

Background

- Head injury is a common and potentially serious condition¹. With patients aging, the use of novel oral anticoagulants (NOAC), oral anticoagulation (AC) and antiplatelet (AP) agents continues to increase.
- New literature suggests that NOACs appear to be a safer alternative to warfarin and may not be associated with a higher increase in traumatic intracranial hemorrhage (TICH) in patients with minor trauma.²⁻³
- Currently, it is unknown if dual antiplatelet therapy increases the risk of TICH more than AC.⁴
- However, some studies show that physical exam may be a better predictor of TICH than medication use alone.²

Objective

- Our goal is to analyze geriatric patients (age 65+) who present to the ED with trauma that does not meet trauma activation criteria, but required a head CT.
- Here we attempt to identify high risk features such as AC or AP use and physical exam findings to identify patients who may benefit from faster head imaging.

Materials and Methods

- We conducted a retrospective structured chart review of ED patients ages 65 and greater presenting to a large academic ED from January 2021 through July 2022 with minor trauma within 24 hours, did not meet ACS trauma team activation criteria and required a head CT.
- Exclusion criteria included if a patient met trauma activation criteria, were a transfer from outside facility, presented to the ED with a diagnosis of TICH on outside imaging, GCS less than 14, or had trauma more than 24hrs before the ED visit.
- Primary outcome was TICH while secondary outcomes included mortality, admission, and neurosurgical intervention within 24hrs.
- Univariate and multivariate statistical analyses were performed.
- Population was mainly suburban non-Hispanic Caucasian with past medical history having no impact on TICH rates.

Results

TICH Rates

| Individual Medication TICH Rate | | | | | Multivariable Analysis | | |
|---------------------------------|------|------|---------------|----------|----------------------------|------------|----------|
| Medication group | N | TICH | TICH rate (%) | 95% CI | Medication | Odds ratio | 95% CI |
| None | 402 | 12 | 3.0 | 1.7-5.2 | None | Reference | |
| Warfarin | 38 | 1 | 2.6 | 0.1-15.4 | Warfarin | 1.05 | .13-8.59 |
| DOAC | 179 | 2 | 1.1 | 0.2-4.4 | DOAC | .36 | .08-1.66 |
| Aspirin | 238 | 8 | 3.4 | 1.6-6.8 | Aspirin or P2Y12 inhibitor | 1.07 | .23-5.07 |
| P2Y12 inhibitor | 17 | 0 | 0 | 0-22.9 | AC+AP | 1.09 | .23-5.07 |
| AC+AP | 67 | 2 | 3.0 | 0.5-11.3 | Dual Antiplatelet | 2.44 | .75-7.98 |
| Dual Antiplatelet | 59 | 4 | 6.8 | 2.2-17.3 | | | |
| TOTAL | 1000 | 29 | 2.9 | 2.0-4.2 | | | |

Table 1 (left) represents rates of TICH among medication groups. Table 2 (top) was performed using multivariable analysis for predicting TICH. No medication group was found to statistically increase rate of TICH

Predictive Values for TICH

| Symptoms and Physical Exam | | | |
|------------------------------|-------------|-----------------|------|
| Characteristic | TICH (n=29) | No TICH (n=971) | p |
| None | | | |
| Any finding | 24 (3%) | 715 (97%) | .39 |
| No findings | 5 (2%) | 256 (98%) | |
| Headache | | | |
| | | | 1.00 |
| No | 24 (3%) | 809 (97%) | |
| Yes | 5 (3%) | 162 (97%) | |
| Vomiting | | | |
| | | | .19 |
| No | 28 (3%) | 965 (97%) | |
| Yes | 1 (14%) | 6 (86%) | |
| Trauma above clavicle | | | |
| | | | .002 |
| No | 7 (1%) | 512 (99%) | |
| Yes | 22 (5%) | 459 (95%) | |
| Trauma below clavicle | | | |
| | | | .29 |
| No | 24 (3%) | 704 (97%) | |
| Yes | 5 (2%) | 267 (98%) | |
| Loss of consciousness | | | |
| | | | .62 |
| No | 28 (3%) | 940 (97%) | |
| Yes | 1 (3%) | 31 (97%) | |
| Agitation | | | |
| | | | 1.00 |
| No | 29 (3%) | 962 (97%) | |
| Yes | 0 | 9 (100%) | |

Age, Living Situation, GCS

| Characteristic | TICH (n=29) | No TICH (n=971) | p |
|--------------------------|-------------|-----------------|-----|
| Mean age (sd) | 81 (10%) | 82 (9%) | .50 |
| Living situation | | | |
| | | | .84 |
| Independent | 19 (3%) | 639 (97%) | |
| Independent w/family | 2 (3%) | 60 (97%) | |
| Assisted living facility | 2 (2%) | 112 (98%) | |
| Nursing home | 6 (4%) | 160 (94%) | |
| GCS | | | |
| | | | .22 |
| 14 | 8 (4%) | 178 (96%) | |
| 15 | 21 (3%) | 793 (97%) | |

Table 3 (left and top) represents univariable analysis for TICH rates. Only trauma above clavicles was found to be statistically significant.

TICH Outcomes Analysis

| Admission Location by TICH | | | | Need for Intervention | | ICU Predictor Analysis | | | |
|----------------------------|------------|----------|-------|---|---------|-----------------------------------|------------|------------|---|
| TICH | Floor/IC R | ICU | P | Neurosurgical intervention within 24hrs | | Characteristic | ICR (n=10) | ICU (n=19) | p |
| Presence of TICH | | | | | | Symptoms and Physical exam | | | |
| Yes | 10 (34%) | 19 (66%) | <.001 | Craniotomy | 3 (0.3) | None | | | |
| No | 125 (93%) | 9 (7%) | | MMA embolization | 1 (0.1) | Trauma above clavicle | | | |
| Type of TICH | | | | | | Medication group | | | |
| Subdural | | | | | | None | | | |
| Yes | 1 (7%) | 14 (93%) | .002 | | | None | | | |
| No | 9 (64) | 5 (36) | | | | None | | | |
| Subarachnoid | | | | | | None | | | |
| Yes | 7 (65%) | 6 (46%) | .06 | | | None | | | |
| No | 3 (19) | 13 (81) | | | | None | | | |
| Intraparenchymal | | | | | | None | | | |
| Yes | 2 (50%) | 2 (50%) | .59 | | | None | | | |
| No | 8 (32) | 17 (68) | | | | None | | | |

Table 4 (top) represents univariable analysis for ICU admission by TICH type. Presence of TICH was significant for ICU admission, of which only subdural hemorrhages were significant for ICU admission.

Table above represents need for neurosurgical intervention within 24 hours and discharge location. Only four patients with TICH required neurosurgical intervention and majority of patients with TICH were able to be discharged home.

Table 5 (table) represents ICU prediction rates. Two variables from the symptoms and physical exam were selected with the lowest p value. Neither symptoms and physical exam nor medication group were associated with increased ICU admission rate.

Conclusions

- Rates of TICH were low for geriatric patients who didn't meet trauma activation criteria, even those on AC or AP agents.
- Few patients that developed TICH required urgent neurosurgical intervention.
- Trauma above clavicles was the only reliable physical exam findings for TICH, although the rate of TICH was still low.
- Only subdural hemorrhage was associated with higher ICU admission rate.
- No reliable criteria was able to be identified to identify patients who may benefit from faster head imaging

Limitations/Future Directions

- Data collected was retrospective in nature.
- Small sample size for patients who experienced vomiting or patients on dual antiplatelet therapy which could result in a type II error.
- Unknown if the results were biased due to if patients on AC or AP agents were more likely to receive head CTs or were more likely to have a trauma activation than those not on any medications.
- Future studies could examine the trauma registry in the same time frame to address the previous limitation.
- Future prospective study could be developed that focuses on patients on dual antiplatelet therapy and if they may benefit from earlier imaging.

References

- 1 Angelozzi, A., Renda, G., Mercuri, M., & Caterina, R. (2015, December 21). The Risk of Intracranial Hemorrhage with Anticoagulation in the Elderly - Estimates of Prevalence and Therapeutic Strategies. Retrieved October 19, 2021
- 2 Nishijima DK, Gaona SD, Waechter T, et al. The Incidence of Traumatic Intracranial Hemorrhage in Head-Injured Older Adults Transported by EMS with and without Anticoagulant or Antiplatelet Use. *Journal of neurotrauma*. 2018;35(5):75-759. doi:10.1089/neu.2017.5232
- 3 Lampart A, Kuster T, Nickel CH, Bingisser R, Pedersen V. Prevalence and Severity of Traumatic Intracranial Hemorrhage in Older Adults with Low-Energy Falls. *Journal of the American Geriatrics Society (JAGS)*. 2020;68(5):977-982. doi:10.1111/jgs.16400
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