

# A nurse-led protocol improves the time to first dose intravenous antibiotics in septic patients post chemotherapy

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## Abstract

**Purpose** Neutropenic sepsis is a time-dependent emergency with early interventions shown to improve outcomes. Broad spectrum intravenous antibiotic administration is the initial therapy in patients with suspected neutropenic sepsis. Compliance with early antibiotic administration in febrile neutropenia patients is poor. Innovations have been trialled to improve the time to first dose intravenous antibiotics in patients with suspected neutropenic sepsis. Consideration of extending first dose intravenous antibiotic prescribing to trained nursing staff may improve performance in this key standard.

**Methods** A retrospective analysis was performed at a specialist oncology hospital in the North West of England from January 1st 2015 to January 31st 2016. The nurses on the Medical Admissions Unit (MAU) have been given the responsibility of assessing patients presenting with fever post chemotherapy including prescribing and administering the first dose of intravenous antibiotics with the aim of improving the speed of this intervention.

**Results** During the study period, 697 patients presented to the MAU with suspected sepsis post chemotherapy. Six hundred seventy-two (96.4 %) patients received their first dose of intravenous antibiotics within 60 min of presentation to the MAU. Of this group, 323 (48.1 %) were administered antibiotics within 15 min of arrival. Of the 25 (3.6 %) patients who did not receive antibiotics within 1 h, root cause analysis revealed the reason in 23 (92 %) patients was an inability to ascertain intravenous access.

**Conclusion** Nurse-led protocols are an effective, safe, and sustainable method for achieving early antibiotic administration in patients with suspected febrile neutropenia. This is a key component of ensuring improved outcomes for this cohort of patients.

**Keywords** Neutropenia · Sepsis · Time to antibiotics · Nurse-led · Chemotherapy

## Introduction

Sepsis is a time-dependent emergency with early interventions shown to improve outcomes [1–3]. Sepsis is more prevalent in patients with cancer. Neutropenic sepsis, in particular, has high mortality rates and prolonged inpatient hospital stays [4–6].

Broad spectrum intravenous antibiotic administration is the initial therapy in patients with suspected febrile neutropenia. The American Society of Clinical Oncology and National Institute of Clinical Excellence (NICE) guidelines recommend “immediate” administration of first dose intravenous antibiotic in patients with suspected neutropenic sepsis [7, 8]. A prolonged time to antibiotic administration is associated with poor outcomes in patients with neutropenic sepsis [9–11].

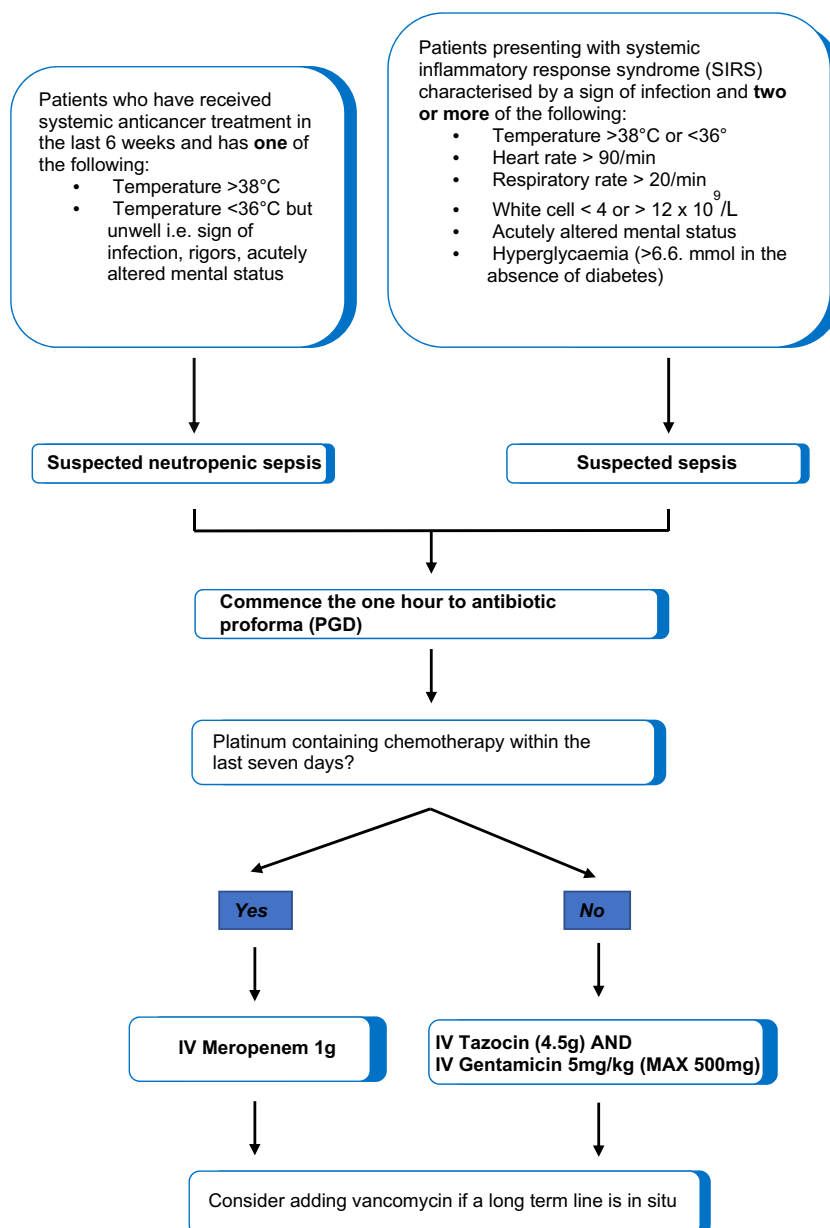
Compliance with early antibiotic administration in febrile neutropenia patients is poor [12, 13]. A 2011 national UK audit demonstrated that only 26 % of patients with neutropenic sepsis received initial antibiotics within 1 h [13].

Innovations have been trialled to improve the time to first dose intravenous antibiotics in patients with suspected neutropenic sepsis [14, 15]. Consideration of extending first dose intravenous antibiotic prescribing to trained nursing staff may improve performance in this key standard.

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Fig. 1 PGD protocol



## Methods

A retrospective analysis was performed at a specialist oncology hospital in the North West of England from January 1st 2015 to January 31st 2016. The hospital has a medical admissions unit (MAU) which receives patients via a number of access points including directly from the hospital patient hotline, outpatient clinics and as tertiary referrals from other hospitals.

The nurses on the MAU have been given the responsibility of assessing patients presenting with fever post chemotherapy including prescribing and administering the first dose of intravenous antibiotics with the aim of improving the speed of this intervention. This responsibility is governed by a policy known as a patient group directive (PGD) and there are

defined criteria for patients to meet PGD (see Fig. 1). Nursing staff on the MAU undergo training to ensure they are competent to perform PGD administration of intravenous antibiotics and this is revalidated on a yearly basis. Patients who do not receive the first dose of intravenous antibiotics within 1 h of arrival to the MAU are subject to a root cause analysis to determine the causative factors.

Basic demographic data was collected for each patient who presented with sepsis (based on SIRS criteria) alongside site of primary cancer and the time to first dose of intravenous antibiotic. Patients were excluded if they received their first dose of intravenous antibiotics prior to arrival on the MAU. The primary outcome measure was compliance with the 1-h door-to-needle time for first dose intravenous antibiotics.

**Table 1** Patients demographics and site of malignancy

	Number of patients	
	Frequency ( <i>n</i> )	Percentage (%)
Gender		
Male	259	37.1
Female	438	62.9
Total	607	100
Age		
Median (range)	60 (16–87)	
Primary malignancy		
Colorectal	103	14.8
Breast	102	14.6
Lymphoma	78	11.2
Leukaemia	72	10.3
Lung	51	7.3
Gynaecological	43	6.2
Myeloma	35	5
Sarcoma	32	4.6
Upper gastrointestinal	28	4
Skin	25	3.6
Pancreatic	23	3.3
Prostate	20	2.9
Hepatobiliary	19	2.7
Head and neck	16	2.3
Bladder	13	1.9
Renal	13	1.9
Primary CNS	10	1.4
Genitourinary	7	1
Cancer of unknown primary	7	1

## Results

During the study period, 697 patients presented to the MAU with suspected sepsis post chemotherapy. Four hundred thirty-eight (62.9 %) of the patients were female and 259 (37.1 %) male. The median age of patient was 60 (range 16 to 87). The most common malignancies presenting with fever post chemotherapy were colorectal ( $n = 103$ ; 14.8 %) and breast ( $n = 102$ ; 14.6 %). The demographic data, including site of primary tumour, are shown in Table 1.

**Table 2** Time to first-dose intravenous antibiotic

Time to 1st dose intravenous antibiotic	Number of patients	% Patients	95 % Confidence interval
Within 60 min	672	96.4	95.0–97.8
0–15 min	323	48.1	42.7–53.6
15–30 min	118	17.6	10.7–24.5
30–45 min	138	20.5	13.8–27.2
45–60 min	93	13.8	6.8–20.8
Greater than 60 min	25	3.6	–3.7–10.9

Six hundred seventy-two (96.4 %) patients received their first dose of intravenous antibiotics within 60 min of presentation to the MAU (see Table 2). Of this group, 323 (48.1 %) were administered antibiotics within 15 min of arrival. Figure 2 shows the time from presentation to first dose antibiotic administration. Four hundred forty-one (63.3 %) patients received their first dose of antibiotics within 30 min of presentation.

Of the 25 (3.6 %) patients who did not receive antibiotics within the 1-h target, root cause analysis revealed the reason in 23 (92 %) patients was an inability to ascertain intravenous access and 2 (8 %) breaches related a high volume of nurse workload on the MAU at the time of presentation. The number of breaches was too small to derive any conclusion as to whether these were related to time and day of admission.

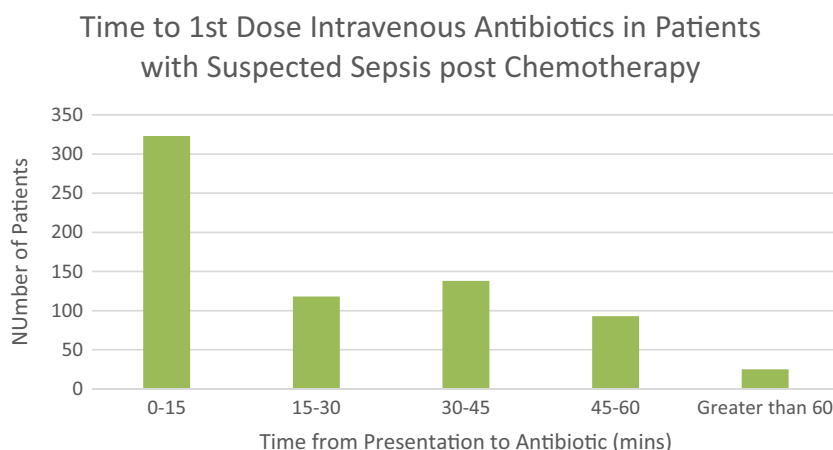
One patient received an aminoglycoside despite having recently been given a platinum-based chemotherapy. There were no other cases of adverse events from the PGD or failure to comply with the antibiotic protocol.

## Discussion

Our study suggests that a nurse-led protocol is an effective and consistent strategy for early administration of first-dose intravenous antibiotics. A total of 96.4 % of patients with suspected sepsis post chemotherapy were given antibiotics within 60 min of arrival to the MAU with 48.1 % of these patients receiving their first dose within 15 min of presentation.

Early antibiotic administration is the paradigm for the management of patients presenting with fever post chemotherapy. Despite its importance and recognition as a quality marker, many patients experience prolonged delays. A benchmarking audit in a region of Canada reported median time from triage to antibiotic administration in patients with febrile neutropenia was 5 h (range 1.23–22.8 h) [16]. A recent study demonstrated a delay of over 5 h in 20 % of patients [10]. Only 9 % of febrile neutropenia patients in a single-centre UK study received first-dose intravenous antibiotics within 1 h [17], and a national UK audit reported 26 % compliance with the “door-to-needle” target time [13].

**Fig. 2** Graph showing time to first-dose intravenous antibiotics in patients with suspected sepsis post chemotherapy



There are a number of factors which have contributed to the poor performance in the administration of first-dose intravenous antibiotic. These include a delay to the initial assessment by a doctor, an absence of a febrile neutropenia protocol, a lack of understanding of the evolution of sepsis, particularly in neutropenic patients, and the importance of early antibiotic administration among junior staff [10, 13, 18]. There may also be poor communication between the doctor and nursing staff once the antibiotics have been prescribed. Our PGD protocol circumvents a number of these factors.

Traditional practice of patient triage, awaiting initial assessment by a doctor and then treatment is not appropriate in the management of patients with febrile neutropenia. Further studies have demonstrated significant decreases in time to antibiotics with specific order sets or developing multiple Emergency Department initiatives [14, 19, 20]. Improvements in the management of patients with febrile neutropenia can be achieved with streamlining of processes and regular review of performance [15]. Further protocols with paramedic-led first-dose antibiotic administration need to be designed and studied.

The implementation of the PGD has been driven by clinical leadership and flattening of hierarchy in response to improving performance in a key area driven by national standards. The protocol was introduced with the support the MAU nursing team and senior managers within the organisation who recognised the importance of time to first dose intravenous antibiotic administration in this cohort. The empowerment facilitating this change has developed a culture of ownership and leadership in this among nursing staff. The analysis of any breaches with a root cause analysis ensures that this standard is maintained and helps identify any barriers to performance. The PGD is now embedded in the culture of the MAU.

Our study is limited by the fact it is performed in a specialist tertiary oncology unit. This means that there is an expertise among the nursing staff in managing patients with febrile neutropenia and there are less patient attendances compared to a

standard Emergency Department. However, there is clearly a scope for novel nurse-led protocols such as this to improve performance for febrile neutropenia patients attending Emergency Departments.

## Conclusion

Nurse-led protocols are an effective, safe, and sustainable method for achieving early antibiotic administration in patients with suspected febrile neutropenia. This is a key component of ensuring improved outcomes for this cohort of patients.

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## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no competing interests.

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