

Development of Tools and Processes to Improve Treatment Times in Patients With Febrile Neutropenia

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Despite medical advances, febrile neutropenia remains a potentially life-threatening emergency for patients with cancer undergoing chemotherapy. A current literature review found only two oncology nursing studies addressing timeliness of antibiotic administration during a febrile neutropenic episode. Anecdotal patient reports and chart audits reflected up to a seven-hour delay in antibiotic administration for patients with febrile neutropenia presenting to the study hospital's emergency department. This article describes a multidisciplinary best practice model with tools developed for achieving timely recognition of febrile neutropenia and a one-hour benchmark for antibiotic administration at any point of entry to the hospital. Collaboration between the cancer center and emergency department provided a vehicle for critically analyzing current practice and developing effective throughput pathways. The Neutropenic Fever Team process reduced throughput to an average of 53 minutes for patients with febrile neutropenia. Educational tools were developed and used to reinforce what patients and families can do to reduce the risk of life-threatening complications. Nurses are encouraged to implement this best practice model in different settings and to investigate how throughput processes and educational tools improve clinical outcomes for this high-risk population.

Neutropenia is the most common dose-limiting toxicity of chemotherapy treatments in patients with cancer (Nirenberg et al., 2006). Complications from chemotherapy-induced neutropenia can significantly effect morbidity and mortality (Nirenberg et al., 2006). All patients receiving myelosuppressive chemotherapy are at risk for developing febrile neutropenia—marked by a fever of 38.1°C or higher and an absolute neutrophil count (ANC) lower than 500/mm³—which may quickly lead to sepsis, septic shock, and death. Clinicians' prompt assessment and treatment of symptoms of febrile neutropenia provide the best defense against this negative outcome. According to Nirenberg, Mulhearn, Lin, and Larsen (2004), "About 70%–75% of

At a Glance

- ◆ Multidisciplinary team collaboration increased throughput of patients with cancer presenting with febrile neutropenia.
- ◆ A Neutropenic Fever Team process with defined roles and responsibilities for each member enabled the cancer center to achieve a one-hour benchmark for antibiotic initiation.
- ◆ Oncology nurses need to offer patients tangible education and take-home tools to reinforce what to do when potentially neutropenic to minimize delays in seeking medical attention and the risk of life-threatening sepsis.

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Case Study: Hospital Process of Supporting a Patient With Cancer Presenting With Febrile Neutropenia

- Patient** D.V., a 67-year-old man, completed his second cycle of hyperCVAD (cyclophosphamide, vincristine, doxorubicin, and dexamethasone) for mantle-cell lymphoma. D.V. was experiencing post-treatment fatigue, fingertip numbness, and insomnia. On day eight post-treatment, his wife reported increased weakness in D.V.
- Admittance** D.V. was seen by the cancer center triage nurse, who obtained a complete blood count with differential, revealing an absolute neutrophil count of 0/mm³ and oral temperature of 100.8°F. She notified the oncologist and received orders to admit D.V. to the hospital for antibiotics.
- First hour** The nurse feared that failure to administer D.V.'s first antibiotic prior to admission might result in a delay of hours to receive the vital medication, increasing his risk for sepsis and septic shock. As a result, the oncology nurse performed an individualized risk assessment, established IV access, obtained blood cultures and electrolytes, received antibiotic orders, and initiated D.V.'s first antibiotic within 50 minutes of arrival.
- Outcome** D.V. was admitted after a second ordered antibiotic was initiated. D.V. received empiric antibiotics during his four-day hospitalization. He was discharged home following a recovered white blood count (4.1 K/ul) and reported feeling great. D.V. was fortunate, presenting to a cancer center where processes existed for treating patients at risk for neutropenic fever.

deaths from acute leukemia and 50% of deaths in patients with solid tumors are related to infection secondary to neutropenia" (p. 711). Patients admitted to the hospital with neutropenic fever may experience an average length of stay of 9.2 days and costs for inpatient and subsequent care reported may average \$14,407 (Nirenberg et al., 2006; Weycker et al., 2008).

In patients with neutropenia, fever may be the only sign of infection (Robbins, 2007), yet Nirenberg et al. (2006) found patients with cancer with a fever of 38°C or higher waited a mean time of 21 hours before calling or going to the emergency department (ED), despite education. Oncology nurses need to look beyond their point of contact in providing anticipatory guidance to ensure the safe passage of patients following chemotherapy. Potential risk for developing life-threatening sepsis or septic shock increases as the standard of care, prompt initiation of antibiotics, is delayed (Nirenberg et al., 2004, 2006). This topic is a priority, as barriers to achieve this goal continue to exist.

Identification of a Need

Cleveland Clinic Cancer Center at Hillcrest Hospital in Mayfield Heights, OH, recognized obstacles for the timely treatment of patients with cancer experiencing neutropenic fever at any point of entry to the hospital through anecdotal experiences and chart reviews. Research revealed delays up to seven hours when high-risk patients with febrile neutropenia presented to an ED. The project included collaboration from a multidisciplinary team (i.e., ED, cancer center, infectious disease, pharmacy, and quality staff) for quick treatment and adoption of a one-hour benchmark for initiation of antibiot-

ics from any point of entry to the hospital. Prompt treatment required development of standards of practice, throughput processes, and patient and staff education via coordination and communication with the ED.

Multidisciplinary Team Project

The team process for timely treatment focused on the ED and cancer center. A current shift of cancer treatment care has created a critical need to institute a rapid response process for patients with cancer with febrile neutropenia who present to EDs (Nirenberg et al., 2004). Hillcrest Hospital found similar anecdotal delay experiences at Dartmouth-Hitchcock Medical Center in New Hampshire, where the mean cycle time ranged from 70–254 minutes, depending on patients' point of entry into the hospital's system—identifying a clear need for improvement (Baltic, Schlosser, & Bedell, 2002). In addition, at an ED in New York, NY, the median waiting time before antibiotics were given was 210 minutes (Nirenberg et al., 2004). After conducting an initial literature review, the team adopted a 60-minute standard from Dartmouth-Hitchcock Medical Center as a benchmark for antibiotic administration and took it one step farther by developing a best practice throughput model.

Team practices were as follows.

- Identified consistent symptom criteria to define neutropenic fever (temperature higher than 100.5°F [38.1°C], chemotherapy in prior 7–14 days)
- Added a neutropenic fever rule-out-sepsis track to the ED triage sheet (criteria, ANC lower than 500/mm³)
- Created standard neutropenic fever admission orders
- Designed Chemotherapy Neutropenic Fever Alert magnets and wallet cards, which included steps to follow for symptomatic patients presenting at ED for prompt triage.

Neutropenic Fever Team Process

The outpatient cancer center has an advantage in recognizing neutropenic symptoms, as patients and treatment may be familiar to staff. Chart audits revealed this patient population often presented to the ED during open hours of the cancer center, as patients remembered through education that neutropenic fever was an emergency. The Neutropenic Fever Team process enables quick rerouting of patients from the ED to the cancer center for timely diagnosis and treatment (i.e., initiation of antibiotics in one hour, if applicable) (see Figure 1).

Cancer center staff are assigned to the Neutropenic Fever Team daily, including secretaries, medical assistants, RNs, pharmacists, and physicians, whose roles and duties were identified clearly (see Figure 2). Staff tools include standard orders, the process checklist, documentation guidelines, and data collection sheets. The private cancer center neutropenic bay room contains all supplies necessary to treat patients.

Throughput process and identification of team members are key to successful antibiotic administration and positive patient outcomes. Cancer center staff work together to follow processes to prevent complications and increase quality of care. Unscheduled urgent patient visits are met with staff members rushing to assess and appropriately administer treatment. Patients verbalize appreciation for the urgency with which they are treated.

Targeted Education

Professional practice standards and patient education materials address chemotherapy-induced neutropenia with a focus on development, risk assessment, prevention, signs and symptoms, management with antibiotics, and impact on morbidity and mortality (National Comprehensive Cancer Network [NCCN], 2011). Additional needs include directions on what to do when a patient with cancer becomes febrile following a course of chemotherapy (Nirenberg et al., 2004, 2006). Chemotherapy-induced bone marrow suppression reduces neutrophils and the body's ability to counteract infectious organisms. Fever must be recognized as an emergency, and antibiotics initiated quickly, to prevent sepsis, septic shock, and death (NCCN, 2011; Robbins, 2007).

Oncology nurses provide staff, patients, and families with critical information about the risk and timely management of neutropenic fever. The first educational target included the ED as a point of contact for febrile patients with cancer when the cancer center is closed. The ED clinical nurse specialist reviewed the following with all staff.

- Neutropenic fever as a life-threatening emergency
- Neutropenic fever standard physician order-sets outlining priority assessment and interventions
- ED triage guide to reinforce febrile neutropenia rapid triage response
- Immediate feedback to individuals about their throughput of patients with febrile neutropenia presenting to the ED

Physician education also was provided. An infectious disease physician reviewed neutropenic fever, potential sequelae, assessment, and timely management with antibiotics using standard order-sets with ED physicians. In addition, a memo with standard order-sets was mailed to all oncologists and attending physicians.

In-services also were held for the cancer center and inpatient oncology staff by the oncologist and oncology clinical nurse specialist. Nursing supervisors received information to increase understanding of the needs and priorities of patients with febrile neutropenia. Finally, laboratory staff received information regarding the critical timeline to confirm ANC in patients with cancer presenting to the ED with febrile neutropenia.

The project team and cancer center staff examined current patient education about neutropenia, including reinforcing precautions and possible signs of infection. Patients at risk received thermometers and directions for temperature monitoring following chemotherapy. New patient and family tools were developed, including red flag magnets and pocket or wallet cards, which were distributed during initial treatment education. The tools instruct patients to call the oncologist immediately if they develop a fever of 100.5°F (38.1°C) or higher.

Communication and Collaboration With the Emergency Department

The cancer center framed a project around a major principle from the Oncology Nursing Society's *Statement on the Scope and Standards of Oncology Nursing Practice* to provide patients with optimal care, specifically Standard VI, Collaboration, under the Standards of Professional Performance (Brant & Wickham, 2004). Standards illustrate competent behavior, the role of the professional oncology nurse, and criteria to provide patients with effective care. Oncology nurses must use all resources necessary and

work with healthcare partners to coordinate safe patient care. The cancer center recognized the need to collaborate with the ED to effectively treat patients with neutropenic fever. The cancer center worked closely with the ED to communicate the importance of quickly treating these patients. Unfamiliar with patients with cancer experiencing febrile neutropenia, the ED staff was open and willing to participate in a quality project. If a patient with cancer presented to the ED within parameters of possible

If the patient walks in: The secretary notifies the charge nurse via phone and the charge nurse makes the decision to activate the team. *Go to step 3 below.*

If the patient calls: The patient calls with possible neutropenic symptoms. The secretary calls the charge nurse and creates a staff message routed to the charge nurse. The charge nurse calls the patient to ask key questions regarding symptoms and alerts the team that "Patient with neutropenic fever to arrive in ___ minutes." *Go to step 2 below.*

If the physician calls: The physician calls regarding the patient with neutropenic symptoms. The secretary immediately gives the call to the charge nurse, who alerts team that "Patient with neutropenic fever to arrive in ___ minutes." *Go to step 2 below.*

If the emergency room calls: *Follows steps 1–13.*

1. Secretary receives phone call from the emergency room stating, "We have a possible neutropenic risk patient." **Time:** _____
2. Secretary uses overhead page: "Neutropenic Team to front." **Time:** _____
3. Secretary alpha pages the nurse practitioner "Neutropenic Alert." **Time:** _____
4. Secretary starts a Neutropenic Process Checklist and hands it to the responder at the front desk. **Time:** _____
5. Medical assistant on the Neutropenic Fever Team transports the patient from the emergency room to the cancer center. **Time:** _____
6. Infusion nurse on the Neutropenic Fever Team gives report of current patients to the charge nurse and awaits patient arrival in assigned bay with order set and all needed supplies. **Time:** _____
7. Patient arrives in the neutropenic bay. **Time:** _____
8. Medical assistant obtains vital signs (including orthostatic), weight, and allergies, and completes medication reconciliation. **Time:** _____
9. Infusion nurse initiates IV access, obtains laboratory studies (holding red and green top tubes), and sends STAT to laboratory. **Time:** _____
10. Infusion nurse or charge nurse calls hematology and alerts personnel about possible neutropenic risk patient. **Time:** _____
11. Infusion nurse checks absolute neutrophil count (ANC) after 15 minutes, receives results, and alerts the pharmacist. **Time:** _____
12. Infusion nurse alpha pages the nurse practitioner or the Neutropenic Fever Team physician with ANC results. **Time:** _____
13. If ANC is lower than 500/mm³, temperature is higher than 38.1°C (100.5°F), and the patient has received chemotherapy in the past 14 days, initiate Neutropenic Order Set immediately. Blood cultures x 2 STAT and urine specimen obtained (do not wait for urine specimen before starting antibiotic). **Time:** _____
14. Infusion nurse starts antibiotic. **Time:** _____
15. Infusion nurse awaits additional orders from the nurse practitioner or Neutropenic Fever Team physician. **Time:** _____
16. If the patient is to be admitted, the charge nurse follows Admission Checklist, calls the inpatient oncology charge nurse with Neutropenic Alert, and orders infusion pump. **Time:** _____

Figure 1. Neutropenic Fever Throughput Process

Charge nurse: Acts as a facilitator; receives report from infusion nurse on team and alerts Admitting department if a bed is needed.

Infusion nurse: First priority is care of the neutropenic risk patient; gives report on current assignment to the charge nurse immediately. The nurse to patient ratio is 1:1 to start antibiotic administration in less than one hour, if necessary.

Medical assistant: First priority is to transfer the patient to the neutropenic bay and obtain necessary information.

Neutropenic team physician: Acts as physician champion; covers the patient for admission, if necessary, and performs the nurse practitioner's duties if off. This is typically a physician holding an examination clinic on site that day.

Nurse practitioner: Receives assessment and laboratory results from the infusion nurse and facilitates admission, if necessary.

Pharmacist: First priority is to dispense the antibiotic if the patient meets the criteria of an absolute neutrophil count lower than 500/mm³, a temperature higher than 38.1°C (100.5°F), and the administration of chemotherapy in the past two weeks.

Secretary: First priority is receiving a call for the neutropenic risk patient; also starts the Neutropenic Process Checklist.

Figure 2. Cancer Center Neutropenic Fever Team Members' Roles and Responsibilities

febrile neutropenia, ED staff immediately notified the cancer center to institute the Neutropenic Fever Team process by rerouting patient to the cancer center during open hours. When the cancer center is closed, ED staff initiate the process themselves.

Prompt attention and superior assessment skills by ED nurses contributed to immediate improvement in treatment times for at-risk patients. Every call received from the ED was a success story, even if a patient with febrile neutropenia with antibiotic administration within one hour was not the result of the call. A vulnerable patient population was treated effectively in a familiar and comfortable environment, with known, specialized nurses and trusted physicians.

Initial Outcomes

Initial results from 42 retrospective chart reviews for patients with cancer meeting criteria revealed ED door-to-antibiotic times improved by 22%, from a mean wait time of 138 minutes to 91.6 minutes. In addition, cancer center door-to-antibiotic times improved by 80%, from a mean wait time of 70 minutes to 52.6 minutes.

Completion of this quality improvement project has prompted Hillcrest's Cancer Center team to share information with the entire Cleveland Clinic Health System, as well as other institutions, with hope that patients with cancer everywhere may benefit from this potentially life-saving practice model.

Future Directions

As outpatient chemotherapy-treated patient volume increases, the need for prompt attention and immediate treatment for febrile neutropenia also increase. Most patients with cancer

present to the ED first with a fever, so working partnerships between the cancer center and ED are critical. Cancer centers are challenged to implement innovative processes, such as the Neutropenic Fever Team, to improve patient throughput and quality care by reaching a 60-minute benchmark for antibiotic administration. Future research should examine the throughput model presented in this article and its effect on improving outcomes for patients with cancer experiencing febrile neutropenia over a longer period of time. Tangible tools, paired with ongoing targeted education of patients, families, and healthcare workers, are keys to prompt recognition and communication about potentially life-threatening symptoms associated with neutropenia.

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