2022 LLSA Articles

BRADFORD L. WALTERS, MD, FACEP
WILLIAM BEAUMONT HOSPITAL – DEPARTMENT OF EMERGENCY MEDICINE
OAKLAND UNIVERSITY WILLIAM BEAUMONT SCHOOL OF MEDICINE

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Disclosures

- None
- My dog, Winston Churchill, is the official MCEP mascot, will do just about anything for a dog treat and my goal is to be the person Winston thinks I am.

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2022 LLSA Topics

1. Atrial Fibrillation
2. Acute Headaches
3. Care of Breastfeeding Patient
4. Emergency Diagnostic Imaging
5. Intraparenchymal Hemorrhage
6. Peds ALS
7. Procedural sedation
8. PE
9. Cardiac Syncope

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Atrial Fibrillation

- A multicenter randomized trial to evaluate a chemical-first or electrical-first cardioversion strategy for patients with uncomplicated acute atrial fibrillation.
- Scheuermeyer FX, Andolfatto G, Christenson J, et al.
- Academic Emergency Medicine 2019;26:970-981.
- A study in six Canadian ED's testing whether medications first or cardioversion first approach to atrial fibrillation is the better strategy focusing on clinical outcomes, safety, and patient-reported outcomes.

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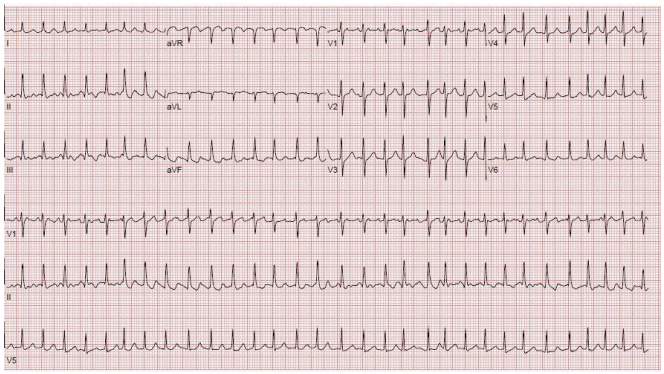
Overview

- Atrial fibrillation (AF) is the most common significant dysrhythmia seen in the ED and in uncomplicated patients with symptoms <48 hours Canadian guidelines permit either rate or rhythm control.
- There are two strategies typically employed in Canada:
  - Chemical cardioversion with procainamide, if unsuccessful electrical cardioversion (used in 56% of cases)
  - Go directly to electrical cardioversion and if unsuccessful then to medications (used in 44% of cases)
- Both strategies have been found to be safe with no serious adverse events within 30 days (stroke, MI, death) reported.



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Study Design

- Six urban university-affiliated ED's in Western Canada.
- Adult patients (18-75 y/o), **AF < 48 hours**, **CHADS2 score 0-1**, on anti-coagulation per 2011 Canadian guidelines.
- Atrial flutter, unknown time of Sx, and unstable patients excluded.
- Randomized to:
  - Chemical first and if unsuccessful electrical cardioversion.
  - Sedated, electrical cardioversion, if unsuccessful chemical cardioversion.

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Study Design

- Chemical-first:
  - Procainamide 17 mg/kg (max. 1500mg) infused over 1 hour (prior research shows 50% convert in 1 hour, 90% in 2 hours).
  - If fails, sedated and electrical cardioversion.
- Electrical-first:
  - Propofol 0.50 mg/kg bolus, 0.25 mg/kg q-1-min until sedated.
  - Synchronized cardioversion sequence 100J, 150J, 200J.
  - Procainamide immediately after 3rd shock if unsuccessful.
- Primary outcome = ED discharge in 4 hours.
- Secondary outcome = adverse events, 30-day patient-centered outcomes (quality of life assessment tool).
- Sample size calculation = 86 patients.

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Results

- 222 patients screen, 86 enrolled, 2 withdrew, 84 left for analysis.
- Discharge within 4 hours:
  - 13 of 41 (32%) in the chemical-first group were discharged within 4 hours with mean LOS 5.1 hours.
  - 29 of 43 (67%) in electrical-first group were discharged within 4 hours with an mean LOS 3.5 hours.
- In the chemical-first group 54% converted, 46% required countershock with average of 110 minutes waited to see if the procainamide worked.
- In the electrical-first group 88% successfully cardioverted, 4 of 5 remaining received procainamide and reverted to NSR.
- One in each group required a cardiology consult.
- All patients were eventually discharged home.

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Secondary Outcomes

- All adverse events were in the minimal risk category at ~ 25% seen in each group.
- **At 30 days there were no strokes or deaths in either group.**
- All patients followed up within 3-30 days with their PMD (this is Canada).
- ED re-visits:
  - Chemical-first at 3 days there were 5 re-visits, 1 admitted; at 30 days there were 9 re-visits, 2 admitted.
  - Electrical-first at 3 days there was 1 re-visit, no admissions; at 30 days there were 3 re-visits, no admits.

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LLSA Questions

- In the Scheuermeyer, et al., study on acute atrial fibrillation, study patients presented with *uncomplicated AF* of less than 48 hours, CHADS2 score of *0 or 1* and were between *18 and 75* years of age.
- In the AF study, all patients were eventually discharged from the ED but patients in the *electrical first strategy* had a significantly shorter ED LOS.

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Pearls for Chemical-first vs. Electrical-first Cardioversion for AF

- A great proportion of uncomplicated AF patients with symptoms < 48 hours can be discharged within 4 hours who are electrically cardioverted.
- Fewer electrically cardioverted patients end up re-visiting the ED within 30 days, few end up admitted in either strategy.
- For patients who do not convert with the initial strategy choice can be successfully cardioverted using the other strategy (electrical to chemical, chemical to electrical).
- Both strategies are very safe with no serious adverse events, i.e. stroke/death, at 30 days.

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Conclusion for AF

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Headaches

- Clinical policy: critical issues in the evaluation and management of adult patients presenting to the emergency department with acute headache.
- Goodwin SA, Cherkas DS, Panagos PD, et al.
- Ann Emerg Med 2019;74:e41-e74.
- An ACEP Clinical Policy series from the Clinical Policies Subcommittee on Acute Headache - an exceptional review of a common presentation to the ED.
- It uses the usual format of an critical literature review asking four questions giving strength of evidence and level of recommendation.

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Introduction

- Headaches are common ED presentation with the potential etiologies being high risk and time sensitive for diagnosis.
- It accounts for 2.8% of ED visits (3.8 million a year), ~14% undergo imaging, and 5.5% of that group found to have a significant lesion.
- **The authors emphasis that *"a response to treatment should not be solely used to determine whether a cause is benign".***
- CT or MRI remain the imaging modalities of choice, of note a CT exposes the patient to 2 mSv of radiation (CXR = 0.2 mSv).
- This clinical policy addresses the question in what circumstance is an **intracranial lesion** (saccular berry aneurysm, AV malformations) cause hemorrhage part of the suspected **rule-out diagnosis**.

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Risk Stratification

- *Question 1: In the adult ED patient presenting with acute headache, are there risk-stratification strategies that reliably identify the need for emergent neuroimaging?*
- Recommendation: **Level B**, **Ottawa Subarachnoid Hemorrhage Rule has a high sensitivity to rule out SAH but a low specificity to rule in the diagnosis.**
- Do not use a singe physical exam finding or symptom to rule out SAH, i.e. neck pain/stiffness.
- Use of a decision rule may decrease the incidence of missed SAH, expedite care, and avoid unnecessary imaging.
- But, because of poor specificity its application to the incorrect headache population may increase unnecessary imaging.

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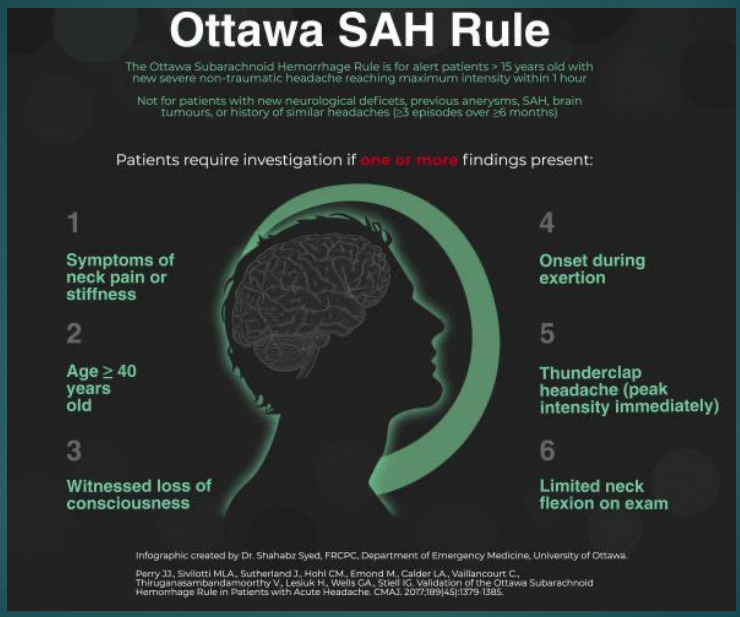

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Studies

- Sudden-onset, severe headaches peaking in 1 hour have a 6%-7% incidence of SAH.
- The mortality of SAH is as high as 50%.
- In a risk stratification study the OSAH Rule identified all 132 patients with SAH out of 2,131 subjects and in a second study all 67 or 1,153 patients with SAH were also identified by the rule.
- Studies looking at individual symptoms found an average specificity of 39% for the clinical parameters concluding that a single symptom, including the "thunderclap headache", as being unreliable.
- In terms of biomarkers none are currently available but, copeptin is promising and may be used in the future.

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Opioid vs. Nonopioids

- *Question 2: In the adult ED patient treated for acute primary headache, are nonopioids preferred to opioid medications?*
- Recommendation: **Level A**, **nonopioids are the preferred treatment for acute primary headaches.**
- With the opioid epidemic multiple national guidelines strongly discourage the use of opioids with the American Academy of Neurology making it a primary goal in their Choosing Wisely guideline.
- There is "clear and overwhelming evidence to support the use of nonopioid management".

'NUF SAID

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Non-Con Head CT

- *Question 3: In the adult ED patient presenting with acute headache, does a normal noncontrast head CT scan performed within 6 hours of headache onset preclude the need for further diagnostic workup for SAH?*
- Recommendation: **Level B**, **a normal noncontrast head CT within 6 hours coupled with a normal neurologic exam is sufficient to rule out nontraumatic SAH.**
- Such patients no longer need an LP as a confirmatory test given the accuracy of current generation CT scanners to detect an ICH within 6 hours to symptoms.
- As blood proteins diffuse out of an area of hemorrhage, particularly hemoglobin, the contrast between the brain parenchyma and the hemorrhage decreases to the point where after 6 hours the accuracy of the head CT is decreased.

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CTA vs LP

- Question 4: *In the adult ED patient who is still considered to be at risk for SAH after a negative noncontrast head CT, is CTA of the head as effective as LP to safely rule out SAH?*
- Recommendation: Only a Level C recommendation was found (level of expert opinion) **that both an LP and CTA can safely rule-out an SAH after a negative noncontrast CT.**
- Given that the benefit could be to avoid the LP and all of its difficulties (painful, time consuming, prone to false positives, complications such as spinal headaches).
- However, the downside is that CTA may identify incidental cerebral aneurysms that lead to unnecessary invasive procedures.

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CTA vs LP

- IN one study of 1739 patients who had an LP for SAH 15 were found to have an SAH with a number needed to diagnose of 116 (needed to do 116 LP's to diagnose one SAH); given that only 6 of those 15 patients underwent neurosurgical intervention that number needed to diagnose an SAH requiring intervention is 229.
- Traumatic taps are the bane of LP's with a number of different strategies to ascertain traumatic vs. SAH findings including cell count > 1000 in the last tube, xanthochromia, reduction of RBC count from the first to last tube – none of which have high sensitivities.
- Spinal headaches are reported to occur in 4%-30%, not a trivial number in the days past when LP's were a common, an almost every shift procedure.

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LLSA Questions

- Although the presence of neck pain and stiffness on physical examination in ED patients with an acute headache is strongly associated with SAH, their absence *should not be used* to rule out SAH.
- The use of non-opioid medications in the treatment of acute primary headaches in ED patients is *preferred* over potent opioid medications.

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Pearls for the Work-up of Non-Traumatic Headaches

- In a deep dive into the literature on non-traumatic headaches presenting to the ED the ACEP Clinical Policies group found:
  1. The key issue is diagnosing an SAH.
  2. The Ottawa Subarachnoid Hemorrhage Rule has a high sensitivity to rule out SAH, its specificity is not sufficient to rule it in.
  3. The initial test of choice is a noncontrast head CT that if negative in patients whose symptoms started less than 6 hours ago no further testing is necessary given current CT accuracy.
  4. Non-opioid analgesics are overwhelmingly the recommended over opioids.
  5. If the initial CT is negative but there is still concern for an SAH either an LP or CTA are equally recommended as the next test.
  6. LP's have a host of issues but is found to be highly sensitive, most of those issues are obviated by a CTA though it confers greater radiation exposure.

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Breastfeeding Patient

- *Managing the breastfeeding patient in the emergency department.*
- Black AD.
- Ann Emerg Med 2020;75:105-110.
- This was a summary of the topic from an emergency physician from the Rutgers New Jersey School of Medicine.
- There is a large table in the article highlighting safe and generally safe medications that is too large and detailed to be gone over in this lecture – most drug compendiums have this information.

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Concerns

- Brief interruptions in breastfeeding can lead to early weaning.
- Indiscriminate advice to "pump and dump" is often not in the best interests of either the mother or baby.
- **The breast is not the placenta and many meds are safe.**
- Obtaining a breast pump is often a means of maintaining a patient's supply of breast milk and easily procured in the ED.

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Medication Selection

- One of the common concerns in managing a breastfeeding patient is the safety of a given medication during lactation.
- Much of this depends on the concentration of said drug in breast milk that depends on lipid solubility, molecular weight, and protein binding.
- Not all medications contra-indicated during pregnancy are contra-indicated during lactation however, infant toxicity may differ considerably to that in adults.
- Analgesics tend to be safe including acetaminophen and NSAIDS.
- Opiates in general are safe save in high doses such as PCA pumps; fentanyl and morphine are recommended in single doses and hydromorphone should be avoid due to its long half-life in breast milk.
- Oxycodone and tramadol concentrates in breast milk and are not recommended.
- For procedural sedation midazolam and fentanyl are considered safe.

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Diagnostic Imaging

- CT scanning with contrast does not require interrupting breastfeeding.
- While there is a theoretical issue of toxicity or allergic reaction in the infant no reports of such have occurred.
- The same recommendation for MRI with gadolinium is extent.
- Nuclear studies are more challenging with current recommendations for HIDA scanning is not to interrupt breastfeeding while a V/Q scan requires a 13-hour interruption.

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Infections

- Illness in the mother is almost **never** a reason to disrupt breastfeeding.
- With maternal illness with the potential for airborne exposure (Tb, varicella) direct breast feeding should be avoided and pumped milk can be used by another caregiver; a mask is recommended if the mother is feeding the child.
- In herpes zoster breastfeeding can continue unless the lesions involve the breast directly.
- Simple mastitis is also not contraindicated in breastfeeding unless there is an abscess.

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LLSA Questions

- According to the American Academy of Breastfeeding Medicine, *hydrocodone* is the preferred oral narcotic analgesic agent.
- According to the American College of Radiology magnetic resonance imaging with gadolinium is considered *safe* in breastfeeding patients.

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Pearls for Managing the Breastfeeding Patient

- Medications that are contraindicated in pregnancy are often safe during lactation – the breast is not a placenta.
- Recommended analgesics include acetaminophen, NSAIDs, and single dose fentanyl or morphine.
- Oxycodone, hydromorphone, codeine, and tramadol are not recommended – hydrocodone is the recommended oral opiate when needed.
- CT and MRI contrast are safe and no interruption in breastfeeding is necessary.
- For nuclear studies HIDA scans are fine, V/Q scans need a 13 hour interruption.
- There are ample drug references on line to verify the safety of a given medication, use them liberally.

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Imaging in Renal Colic

- *Imaging in suspected renal colic: systemic review of the literature and multispecialty consensus.*
- Ann Emerg Med 2019;74:391-399.
- This was a brilliant article on the selection of the initial imaging study in suspected renal colic that not only looked at the literature but brought together a group of 3 emergency physicians, 3 radiologists, and 3 urologists who were presented with a clinical scenario and then voted on the imaging study to recommend; then the scenario was changed (patient sex, age, typical presentation, first time or previous history of kidney stones, etc.) and the process was repeated.

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Methodology

- 29 brief clinical scenarios were developed representing a variety of patient presentations that varied by age, sex, pregnancy, likelihood of stone, and likelihood of alternative diagnoses.
- Panel of 9 physicians were asked to select the "optimal imaging strategy" including no imaging, POCUS, radiology-performed US, reduced radiation CT, standard noncontrast CT, and contrast CT.
- Consensus was deemed perfect (9/9), excellent (8/9), good (6-7/9), moderate (5/9) and not reached (<5/9).
- Literature search provided screened 6337 articles, 232 deemed relevant.

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Scenario Examples

1. 35 y/o male, 2 previous stones, acute onset pain, N&V, + blood on dipstick, pain relieved with analgesics – moderate agreement **(5 POCUS, 4 no imaging).**
2. 55 y/o male, same as #1 – moderate agreement **(5 no imaging, 4 POCUS).**
3. 75 y/o male, same as #1 – good agreement **(7 CT, 2 US).**
4. 35 y/o male, no Hx stones, acute flank pain, N&V, + blood on dipstick, pain relieved – perfect **(9 POCUS).**
5. 55 y/o male, same as above – excellent **(8 CT, 1 POCUS).**
6. 75 y/o male, same as above – perfect (**9 CT).**
7. 35 y/o male, 6mm stone with stent placed yesterday, worse pain, N&V, pain relieved with IV analgesics – agreement perfect **(9 POCUS).**
8. 12 y/o male, no h/o stones, flank pain and vomiting, now relieved – agreement perfect **(9 US**).
9. Same as #7 but with positive US with hydronephrosis on same side – agreement perfect **(no imaging**).
10. Same as #7 but negative US and no hydronephrosis – agreement excellent **(8 no imaging, 1 CT).**

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Scenario Examples

1. 35 y/o female, 10 weeks pregnant, no h/o stones, acute onset pain, N&V, blood on dipstick, pain relieved with analgesics – perfect agreement **(9 US, 8 RPUS, 1 POCUS).**
2. 35 y/o female, same as above, POCUS shows hydronephrosis on same side as pain – perfect agreement (**no imaging**).
3. 35 y/o female, 30 weeks pregnant, no h/o stones, acute onset flank pain, N&V, pain relieved with analgesics – perfect agreement **(9 US, 8 RPUS, 1 POCUS).**
4. Same scenario as #3, US shows hydronephrosis on same side as pain – perfect agreement **(9 no further imaging).**

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Results

- RPUS is less sensitive for detection of stones compared to CT but it rarely misses stones that require intervention.
- CT is the reference standard with alternative findings ranging from 0%-33% in the literature, a closer look shows typically < 5% for clinically relevant findings.
- Reduced dose CT's are recommended though often not used.
- Perfect agreement found in 15 of 29 vignettes (45%) and excellent in 8/29 (28%)with CT recommended in only 7/29 (24%).
- This panel and study challenged the oft cited opinion that every first time stone requires a CT, particularly in younger patients.
- A negative US with no hydronephrosis is often a place where RDCT is recommended.
- In Older patients (> 75) regardless of h/o stones there was good to perfect consensus that CT is the recommended imaging study.

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LLSA Questions

- In this systematic review it was found that *radiology performed ultrasound* was unlikely to miss stones needing intervention.
- In this multi-specialty evidence-based consensus article by Moore, et al., a 35 year-old male with a history of stones who presents with typical symptoms and adequate pain relief, the imaging study of choice is *ultrasound*.

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Pearls for Imaging in Renal Colic

- For typical presentations in younger patients including young children, even with first time stones, US is the recommended study.
- With older patients >75 a CT is the recommended study with clinically relevant alternative findings found in < 5%.
- In women a RPUS is recommended as it may pick up pelvic pathology.
- Even with stent placement and recurrent symptoms US is still the recommended study.
- With lithotripsy and recurrent pain that is controlled in the ED an RPUS is recommended as a kidney hematoma is more likely to be seen compared to a POCUS.
- Reduced dose CT's are recommended in all cases.

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ICH

- *Cerebral Intraparenchymal hemorrhage, a review.*
- Gross BA, Jankowitz BT, Friedlander RM.
- JAMA 2019;321:1295-1303.
- This was one of the JAMA Clinical Review and Education series out of the University of Pittsburg Department of Neurosurgery and as such not from the point of view of emergency medicine.
- It is a good review of the subject but some of it is not applicable to the practice of emergency medicine.

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Overview

- Spontaneous intraparenchymal hemorrhage (IPH) is common, devastating, and clinically similar to ischemic stroke.
- Accounts for 6.5-20% of strokes with a 1-year survival of 40% and 10-year survival of 24%, functional independence 12-39%.
- Primary IPH accounts for 78-88% of cases due to rupture of damaged arteries most often due to HTN or cerebral amyloid angiopathy (CAA).
- Secondary IPH is due to coagulopathy, cerebral venous thrombosis, moyamoya, AVM, or cavernous malformation.

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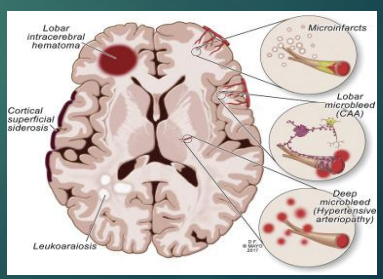
Primary IHP

- HTN is main risk factor causing degeneration in small arteries, more likely to occur in deep brain structures; smoking and alcohol use adds to the risk.
- CAA from amyloid deposition cause vessel wall weakness leading to rupture, diagnosis only made at autopsy but, is suggestive in older patients without another cause of bleed with multiple bleeds in lobar, cortical, or subcortical regions.



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Secondary IHP

- Secondary IHP tends to be due to more structural issues aside from coagulopathies such as AVM's, venous thrombosis, mycotic aneurysm rupture, tumor, moyamoya, conversion of ischemic stroke.
- AVM's have a 2% per year risk of rupture rising to 6% risk if hemorrhagic.
- Cavernous malformations are low-flow collections of dilated sinusoids that have a low rate of rupture and more often result in full recovery or minimal disability.
- Central venous thrombosis is a rare cause of IPH typically in patients with a known predisposing factor like pregnancy, use of OCP's, cancer, SLE, or thyroid disease.
- Moyamoya data comes mostly out of Japan is due to intracranial stenosis and formation of fragile collateral vessels.
- Hemorrhagic conversion of an ischemic stroke occurs in 12% of cases with atrial fibrillation the main risk factor.

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Clinical Presentation

- A patient with acute onset headache, seizure, or focal-CNS deficit(s) should be considered for IPH.
- Presentation is pretty similar to ischemic stroke, the main differential.
- CNS findings include arm paralysis (in 60%), leg paralysis (in 50%), dysphasia/aphasia (in 59%).
- Patients with cavernous malformations or AVM's are more prone to seizures.
- Pregnancy, known hypercoagulability, or recent dehydration suggests venous sinus thrombosis.

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Assessment, Diagnosis

- Timely assessment is key as 25% deteriorate on the way to the hospital with another 25% deteriorating in the ED.
- Immediate CT or MRI are the class 1 recommended studies.
- BP control, reversal of anticoagulants, and neurosurgical evaluation are all indicated and time sensitive and primarily where emergency physicians play a role.
- The American Heart Association/American Stroke Association guidelines can provide a severity score that predicts mortality but, are more relevant once the patient is admitted.

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Treatment IPH

- As always the ABC's are paramount, particularly **airway protection**.
- Patients on anticoagulants (VKA or DOAC) will **need reversal** including prothrombin concentrates, idarucizumab, or andexanet alfa - all have been shown to decrease hematoma growth.
- TXA and activated F-VIIa are **not recommended**.
- Patients on antiplatelets **should not get platelet transfusions** because the risk of death was higher and lower functional independence seen in several studies.
- Hematoma growth occurs in 30-38% of patients so BP control is important with a goal of < 140mmHg though studies looking at **BP control to 110-139 vs 140-179** showed **no difference in outcomes at 90 days.**
- **Routine anti-epileptic** prophylaxis is **not recommended** with worse outcomes seen but, patients who do seize should be loaded with Keppra or another anti-epileptic agent.

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Secondary IPH Treatment

- Treatment for **secondary IPH** is largely the same as primary: **ABC's, reverse anticoagulation, BP control, neurosurgery consultation.**
- Most of the considerations involved at this point would be up to the admitting team, neurosurgery, and IR such as:
  - Excision or embolization of AVM's.
  - Embolization of AV fistulas.
  - Cavernous malformations are generally excised.
  - Ruptured aneurysms are generally embolized.
- Recovery units specializing in neurorehabilitation is suggested but does not involve the ED.

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LLSA Questions

- According to the JAMA review article by Gross, et al., the 1-year survival rate for cerebral intraparenchymal hemorrhage is *40%*.
- In patients with a high international normalized ratio (INR) due to vitamin K antagonists, *prothrombin complex concentrates* are preferred over *FFP*.

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Pearls for Intraparenchymal Hemorrhage

- The clinical presentation of IPH mimics embolic stroke and includes headache, neurologic deficits particularly arm or leg paralysis or dysphasia/aphasia, seizures.
- Those patients particularly at risk are primarily HTN though smoking and ETOH use are contributory.
- First the ABC's must be addressed and airway control if necessary.
- Immediate neuroimaging, either CT or MRI, is essential.
- Reversal of anticoagulation is also necessary on an emergent basis however, use of platelets for patients on anti-platelets is not recommended.
- BP control is recommended with various BP goals studied but none firmly established – a goal of 140 mmHg has been shown to be safe and seems to be reasonable - nicardipine is the presenters choice for BP control, it is effective and titratable.
- Further considerations like surgical or IR intervention require consultation that should be sought in the ED if available.

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Peds Advanced Life Support

- *2019 American Heart Association Focused Update on Pediatric Advance Life Support: An Update to the American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care.*
- Duff JP, Topigan AA, Berg MD, et al.
- Pediatrics 2020;145:e20191361.
- This was an review focusing on airways in cardiac arrest, ECMO, and temperature control.
- As such there was little of relevant value for the ED as ECMO and temperature control post-cardiac arrest may not apply.

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Airway Management During CPR

- As pediatric cardiac arrest is **primarily due to respiratory issues** airway management is both paramount and clearly within the bailiwick of emergency physicians.
- The authors looked at data dating back at least a decade but compared BVM, intubation, and the use of subglottic airways (SGA's).
- Studies comparing **intubation to BVM** use found **no significant difference** in outcomes – both survival or neurologic recovery.
- In a review of the major US registry of pediatric cardiac arrest the outcomes of the BVM group vs. the intubated group showed double the rate of hospital discharge in the BVM group.

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Airway Management During CPR

- So looking at SGA placement compared to BVM and intubation the authors found:
  - SGA compared to BVM use showed no improvement or difference in outcomes or neurologic function in a propensity-adjusted cohort study but in 2 non-propensity matched observational studies the SGA group did better in terms of ROSC and hospital discharge.
  - **SGA compared to intubation showed no differences in neurologic or survival outcomes.**
  - Subgroup analyses (traumatic vs. medical arrests) could not be compared as there was just not enough data.

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Airway Management During CPR

- Recommendations updated for 2019:
  - ***BVM is reasonable compared with advanced airway interventions (endotracheal intubation or SGA) in the management of children during cardiac arrest in the out-of-hospital setting.***
  - That recommendation would seem to apply to the ED setting as well.
  - They could not make any definitive recommendation for or against the use of advanced airway management for in-hospital cardiac arrest (IHCA).

***presenters comments: BVM use is not simple as it appears and requires meticulous attention to well fitting masks in children and is absolutely a 2-person procedure, intubation of children in my experience is successful in the majority of cases and takes little time, it allows the use of a ventilator (particularly if ROSC is obtained) and frees up my staff.**

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EPRC in Pediatric Cardiac Arrest

- Extracorporeal CPR (ECMO) is a highly specialized endeavor that is not available in the majority of hospitals, it is primarily used in IPCA, and as such has little applicability to the practice of the majority of emergency physicians faced with a pediatric cardiac arrest.
- While not going into the detailed analysis of the literature and data the bottom line was:
  - ***ECPR may be considered for pediatric patients with cardiac diagnoses who have IHCA in settings with existing ECMO protocols, expertise, and equipment.***

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Post-Cardiac Arrest TTM

- Targeted temperature management (TTM) is something that most emergency physicians are not faced with as typically in a pediatric cardiac arrest the time in the ED is not such that TTM is an issue.
- However, knowledge of the issue is important as cooling might be at least initiated in the ED typically with cooling pads.
- Studies have looked at this issue pretty intensively with finding that a **fever is clearly detrimental** to patient outcomes so at the outset TTM to 36-37.5°C is important.
- **Cooling below that**, to 32-34°C, has **not been shown to be of substantive advantage** over keeping the patient normothermic at 36-37.5°C.
- This has been studied in both out-of-hospital and in-hospital cardiac arrest in the THAPCA-OH and THAPCA-IH trials with the in-hospital trial stopped early because of lack of difference between the hypothermia and control groups.

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Post-Cardiac Arrest TTM

- The conclusions to TTM by the authors is as follows:
  - **Continuous measurement of core temperature is recommended.**
  - **For infants and children between 24 hours and 18 years of age who remain comatose after OHCA or IHCA, it is reasonable to use either TTM 32-34°C followed by TTM 36-37.5°C or to use TTM 36-37.5°C.**

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LLSA Questions

- For airway management, the AHA PALS update concluded that it is reasonable to continue bag-valve mask ventilation versus *attempting an advanced airway such as endotracheal intubation* in pediatric patients with out-of-hospital cardiac arrest.
- The AHA PALS update concluded it is reasonable to use targeted temperature management of 32-34°C followed by 36-37.5°C, or to use targeted temperature management of 36-37.5°C *for pediatric patients who remain comatose* after resuscitation from out-of-hospital or in-hospital cardiac arrest.

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Pearls for Pediatric Cardiac Arrest Update 2019

- BVM use in pediatric cardiac arrest was found to as effective with equivalent outcomes (survival and neurologic) to using a SGA or intubating the patient – so there is really no need to immediately intubate the patient and it can wait until ROSC is obtained.
- The use of ECMO in pediatric cardiac arrest has been shown to be advantageous primarily in IHCA but, is beyond the ED.
- Temperature management with cooling pads is important mostly to keep the patient normothermic, 36-37.5°C, and cooling below that has not shown to improve outcomes – again may not be something applicable in the ED as the patient is often out of the ED by the time that issue becomes a consideration.

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Propofol Guideline Update

- *Clinical practice for emergency department procedural sedation with propofol: 2018 update.*
- Miller KA, Andolfatto G, Miner JR, Burton JH, et al.
- Ann Emerg Med 2019;73:470-480.
- This was an update to the guideline on the mainstay drug for procedural sedation in emergency medicine – it did not go into the use of propofol for continued sedation in an intubated patient.
- It is a drug every emergency physician needs to be facile and expert with and as such this is a worthwhile review.
- The editor, Baruch Krauss, MD is someone worth noting as one of the clearest and cogent thinkers in emergency medicine today.

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Update on Propofol

- First clinical advisory in 2007 (while I was fighting turf battles over this drug) addresses special pediatric dosing and oxygen requirements, further literature has clearly established its safety and commenting on combining propofol with other medications (ketamine, fentanyl).
- Propofol is a highly lipid soluble drug encased in microspheres of lipid that potentiates the gamma-aminoburtyric acid activity, 30-60 second onset, < 10 minute duration of action.
- Has amnestic properties but **NO** analgesic effect.
- Contraindications revolved primary around allergy to soy and egg proteins however, the American Academy of Allergy, Asthma, and Immunology has stated **propofol is safe in soy/egg allergic patients.**
- The only TRUE contraindication is actual allergy to propofol itself.

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Higher Risk Patients

- Age – children < 6 months old (particularly < 3 months) or < 5 kg have a higher risk for any sedative, including propofol.
- Age – geriatric, more prone to hypotensive and respiratory depressive effects.
- Comorbidities – higher ASA classification are at increased risk, particularly hypotension, having said that it has been used very successfully due to its titratability.
- Fasting - as shown most definitively by Steven Green, MD from Loma Linda has insufficient evidence as a requirement for procedural sedation, care of course in patients at risk for aspiration.*

**** Presenters comment – procedural sedation is NOT general anesthesia, the procedure is more important than fasting state.***

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Administration

- **Adult Dosing** – based on lean-body mass:
  - Initial bolus = **0.5-1.0 mg/kg**, slow IV push.
  - Subsequent boluses = q-1-3-minutes, **0.25-.05 mg/kg**
- Pediatric Dosing – require a higher dose/kg due to larger volume of distribution:
  - Initial bolus younger children (< 3 y/o) – **2.0 mg/kg**
  - Initial bolus older children (> 3 y/o) – **1.5 mg/kg**
  - Subsequent boluses – **0.5-1.0 mg/kg**
  - Expect wide variation in pharmacokinetics in children so patience and titration is paramount to successful sedation.

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Presenter's Approach to Propofol Dosing in Adults

- *Propofol is among the most titratable drugs available, as such one can always give more and with small, frequent doses can put the patient to the exact depth of sedation for a given procedure.*
- *Often the cited bolus doses are associated with hypotension.*
- *Adults: initial bolus in average adult – 20-40mg IV, assess sedative effect, repeat q-30-60-seconds giving more or less depending on that individual patient's reaction and duration of the procedure and depth needed.*
- *Children: calculate the bolus (1.5-2.0 mg/kg), given half IV, assess patient's reaction, repeat with rest of bolus and 0.5-1.0 mg/kg q-30-60-seconds increasing or decreasing dose as patient's response dictates, depth of sedation necessary, duration of procedure.*

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Co-Administration with Other Drugs

- Adding additional medications along with propofol is common practice and there is an increasing body of literature that supports the safety and efficacy of such.
- Again, propofol is sedative and amnestic but, not analgesic (it is also a very effective anti-emetic).
- Ketamine – frequently combined 1:1 with propofol (Ketofol), recovery time may be longer, works well.*
- Fentanyl – not as much literature on this combination, does seem to work better than fentanyl/midazolam, shown to be as effective as Ketofol.

***presenter's comment: have used Ketofol, works well, however personally found no greater advantage to just propofol alone, and there is the added hassle of getting it mixed up by our pharmacy staff.**

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Adverse Effects – Respiratory Depression

- **Respiratory depression** – can occur, particularly in younger children, supplemental oxygen with ETCO2 monitoring is highly suggested to the point of being required in all cases.
- In adults hypoxia ranges from 1-12% of cases with BVM use in 3-20%.
- In children hypoxia is seen in 1-9%, apnea in 1-6%.
- Vast majority of these incidents resolve with airway support for a short period of time.
- Serious adverse events (laryngospasm, intubation)are rare and occurs in adults < 0.1% and <0.2% in pediatric propofol cases.
- With Ketofol or propofol/fentanyl the incidence of respiratory events seems to be the same as with propofol alone.

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Adverse Events - Hypotension

- Aside from hypoxia/respiratory depression the other major side-effect of propofol is **hypotension**.
- Incidence in adults ranges from 4-17% and in children 2-15%.
- All reported cases were transient, self-resolved, or resolved with IV fluid administration.
- Can occur more often in volume depleted patients so giving a bolus of fluids before the procedure is prudent in such cases.
- Hypotension tends to occur more with the initial bolus, particularly when given rapidly.
- As expected the incidence of hypotension is less with Ketofol.

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Adverse Events – Pain, N&V, Infusion Syndrome

- Pain with the initial injection is commonly reported, one can go through the hassle of infusing lidocaine 0.5 mg/kg with a tourniquet around the arm and letting it dwell for 90 seconds, or just give it.
- N&V – propofol is an excellent anti-emetic and decreases the incidence of vomiting seen with ketamine, aspiration is rare (1/12,500 sedations).
- Propofol infusion syndrome is where acute, refractory bradycardia progressing to asystole seen in the presence of metabolic acidosis, rhabdomyolysis, hyperlipidemia, or fatty liver; seen with higher doses used in the ED like the ICU in intubated patients– **HAS NOT BEEN reported in ED use**.

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LLSA Questions

- According to the clinical practice guideline for ED procedural sedation with propofol the recommended initial bolus is *0.5-1 mg/kg* with additional boluses of *0.25-0.5 mg/kg* every 1-3 minutes with obese patients receiving a lower total body weight dose.
- Children require *higher* per kilogram dosing to achieve desired sedation.
- Use of supplemental oxygen is *recommended* in the adult and pediatric patient receiving propofol.

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Pearls on the Updates Guideline for Propofol

- Propofol is a highly effective and safe sedative agent for procedural sedation in the ED – every EM physician should be skilled in its use.
- Given its high lipid solubility it has a rapid onset and short duration of action.
- It is safe for use in both pediatric and adult patients.
- Contraindications include true allergy to propofol – not allergy to peanuts or soy, younger than 6 months, caution in older patients.
- Respiratory depression, hypoxia, and hypotension are the major adverse events associated with propofol – can be lessened with routine oxygen supplementation, titration with smaller more frequent doses, pre-treating with IV fluid administration.
- Doses as noted with children requiring higher mg/kg dosing.

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Adjusted d-Dimer

- *Diagnosis of pulmonary embolism with a d-Dimer adjusted to clinical probability.*
- Kearon C, de Witt K, Parpia S, et al – for the PEGeD Investigators.
- N Engl J Med 2019;381:2125-34.
- The dean of pulmonary emboli, Dr. Jeffrey Kline, has emphasized the use of an adjusted d-dimer coupled with a risk assessment for a long time.
- This is a retrospective analysis of the PEGeD study of 2017 where there was an incidence of PE of 7.4% to **see if a d-dimer of < 1,000 ng/ml ruled out a PE in low risk patients and < 500 ng/ml in moderate risk patients.**

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Diagnosis

- CT angiography imaging is the gold standard with a high negative and positive predictive values.
- The disadvantage is that it imparts a fair bit of radiation, expensive, potential contrast reactions, and currently with COVID ties up the CT scanner with the more intense decontamination protocols.
- The usual clinical pretest probability is based on one of the clinical prediction rules such as the Wells Criteria into low, medium, and high pretest probability.
- D-dimer is formed when fibrin is broken down with a typical threshold of < 500 ng/ml
- **The combination of a low Wells Criteria and d-dimer < 500 can be considered to have ruled out a pulmonary embolus with no further testing necessary.**

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Wells Criteria

Features	Score (points)
Clinical signs and symptoms of DVT	3.0
No alternative diagnosis	3.0
Heart rate >100 beats/min	1.5
Immobilization ≥3 days or surgery in the previous 4 weeks	1.5
Previous DVT or PE	1.5
Hemoptysis	1.0
Malignancy with active treatment in the past 6 months or under palliative care	1.0
Pretest clinical probability	
PE unlikely	≤4.0
PE likely	>4.0

PE = Pulmonary embolism, DVT = Deep vein thrombosis

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Study Design, Results

- PEGeD was a prospective study with enrollment at Canadian university-based centers.
- Patients were categorized by the Wells criteria and then had a d-dimer done.
- **Patients at low risk by Wells and a d-dimer < 1,000 ng/ml or moderate risk by Wells and a d-dimer < 500 ng/ml underwent no further work-up.**
- Follow-up was in 90 days or sooner if symptoms did not improve or worsened with the primary outcome was **symptomatic, objectively verified VTE (PE or DVT).**
- 1,970 patients, mean age was 52 y/o, 66% female, who had a low or moderate Wells score and 1,325 had a negative d-dimer, none were anticoagulated, **NONE** had a subsequent **VTE**.
- PEGeD diagnostic criteria resulted in the imaging of 34% of patients who by standard criteria 52% would have had CT's.
- In this PEGeD strategy 98% of patients had a d-dimer compared to 87% by standard criteria.

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LLSA Questions

- According to the authors, avoiding chest CTA in suspected PE patients with low Well's C-PTP and d-dimer of *less than 1000 ng/ml* is safe and PE can be ruled out.
- The authors of this study explain that the two ways to possibly increase the percentage of patients who have suspected PE ruled-out using the C-PTP/d-dimer assessment are either *increasing the d-dimer cutoff threshold level that defines a negative test or using the d-dimer testing to rule out PE in more than just patients with a low C-PTP.*

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Pearls for Adjusted d-Dimer for PE

- A clinical decision rule such as the Wells Criteria coupled with a d-dimer of < 500 ng/ml safely identifies patients who need no further work-up for PE (i.e. CT angiography or V/Q scanning).
- However, adjusting the d-dimer threshold upwards to 1,000 ng/ml for patients with a low pre-test probability was safe and accurately identified patients in whom no further work-up is necessary.
- This strategy would be expected to reduced CT scanning by ~20% with the minimal extra cost of an additional 11% more d-dimer measurements.

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Anticonvulsants

- *Randomized trial of three anticonvulsant medications for status epilepticus.*
- Jaipeep K, Elm J, Chamberlain JM, et al.
- N Engl J Med 2019;381:2103-2013.
- This was a multi-center trial of 384 patients in status epilepticus who were randomly assigned to receive levetiracetam, fosphenytoin, or valproate in the *Established Status Epilepticus Treatment Trial (ESETT)*.
- Interim analysis led to the **trial being stopped early** as all three drugs showed no superiority over any of the others.

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Introduction, Study Design

- Status epilepticus (SE) is a medical emergency, with the increase in brain metabolism and the fact the brain is essentially a strictly glucose dependent tissue sustained seizures can lead to brain injury.
- Benzodiazepines are the first line anti-seizure medication but, up to 1/3 of patients do not respond and need another anti-epileptic.
- Early termination of SE decreases the risk of respiratory/cardiac complications, reduced risk of ICU admission, and lower mortality in children.
- This randomized, blinded, comparative-effectiveness study compared levetiracetam, fosphenytoin, and valproic acid who had failed a **"generally accepted"** dose of a benzodiazepine and remained seizing.
- Minimal adequate cumulative benzo doses were defined as **diazepam 10mg (IV, PR), , lorazepam 4mg (IV), or midazolam 10mg (IV, IM).**

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Outcomes

- Primary outcome – absence of seizures and improving responsiveness in 60 minutes.
- Secondary outcomes – time to termination of seizure activity, ICU admission, length of ICU admission.
- Primary safety outcome was composite of life-threatening hypotension or cardiac arrhythmia within 60 minutes with additional safety outcomes of death, intubation, siezure recurrence more than 60 minutes after trial drug infusion, and acute anaphylaxis.
- Trial drug adult dosages (for pediatric doses see appropriate database):
  - Levetiracetam (Keppra) 60mg/kg (max 4500mg)
  - Fosphenytoin 20 mgPE/kg (max 1500 mgPE)
  - Valproate 40mg/kg (max 3000mg)

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Results

- 384 patients enrolled 11/2015 – 10/2017, 16 enrolled twice.
- Deviations from enrollment included inadequate or mis-timed benzodiazepine administration, not in status (including psychogenic siezures).
- **Termination of seizure activity was seen in 47% levetiracetam patients, 45% with fosphenytoin, 46% for valproate – statistically the same for each agent with none showing great efficacy.***
- Adverse safety events (no significant difference seen):
  - Levetiracetam – hypotension 0.7%, arrhythmia 0.7%, intubation 20%.
  - Fosphenytoin – hypotension 3.2%, arrhythmia 0%, intubation 26.4%.
  - Valproate – hypotension 1.6%, arrhythmia 0%, intubation 16.8%.

Authors did NOT suggest what the next step would be with the ~50% failure of agents used to break SE.

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LLSA Questions

- While evidence support the use of benzodiazepines in seizures, up to *33%* of patients do not respond to them.
- Of the three most commonly used medications to treat refractory seizures, only *fosphenytoin* is labeled by the FDA for this in adults and none approved for children

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Pearls for Status Epilepticus

- Rapid termination of SE results in better patient outcomes and starts with **adequate** doses of a benzodiazepine, at a minimum:
  - **diazepam 10mg (IV, PR)**
  - **lorazepam 4mg (IV)**
  - **midazolam 10mg (IV, IM)**
- Expect ~1/3 of patients to be benzodiazepine refractory.
- The use of an anti-epileptic agent is the next step, effective in ~50% of cases:
  - Levetiracetam 60mg/kg (max 4500mg)
  - Fosphenytoin 20 mgPE/kg (max 1500 mgPE)
  - Valproate 40mg/kg (max 3000mg)
- Arrhythmia or hypotensive adverse events are relatively uncommon and equal between agents, expect to intubate ~ 20%-25% of patients.

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Syncope

- *Did this patient have cardiac syncope? The rational clinical examination systemic review.*
- Albassam OT, Redelmeier RJ, Shadowitz S, et al.
- JAMA 2019;321:2448-2457.
- This was part of JAMA "The Rational Clinical Exam" series out of the internal medicine division of the Sunnybrook Health Sciences in Toronto, Ontario.
- As such it is NOT geared toward emergency medicine but has some worthwhile information though it does go into aspects of the treatment/work-up that is beyond what would typically occur in the ED.
- This was an intensive literature review to answer the question if there **are clinical parameters or combinations of such that can distinguish cardiac syncope from other etiologies.**

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Overview – Cardiac Syncope

- The common serious causes of syncope are cardiac syncope, reflex syncope, and orthostatic hypotension.
- Transient LOC can also be due to seizures.
- Cardiac syncope is due to a reduction in cardiac output due to cardiopulmonary disease; i.e. arrhythmia, structural heart disease, or pulmonary embolism.
- May be preceded by chest pain, SOB, or palpitations with witnessed **cyanosis** strongly pointing to a cardiac cause if noticed.
- Abnormalities in heart rate or rhythm, abnormal EKG, or elevated troponin or BNP all point to a cardiac cause for syncope.

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Overview – Reflex Syncope

- Reflex syncope is mediated centrally with a reduction in heart rate, vascular resistance, or both.
- **Vasovagal syncope** is the most common form usually initiated by prolonged sitting or standing resulting in pooling of blood in the legs.
- The usual adjustments to maintain perfusion with the change in position lead to exaggerated increase in heart rate and contractility against an underfilled ventricle that then lead to a reflex increase in vagal tone, lower heart rate, reduced peripheral resistance, and a fall in perfusion leading to unconsciousness.
- Afferent stimuli in the gut, pressure on the carotid sinus baroreceptor, pain, sight of blood can all trigger a similar reaction.

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Overview – Orthostatic Hypotension, Seizures

- In syncope due to orthostatic **hypotension the primary issue is reduced venous return to the heart** resulting in a fall in cardiac output.
- **Volume depletion**, blood loss, medications, disorders of the autonomic nervous system are all potential etiologies of this type of syncope.
- In **seizures** observation of tonic/clonic movements, LOC prior to the onset of muscle activity, and a confusional state after the period of LOC all point to a CNS etiology of syncope.
- **Previous history of sudden LOC** might also point to seizures as an etiology.

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Prevalence, Study Design

- Incidence of syncope in adults is 0.6%/year, increased to 2-6% in elderly adults.
- Cardiac syncope is seen in 5-21%, vasovagal 21-48%, orthostatic in 4-24%, and non-syncopal syndromes (cataplexy, psychogenic) 8-20%.
- This study was a literature review out of 11,460 abstracts 552 were reviewed with 12 studies meeting pre-set criteria.
- 4,317 patients within these 12 studies, 6 studies enrolled patients from the ED, 3 studies were in-patient, 2 enrolled out-patients.
- **In these studies 9-58% of patients were diagnosed with cardiac syncope and in 3-37% no cause for syncope found after an extensive work-up.**

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Demographics, Factors

- Demographics: age > 35 y/o with first syncope was associated with a higher incidence of cardiac etiology along with known structural heart disease, atrial fibrillation/flutter, CHF.
- Pain or medical procedure were factors that lowered the likelihood of cardiac syncope.
- Syncope after using the toilet along with effort syncope or LOC during effort lessened the chance of cardiac syncope.
- Dyspnea and chest pain prior to syncope suggests a cardiac cause while headache or abdominal pain prior to the LOC pointed away from the heart as a source.
- Witnessed cyanosis during the event suggests cardiac syncope while inability to recall events lowered the likelihood.
- Injury after syncope was inconsistent in terms of including or excluding cardiac causes of syncope.

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Combination of Findings

- Given relatively low sensitivities and/or specificities for a given finding a scoring system using multivariable analysis to group findings has been developed.
- The Evaluation of Guidelines in Syncope Study **(EGSYS)** validated a scoring guideline with 6 variables with a higher score associated with a greater likelihood of cardiac syncope.
- A second scoring system validated is the **Vasovagal Score** that looks at 7 clinical variables with a higher score indicating a greater likelihood of cardiac syncope.

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Table 2. The Evaluation of Guidelines in Syncope Study (EGSYS) Scores[a,b]

Clinical Variable	Points
Palpitations	4
Abnormal ECG/heart disease[c,d]	3
Effort syncope	3
Syncope in supine position	2
Neurovegetative prodromes[e]	−1
Precipitating and predisposive factors[f]	−1

An EGSYS score < 3 associated with a lower likelihood of cardiac syncope.

Category	Points
Clinical evaluation	
Predisposition to vasovagal symptoms	-1
History of heart disease	1
Any systolic pressure reading < 90 or > 180 mm Hg	2
Investigations	
Elevated troponin level (> 99th percentile of normal population)	2
Abnormal QRS axis (< -30° or > 100°)	1
QRS duration > 130 ms	1
Corrected QT interval > 480 ms	2
Diagnosis in Emergency Department	
Vasovagal syncope	-2
Cardiac syncope	2
Total score (-3 to 11)	---

A Vasovagal Score < -2 was associated with a lower likelihood of cardiac syncope.

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Biomarkers

- The two biomarkers noted in this study of the literature were high-sensitivity troponin and N-terminal pro-B-type natriuretic peptide (NT-proBNP) in which elevations would point to a cardiac etiology for syncope.
- An HS-Troponin T of 42 ng/L or HS-troponin I of 31.3 ng/L indicates cardiac syncope (LR+ 5.1-5.4).
- A NT-proBNP > 1,966 pg/ml achieved a 95% specificity to rule-in cardiac syncope but with wide variations in the studies.
- However, given variability in the studies the authors **DO NOT** recommend routine use of biomarkers to identify or rule-out cardiac syncope but, can be used in selected patients (just which ones?).

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Syncope vs. Seizure

Clinical Prediction Rule Distinguish Seizure vs Syncope

Symptom	Points
Injury/cut to tongue	2
Abnormal behavior noted*	1
LOC with emotional stress	1
Postictal confusion	1
Head turned to one side during LOC	1
Prodromal déjà vu, j'amais vu	1
Any presyncope	-2
LOC with prolonged standing or sitting	-2
Diaphoresis before a spell	-2

Score ≥ 1 suggests seizure, score < 1 suggests syncope
***Abnormal behavior = amnesia, unresponsiveness, unusual posturing, limb jerking**

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LLSA Questions

- According to the review article by Albassam, et al., an age at first syncope of at least *35 years old* was associated with the greatest likelihood of cardiac syncope.
- Reviews by the European Society for Cardiology and American College of Cardiology/AHA guidelines indicate that cardiac markers such as NT-proBNP and troponin should *not be* routinely used when evaluating cardiac syncope.

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Pearls to Determine if a Patient has Cardiac Syncope

- Features that suggest Cardiac Syncope:
  - EGSYS score ≥ 3, Vasovagal Score < -2.
  - Onset > 35 years old.
  - Known structural heart disease, atrial fibrillation/flutter. HTN, CHF.
  - Chest discomfort or dyspnea.
  - Cyanosis witnessed while unconscious.
  - Abnormal EKG.
- Features from Recent Guidelines that suggest cardiac syncope:
  - Palpitations
  - Male
  - FH sudden cardiac death, syncope, drowning
  - Patient has had 2 or fewer syncopal episodes
  - Known congenital heart disease
  - Abnormal cardiac exam

If YES to any assess for orthostatic hypotension, manage as cardiac syncope

If NO to all go to next.

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Pearls to Determine if a Patient has Cardiac Syncope

- Presence of features that suggest reflex syncope:
  - EGSYS score < 3
  - Vasovagal Score > -2.
- Features derived from recent guidelines that suggest reflex syncope:
  - Head rotation or neck pressure prior to event.
  - Cough or sneeze prior to event.
  - Normal EKG and cardiac exam.

If YES to any assess for orthostatic hypotension, manage as reflex syncope, consider carotid sinus hypersensitivity.

If NO to all go to next.

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Pearls to Determine if a Patient has Cardiac Syncope

- Presence of features that suggest seizure:
  - Multivariable seizure score ≥ 1.
  - Head turning during event.
  - Unusual posturing prior to event.
  - Urinary incontinence.
  - Tongue injury/cut.
  - Unable recall behaviors prior to event.

If YES to any assess for orthostatic hypotension, manage as possible seizure.

If NO to all assess for orthostatic hypotension and consider rarer causes, mimicking syndromes, refer to syncope specialist.

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Winston, the official MCEP mascot, and I are now pretty old and our skiing days are mostly behind us - however we wish you the very best, thank you for listening, and have a great time in the snow

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