Impact of Nosocomial Infection on Patient outcome after Pediatric Cardiac Surgery

Essay

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Abstract

Cardiac surgery is a high risk for infection, someone on the heart bypass machine, has his or her chest opened heart exposed to air, infections can be devasting.

Cardiac surgery is a non contaminated clean surgery. However, patient in the early post operative period are highly susceptible for infection, witch will affect both early & late morbidity & mortality. Several risk factors will contribute to infection, the patient medical condition, use of multiple invasive devices (indwelling catheters and chest tubes), the immunologic consequence of the cardiopulmonary bypass & risk of infection from intubation. The most common infections are: septicemia, respiratory tract infection, operative site infection & urinary tract infections**.**

Key Words :

Nosocomil Infection – Transvenous Ventricular Pacin

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Abbreviation

ABG	Arterial blood gases
ASD	Atrial septal defect
ASD	Atrial septal defect
AVSD	Atrioventricular septal defect
AVSD	Atrioventricular septal defect
BAL	Broncho alveolar lavage
BSI	Blood stream infection
CBC	Cardiopulmonary by pass
CHD	Congenital heart disease
CHS	Congenital heart surgery
CHS	Congenital heart surgery
CL$	Capillary leak syndrome
CNE	Culture negative endocarditis
CRBSI	Catheter related blood stream infection
CRI	Catheter related infection
CT	Computerized tomography
CVC	Central venous catheter
ECG	Electrocardiogram
GCSF	Granulocyte colony stimulating factor
HAI	Hospital acquired infection
HMWK	High molecular weight kinenogen
ICU	Intensive care unit
IE	Infective endocarditis
IgM	Immunoglobulin M
IL 1 B	Interleukin B1
IL6	Interleukin 6
IL8	Interleukin 8
IVDAs	Intravenous drug abuser
LV	Left ventricle
LVADs	Left ventricular assist device
MAP	Mean airway pressure
MOSF	Multiple organ system failure
MRI	Magnetic resonance imaging

NNIS	National Nosocomial infection system
NP	Nosocomial pneumonia
NP	Nosocomial pneumonia
OHCA	Deep hypothermic circulatory arrest
PICU	Pediatric intensive care unit
PMNs	Polymorph nuclear leucocytes
PRISM	Pediatric risk of mortality score
PVC	Polyvinyl chloride
PBS	Postbronchoscopic sputum sample
SIMV	Synchronized intermittent mechanical ventilation
SIR$	Systemic inflammatory response $
SSI	Surgical site infection
TCC	Terminal complement complex
TNF	Tumor necrosis factor
TEE	Trans esophageal echo
TTE	Transthoracic echo
USA	United states of America
UTI	Urinary tract infection
UV	Ultraviolet rays
VAP	Ventilator associated pneumonia
VSD	Ventricular septal Detect
VSD	Ventricular septal defect
DDD	Atrioventricular synchronized pacing
VVI	Transvenous ventricular pacing

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Introduction

Nosocomial infections are a term for infections contracted in the hospital. If tailed as a cause of death, along with statistics for fatalities it would rank in the top 10. ***(Center for disease control and prevention CDC defintion 2004).***

Cardiac surgery is a high risk for infection, someone on the heart bypass machine, has his or her chest opened heart exposed to air, infections can be devasting.

Cardiac surgery is a non contaminated clean surgery. However, patient in the early post operative period are highly susceptible for infection, witch will affect both early & late morbidity & mortality. Several risk factors will contribute to infection, the patient medical condition, use of multiple invasive devices (indwelling catheters and chest tubes), the immunologic consequence of the cardiopulmonary bypass & risk of infection from intubation. The most common infections are: septicemia, respiratory tract infection, operative site infection & urinary tract infections ***(Dominique et al., 1996*).**

Nosocomial infections are still a serious problem in patient undergoing open heart surgery. The identifiable predictors of nosocomial infections may be useful in identifying those at risk ***(Michalopoulos et al., 2003).*** The

majority of children in the pediatric cardiovascular ICU if successfully treated will return to normal life since a smaller number of patients have irreversible disease as often seen in adults ***(Crone et al., 1988)***

Blood stream infection (28%) is the most frequent nosocomial infection in pediatric intensive care units, followed by ventilator associated pneumonia (21%).The presence of arterial catheter & multiple central venous catheters such as those used in cardiac surgical patients, increase the risk of developing blood stream infection ***(Milliken et al., 1995)***

Nosocomial pneumonia after cardiac surgery, represents a major cause of morbidity & morlalily; with a mortality rate of about 11% ***(Millikan et al., 1988)*** with a concomitant increase of hospital cost ***(Brown et al., 1987).***

Infections that involve sternum, sternal wires or sutures almost always involve substenal space. Suppurative mediastinitis is a catastrophic complication & cause a high mortality (25% - 35%) ***(Ottino et al., 1987).***

The occurrence of nosocomial infection represent failure and is not an acceptable outcome of treating critically ill children , appropriate infection control measures can lead to significant reduction in hospital acquired infection in children***(Jana stockwell ,2007***)

Aim of the Work

The aim of this research is to provide an updated review about post operative infection in pediatric cardiac surgical patients. We aim to highlight the exact sources, causative organisms, risk factors and clinical presentation of these infection. A primary goal to display methods to minimize this infection in hope of improving outcome in pediatric cardiac surgical patients, so protocols of management will be discussed.

Nosocomial Infection

The Organization of the National Nosocomial infection system (NNIS) defines a nosocomial infection as a localized or systemic condition

1) That result from adverse reaction to the presence of an infectious agent or its toxin.

2) That was not present or incubating at the time of admission to the hospital ***(Garner JS et al., 1988).***

For most bacterial nosocomial infection, this means that the infection became evident 48 hours after admission However, because the incubation period varies with the type of pathogen and to some extent with the patient underlying condition, each infection must be assessed individually for evidence that links it to the hospitalization ***(Sherertz RJ et al., 1992).***

There are several other principles upon which nosocomial infection definition are based.

- First, the information used to determine the presence and classification should be a combination of clinical findings and the result of the laboratory and other tests.
- Second, a physician or surgeon diagnosis of infection derived from direct observation during a surgical operation, endoscopic examination, or other diagnostic studies or from clinical judgment is an acceptable criterion for an infection,

unless there is a compelling evidence to the contrary ***(Sherert RJ et al., 1992)***.

Risk factors of Nosocomial Infection:

Within hours of admission, colonies of hospital strains of bacteria colonize in the respiratory tract, and genitourinary tract.

Risk factors for the invasion of colonizing pathogens:

- Iatrogenic risk factors that include pathogens present on medical personnel hands, invasive procedures (e.g., intubation, indwelling vascular lines, urine catheterization), and antibiotic use.
- Organizational risk factors include contaminated air conditioning system, contaminated water system, staffing and physical layout of the facility (e.g., nurse to patient ratio, open beds close)
- Patient risk factors include the severity of illness, underlying immunocompromized state and length of stay ***(Nguyen Q et al., 2006).***

Nosocomial infection is strongly correlated with patient census, also with the nursing hours and patient day ratio. These factors may influence the infection rate because of breaks in health care workers aseptic technique or decreased hand washing ***(Lennox A et al., 1997)***.

Prevalence and Incidence:

In the USA: nosocomial infections are estimated to occur in 5% of all hospitalized patients, the highest rate of infection occur in burn ICU, neonatal ICU, and pediatric ICU. Internationally: its impact on the health care system of developed countries is significant and proportionate to that of the United States ***(Nguyen Q et al., 2006).***

Sex:

Low birth weight and male sex are associated with increased incidence ***(Nguyen Q et al., 2006).***

Age:

Among bacterial hospital acquired infections, bacteremias and surgical site infections occurred more frequently in infants less than 2 months compared with older child. Urinary tract infections were reported more in children older than 5 years than in younger children ***(Nguyen Q et al., 2006).***

Incidence

In the 1986 NNIS report, the overall incidence of nosocomial infection was 33.5 per 1,000 discharges; the range extended from 13.3 per 1,000 pediatric discharges to 46.7 per 1,000 surgical discharges. Generally, the rate of infection is highest in large teaching hospitals and lowest in no teaching hospitals. The higher incidence of infection

among surgical patients is largely attributable to SSI. SSIs are the most frequent adverse events reported for hospitalized surgical patients and account for 38% of all nosocomial infections in surgical patients ***(Pachen D et al., 2006)***. Two thirds of SSIs are incision infections, and one third are organ/space infections. Some 38% of all SSIs result in readmission to the hospital ***(Pachen D et al., 2006).***

All other categories of infections combined account for 13.8% of nosocomial infections. The total incidence of nosocomial infection from all sites on surgical services ranges from 30.8 to 59.3 per 1,000 discharges. The risk that a surgical patient will acquire any infection varies according to the type of procedure performed as well as to the patient's medical condition ***(Pachen D et al., 2006).***

Epedemiology:

Nosocomial infections are caused by viral, bacterial, and fungal pathogens. Viruses are the leading etiologies of nosocomial Infection in pediatric patients, bacterial and fungal infections are less common, however viral infections significantly associated with less morbidity and mortality. Most patients who are infected with nosocomial bacterial infection have a predisposition via invasive supportive measure such as intubation and the placement of central

lines and urinary catheters. Fungal infections are more likely to arise from the patient own flora or from contaminated solutions (those used in parental nutrition).

The incidences of bacterial and fungal infections were:

Blood stream infection, 28%

Ventilator associated pneumonia, 21%

Urinary tract infections, 15%

Lower respiratory infections, 12%

Gastrointestinal, skin, soft tissue and cardiovascular infections, 12%

Surgical site infection, 7%

Ear, nose and throat infections, 7%.

Nosocomial pathogens in blood stream infection include:

Coagulase negative staphylococci, 40%

Enterococcci, 11.2%

Fungi, 9.62%

Staphylococcus aureus9.3%

Enterbacter species, 6.2%

Pseudomonas, 4.9%

Acinetbacter

(Nguyen Q et al., 2006).

Nosocomial etiologies in UTI include the following:

Gram – negative enterics, 50%

Fungi, 25%