Neutropenic Fever: One Institution’s Quality Improvement Project to Decrease Time From Patient Arrival to Initiation of Antibiotic Therapy

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Neutropenic fever is an oncologic emergency requiring prompt assessment and administration of antibiotics. Although the literature does not specifically define the word “prompt,” the general belief is that the sooner antibiotics are started, the better the clinical outcome (Barber, 2001; Garcia-Carbonero & Paz-Ares, 2002; Hughes et al., 1997; Viscoli, 1998). At Dartmouth-Hitchcock Medical Center (DHMC), a 330-bed teaching hospital and tertiary care referral center in Lebanon, NH, nurses and physicians expressed concern about the length of time adult inpatients were waiting before receiving their initial dose of antibiotics on the hematology and oncology units. This was a concern because during the first 48 hours of infection in untreated patients with severe neutropenia, mortality rates have been reported to exceed 50% (Ellerhorst-Ryan, 2000; Rolston & Brody, 2000; Segal, Walsh, & Holland, 2001).

Discussions with inpatient care providers generated several hypotheses about what was causing these delays in antibiotic administration. To better understand this phenomenon, a quality improvement project was initiated to determine whether the staff’s perceptions were accurate.

**Cycle Time**

Quality improvement literature defines “cycle time” as the length of time it takes to complete a task (Espanosa, 2001; Langley, Nolan, Nolan, Norman, & Provost, 1996). In an effort to determine whether systems could and should be improved, a retrospective chart review was conducted. The purpose of the chart review was to determine the cycle times from the arrival or diagnosis of febrile neutropenia for patients with the condition to the initiation of antibiotic therapy. Cycle times were reviewed for each point of entry into the healthcare system (i.e., hematology and oncology outpatient clinic, emergency department [ED], and direct admissions to the hematology and oncology inpatient units). Thirty-one patients in the hematology and oncology units with the principal discharge diagnosis of agranulocytosis (International Classification of Disease, Ninth Revision [ICD-9], Code 288.0) or fever (ICD-9, Code 780.6) and the secondary diagnosis of agranulocytosis were identified during a five-month period. Patients were excluded on the basis of a white blood cell count greater than or equal to 4,000/mm² or absolute neutrophil count greater than 1,000/mm³, admission to an inpatient unit other than hematology and oncology, and antibiotic therapy initiated at the transferring institution. Twenty-two patients met the inclusion criteria. Mean cycle times ranged from 70–254 minutes depending on the patients’ points of entry into the DHMC system (see Table 1).

Clearly, the facility had room for improvement. A multidisciplinary team of physicians (representing the oncology, hematology, and infectious disease departments), inpatient staff nurses, an oncology clinical nurse specialist,
an oncology nursing director, pharmacists (oncology and infectious disease), and a liaison from the quality improvement department came together to form a task force to develop ways to reduce cycle time on the inpatient unit.

### Quality Improvement Measures

Multiple quality improvement tools and techniques were used to identify problems. Flow-charting examined the entire current admission process for patients with febrile neutropenia. Additionally, a cause-and-effect diagram identified other possible causes of treatment delay. The diagram helped illustrate how methods, materials, machinery, and people can affect the overall quality of a process. Three areas to improve the system were identified: streamline the inpatient order process, ensure that inpatient staff are notified when a patient with febrile neutropenia is admitted, and develop febrile neutropenic antibiotic guidelines for interns and residents in the ED.

To streamline the order-writing process for patients with febrile neutropenia, a standardized provider order form was created. This form was designed in a quick and easy format that included orders for blood cultures, urine culture and sensitivity, chest x-ray, IV hydration, and other treatments, such as frequency and type of laboratory draws and as-needed medications for fever. The pre-existing antibiotic order form was labeled with a bright orange “stat” sticker to remind the team that antibiotics must be started immediately. It also provided an unmistakable visual clue for pharmacists.

The team created a standardized order sheet and an algorithm of the admission process for patients with febrile neutropenia and set a standard of 60 minutes from patient arrival to the inpatient unit to initiation of antibiotics (see Figures 1 and 2). Approximate expected start times for each step in the process were incorporated into the algorithm. The algorithm also delineated specific responsibilities of each team member. For example, pharmacists were expected to notify the inpatient unit when sending antibiotics via pneumatic tube to decrease the risk of the unit staff forgetting to check the tube.

A copy of the algorithm, provider order sheet, and an antibiotic order form with an orange stat sticker on it comprised the febrile neutropenia admission packet. Packets were preassembled and stocked on the inpatient unit, and all staff members were introduced formally to the new system. Nurse practitioners, interns, residents, fellows, and attending physicians were made aware of the packet, the 60-minute cycle time standard, and their role in the process. A letter explaining the changes was also sent to all house staff. The admitting department was notified that all patients with febrile neutropenia needed to be assigned emergent status and that emergent status triggered the process outlined in the algorithm. Finally, a letter was sent to senior nurse executives of the regional hospitals that transferred patients to DHMC, requesting that a nursing report be called to the inpatient unit as soon as the decision was made to transfer a patient. This enabled inpatient nurses to alert house staff that a patient with febrile neutropenia was being transferred and to have a preassembled packet ready for use.

Following implementation of these strategies, the oncology clinical nurse specialist completed chart reviews on every patient with febrile neutropenia admitted to the inpatient unit. Immediate feedback was given to each member of the inpatient team involved in the admission process, regardless of the outcome, and a handwritten thank-you note was sent when the cycle time of one hour or less was achieved.

### Table 1. Time to Antibiotic Administration

<table>
<thead>
<tr>
<th>Location</th>
<th>Antibiotics Administered at First Location of Care</th>
<th>Antibiotic Administration Deferred to Second Location of Care/Inpatient Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outpatient unit</td>
<td>70 minutes</td>
<td>233 minutes</td>
</tr>
<tr>
<td></td>
<td>n = 3</td>
<td>n = 2</td>
</tr>
<tr>
<td>Emergency department</td>
<td>107 minutes</td>
<td>254 minutes</td>
</tr>
<tr>
<td></td>
<td>n = 6</td>
<td>n = 7</td>
</tr>
<tr>
<td>Inpatient unit</td>
<td>188 minutes</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>n = 4</td>
<td></td>
</tr>
</tbody>
</table>

### Figure 1. Physician’s Order Sheet for Patients With Febrile Neutropenia

Note: Figure courtesy of Dartmouth-Hitchcock Medical Center. Reprinted with permission.
Figure 2. Dartmouth-Hitchcock Medical Center Direct Admission Process—Neutropenic Fever Algorithm

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Results

Since the changes were implemented, quantitative and qualitative improvements have been evident. Chart reviews reveal a nearly 65% reduction of the cycle time for patients arriving to and receiving their first dose of antibiotics on the inpatient unit (see Figure 3). However, the patients that were admitted to the inpatient unit from the clinic or through the ED, without receiving their first doses of antibiotics in either of these locations, had the longest cycle times. Initially, the team assumed that having the first dose of antibiotics available for nurses to mix and administer was critical in decreasing cycle time. However, the findings dispelled this notion. Pharmacy processing time did not contribute to delays in antibiotic administration. One change that did make a difference was the use of the stat sticker on the antibiotic order sheet, which was instrumental in decreasing cycle times for patients with febrile neutropenia admitted to the inpatient unit. The use of standard orders and order sheet should be an ongoing need because of staff and personnel changes.

Instead of waiting for three to six months to see if process changes resulted in improvements, the team used concurrent case reviews. These case-by-case reviews were instrumental in reinforcing and applauding process and behavioral changes, identifying additional learning opportunities, improving the process for future patients, and ultimately reducing cycle times.

Since the implementation and evaluation of the admission algorithm and accompanying order sheet for patients with febrile neutropenia, general guidelines for initiation of antibiotic therapy for the patients are being developed for use in the ED. Continuing education and reinforcement of the use of the algorithm and order sheet should be an ongoing need because of staff and personnel changes.

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References


For more information on this topic, visit the following Web sites:

University of Iowa: Neutropenic Fever Slide Show
http://pharmacy.uiowa.edu/currentstu/class%20slides/Neutropenic%20Fever.pdf

Medical Housestaff Manual: Neutropenic Fever

Management of Fever in Neutropenic Cancer Patients: Review Questions
www.turner-white.com/pdf/HP_feb00_class%20slides/Neutropenic%20Fever.pdf

These Web site are provided for information only. Hosts are responsible for their own content and availability. Links can be found using ONS Online at www.ons.org.

Rapid Recap

Neutropenic Fever: One Institution’s Quality Improvement Project to Decrease Time From Patient Arrival to Initiation of Antibiotic Therapy

• Quality improvement projects can be used to examine and improve clinical procedure and care.
• “Cycle time” refers to the time needed to complete an activity and can be used as a tool for measuring the time from procedure initiation to completion.
• One example of an area in which quality improvement projects can be used in oncology is in decreasing the amount of time from patient arrival to initiation of antibiotics for patients experiencing chemotherapy-induced neutropenia.