Evidence Generation of Standard Nursing Protocol on Chemotherapy-Induced Neutropenia Among Oncology Nurses

Payal R. Bawankar 1, Ruchira Ankar 1

1. Nursing, Smt. Radhikabai Memorial College of Nursing, Datta Meghe Institute of Medical Sciences (Deemed to be university), Wardha, IND

Corresponding author: Payal R. Bawankar, payalbawankar2@gmail.com

Abstract

Background
Chemotherapy uses anti-neoplastic agents, the drugs used to treat malignancies. Neutropenia is associated with cytotoxic therapy. Anti-neoplastic agents are poisonous to the cells, affecting the synthesis of folic acid and damaging the DNA, RNA, and protein that damage the bone marrow. Destruction of bone marrow decreases absolute neutrophil count in the blood. To assess the baseline data and practice of oncology nurses, develop and implement the evidence-based standard nursing protocol, assess the satisfaction level of the patients for the utility of the standard nursing protocol, find out the correlation between knowledge and practice and to associate the knowledge and practice score with selected demographic variables.

Material And Method
In the study quasi-experimental design was utilized. The study was conducted at Siddharth Gupta Memorial Cancer Hospital, Sawangi (Meghe), Wardha city, between June to Aug 2022

Result
The result of the study shows the mean value per existing knowledge is 7.59 and practices is 37.95, post knowledge is 14.23, and post practices is 71.15. The standard deviation values of per existing knowledge are 2.67 and, practice 3.09 and, post knowledge is 2.32, post practices are 1.32. The calculated t-value of knowledge is 46.57 and the p-value is 0.0001. The calculated t-value of practice is 12.03, and the p-value is 0.0001.

Conclusion
The present research concluded that the knowledge and skills of oncology nurses are enhanced after implementing the standard nursing protocol.

Categories: Family/General Practice, Medical Education, Oncology
Keywords: oncology nurses, chemotherapy-induced neutropenia, practice, knowledge, standard nursing protocol

Introduction
Cardiovascular diseases (CVD) are the leading cause of mortality, accounting for 73% of deaths worldwide [1,2]. Cancer is the second leading cause of mortality, accounting for 10 million deaths worldwide [3,4]. Chemotherapy uses anti-neoplastic agents to treat different malignancies. The goal of cytotoxic therapy is to decrease the number of malignant cells in cancer, such as leukemia, or to reduce the size of tumors and thereby lessen the severity of the symptoms. Anti-neoplastic agents inhibit cell replication by interfering with the specific cell phase, inhibiting the enzymes, or damaging the target cell’s DNA, RNA, and protein synthesis, which leads to bone marrow destruction and depletion in neutrophil production [5]. Neutropenia occurs due to the depletion of the absolute neutrophil count in a cancer patient’s blood. Neutropenia occurs in 1 in 3 cancer patients treated with cytotoxic therapy. Anti-neoplastic drugs schedule and dose to be delayed sometimes to give the body a chance to produce new neutrophils [6].

In neutropenia, absolute neutrophil count decrease <500 cells/mm3 in the next 48 hours. Body circulating white blood cells consist of 60% of neutrophils. Mostly WBC reached their lowest point 7–14 days after the administration of chemotherapy [7]. Oncology nurses play a crucial role in preventing, early diagnosing, and managing CIN neutropenia and educating patients and their families to ensure better compliance rates. Oncology nurses must detect the patient at risk of developing neutropenia early and monitor them for better implementation of nursing interventions to improve the care and quality of life of patients undergoing CIN [8]. Nurses must require specialized skills and knowledge beyond basic nursing to understand the psychological, physical, and cost implications of supporting the patient and family integrity during the CIN
The development of a standard nursing protocol should be based on oncology care guidelines and need-based assessment of nurses, patients, and families giving care to the patients. The standard nursing protocol can guide nurses and patient caregivers in making decisions for adequate care for cancer patients. Therefore, it is essential to develop and implement standard nursing protocols to reduce infection and improve care quality. Evidence-based practices are expanding rapidly in support of nursing intervention, generating a demand to bring this new education and specialized skills to the bedside. To identify evidence and their base for the oncology nurses and illustrate the impact of nursing interventions on patient outcomes, the oncology nursing society is committed to managing specific cancer symptoms. The evidence-based practice consists of the conscious application of various skills and knowledge sources, including published articles on clinical practices, patient value, and care according to the priority of the patient.

Materials And Methods

Study setting and design
A quasi-experimental research design was used in the current study. The study was conducted at Siddharth Gupta Memorial Cancer Hospital, Sawangi (Meghe), Wardha city, between June to Aug 2022. Oncology nurses working in the oncology ward were selected for this research study.

Study population
Non-probability purposive sampling technique was utilized in this study. A total of 100 oncology nurses were selected for the study, in addition to 50 cancer patients who are on chemotherapy.

Study tools
The tool consists of four sections: tool I was generated to collect data on oncology nurses’ age and years of experience; tool II, staff nurses’ pre-test/post-test questionnaire, was used to measure oncology nurses’ knowledge. This tool was given to nurses before the implementation of the SNP and after seven days to assess the gain in knowledge and change in practice after the implementation of the protocol, and it consists of 20 knowledge questions; tool III consists of the observation checklist data from this tool were collected before discussion of the protocol and after seven days to evaluate the impact of the SNP on oncology nurses’ practice. It consisted of the following 24 items, including neutropenia stratification, calculation of absolute, assessment and monitoring of cancer patients on chemotherapy and nursing intervention to reduce infection; tool IV consists of patient feedback from data from these tools were collected from patients after the discussion of a protocol to evaluate the impact of the standard nursing protocol in reduction of infection and to know nurses practicing the protocol is effective in decreasing infection.

The tool was submitted to 3 medical oncologists and seven nursing experts to ensure content validity. Reliability analysis was done using the parallel form reliability method, which is found to be 0.94; the tool is reliable. The pilot study was done in Jan 2022 per the criteria for 10 samples collected from the Rast Sant Tukdoji cancer hospital, Nagpur.

Data collection
Data collection was done in four steps; in the first step, staff nurses gave a knowledge questionnaire and neutropenic patient management observation checklist, which contained 24 items to evaluate the oncology nurses’ practice. They were asked to fill in some socio-demographic data like age and years of experience. Oncology nurses’ knowledge and practice were measured to be utilized as baseline data before the nursing protocol implementation. On the same day, the standard nursing protocol was given to the staff nurses in the form of a booklet and demonstrated and re-demonstrated with the main teaching methods. This was done in 5 sessions for each group of 10-20 nurses, and the duration was 30-60 min. In the second step, a post-test was collected from staff nurses after seven days. In the third step, feedback is taken from the staff nurses, and in the fourth step, data collected is entered in the Excel sheet.

Statistical analysis
Data collected were analyzed using the software SPSS statistics version 24.0. Using descriptive statistics (Socio-demographic variables were described/expressed in frequencies and percentages, mean percentage, mean and standard deviation) and inferential statistics ‘paired t-test’ was used to assess the effectiveness of the standard nursing protocol. Item analysis was done on an observation checklist, and the correlation coefficient was used to find the correlation between knowledge and expressed practices. The chi-square test was used to determine the association of knowledge and expressed practice with demographic data. The acceptable level of significance is NS, p>0.05.

Ethical consideration
Informed consent was taken from each staff nurse and patient after a detailed explanation of the study.
participants were ensured privacy and confidentiality. Permission is obtained from the concerned authority of the selected hospital. The study proposal has been sanctioned by the ethical committee of the college (referral no: DMIMS(DU)/IEC/2021/282).

**Results**

A convenient sample of 100 nurses was selected based on the distribution of oncology nurses about their demographic characteristics. About 40% were in the 31–40 years, 35% were in 21–30 years, 18% were in the age group of 41–50 years, and 7% of staff nurses were in the age group of 51–60 years, respectively. 47% of staff nurses had working experience of up to 10 years, 42% had between 11–20 years, 6% had working experience of 21–30 years, and 5% of staff nurses had working experience of 31–40 years (Table 1).

| Demographic Variables | Frequency (n=100) | Percentage (%) |
|-----------------------|------------------|----------------|
| Age (yr)              |                  |                |
| 21-30 year            | 35               | 35%            |
| 31-40 year            | 40               | 40%            |
| 41-50 year            | 18               | 18%            |
| 51-60 year            | 7                | 7%             |
| Experience in yrs     |                  |                |
| ≤ 10 years            | 47               | 47%            |
| 11-20 years           | 42               | 42%            |
| 21-30 years           | 6                | 6%             |
| 31-40 years           | 5                | 5%             |

**TABLE 1: Distribution of oncology nurses according to their demographic characteristics.**

47% of the oncology nurses had an average score, 32% had a poor one, 16% had a good, and 5% of oncology nurses had an excellent knowledge score. The mean score was 7.59±3.97, and the mean percentage was 37.95±19.87 (Table 2).

| Knowledge Score | Score Range | Pre-test |
|-----------------|-------------|----------|
|                 | Frequency   | Percentage|
| Poor            | 0-25% (1-5) | 32       | 32%     |
| Average         | 26-50% (6-10) | 47    | 47%     |
| Good            | 51-75% (11-15) | 16  | 16%     |
| Excellent       | 76-100% (16-20) | 5   | 5%      |
| Minimum         | 2            |          |
| Maximum         | 18           |          |
| Mean            | 7.59±3.97    |          |
| Mean%           | 37.95±19.87  |          |

**TABLE 2: Assessment of pre-test knowledge score**

In the post-test, 64% of oncology nurses scored well, and 35% had excellent knowledge. The minimum score in the post-test was 10, and the maximum was 19. The mean was 14.23±2.50, and the mean percentage obtained was 71.15±12.50 (Table 3).
TABLE 3: Assessment of post-test knowledge score

In the pre-test, 46% of staff nurses had average, 24% had poor, 20% had good, and 10% had excellent practice scores. The minimum practice score was three, and the maximum was 23. The mean was 10.69±5.35, and the mean percentage was 44.54±22.30 (Table 4).

| Knowledge Score | Score Range   | Post-test |          |          |
|-----------------|---------------|-----------|----------|----------|
|                 |               | Frequency | Percentage|
| Poor            | 0 – 25% (1-5) | 0         | 0        |
| Average         | 26 – 50% (6-10) | 1   | 1%       |
| Good            | 51- 75% (11-15) | 64  | 64%      |
| Excellent       | 76-100% (16-20) | 35  | 35%      |
| Minimum         |               | 10       |          |
| Maximum         |               | 19       |          |
| Mean            |               | 14.23± 2.50 | 71.15 ± 12.50 |

TABLE 4: Assessment of pre-test practice score

In the post-test, 41% of oncology nurses had a good, 59% had an excellent, and 41% had a good practice score. The minimum practice score was 13, and the maximum was 24. The mean score was 18.44±2.94, and the mean percentage was 76.83±12.28 (Table 5).

| Practice Score | Score Range | Pre-test |          |          |
|----------------|-------------|----------|----------|----------|
|                |             | Frequency | Percentage|
| Poor           | 0-6         | 24       | 24%      |
| Average        | 7-12        | 46       | 46%      |
| Good           | 13-18       | 20       | 20%      |
| Excellent      | 19-24       | 10       | 10%      |
| Minimum        |             | 3        |          |
| Maximum        |             | 23       |          |
| Mean           |             | 10.69 ± 5.35 | 44.54 ± 22.30 |

2022 Bawankar et al. Cureus 14(11): e31217. DOI 10.7759/cureus.31217
### TABLE 5: Assessment of post-test practice score

The comparison between pre-test and post-test knowledge and practice scores of oncology nurses. The calculated 't' value, i.e., 14.98, is much higher than the tabulated value at a 5% significance level for the overall knowledge, which is a statistically acceptable significance level. The tabulated value for n=100-1, i.e., 99 degrees of freedom, was 1.98. The estimated 't' value, i.e., 12.03, is much higher than the calculated value at a 5% significance level for the overall practice score, which is a statistically acceptable significance level. Hence it is statistically interpreted that the nursing protocol regarding CIN among oncology nurses was effective. Thus, the H1 is accepted (Table 6).

| Practice Score | Score Range | Post - test |
|----------------|-------------|-------------|
|                | Frequency   | Percentage  |
| Poor           | 0           | 0           |
| Average        | 0           | 0           |
| Good           | 41          | 41%         |
| Excellent      | 59          | 59%         |
| Minimum        | 13          |             |
| Maximum        | 24          |             |
| Mean           | 18.44 ± 2.94|             |
| Mean%          | 17.83 ± 12.28|            |

### TABLE 6: Association of pre and post-test knowledge and practice score

The nurses give care to the patient appropriately as feedback collected from the patient shows that nursing care is effective and fever is reduced. Irritation is reduced after catheter care, and they follow the standard nursing protocol, which helps them reduce chemotherapy-induced neutropenia (Table 7).
| Sr no. | Nursing action                                                                 | agree          | disagree |
|-------|---------------------------------------------------------------------------------|----------------|----------|
| 1     | Detailed history regarding chemotherapy-induced neutropenia taken               | 50(100%)       | 0(0%)    |
| 2     | Physical examination done properly                                              | 50(100%)       | 0(0%)    |
| 3     | Temperature, blood pressure, oxygen saturation checked properly and management of fever and blood pressure done properly | 50(100%)       | 0(0%)    |
| 4     | All investigation done                                                          | 50(100%)       | 0(0%)    |
| 5     | Before and after doing the procedure nurses do handwashing or use sanitizer     | 47(94%)        | 3(6%)    |
| 6     | Oral care is given thrice a day and helps you to prevent mouth ulcers and mouth odor | 48(96%)        | 2(4%)    |
| 7     | Intravenous line dressing is changed every 4 hourlies                           | 47(94%)        | 3(6%)    |
| 8     | Proper Indwelling catheter care is provided which helps you to prevent irritation | 47(94%)        | 3(6%)    |
| 9     | Nurses wear masks and gloves before giving care                                 | 45(90%)        | 5(10%)   |
| 10    | Fever and infection reduced after giving care                                   | 41(82%)        | 9(18%)   |
| 11    | Restricted animals near them because they may cause infection                   | 41(82%)        | 9(18%)   |
| 12    | Avoided keeping fresh or dried flowers and plants in the room                   | 37(74%)        | 13(23%)  |
| 13    | The avoided crowd only one or two visitors should allow for meeting at a time   | 50(100%)       | 0(0%)    |
| 14    | Given information regarding the prevention of infection you and your relative   | 49(99%)        | 1(2%)    |
| 15    | Avoid contact with individuals suffering from respiratory disease               | 47(94%)        | 3(6%)    |

**TABLE 7: Feedback analysis**

The correlation between post-test knowledge and practice scores of oncology nurses. The correlation was done with the help of Pearson’s correlation coefficient, and students’ unpaired t-test was applied at a 5% significance level. Hence it is statistically interpreted that a positive correlation was established between knowledge and practice scores (Table 8).

| Overall          | Mean | SD  | Mean difference | r - value | P - value |
|------------------|------|-----|-----------------|-----------|-----------|
| Knowledge Score  | 14.23| 2.50| 4.21± 3.47      | 0.19      | 0.054 NS, p > 0.05 |
| Practice Score   | 18.44| 2.94|                 |           |           |

**TABLE 8: Correlation between knowledge score and Practice score**

The association of practice scores with age and experience in years of staff nurses. It is interpreted that the age and experience of staff nurses are statistically associated with their post-test practice scores (Table 9).
### Demographic data

| Age        | Frequency | Mean practice score | F - value | P - value |
|------------|-----------|---------------------|-----------|-----------|
| 21-30 yrs  | 35        | 19.34±2.87          |           |           |
| 31-40 yrs  | 40        | 17.30±3             |           |           |
| 41-50 yrs  | 18        | 18.83±2.81          | 3.74      | 0.014, S,p<0.05 |
| 51-60 yrs  | 7         | 19.42±0.53          |           |           |
| ≤10 yrs    | 47        | 19.53±2.70          |           |           |
| 11-20 yrs  | 42        | 16.88±2.81          |           |           |
| 21-30 yrs  | 6         | 19.72±1.48          | 12.49     | 0.0001 S,p<0.05 |
| 31-40 yrs  | 5         | 20.21±1.62          |           |           |

### TABLE 9: Association of the post-test and pretest practice score

**Discussion**

The present study aims to generate an evidence-based standard nursing protocol on CIN for oncology nurses. The study findings reveal that oncology nurses have insufficient knowledge and unsatisfactory skills before the implementation of standard nursing protocols after. This reflects that nurses require proper training, in-service program, and guidelines for caring for patients with a high risk of developing CIN.

The study is supported by a descriptive cross-sectional study conducted to evaluate nursing students’ knowledge about the management of CIN. The sample selected for the study is 230 nursing students from the nursing colleges of Saudi Arabia. The study finding reveals that nursing students have a poor knowledge mean of 10.1. The bridging students had higher Score M = 12.6 & SD = 9.8 the regular students had M = 9.8 &SD = 5.5, [t = 2.9, df = 38.9, p = 0.006]; Students who had previous training about Neutropenia [M = 11.6, SD = 5.0] had higher knowledge than the students who did not get any training previously [M = 9.5, SD= 5.6][t= - 2.75, df= 154, p= 0.007]. The study concluded that it is essential to improve nurses’ quality of care and knowledge regarding neutropenia management [13].

A descriptive study supports the study to assess the knowledge of preventing infections in patients undergoing chemotherapy among student nurses. Non-probability purposive sampling technique was used, and 60 samples were selected for data collection. 50% of subjects were in the age group of below 20 years, and females were 95%. Among 60 students 40(66.7%) had adequate knowledge 20(33.3%) had inadequate knowledge. The mean score of knowledge is 40.90%. The study’s finding reveals an association between the knowledge of student nurses and selected demographic variables exposed to mass media [14].

A cross-sectional survey supports the study to evaluate nurses’ knowledge of CIN. The finding of study participants aged 54 years (78%) was female and with an undergraduate degree in nursing (95.6%). The nurses had an average knowledge mean total score is 16.4. The nurses had a post-graduation degree P = 0.045, had attended a training P = 0.011, had completed an education course on Neutropenia P= 0.07, were working in an oncology unit P = 0.002, and had to experience an oncology hospital P= 001, were having more knowledge of CIN as compare to others. The study concluded that plans for training and in-service education on CIN are other choices with a more impact on the knowledge and practice of nurses [15].

The Present study is supported by the methodological study utilized to develop a protocol for nurses and caregivers related to the prevention, early detection, and management of CIN. After analysis of different studies and review and assessing the practice of nurses and families, the first draft was prepared. Three Delphi rounds were conducted to validate the protocol by experts so that the protocol in the form of a booklet is feasible. A checklist also develops, which was used to evaluate the protocol. The protocol and checklist Content Validity Index (CVI) was 100%. Overall, Cronbach’s alpha value was 0.859. It is concluded that the study has provided valid and reliable written guidelines for nurses and caregivers concerning the prevention, early detection, and management of CIN complications [16].

**Limitations of the study**

Our study has a few limitations. Primarily, our sample size (100) was small, and the patient outcome and follow-up were not evaluated in this study.

**Strengths of the study**
Although the study was a small-scale analysis due to the availability of fewer oncology nurses in one hospital and time limitation, it showed that standard nursing protocols are important interventions that would help to increase the level of knowledge and practice among staff nurses to reduce the neutropenia, especially in the field of oncology. We also have taken the feedback, which helps us to generate evidence that nurses implementing the protocol and it helps reduce infection.

Conclusions
Designing and executing evidence-based standard nursing procedures is crucial for enhancing patient satisfaction and nurses' knowledge and practice. By providing education, information, and assessment while influencing rules and procedures, nurses can proactively manage CIN. The results of the current study confirmed this. After introducing the protocol, nurses' skills and knowledge for managing CIN patients after chemotherapy have greatly improved.

Appendices
Chemotherapy-induced neutropenia (CIN)

Standard Nursing Protocol (SNP)

Standard deviation (SD)

STRUCTURED QUESTIONNAIRE

Sample No........

INSTRUCTION

Read all questions carefully.

Select the only alternative which is most appropriate and tick mark (√) against it.

SECTION A:

Demographic data

1. Age

---------------

2. Work experience in years

---------------------------

SECTION B

Choose the appropriate answer and put a (√) mark against the option

1. In chemotherapy-induced neutropenia depletion of

   a) White blood cells
   b) Red blood cells
   c) Granulocytes
   d) Platelets

2. Neutrophils are synthesized and produced by

   a) Mesenchymal stem cell
   b) Neural stem cell
   c) Hematopoietic stem cell
3. In mild neutropenia absolute neutrophil count is
   a)  >1.0 x 10⁹
   b)  1.0-1.5 x 10⁹
   c)  0.5-1.0 x10⁹
   d)  < 0.5 x 10⁹

4. Neutropenia called as severe if it exceeds from
   a)  8 to 9 days
   b)  11 to 13 days
   c)  10 to 15 days
   d)  10 to 14 days

5. In cell-cycle-specific drugs nadir occur in
   a)  7 to 14 days
   b)  10 to 15 days
   c)  7 to 12 days
   d)  5 to 14 days

6. In children due to some cell cycle nonspecific drugs nadir occurs in
   a)  21 to 35 days
   b)  23 to 30 days
   c)  20 to 30 days
   d)  15 to 32 days

7. Disease-specific risk factors of neutropenia are
   a)  Pneumonia
   b)  Lung cancer
   c)  Chemotherapy regimen
   d)  Hypertension

8. MASCC score of ≥ 21 is considered
   a)  High risk
   b)  No risk
   c)  Mild risk
   d)  low risk

9. During high-risk assessment what do we have to assess
a) Outpatient status at the time of development of fever
b) No concomitant acute comorbid illness
c) Hepatic or renal insufficiency
d) Pneumonia or other complex infections at clinical presentation

10. During history collection review of current antibiotic regimens reveals the use of agents such as
a) Amphotericin B
b) Cephalexin
c) Ciprofloxacin
d) Sulfamethoxazole

11. In neutropenic patient during skin examination abnormalities is present
a) Contact dermatitis
b) Hives
c) Psoriasis
d) Erythema

12. In neutropenic patients during throat examination oropharynx may reveal
a) Laryngitis
b) Tonsillitis
c) Sore throat
d) Ulcers

13. In neutropenic patients chest x-ray reveals
a) Diffuse infiltrates
b) Heart-related lung problems
c) Calcium deposits
d) Blood vessels

14. Lactate test is done in neutropenic patients to diagnose
a) Lactic acidosis
b) Metabolic acidosis
c) Metabolic alkalosis
d) Lactic alkalosis

15. Medical handwashing should be done till
a) 15sec
b) 12sec
16. Neutropenic patient oral care includes rinsing of the mouth at least
   a) 4 times a day
   b) 5 times a day
   c) 3 times a day
   d) 2 times a day

17. Examination of the cannulation site is necessary to know
   a) Inflammation
   b) Swelling
   c) Phlebitis
   d) All of the above

18. Neutropenic patients should avoid crowding gatherings because
   a) It helps to maintain silence
   b) It can prevent infection
   c) It can prevent irritation
   d) It helps for better treatment

19. If fresh and dried flowers are kept inpatient room can cause a risk of
   a) Aspergillus infection
   b) Blastomycosis
   c) Neoformans infection
   d) Coccidioidomycosis

20. Portable ultrasound bladder scans are useful to detect
   a) Renal calculi
   b) Nephritis
   c) residuals urine amounts
   d) Urinary tract infection

Answer key of 20 knowledge questionnaires (Table 10).
| Sr no. | Content                                                                 | yes | No  |
|-------|--------------------------------------------------------------------------|-----|-----|
|       | Calculate the absolute neutrophil count                                 |     |     |
|       | Determine the risk and duration of neutropenia                          |     |     |
|       | Identify the nadir                                                      |     |     |
|       | Identify the risk factor for neutropenia and related events             |     |     |
|       | Calculate the mask index score for the adults                           |     |     |
|       | Assessed the neutropenic patient who are at "low-risk" and "high-risk" for medical complications |     |     |
|       | Checked ECOG performance status of patient                              |     |     |
|       | Document history of neutropenic patient                                 |     |     |
|       | Duration of the symptoms                                                |     |     |
|       | A description of the onset of symptoms                                  |     |     |
|       | Anatomic location of the symptoms                                       |     |     |
|       | Severity of the symptoms                                                |     |     |
|       | Alleviating and aggravating factors                                     |     |     |
|       | Previous history of similar symptoms                                    |     |     |
|       | Initial clinical assessment check                                        |     |     |
|       | Temperature                                                              |     |     |
|       | Pulse                                                                   |     |     |
|       | Blood pressure                                                          |     |     |
|       | Respiration rate                                                        |     |     |
|       | Oxygen saturation                                                       |     |     |
|       | Fluid balance (input and output charting)                               |     |     |

Tool II: observation checklist consists of 24 items to evaluate the practice of oncology nurses (Table 11).

Tool III: Feedback form which shows that nursing care is effective and infection is reduce (Table 12).
**Initial Investigations**

- Biochemical profile
- C-reactive protein
- Full blood count
- Peripheral blood cultures (irrespective of temperature)
- Blood cultures from venous access device including each lumen if applicable
- Serum lactic acid (if signs of ongoing clinical deterioration)
- Before and after every procedure handwashing is done
- Proper handwashing should be done till 15min
- After handwashing with alcohol-based solution dried hand till 20-30sec
- Oral care given thrice a day and if needed
- Asses the intravenous line for patency, erythema, tenderness, pain, swelling, dressing integrity and position
- Intravenous line dressing changed every 4 hourly
- Cleaned the skin around the IV line with chlorhexidine solution
- Uses 0.9 % normal saline for a flush of the intravenous line after every drug administration
- Written date of IV Cannulation
- Proper Indwelling catheter care provided to patient
- Appropriately secure the catheters
- Maintained good hygiene at the catheter-urethral interface
- Remove catheters when no longer needed

**TABLE 11: Observation checklist**

[17]
Sr no. | Nursing action                                                                                                                                                                                                 | agree | disagree |
--- | --- | --- | --- |
1   | Detailed history regarding chemotherapy-induced neutropenia taken |    |    |
2   | Physical examination did properly |    |    |
3   | Temperature, blood pressure, oxygen saturation checked properly and management of fever and blood pressure done properly |    |    |
4   | All investigation done |    |    |
5   | Before and after doing the procedure nurses do handwashing or use sanitizer |    |    |
6   | Oral care is given thrice a day and helps you to prevent mouth ulcers and mouth odor |    |    |
7   | Intravenous line dressing is changed every 4 hourlies |    |    |
8   | Proper Indwelling catheter care is provided which helps you to prevent irritation |    |    |
9   | Nurses wear masks and gloves before giving care |    |    |
10  | Fever and infection reduced after giving care |    |    |
11  | Restricted animals near them because they may cause infection |    |    |
12  | Avoided keeping fresh or dried flowers and plants in the room |    |    |
13  | The avoided crowd only one or two visitors should allow for meeting at a time |    |    |
14  | Given information regarding the prevention of infection you and your relative |    |    |
15  | Avoid contact with individuals suffering from respiratory disease |    |    |

**TABLE 12: Feedback form**

**Additional Information**

**Disclosures**

**Human subjects:** Consent was obtained or waived by all participants in this study. Institutional Ethical Committee issued approval DMIMS(DU)/IEC/2021/282. Evidence Generation of Standard Nursing Protocol on Chemotherapy-Induced Neutropenia Among Staff Nurses. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

**References**

1. Badimon L, Chagas P, Chiva-Blanch G: Diet and cardiovascular disease: effects of foods and nutrients in classical and emerging cardiovascular risk factors. Curr Med Chem. 2019, 26:5639-51. 10.2174/09298673266170428103206
2. Jamison DT, Feachem RG, Makgoba MW: Disease and Mortality in Sub-Saharan Africa . The International Bank for Reconstruction and Development / The World Bank; 2006, Washington; 2006.
3. Doshi BD, Pandya M, Shah CA, Gupta AK, Makwana MV: Chemotherapy-induced neutropenia in cancer patients with solid tumors in India. Der Pharmacia Lettre. 2012, 4:584-90.
4. Cancer. (2022). Accessed: October 28, 2022: https://www.who.int/news-room/fact-sheets/detail/cancer.
5. Amjad MT, Chidharla A, Kasi A: Cancer Chemotherapy. StatPearls Publishing, Treasure Island (FL); 2022.
6. A Close Look at Neutropenia among Cancer Patients — Risk Factor and Management | IntechOpen. . (2022). Accessed: October 11, 2022: https://www.intechopen.com/chapters/48520.
7. Coughlan M, Healy C: Nursing care, education and support for patients with neutropenia . Nurs Stand. 2008, 22:35-41. 10.7748/nst.22.46.35.e6598
8. Fortner BV, Schwartzberg L, Tauer K, Houts AC, Hackett J, Stolshek BS: Impact of chemotherapy-induced neutropenia on quality of life: a prospective pilot investigation. Support Care Cancer. 2005, 13:522-8. 10.1007/s00520-004-0757-4
9. Methven C: Effects of chemotherapy-induced neutropenia on quality of life: patients undergoing therapy can develop neutropenia, which can delay further treatment. It is vital that nurses understand the physical, psychological and cost implications to enable them to support patients. Cancer Nursing Practice. 2010, 9:

10. White N, Maxwell C, Michelson J, Bedell C: Protocols for managing chemotherapy-induced neutropenia in clinical oncology practices. Cancer Nurs. 2005, 28:62-9. 10.1097/00002920-200501000-00009

11. Ginex PK, Dickman E, Thomas B, Tucker S, Guo J, Gallagher-Ford L: Evidence-based practice in oncology nursing: Oncology Nursing Society survey results. Clin J Oncol Nurs. 2021, 25:282-9. 10.1188/21.CJON.282-289

12. Swanson JA, Schmitz D, Chung KC: How to practice evidence-based medicine. Plast Reconstr Surg. 2010, 126:286-94. 10.1097/PRS.0b013e3181dc54ee

13. Al Qadire M, Ballad CA, Al Omari O, Alkhalileh M, Sharour LA, Khalaf A, Aljezawi M: Student nurses’ knowledge about the management of chemotherapy-induced neutropenia: multi-national survey. Nurse Educ Today. 2021, 105:105053. 10.1016/j.nedt.2021.105053

14. Vijayan A: Knowledge regarding prevention of infections in patients receiving cancer chemotherapy among nursing students. Int J Health Sci. 2019, 7:104-109.

15. Al Qadire M, Ballad CA, Aljezawi M, et al.: Nurses’ knowledge of chemotherapy-induced neutropenia and its management: a cross-sectional survey. J Cancer Res Clin Oncol. 2022, 10.1007/s00432-022-04140-9

16. Kumar P, Kaur R, Kaur S, Trehan A, Kapoor R: Development of a protocol for nurses and caregivers related to prevention, early detection and management of chemotherapy induced neutropenic complications. J Res Dev Nurs Midw. 2020, 10.53698/NRF0266

17. Smith L, Woolery M: SOP: care of the neutropenic patient. NIH. 2017, 7.

18. Oncology Neutropenia Policy: Canterbury District Health Board. https://edu.cdhb.health.nz/Hospitals-Services/health-professionals/Cytotoxic-Biotherapy/Documents/Oncology%20Neutropenia....