Safety of Sedation for Patients Undergoing Bone Marrow Biopsy and Aspiration While Febrile

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Abstract

Objective: To determine the risks and outcomes of providing sedation to febrile patients scheduled for bone marrow aspiration or biopsy procedures.

Patients and Methods: During the 4-year period from January 1, 2013, through December 31, 2016, data from the periprocedural courses of 12,134 consecutive patients in an outpatient procedure center at a large tertiary medical center were collected retrospectively and analyzed to determine whether febrile patients undergoing bone marrow aspiration and/or biopsy with propofol sedation present a unique patient safety risk.

Results: Eighty-four patients (0.7%) had preprocedural temperatures of greater than or equal to 38.3°C. Of these, 6 required unanticipated hospital admission for sustained hypoxemia and symptoms suggesting pneumonia. All 6 of these patients had a productive cough and room air oxygen saturations of less than 92% before their procedures. These 6 patients were diagnosed during their hospitalizations with either confirmed or presumed community-acquired pneumonia. All recovered without pulmonary sequelae. Only 2 of the other 78 febrile patients required unanticipated hospital admission, for both general weakness and dehydration.

Conclusion: Our findings suggest that patients who are febrile and who also have productive coughs and oxyhemoglobin saturations by pulse oximetry of less than 92% would be best served with outpatient evaluation of their pulmonary symptoms before undergoing their elective bone marrow aspiration procedures. In contrast, febrile patients without pulmonary symptoms fare well.

Our institution has long used deep sedation with propofol to perform ambulatory bone marrow biopsy and aspiration procedures (BMx). Despite the long track record of safety of this practice, patients presenting for BMx under propofol sedation who are acutely febrile pose a clinical conundrum. Many of these febrile patients often have no discernable signs or symptoms to suggest the source of their fevers. Others, however, have findings such as cough, wheezes, dysuria, or diarrhea that suggest potential sites of bacterial or viral infections.

Our general perception has been that febrile patients undergoing BMx under propofol sedation who are symptomatic have more complicated postprocedural recoveries and may need subsequent hospital admission for general malaise, prolonged hypoxemia, or nausea. However, this perception has not been previously studied. Furthermore, it is unknown whether sedation exacerbates preprocedural symptoms in these patients. To address these questions, we conducted a retrospective review of patients undergoing BMx with propofol sedation in an outpatient setting to determine whether febrile patients have higher rates of postprocedural hospitalizations than nonfebrile patients and whether any additional identifiable risk factors are associated with complications.

PATIENTS AND METHODS

This retrospective cohort study was approved by the Mayo Clinic Institutional Review Board (Rochester, MN). Consistent with Minnesota Statute 144.295, we included only those patients who had provided authorization for research use of their medical records. Using institutional database records, we identified

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all adult patients who underwent 1 or more BMBx with propofol sedation at our outpatient procedure center from January 1, 2013, through December 31, 2016. Any patient who had a planned hospital admission on the day of the procedure was excluded.

Identified patients underwent an automated electronic interrogation of their preprocedural vital signs to review their highest recorded oral temperature within 2 hours of their procedures and for unplanned postprocedural hospital admissions. The study population was further segmented into febrile or low-grade febrile (oral temperatures of <38.3°C; considered to be the febrile patient group in this report) and febrile (temperature ≥38.3°C) patients. Febrile patients underwent further review of their medical records for demographic information, comorbid conditions, periprocedural characteristics and course, and outcomes. Preprocedural information included presumptive or known preprocedural diagnoses and any unusual findings on preprocedural physical examinations by the anesthesiologist. Intraprocedural data included procedural duration, medication administration, hemodynamic changes of more than 20% of preprocedural values, the use of supplemental oxygen, and episodes of hypoxemia (defined by oxyhemoglobin saturations of <92% for ≥5 minutes). Postprocedural outcomes included episodes of hypoxemia, supplemental oxygen requirements greater than 1 hour to maintain oxyhemoglobin saturations of greater than or equal to 92%, oral temperatures elevated 0.5°C or more above preprocedural values, and unanticipated hospital admissions. The clinical courses of all patients with unanticipated postprocedural hospital admissions were reviewed for the reason(s) for admission, treatments, and outcomes of the hospitalization.

The data are presented in tabular form using standard reporting metrics. Comparison between unanticipated hospital admission rates for febrile and afebrile patients was performed with a simple Fisher exact test.

RESULTS
During the study time frame, 12,654 adult patients underwent elective outpatient BMBx with propofol sedation. Hospital admission on the day of the procedure was anticipated in 520 of these patients; thus, the study population consisted of the remaining 12,134 patients who were anticipated to remain outpatients.

Eighty-four of the 12,134 patients included in this study (0.7%) were noted to be febrile before the procedure (summarized in the Table). Comparing the risk of unanticipated postprocedure hospital admissions between those who were febrile and those who were afebrile before their procedures, 8 febrile patients (9.5%) and 2 afebrile patients (0.02%) required admission (P < .001). The 2 patients who were afebrile and subsequently admitted had potential pulmonary aspirations during their procedures; neither experienced pulmonary sequelae. Two of the 8 febrile patients had postprocedural generalized weakness and were admitted for intravenous hydration. The remaining 6 febrile patients who were admitted experienced postprocedural hypoxemia and respiratory symptoms that required treatments (eg, prolonged supplemental oxygen, nebulizer treatments for new or exacerbated wheezing, or antibiotics).

Overall, 14 patients had the combination of 3 noteworthy pulmonary findings before

| TABLE. Preprocedural and Intraprocedural Characteristics of Febrile Patients (n=84) |
|---------------------------------|-----------------|
| Characteristic                  | Value           |
| **Preprocedural**               |                 |
| Sex                             |                 |
| Male                            | 43 (51.2)       |
| Female                          | 41 (48.8)       |
| Mean age (y)                    | 48.2±12.1       |
| Body mass index (kg/m²)         | 27.1±4.5        |
| Oral temperature (°C)           | 38.7±0.9        |
| Blood pressure (mm Hg)          |                 |
| Systolic                        | 128±16          |
| Diastolic                       | 82±12           |
| Pulmonary symptoms              | 21 (25.0)       |
| **Intraprocedural**             |                 |
| Anesthetic duration (min)       | 18.1±6.2        |
| Propofol median dose (mg)       | 84.5            |
| Frequency of hemodynamic change >20% baseline | 12 (14.3) |
| Frequency of oxyhemoglobin saturation <92% for ≥5 min | 12 (14.3) |
| Oral temperature elevations ≥0.5°C | 0              |
| Unanticipated hospital admissions | 8 (9.5)        |

aData presented as No. (percentage), mean ± SD, or median.

bOne or more of cough, room air oxyhemoglobin saturation <92%, dyspnea, sputum production, and pleuritic chest pain.
their procedures: (1) a temperature of greater than or equal to 38.3°C, (2) a productive cough, and (3) an oxyhemoglobin saturation of less than 92% on room air. Six of these 14 patients had postprocedure exacerbations of their hypoxemia or increased pulmonary symptoms and were considered by our anesthesiologists to be too symptomatic for outpatient dismissal. They were admitted to the hospital for further evaluation and treatment. Five of these 6 hospitalized patients subsequently were diagnosed with community-acquired pneumonias. All 5 patients with pneumonia were successfully treated and discharged from the hospital within 2 to 8 days. The sixth patient was discharged on postprocedure day 3 after receiving therapy with bronchodilators but without a definitive pneumonia diagnosis.

The other 8 of the 14 febrile patients who had similar symptoms of preprocedural productive cough and oxyhemoglobin saturations of less than 92% on room air did not require unanticipated hospital admission. They tolerated their procedures well, did not have exacerbation of their hypoxemia or increased pulmonary symptoms, were dismissed from the ambulatory procedural area, and had no subsequent respiratory sequelae. Six of these 8 patients were subsequently found on an outpatient basis to have community-acquired pneumonias and were treated successfully without hospital admissions.

DISCUSSION

The main finding of this study is that BMBx performed with propofol sedation are well tolerated with very low rates of unanticipated hospitalization. However, in the subset of patients who presented with temperatures greater than or equal to 38.3°C, had a productive cough, and room air oxyhemoglobin saturation of less than 92%, we found that they had higher rates of postprocedural complications, with 43% requiring hospitalization and treatment of their underlying respiratory issues.

The primary presenting cause of fever and hypoxic respiratory symptoms in our study population was community-acquired pneumonia. Most of these patients were immunocompromised, and it is not surprising that a small proportion had community-acquired pneumonias. On the basis of our findings, we believe that if there is no urgency in obtaining BMBx, patients with fevers and respiratory symptoms should be evaluated in an outpatient setting for community-acquired pneumonias. If these symptoms are present, they should be treated before proceeding to BMBx. If it is not feasible to delay these procedures, we advise monitoring any febrile patients who present with hypoxemia and respiratory symptoms closely postprocedure. If they experience exacerbated hypoxemia or increased respiratory symptoms that preclude safe outpatient dismissal, we believe it is appropriate to admit them for further evaluation and treatment.

In this study, our anesthesiologists observed all patients who had exacerbated hypoxemia or pulmonary symptoms, started initial treatments, and determined whether they could be safely dismissed as outpatients. For those who were admitted and found to have pneumonias, the treatments of these pneumonias were relatively simple and successful. This expense, the inconvenience of hospitalization, and the risk of exacerbation of the pneumonia during the periprocedural period led us to suggest that patients who present with temperatures of more than 38.3°C and active pulmonary symptoms should, when feasible, first be evaluated on an outpatient basis for potential community-acquired pneumonia before proceeding with their elective BMBx under sedation.

We considered that bone marrow aspiration vs biopsy procedures may differ in that their lengths of exposure to propofol anesthesia might predispose patients undergoing one or the other to an increased risk of complications. A prestudy analysis of all patients in our study environment undergoing these 2 related but distinct procedures during 2015 found that the durations of anesthetic times for them were essentially the same with mean durations of 16.8 minutes. Therefore, we did not evaluate them separately in our overall study.

Limitations and Strengths of the Study

The primary limitation of this study is its retrospective design. Because of the small number
of outcomes of interest, this study cannot examine the specific risk factors associated with unplanned hospital admission. In addition, because we uniformly use propofol in our practice it is not possible to evaluate the role of propofol compared with other sedatives in these outcomes. Important strengths of our study include the quality of our institutional databases and the detailed charting in our electronic medical records. Specifically, our institution uses United Data Platform, a clinical data warehouse that obtains, consolidates, and standardizes all clinical data collected within the institution. This provides us with the ability to retrieve perioperative information on a large scale, as we did in this study.

On the basis of our findings, we believe that patients who present with temperatures of greater than or equal to 38.3°C but who do not have respiratory symptoms suggestive of pneumonia can safely undergo elective BMBx with propofol sedation. However, for those who are febrile and also have productive coughs and oxyhemoglobin saturations by pulse oximetry of less than 92%, we suggest that they would be best served with outpatient evaluation of their symptoms before undergoing elective BMBx.

Abbreviations and Acronyms: BMBx = bone marrow biopsy and aspiration procedures

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