FIELD MEDICINE

NURSING CARE IN IMMUNOCOMPROMISED PATIENTS

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ABSTRACT

Concept of critical care nursing in immunocompromised patients usually comprises of prevention and treatment of life threatening complications of infections. These infections are prevalent due to neutropenia and weak immune response in these patients. Different gram positive and negative bacteria, viruses, Candida, and fungi can cause wide spread infections. Some uncommon and difficult organisms can also cause serious infections in these patients due to their low immunity. Involvement of oral cavity, lungs and central nervous system are most common. Control of infection is the key to success in an immunocompromised patient. Nursing staff are the basic workers who can control the infection rate by taking good care of their patients. The article reviews the basic principles and protocols used in nursing care to prevent infection in immunocompromised patients especially those undergoing bone marrow transplantation.

Keywords: Nursing care, immunocompromised, infection control.

INTRODUCTION

Major advances in the treatment of cancer have resulted in improved survival rates. However, serious infections continue to be a major source of morbidity and mortality in the immunocompromised patients [1,2]. These are patients who have one or more defects in their natural defense mechanisms that put them at an increased risk of developing infections. Not only the infection risk is greater in these people, but also once they get infection it is often severe, rapidly progressive and life threatening. The microorganisms which are usually non pathogenic in the non-compromised patients can cause serious disease in immunocompromised patients. Common causes of immunocompromised state are [3]:-

- Neutropenia i.e. low neutrophil count
- Defects in B and T lymphocytes that may be congenital or acquired
- Hypogammaglobulinaemia i.e. low level of antibodies
- Splenectomy or hyposplenism

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There is a group of patients who is not immunocompromised but is more likely to get various infections. This group include patients with debilitating injury e.g. burns or severe trauma, invasive procedures e.g. central lines, Foley's catheter, dialysis catheters, central nervous system dysfunction predisposing to aspiration pneumonia and use of broad spectrum antibiotics. Important causes of neutropenia are chemotherapy for malignant disorders especially for acute leukaemias, conditioning during bone marrow transplantation and radiotherapy.

INFECTIONS IN IMMUNOCOMPROMISED PATIENTS

Infection continues to be the major cause of morbidity and mortality in patients with cancer because of the alternation of normal host defenses [4]. The risk of infection begins to increase when the absolute neutrophil count falls below 1000/µl, with a dramatic increase in frequency and severity when the

count falls below 200/µl. Common infections among neutropenic patients are: -

- Gram-negative enteric organisms e.g. Pseudomonas
- Gram-positive cocci particularly Staphylococcus aureus, staphlococcus epidermidis and viridans streptococci
- Candida, aspergillus especially nosocomial aspergillus and other fungi like Trichosporon, and Fusarium [5].

Defects in humoral immunity are often congenital, though hypogammaglobulinemia can occur in multiple myeloma and chronic lymphocytic leukemia. These patients have low antibody levels in their blood and are particularly vulnerable to infections by encapsulated organisms such as Haemophilus influenza and Streptococcus pneumonae.

Defects in cellular immunity are seen in HIV infection, lymphomas and Hodgkin's disease and patients receiving immunosuppressive drugs e.g. following bone marrow and organ transplantation such as corticosteroids, cyclosporin, and other cytotoxic drugs. This group also includes patients who are receiving long-term steroids for bronchial asthma, rheumatoid arthritis and various autoimmune diseases.

Patients with cellular immune dysfunction are susceptible to infections by a large number of organisms, particularly intracellular organisms for example bacteria, such as listeria, legionella, salmonella and mycobacterium: virus such as herpes simplex, vericella, and cytomegalovirus, fungi such as cryptoccocus, histoplasma and pneumocystis; and protozoa such as toxoplasma.

Patients having functionally abnormal or absent spleen fail to clear organisms from the blood stream and are at an increased risk of severe infections with encapsulated bacteria like Strep pneumonia, H influenza and Neisseria meningitides. However, any organism can cause infections in immunosuppressed patient at any time. Organism not usually pathogenic in the non-compromised host may cause serious life threatening infection in the compromised patients [3].

Recommendations are given for preventing CMV disease with prophylactic gancyclovir, Herpes simplex virus disease with prophylactic acyclovir, Candidiasis with fluconazole and Pneumocystis carinii pneumonia with trimethoprim and sulfamethaxazole [6].

NURSING CARE IN IMMUNOCOPROMISED PATIENTS

Peculiar tasks in immunocompromised patients are [7]:-

- IV drug administration
- Cytotoxic drug administration
- Disinfection and infection control
- Protective isolation and hygiene
- Protective clothing
- Personal hygiene
- Toilet hygiene
- Oral care
- Visitors
- Symptom relief
- Administration of blood products
- Management of Hickman or central venous catheters
- Patient's education for self and home care

Critical care nurses can improve patient outcome by recognizing and controlling infection [8]. Moreover nursing staff having good knowledge of principles of treatment of malignancies, protective isolation, psychological support of patient and their families, stress management care of dying and

good communication skills can make lot of difference in patient management.

Intravenous Drug Administration:

Hospitalized immunocompromised patients are on multiple intravenous therapies and there is great risk of infections if sterile technique is not used. Observe following precautions [9]:-

- Hand should be washed before parenteral fluids/drugs are opened and administered.
- Inspect vials/containers for any cracks, leaks, discoloration, turbidity and expiry date.
- Label the container indicating time, date and patient's name.
- Parenteral fluids should be discarded if not used within 24 hours.
- I/V sets should be changed every 24 hours.
- Blood specimens should not be withdrawn through I/V tubing.
- The cannula should be changed if there are signs of phlebitis.

Cytotoxic Drug Administration:

Important precautions for preventing errors in chemotherapy administration are [10]:-

- Chemotherapy should only be given with proper arrangements. It is generally not an emergency procedure and should not be given in hurry.
- Only trained nurses should give the chemotherapy.
- Ensure right dose of the right drug for the patient via the right route according to the right schedule.
- Nurses need to question any aspect of the chemotherapy order that is contrary to the customary practice to avoid any serious harm to the patient due to inadvertently wrong chemotherapy prescription by a consultant.
- Avoid distractions like telephone calls etc while administering chemotherapy.
- Chemotherapy should always be written. Don't give chemotherapy on verbal prescription.
- Select a suitable vein if central line is not in place. Distal forearm is the best site to avoid injury to nerve and tendon. Avoid antecubital fossa for vesicant administration. Flush with 5 ml saline before and after giving a vesicant drug.
- In case of extravasations do following:-
  - Stop the drug.
  - Aspirate as much drug as possible.
  - Call the doctor
  - Infiltrate antidote if available
  - Avoid undue pressure
  - Apply cold (ice cubes) for 15 minutes 4 times daily for 24 hours.

Disinfection and Infection Control:

Strict aseptic measures should be adopted while caring for neutropenic patients. Important measures are [11]:-

- Hand washing before handling the patient
- Use antiseptic solution e.g. 70% alcohol for hand cleaning before handling I/V tubing, giving I/V fluids or drugs
- Keep all the instruments in antiseptic solutions
- Avoid flowers since these may contain bacteria or fungi
- Bone Marrow Transplant (BMT) centres should follow basic infection

control practices for control of MRSA infection and colonization, whenever entering the MRSA infected or MRSA colonized patient room

- Proper disposal of all infectious waste, like used syringes, needles, surgical blades, dressings etc.
- Hospitals should prevent bird's faeces gaining access to hospital ventilation ducts.

Protective Isolation and Hygiene:

Ideally the immunocompromised patient should be kept in isolation room; however this depends upon the facilities available in the hospital. Some of the centers have special room fitted with HEPA filters for filtration of air and the patients are kept in germ free environment [12].

Use Protective Clothing:

Use of disposable gowns, caps and masks by the patients and their attendants minimizes spread of bacteria from one person to another.

Personal Hygiene:

- Patient should take daily bath with antiseptic soap.
- Keep skin and body creases clean.
- Wear clean, dry and light clothes. Change them frequently.
- Ensure trimming of nail and hair

Toilet Hygiene:

- Use separate shoes for going inside toilet.
- Wash genitalia and anal area thoroughly after passing urine/stools.
- Following urination or defecation, female patients should wipe the perineum from front to back to prevent urethral contamination and subsequent urinary tract infection
- Wash hands with soap and water before touching your clothes and finally again wash before coming out of toilet.
- Always flush the WC tank after use.
- Do not throw cotton, caps, mask or nappies in the WC it would lead to choking of waste pipes.

ORAL CARE

Chemotherapy and bone marrow transplantation (BMT) are treatment modalities associated with a wide spectrum of gastrointestinal complications. One effect is painful stomatitis. It is defined as an inflammatory and ulcerative reaction of oral cavity. Stomatitis in the transplant patient is attributable to several effects of high dose chemotherapy and radiotherapy.

Effective oral care is extremely important throughout the course of BMT. Following protocol is helpful for all such cases [13].

Oral Assessment:

At admission examine the following for any inflammation, ulcers or other abnormalities.

- Lips
- Tongue
- Mucous membrane of palate, inner aspect of cheek and pharynx
- Gingiva
- Saliva whether normal or thick or scanty
- Voice
- Ability to swallow
- Teeth for caries, ill-fitting denture

Preventive Measures:

- Educate and motivate patients about the oral hygiene.
- Tooth brushing using very soft brush three times daily.

- Normal saline mouth washes every 2-4 hours.
- If thick saliva then add sodium bicarbonate 1x teaspoon in one litre of saline.
- A dilute solution of Hydrogen peroxide in normal saline (1:3) may aid removal of blood and mucous.
- Chlorhexidine mouth washes 4 times daily.
- Nystatin suspension (Nilstat) 1 ml 6 hourly. To be rinsed around the mouth for at least two minutes, then swallowed.
- In case of mouth ulcers Sucralfate suspension (Ulsanic) 10 ml 6 hourly.
- In case of painful mucositis, use 2 tab of paracetamol dissolved in 1x liter of water as mouth wash 6 hourly.
- For localized painful ulcers use xylocaine gel 2%.
- Oral cryotherapies effectively prevent stomatitis, caused by high dose melphalan, and it is recommended that it should be incorporated into the conditioning regimen [14].
- In case of patient's inability for self care, do cleaning in side lying or sitting over sink or basin. Irrigate oral cavity using cleansing device. Remove debris using moistened cotton stick, soft tooth brush or moist swab stick.
- For severe mucositis consider low dose morphine infusion by pump.

Visitors:

Visitors should be kept minimum. Any body that has got active infection like flu, measles, chicken pox etc should not be allowed to come in contact with the patients. In case an attendant is required for patients kept in isolation then it is important that he should not be changed frequently and given proper education in handling immunocompromised patient.

Symptom Relief:

Proper attention should be given for relief of symptoms like pain, constipation, diarrhoea, nausea and vomiting, mucositis and fatigue.

Administration of Blood Product:

Patients suffering from cancer and recipients of bone marrow transplantation require frequent blood component support during treatment. Blood components used frequently are red cell concentrate (RCC), fresh frozen plasma (FFP) and platelet concentrates. Important points to be observed are [15]:-

- Due to frequent blood component administration patients get allergic reactions and should be pre-medicated with paracetamol and antihistamine like piriton or avil.
- If not otherwise advised one unit of whole blood or RCC should be transfused over 2-4 hours.
- Platelets, FFP and cryoprecipitate are transfused rapidly.
- Only fluid compatible with blood products is normal saline and it can be used for priming tubing. No fluid or drug should be added in the blood bag.
- Immunocompromised patients should be given irradiated blood products to avoid transfusion associated GVHD. If facilities are not available for irradiation blood filters may be used.
- As for as possible leukopoor blood components should be given to immunocompromised patients.

Care of Central Catheter:

Central venous catheters are placed in femoral, internal jugular and subclavian veins [16]. Central venous catheterization represents significant medical advancement, particularly in the treatment of critically ill patients, however there is a high risk of

central venous catheters related infection. A Study has shown that central venous catheters with antiseptic coating are safe and has less risk of colonization of bacteria and fungi than standard catheters in the critically ill patients [17].

Infection can be detrimental in any patient, but it is life threatening in immunocompromised patient. It was the nursing staff that first identified an increased rate of central line infections. Studies have clearly supported the central role nurses have in decreasing infection rate in this patient population [18]. Care of catheters is discussed below:

Dressing Change

If a transparent dressing has been applied then the wounds can be examined through it, other wise dressing is not to be removed. If there is any evidence of infection or incomplete wound healing such as redness, induration or exudates then dressing is changed daily, other wise dressing is changed less frequently. Following protocol should be followed [19]:-

- Wash hands thoroughly with soap and water.
- Use strict aseptic technique while changing the dressing.
- Lay down the new dressing kit on a sterile field.
- Carefully remove the old dressing.
- Clean any exudates with swab soaked in hydrogen peroxide or povidone iodine.
- Using a stick swab soaked in povidone iodine and while applying gentle pressure cleans the exit site starting at the catheter and working outward in a circular motion. Never return back to the catheter exit site with the same swab stick.
- Repeat the procedure till whole area is clean.
- Clean three inches of catheter from the exit side out ward with povidone-iodine.
- Apply fresh dressing.
- Coil the catheter and secure its cover dressing.
- It is preferable to apply transparent polyurethane dressing

Irrigation and Heparin Locking

If the catheter is used at least once every 8 hours, flushing with 5 ml of saline in between the infusions is satisfactory. If it is used less frequently then heparin flushing and locking is recommended. Following protocol is followed:-

- Wash hands thoroughly with soap and water.
- Clamp the catheter over clamping sleeve.
- Clean top of the injection cap with 70% alcohol.
- Draw 2.5 ml of heparinised saline in a 5 ml syringe and eliminate air from the syringe.
- Insert needle into the injection cap or attach syringe to catheter and irrigate the catheter.
- Remove the needle or the syringe and close injection cap.
- The use of either vancomycin heparin (VH) or vancomycin heparin Ciproxin (VHC) flush solutions significantly decrease complications [20].

Administration of Fluid / Medication through Catheter

- Clamp the catheter on the sleeve.

- Clean the injection cap or old IV tubing injection with the catheter with 70% alcohol.
- Remove the cap or old cap IV tubing and connect the new tubing after priming.
- Clean the junction again with alcohol.
- Always flush the catheter with normal saline between incompatible solutions being administered sequentially to avoid precipitation in the lumen.

Withdrawal of Blood Sample from Catheter

Blood samples for coagulation tests, cyclosporine and other drug levels should never be taken from catheter. For other samples following protocol is followed:-

- Lay patient flat in the bed and expose the catheter site.
- Wash hands thoroughly with soap and water.
- Clamp the catheter on clamping sleeve.
- Attach 10 cc empty syringes to the catheter after cleaning the hub with 70% alcohol. Remove the clamp and withdraw 5-6 ml of blood to clear the catheter and change the syringe.
- Obtain required blood samples, re-clamp the catheter and remove the syringe.
- Attach another syringe filled with 5 ml normal saline. Remove the clamp and flush the catheter.
- Reconnect infusion tubing or place heparin lock and close the cap.
- Clean the cap or tubing junction with alcohol.

Clearing Blocked Catheter

High resistance to infusion is an indication of possible blockage of the catheter lumen. Rule out blockage by posture related kinking by asking the patient to change the position of upper body and arms. Dye studies may be performed to confirm blockage. If persist then proceed as under:-

- Wash hands thoroughly with soap and water.
- Scrub catheter junction with alcohol swab.
- Remove the injection cap and attach a syringe. Attempt to draw blood. If successful then clean the line from all clots and follow with sterile saline flush and heparin lock.
- If not then attempt cleaning by gentle alternating irrigation and aspiration with a 20 ml syringe half filled with heparinised saline (100 u/ml). Do not use force to avoid catheter damage.
- If this procedure fails then using a 10 ml syringe gently instill a solution of 10,000 units urokinase in 2 ml sterile water. A gentle pull push should be used to dissolve and remove the clot. Care should be taken not to force the clot into blood stream.
- Clamp the catheter on clamping sleeve leaving urokinase solution in place for 15 minutes with syringe attached.
- Unclamp the catheter and again try to remove the clot.
- The procedure can be repeated 3 times in 4 hours if the platelet count is >20x10/1. If it is less then the procedure should be repeated only once in 04 hours.
- Once the clot has cleared, irrigate the catheter and place the heparin lock.

Patient Education

Patient education plays important role in the overall management of immunocompromised patients. A better training of patients in their personal hygiene and more careful measures of

asepsis in hospital could further decrease the incidence of infection, thus improving patient's quality of life [21].

Recommendations Based on Local Experience

Author during her 11 years experience of caring the oncology and bone marrow transplant patients has observed following in our setup and patient population:-

- Majority of our patients and their relative are less educated and do not understand the importance of observing simple measures of cleanliness. However, if efforts are made to teach them, the rate of infection and other complications is decreased.
- Generally there is less than optimum communication between doctor, nurse and patient. More efforts should be made by doctors and nurses to explain the patient about his disease, likely complications during therapy and their treatment. This helps in allaying patient's anxiety.
- Lack of awareness among doctors and nurses about simple but important measures to prevent infections in immunocompromised patients. Most of the preventive measures are simple like frequent hand washing and should be adopted by all concerned.
- Less stress is given on patient education. Education of patients and relatives regarding cleanliness and hygienic measures produces excellent results and decreases the infection rate.
- Aseptic measures are not observed as strictly as these should have been. This results in more infections and use of high potency antibiotics.
- Chemotherapy preparation and administration is not according to international standards. Chemotherapy should be prepared by especially trained staff like pharmacist using proper protective clothing and delivered to the ward nurses for administration. This would avoid risk of exposure to staff and environment.

CONCLUSION

With the advancement in health care facilities and awareness, more number of patients are receiving chemotherapy and other sophisticated treatments like bone marrow transplantation. As a result the number of immunocompromised is increasing with each passing day. These patients require specialized nursing care and observance of strict aseptic measures. This article outlines the important measures for those involved in handling of immunocompromised patients. By adopting these measures, there is marked decrease in the rate of complications resulting in better outcome in cancer patients.

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