalekhaka, 2011)**).

Introduction

Transmission of infections in health care facilities can be prevented and controlled through application of basic infection control precautions which can be grouped into standard precautions, which must be applied to all patients at all times, regardless of diagnosis or infectious status, and additional (transmission – based) precautions which are specific to modes of transmission (airborn, droplet and contact) (**WHO, 2004**).

Review of Literature



Epidemiology of healthcare-associated infection in ICU

Terms and Definitions

Decontamination

It's the use of physical, chemical, or other means to remove, inactivate, or destroy harmful microorganisms, or poisonous, or radioactive chemicals from, persons, spaces, surfaces, or objects. It differs from sterilization, and aims to make a person, or object mostly, rather than completely, free of contaminants. Examples are hand, gastrointestinal decontamination, and selective oropharyngeal decontamination (SOD). (Venes. 2013).

Antisepsis (also called asepsis)

Prevention of infection by preventing or inhibiting the growth of causative agents. It describes the disinfection procedures applied to living tissues such as skin and wounds. (Barer, 2012), (Venes, 2013).

Disinfection

Is to remove all sources of living pathogenic microorganisms from an object. The term is relative and disinfection thus may be described as being partially or highly effective according to the proportion of the pathogenic organisms killed or removed. (Collee, 1989).

Sterilization

Is the removal of all living organisms, including viruses, bacteria, and their spores, and fungi, and their spores, both pathogenic and non pathogenic, from an object. Sterilization is an absolute term. The object is either sterile or unsterile. It should never be described as being relatively sterile. (Rutala& Weber, 2010) (Collee, 1989).

Cleaning

Is the removal of gross visible foreign materials on object or surface. (Donovan& Bearman, 2014).

Infection

It's a microbiologically proven clinical diagnosis of local and / or generalized inflammation. The microbiological criteria are:

Microorganism $\geq 10^5$ Colony Forming Unit (CFU) / ml of diagnostic sample from the infected organ leuckocytic count $\geq 2+$ / High Power Field (HPF) in the sample. The chosen clinical and laboratory features have thresholds that vary with the patient's age and time laps from the onset of infection. These include temperature changes, heart rate, white blood cell (WBC) count, C – reactive protein, and procalcitonin. (Seely& Christo, 2002), (Reny et al., 2002) (Claeys et al., 2002), (Christ – Crain et al., 2004).

Healthcare – associated infection (HAI)

Is defined by World Health Organization (WHO) as an infection occurring in a patient during the process of care in a hospital or other health care facility, which was not present or incubating at time of admission. This includes infections acquired in health care facility, but appearing after discharge, also occupational infections among healthcare workers (HCWs). (Landelle& Pittet, 2016), (Horan et al., 2008).

The previously used term “nosocomial“ infection has been dismissed and was replaced by healthcare – associated infection by the United States Centers for Disease Control and prevention (CDC) and adopted world-wide. (Horan et al, 2008).

There're two important authorities that put the definitions of infections acquired during health care and their classification and criteria used in diagnosis of various anatomic site infections. These are United States CDC, and Hospital in Europe Link for Infection Control through Surveillance (HELICS). The later definitions are used by several European countries. (Landelle& Pittet, 2016).

ICU acquired infection

Is an infection originating in ICU but not clinically manifest at the time of ICU admission. This includes secondary endogenous and exogenous infection. (Sarginson et al., 2004).

The state of acquisition

The patient is said to have acquired a microorganism when that microorganism is found in only one surveillance sample and is absent in the previous and subsequent samples (Sarginson et al., 2012)

The state of colonization

It's the presence of microorganism in a normally sterile site such as bladder or lower respiratory tract, with absence of clinical feature of infection. Diagnostic sample reveals; leucocytes $\leq 1+$ / HPF, microbial growth is $< 2+$ (or, 10^5 CFU / ml) (Acourt et al., 1993), (Sarginson et al., 2012)

Overgrowth

Presence of high concentration of Potentially Pathogenic Microorganisms (PPMs) in surveillance sample of digestive tract (oropharynx and rectum samples). Quantitatively, in a concentration of $\geq 10^5$ CFU / ml of sample or per gram of stool, and semiquantitatively $\geq 2+$. (Husebye, 1995).

Normal and abnormal microorganisms

Normal microorganisms are those that're carried by variable percentages of normal healthy individuals, including 6 species

- Staphylococcus aureus,
- Streptococcus pneumonia,
- Haemophilus influenza,