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Introduction: Utilization of CT pulmonary angiography (CTPA) to rule out pulmonary embolism (PE) has risen dramatically but diagnostic yield has fallen over the past several decades, suggesting that lower risk patients are being tested. Given little evidence to suggest improved patient outcomes with higher CTPA utilization, and increasing evidence of harm, evidence-based guidelines have been developed to reduce unnecessary CTPA use. The objective of this study was to assess the impact of an electronic clinical decision support (CDS) intervention to reduce unnecessary CTPA utilization for emergency department (ED) patients with suspected PE. **Methods:** This was a cluster-randomized, controlled trial with physicians as the unit of randomization. All emergency physicians (EPs) at 4 urban adult EDs and 1 urgent care center were randomly assigned to receive either evidence-based imaging CDS for patients with suspected PE (intervention) or no CDS (control) over a 1-year study period. CDS was launched in an external web browser whenever an intervention EP ordered a CTPA from the computerized physician order entry software for ED patients CTAS 2-5; however, physician interaction with CDS was voluntary. The CDS tool enabled calculation of patient-specific information, including the patients Wells score, PERC score, and age-adjusted D-dimer, as well as prediction of each patients pre-test risk of PE along with an imaging/no imaging recommendation. CDS recommendations could be printed for the medical record as could educational patient handouts to support physician decision-making. The primary outcome was CTPA utilization for patients with CEDIS chief complaints of shortness of breath or chest pain on the index visit. Secondary outcomes included index visit length of stay (LOS), and CTPA use or VTE diagnosis within 90-days. This study was REB approved. **Results:** Demographics were similar among intervention and control EPs; however, during a 2-year pre-intervention period control EPs had a higher baseline CTPA rate (8.5% vs. 7.7%, $p < 0.001$). In the first 8-months following CDS implementation, 94 intervention EPs saw 9,609 patients and voluntarily interacted with the CDS tool on 43.2% of eligible encounters while 91 control EPs saw 9,498 patients. CTPA utilization was higher among intervention EPs than control (9.6% vs. 8.3%, $p < 0.001$) as was ED LOS (302 vs. 287 minutes, $p < 0.001$). There was no difference in 90-day CTPA use or VTE diagnoses. **Conclusion:** In one of the largest RCTs of CDS to date, exposure to CDS was associated with higher rates of CTPA utilization and longer ED LOS on the index visit, and no difference in 90-day CT use or VTE diagnoses. These results differ from a concurrent study of CDS for patients with mild traumatic brain injury in the same physician population and may relate to the implementation of the CDS intervention and/or complexity of the underlying evidence-based algorithms.

Keywords: clinical decision support, pulmonary embolism, diagnostic imaging

LO74

Cost-effectiveness of pathways for diagnosing pulmonary embolism in Canada

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Introduction: Pulmonary embolism (PE) is a common cardiovascular condition with high mortality rates if left untreated. Given the non-specific and varied symptoms of PE, its diagnosis remains challenging and approaches can lend themselves to inefficiencies through over-testing and over-diagnosis. Clinicians rely on a multi-component and sequential approach, including clinical risk assessment, rule-out biomarkers, and diagnostic imaging. This study assessed the potential cost-effectiveness of different diagnostic algorithms. **Methods:** A cost-utility model was developed with an upfront decision tree capturing the diagnostic accuracy and a Markov cohort model reflecting the lifetime disease progression and clinical utility of each diagnostic strategy. 57 diagnostic strategies were evaluated that were permutations of various clinical risk assessment, rule-out biomarkers and diagnostic imaging modalities. Diagnostic test accuracy was informed by systematic reviews and meta-analyses, and costs (2016 CAD) were obtained from Canadian costing databases to reflect a health-care payer perspective. Separate scenario analyses were conducted on patients contra-indicated for computed tomography (CT) or who are pregnant as this entails a comparison of a different set of diagnostic strategies. **Results:** Six diagnostic strategies formed the efficiency frontier. Diagnosing patients with PE was generally cost-effective if willingness-to-pay was greater than $1,481 per quality-adjusted-life year (QALY). CT dominated other imaging modality given its greater diagnostic accuracy, lower rates of non-diagnostic findings and lowest overall costs. The use of clinical prediction rules to determine clinical pre-test probability of PE and the application of rule-out test for patients with low-to-moderate risk of PE may be cost-effective while reducing the proportion of patients requiring CT and lowering radiation exposure. At a willingness-to-pay of $50,000 per QALY, the strategy of Wells (2 tier) –> d-dimer –> CT –> CT was the most likely cost-effective diagnostic strategy. However, different diagnostic strategies were considered cost-effective for pregnant patients and those contra-indicated for CT. **Conclusion:** This study highlighted the value of economic modelling to inform judicious use of resources in achieving a diagnosis for PE. These findings, in conjunction with a recent health technology assessment, may help to inform clinical practice and guidelines. Which strategy would be considered cost-effective reflected ones willingness to trade-off between misdiagnosis and over-diagnosis.

Keywords: health economics, methodology, diagnostic technologies

LO75

Utility of red flags to identify serious spinal pathology in patients with low back pain: a retrospective analysis

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Introduction: Practice guidelines discourage routine imaging for low back pain and recommend selective use when serious underlying conditions are suspected. Evidence about prevalence of serious pathologies and accuracy of red flags for decision-making is limited. We describe rates of serious low back pathology, assess the accuracy of three red flags and model the utility of combining administratively available red flags to reduce imaging. **Methods:** A seven-year retrospective study of patients presenting with low back pain to four emergency departments in Nova Scotia, Canada. Patient characteristics were available from administrative data. We test sensitivity, specificity, positive and negative predictive values, and likelihood ratios of individual and combinations of red flags. We use decision curve analyses to assess the clinical utility of three red flags to inform imaging. **Results:** We included data from 38,714 patients presenting with low back pain. Serious low back pathology was diagnosed in 1,196 (3.09%): 847 (2.19%) were vertebral fractures, 184 (0.48%) unstable fracture, 262 (0.68%) cancer, 57 (0.15%) cauda equina syndrome, and 30 (0.08%) spinal infection. Value of combining three red flags (age >65, female sex, and trauma) was found: positive likelihood ratios of 4.36 and 9.74 for vertebral fracture and unstable fracture, respectively. Imaging for

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low back pain could be reduced by 28 per 100 patients using a model that incorporates sex, age >65, and trauma. **Conclusion:** Serious low back pathology is extremely rare in patients presenting with low back pain. Combinations of red flags readily available in emergency departments have the potential to reduce unnecessary imaging tests.
Keywords: low back pain, diagnostic imaging, red flags

LO76

Can emergency physicians perform carotid artery ultrasound to detect severe stenosis in patients with TIA and stroke?

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Introduction: Carotid artery stenosis (CAS) is a common cause of stroke. Patients with severe, symptomatic CAS can have their subsequent stroke risk reduced by carotid endarterectomy or stenting when completed soon after a TIA or non-disabling stroke. Patients presenting to a peripheral ED with TIA/stroke, may require transfer to another hospital for imaging to rule-out CAS. The purpose of this study was to determine the test characteristics of carotid artery POCUS in detecting greater than 50% stenosis in patients presenting with TIA/stroke. **Methods:** We conducted a prospective cohort study on a convenience sample of adult patients presenting to a tertiary care academic ED with TIA/stroke between June and October 2017. Carotid POCUS was performed by a trained medical student or a trained emergency physician. Our outcome measure, CAS >50% was determined by the final radiology report of CTA imaging by a trained radiologist, blinded to our study. A blinded POCUS expert reviewed the carotid POCUS scans. We calculated the sensitivity and specificity for CAS >50% using carotid POCUS versus the gold standard of CTA. **Results:** We enrolled 75 patients of which 5 did not meet inclusion criteria. The mean age was 70.4 years, 57% were male. 16% were diagnosed with greater than 50% CAS. 47% were stroke codes and 37% were admitted to hospital. Carotid POCUS had a sensitivity and specificity of 72% (46%-99%) and 88% (80%-96%) respectively. There were three false negatives of which two were exactly 50% ICA stenosis on CTA and the other was 100% occlusion of the distal ICA. Kappa coefficient for inter-rater reliability between standard and expert interpretation was 0.68 for moderate agreement. The scan took a mean time of 6.2 minutes to complete. **Conclusion:** Carotid POCUS has moderate correlation with CTA for detection of CAS greater than 50%. Carotid POCUS identified all the critical 70-99% stenosis lesions that would need urgent surgery. Further research is needed to confirm these findings.
Keywords: stroke, point-of-care ultrasound, transient ischemic attack

LO77

Predictors of adverse self-reported 10-day outcomes in emergency department patients with acute ureteral colic

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Introduction: Our objective is to investigate predictors of adverse patient reported outcomes during the 10 days after an index emergency department (ED) encounter for ureteral colic. **Methods:** This prospective two-city patient experience survey enrolled ED patients with confirmed 2-10 mm ureteric stones. Researchers telephoned consenting patients 10 days post-ED visit and assessed quality of life (QoL) using survey items from the VR-12 Health Outcome Survey. We used five survey items and three other variables to derive a composite measure of patient adverse experience (AE). The association between patient characteristics, symptoms and perceptions of care with outcome was determined using multiple logistic regression. **Results:** Of 224 patients studied (68% male, mean age 52 years) 154 (68.8%) indicated that one or more of the following AEs occurred during their 10 day followup interval: 103 (46%) reported that the impact of pain on their life was >4/10; 87 (39%) described poor or fair health status; 83 (37%) required >7 days for return of normal function; 66 (27.7%) had >2 severe pain episodes per day; 62 (27.7%) required ED revisit or hospitalization; 47 (21%) found usual activities were limited most or all the time; 45 (20%) required >2 opioid doses/day; and 24 (10.7%) lost >7 work days. A composite measure derived from 3 survey items (days to normal, pain impact, health status) captured 92% of patients with adverse experiences. On multivariable logistic regression modeling, the strongest predictors of adverse (composite) outcome were male sex (adjusted OR = 0.44; CI, 0.22-0.85), (excellent) quality of physician answers (OR = 0.40; CI,0.2-0.77), proximal or mid-ureteric stone (OR = 1.9; CI, 1.1-3.5), arrival pain severity (OR = 1.18 per unit increase; CI,1.01-1.4), and perceived physician skill (OR = 0.81; CI, 0.65-1.0). Patient age, stone size, pain duration, nausea, discharge pain and perceived ED care quality were not independent predictors of 10-day adverse patient experience in multivariate models. **Conclusion:** Patient sex, quality of physician communication, patient sex, arrival pain severity, and proximal stone location are highly associated with 10-day patient reported AE.
Keywords: renal colic, patient adverse experiences, quality of life

LO78

Point-of-care ultrasound compared with manual palpation for the detection of a carotid pulse in live models: a randomized cross-over study

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Introduction: Pulse check by manual palpation (MP) is an unreliable skill even in the hands of healthcare professionals. In the context of cardiac arrest, this may translate into inappropriate chest compressions when a pulse is present, or conversely omitting chest compressions when one is absent. To date, no study has assessed the utility of B-mode ultrasound (US) for the detection of a carotid pulse. The primary objective of this study is to assess the time required to detect a carotid pulse in live subjects using US compared to the standard MP method. **Methods:** This is a prospective randomized controlled cross-over non-inferiority trial. Health care professionals from various backgrounds were invited to participate. They attended a 15 minute focused US workshop on identification of the carotid pulse. Following a washout period, they were randomized to detect a pulse in live subjects either by MP first or by US first. Both pulse check methods were timed for each participant on 2 different subjects. The primary outcome measure was time to carotid pulse detection in seconds. Secondary outcome measures included comfort levels of carotid pulse detection measured on a 100mm visual analog scale (VAS), and rates of prolonged pulse checks (greater than 5 or 10 seconds) for each technique. Mean pulse detection times were compared using Students t-test. The study was powered to determine whether US was not slower than MP by greater than 2 seconds. **Results:** A total of 93 participants completed the study. Time to detect pulse was 4.2 (SD = 3.4) seconds by US compared with 4.7 (SD = 6.5) seconds by MP (P = 0.43). Seventeen (18%) participants took >5 seconds to identify the carotid pulse using US compared to 19 (20%) by MP (P = 0.74). Eight (9%) candidates took >10 seconds to