

# Decision Making Regarding Trauma Patients in Rhode Island who Present on Anticoagulants and Antiplatelet Agents: A Multidisciplinary and Collaborative Approach

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## ABSTRACT

**OBJECTIVES:** Use of anticoagulant and antiplatelet medications (AAMs) is increasing significantly with our growing population of older adults. AAMs worsen outcomes in trauma patients. Our goal was to improve collaboration between trauma and outpatient providers and to improve safety in making decisions on anticoagulant and antiplatelet medications (AAMs) after injuries.

**DESIGN:** A risk management initiative.

**SETTING AND PARTICIPANTS:** Patients that suffered traumatic injury while on anticoagulation or antiplatelets medications at a level I university trauma center.

**METHODS:** IRB approval was obtained to review records for medications, demographics, mechanism and type of injury, and indication for preinjury AAM use. Inpatient trauma team providers contacted the primary prescriber. A collaborative decision was made regarding AAM plans.

**RESULTS:** One hundred and five patients, mean age 79 years, were followed. The three most common AAMs were warfarin (69 patients), clopidogrel (24), and Factor Xa inhibitors (16). Atrial fibrillation was the most common indication for AAMs (70 patients), venous thrombosis (14) and TIA/CVA (11). Falls were the most frequent injury mechanism, 79.4%. Soft tissue hematomas (27.4%), TBI (16%), and pelvic fractures (12.3%) were the most common injuries. In 56.6% AAMs were held until follow-up, 31.1% had AAMs resumed at discharge, and AAMs were held indefinitely in 12.3%. Patients discharged to home versus facility (37 vs 18%  $p < 0.05$ ), <75 years of age (47 vs 27%  $p < 0.05$ ) were more likely to have AAMs resumed at discharge. Patients who suffered falls versus MVC mechanism were less likely to have AAMs resumed at discharge (28 vs 82%  $p < 0.05$ ). CHA<sub>2</sub>DS<sub>2</sub>-VASc scores were similar between decision groups.

**CONCLUSIONS AND IMPLICATIONS:** This is the first description of mandatory communication between trauma and outpatient providers to guide decision making on AAMs after injury. Efforts should be made to determine if this mitigates risk by following patients longterm. This communication should become standard for a population that is often elderly, frail, and at risk of repeat injuries.

**KEYWORDS:** trauma, injury, anticoagulation, primary care

## INTRODUCTION

The use of anticoagulant and antiplatelet medications (AAMs) is increasing significantly as atrial arrhythmias, valvular diseases and other forms of cardiovascular disease are prevalent in our growing population of older adults. Older adults comprise a sector of our population that is expected to double in the coming years, resulting in estimates that nearly 20% of the United States population in 2030 will be over the age of 65.<sup>1</sup> Based on local registry data the mean age of admitted trauma patients at Rhode Island's only level one trauma center is 59 years compared to a national mean of 52 years. Warfarin has been reported to be used in approximately 13% of patients over 65.<sup>2</sup> In 2010 direct oral anticoagulants (DOACs) were introduced and most of the increase in anticoagulant use from 2009 to 2014 was due to increased prescribing of dabigatran, apixaban, and rivaroxaban.<sup>3</sup> Prior to the introduction of DOACs many physicians felt that anticoagulation had been underutilized for patients with atrial fibrillation. Then in 2014 the American College of Cardiology and the AHA released a report supporting the use of the CHA<sub>2</sub>DS<sub>2</sub>-VASc score to guide anticoagulation decision making for atrial fibrillation patients.<sup>4</sup>

AAMs are known to increase bleeding risk and worsen outcomes in trauma patients, particularly in those with traumatic brain injury (TBI).<sup>2,5-7</sup> Inpatient trauma practitioners have had to increase their breadth of knowledge regarding the potential for exacerbation of hemorrhage from AAM use and to understand the reversal options for AAMs. To this point, though, there remain few published guidelines or recommendations as to when and whether AAMs should be restarted for patients that suffer traumatic injuries, especially higher risk older adults.

Outpatient prescribers of AAMs, usually a primary care physician or cardiologist, carefully weigh the benefits of AAMs including prevention of thromboembolic and cardiovascular events against the likelihood of injury. Trauma providers only come to know patients on AAMs after they have suffered injuries and possibly exacerbation of hemorrhage which likely affects their perspective on the safety and utility of AAMs. Outpatient prescribers have a unique knowledge of their patients compared to those who admit them to the inpatient setting. Our goal was to improve collaboration between trauma and outpatient prescribers and to improve safety in making decisions on AAMs after injuries. Here we present a descriptive review of the findings from patients enrolled in a quality and risk management communication initiative and to suggest this as a generalizable standard of care.

## METHODS

This risk management and quality improvement initiative was submitted and accepted by Lifespan at Rhode Island Hospital with funding provided for data collection and maintenance. Inpatient trauma team providers contacted the outpatient primary prescriber for all adult patients on AAMs admitted to the trauma service. A collaborative decision was then made regarding AAM plans and a paper data collection form was completed. Support and approval was given to enroll patients for a one-year period and consent by patients or proxies was not required as this was considered a clinical quality initiative (CQI) with potential for immediate improvement in clinical care and was of low risk to patients. At the conclusion of the period an interval report was submitted and enrollment was extended 6 months. At the conclusion of the 18 months IRB approval was obtained to review patients that had suffered injuries while on AAMs. IRB approval was provided to the trauma registry and basic patient data was obtained. The remainder of patient data was obtained through chart review.

Charts were reviewed for demographics, which AAMs were being used at the time of injury, indications for preinjury AAM use, mechanism of injury, and types of injuries. AAMs were categorized for simplicity as warfarin, clopidogrel, factor Xa inhibitors, dabigatran, or multiple AAMs. Collaborative decisions between trauma providers and outpatient prescribers on AAMs were categorized as “hold indefinitely”, “hold AAM until follow up with prescriber”, “resume AAM before discharge.” Charts were also reviewed for subjective text accounts of the conversation between the trauma provider and the outpatient prescriber as recorded by the trauma provider. Patient discharge disposition was reviewed and categorized as discharged to home or facility. Facility was defined to include nursing homes and rehabilitation centers.

CHA<sub>2</sub>DS<sub>2</sub>-VASc scores, head injury abbreviated injury severity (AIS) scores, and presenting INR were determined for each patient by chart review. Univariate analysis was done with these factors to determine if there were associations with decision making results. Associations between decision results and age, injury mechanism, and discharge disposition were also examined.

Descriptive data are presented as frequencies, means for parametric continuous variables, and medians for non-parametric continuous variables. We applied Pearson’s Chi square test with Fisher exact test for sparse values to test independence for categorical data. Parametric continuous data were compared using ANOVA. Nonparametric data were analyzed using Kruskal Wallis test. Significance was set at p=0.05. We completed all analyses using Stata/SE statistical software, version 14.0 for Windows 10, copyright 1985–2015 Statacorp LP, College Station, TX, USA.

## RESULTS

One hundred and two patients, mean age 79 years, were enrolled. The three most common preinjury AAMs were warfarin (65 patients), clopidogrel (19), and Factor Xa inhibitors (11) (**Table 1**). Atrial fibrillation was the most common indication for AAMs (59 patients), followed by pulmonary embolism (PE) (11), TIA/CVA (7), and coronary artery disease (CAD) (6) (**Table 2**). Falls were the most frequent injury mechanism occurring in 82 patients (80.4% of our sample). Soft tissue hematomas in 29 patients (28.4%), traumatic brain injury (TBI) in 18 patients (17.6%), and hemothorax in 13 patients (12.7%) were the most common injuries (**Table 3**). In 54.9% AAMs were held until follow up, 33.3% had AAMs resumed at discharge, and AAMs were held indefinitely in 11.8% (**Table 4**).

No differences regarding plans to resume or hold AAMs were found when the different AAM agents were compared. Patients age greater than 75 years were less likely to have AAMs resumed at discharge (26.5% vs. 47.1%; p=0.05) and more likely to have them held until follow-up (63.2% vs 38.2%;p=0.05) compared to those less than 75 years of age. Those discharged to home versus a facility were more likely to have AAMs resumed at discharge (36.8% vs. 9.1%; p=0.05). Head AIS and CHA<sub>2</sub>DS<sub>2</sub>-VASc scores were similar between the three decision groups (**Table 5**). Patients who suffered falls versus MVC mechanism were less likely to have AAMs resumed at discharge (28 vs 82%; p<0.05).

**Table 1.** Demographics and preinjury AAM use, n = 102 patients

Mean age	78.9 years	
Male sex	60/102	
	n	%
Warfarin	65	63.7%
Clopidogrel	19	18.6%
Dabigatran	2	2%
Factor X Inhibitor	11	10.8%
Multiple AAM	5	4.9%

**Table 2.** Indication for preinjury AAM use, n = 102 patients

Comorbidity	n	%
Atrial fibrillation	59	57.8%
TIA/CVA	7	6.9%
DVT	3	2.9%
PE	11	10.8%
CAD	6	5.9%
Unknown/Other	16	15.7%

**Table 3.** Mechanism of injury, injuries suffered

Mechanism	n	%
Fall	82	80.4 %
MVC	11	10.8%
MCC	2	2%
Unknown/Other	7	6.9%
<b>Injuries</b>		
TBI	18	17.6%
Pelvic Fracture	9	8.8%
Solid Organ Injury	4	3.9%
HTX	13	12.7%
Soft Tissue Hematoma	29	28.4%

**Table 4.** Results of collaborative conversation regarding AAMs

Result	n	%
Hold Indefinitely	12	11.8%
Resume	34	33.3%
Hold Until Follow-up	56	54.9%

**Table 5.** Factors and association with AAM decisions

	Total	Held indefinitely	Resumed at discharge	Held until follow up	p
<b>Agent</b>					<b>0.23</b>
Warfarin	65	9 (13.9%)	19 (29.2%)	37 (56.9%)	
Clopidogrel	19	3 (15.8%)	6 (31.6%)	10 (52.6%)	
Dabigatran	2	0	2 (100%)	0	
Factor X Inhibitor	11	0	3 (27.3%)	8 (72.7%)	
Age (years, SD)	78.9 +/- 11.9	79.5 +/- 11.5	75.1 +/- 11.4	81.1 +/- 11.8	0.07
Age >75	n = 68 (66.7%)	7 (10.3%)	18 (26.5%)	43 (63.2%)	0.05
Age <75	n = 34 (33.3%)	5 (14.7%)	16 (47.1%)	13 (38.2%)	
<b>Disposition</b>					<b>0.05</b>
Home	n = 87 (88.8%)	8 (9.2%)	32 (36.8%)	47 (54%)	
Facility	n = 11 (11.2%)	3 (27.3%)	2 (9.1%)	7 (63.6%)	
Head AIS (if TBI) – (median, IQR)	3 (2–5)	3(3–3)	2 (2–3)	3 (2–5)	0.4
INR (median, IQR)	2.9 (2.3 – 3.6)	4.2 (2.8 – 6)	3.2 (2.2 – 3.6)	2.7 (2 – 3.3)	0.02
CHA2DS2Vasc (median, IQR)	4 (3–4)	4 (3–4)	4 (3–4)	4 (3–4)	0.25

## DISCUSSION

In this quality initiative of just more than 100 patients we showed feasibility of making it a routine process for the inpatient trauma team to communicate with the primary AAM prescriber after patients are admitted with injuries and to document decision making. We have since maintained this practice to promote collaboration with our colleagues in

cardiology and primary care. To our knowledge this project is the first to attempt to formalize and describe this practice. We are encouraged that the practice may be generalizable not just to trauma services but to any inpatient service that admits patients on AAMs.

With our growing population of older adults and increased longevity, the use of AAMs will continue to increase in Rhode Island and beyond. Recent estimates from a 2015 American Heart Association (AHA) report that over 3 million Americans have atrial fibrillation and nationwide there are about 75,000 new cases of venous thromboembolism diagnosed annually.<sup>8</sup> This past decade use of oral anticoagulants has nearly doubled for atrial fibrillation in the United States but warfarin use has remained stable. Antiplatelet medication use has also increased substantially with the introduction of clopidogrel in 1997 and more recently with the third generation agents ticagrelor and prasugrel.<sup>9</sup> DOACs pose a particularly unique challenge when patients present on these agents while bleeding after injury. Degree of anticoagulation while on a DOAC cannot be readily assessed by traditional laboratory means such as prothrombin and partial thromboplastin times and reversal is similarly uncertain. At our institution we do now have idarucizumab available to block dabigatran and use PCCs for the other DOACs.

It is important for inpatient providers, especially trauma teams, to be aware of the emergence of DOACs and CHA<sub>2</sub>DS<sub>2</sub>-VAsc and the overall increased use of anticoagulants. Any patient of advanced age that suffers trauma should be queried immediately on presentation as to whether they are on an AAM and reversal should be considered based on the options and severity of injuries. As the hospital course progresses and injuries have stabilized, the inpatient trauma team can determine a patient's CHA<sub>2</sub>DS<sub>2</sub>-VAsc score, assess risk of future traumatic events, and communicate with the primary AAM prescriber. It is likely that inpatient trauma teams have a bias towards holding AAMs longterm as they regularly receive patients who have suffered exacerbations of injury from AAM use. However, our results showed that more than half of trauma patients had AAMs held until follow-up, one third

were resumed at discharge, and only 12 percent were held indefinitely. Unfortunately, we do not have a comparison group from prior to initiation of the communication practice but it appears that shared decision making has not resulted in an overly conservative approach to AAMs after injury.

Falls were the most common mechanism of injury in our cohort and these patients were less likely to have AAMs

resumed on discharge compared to those that suffered an MVC. These results are not surprising as a fall is often considered an event that indicates some level of patient frailty and may occur serially while an MVC may be considered a random event. While multiple frailty indicators exist, there is not substantial data regarding these indicators to predict subsequent falls. Radiologic scoring of sarcopenia has been found to be a predictor of mortality and postoperative complications in elderly patients, but few studies have evaluated it as a predictor of falls.<sup>10,11</sup> This further supports the need to communicate with the AAM prescriber that has an ongoing relationship with the patient while we continue to create and analyze objective tools that assess risk of suffering trauma. PCPs may be alerted after the communication to adjust medications such as antihypertensive agents, provide calcium or vitamin D supplementation, or refer a patient for outpatient physical therapy for strength and balance improvement. Also, PCPs have been shown to play a key role in assessing and reducing risk of falls in the elderly. In 2013 the Centers for Disease Control released a tool kit titled Stopping Elderly Accidents, Deaths, and Injuries (STEADI) with algorithms designed for primary care providers to specifically assess fall risk.<sup>12</sup>

We should also determine how to better apply bleeding risk scores to trauma patients who have been on AAMs. HAS-BLED, ORBIT and ATRIA are three scoring systems that have emerged recently to assess risk of a major bleeding event while on anticoagulation for atrial fibrillation.<sup>13,14</sup> Prior to the development of scoring systems, decisions to start or resume anticoagulation were primarily based on thromboembolic risk through clinical assessment and use of the CHA<sub>2</sub>DS<sub>2</sub>-VASc score. Risk of a bleeding event was considered secondarily. In older patients CHA<sub>2</sub>DS<sub>2</sub>-VASc and one of the bleeding risk scores such as the HAS-BLED system should now be considered concurrently when making decisions as HAS-BLED has been shown to predict clinically relevant major bleeding events.<sup>14</sup> We now routinely determine HAS-BLED scores alongside CHA<sub>2</sub>DS<sub>2</sub>-VASc before discussions with the primary prescriber.

A Danish registry study compared resumption of anticoagulation for atrial fibrillation to non-resumption in over 4000 patients who had suffered major injury. Patients that resumed anticoagulation had lower mean HAS-BLED scores (2 vs 3) but had similar CHA<sub>2</sub>DS<sub>2</sub>-VASc scores and were of similar age when compared to those that did not resume anticoagulation.<sup>15</sup> Unfortunately the authors do not include mechanism of injury, only types of injuries suffered. We are unable to determine whether falls compared to other mechanisms were associated with decisions about anticoagulation. All of the bleeding risk scores are comprised of mostly medical comorbidities that exacerbate bleeding risk and only the age component addresses risk of a traumatic event and does so crudely. A future goal should be to create a

bleeding risk score that incorporates medical comorbidities and some of the developing frailty and fall assessment tools.

For too long anticoagulation has been a siloed area of study. CHA<sub>2</sub>DS<sub>2</sub>-VASc was created several years before most of the bleeding risk scores. This is an indicator of how anticoagulation for atrial fibrillation was mostly thought of as a cardiology or primary care issue. Anticoagulation decisions need to be multidisciplinary processes that include expertise and experience of the prescribers and those that care for patients when they are injured. There are examples of improvements in care when communication is enhanced with other medical issues. Oncology is a truly multidisciplinary field and increased communication between oncologists and surgeons has been shown to improve outcomes in patients with advanced stage colon cancer.<sup>16</sup> Patient care is improved when pulmonologists and thoracic surgeons, and transplants surgeons and nephrologists work together closely.

## LIMITATIONS

There are important limitations to our study. During the study period there may have been data acquisition fatigue or failure as a data collection sheet was required for each patient to be captured. Rates of entry and collection regarding the conversation with the primary prescriber could be improved by allowing entry into the electronic health record. Our enrollment and data collection also took place without use of a bleeding risk score which could improve decision making regarding restarting AAMs. Decisions also may have been affected by biases and how information regarding trauma mechanism and injuries is shared and discussed among the reporting trauma team provider and the primary prescriber.

## CONCLUSIONS AND IMPLICATIONS

In this quality and risk management initiative we show feasibility of making communication between inpatient trauma providers and outpatient AAM prescribers a routine process. This is now the standard at our center and should be generalizable at other centers. With a growing population of advanced-age patients presenting on AAMs it will be important to continue to explore how to improve their outcomes after injury in a multidisciplinary fashion. To show this intervention improves safety will likely require a comparison group and longitudinal follow-up. We are committed to performing a multidisciplinary project combined with primary prescribers that follows patients on AAMs a year and beyond. We also need to further develop and regularly use objective assessment tools for frailty to predict falls and bleeding risk.

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## Disclosures

There are no conflicts of interest.

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