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**The Management of ED  
TIA Patients:  
*Can We Send Them Home, and  
What Work-up Must Be Done  
First?***

Michael Ross, MD, FACEP



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**2006 Advanced Emergency &  
Acute Care Medicine and  
Technology Conference**

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**Emergency Medicine  
Associates**

**Atlantic City, NJ  
September 26-27, 2006**

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**Disclosures**

- **All past advisory board or speakers' bureau activities have expired within the past year**

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**Case presentation**

- A 58 year old female presents to the emergency department after developing dysarthria, diplopia, numbness, and pronounced weakness of the right face and hand that lasted roughly 12 minutes. The patient feels completely normal and only came in at his families insistence.
  - Review of systems - mild headache with event. No palpitations, chest pain, or SOB.
  - Past medical history - Positive for hypertension and hyperlipidemia. No prior stroke or TIA.
  - Family history positive for premature coronary disease.
  - Meds - Beta-blocker for HTN. Not on aspirin.
  - Social - She does not smoke.

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## Case presentation

- **Physical Exam:**  
On examination the patient was normotensive, and comfortable.
- **HEENT** exam showed no facial or oral asymmetry or numbness. No scalp tenderness.
- **CHEST** exam showed no murmurs and a regular rhythm,
- **ABDOMINAL** and **EXTREMITY** exam was normal,
- **NEUROLOGICAL** exam showed normal mentation, CN II-XII normal as tested, motor / sensory exam normal, symmetrical normal reflexes, and normal cerebellar exam.

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## Case presentation

- ED course:
  - ECG showed a normal sinus rhythm with mild LVH.
  - Non-contrast head CT scan was normal.
  - Blood-work (CBC with differential, electrolytes, BUN/Cr, and glucose) was normal. ESR was normal.
  - Monitor showed no dysrhythmias
  - Normal subsequent neurological symptoms.
  - The patient feels fine and is wondering if she can go home.

What do you think?

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## TIA Background

- **300,000 TIAs occur annually**
- **Within 90 days:**
  - **10.5%** will suffer a stroke
    - 21% will be fatal
    - 64% will be disabling
    - Half of these will occur within 1 - 2 days of ED visit
  - **2.6%** will die
  - **2.6%** will suffer adverse cardiovascular events
  - **12.7%** will have additional TIAs

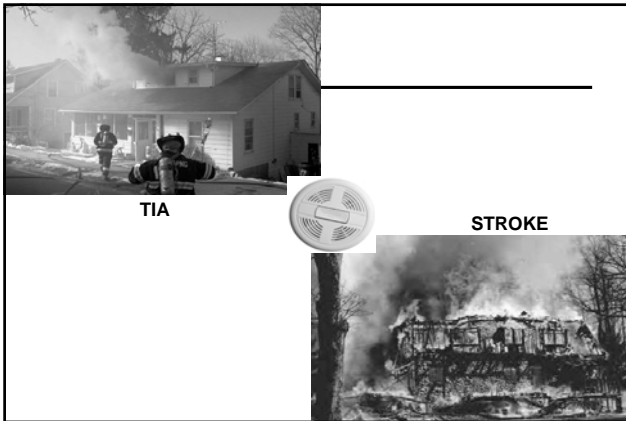
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## TIA Background

- **Stroke is preceded by TIA in 15% of pts**
- **Stroke is the THIRD leading cause of death**
  - National cost of stroke = \$51 billion annually!
  - Many consider stroke to be worse than death.

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## Topics to be covered

1. Appropriate history and physical
2. ECG, monitor, HCT
3. Carotid dopplers - why, when, how?
4. Further clinical testing
5. Therapy – starting with aspirin

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## 1. History and physical - definition of TIA

- History:
  - Symptom duration
  - Brain area affected
  - PMHx
    - atrial fibrillation, TIA, stroke, DM
- Re-definition of TIA
  - ...a brief episode of neurologic dysfunction
  - caused by focal brain or retinal ischemia,
  - with clinical symptoms typically lasting less than 1hr,
  - and without evidence of acute infarction".

TABLE 1. FEATURES OF THE CURRENT AND PROPOSED DEFINITIONS OF TRANSIENT ISCHEMIC ATTACK.

Current, Time-Based Definition*	Proposed, Tissue-Based Definition†
Based on an arbitrary 24-hour time limit	Based on the presence or absence of a biologic end point
Suggests transient ischemic symptoms are benign	Indicates that transient ischemic symptoms can cause permanent brain injury
Promotes diagnosis on the basis of the temporal course rather than pathophysiology	Encourages use of neurodiagnostic tests to identify brain injury and its cause
Fosters delays in interventions for acute cerebral ischemia	Facilitates rapid interventions for acute brain ischemia
Inaccurately predicts the presence or absence of ischemic brain injury	More accurately reflects the presence or absence of ischemic brain injury
Diverges from the distinction between angina and myocardial infarction	Consistent with the distinction between angina and myocardial infarction

\*A transient ischemic attack is a sudden focal neurologic deficit lasting for less than 24 hours, of presumed vascular origin, and confined to an area of the brain or eye perfused by a specific artery.  
 †A transient ischemic attack is a brief episode of neurologic dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than one hour, and without evidence of acute infarction.

## Physical Exam

- Exam –
  - Carotid bruits
  - Atrial fibrillation
  - Neuro exam:
    - Six major areas
      - \_ MS, CN II-IX, Motor, Sensory, Reflex, Coordination
    - NIH stroke score
      - \_ Structured neurological exam
      - \_ Validated tool for detection of common clinically significant deficits
      - \_ Value as an educational tool
      - \_ Thrombotic screening tool

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## History and Physical - Differential Diagnosis

### Conditions That May Cause Symptoms or Signs Suggestive of Transient Ischemic Attack.

Migraine	Hypoglycemia
Inner-ear dizziness	Thrombocytopenia
Arterial dissection	Polycythemia
Transient global amnesia	Severe postural hypotension
Subdural hematoma	Hyperviscosity
Anticardiolipin-antibody syndrome	Cervical disk disease
Akinetic seizure	Carpal tunnel syndrome
Parietal-lobe epilepsy	Cerebral venous thrombosis
Subacute bacterial endocarditis	Temporal arteritis

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## Utility of the H/P?

- TIA risk stratification
  - Johnston criteria
  - Rothwell criteria - “ABCD”
  - Combination of the above => stay tuned

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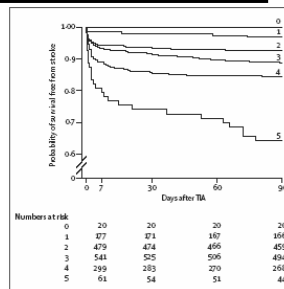
## TIA risk stratification - California Model

Johnston et al. Short-term prognosis after emergency department diagnosis of TIA.  
 JAMA. 2000;284:2901-6.

### Independent risk factors for stroke:

- Age > 60yr (OR = 1.8)
- Diabetes (OR = 2.0)
- TIA > 10 min. (OR = 2.3)
- Weakness with TIA (OR = 1.9)
- Speech impairment (OR = 1.5)

Risk factors were additive



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## Our patient's Johnston score?

### Independent risk factors for stroke:

- Age > 60yr 0
- Diabetes 0
- TIA > 10 min. 1
- Weakness with TIA 1
- Speech impairment 1

stroke risk score of 3:

- ~5% at one week
- ~8% at 3 months

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## TIA risk stratification - British model?

Rothwell, et al. *Lancet* 2005; 366: 29-36

- A = Age >60 years = 1pt
- B = BP: SBP >140 or DBP >90 = 1pt
- C = Clinical:
  - Unilateral weakness = 2pt
  - Speech disturbance = 1pt
- D = Duration:
  - >60 min = 2pt
  - 10 – 59 min = 1pt
  - <10 min = 0pt

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Patients (%)      Strokes (%)      % risk (95% CI)

ABCD score	Patients (%)	Strokes (%)	% risk (95% CI)
≤1	2 (1%)	0	0
2	28 (15%)	0	0
3	32 (17%)	0	0
4	46 (24%)	1 (5%)	2.2 (0-6.4)
5	49 (26%)	8 (40%)	16.3 (6.0-26.7)
6	31 (16%)	11 (55%)	35.5 (18.6-52.3)
Total	188 (100%)	20 (100%)	10.5 (6.2-14.9)

Table 3: 7-day risk of stroke stratified according to ABCD score at first assessment in the OXVASC validation cohort of patients with probable or definite TIA

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## Our patients ABCD score?

- A = Age >60 years = 0
- B = BP: SBP >140 or DBP >90 = 0
- C = Clinical:
  - Unilateral weakness = 2pt
  - Speech disturbance = 1pt
- D = Duration:
  - >60 min = 0
  - 10 – 59 min = 1pt
  - <10 min = 0
- TOTAL SCORE = 4 (5% risk of stroke at one week)

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## 2. HCT, ECG

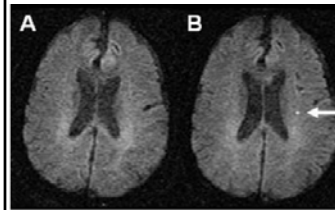


Figure 2. (A) Normal scan at baseline (no DWI lesion seen, no vessel occlusion, and no perfusion abnormality) in a 79-year-old man with a left hemispheric TIA lasting 90 minutes. (B) Arrow points to a small new DWI lesion in left middle cerebral artery territory seen at 30 days on follow-up MR. DWI = diffusion-weighted image.

- HCT - tumor, SDH, NPH, etc
- Minor stroke and TIA associated with a 10% incidence of stroke on MRI.

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## Risk of clinically silent CT or MRI infarct in TIA / small stroke patients?

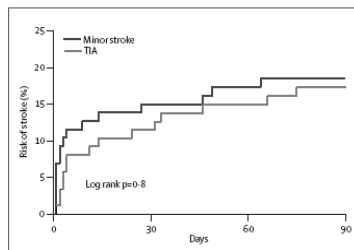


Figure 1: Cumulative risk of stroke following a transient ischaemic attack or minor stroke in the Oxford Vascular Study<sup>21</sup>

*Lancet Neurol* 2006; 5: 323-31

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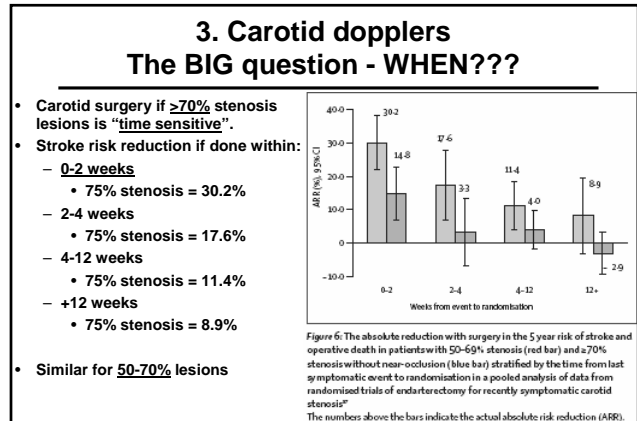
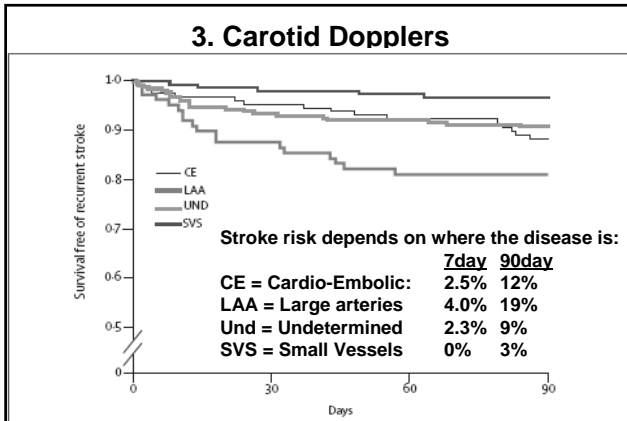


## 2. HCT, ECG

- ECG – **ATRIAL FIBRILLATION!!!**
  - Stroke risk – cardio-embolic risk
    - 4.6% at 1 month
    - 11.9% at 3 months
  - 61% reduction in annual risk of stroke (both ischemic or hemorrhagic) with coumadin

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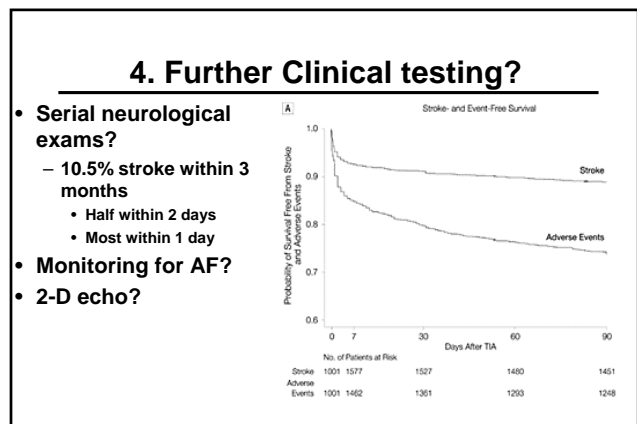
### Outpatient carotid dopplers?

#### Office management of TIA???

Goldstein et al. New transient ischemic attack and stroke: outpatient management by primary care physicians. Arch Intern Med. 2000;160:2941-6.

- Design:
  - Retrospective study of 95 TIA and 81 stroke patients seen in office
- Diagnostic testing within 30 days:
  - 23% had head CT done
  - 40% had carotid dopplers done
  - 18% had ECG done
  - 19% had echo done
  - 31% had no other evaluation

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### 5. Medical management

#### Antiplatelet Therapy

- Useful in non-cardioembolic causes
  - Aspirin 50-325 mg/day
  - Clopidogrel or ticlopidine
  - Aspirin plus dipyridamole
    - Latter two if ASA intolerant or if TIA while on ASA
- Routine anticoagulation not recommended

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### 5. Medical management

#### Risk Factor Management

- HTN: BP below 140/90
- DM: fasting glucose < 126 mg/dl
- Hyperlipidemia: LDL < 100 mg/dl
- Stop smoking!
- Exercise 30-60 min, 3x/week
- Avoid excessive alcohol use
- Weight loss: < 120% of ideal weight

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## Management of TIA:

- Areas of Certainty:
  - Need for ED visit, ECG, labs, Head CT
- Areas of less certainty
  - The timing of the carotid dopplers
- Areas of Uncertainty - Johnston SC. *N Engl J Med.* 2002;347:1687-92.
  - “The benefit of hospitalization is unknown. . . **Observation units within the ED.** . . may provide a more cost-effective option.”

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## An Emergency Department Diagnostic Protocol For Patients With Transient Ischemic Attack: A Randomized Controlled Trial

To determine if emergency department TIA patients managed using an accelerated diagnostic protocol (ADP) in an observation unit (EDOU) will experience:

- shorter length of stays
- lower costs
- comparable clinical outcomes
- . . . relative to traditional inpatient admission.



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## Setting:



- William Beaumont Hospital: A high-volume university-affiliated suburban teaching hospital
  - Emergency department
    - 2005 ED census = 115,894
  - ED observation unit = 21 beds
    - Emergency physician - “admitting” physician for all patients

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## Patient population:

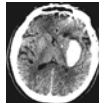
- Presented to the ED with symptoms of TIA
- **ED evaluation:**
  - History and physical
  - ECG, monitor, HCT
  - Appropriate labs
  - Diagnosis of TIA established
    - Decision to admit or observe
    - SCREENING AND RANDOMIZATION

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## Methods: ADP Exclusion criteria

- Persistent acute neurological deficits
- Crescendo TIAs
- Positive HCT
- Known embolic source (including a. fib)
- Known carotid stenosis (>50%)
- Non-focal symptoms
- Hypertensive encephalopathy / emergency
- Prior stroke with large remaining deficit
- Severe dementia or nursing home patient
- Unlikely to survive beyond study follow up period
- Social issues making ED discharge / follow up unlikely
- History of IV drug use



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## Methods: ADP Interventions

- Four components:
  - Serial neuro exams
    - Unit staff, physician, and a neurology consult
  - Cardiac monitoring
  - Carotid dopplers
  - 2-D echo
- BOTH study groups had orders for the same four components

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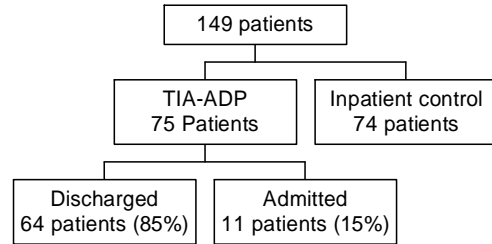
## Methods: ADP Disposition criteria

- Home
  - No recurrent deficits, negative workup
  - Appropriate antiplatelet therapy and follow-up
- Inpatient admission from EDOU
  - Recurrent symptoms or neuro deficit
  - Surgical carotid stenosis (ie >50%)
  - Embolic source requiring treatment
  - Unable to safely discharge patient

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## Results



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## Results: Patient Characteristics

	Inpatient Total n=74	TIA-ADP Total n=75
Mean Age (sd)	67.7yr (15.4)	68.4yr (15.3)
Male n (%)	34 (46%)	31 (41%)
TIA Stroke Risk Factors - mean (sd) *	2.7 (1.4)	2.4 (1.1)
Median (IQR) Initial ED Length of Stay	6.2 hrs (5.0-6.2)	5.7 hrs (4.5-5.5)

\* Johnston - JAMA. 2000;284:2901-6.

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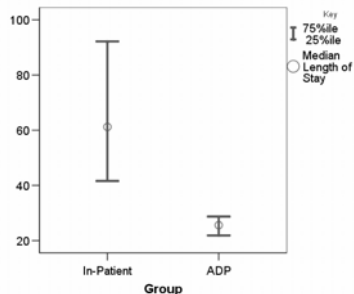
## Results: Performance of clinical testing

	Inpatient (n=74)	TIA-ADP (n=75)
Carotid imaging		
Number completed (n, %)	67 (90.5%)	73 (97.3%)
Time to completion	25.2 hr (17.3 – 37.1)	13.0 hr (8.4 – 18.0)
Echocardiography		
Number completed (n, %)	54 (73%)	73 (97.3%)
Time to completion	43.0 hr (23.8 – 63.8)	19.1 hr (16.7 – 22.5)

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## Results: Length of Stay



Median  
Inpatient = 61.2 hr  
ADP = 25.6 hr  
Difference (Hodges-Lehmann) = 29.8 hr  
(p<0.001)

ADP sub-groups:  
ADP - home = 24.2 hr  
ADP - admit = 100.5 hr

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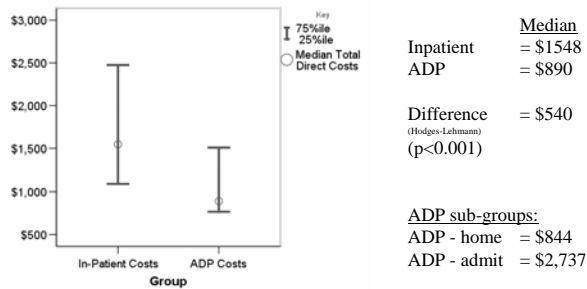
## Results: 90-Day Clinical Outcomes

90 Day Outcomes	Inpatient Total n=74	TIA-ADP Total n=75
Related return visits	9 (12%)	9 (12%)
Clinical Outcomes		
Index visit CVA	5	7
Subsequent CVA (90 day)	2	3
Total 90 day CVA	7 (9%)	10 (13%)
Related Major event or MACE	4	4

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## Results: 90 - day Costs



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## Summary:

**A diagnostic protocol for TIA in an EDOU is more efficient, less costly, and demonstrated comparable clinical outcomes to traditional inpatient admission.**

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## Implications

- National feasibility of ADP:
  - 18% of EDs have an EDOU
  - 220 JCAHO stroke centers
- National health care costs
  - Potential savings if 18% used ADP:
    - \$29.1 million dollars
  - Medicare observation APC
- Impact of shorter LOS
  - Patients – satisfaction, missed Dx . . .
  - Hospitals – bed availability

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## CLINICAL CASE - OUTCOME

- The patient was started on aspirin and admitted to the ED observation unit.
- While in the unit she had a 2-D echo with bubble contrast, that was normal. She had no arrhythmia detected on cardiac monitoring and no subsequent neurological deficits.
- However, carotid dopplers were abnormal. She showed 30-50% stenosis of the right internal carotid artery, and a severe flow limiting >70% stenosis of the left carotid artery at the origin of the internal carotid artery.
- She was admitted to the hospital for endarterectomy. Five days following ED arrival, and following inpatient pre-operative clearance, she underwent successful endarterectomy.
- On one month follow-up she was asymptomatic and her carotids were doing well.

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## Who do you send home from the ED???

- C. Johnston:
  - “TIA risk score does not identify a “zero” risk group”
  - But it is a good start. . .
- Possibly:
  - Negative ED work-up (ECG, exam, CT), low TIA score, negative carotid dopplers within 6 months, safe home support for return in next 48 hours if needed?
- Appropriate medications.

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## Who do you send home from the ED???

- Ron Krome:
  - “It doesn’t matter what you do, as long as you are right”
- If you are not sure, better play it safe. . .
  - Admit or observe

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## Questions?

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