Critical Review Form
Prognosis

PGY-1

HYPERLINK "http://pmid.us/32332255"Cohan CM, Beattie G, Bowman JA, et al. Repeat computed tomography head scan is not indicated in trauma patients taking novel anticoagulation: A multicenter study. J Trauma Acute Care Surg. 2020 Aug;89(2):301-310.

Objectives: **"to determine the incidence of ICH-d [delayed intracranial hemorrhage] and the clinical outcomes associated with ICH-d in trauma patients on NOACs [novel oral anticoagulants] with an initial negative CTH." (p. 302)**

Methods: **This was a retrospective study using data collected on patients presenting to five level 1 trauma centers in Northern California between 2016 and 2018. Patients taking an oral anticoagulant (warfarin, dabigatran, apixaban, or rivaroxaban) with a concern for a possible traumatic brain injury based on head strike, signs of external injury, or mechanism and with an initial negative head CT scan were included. Patients taking a non-oral anticoagulant (e.g. enoxaparin) or dual antiplatelet therapy, and those dead on arrival were excluded. Patients taking a single antiplatelet agent remained eligible for inclusion.**

Practice varied between institution, with the decision to repeat the CT scan provider dependent at some institutions and repeat CT scans being routine after 4-6 hours of observation in others.

There were 777 anticoagulated patients meeting inclusion criteria during the specified time frame. Of these, 431 (55%) were taking warfarin and 346 (45%) were taking a NOAC. The mechanism of injury was fall in 84% and 87% of patients in these two groups, respectively. The median ages were 75 and 77 years and 49% and 51% were male. Among 423 patients who underwent repeat CT scan, the median time to repeat CT was 6 hours.

Guide		Comments
I.	**Are the results valid?**	
A.	**Was the sample of patients representative?** *In other words, how were subjects selected and did they pass through some sort of "filtering" system which could bias your results based on a non-representative sample. Also, were objective criteria used to diagnose the patients with the disorder?*	Yes. The authors included all patients on oral anticoagulation presenting to one of five level 1 trauma centers in Northern California with concern for a possible traumatic brain injury. The "disorder" of interest (head trauma) is not entirely objective. The authors did attempt to define head trauma somewhat more specifically, but given the retrospective nature of the study it is possible that patients without direct head injury may have been included.
B.	**Were the patients sufficiently homogeneous with respect to prognostic risk?**	Likely yes. This study included all patients with a negative initial CT, regardless of mechanism of injury, loss of consciousness, or mental status (GCS), and it is possible that patients with

	In other words, did all patients share a similar risk from during the study period or was one group expected to begin with a higher morbidity or mortality risk?	depressed mental status and dangerous mechanism would be included. However, as in other comparable studies the predominant mechanism of injury was fall and the mean GCS in the ED was > 14. This is still likely a low-risk sample of patients with mostly normal mental status.
C.	**Was follow-up sufficiently complete?** *In other words, were the investigators able to follow-up on subjects as planned or were a significant number lost to follow-up?*	No. Out of 777 patients identified, 354 (45.5%) did not have a repeat CT and were excluded from the final analysis. Of the 423 remaining patients, 246 (58%) were taking warfarin and 177 (42%) were taking a NOAC.
D.	**Were objective and unbiased outcome criteria used?** Investigators should clearly specify and define their target outcomes before the study and whenever possible they should base their criteria on objective measures.	No. At no point do the authors specify a primary outcome. While delayed ICH is presumably the primary outcome, the authors fail to define this and do not specify whether cerebral contusion is included in this outcome. There were 3 patients taking warfarin who had equivocal repeat head CT scans.
II.	**What are the results?**	
A.	**How likely are the outcomes over time?** *For the defined follow-up period, how likely were subjects to have the outcome of interest.*	● There were 10 cases of delayed ICH among patients taking warfarin (4.1%, 95% CI 2.0% to 7.4%). o There were 3 additional patients with an equivocal repeat CT; in 2 of these cases a 3rd CT was negative and in the third case the neurosurgeon felt the lesion was a calcification and NOT a hemorrhage. o Two of the patients with a delayed ICH (0.46%) required a neurosurgical intervention. ● There were only 4 cases of delayed ICH among patients taking a NOAC (2.3%, 95% CI 0.62% to 5.7%). o None of the patients in the NOAC group with a delayed ICH required a neurosurgical intervention and there were no deaths. ● None of the patients with a delayed ICH were taking a concomitant antiplatelet agent.
B.	**How precise are the estimates of likelihood?** *In other words, what are the confidence intervals for the given outcome likelihoods?*	See above.

III.	How can I apply the results to patient care?	
A.	**Were the study patients and their management similar to those in my practice?**	Yes. This study was conducted at multiple level 1 trauma centers in Northern California and included patients on any oral anticoagulation (regardless of concomitant antiplatelet use) with signs of head injury and a normal initial head CT. I would expect this cohort of patients to be similar to patients in our institution in whom I would be concerned for a possible delayed intracranial hemorrhage.
B.	**Was the follow-up sufficiently long?**	No. The median time to repeat CT scan was only 6 hours. While the optimal duration of observation (if any) is unknown, prior protocols for patients receiving warfarin recommended 24-hour observation and repeat CT scan. It is possible that more cases of delayed hemorrhage would have been seen in this study with a longer median interval.
C.	**Can I use the results in the management of patients in my practice?**	Uncertain While the risk of delayed hemorrhage among patients taking warfarin and NOACs was fairly high (4.1% and 2.3%, respectively), the need for neurosurgical intervention was low (0.46% and 0%, respectively). It is unclear from this study if those patients requiring an intervention developed concerning signs or symptoms during their period of observation that would have alerted providers to the presence of a significant hemorrhage.

Limitations:

1. **No primary outcome was specified.**
2. **This was a retrospective chart review relying on documentation in the medical record, which is often incomplete.**
3. **A repeat head CT was not obtained in 45% of patient encounters (loss to follow-up). No chart review was conducted to evaluate for delayed bleed, and it is possible that delayed hemorrhages were missed.**
4. **The authors failed to provide confidence intervals for the outcomes.**
5. **This was a rather small study with a low incidence of the primary outcome. As a result, the confidence intervals are rather wide.**

Bottom Line:

This small, retrospective study found that among patients taking warfarin and NOACs, the risk of delayed ICH was relatively high compared to other studies (4.1% and 2.3%, respectively). Need for neurosurgical intervention, however, was infrequent (0.46% vs. 0%). Repeat CT was not routinely performed at all of the included centers, and kit is unclear from this retrospective study whether patients with delayed hemorrhage, or specifically those requiring neurosurgical intervention, developed concerning signs of symptoms that would have alerted clinicians to the presence of a significant hemorrhage.