

## Reducing error in anticoagulant dosing *via* multidisciplinary team rounding at point of care

Munish Sharma,<sup>1</sup>  
Mahesh Krishnamurthy,<sup>1</sup>  
Richard Snyder,<sup>2</sup> James Mauro<sup>3</sup>

<sup>1</sup>Department of Internal Medicine;

<sup>2</sup>Department of Nephrology;

<sup>3</sup>Department of Pharmacy, Easton Hospital, Easton, PA, USA

### Abstract

The incorporation of a clinical pharmacist in daily rounding can help identify and correct errors related to anticoagulation dosing. Inappropriate anticoagulant dosing increases the risk of developing significant bleeding diathesis. Conversely, inappropriate dosing may also fail to produce a therapeutic response. We retrospectively reviewed electronic medical records of 41 patients to confirm and analyze the errors related to various anticoagulants. A clinical pharmacist in an integrated rounding between the period of February 2016 and April 2016 collected this data. We concluded that integrated rounding improves patient safety by recognizing anticoagulant dosage error used for the purpose of prophylaxis or treatment. It also allows us to make dose adjustments based on renal function of the patient. We think that it is prudent for physicians to pay particular attention to creatinine clearance when dosing anticoagulants in order to achieve the intended dosing effect and reduce the risk of adverse drug events.

### Introduction

Lack of pertinent and sufficient information during the initial prescription of a medication has been found to be the root cause of medication errors. Multidisciplinary rounds incorporating a clinical pharmacist have demonstrated to improve patient safety by reducing medication errors.<sup>1,2</sup> This reduces the risk of developing adverse drug events (ADEs). Inappropriate anticoagulant dosing increases the risk of developing significant bleeding diathesis. Conversely, inappropriate dosing may also fail to produce the intended therapeutic effect.

### Hypothesis

We believe that the incorporation of

clinical pharmacist in daily rounding can help identify and correct errors related to anticoagulation dosing.

### Materials and Methods

We retrospectively reviewed electronic medical records of 41 patients to confirm and analyze the errors related to various anticoagulants. A clinical pharmacist in an integrated rounding between the period of February 2016 and April 2016 collected this data. The purpose was to collect a sample data to test our hypothesis. The data included both traditional anticoagulants like heparin, warfarin as well as the novel oral anticoagulants (NOACs). It included anticoagulant dosing for both prophylaxis and treatment. The data was collected at a single community based teaching hospital. The clinical pharmacist rounded with the inpatient teaching internal medicine team led by a hospitalist and consisting of resident physicians. The clinical pharmacist actively participated in the round and provided immediate feedback about the medication errors that were resurrected before any potential ADEs occurred.

### Results

There were a total number of 41 patients identified to have medication errors during our study. Out of these, 16 were over anticoagulated while 25 were under anticoagulated (Figure 1). Most numbers of medication errors were related to low molecular weight heparin (LMWH) (20 cases) followed by 10 cases of medication errors related to novel oral anticoagulants (NOACs), 9 cases where appropriate anticoagulation was not initiated and 2 cases involved errors with warfarin (Figure 2). Most numbers of errors related to all anticoagulation was due to inaccurate renal dose adjustment. Total 15 patients were inaccurately dosed based on their creatinine clearance (CrCl). Out of these, 4 patients were under dosed. All these 4 cases involved LMWH. According to the guidelines, in spite of renal insufficiency, if the CrCl is not less than 30 mL/min, the prophylactic dose of LMWH does not need to be decreased to 30 mg and a prophylactic dose of 40 mg daily can be used subcutaneously. This underdosing of prophylactic LMWH was corrected by the clinical pharmacist. Out of the 11 patients who were overdosed on the basis of CrCl had errors involved with LMWH. In all these patients, 40 mg subcutaneous daily dose of LMWH was

Correspondence: Munish Sharma, 2040 Lehigh Street, apt 506, Easton, PA, USA, 18042.  
Tel.: +1.610.250.4000 (office).  
E-mail: munishs1@hotmail.com

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ordered while the correct dose had to be 30 mg daily as all the patient's had CrCl <30 ml min. 8 patients were found to be not on any anticoagulation when they actually needed to be. For example, 1 patient's anticoagulation was not restarted after PEG tube placement while in others appropriate DVT prophylaxis was not initiated at all. 7 patients had inaccurately dosed NOACs. For example, 2 patients were dosed with 15 mg daily of rivaroxaban for DVT prophylaxis, which were corrected to 20 mg daily dose. Another example elicited errors in apixaban where 2.5 mg twice daily dose was used for stroke prophylaxis in a nonvalvular atrial fibrillation in absence of contraindications; more than or equal to 80 years of age, weight < 60 kgs or creatinine more than 1.5. Conversely, in 2 cases apixaban was overdosed for treatment of pulmonary embolism. It was wrongly started at a loading dose of 10 mg twice a day for 30 days, which was promptly changed to 7 days duration, followed by 5 mg twice-daily maintenance dose. It is to be noted that there is no adjustment with loading or maintenance dose of apixaban specifically for treatment of pulmonary embolism/deep vein thrombosis on the basis of compromised CrCl. In 4 of the cases, it was noted that the bridging therapy for LMWH with warfarin was not optimally done for period of 5 days or when the target INR >2 for 24 hours. There were errors noted during conversion of one type of anticoagulant agent to another one. In a patient who was on heparin drip and needed to be switched to LMWH, a lag of 3 hours was seen between stopping the heparin drip and initiating the LMWH. As the effect of heparin drip wears off within 30 minutes, the first dose of LMWH should be given immediately after

turning off the heparin drip. In a single case it was also noted that LMWH was not discontinued with a platelet count of 40,000 (Figure 3).

All the errors including the under dosing or overdosing with various kind of anticoagulant agents were promptly identified by the clinical pharmacist during the inpatient round and was corrected before the orders could even reach the pharmacist sitting behind the desk at the dispensing pharmacy. An interactive discussion was held with the members of the inpatient rounding team when the medication error was detected. This led to the better understanding of the clinical profile and dosing of the anticoagulants amongst the involved physicians. It was mainly beneficial in our set up of teaching Hospital. Notably, no ADEs were noted in any of the patients.

### Discussion

Fatal adverse drug events (ADEs) have always been a subject of concern in the patient care. In 1994, 10.9% of all hospital admission in the United States experienced some ADEs. 2.1% of these admissions resulted in serious events.<sup>1</sup> Majority of the ADEs had been found to be iatrogenic events. These are mainly due to errors and are, therefore, potentially preventable.<sup>2</sup> According to the Division of Medication Error Prevention and Analysis (DMEPA), a medication error is *any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures, and systems, including prescribing; order communication; product labeling, packaging, and nomenclature; compounding; dispensing; distribution; administration; education; monitoring; and use.* Most of the medication errors occur at the time when a decision about a therapy is made. Lack of sufficient information during the prescribing step leads to most of the medication errors.<sup>3</sup> Poor communication between health care providers, poor communication between providers and their patients and sound-alike medication names and medical abbreviations have also been found to be the common cause of medication errors.<sup>4</sup> These preventable ADEs occurring during the medication use process in hospitals are associated with additional length of stay and healthcare costs apart from jeopardizing the life of the patient.

Clinical pharmacists are trained in therapeutics and can provide comprehensive

## Anticoagulation dosing error

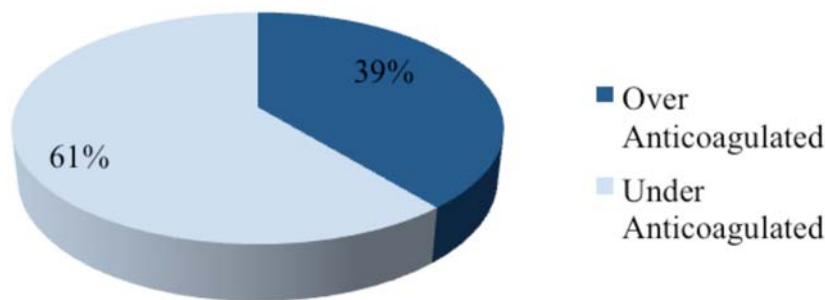


Figure 1. Anticoagulation dosing error.

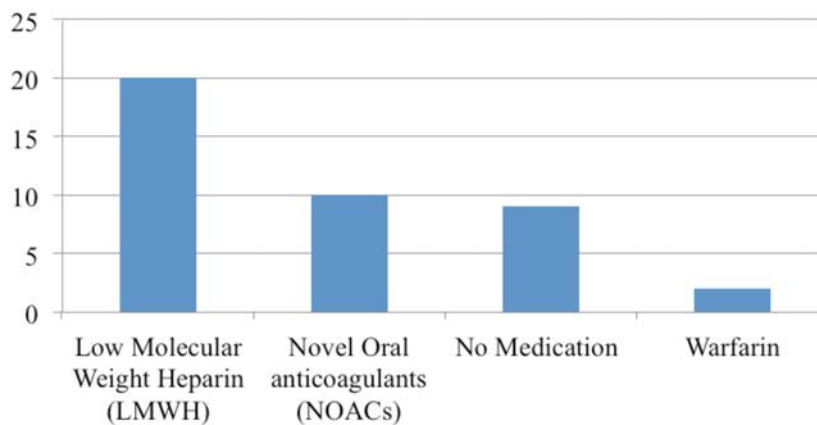


Figure 2. Intervention by Medication Class.

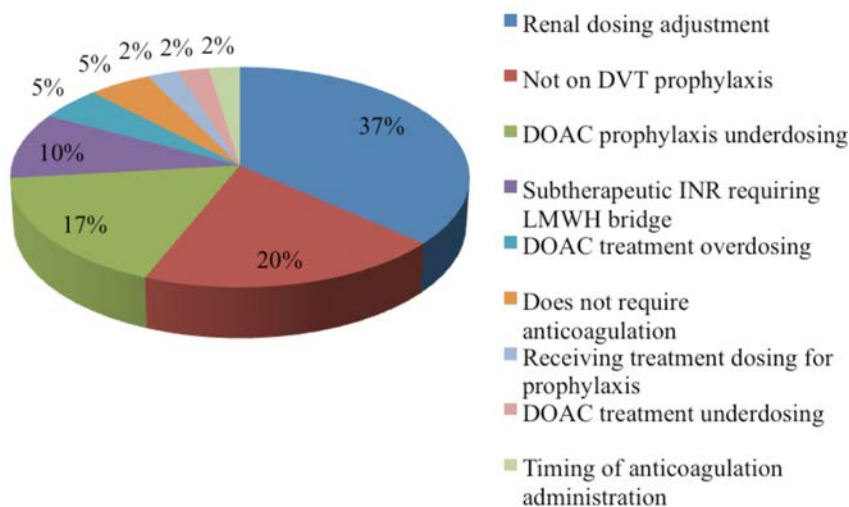


Figure 3. Type of Intervention required.

management about medications to patients and providers. Integral rounding consisting of clinical pharmacist have shown to improve patient care, with no evidence of harm.<sup>5</sup> The improved outcomes are mainly due to close interaction of the clinical pharmacist with the inpatient team rounding of the patient, direct interview of the patient by the clinical pharmacist, active participation in medication reconciliation and direct involvement in planning discharge and follow-up. In a recent survey, 30% of hospitals (74% of hospitals with more than 400 beds) reported that pharmacist attend rounds.<sup>6</sup> Two other reports clearly suggested that clinical pharmacists are an essential asset in safe medication use and pharmacist-physician-patient collaboration is extremely important.<sup>7-9</sup> Due to the direct work-related involvement with the healthcare providers and patients, clinical pharmacist can offer more than simply dispensing medications. Though they can help check the errors by sitting behind a desk, the prompt correction of medication error may not happen. Sometimes, the medications in the stock may be used by a nurse before it can arrive from the pharmacy and the error cannot be corrected. Active interaction with the inpatient rounding team also provides an arena for better learning opportunities especially in a teaching hospital setting.

In our study, the clinical pharmacist helped to identify various errors related to various anticoagulants used for prophylactic as well as therapeutic purposes. A thorough discussion about the rationale was done between the respective attending physician, residents and the clinical pharmacist during the integrated rounding. Established standard guidelines were referred prior to concluding that the recommendations made by the clinical pharmacist where in adherence with standard of patient care. No ADEs were noted during the period of our study mainly due to prompt correction and proper feedback of the underlying error.

### Limitations

The main limitation of our study is that it is a single center retrospective chart analysis. This study lacked a controlled

group to directly compare the efficacy of the intervention strategy. The sample size in the study is also small to extrapolate our finding to the general patient population. Longer duration of study would also have helped garner further data. The data was collected while rounding with the inpatient internal medicine team so the inferences drawn from this study cannot be arbitrarily applied to other faculties. Overall, this study certainly raises a red flag and further data can be built upon the foundation provided by it.

### Conclusions

Our study has further solidified the existing data about the advantages of incorporating clinical pharmacist in the multidisciplinary team rounding at a point of care. This approach can definitely help lower ADEs and associated mortality, cost of drug and medical care and even the length of stay in the hospital.<sup>10,11</sup> Though widely used in the bigger medical centers in the United States, number of community hospitals have not yet embraced this concept. Channelization of the existing resources to increase the clinical pharmacist services could help the hospitals in terms of extra cost avoidance. This will help alleviate skepticism about incorporating the clinical pharmacist in the integrated rounds on the part of corporate/private hospitals and smaller community hospitals.

We can specifically conclude from our study that integrated rounding definitely improves patient safety by recognizing anticoagulant dosage error used for the purpose of prophylaxis or treatment. It also allows prompt dose adjustments based on renal function of the patient. It is prudent for physicians to pay particular attention to creatinine clearance when dosing anticoagulants in order to achieve the intended dosing effect and reduce the risk of ADEs.

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