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20 Outcome Study of Mild Traumatic Brain Injury Patients Integrating a Brain Electrical Activity-Based Decision Rule

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Background / Study Objectives: Clinical decision rules such as the Canadian Head CT rule have high sensitivity but lack specificity for identifying significant intracranial findings when evaluating patients with mild traumatic brain injury (mTBI). Advances in brain electrical activity (EEG) signal processing, real-time analyses, and use of an AI/machine learning for the derivation of brain activity-based biomarkers have greatly enhanced the pragmatism of EEG clinically. High accuracy and negative predictive value have been demonstrated (n-720) using an FDA cleared brain activity-based multivariate algorithm for predicting the likelihood of intracranial injuries with $\geq$ 1mL blood visible on a CT scan. The SIC algorithm was derived using machine learning to identify distinctive waveform patterns in these mTBI patients. The purpose of this study was to evaluate the utility of an EEG-based structural injury classification (SIC) when added to the clinical evaluation of mTBI patients.

Study Design / Methods: A multi-center, prospective observational cohort study. Patients were eligible that were 18-85 years, sought ED care for traumatic closed head injury within 72 hours, and had a GCS 14-15. We excluded patients with conditions that prevented application of electrodes on the forehead, known neurological disease such as dementia or stroke, use of anticoagulants, age <18 years, and those with acute psychosis. We collected 5-10 minutes of eyes-closed EEG from frontal and frontotemporal regions, using an FDA cleared EEG-based algorithm (SIC). Clinician evaluations and imaging were conducted as per standard care with the addition of acquiring and sharing the results of the SIC algorithm with the clinicians. Clinicians were educated on the results of previous clinical trials utilizing this algorithm prior to study start up. Follow-ups included a symptom inventory and information on the need for additional clinical care or neuroimaging evaluation and was conducted by phone 72-96 hours after the initial evaluation.

Results / Findings: We present the results of the 142 subjects enrolled with a negative SIC result (those identified as likely no structural injury visible on CT). Their average age was 31.2 (18.3-75.3 years) and 86 (58%) were female. The most common injury was motor vehicle accident (70%). Treating clinicians nevertheless performed head CT on 36 (25%) participants, all of which were CT negative. Treating clinicians discharged the remaining 106 (75%) SIC negative participants without neuroimaging. In follow-up, 2 of these 106 participants returned to the hospital and received CT scans, both of which were found to be negative.

Conclusion: Integration of a rapid EEG-based algorithm in the evaluation of mTBI has the potential to reduce the utilization of neuroimaging.

Yes, authors have interests to disclose

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21 Emergency Department Observation of Children With Minor Blunt Head Trauma

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Objective: The Pediatric Emergency Care Applied Research Network (PECARN) traumatic brain injury (TBI) prediction rules suggest a period of observation prior to decision-making regarding computed tomography (CT) in children with minor blunt head trauma (BHT) who are not immediately identified as high- or very low-risk of clinically important TBI (ciTBI). We sought to evaluate the role of observation in the management of children with minor BHT.

Methods: We performed an a priori subanalysis of a prospective multicenter study of children with minor BHT (Glasgow Coma Scale Score $\geq$14). Physicians documented whether a child was observed before deciding on CT. We defined ciTBI as a TBI resulting in death, neurosurgical intervention, intubation > 24 hours, or admission for >2 nights due to the TBI in association with a positive CT. Guardians of patients discharged from the emergency department (ED) were contacted one week later to assess for ciTBI. To determine the association of observation on CT use, a multivariable logistic regression model controlling for hospital clustering and patient characteristics was created for patients < 2 years and $\geq$ 2 years old.

Results: 20,316 children (mean age $\pm$ standard deviation: 6.5 $\pm$ 5.3 years) were enrolled. Clinicians noted if the patient was observed before CT decision-making in 20,037 (99%) patients, and 4,564 (23%) patients were observed. The CT rate was 619/4,564 (13.6%) in those observed versus 5,779/15,473 (37.3%) in those not observed (difference: 23.8%; 95% confidence interval (CI): 22.5 to 25.0%). The rate of ciTBI was 14/4,564 (0.3%) in those observed versus 210/15,473 (1.4%) in those not observed (difference: 1.0%; 95% CI 0.8, 1.2%). The median age in those observed (4.0 years) was lower than those not observed (5.3 years, p<0.001). After adjustment for hospital and patient characteristics, observation was associated with decreased CT use in both patients < 2 years (odds ratio = 0.15 [95% CI 0.12, 0.19]) and $\geq$ patients 2 years (odds ratio = 0.15 [95% CI 0.12, 0.17]). The median length of stay (LOS) for patients who had an immediate CT decision (2.6 hours) was shorter than that for observed patients (2.97 hours, p<0.001). In the 619 patients who underwent CT after observation, the median time from ED arrival to CT was 1.75 hours. 90/619 (15%, 95% CI 12, 18%) had TBI on CT and 14/619 (2.3%, 95% CI 1.2, 3.8%) had ciTBI. 4,182 patients were discharged home after observation without CT and none (0%, 95% CI 0.000, 001%) were subsequently identified with ciTBI.

Conclusions: Observation was associated with a safe decrease in CT use among children with minor BHT with a slight increase in ED LOS. For children who are not immediately identified as having high- or very low-risk of ciTBI, a period of observation is recommended.

No, authors do not have interests to disclose

22 Efficacy of Emergency Department-Initiated 14-Day Ambulatory ECG Patch Monitors in Patients With Unexplained Syncope

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Study Objectives: Syncope is a common and costly emergency department (ED) chief complaint. Unfortunately, more than 50% of high-risk syncope patients do not follow up for further outpatient cardiac monitoring following ED or hospital discharge. Leadless and wireless ECG patch monitors are now widely available for ambulatory cardiac monitoring. We initiated a protocol in which ED physicians were given the option of discharging patients with a diagnosis of syncope with a 14-day ambulatory ECG monitor (AEM) placed by ED staff. The objective of this study is to evaluate the efficacy of our ED AEM protocol as defined by a change in medical management.

Study Design: This is a retrospective chart review of all ED patients, including both the ED and ED observation unit (with less than a 48-hour stay), with unexplained syncope who were discharged wearing an AEM between February 2019 and May 2021. Medical management was *a priori* defined as the initiation of new cardiovascular medications, further diagnostic testing, or cardiac-related procedures. We provide descriptive statistics and use chi-square for comparison of groups.

Results: 126 patients with unexplained syncope and AEM placement at the time of discharge were identified during the study period. 115 patients (53% female, age 58.5 $\pm$ 17.4 years) complied with wearing and returning the AEM and were included in the final analysis. 51 patients (44.0%) were directly discharged from the ED and 65 patients (56%) were discharged from the ED observation unit. 11 patients (9.6%) required ED provider calls to discuss AEM findings, 4 (3.5%) of which required emergent call back to the ED based on diagnoses of sustained ventricular tachycardia, sinus pause >6 seconds, or complete heart block. Ultimately, 12 patients (10.3%) had AEM findings that resulted in a change in medical management of: initiation of medications (58%), pacemaker implantation (25%), implantable or other loop recorder monitoring (25%), diagnostic cardiac catheterization (16.7%), and arrhythmia catheter ablation (8.3%). Change in medical management was not statistically significant when comparing patients with ED discharge to ED observation discharge (6.3% vs. 14.1%, p=0.15). No patients experienced sudden death or injury due to arrhythmia after ED discharge with AEM.

Conclusion: ED-placed AEMs for patients with unexplained syncope show high compliance rates and led to clinically important changes in medical management. Future prospective trials should assess time to change in medical management and time to arrhythmia diagnosis and incorporate a control group.

No, authors do not have interests to disclose

23 "Tele-observation": Evaluation of a Virtual Provider Program in an Emergency Department Observation Unit

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Objectives: The critical shortage of health care providers has been accelerated by the COVID-19 pandemic into a staffing crisis. In this setting, it became infeasible for

our large tertiary academic hospital to consistently staff our emergency department observation unit with on-site providers. Telemedicine has been utilized and studied as a solution to this shortage in part because it enhances access to a larger staffing pool and allows for increased flexibility without geographic constraints. While telemedicine is well vetted across the continuum of health care, there is a paucity of data regarding the use of telemedicine in the observation medicine setting. This study aimed to primarily evaluate the safety and quality of care and secondarily the satisfaction of staff and patients when using a virtual provider in an emergency department observation unit.

Design/Methods: This prospective observational quality improvement study occurred over a three month period where a virtual provider was piloted in an emergency department observation unit on dedicated night shifts at a tertiary care, academic hospital. Utilizing structured survey instruments and post shift interviews, nursing and provider perceptions of care were assessed across multiple domains of both health care quality, safety, and workflow efficiency. Secondary objectives evaluated include: patient and staff satisfaction, overall observation unit census and number of patients upgraded to a higher level of care. Patient satisfaction was assessed through surveys with questions based on Emergency Department Consumer Assessment of Healthcare Providers and Systems (ED-CAHPS) questionnaires. These were compared to the unit's ED- CAHPS results in the three month time frame prior to the pilot.

Results/Findings: 89% of nurses rated the virtual provider as equal, or better than an in-person provider when addressing clinical concerns. 96% of nurses similarly reported that the virtual provider was more or equally accessible. Moreover, 89% highlighted that the telemedicine workflow resulted in minimal or no increase to their work burden. Of the 16 virtual providers, 14 reported that they were *"extremely"* or *"very"* able to deliver appropriate care and engage with patients; the other 2 providers reported they were "*somewhat able*." 97% of patients reported satisfaction regarding their telemedicine experience. 3% of patients reported a neutral experience and none endorsed being dissatisfied. For ED-CAHP scores in the following categories: "*treated with courtesy and respect*," "*listened carefully*," "*explained in a way you understand,*" virtual providers scored "always," the highest mark possible, greater than 93% of the time. Comparatively, in-person providers scored, "*always*", 63-73% of the time in the above categories during the three month period prior to this pilot. There was only one patient upgraded to a higher level of care, which compared favorably to baseline.

Conclusions: After implementation of a virtual provider in an emergency department observation unit, clinical staff and patients perceived virtual care to be either similar or improved as compared to an in-person provider. A virtual provider may be an efficient and safe staffing solution in an emergency department observation unit. This may be particularly relevant in the context of an ongoing nationwide staffing crisis.

No, authors do not have interests to disclose

24 Emergency Department Virtual Telehealth Rounding – A Strategy for a Pandemic and Beyond

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Objective: Telehealth in the ED seems counterintuitive. However, COVID-19 surges have led to crowding and increases in patients leaving without being seen (LWBS). This study evaluated the impact of a novel virtual telehealth initiative (virtual telehealth rounding or VTR) in the ED on the prevalence of LWBS dispositions during the pandemic and its effect on mortality and patient safety.

Methods: We conducted a cross sectional study on adult patients presenting to a level 1 trauma and tertiary referral center who were triaged to the waiting room. The trial of VTR took place for 107 days in December 2021-April 2022 and was operational for 65 days (8-hours a day). The remaining 42 days without VTR served as a comparison group. During VTR patients were triaged per usual care on arrival to the ED. Those patients with triage acuity categories II to V who were triaged to the waiting room were then evaluated virtually by a remote clinician (advanced practice providers such as physician assistants, advanced nurse practitioners, and third year emergency medicine residents) after their initial screening examination using a secure virtual health platform in a private cubicle in the ED waiting room. Patients were then reevaluated at 1-2 hour intervals if necessary. ED paramedics were available onsite to take vital signs, transport patients, and communicate directly with the onsite nurses and ED physicians. Patients were evaluated virtually via an iPad by the virtual clinician and provided an initial assessment. They expedited care by ordering labs, radiography, changing the patient's triage category and determining early disposition according to usual clinical practice. Patients were then either left to wait in the waiting room, taken for radiography and/or blood work, or taken back to a room in the ED where they were seen by an onsite ED physician. The main outcome was the LWBS rate, including LWBS before and after triage, patients leaving against medical advice and elopements. Secondary patient outcomes included in-hospital mortality and improved patient safety via "great saves" defined as care that was urgently/emergently escalated by the virtual rounding provider.

Results: There were 19,958 patients in the analysis, 6,953 (35%) were evaluated via VTR and 13,006 (65%) received standard of care. Mean patient age was 50 years (SD20), 48 (95% CI 48-49) in the VTR group and 50 (95% CI 50-51) in the standard group. Females were 49%, with 3,489 (50%) females in the VTR group and 6,204 (48%) in the standard care group. Overall acuity levels at triage were II 24%, III 54%, IV 22%, and V 1%. Mean triage levels were 2.95 (95% CI 2.94-2.97) in the VTR group and 3.07 (95% CI 3.06 – 3.09) in the standard group. The proportion of LWBS was 565 (8%) in the VTR group and 3,246 (25%) in the standard care group ($p<0.001$). Overall, 27 (0.1%) of patients did not survive to hospital discharge, 7 (0.1%) in the VTR group and 20 (0.2%) in the standard care group ($p=0.421$). VTR clinician documented "great saves" in 5% of their patient encounters.

Conclusion: This novel approach to triage in the ED significantly reduced the proportion of patients with LWBS dispositions by 17%. Although in-hospital mortality was lower in the VTR group it was not statistically significant. Furthermore, VTR clinicians documented rapid escalations in care that may have otherwise been delayed or missed. This approach has the potential to improve patient care and provide relief from crowding.

No, authors do not have interests to disclose

25 Derivation and Validation of a Clinical Decision Rule to Risk Stratify Emergency Department Patients Diagnosed With Seasonal Influenza

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Study Objectives: Seasonal influenza is diagnosed in over 1 million United States emergency department (ED) visits yearly and leads to over 12,000 annual US deaths. Evidence to aid emergency medicine providers in risk-stratifying patients diagnosed with influenza in the ED is limited.

Methods: We completed a single-center retrospective cohort study evaluating all patients with a positive influenza test collected in the ED of a large tertiary care center that evaluates more than 88,000 patients annually. We analyzed clinical factors easily measured in the ED including demographics, vital signs, chest x-ray findings, and basic laboratory test results. We then developed a clinical decision rule to predict intubation or death in a derivation cohort comprised of patients diagnosed with influenza between 2007 and 2018 using those clinical factors with the most robust associations with the composite outcome of intubation or death. The rule was then validated in a second independently collected and analyzed retrospective cohort of influenza-positive patients evaluated in the same ED from 2018 to 2020.

Results: We analyzed patient-level data from 2,196 subjects in the derivation cohort and from 933 subjects in the validation cohort. Seventy (3.2%) and twenty-one (2.3%) patients were intubated or died in the derivation and validation cohorts, respectively. The combined cohorts were 56.7% female, 72.8% black, and 21.9% white. We found that a clinical decision rule assigning increasing risk to patients with 1) age $\geq$ 50, those with 2) two or more CDC-defined medical conditions associated with increased risk for influenza, those with 3) an SpO2 $<$ 96% on room air or requiring oxygen at triage, those with 4) a respiratory rate $\geq$ 22, those with 5) multifocal opacities or 6) a pleural effusion on chest x-ray, those with 7) a blood glucose concentration $\geq$ 130 mg/dL, those with 8) a blood urea nitrogen concentration $\geq$18 mg/dL, those with 9) a blood lactate concentration $\geq$ 1.7 mmol/L, and those with 10) a red cell distribution width $\geq$ 15% could successfully predict the need for intubation or death. This 10-component clinical decision rule exhibited an area under the curve (AUC) of 0.897 and 0.809 in the derivation and validation cohorts, respectively. The decision rule demonstrated high sensitivity for severe disease and substantially better performance than CURB-65 in the same cohorts. Removing the laboratory testing and chest x-ray components of the rule (factors 5-10) did not markedly affect performance, and the AUCs decreased to 0.841 and 0.795 in the derivation and validation cohorts.

Conclusions: This clinical decision rule shows promise in the risk stratification of patients diagnosed with seasonal influenza in the ED. It can assist emergency physicians in determining which patients with a positive influenza test during ED evaluation are at risk for progression to severe disease and therefore should be considered for inpatient admission. It performs better than existing clinical decision