Clinical Utility of Routine CBC Testing in Patients with Community-Acquired Pneumonia

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The goal of this study was to identify situations in which routine complete blood count (CBC) testing could be avoided in patients with community-acquired pneumonia (CAP). This was a retrospective study of 50 patients with CAP. Vital signs, lab results, assessment and plan data, and computerized provider order entry logs were collected to determine if a lab result or clinical finding changed clinical management. Clinical stability was defined based on Patient Outcomes Research Team study criteria. There were 94 CBCs obtained after admission, of which only 6 were associated with management changes. Only two of these instances involved management changes related to patients' pneumonia, while the other cases represented chronic illnesses. Among all patients, the positive likelihood ratio of a post-admission CBC predicting a change in clinical management was low (1.12 [95% confidence interval, 0.86-1.44]). Low utility of CBC testing after admission may represent an opportunity to improve the value of care in CAP patients. *Journal of Hospital Medicine* 2017;12:336-338. © 2017 Society of Hospital Medicine

Avoiding repeated complete blood count (CBC) tests in the face of clinical and lab stability is a focus of the Choosing Wisely® initiatives launched by the American Board of Internal Medicine Foundation[1] and endorsed by the Society of Hospital Medicine.[2] However, specific scenarios in which daily morning labs can be safely avoided have not been identified. The goal of this study was to identify situations in which routine CBC testing can be avoided in patients with community-acquired pneumonia (CAP), one of the most common reasons for hospital admission.[3]

METHODS

This was a retrospective study of 50 patients with CAP discharged from our hospital between February 1, 2015 and May 1, 2015. We performed chart abstractions collecting daily vital signs, lab results, provider notes including assessments and plans (A&Ps), and order entry logs, as well as documentation indicating whether a lab result or clinical finding appeared to affect clinical management (eg, a new order or documentation of changing plans). Both escalations and de-escalations were included as management changes. For example, if the note stated "Persistent leukocytosis, add vancomycin," then the clinical action of expanded antibiotic coverage would be attributed to the CBC.

We defined clinical stability based on Definition B of the Pneumonia Patient Outcomes Research Team (PORT) study criteria.[4] We used descriptive statistics and likelihood ratios to characterize the utility of CBC testing in terms of producing clinical management changes. Likelihood ratios were calculated with the "test" representing a CBC being ordered or not ordered and the outcome being any change in management independent of whether it was due to the CBC.

RESULTS

Of 50 patients, 33 (66%) were female, the mean age was 75 years, the mean length of stay was 2.8 days, and the median CURB-65 score,[5] an estimate of mortality in CAP used for decision-making about inpatient versus outpatient treatment, was 1 (25^{th} to 75^{th} interquartile range: 1, 2); no patients had a CURB score greater than 3 (Table 1). Forty-one (82%) patients met PORT clinical stability criteria prior to discharge, and 30 (75% of stable patients) had CBCs obtained.

On days after admission, 94 subsequent CBCs were obtained. Of these CBCs, 6 (6.4%) were associated with management changes indicated in documentation or orders (Table 2). In 2 of the 6 patients, management changes were likely relevant to pneumonia. In the first case, the patient had a white blood cell count (WBC) of 15.4 on the planned day of discharge but no accompanying clinical changes. Her discharge was potentially delayed pending a repeat CBC which again showed a WBC 14.7; the patient was then discharged without any additional changes in plan. In the second case, the patient experienced new-onset altered mental status on hospital day 3 and increasing O_2 requirement with a rising WBC noted on hospital day 4. Repeat chest x-ray, repeat blood cultures, and an ultrasound for parapneumonic effusion were obtained, and the patient's symptoms and signs resolved over a period of days without changes in treatment. In the 4 other cases, available documentation suggested

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the hemoglobin abnormalities found represented chronic or incidental illnesses, specifically iron deficiency anemia, iatrogenic anemia due to fluid resuscitation and hemodilution, previously known chronic lymphocytic leukemia, and thrombocytopenia due to acute infection. In all 6 instances, CBC values improved without treatment intervention.

Among all patients, the positive likelihood ratio of CBCs obtained after admission in terms of being followed by a change in clinical management was very poor (1.12, 95% confidence interval [CI], 0.86-1.44). For clinically unstable patients, there were 64 CBCs ordered, and the likelihood ratio was similar at 0.98 (95% CI, 0.75-1.29). The positive likelihood ratio among clinically stable patients, who had 30 CBCs ordered, was still quite weak, though confidence intervals were wider (1.23, 95% CI, 0.66-2.29).

TABLE 1. Patient Characteristics

Characteristic	n (%)
Age, mean	75.2 y
Race	
White	21 (42)
Black	4 (8)
Hispanic, Asian, other	25 (50)
Length of stay	2.8 days
Smoking status	
Current	4 (8)
Former	18 (36)
Never	28 (56)
Comorbid conditions	
COPD	12 (24)
Asthma	7 (14)
CHF	5 (10)
CKD	7 (14)
CURB-65 score	
0	8 (16)
1	19 (38)
2	21 (42)
3	3 (6)
4 or 5	0 (0)

NOTE: Abbreviations: CHF, congestive heart failure; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease.

DISCUSSION

Though small, our initial study suggests the potential opportunity for savings if Choosing Wisely® recommendations for CBC testing were implemented in patients with community-acquired pneumonia.

Our study has several limitations. Note-writing practices and ordering patterns likely varied between providers, and documentation bias may play a role in our results. However, we defined whether a CBC was associated with changes in clinical decision-making or management by incorporating a number of mutually reinforcing elements of the medical record. We recognize, however, that our approach may not capture undocumented clinical issues or other cognitive (eg, reassurance of clinical resolution) reasons why CBCs were obtained.

Even with these limitations, the likelihood of a CBC value meaningfully changing clinical management among patients with CAP appears to be quite low as evidenced by the case descriptions, particularly when obtained in stable patients by PORT criteria and on the day of discharge. Whether clinical stability as measured by PORT score can be used to target patients in whom CBC testing is unnecessary is difficult to discern from our data, as the overall

TABLE 2. Complete Blood Counts and Changes in Management

Day	Initial Evaluation (Emergency Room and First Admitting Team Note)	All Days of Hospitalization (Excluding Admission Day)	Day of Discharge
Patients with CBCs ordered (n, %)	50 (100)	94 (N/A)[a]	26 (52)
CBCs with any abnormal value (n, %)	41 (82)	87 (93)	25 (96)
CBCs with any mention in note (n, %)	30 (60)	32 (34)	11 (42)
CBCs with any associated management changes (not restricted to pneumonia) (n, %)	6 (12)	6 (6.4)	2 (7.7)
Patients meeting clinical stability criteria[b] (n, %)	9 (18)	54 (N/A)[c]	41 (82)
Patients meeting clinical stability criteria and who had clinical management changes due to CBC results (n, %)	3 (33)	2 (6.7)	2 (10)
Patients not meeting clinical stability criteria and who had clinical management changes due to CBC results (n, %)[d]	3 (7.3)	4 (6.3)	0 (0)

[a]Represents total number of CBCs ordered.

[b]Clinical stability criteria are based on vital signs cutoffs for clinical stability as defined by Definition B of the PORT study.

[c]Represents total number of inpatient days that patients met vital stability criteria.

[d]Denominator n = 41 for initial evaluation; n = 64 for all days of hospitalization; n = 6 for discharge.

NOTE: Abbreviation: CBC, complete blood count.

utility of CBCs obtained after admission was quite low and the rate of changes in management was also low. However, even if CBCs are not particularly costly, unnecessary testing may produce harm in the form of prolonged length of stay, making even one unnecessary CBC potentially extremely expensive. More research involving larger-scale studies are needed to determine the "number needed to screen" for the daily CBC in CAP to determine if the cost savings from overtesting and treatment outweigh the potential benefit of a single CBC that changes management.

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