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A quality improvement project: identifying and managing latent safety threats though a zone wide emergency department in-situ multidiscipline simulation program

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Introduction: High fidelity in-situ simulation has been found to detect system deficiencies, equipment failures, and conditions predisposing to medical errors, also known as latent safety threats (LST). What is not well reported is whether these LSTs are effectively managed. As a part of an ongoing quality improvement project, multidisciplinary, in-situ simulations were conducted across emergency departments (ED) in the Edmonton zone with the aim to identify LST and subsequently manage them to improve patient care. **Methods:** In 2017 simulations were conducted at EDs in the Edmonton Zone (N = 10). Following each simulation, a cross sectional, survey based assessment tool, was completed by participants to identify LST. These LST were shared with the site clinical nurse educator and/or site manager and a management plan made. Two to six months follow-up was made to track progress. For reporting, LST were grouped into themes, progress on LST were coded as either resolved, ongoing, or not managed. **Results:** A total of 112 LST were identified through 18 separate simulations. The most commonly identified LTS were: resuscitation resource required (n 23), lack of staff training (21), equipment not immediately available (20), IT resource required (8), medication not immediately available (6), staff requiring familiarization (5), medication resource required (5), IT issue (4), large equipment needed (4), small equipment needed (4), lack of staff resource (3), medication needed, (3), equipment malfunction (2), Environment cluttered (2), non-appropriate resource removed (2). Site follow-up identified a total of 52 LST that where resolved, and 60 LST that had ongoing work to manage them. No occurrences of LST not being managed were identified. **Conclusion:** Simulation was used to effectively identify LST. Creating a structured plan and follow up allowed many LST to be resolved and effectively managed. In 2018 simulation will reassess if LST remain.

Keywords: quality improvement and patient safety, simulation, latent threats

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Performance characteristics of the modified Sgarbossa criteria for diagnosis of acute coronary occlusion in emergency department patients with ventricular paced rhythm and symptoms of acute coronary syndrome

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Introduction: The ECG diagnosis of acute coronary occlusion (ACO) in the setting of ventricular paced rhythm (VPR) is purported to be impossible. However, VPR has a similar ECG morphology to LBBB. The validated Smith-modified Sgarbossa criteria (MSC) have high sensitivity (Sens) and specificity (Spec) for ACO in LBBB. MSC consist of 1 of the following in 1 lead: concordant ST Elevation (STE) 1 mm, concordant ST depression 1 mm in V1-V3, or ST/S ratio < -0.25 (in leads with 1 mm STE). We hypothesized that the MSC will have higher Sens for diagnosis of ACO in VPR when compared to the original Sgarbossa criteria. We report preliminary findings of the Paced Electrocardiogram Requiring Fast Emergency Coronary Therapy (PERFECT) study **Methods:** The PERFECT study is a retrospective, multicenter, international investigation of ED patients from 1/2008 - 12/2016 with VPR on the ECG and symptoms suggestive of acute coronary syndrome (e.g. chest pain or shortness of breath). Data from four sites are presented. Acute myocardial infarction (AMI) was defined by the Third Universal Definition of AMI. A blinded cardiologist adjudicated ACO, defined as thrombolysis in myocardial infarction score 0 or 1 on coronary angiography; a pre-defined subgroup of ACO patients with peak cardiac troponin (cTn) >100 times the 99% upper reference limit (URL) of the cTn assay was also analyzed. Another blinded physician measured all ECGs. Statistics were by Mann Whitney U, Chi-square, and McNemars test. **Results:** The ACO and No-AMI groups consisted of 15 and 79 encounters, respectively. For the ACO and No-AMI groups, median age was 78 [IQR 72-82] vs. 70 [61-75] and 13 (86%) vs. 48 (61%) patients were male. The median peak cTn ratio (cTn/URL) was 260 [33-663] and 0.5 [0-1.3] for ACO vs. no-AMI. The Sens and Spec for the MSC and the original Sgarbossa criteria were 67% (95% CI 39-87) vs. 46% (22-72; $p = 0.25$) and 99% (92-100) vs. 99% (92-100; $p = 0.5$). In pre-defined subgroup analysis of ACO patients with peak cTn >100 times the URL ($n = 10$), the Sens was 90% (54-100) for the MSC vs. 60% (27- 86) for original Sgarbossa criteria ($p = 0.25$). **Conclusion:** ACO in VPR is an uncommon condition. The MSC showed good Sens for diagnosis of ACO in the presence of VPR, especially among patients with high peak cTn, and Spec was excellent. These methods and results are consistent with studies that have used the MSC to diagnose ACO in LBBB.

Keywords: Sgarbossa's criteria, acute coronary occlusion, ventricular paced rhythm

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Evaluating the use of the pulmonary embolism rule-out criteria in the emergency department

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Introduction: Diagnosing pulmonary embolism (PE) can be challenging because the signs and symptoms are often non-specific. Studies have shown that evidence-based algorithms are not always adhered to in the Emergency Department (ED), which leads to unnecessary CT scanning. The pulmonary embolism rule-out criteria (PERC) can identify patients who can be safely discharged from the ED without further investigation for PE. The purpose of this study is to evaluate the use of the PERC rule in the ED and to compare the rates of testing for PE if the PERC rule was used. **Methods:** This was a health records review of ED patients investigated for PE at two emergency departments over a two-year period (April 2013-March 2015). Inclusion criteria were ED physician ordered CT pulmonary angiogram, ventilation-perfusion scan, or D-dimer for investigation of PE. Patients under the age of 18 were excluded. PE was considered to be present during the emergency department visit if PE was diagnosed on CT or VQ (subsegmental level or above), or if the patient was subsequently found to have PE or deep vein thrombosis during the next 30 days. Trained researchers extracted anonymized data. The rate of CT/VQ imaging and the negative predictive value was calculated. **Results:** There were 1,163 patients that were tested for PE and 1,097 patients were eligible for our analysis. Of the total, 330/1,097 (30.1%; 95% CI 27.4-32.3%) had CT/VQ imaging for PE, and 48/1,097 (4.4%; 95% CI 3.3-5.8%) patients were diagnosed with PE. 806/1,097 (73.5%; 95% CI 70.8-76.0%) were PERC positive, and of these, 44 patients had a PE (5.5%; 95% CI 4.1-7.3%). Conversely, 291/1,097 (26.5%; 95% CI 24.0-29.2%) patients were PERC negative, and of these, 4 patients had a PE (1.4%; 95%

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CI 0.5-3.5%). Of the PERC negative patients, 291/291 (100.0%; 95% CI 98.7-100.0%) had a D-dimer test done, and 33/291 (11.3%; 95% CI 8.2-15.5%) had a CT angiogram. If PERC was used, CT/VQ imaging would have been avoided in 33/1,097 (3%; 95% CI 2.2-4.2%) patients and the D-dimer would have been avoided in 291/1,097 (26.5%; 95% CI 24.0-29.2%) patients. **Conclusion:** If the PERC rule was used in all patients with suspected PE, fewer patients would have further testing. The false negative rate for the PERC rule was low.
Keywords: pulmonary embolism, D-dimer, diagnosis

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Transforming emergency stroke care through innovation: Canada's first stroke ambulance

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Introduction: A two-year Stroke Ambulance (SA) pilot project was implemented at the University of Alberta Hospital (UAH) in February, 2017, the first in the world to utilize this specialized technology in a rural setting. The primary objective is to evaluate clinical and economic implications of timely SA assessment and treatment of hyperacute stroke patients who present to non-stroke centres in rural Alberta and might otherwise have received delayed treatment, or not at all, due to prolonged transfer times. **Methods:** A steering committee and seven working groups were established, with representation from Alberta Health Services (AHS) programs impacted, to ensure comprehensive project development and implementation. The SA portable CT scanner, point of care laboratory, and videoconference system facilitate diagnosis of stroke in the field. The multidisciplinary team includes a stroke fellow, advanced & primary care paramedics, registered nurse, CT technologist, and telestroke physician. When not dispatched, the team provides stroke expertise and patient care in the emergency department (ED) and diagnostic imaging. The service model includes suspected stroke patients presenting to non-stroke centres within a 250 Km radius of Edmonton (Phase I); patients presenting to Edmonton Zone (EZ) hospitals without CT capability and/or tPA protocols (Phase 2); and expedited transport from EZ hospitals to the UAH for urgent endovascular therapy (EVT) (Phase 3). A health economic analysis will compare stroke ambulance care with standard care. **Results:** The SA has responded to 54 dispatches, 13 patients thrombolyzed and 3 patients receiving EVT. Median rendezvous to CT time was 10 minutes, median rendezvous to tPA time was 21 minutes, and mean time from symptom onset to tPA was 180 minutes. There were no complications. After SA imaging and assessment, 18 patients were repatriated back to their local community hospital, avoiding unnecessary admission to tertiary care. **Conclusion:** Our preliminary experience demonstrates that the SA offers a novel approach to performing timely evaluation and treatment of suspected stroke from non-stroke centres and may serve as an excellent triage mechanism, reducing avoidable admissions to overcapacity tertiary care EDs. The SA team provides added value to the ED with stroke expertise and patient care. A comprehensive health economic analysis will determine cost-effectiveness and whether spread is feasible.
Keywords: stroke, innovation, transforming

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Systemic thrombolysis for suspected high-risk pulmonary embolism: a retrospective medical record review

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Introduction: Current treatment guidelines advocate for the aggressive management of both high-risk and subsets of moderate-risk pulmonary embolism (PE) with fibrinolytic therapy. However, there is limited evidence on the risks and benefits of fibrinolytic therapy in PE, with mortality improvement still to be proven. This study aimed to report the incidence of major bleeding and death after thrombolysis for PE. **Methods:** A health records review was performed on data from two hospitals between 2007 and 2017. Pharmacy identified all patients who had received either alteplase or tenecteplase. Trained abstractors reviewed each chart to determine the indication for thrombolytic therapy. Patients were included if they received systemic thrombolysis for diagnosed or presumed PE. Data was extracted on 30-day mortality, International Society of Thrombosis and Hemostasis defined major bleeding within 30 days, premorbid anticoagulant and antiplatelet prescription, age, sex, comorbidities, renal function, history of bleeding, type and dose of thrombolytic and category of PE (high or moderate risk). **Results:** 1,534 patients were identified, of which 72 received systemic thrombolysis for PE. The median age was 57, 34 were male, 17 with a history of venous thrombosis and 12 with cancer. Fifty-four were classified as having high-risk PE, of whom 39 received cardiopulmonary resuscitation (CPR) when thrombolysis was administered. Formal confirmatory imagining for PE was obtained in only 23/39 patients who were in cardiac arrest. Eighteen patients were classified as moderate-risk PE. The incidence of major bleeding was 28/54 (52%, 95% CI 39-65%), and 3/18 (17%, 95% CI 6-39%) for the high and moderate risk groups respectively. There were 4 intracranial bleeds, all in the high-risk PE group. The only significant predictor of major bleeding was the need for CPR at the point of administration of the thrombolytic agent (OR 2.6, 95% CI 1.0-7.5, adjusted for age). Thirty-four patients died within 30 days (47%, 95% CI 36-59%), all in the high-risk PE group. Death was not associated with any demographic variable on univariate analysis. Death occurred in 28/39 (72%, 95% CI 56-83%) patients who received CPR and 6/33 (18%, 95% CI 9-34%) who did not. **Conclusion:** We found a high incidence of 30-day major bleeding and death following administration of thrombolysis for PE which will help inform future prognostic discussions in our institution.
Keywords: pulmonary embolism, thrombolysis, bleeding

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The development of a mentorship based, near-peer simulated resuscitation training program for medical trainees

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Introduction: High quality Cardiopulmonary Resuscitation (CPR) saves lives, however skill retention after standard Basic Life support (BLS) courses has been shown to be poor. Our goal was to develop a student-run, mentorship based program to allow repetitive practice of BLS skills while minimizing resource commitment and time requirements. **Methods:** We developed a top down training program that relied on online teaching resources, regular simulation training and near-peer feedback. First year medical students were given the opportunity to participate in the program and baseline CPR quality was documented. They were then divided into intervention and control groups. The intervention group participated in bimonthly 40-minute small group training sessions directed by senior medical students and monitored by a staff physician. The control group received no further training. At the end of the 8-month study period CPR quality was documented for all participants. **Results:** We included data from 54 medical students. Overall compression depth and rate were monitored using Laderall SimMan 3G(TM) high-fidelity CPR mannequins. Average rate and depth of compression were significantly improved in the intervention group relative to both the control group that did not