IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 18, Issue 3 Ser. 4 (March. 2019), PP 51-72
www.iosrjournals.org

A study on hospital acquired infection and prevention in CCU at College of Medicine &JNM Hospital

Sumit Nayek
M Sc Critical Care Sciences
Master of Hospital Administration
West Bengal University of Health Sciences
Corresponding Author: Sumit Nayek

Abstract: *A hospital-acquired infection (HAI), also known as a nosocomial infection is an infection that is acquired in a hospital or other health care field.Hospital acquired infection are major complication in every unit of hospital, Specially Critical Care Unit. Hospital acquired infection is burden for the society. This increased morbidity, mortality, cost of treatment and also hospital staying condition. Mostly patients, their relatives & health care provider get infected by the nosocomial infection.*

The main aims of this study were to To assess magnitude of different hospital acquired infection (HCAI) ,duration of stay and antibiotic use in CCU and also to assess the cleanness practice among doctors and staffs in CCU.

An observational studywas conducted during the period of two months in department of CCU, College of Medicine and JNM hospital. The data has been collected by visiting at the CCU on daily basis at 10 am in the morning to note the type of patients, signs, symptoms, demographic, vital etc. of nosocomial infection as per the guideline of center for disease control and prevention (CDC). By using the detail record of admitted patients and also by interaction with clinical staffs, absence or presence of nosocomial infection was established. Statistical technique used for further evaluation analysis.

During the 2months period a total of 84 patients were admitted in CCU of College of Medicine And JNM Hospital for more than 48hours and were included in the study. In admitted 84 patients, 28 (33.33%) were confirmed and documented with nosocomial infection.Out of 28 nosocomial infected patients

,*that rate of urinary tract infection ,respiratory tract infection ,surgical site infection, intravascular infection and other was 15(53.57%) ,9(32.14%), 6(21.42%) ,8(28.57%) and 5(17.85%) respectively****.***

Date of Submission: 22-02-2019 Date of acceptance: 08-03-2019

I. Introduction

A hospital-acquired infection (HAI), also known as a nosocomial infection, is an infection that is acquired in a hospital or other tertiary health care unit. It is sometimes called a health care associated infection . Such an infection can be acquired in hospital, nursing home, rehabilitation facility, clinic, or other clinical settings. The Infection is spread to the susceptible patient in the clinical setting by various mode of transmission. Health care staff can transferred infection to susceptible patient , in addition to contaminated medical equipment, bed linens, or air droplets etc. The infection can originated from the outside environment, another infected patient, staff that may be infected, or in some cases, the source of the infection cannot be determined. In some cases the microorganism originates from the patient's own skin microbiot, becoming opportunistic after surgery or other procedures that compromise the protective skin barrier.

II. Aims And Objectives

1. To assess magnitude of different hospital acquired infection (HAI),duration of stay in CCU.
2. To assess the cleanliness practice among doctors, medical technologists, nurses and nonmedical staffs in CCU.

III. Review of literature

Nosocomial infection or hospital-acquired infection (HAI) is a localized or a systemic condition resulting from an adverse reaction to the presence of infectious agents. Nosocomial infections are not present or incubating when the patient is admitted to the Critical Care Unit. They are caused by pathogens that easily spread through the body. Many hospitalized patients in CCU have compromised immune systems, so they are less able to fight off infections. These infections occur in the world, both in the developing and developed

countries. They are a significant burden to patients and community public health. They are a major cause of death and increased morbidity in hospitalized patients, which is a matter of serious concern today(2)

Source of hospital acquired infection ;-

Infectious agents causing healthcare-associated infections(HCAI) may come from endogenous or exogenous sources.

- **Endogenous source**:

Infection is endogenously acquired from own body flora . Bacteria's are present on the skin and in the nose, mouth ,throat, gastrointestinal tract and in the female genital tract. Whenever there is a lowering of resistance, these organisms invade the tissues. Such opportunistic infections are difficult to prevent and control in susceptible individuals. Prolonged hospital stay and the use of antibiotics alters the normal flora, both in the type of organisms and in their susceptibility towards antibiotics. Studies have shown that hospitalised individuals have a greater incidence of faecal carriage of Pseudomonas aeruginosa than the general population and intestinal carriage of multiply resistant strains of Gram-negative bacteria often precedes self-infection and cross infection.(31)

- **Exogenous source:**

Exogenous sources of infection may be either animate or inanimate. People, both patients and hospital staff disperse a large number of bacteria into the environment from their skin and in their oral and nasal secretions during sneezing, talking and other body movements. Studies done on staphylococcal carriage in hospitals have shown that certain individuals shed large numbers of organisms from their body surface especially the perineum and are referred to as 'dispersers', such individuals may also contaminate their hands and clothing and other inanimate objects. Contamination of environment results from human activity. Food, fluids, disinfectants, instruments, equipment, wound dressing, all act as sources of infection as a result of contamination from human organic waste, pus, blood and blood products (Table 3). Rarely free living bacteria and saprophytic fungi which are derived .from the environment may cause infection in susceptible individuals (31).

Major common infection:

Urinary tract infection:-

Urinary tract infection (UTI) is a major threat to human health. It is called due to various physiological changes of the urinary tract by the activity of microorganisms. Urinary tract infection has also been a major type of hospital acquired infection.In a review article by Nicolle et al., it has been reported that in cases of Catheter Associated Urinary Tract Infection, 70-80% of the infections are attributed by the over use of indwelling urethral catheter.Urinary tract infection (UTI) is the most common infection in developing countries .Recently Survey shows that 17.6% of patients are infections cause urinary catheter in 66 hospitals across Europe and 23.6% of patients across 183 hospitals in United states of America. In another surveillance report in 2011 by National Health Service (NHS), it was reported that 45-79% patients are catheterized in critical care unit (4,5).

The increasing incidence of UTI in ICUs is affected by the high rate of urinary catheterization, frequent contact with health care workers, and increased resistant pathogens (38).

Risk factors include female genital anatomy, sexual intercourse, diabetes, obesity, lack of education, malnutrition and family history..

About 150 million people developed a urinary tract infection each year in India. It has been observed that urinary tract infections are more common in women than men individual. The infection rate was high to women patient than the male patient. Up to 10% of women have a urinary tract infection in a given year and half of women having at least one infection at some point in their lives.(33)

Surgical site infections;-

Defining surgical site infection (according to center for disease control and prevention)

1. The *superficial incisional*, affecting the skin and subcutaneous tissue. These infections may be indicated by localised (Celsian) signs such as redness, pain, heat or swelling at the site of the incision or by the drainage of pus.
2. *deep incisional*, affecting the fascial and muscle layers. These infections may be indicated by the presence of pus or an abscess, fever with tenderness of the wound, or a separation of the edges of the incision exposing the deeper tissues.
3. *organ or space infection*, which involves any part of the anatomy other than the incision that is opened or manipulated during the surgical procedure, for example joint or peritoneum. These infections may be indicated by the drainage of pus or the formation of an abscess detected by histopathological or radiological examination or during re-operation.

Atul jain shows, SSIs are divided into incisional SSIs and organ-space SSIs. Only 33 to 67% of infected wounds are cultured, among those, 15 to 20% of SSI are caused by Staphylococcus aureus, Enterococcus(15%) and remainder are caused by gram-negative organisms and yeast(30)

Surgical site infection results in increased pain, sufferings, delayed wound healing, increased used of antibiotics and antibiotics resistance revision surgery, increased length of hospital stay, mortality, morbidity and excess healthcare costs. Depending on the type of surgery and the severity of the infection,additional costs attributable to SSI of between £814 and £6626 have been reported.The main additional costs are related to re-opening , extra investigations extra nursing care and interventions, and drug treatment costs. The indirect costs, due to loss of productivity, dissatisfaction of patient and patients parties and litigation, and reduced quality of life and decreased hospital brand value.SSIs have also been associated with the emergence multi-drug resistant bacteria. However, the incidence of SSIs in India has not been systematically studied.

As widely shown in the literature from high-income countries, including the United States, the implementation of an effective surveillance approach can lead to a reduction in the incidence of HAI by as much as 30%, and by 55% in the case of SSIs(6,35)

Nosocomial pneumonia:

Nosocomial pneumonia (NP) is defined as an infection of the lung parenchyma that was neither present nor incubating at the time of hospital admission and which develops after 48 hours of hospital admission**.**

Data from the National Nosocomial Infections Surveillance system (NNIS) of the United States suggests nosocomial pneumonia as the second most common nosocomial infection in intensive care units. Additionally pneumonia is associated with the greatest mortality among nosocomial infections and with considerably increased costs of care. The widespread use of tracheal intubation and mechanical ventilation to support the critically ill patients further increases in patients who are already high risk for development of NP. Despite advances in the diagnosis and treatment, our understanding of the NP remains incomplete. The incidence of NP in the ICU ranges from 9 –24% with variation relating to the intensive care and differences in the definitions and diagnostic techniques used(7)

In India incidence of postoperative infections in various hospitals varies from 10-25%(8)

The mortality rates in patients with NP are higher than in patients without NP, but whether this reflects a direct cause – effect relationship is uncertain. It is perhaps, more a reflection that patients who develop nosocomial infection are already in a high risk group of critically ill patients with higher mortality rates than the rest of the population. Currently the exact role of nosocomial infection themselves in worsening the prognosis of ICU patients is difficult to assess, as such patients are critically ill and thus their clinical status is severe enough to require ICU care and potentially to cause death. Thus, although rates of NP and mortality are high, assessment of responsibility of several other risk factors that confound this relationship is difficult (37)

Catheter related blood stream nosocomial infection:

Catheter-related bloodstream infection (CRBSI) is defined as the presence of bacteraemia originating from an intravenous catheter at the time of admission of patient in CCU. It is one of the most frequent, lethal, and costly complications during central venous catheterization . Intravascular catheters are integral to the modern practices and are inserted in critically-ill patients for the administration of fluids, blood products, medication, nutritional solutions, and for hemodynamic monitoring. Central venous catheters (CVCs) pose a greater risk of device-related infections than any other types of medical device and are major causes of morbidity and mortality (39).

The use of central vascular catheter (CVC) was introduced into hospitals in the 1940's and become essential to the modern medical practiceIntravenous catheters were the devices most frequently used for providing fluids directly into the bloodstream. Although the incidence of local or BSIs associated with these devices is usually low, serious infectious complications produce a considerable number of deaths annually because of the frequency with which such catheters are used.(9,39)

Central venous catheterization is the main factor of risk of bloodstream infections in CCU.

Mortality rate attributed to its use is of 12%-25%, extending hospitalization by additional 10-40 days which adds costs to the treatment about $33,000- 35,000/ patient (10,11)

The incidence of CRBSI is a good quality indicator.

The incidence of catheter related blood stream infection varies considerably by type of catheter, frequency of catheter manipulation, place of catheter insertion and patient-related factors, such as underlying disease and severity of illness.

Majority of CRBSIs are associated with CVCs, and in prospective studies, the relative risk for CRBSI is up to 64 times greater with CVCs than with peripheral venous catheters. For short-term CVCs (<10 days), which are most commonly colonized by cutaneous organisms along the external surface of the catheter, the most important preventive systems are those that decrease the extra-luminal contamination. In contrast, with long-

term CVCs (>10 days), endo-luminal spread from the hub appears to be the primary mechanism of infection. Technologies that reduce endo-luminal colonization in addition to extra-luminal invasion of the catheter should provide additional protection against CRBSI. The incidence of dialysis-related CRBSI is reported to be 2.5-F5.5 cases per 1,000 catheter days, or 0.9-2.0 episodes per patient-year.(39)
Among the predisposing factors of risk for CVC-associated bloodstream infections are: presence of multi-luminal catheter, hemodialysis catheter, catheter-related thrombosis, anatomical site of insertion, catheterization lasting, difficulty of inserting the catheter, and hospital lasting before the insertion(12)

Skin and Soft Tissue Infections (SSTI)

Skin and soft tissue infections (SSTIs), referred to as severe microbial invasion of skin and skin structure , represent a group of infections that are diversed in their clinical presentations and degrees of severity. There are two types: purulent infections (e.g. furuncles, carbuncles, abscesses) non purulent infections (e.g., erysipelas, cellulitis, necrotizing fasciitis).

Stevens DL, Bisno A L, Chambers HF, et al classified into three subcategories: mild, moderate, and severe. Mild skin and soft tissue infections present with local symptoms(inflammatory symptoms) only and authors describe moderate to severe infections are associated with systemic signs of infection such as temperature higher than 38ºC, heart rate higher than 90 beats/minute, respiratory rate higher than 24 breaths/minute, or W BC higher than 12 x 10cel l s/m m3. And Patients with immunocompromising conditions, inflammatory conditions(redness of skin, pain or tenderness, swelling ,blister) .a red streak(swollen lymph node, fever or chills, fatigue, irritability, loss of appetite, nausea and vomiting)clinical signs of deeper infection, or infection that fails to improve with incision and drainage (I&D) plus oral antibiotics are also classified as severe cases. (41). antibiotics required for control Purulent and non purulent infection.

Soft-tissue infections are a common occurrence, generally of mild to modest severity, and are easily treated with a variety of agents. Superficial infections such as impetigo, erysipelas, cellulites, and subcutaneous bursitis are common, and for the most part, they can be easily treated. In contrast, diffuse necrotizing infections may masquerade in many forms, delaying diagnosis and treatment. Edema out of proportion to erythema, subcutaneous gas, and skin vesicles are important markers of such necrotizing infections.(40)

Diabetic foot ulcers (DFU) and concomitant infections are one of the most frequent complications in patients with diabetes mellitus. Diabetics develop chronic foot ulcers which can be limb or life-threatening. Chronic DFU are one of the most common indications for hospitalization in diabetics, and almost 50% of all the non-traumatic amputations are performed on diabetic patients.[40)

Sonja Marie shows that Among hospital acquired SSTI one selected situation particularly difficult to treat and control is that of burn wounds. Approximately 50%–75% of patients present with abscesses, and 25%–50% with cellulitis (14)

Cause of nosocomial infection:-

Three major causes of nosocomial infection are documented. First is antimicrobials use ,long term and irrinational use of antimicrobials leads to the development of resistant strains of pathogens. Second the leniency of hospital staff and infection control committee in maintaining strictly conditions. And lastly the patient itself is prone to nosocomial infections due to low immunity and unhygienic conditions around themselves. Apart from these major factors some other precipitating factors may also add up the cause of nosocomial infections.

Factors influencing the development of nosocomial infection:

The microbial agent:-

During hospitalization the patient is exposed to a variety of microorganisms. Contact from patient to patient and health care provider result in the development of clinical disease — other factors influence the nature and frequency of nosocomial infections. The likelihood of exposure leading to infection that depends partly on the characteristics of the microorganisms, including resistance to antimicrobial agents, intrinsic virulence, and amount of infective material.

Many different bacteria, viruses, fungi and parasites cause nosocomial infections. Infections may be caused by the patient's own flora (endogenous infection)and also may be caused by a microorganism acquired from another person in the hospital (cross-infection) or some particles may be acquired from an inanimate object or substances recently contaminated from another humans source .

Before the introduction of basic hygienic practices and antibiotics into medical practice, most hospital infections were spread due to pathogens of external origin (foodborne and airborne diseases, gas gangrene, tetanus, etc) or were caused by microorganisms not presents in the normal flora of the patients (diphtheria, tuberculosis etc). Progress in the antibiotic treatment of bacterial infections has reduced mortality from many

infectious diseases. Most infections acquired in hospital now-a-days are caused by microorganisms which are common in the general population, in whom they cause no or milder disease than among hospital patients (Staphylococcus aureus, coagulase-negative staphylococci, enterococci, Enterobacteriaceae).(15)

Patient susceptibility:

Important patient factors influencing acquisition of infection include age, immune status, underlying disease, nutritional status ,and diagnostic and therapeutic interventions. Resistance to infections is gradually decreased in infant and old ages patients.

Increased susceptibility to infections happens in patients with chronic disease such as malignant tumours, leukaemia, diabetes mellitus, renal failure, or the acquired immunodeficiency syndrome (AIDS). The latter are infections with organisms that are normally innocuous, part of the normal bacterial flora in the human, but may become pathogenic when the body's immunological defences are compromised.

Immunosuppressive drugs or irradiation may decreased resistance to infection. Injuries to skin or mucous membranes can bypass natural defence mechanisms. Malnutrition is also a risk factor. Many modern diagnostic and therapeutic procedures, such as biopsies, endoscopic examinations, catheterization, intubation, ventilation ,central line insertion, during dialysis ,suction , surgical procedures increase the risk of infection. Contaminated objects or substances may be introduced directly into tissues or normally sterile sites such as the urinary tract and the lower respiratory tract.(15)

Environmental factors:

Patients with infections or carriers of pathogenic microorganisms admitted to hospital are potential sources of infection for patients, patients parties and health care provider. Patients who become infected during the hospitalization period, are a further common source of infection. Crowded conditions within the hospital, frequent transfers of patients from one department to another department , and concentration of patients highly susceptible to infection in one area (new-born infants unit, burn unit, intensive care unit ,operation ,dialysis unit) all contribute to the development of nosocomial infections. Microbial flora may contaminate objects, medical devices, and materials which subsequently contact susceptible body sites of the patients. In addition, new infections associated with bacteria such as waterborne bacteria (atypical mycobacteria) and/or viruses and parasites continue to be identified.(15)

Bacterial resistance:

Many patients receive antimicrobial drugs. Through selection and exchange of genetic resistance of microorganism's elements, antibiotics promote the emergence of multi drug resistant strains of bacteria; microorganisms in the normal human flora sensitive to the given drug are suppressed when resistant strains persist and may become endemic in the hospital. The indiscriminate use of antimicrobial agents for therapy or prophylaxis (including topical) is the major determinant of resistance. In some cases, antimicrobial agents are becoming less effective because of resistance. As an antimicrobial agent becomes widely used, bacteria resistant to this drug eventually emerge and may spread in the health care setting(15)

Prevention of nosocomial infection:

Prevention of nosocomial infection two types

1. standard precaution
2. transmission based precaution

Standard Precaution

Basic infection prevention and control strategies applied routinely for care of all patients in hospital to minimize risk to both patients and healthcare workers.

Cardinal rules of Standard precautions:

I. Standard precautions are to be followed in all patient care situations.
II. Standard precautions are to be used for contact with blood, all body fluids, secretions and excretions regardless of whether contaminated grossly with blood or not; non-intact skin; and mucous membrane.

Procedure for standard precautions for infection control:

Hand Washing:

Hand washing is the most important preventive strategy for infection control. The microbial flora of the skin helps to prevent colonization of hospital-acquired microorganisms. Skin flora are composed of resident and transient micro-organisms. In CCU hand washing is required routinely before and after contact with a patient; before and after performing invasive procedures; before and after touching wounds; and after contact with inanimate sources, such as patients urine bag handling that are potentially contaminated with

microorganisms, could prevent many nosocomial infections. A brief, vigorous rubbing together of all skin surfaces of hands, followed by rinsing under a stream of water, is adequate hand washing, microorganisms can either be removed mechanically, by washing hands with soap or liquid hand washing solution and rinsing; or chemically, by washing hands with antimicrobial products that can prevent the growth or kill the microorganisms.

In intensive care unit, effective hand washing with antimicrobial agents (containing chlorhexidine, cetrimide , providone iodine solution), compared with washing with soap and water, was shown to reduce nosocomial infections.

Transient microorganisms, in contact to resident flora, are easily removed by mechanical means. Antimicrobial soaps, should he used in nurseries, neonatal units, ICUs ,PICU and when dealing with patients with immune deficiencies or who are at risk of developing infections with resistant organisms. Factors leading to poor hand washing compliance include lack of education of health care provider, poor hygienic habits, perceived lack of importance, lack of time, dry skin, skin irritation or dermatitis, absence of suitable cleansing agent, and inadequate hand washing facilities. (30)

Different Levels of Hand Hygiene

There are three recommended levels of Hand Hygiene to ensure that the hand hygiene performed is suitable for the task being undertaken. The efficacy of hand hygiene will depend on application of an adequate volume of a suitable hand hygiene agent with good technique for the correct duration of time, and finally ensuring that hands are dried properly.

(A) Social Hand Hygiene- Routine Hand Washing

The aim of social (routine) hand washing with soap and running warm water is to remove debris and organic material,dead skin and most transient organisms. On visibly clean hands it can be undertaken using an alcohol based hand rub, and this helps to remove transient organisms.

(B) Antiseptic Hand Hygiene

Antiseptic hand hygiene is achieved with an antiseptic hand washing agent i.e. providione iodine solution, chorohexidine solution is generally carried out for aseptic procedures on the ward and for areas of Isolation. Hygienic hand disinfection helps to remove and kill most transient micro- organisms- indications of antiseptic hand hygiene

- During outbreaks of infection where contact with blood/body fluids or situations where microbial contamination is likely to occurs in "high" risk areas (isolation, ICU etc),before/after performing an invasive procedure and before/after wound care, urethral or IV catheters etc.

(C) Surgical Hand Hygiene

Surgical hand washing helps to remove and kill the transient micro-organisms and substantial reduce and suppuration of the resident flora of the surgical team for the duration of the operation, in case of surgical glove is punctured/torn. Ensure of all staffs fingernails are kept short and clean. Wrist watch and jewellery must be removed before surgical hand washing.

Use of Alcohol Based Handrub

Definition according according to CDC

An alcohol-containing preparation designed for application to the hands for reducing the infection. In India, such preparations usually contain 60%--95% ethanol or isopropanol**.**

Steps of hand hygiene using alcohol based hand rub (according to national infection control guidelines)

Duration of the entire procedure: 20-30 seconds

Step 1 -Apply a palm full of the product in a cupped hand, covering all surfaces.

Step 2 -Rub hands palm to palm.

Step 3 -Right palm over left dorsum with interlaced fingers and vice versa.

Step 4 -Palm to palm with fingers interlaced.

Step 5 -Backs of fingers to opposing palms with fingers interlocked.

Step 6 -Rotational rubbing of left thumb clasped in right palm and vice versa.

Step 7 -Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa. Once dry, hands are safe.

Advantages of alcohol-based handrubs

- It is easily accessible at point of care.
- Alcohol based solution is a good antimicrobial activity against Gram-positive and Gram-negative vegetative bacteria, Mycobacterium tuberculosis and a wide range of fungi.
- However, the disadvantages of alcohol based hand rubs are no activity against the bacterial spore..

Use of gloves

The wearing of protective gloves is a sensible precaution in various clinical situations in order to prevent cross contamination of nosocomial infection . It break down the chain of infection more effectively than hand-washing or hand disinfection. A prospective, controlled intervention study showed that a training session and the availability of gloves directly at the bedside can significantly reduce the incidence of ***Clostridium difficile***–associated diarrhoea (CDAD). All ways, the hands should be disinfected when protective gloves are used, because in contrast to surgical gloves, ordinary protective gloves are often permeable to pathogens even before use. In the case of vancomycin-resistant enterococci (VRE), a study showed that despite the use of gloves the same pathogen could be found on the hands of staff involved in treatment in 30% of cases(18)

Use of Fluid Resistant Gown / Apron

- Wear a fluid resistant gown to prevent soiling of clothing and skin during the invasive procedures that are likely to generate splashes of blood, body fluids, secretions or excretions.
- The sterile gown is required only for aseptic procedures that prevent the nosocomial infection
- Remove the soiled gown as soon as possible, that prevent the cross contamination.

Room sterilization :

According to protocol of department of CCU of college of medicine & JNM hospital

I. Cleaning :

Floor wash with available antiseptic (certimide and cholorohexidine solution, Phenyl) in the morning and evening , if not once per shift.

II. Fumigation :

- fumigation can be done using silver nitrate and hydrogen peroxide or formal dehydrate solution. The room must be closed for 4 hours after fumigation.

Isolation room:

Definition :-

Isolation is a process of separation of a person or a group of person infected or believed to be infected with contagious disease to prevent spread of infection in hospital setting**.**

Types of Isolation :

• Source Isolation :AIIR (Airborne Infection Isolation Room) or negative pressure room.

• Protective Isolation : Positive Pressure Room Source Isolation (Most frequent Type ;Negative Pressure Room) – This type of isolation facility is used to prevent spread of infection from the patient to other patient and hospital Staffs .

• Patients with communicable disease who can pass infections to others patients, healthcare provider and patients relative via airborne droplets are isolated in this type of room. eg.TB.SARS,H1N1 etc.

Protective Isolation: (positive Pressure Room)-These type of isolation facility are meant to isolate profoundly immune -compromised patients, such as

patient undergoing organ transplant, or oncology patient receiving chemotherapy, HIV, etc.

Requirement of Isolation Facility

Influenced by the pattern of clinical work and type of specialist units

• 2.5% of total beds ,

• 10-20% of Total ICU beds in ICU (1 per 5 bed)

• Area required for Isolation Room – 22 Sq. m

Device Related Protocol :

Daily check list is to be maintained according to CCU department protocol

• **Peripheral venous catheter:**− Change after every 3 days. If patient comes with Peripheral venous Catheter – in case coming from Emergency OPD – change immediately and if from the ward – 1st. change after 24 hrs. allways avoid insertion in legs.

• **Central venous catheter:**− Not to be changed routinely. Fresh replacement is done in case of strongly suspected / documented CV catheter related infection by C/s test or mechanical problems like blockage / kinking. When indicated fresh insertion is done on the opposite side. Always avoid insertion in femoral site

• **IV Drip set:** − Needs to be changed daily.

• Ryle's tube:− In case of malfunction or after every 5 – 7 days to avoid formation of biofilm and thereby preventing pneumonia. Every day changed Ryle's tube dressing

• **Tracheostomy tube:** − 1st change 48 hrs. of insertion and every after 24 hrs thereafter. Every day dressing changed of tracheostomy tube.
• **Foley's catheter :**− Not to be changed routinely. Bladder wash is also abandoned except in selected urosurgical conditions. In case of catheter block by sediment, controlled catheter wash may be cautiously tried avoiding bladder wash. These are to avoid vesico ureteral reflux and UTI – sepsis. − Change is indicated in case of malfunctioning catheter or infection strongly suspected / documented by culture. − Closed system with two bags - Storage & collecting is preferred.
• **Arterial Catheter and Pulmonary Arterial Catheter:** − These catheters need not to be changed routinely. Every day changed the dressing.

IV care practices:
• Clean injection ports/caps with alcohol based solution or providion iodine solution before accessing the system.
• Cap all stopcocks when not in use.
• Use aseptic technique including a cap, mask, sterile gown, sterile gloves and a large sterile sheet for the insertion of central venous catheters (including Peripherally Inserted Central Catheter or PICCs) or guide-wire exchange.
• Do not routinely replace central venous catheters, haemodialysis catheters, or pulmonary artery catheters.
• Do not remove central line or peripheral line on the basis of fever alone. Remove the catheter if infection is evidenced • Do not routinely replace peripheral arterial catheters.

Respiratory care - Patient-Based Interventions:
• If there is no medical contraindication, elevate the head of the bed of a patients who are at high risk for aspiration pneumonia, e.g., a person receiving mechanically assisted ventilation and/or who has an enteral tube in place, at an angle of 30 degree.
• Periodically drain and discard any collection in the tubing of a mechanical ventilator, taking precautions not to allow condensate to drain toward the patient. Decontaminate hands with soap and water or chlorohexidine or providone iodine based antiseptic agent after performing the procedure or after handling the fluid.
If available, use an endotracheal tube with a dorsal lumen above the endotracheal cuff to allow drainage (by continuous suctioning) of tracheal secretions that accumulate in the patient's subglottic area.
• Use sucralfate, H2-blockers, PPIs and/or antacids interchangeably for stress-bleeding prophylaxis in a patient receiving mechanically assisted ventilation (H2-blockers alone decrease gastric acidity and increase gastric colonization and increases the susceptibility to respiratory infections).
• Instruct preoperative patients, especially those at high risk of contracting pneumonia, regarding taking deep breaths and ambulating as soon as medically indicated in the postoperative period and high-risk patients include those who will have an abdominal, thoracic, head or neck operation or who have substantial pulmonary dysfunction.
• Follow manufacturers' instructions for use and maintenance of central oxygen line &humidifiers.
• Between patients, change the tubing, any nasal prongs or oxygen mask or nebulizer mask used to deliver oxygen from a wall outlet.
• Small-volume medication nebulizers: "in-line" and hand-held nebulizers: Between treatments on the same patient, disinfect; rinse with sterile or pasteurized water; and air-dry small-volume in-line or hand-held medication nebulizers.
• Use only sterile water for nebulisation and dispense the fluid into the nebulizer aseptically.
• If multidoses medication vials are used, then handle, dispense, and store them according to instructions using sterile techniques.
• Total Parenteral Nutrition to be infused through central line and not beyond 12 hours at a time.

Suction & drainage bottles:
These are usually disposable, with a self-sealing inner container held in a outer container. Non-disposable bottles:
• Must be changed every 24 hourly .
• The contents may be emptied .
• Must be rinsed with water and autoclaved.
• Do not leave fluids present in suction bottles

Antibiotic prophylaxis:
Appropriate use of antibiotics is important. Up to 30% of ventilator associated pneumonias are treated inadequately. There is increasing evidence to suggest that the use of appropriate and early antibiotics improves

morbidity and mortality. Appropriate antibiotic use requires a thorough knowledge of their mode of action , previous antibiotic history, local bacterial resistance profile and local pathogen prevalence. Antibiotics should be administered at the right dose and for the appropriate duration. The local antibiotic formulary and consultant microbiologists are valuable resources.

Antibiotic-resistant bacteria prolong hospitalization, increase the risk of death, and require treatment with toxic and expensive antibiotics. Empirical use of antibiotic is often necessary as laboratory results are often not available for 48 h after the samples are sent to the laboratory for culture. Appropriate specimens include blood, urine, sputum, bronchoalveolar lavage, pus and wound swabs. Blood cultures are only positive for pathogens in a third of cases.(29)

Chemoprophylaxis is used only when it has been documented that benefits are greater than risks. Some of the indications are selected surgical procedures, persons at risk of infective endocarditis (patient with mechanical heart valves) and in severely immune compromised patient where the chance for infection is higher. There are conflicting result when it comes to VAP and administration of antibiotic prophylaxis. There exist some clinical evidence that aerosolized antibiotics could prevent VAP, but they are weak. The concerns about high cost, resistant bacteria and other potentially risk factors of aerosolized antibiotics led several evidence-based groups to recommend against routine use of antibiotic prophylaxis(24)

Sharp instrument and disposal instrument handling:

"Needle stick injury (NSI)" is a puncture wound, cut, or scratches inflicted by medical instruments intended for cutting or puncturing (intra venous or arterial cannula, lancets, scalpels, etc.) during the invasive procedure in that may be contaminated with a patient's blood or other body fluids. As needles cause more than 70% of sharps related injuries, the term (NSI)s is sometimes used instead or combined with sharp injuries (SIs). A safe injection does not harm the recipient, does not expose to the provider to any avoidable risks and does not result in waste that is dangerous for the patient , patient party ,health care provider and community**.** Thus, the risk of infection of health care workers (HCWs) from contaminated sharps and needle sticks should be considered part of a larger risk-factor group called "Unsafe injections .Needle stick injury (NSI) is considered the second commonest cause of occupational injury within the National Health Service (NHS)(22)

The inadequate contaminated waste collection, transport, treatment and disposal in India are causing major environmental challenges.

It is estimated that out of around 3 billion injections administered annually in India, 83% were for curative purpose, and 63% injections were administered in an unsafe manner.

lot of importance is being given to diabetes self-care. This involves self-administration of insulin and/or self-monitoring of blood glucose (SMBG). As a part of self-care, various kinds of medical devices and instruments like insulin pens, needles, syringes, lancets, etc., are used by diabetes patients at home. These are either sharps or contain plastic material. Sharps instruments have been defined by World Health Organization(WHO) as "items that could cause cuts or puncture wounds, including needles, hypodermic needles, scalpel and other blades, knives, infusion sets, saws, broken glass, and nails''(42).

IV. Practical Guidance On Giving Medications

(According to guideline of NATIONAL CENTRE FOR DISEASE CONTROL, government of India)

Injection safety protocol

- Use a new device for each invasive procedure in ccu, including for the reconstitution of a unit of medication or vaccine.
- Inspect the package of the syringe to ensure that the protective barrier has not been breached.
- Discard the syringe if the package has been punctured, torn or damaged by exposure to moisture, or if the expiry date has been passed

Single vial use

Always use a single dose vial for each patient in CCU, to reduce the cross contamination between patients

Multidose vials uses protocol

1. Use multi doses vial only if there is no alternative route of option.
2. Open only one vial of a particular medication at a time in each patient care area.
3. If possible, keep one multi dose vial for each patient, and store it with the patient's name on the vial in a separate treatment or medication room.
4. Don't store multi dose vials in the open ward, where they could be inadvertently contaminated with spray or spatter.
5. Discard a multi doses vial: if sterility or content is compromised;

- if the expiry date or time has passed (even if the vial contains antimicrobial preservatives);

- if it has not been properly stored after opening; within 24 hours of opening, or after the time recommended by the manufacturer, if the vial does not contain antimicrobial preservatives;
- if found to be undated, improperly stored, inadvertently contaminated or perceived to be contaminated, regardless of expiration date.

6. Pop open ampoules whenever possible, use pop open ampoules rather than ampoules that require use of a metal file to open.

Practical guidance on preparing injections

Following step must be followed when preparing injections in CCU.

1) Before starting the injection session, and whenever there is contamination with blood or body fluids, clean the preparation surfaces with 70% alcohol (isopropyl alcohol or ethanol) and allow to dry.
2) Assemble all equipment needed for the injection: sterile single use needles and syringes; reconstitution solution such as sterile water or specific diluents; alcohol swab or cotton wool; sharps container.

Biomedical waste management:

Biomedical waste means waste which is generated during the diagnosis, treatment or immunization of patient or in research activities pertaining there to or in the production or testing of biological and including categories mentioned in the schedule one of biomedical waste rules 2000 by Ministry of environment and forest notification (19).

The hospital waste like body parts, organ, tissue, blood and body fluids along with solid linens, cotton bandages, used disposables and plaster from infected and contaminated areas are very essential to be properly collected, segregated, stored, transported, treated and disposed of in a safe manner to prevent nosocomial or hospital acquired infections.

The range of medical waste generation in India is between 0.5 and 2.0 kg /bed/ day. Annual Indian estimation of total medical waste was about 0.33 million tons. Among the hospital waste, food, bandage, soiled linen and other infectious waste constitutes 70-80%, while plastics, disposable syringes and glass constitute7-10%, 0.3-0.5%, 3-5%, respectively. This waste is generally collected in a mixed form, transported and disposed of along with municipal solid wastes (43).

The types of biomedical waste is

- General waste includes kitchen waste, packing materials, paper, patient used food and plastic material.
- Pathological waste includes human tissue organ, body parts, human fetus, blood and body fluids(20).
- Infectious waste like pathogens in sufficient concentration that are culture media and slocks of infectious agents from laboratory
- Sharps instrument includes needles, blades, scalpels etc..
- Pharmaceuticals waste includes drugs and chemicals that have been return from wards, out dated and contaminated items
- Chemical wasted includes housekeeping, floor cleaning and infectious materials.
- Radioactive waste includes solid, liquid and gaseous wastes produce from radiology department

TRANSMISSION BASED PRECAUTIONS

Formerly referred to as additional precautions: Effectively managing infectious agents where standard precautions may not be sufficient on their own these specific interventions for patients known or suspected to be infected or colonized with epidemiologically important pathogens that can be transmitted by airborne, droplet or contact with dry skin or contaminated surfaces, should be applied to control infection by interrupting the mode of transmission.

ISOLATION POLICIES AND PROCEDURES

Isolation procedures are means to prevent or interrupt transmission of pathogenic microorganisms within the CCU. Selected patients may be require specific precautions to control cross transmission of potential infecting organisms to other patients.

Recommended Isolation Precautions: Routes of Transmission

Microorganisms are transmitted by three main routes:

• Contact
• Air
• Droplet

In nosocomial infections, transmission by contact, droplet, and air plays a major role in CCUs.

Nosocomial Infection by direct or indirect contact: Nosocomial infection occurs through direct contact between the source of infection and the recipient or indirectly through contaminated objects.

Air-borne infection: Infection usually occurs by the respiratory route, with the agent present in aerosols (infectious particles less than 5 μm in diameter).
Droplet infection: Large droplets transmit the infectious agent (greater than 5 μm in diameter).
Contact Isolation Precautions
(According to HOSPITAL EPIDEMOLOGY AND INFECTION CONTROL: of UCSF MEDICAL CENTER)

Contact, or touch, is the most common mode of transmission of infectious agents. Contact transmission can occur by directly touching the patient, through contact with the patient's environment, or by using contaminated gloves or equipment, patient used linen. Patients in CCU Contact Isolation Precautions include those with confirmed or suspected Clostridium difficile infection (CDI) rotavirus, or other organisms deemed significant by Infection Control. Contact Isolation Precautions requires:
1. Private Room
2. Dedicated, disposable equipment (e.g., stethoscope, blood pressure cuff, thermometer, mask etc.). If shared equipment is used, it must be cleaned with hospital disinfectant and sterilised after each use.
3. Children under 2 years who was in Droplet Precautions and also placed in Contact Precautions.
4. Show in appropriate door signage (green)
5. Education for the all patient/representative: "Contact Isolation Precautions Patient Information Sheet"

Healthcare workers caring isolated patients in CCU for Contact Isolation Precautions must:
1.Allways Clean hands before putting on gloves.
2. Put on gloves and gown prior to entering the patient's isolation room.
3. Remove and discard gloves and gown and clean hands before leaving the patient's room or, in semiprivate room or multi-bed bay situation, before leaving the patient's immediate vicinity.
4. For CCU patients in Contact Isolation Precautions for diarrhea (suspect or confirmed), use soap and water to clean hands upon exiting unless CDI is ruled out.
5. Patients on Contact Isolation Precautions are not allowed in communal spaces (play room, school room), but may ambulate in hospital always wearing a clean and disposal gown and after washing hands with soap and water.
6. Always place a clean patient gown and bed cover on the patient prior to transporting patient off unit for test/procedure.

Patient Transport: Gown and gloves must be wear during the transportation of a patient on Contact Isolation Precautions. Personal protective equipment must be discards and hand hygiene performed when the transfer is complete. Visitors must be choose to wear indicated personal protective equipment.

Droplet Isolation Precautions require:
According to HOSPITAL EPIDEMOLOGY AND INFECTION CONTROL: of UCSF MEDICAL CENTER
1. Private room, except when directed otherwise by Infection Control.
2. Patients to remain in their room except for essential purposes (surgery, tests, treatments, therapy services). The patient may ambulate in the hallway, however not allowed in communal spaces (playroom, school rooms, solarium, cafeteria, etc.).
3. When patients on droplet precautions are out of their room they must wear a regular mask (without the eye shield), clean gown, and must complete hand hygiene (hand gel and/or wash with soap and water) before leaving their room. If the patient is unable or unwilling to wear a mask the patient must remain in their room.
4. Children under the age of 2 years who require Droplet Precautions also require Contact Precaution
5. Appropriate door signage (yellow).
6. Education for the patient/representative: "Droplet Isolation Precautions Patient Information Sheet".
Healthcare workers caring for patients in Droplet Isolation Precautions will: 1. Hand hygiene with alcohol based hand rub or soap and water should be performed prior to entering room. Put on a mask that covers the mouth and nose (regular surgical or paper mask), and eye protection (safety goggles, fluid shield) upon entering the room of a patient in precautions.
2. Wear eye protection and respiratory protection at least as effective as an N-95 respirator when performing high hazard procedures (bronchoscopy, sputum induction, elective intubation and extubation, autopsies, open suctioning of airways. and when feasible during emergent situations such as cardiopulmonary resuscitation, emergent intubation) for patients with suspected or confirmed diseases requiring Droplet Isolation Precautions.
3. Remove and discard mask/respirator and clean hands before leaving the patient's room or, in semiprivate room or multi-bed bay situation, before leaving the patient's immediate vicinity. Goggles may be reused; they should be cleaned with a disinfectant wipe between uses by different healthcare workers.

4. Notify receiving department of patient isolation status when patient transportation (e.g., off-unit testing/procedure) is required.

Visitors precautions policy

1. Visitors will be educated regarding the transmission of diseases requiring Droplet Isolation Precautions:
a. Hand hygiene with alcohol based hand rub or soap and water should be performed regularly and always upon leaving the patient's room.
b. Risk of acquisition of diseases requiring Droplet Isolation Precautions is reduced through the use of personal protective equipment (i.e. surgical mask with eye shield or goggles). This equipment will be available for visitors upon request.
2. Visitors with upper respiratory symptoms are asked to refrain from visiting. Special consideration may be given to close family members. Those family members will be required to wear a surgical mask while visiting.
3. Nursing staff will instruct family/visitors to clean hands after contact with patient secretions or contact with immediate patient environment.
4. Visitors may choose to wear the indicated PPE.
5. Patients on Droplet Precautions (and their paediatric siblings) are not allowed in communal spaces (play room, school room, solarium, etc.)

Airborne Isolation Precautions Require:

According to GUIDELINES FOR ISOLATION PRECAUTIONS of MONTANA STATE HOSPITAL POLICY AND PROCEDURE

1. Applies to patients known or suspected to be infected with a pathogen that can be transmitted by the droplet route: these include, but are not limited to: a. Respiratory viruses (influenza), pertussis, and Neisseria meningitides (group A streptococcus) for the first 24 hours.
2. Place the patient in a private room. When a private room is not available , place the patient in a room with patient(s) who has present same infection and the same microorganism . When a private room is not available maintain spatial separation of at least 3 feet between the infected patient and other patients and visitors.

Personal Protective equipment use For Airborne Isolated Patients

a. Wear a face mask when working within 3 feet of the patient. The face mask should be donned upon entering the patient's room.
b. If substantial spraying of respiratory fluids with microorganism is anticipated, gloves and gown as well as goggles (or face shield in place of goggles) must be wear.
c. Perform hand hygiene before and after toughing the patient and after contact with respiratory secretions and contaminated objects/materials; note: use soap and water when hands are visibly soiled.
d. Instruct patient to wear a facemask when exiting the patient room, avoid coming into close contact with other patients, and practice respiratory hygiene and cough etiquette.
e. Clean and disinfect the patient room accordingly.

Patient Transport Policy:

Limit the movement and transport of the isolated patient from the room to essential purposes only. Face mask required during the transportation or movement.

Visitor's Policy When Patient is in Isolation

(*According to NABH Standard*)

The ward sisters doctors and security guard concerned have the responsibility of informing the patient's and their relatives of the measures to be taken and the importance of restriction of visitors.

1. The patient and the relatives must be given health education about the cause, spread, and prevention of the infection in detail. The need for isolation and restriction of visitors of isolated patients should be discussed with them.
2. Hand washing after all contact with the patient has to be stressed.
3. Visitors need to wear an respiratory protective device. Be aware of restrictions on visitation of relatives of patient due to outbreak or other hazardous conditions within the facility.
4. No more than two adult visitors should be allowed at a time during the hospital visiting hours and the length of stay should be governed by the needs of the patient.
5. Children below 12 years of age should not be allowed into isolation areas.

- Visitors' footwear, bags, and other belongings should be left outside of the isolated room.
- Visitors should not be allowed to sit down on the patient's bed.
- Visitors should wash their hands well with soap and water and hand rub apply before entering and when leaving the room.

- Any prophylactic medication or active immunization for attendants should be conducted by the attending medical officer and sister.

Use specific strategies focused on prevention of specific nosocomial infection:-

In addition to the standard and transmission-based precautions, there are several strategies focused on prevention of specific hospital acquired infections in critically ill patients. Of these, ventilator-associated pneumonia (VAP), catheter-related bloodstream infection (CRBSI) and urinary tract infection (UTI) are the most important. Hospital acquired infection.

Strategy for reduce ventilator-associated pneumonia (VAP):-
According to guideline of reference no (32, 7)

 Thorough hands washing is the simplest and most effective means of limiting spread of infection but is frequently inadequate or/ not performed at all.
 Heat and moisture exchanges may decrease the incidence of NP. However, not all studies confirm this.
 Noninvasive ventilation has been associated with reduced rates of infection and should be considered in appropriate patients.
 Nursing patients in the supine position may increase the risks of pulmonary aspiration of gastric contents. Several studies have confirmed reduced rates of NP in patients nursed in semi recumbent rather than supine and this should be encouraged although it is not always practically possible.
 Avoiding excessive sedation – sedation should be titrated to minimal level required to keep patient comfortable.
 Several authors have suggested an increased incidence of pneumonia with antacids and H_2 blockers. Routine use of antacid strategies should be avoided.
 Selective digestive decontamination (SDD): Consists of non-absorbable tropical antibiotics (Polymycin, tobramycin and amphotericin B) plus the use of systemic antibiotics (cefotaxime). Many studies have shown that SDD reduces NP. However, concern has been raised about risks of encouraging antimicrobial resistance and this has not gained wide acceptance.
 Kinetic beds and continuous subglottic suctioning of secretions that pool above endotracheal different cuff both are expensive and not widely used.
 Simple techniques such as had washing, placing the patient in semi recumbent position and avoiding excess sedation must become a routine part of ICU care.

Strategy for reduce Catheter related blood stream infection
(*According to operational guideline CCU and HDU WB health & family welfare*)

1. Prefer the upper extremity for catheter insertion. Avoid femoral route for central venous cannulation (CVC)
2. If the intravenous or arterial catheter is inserted in a lower extremity site, replace to an upper extremity site as soon as possible.
3. Use maximal sterile barrier precautions (cap, mask, sterile gown and sterile gloves) and a sterile full-body drape while inserting CVCs, peripherally inserted central catheters, or guide wire exchange.
4. Clean skin with more than chlorhexidine preparation with alcohol (usually 0.5% chlorhexidine with 70% w/v ethanol) before CVC, arterial catheter insertion, etc.,
5. Use ultrasound-guided insertion if technology and expertise medical persons are available.
6. Use either sterile gauze or sterile, transparent, semi permeable dressing to cover the catheter site. Replace the catheter site dressing only when the dressing becomes damp, loosened, blood content or visibly soiled.
7. Evaluate the catheter insertion site daily check if a transparent dressing is present and palpate through the dressing for any tenderness.
8. Insertion date ,time should be put on all vascular access devices
9. Use chlorhexidine based solution wash daily for skin cleansing to reduce catheter related blood stream infection.
10. Clean injection ports with an appropriate antiseptic solution (chlorhexidine, povidone-iodine, an iodophor, or alcohol), accessing the port only with sterile devices. Cap stopcocks when not in use
11. Assess the need for the intravascular catheter daily and remove when it is not required.
12. Peripheral lines should not be replaced more frequently than 72-96 h. Routine replacement of CVCs is not required
13. Replace administration sets, including secondary sets and add-on devices, every day in patients receiving blood, blood products, or fat emulsions
14. If other intravenous fluids are used, change not <96-h intervals and at least every 7 days
15. Needleless connectors should be changed frequently (every 72 h)
16. Replace disposable or reusable transducers at 96-h intervals.

Strategy for reduce urinary tract infection (UTI)

1. **Personnel**

a. Only medically trained persons (e.g., hospital personnel, family members, or patients themselves) who know the correct technique of aseptic insertion and maintenance of the catheter should handle catheters

b. Health care provider and others trained person who take care of catheters should be given periodic in-service training stressing the correct techniques and potential complications of urinary catheterization.

2**. Catheter Use**

a. Urinary catheters should be inserted only when required appropriate medical cause.

b. Others useful methods f urinary drainage system such as condom catheter drainage, supra pubic catheterization, and intermittent urethral catheterization can be useful alternatives to indwelling urethral catheterization.

3. Hand washing

Hand washing should be done immediately before and after any touches of the catheter site , catheter bag and apparatus.

4. **Catheter Insertion**

i. Catheters should be inserted using aseptic technique and sterile equipment.
ii. Gloves, drape, sponges, an appropriate antiseptic solution for periurethral cleaning, and a single-use packet of lubricant jelly should be used for insertion.
iii. As small a catheter as possible, consistent with good drainage, should be used to minimize urethral trauma .
iv. Indwelling catheters should be properly secured after insertion to prevent movement and urethral traction .

5. **Closed Sterile Drainage**

i. A sterile, continuously closed circuit drainage system should be maintained .
ii. The catheter and drainage system should not be disconnected unless the catheter must be irrigated
iii. If breaks the aseptic technique, disconnection, or leakage occur, the collecting system should be replaced using aseptic technique after disinfecting the catheter-tubing junction.

6.Irrigation

I. Irrigation should be avoided unless obstruction is anticipated (e.g., as might occur with bleeding after prostatic or bladder surgery);closed continuous irrigation may be used to prevent obstruction. To relieve obstruction of urinary drainage system due to blood clots, mucus, or other causes, an intermittent method of bladder wash irrigation may be used. Don't collected urine sample of routine urine examination and culture sensitivity during the continuous bladder wash irrigation.
II. Always urinary catheter-tubing junction must be disinfected(povidone iodine solution)before disconnection.
III. A large-volume sterile syringe and sterile irrigant should be used and then discarded. The person performing irrigation should use aseptic technique.
IV. If the catheter becomes obstructed and can be kept open only by frequent irrigation, the catheter should be changed if it is likely that the catheter itself is contributing to the obstruction (e.g. Formation of concretions).

7. Urinary Flow

1. Unobstructed flow should be required . (Occasionally, it is necessary to temporarily obstruct the catheter for urine specimen collection or other medical purposes.)

2. To achieve free flow of urine

a) the catheter and collecting tube should be kept from kinking; the collecting bag should be emptied regularly using a separate collecting container for each patient (the urometer and uro bags collecting container should never come in contact) ;

b) poorly functioning or obstructed catheters must be irrigated.

c) or if necessary, replaced; and sent the catheter tip for culture sensitivity.

d) collecting bags must be kept below the level of the bladder.

8. **Catheter Change Interval**

Indwelling catheters should not be changed at arbitrary fixed intervals.

11. **Spatial Separation of CatheterizedPatients**

To minimize the chances of cross-infection, infected and uninfected patients with indwelling catheters should not share the same room or adjacent beds .

12. **Bacteriologic Monitoring**

The value of regular bacteriologic monitoring of catheterized patients as an infection control measure has not been established and is not recommended.

Architecture and layout, especially while designing a new ICU

According to guideline of reference no(32)

- ☐ The CCU may be situated close to the operating theater and emergency department for easy accessibility, but should be away from the main ward areas .
- ☐ Central air-conditioning systems are designed in such a way that recirculated air must pass through appropriate filters and maintain the temperature.
- ☐ Suitable and safe air quality must be maintained at CCU all times.
- ☐ It is recommended to CCU a minimum of six air circulation per room per hour,
- ☐ Adequate space required around beds is ideally 2.5-3 m
- ☐ Electricity, oxygen connection ,air, vacuum outlets/connections should not hamper access around the bed
- ☐ Adequate no of washbasins should be installed in CCU.
- ☐ Alcohol gel dispensers are required at the CCU entry, exits, every bed space and every workstation
- ☐ There should be separate medication preparation area
- ☐ There should be separate areas for clean storage , soiled waste storage, a disposal and storage for cleaning instruments.
- ☐ Adequate toilet facilities should be provided for CCU staff.

Organizational and administrative measures[32]

- Hospital administration to maintain ratio of patient nurse
- Hospital administration to implement the policies for controlling traffic flow to and from the unit to reduce sources of contamination from visitors, staff and medical equipment .
- To maintain the biomedical waste and sharp disposal policy
- Education and training for all CCU staff about prevention of nosocomial infections
- ICU protocols making for prevention of nosocomial infections
- To maintain Antibiotic uses policy
- Provide vaccination of all health care personnel

III. Material and method

1. **Study area**:- in patient department in the department of critical care unit, the college medicine &jnm hospital
2. **Study population**:- Indore patient who admitted in ccu at the College of Medicine &jnm hospital
3. **Period of study:-**2 months
4. **Sample size:-** 130 admitted patients in ccu
5. **Study design:-**It is a observational study
6. **Study tools:-**The CDC for disease control and prevention define hospital associated infection as those that occur after 48 hours staying in CCU admission or within 48 hour after transfer from an CCU. In the present study patients who had developed infection after 48 hour of admission to the CCU or clinically suspected of having acquired any infection were included in the study. Patient showing clinical signs of infection on or prior to admission or transfer to CCU were not included

Predesigned proforma was developed to assess the incidence of nosocomial infection in CCU. The proforma was designed in two parts.

Part A: The proforma enlisted demographic details of the patient including age, sex, geographic details and diagnosis.

Part B: It was used to establish presence or absence of nosocomial infection in the study subject. Criteria for establishment of nosocomial infection were adopted in accordance with the simplified definition derived from the Centre for disease control, USA. The selected criteria to establish the presence or absence of nosocomial infection was as under

1. **Surgical site infection**: Any purulent discharge, abscess or spreading cellulitis at the surgical site during the month after the operation.
2. **Urinary tract infection**: Positive urine culture (1 or 2 species) with at least 105 bacteria/ ml, with or without clinical symptoms.
3. **Respiratory tract infection**: Respiratory symptoms with at least two of the following signs appearing during hospitalization.

- Cough
- Purulent sputum
- New infiltrates on chest radiograph consistent with infection

4. **Septicaemia:** Fever or rigors and at least one positive blood culture.
5. **Vascular catheter associated infection:** Inflammation, lymphangitis or purulent discharge at the insertion site of catheter.
6. **Plan for analysis** :- approximate statistical technique will be applied to establish the analysis and evaluate the study

IV. Result

Table 1: Total number of observed patients in CCU during the study period (2 months)

No of stay (day)	No of patient	No of male patient	No of female patient
0	10	7	3
1	19	13	6
2	15	7	8
3	16	8	8
4	16	10	6
5	17	10	7
6	9	5	4
7	5	4	1
8	7	5	2
9	4	3	1
10	3	3	0
12	3	2	1
13	1	0	1
16	1	0	1
20	2	1	1
Total	128	78	50

Table 2: Distribution of Sex and Admitted in CCU more than 48 hr

Duration of staying	No of total patient	No of male patient	No of female patient
3	**16**	**8**	**8**
4	**16**	**10**	**6**
5	**17**	**10**	**7**
6	**9**	**5**	**4**
7	**5**	**4**	**1**
8	**7**	**5**	**2**
9	**4**	**3**	**1**
10	**3**	**3**	**0**
12	**3**	**2**	**1**
13	**1**	**0**	**1**
16	**1**	**0**	**1**
20	**2**	**1**	**1**
Total	**84**	**51**	**33**

During the study period for more than 48hours staying , 84 patients were nosocomial infected and out of total 84 patients 51 male and 33 female. Most of the patient stays for 3 to 5 days.

Figure 1: Showing Sex Distribution

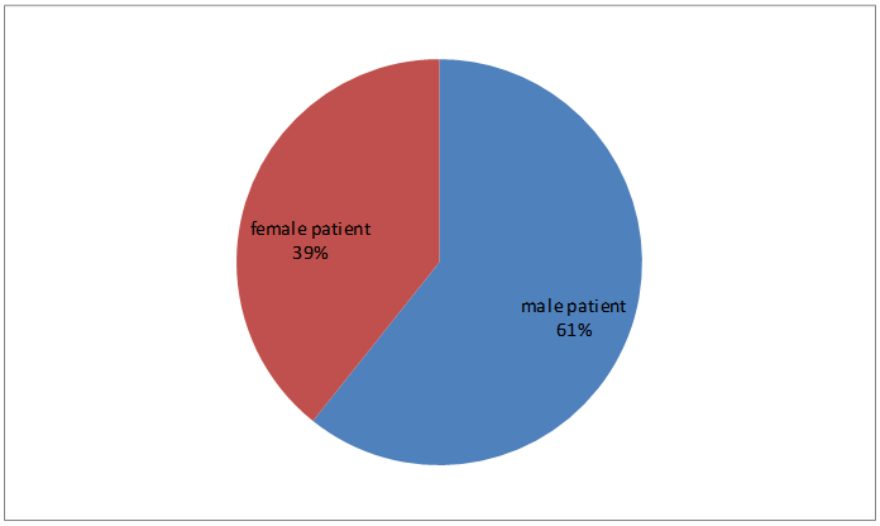

Figure 1 shows that out of total 84 patients , male patient were 51 and female patients were 33. According to percentage calculation male patients were 61% and female patients were 39 %

Figure 2: Showing No. of Total Patient, Sex and No of Day Staying

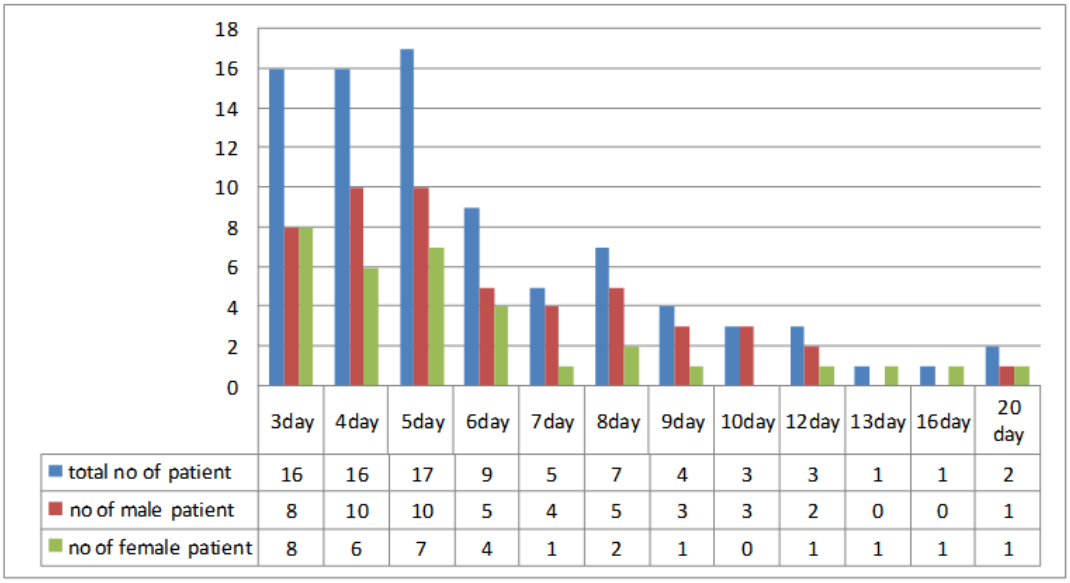

Table 2 : Average Duration of ICU stay

Patient group	No of days
Nosocomial infection	9.71
Without nosocomial infection	6.1O

Table 2 shows that non nosocomial infected patients' average staying days were 6.10 days when patients were nosocomial infected , their average staying days were increasing(9.71days).

TABLE 3 DISTRIBUTION OF SOCIO ECONOMIC STATUS

Socio economic status	Nosocomial infection	
	Yes	No
Lower class	16	35
Middle class	9	51
Upper class	3	14
total	28	100

Table 3 shows that among 28 nosocomial infected patients, belonging in lower class 16, middle class 9 and upper class 3

Figure 3: Socioeconomic Status of Nosocomial Infected Patients

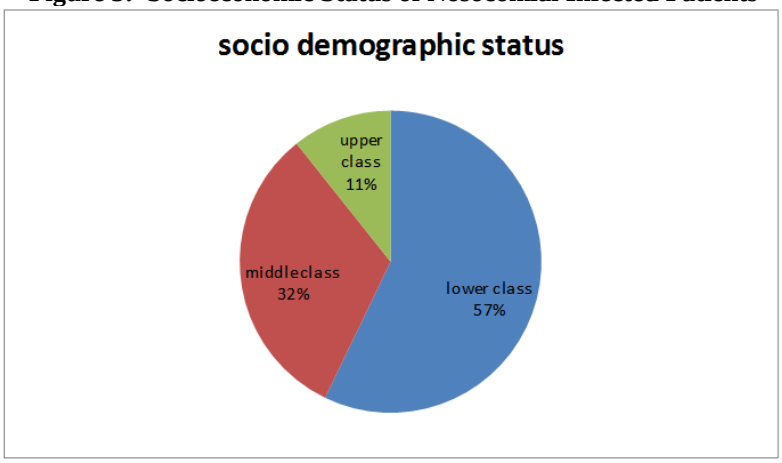

Figure 3 shows that among 28 nosocomial infected patients ,16 patient were in lower class ,9 were in middle class and 3 were in upper class. According to percentage calculation lower class were 57% ,middle class were 32% and upper class were 11%.

Table 5 : Outcome Result Due To Nosocomial Infection And Without Nosocomial Infection

Types of infection	Total no. of patient	expired	discharged	Transfer out	Transfer to general ward	Percentage of mortality
Nosocomial infection	28	12	7	3	6	42.85%
Non nosocomial infection	56	15	20	4	17	26.78%

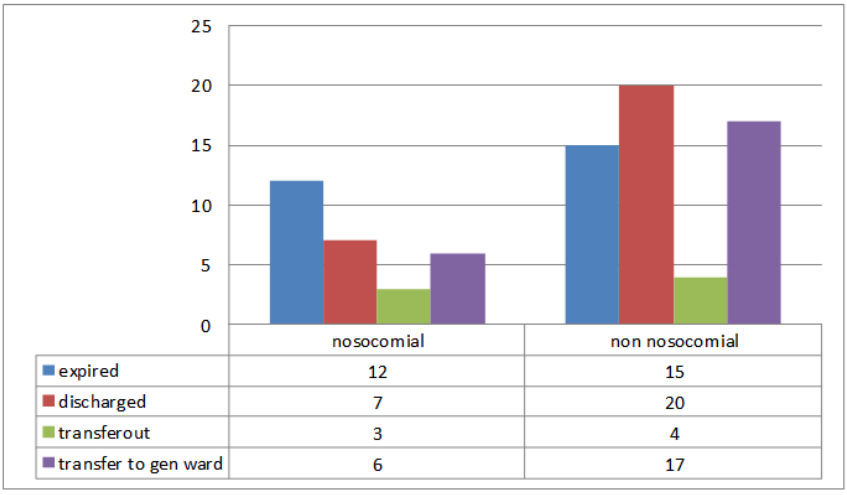

Table 5 shows that among 28 nosocomial infected patient, 12(43%) expired,7(25%) discharged ,3(10.71%)transferred out and 6(21%) transferred to general ward. Percentage of mortality was 42.85%
among 56 non nosocomial infected patient, 15(27%) expired ,20 (36%)discharged , 4(7%) transferred out and 17(30%) transfer to general ward. Percentage of mortality rate was 26.78%.

Table 6: Distribution Of Nosocomial Infection Among Nosocomial Positive Patients.

Nosocomial infection	Number of patient
Urinary tract infection	15
Respiratory tract infection	9
Surgical site infection	6
Intravascular infection	8
Other	5

Table 6 shows that among the positive nosocomial infected patient ,15 patient were urinary tract infection ,9 patient were respiratory tract infection, 6 patient were surgical site infection 8 patient were intravascular infection and 5 patient were other nosocomial infection.

Figure 6: Distribution of Nosocomial Infection Among The Nosocomial Positive Patients

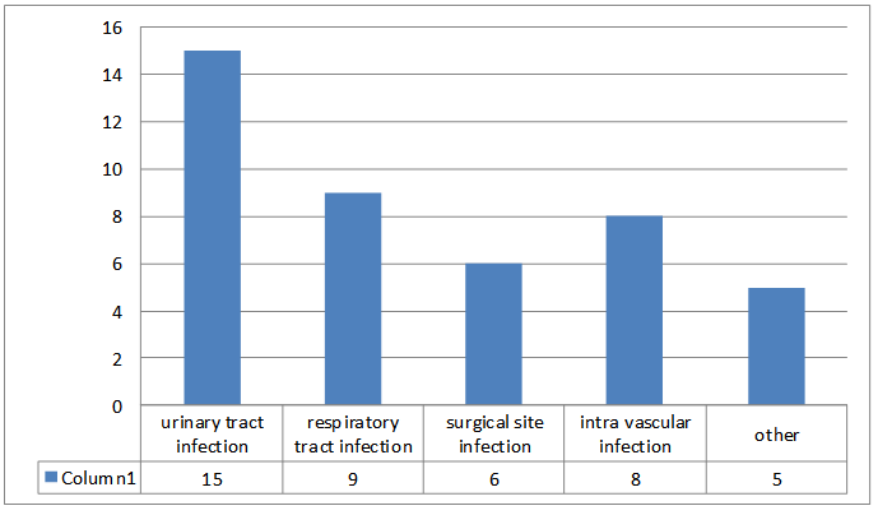

Figure 6 shows that among the positive nosocomial infected patient ,15 patient were urinary tract infection ,9 patient were respiratory tract infection, 6 patient were surgical site infection 8 patient were intravascular infection and 5 patient were other nosocomial infection.

Table 7 Distribution Of Sex In Urinary Tract Infection

Urinary tract infection	
Male	Female
6	9

Table 7 shows that out of 15 urinary tract infection , 6 male patient were urinary tract infected and 9 female patient were urinary tract infected.

Figure 7: Distribution Of Sex In Urinary Tract Infection

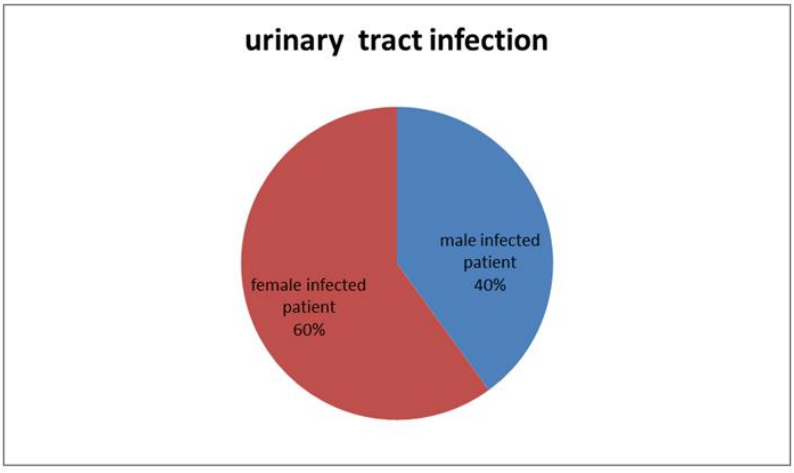

Figure 7 shows that out of 15 urinary tract infection , 6 male patient were urinary tract infected and 9 female patient were urinary tract infected. According to percentage male urinary tract infected patient were 40% and female urinary tract infected patient were 60%.

V. Discussion

During the study period for more than 48 hours at CCU of college of medicine and JNM hospital among 84 patients number of male patients was 51(61%) and number of female patients was 33(39%). 28 patients were nosocomial infected out of total number of patients.

During the studyperiod, the hospital acquired infection rate was 33.33% .In India nosocomial infections rate is alarming and is estimated at about 30-50% of all hospital infections according to world health organisation.

A study from GD Hospital & Diabetes Institute, Kolkata, India ,it has been observed that infection rate was 24.3% (2).

A govt institute of west Bengal , R G Kar Medical college ,Kolkata, India, shows their infection rate of 12 bedded surgical ICU was 11.98%(46).

The observed study indicated high prevalence rate .However, in developing countries, due to lack of formal surveillance the rate of health-care-associated infections is high and compliance with hand hygiene is low.

Healthcare-associated infections (HAIs) are additional burdens on individual hospitals and healthcare systems. They can increase the costs of patient care from several economic perspectives, including those of hospital administrators, third-party payers and patients. In healthcare systems relying on fixed per diem accounting systems, the presence of an HAI does not necessarily decrease reimbursement revenue for hospitals, as added bed-days can be charged to third-party payers (e.g. health insurance companies). Excess costs of HAI are related to additional diagnostic tests and treatment, additional hospital days, and post discharge complications, among others. Quantifying the exact economic burden attributable to HAI still remains a challenging issue. (25)

In table 2 the observed study shows that average duration of stay of non infected nosocomial infection and nosocomial infected patient's was 6.10 days and 9.71 day respectively where as mortality of two group was 28.1% and 31.2% respectively. (Table3, 4)

In other study it has been found that the average ICU stay of patients with and without nosocomial infection was 15.7days (4-40days) and 5.2 days (3-21days) accordingly (2) t GD Hospital & Diabetes Institute, Kolkata.

Table 3 shows that out of 28 nosocomial infected patients , the socio economic status of nosocomial infected patients presents socioecomically lower class was 16 , middle class was presented 9 and upper class presented in 3 .

Nosocomial infection rate was inversely proportional to the socio-economic status of the patient. At the same time some underlying diseases in the patients influenced the rate of infection to a great extent, eg infection rates in patients with anaemia , diabetes mellitus , hypertension and obesity were much more than in patients with no such underlying disease (47).

In table 5presents, non-nosocomial infected patients are 56,among them 15 expired,20 discharged 4 transferred out and 17 transfer to general ward and it has been observed mortality rate 26.78% .

In table 5 presents nosocomial infected patients are 28,among them 12 expired, 7 discharged, 3 transferred out,6 transfer to general ward and it has been observed mortality 42.85%

In table 4 & table 5 present ,in case of nosocomial infection mortality rate is increasing and survival rate is decreasing.

In our observed study shows that rate of urinary tract infection ,respiratory tract infection ,surgical site infection, intravascular infection and other was 15(53.57%) ,9(32.14%), 6(21.42%) ,8(28.57%) and5(17.85%) respectively.

most common nosocomial infection is urinary tract infection. Infection rate of male and female was 40% and 60% respectively.

Women are particularly more vulnerable to develop UTI because of their short urethra and certain factors like delay in micturition, sexual activity and use of diaphragms and spermicides which promote colonization of coliform bacteria in the periurethral region. Infection in most women occurs when the bacteria present in the perineal or per urethral region enter the urethra and ascend into the bladder(2).

second most common nosocomial infection respiratory tract infection.

It is the most common nosocomial infection encountered in the intensive care unit (ICU), with 9-28% of all intubated patients developing VAP(50)

ManuelaCavalcantiMauricioValenciaAntoniTorres shows the study from InstitutClínic de Pneumologia i CirurgiaToracica, Hospital Clínic de, Barcelona,spain,-Intensive care unit (ICU)-acquired lower respiratory tract infections include acute trachea bronchitis and hospital-acquired and ventilator-associated pneumonia (VAP). Nosocomial pneumonia is the second most common hospital-acquired infection and the leading cause of death in hospital-acquired infections. The mortality rate in VAP ranges from 24% to 76% in several studies(49).

Dr Ansul Kumar, shows that the3321 elective surgeries and 452 emergency surgeries during the period between 1st June 2010 to 31st May 2011, revealed rate of SSI as 12.5% (415) in elective surgeries and 17.7% (80) in emergency surgeries at the Department of General Surgery, RIMS(52).

M kaur shows the study from Government Medical College Hospital, Chandigarh, India ,The incidence of CVC-BSI was 21.73% and the rate was 14.59 per 1000 catheter days (51).

The intravascular infection rate was very high because lack of knowledge , not maintain proper aseptic techniques , lack of man power etc

VI. Recommendation

1. During entering in CCU wear apron and uses caps and mask.
2. Proper hand washing and use of hand rub solution before touching patient.
3. Used of disposal shoe cover before entering in CCU.
4. Fumigation to be processed in the regular interval**.**

Reference

[1]. Who guideline on Prevention of hospital-acquired infections, A practical guide 2nd edition .2012. available from http://apps.who.int/medicinedocs/documents/s16355e/s16355e.pdf

[2]. PampitaChakraborty and Sukumar Mukherjee. 2016. A Study on the Prevalence and Microbiological Profile of Nosocomial Infections in the ICU of a Tertiary Care Hospital in Eastern India. Int.J.Curr.Microbiol.App.Sci. 5(5): 920-925**.**

[3]. https://emedicine.medscape.com/article/967022-overview#a6

[4]. DebanjanKundu, TulikaPaul ,PranitaSaikiaMedhi , Namita Bedi.2017 .Hospital Acquired Urinary Tract Infection: An Epidemiological Study Carried out in A Tertiary Care Hospital of North East India.Int. J. Life. Sci. Scienti. Res., 3(3): 1059-1062.

[5]. Nicolle L Catheter; Associated urinary tract infections A review; Antimicrobial Resistance and Infection Control 2014; 3:23

[6]. SanjeevSingha, Murali Chakravarthyb,Victor Daniel Rosenthalc, Sheila N. Myatrad, Arpita Dwivedye, Iqbal Bagasrawalaf , Nita Munshig, SwetaShahh, BishnuPanigrahii , SanjeevSoodj , Pravin Kumar-Nairk, Kavitha Radhakrishnana, B.N. Gokulb, R. Sukanyab, L. Pushparajb .2014. Surgical site infection rates in 6 cities of India: findings of the International Nosocomial Infection Control. Consortium(INICC).IntHealthdoi:10.1093/inthealth/ihu089

[7]. Jarvis WR, Edward JR, Culver DH. Nosocomial Infection rates in ICUs in the United States: National Nosocomial Infection Surveillance System. Am J Med Br. 1991;91:1855–15

[8]. Verdeil X, Bossary JP, Roche R, Barret A, Pouns J. Nosocomial infection surveillance in a vascular surgery unit. Am Vasc Surg. 1990;4:553–7.

[9]. Worthington T., Elliot T.S.J. Diagnosis of central venous catheter related infection in adult patients. J Infect 2005; 51:267-80

[10]. Safdar N., Fine J.P., Maki D.G. Meta-Analysis: Methods for diagnosing untravasacular device-related bloodstream infection. Ann Intern Med 2005;142:451-66

[11]. Digiovine B., Chenoweth C., Watts C., Higgins M. The attributable mortality and costs of primary nosocomial bloodstream infections in intensive care unit. Am J RespirCrit Care Med 1999;160:976-81**.**

[12]. Reacher M.H., Shah A., Livermore M.D., et al. Bacteraemia and antibiotic resistence of its pathogens reported in England and Wales between 1990 and 1998:trend analysis. British Medical Journal 2000;320(22)

[13]. Likumahuwa, Sonja Marie (2008). A Social-Ecological Perspective on Nosocomial Infection Control in Developing Countries: Exploring the Role of International NGOs. Master's Thesis, University of Pittsburgh

[14]. RuheJJ, Smith N, Bradsher RW; Menon A. Community-onset methicillin-resistant Staphylococcus aureus skin and soft-tissue infections: impact of antimicrobial therapy on outcome.Clin Infect Dis. 2007 Mar 15;44(6):777-84. Epub 2007 Feb 1.

[15]. Who guideline on Prevention of hospital-acquired infections, A practical guide 2nd edition .2012. available from http://apps.who.int/medicinedocs/documents/s16355e/s16355e.pdf

[16]. Habibi S, Wig N, Agarwal S, Sharma SK, Lodha R, Pandey RM, et al. Epidemiology of nosocomial infections in medicine intensive care unit at a tertiary care hospital in northern India. Trop Doct. 2008;38:233–5.

[17]. Günter Kampf, PD Dr. med., HaraldLöffler, Prof. Dr. med. and Petra Gastmeier, Prof. Dr. med., Hand Hygiene for the Prevention of Nosocomial Infections.DtschArztebl Int. 2009 Oct; 106(40): 649–655.

[18]. Tenorio AR, Badri SM, Sahgal NB, Hota B, Matushek M, Hayden MK, Trenholme GM, Weinstein RA. Effectiveness of gloves in the prevention of hand carriage of vancomycin-resistant enterococcus species by health care workers after patient care.Clin Infect Dis. 2001 Mar 1;32(5):826-9**.**

[19]. A.G.Chandorkar.et.al.,(2008),Hospital waste management,(3rdedi.), Paras publishers, Hyderabad

[20]. Sundarlal.et.al.,(2009), Textbook of community medicine,(2ndedi.), CBS Publishers, New delhi

[21]. Dr. Jennifer H. Han, Mr. Brian F. Leas, ,Dr. David A. Pegues, and Dr. Craig A. Umscheid,Cleaning Hospital Room Surfaces to Prevent Health Care–Associated Infections.Ann Intern Med. 2015 Oct 20; 163(8): 598–607.

[22]. Nermine Mohamed TawfikFodaNohaSelimMohamedElshaerYasmine Hussein MohamedSultan.Safe injection procedures, injection practices, and needlestick injuries among health care workers in operating rooms.Alexandria Journal of MedicineVolume 54, Issue 1, March 2018, Pages 85-92.

[23]. Heidi RiddervoldMourud. April 2010. Prevention of Nosocomial Infections.Master'sprogramme of study General Medicine thesis.CHARLES UNIVERSITY IN PRAGUE

[24]. G.DeAngelisA.MurthyJ.BeyersmannS.Harbarth .Estimating the impact of healthcare-associated infections on length of stay and costs.Clinical Microbiology and InfectionVolume 16, Issue 12, December 2010, Pages 1729-1735

[25]. Laurent G. Glance, Pat W. Stone, Dana B. Mukamel, and Andrew W. Dick.Increases in Mortality, Length of Stay, and Cost Associated With Hospital-Acquired Infections in Trauma Patients.Arch Surg. 2011 Jul; 146(7): 794–801.

[26]. R. MoninaKlevens, Jonathan R. Edwards, Chesley L. Richards, Teresa C. Horan, Robert P. Gaynes, Daniel A. Pollock, and Denise M. Cardo,.Estimating Health Care-Associated Infections and Deaths in U.S. Hospitals, 2002.Public Health Rep. 2007 Mar-Apr; 122(2): 160–166.

[27]. Who guidelines on Practical Guidelinesfor Infection Control inHealth Care Facilities ,SEARO Regional Publication No. 41WPRO Regional Publication; 2004.

[28]. Ken Inweregbu ,JayshreeDave,AlisonPittard ;Nosocomial infections,Continuing Education in Anaesthesia, Critical Care & Pain | Volume 5 Number 1 2005**.**

[29]. Jain Atul,SinghK.Recent Advances in the Management of Nosocomial Infections, Review article. JK Science, 2007;9:1.

[30]. FARIDA JAMAL,HOSPITAL INFECTION : SOURCES AND ROUTES OF TRANSMISSION,Malaysian J Path01 1981; 4: 1-5 .

[31]. Yatin Mehta, AbhinavGupta,SubhashTodi,SNMyatra, D. P. Samaddar,VijayaPatil,Pradip Kumar Bhattacharya, Suresh Ramasubban; Guidelines for prevention of hospital acquired infection;Indian J Crit Care Med. 2014 Mar; 18(3): 149–163**.**

[32]. Nicolle LE (2008). "Uncomplicated urinary tract infection in adults including uncomplicated pyelonephritis". UrolClin North Am. 35 (1): 1–12, v. *doi*:*10.1016/j.ucl.2007.09.004*. *PMID 18061019*

[33]. Astagneau P, Rioux C, Golliot F, et al. Morbidity and mortality associated with surgical site infections: results from the 1997–1999 INCISO surveillance. Journal of Hospital Infection. 2001;48:267–74.

[34]. Plowman R, Graves N, Griffin MA, et al. The rate and cost of hospital-acquired infections occurring in patients admitted to selected specialties of a district general hospital in England and the national burden imposed. Journal of Hospital Infection. 2001;47:198–209.
[35]. Surgical Site Infection: Prevention and Treatment of Surgical Site Infection. NICE Clinical Guidelines, No. 74.National Collaborating Centre for Women's and Children's Health (UK).London: RCOG Press; 2008 Oct.
[36]. Girish L. Dandagi. Nosocomial pneumonia in critically ill patients; Lung India. 2010 Jul-Sep; 27(3): 149–153.
[37]. National nosocomial infections surveillance (NNIS) system report, data summary from January 1992-April 2000, issued June 2000. Am J Infect Control. 2000;28:429–48
[38]. RupamGahlot, Chaitanya Nigam, Vikas Kumar, GhanshyamYadav,andShampaAnupurba. Catheter-related bloodstream infections.Int J CritIllnInj Sci. 2014 Apr-Jun; 4(2): 162–167.
[39]. Baldev Singh, Sukha Singh, SudhirKhichy, and AvinashGhatge.Clinical Presentation of Soft-tissue Infections and its Management: A Study of 100 Cases:Niger J Surg. 2017 Jul-Dec; 23(2): 86–91.
[40]. Stevens DL, Bisno A L, Chambers HF, et al; Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the Infectious Diseases Society of AmericaClin Infect Dis 2014;59:e10-52
[41]. Anindo Majumdar, Jayaprakash Sahoo, Gautam Roy, Sadish kumar Kamalanathan .Improper sharp disposal practices among diabetes patients in home care settings: Need for concern? .Year : 2015 | Volume : 19 | Issue : 3 | Page : 420-425
[42]. Vasudha Iyengar,MdRafiqul Islam. Biomedical, Sharps and General Waste Disposal in India: Potential for the Spread of Contagious Diseases and Serious Environmental Contamination,Universal Journal of Public Health 5(5): 271-274, 2017.DOI: 10.13189/ujph.2017.05050
[43]. Hospital infection control manual for small health care organisation ,NABH guidelines
[44]. UCSF Medical Centre Hospital, Epidemiology And Infection Control: standard and transmission -based precaution, policy 1.1. Issued: 03/06
[45]. Montana State Hospital Policy And Procedure . Guidelines for isolation precations, Policy: IC-11 , April 28, 2016.
[46]. Dasgupta S, Das S, Chawan NS, HazraA.Nosocomial infections in the intensive care unit: Incidence, risk factors, outcome and associated pathogens in a public tertiary teaching hospital of Eastern India.Indian J Crit Care Med. 2015 Jan;19(1):14-20. doi: 10.4103/0972-5229.148633.
[47]. Ganguly P, Yunus M, Khan A, Malik A.A study of nosocomial infection in relation to different host factors in an Indian teaching hospital.J R Soc Health. 1995 Aug;115(4):244-6.
[48]. ManuelaCavalcanti, Mauricio Valencia, Antoni Torres, Respiratory nosocomial infections in the medical intensive care unit,Microbes Infect. 2005 Feb;7(2):292-301. Epub 2005 Jan 8.
[49]. Mitra S, Roy S, Dasgupta R. Ventilator associated pneumonia in the critical care unit in a tertiary care hospital by Burkholderiacepacia by an unusual mode of infection. Int J Health Sci Res. 2015; 5(11):125-128.
[50]. Kaur M, Gupta V, Gombar S, Chander J, Sahoo T. Incidence, risk factors, microbiology of venous catheter associated bloodstream infections - A prospective study from a tertiary care hospital. Indian J Med Microbiol [serial online] 2015 [cited 2018 Oct 6];33:248-54. Available from: http://www.ijmm.org/text.asp?2015/33/2/248/153572.
[51]. Kumar A, Rai A. Prevalence of surgical site infection in general surgery in a tertiary care centre in India. IntSurg J 2017;4:3101-6.

Annexure
Proforma

Name of patient:…….
RegNo……..Age……..Sex……
Duration of stay …….....
Outcome…….....
Economic status…….....

A. Patient exposure

1. Surgical procedure (during the last month) ■ Yes ■ No
2. Urinary catheter ■ Yes ■ No
3. Mechanical ventilation ■ Yes ■ No
4. Intravascular catheter ■ Yes ■ No

B. **Nosocomial infection**

■ Yes ■ No

If yes, fill the following items

1. Surgical site infection ■ Yes ■ No
2. Urinary tract infection ■ Yes ■ No
3. Respiratory tract infection ■ Yes ■ No
4. Intravenous catheter related infection ■ Yes ■ No
5. Other nosocomial infection ■ Yes ■ No