Clinical reasoning: Don't be indifferent about your differential

Curriculum design for diagnostic processes and reasoning errors

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Disclosure

No financial disclosure

Goals and Objectives

Attendees will be able to:

1. Understand key concepts in clinical reasoning
    a. Define **illness script**, **problem representation**, and **diagnostic schema**
    b. Review a diagnostic schema for chest pain
    c. Apply schema to a clinical unknown case
2. Learn to lead a clinical reasoning curriculum at their home institution
    a. Describe effective teaching strategy for residents about the diagnostic process
    b. Discuss areas of future improvement for similar project

Introduction

- Clinical reasoning: The conscious and unconscious processes a clinician utilizes with a patient and environment to collect and interpret data
  - Weigh the benefits and risks of actions
  - Understand patient preferences to determine a working diagnostic and therapeutic management
- Diagnostic error: Situation in which a clinician had at her or his disposal all the necessary information to make the diagnosis but then made a:
  - delayed diagnosis
  - wrong diagnosis
  - missed diagnosis

Why do we care?

- Reduce 12,000 known diagnoses to 1
- Outpatient visits in US, 1/20 adults suffer from diagnostic error
- 1/9 inpatient admission diagnoses was substantially different than discharge
    - If this discrepancy occurred, there was increased risk of mortality
- Malpractice cost of diagnostic errors from 1986-2010 is estimated to be $38.8 billion

Poll

What stage of your medical career are you in?

a. Medical student
b. Resident/fellow
c. Attending

Illness Scripts

- Mental representation of a disease
  - Epidemiologic factors- sex, age, location, season, socioeconomic status
  - Patient history- medical, surgical, social, family
  - Patient symptoms
  - Patient signs
  - Imaging and laboratory results
- Atopic dermatitis: 80% present by age 5, 80% also have allergic rhinitis or asthma, commonly family history. Chronic pruritus, cyclic exacerbations and remissions, dry skin with erythematous macules and papules that can coalesce into patches and plaques, often flexor surfaces. Spongiosis on histology. Elevated IgE.

Problem representation

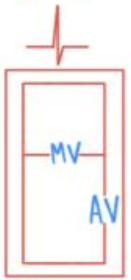
- A comprehensive “one-liner”
  - Pertinent history- Immune status, key family/surgical/medical hx
  - Environmental factors- time of year, location
  - Patient signs and symptoms
  - Key lab and imaging findings
  - Does NOT include diagnosis
- 30 year old female hiker presenting in midsummer in central Connecticut to the ER with 1 week of palpitations, large red skin patches, polyarthralgia found to have mild transaminitis, and in first degree and second degree type two heart block

Diagnostic Schema

- Systematic approach to narrow a medical problem to differential diagnoses
- Include “do not miss” diagnoses, then identify to “buckets” with specific diagnoses
    - “Buckets” can be body system, location, lab features, etc.
- Obtain history, physical exam findings, or lab/imaging to eliminate diagnoses or move illnesses up or down on your differential

DYSPNEA

CV



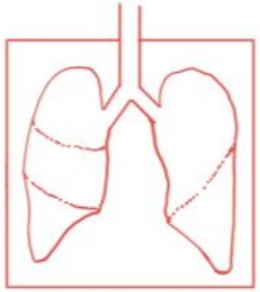
Myocardium
- Heart Failure
- CAD/ACS
- Valvulopathy

Electrical
- Arrhythmia
  - Too Fast
  - Too Slow

Pericardium
- Constrictive
- Tamponade

Life threatening:
Pneumothorax
Tamponade
Pulmonary embolism
Arrhythmia
ACS

Pulm



Airways
- Asthma
- COPD
- Bronchiectasis

Vasculature
- PE
- Pulm HTN
- Vasculitis
- Hepatopulm Syndrome

Parenchyma
- ILD

Alveoli
- Water
- Pus
- Blood

Pleura
- Effusion
- Pneumothorax

Chest Wall
- Kyphoscoliosis
- Obesity
- Flail Chest

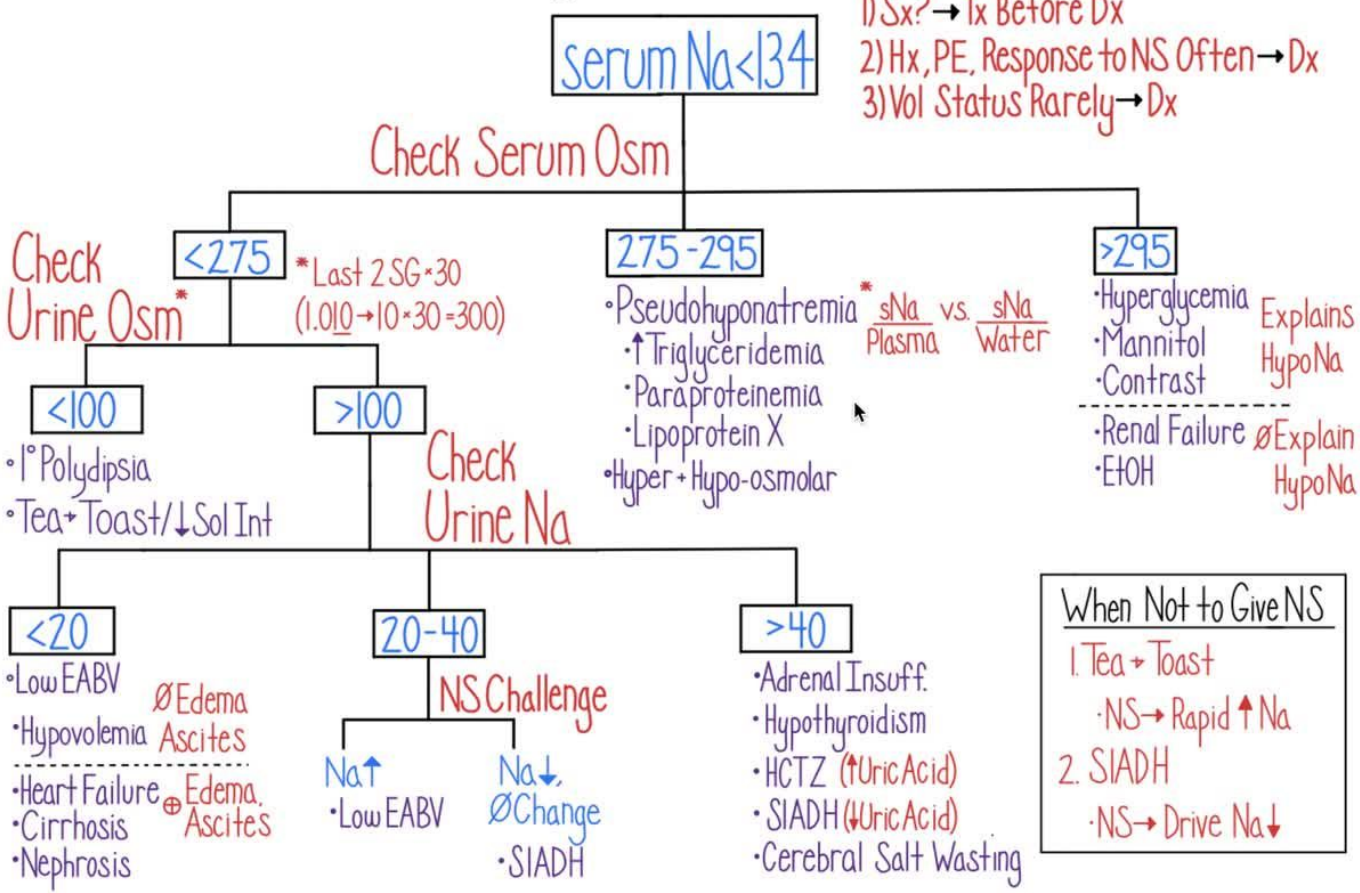
Neuromuscular
- Myasthenia
- Guillian Barre
- ALS

Hematology
- Anemia

Other
- Acidosis
- $\uparrow T_4$
- Anxiety
- Deconditioned

@CPSolvers

Hyponatremia



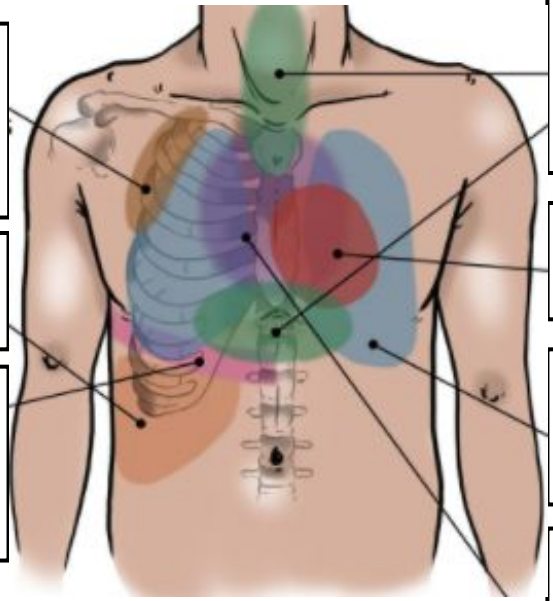
Chest Pain Schema

Do not miss:
-ACS
-Aortic dissection
-Tamponade
-PE
-Pneumothorax
-Esophageal rupture

Psych:
-Anxiety
-Conversion disorder

GI:
-Esophageal spasm
-PUD
-Esophagitis/GERD
-Foreign body ingestion

MSK:
-Costochondritis
-Rib fracture
-Muscle Spasm



Cardiac:
-Pericarditis

Neuro:
- Thoracic radiculopathy

Pulm:
-Pneumonia
-Pleurisy

Derm:
-Zoster
-SJS/TEN
-Porphyria

Heme:
-Sickle crisis
-Malignancy

Poll

"A 60 year old male with hypertension, hyperlipidemia developed sudden onset left sided facial droop and slurred speech" is an example of which of the following?

a. Illness script
b. Problem representation
c. Diagnostic schema

Activity

- Separate into breakout rooms of 3-5 people
- Get a piece of paper and pen or use your computer
- Work through a “clinical unknown” case while using the provided schema
    - You can update the schema during the case if you feel a need
- We will pause after each aliquot to discuss our reasoning
- Move the likelihood of differentials up or down after each discussion

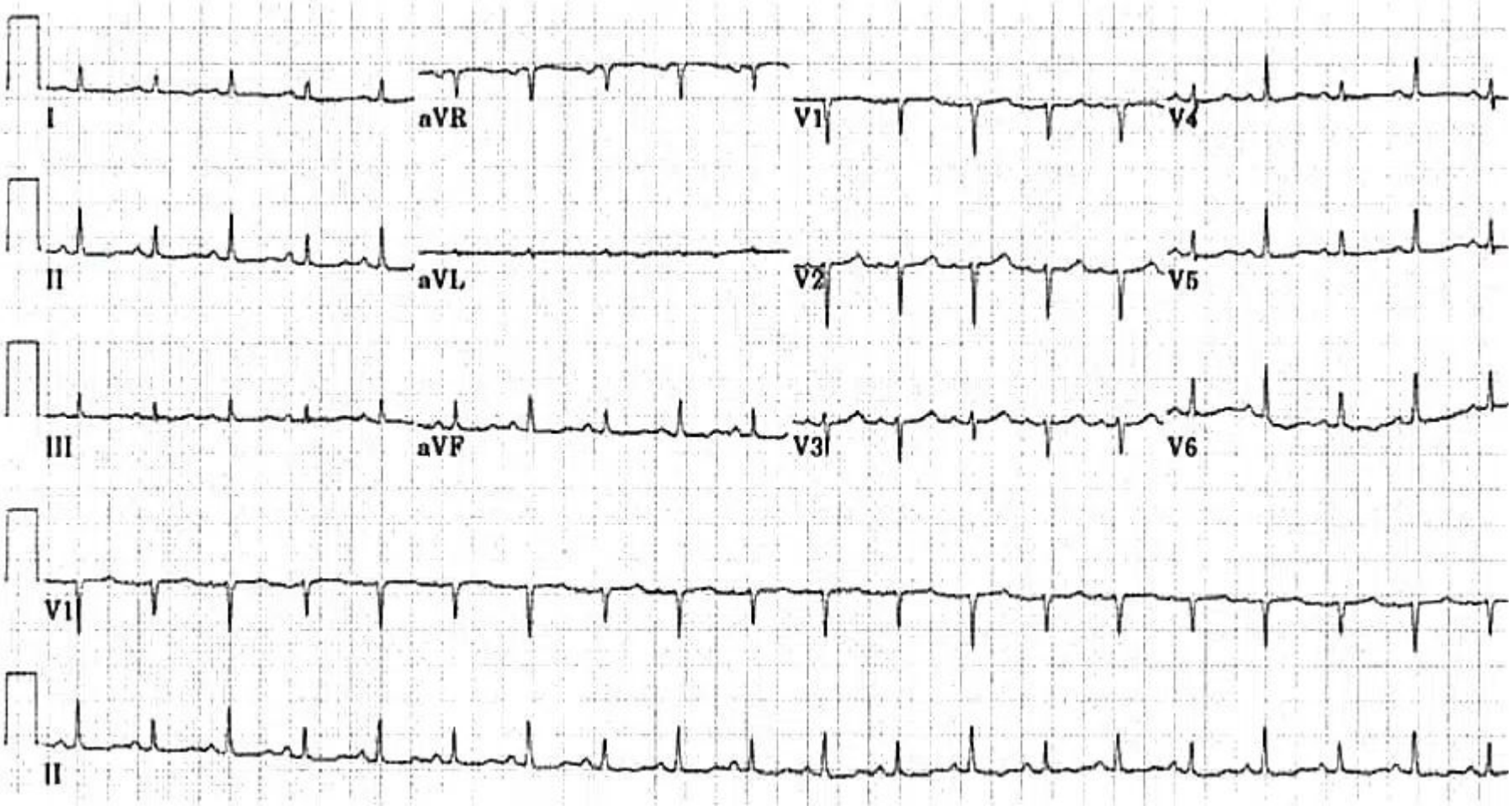
Demonstration

Case: 48 year old male with chest pain

1. HPI: 1 day of sharp, substernal, non-radiating chest pain. Neither alleviated nor worsened by position, activity or respiration
2. PMH: ESRD, HTN, anemia, gout
3. Meds: ASA 81mg daily, carvedilol 6.25mg BID, colchicine 0.6mg daily, sevelamer 800mg TID
4. ROS:
    a. General: Denies- weight change, fever, chills, night sweats
    b. HEENT: Denies- H/A, blurry/double vision
    c. Cardio: + chest pain, + palpitations
    d. Pulm: Denies- SOB, cough, hemoptysis
    e. Neuro: Denies- lightheadedness/dizziness

Case: 48 year old male with chest pain

5. PE:
    a. Vitals: 99.1F, HR 141, BP 84/58, RR 14, O2 96% on RA
    b. Gen: Mild distress 2/2 CP, obese
    c. Cardio: Tachy, regular, distant heart sounds, normal S1 & S2, no murmur
    d. Pulm: Diminished breath sounds, no wheezes, rales, rhonchi
    e. Vascular: No edema
6. Labs:
    a. CK: 37
    b. Trop: <0.1
    c. D-Dimer: 2.9 (elevated)
    d. CBC and BMP unchanged from baseline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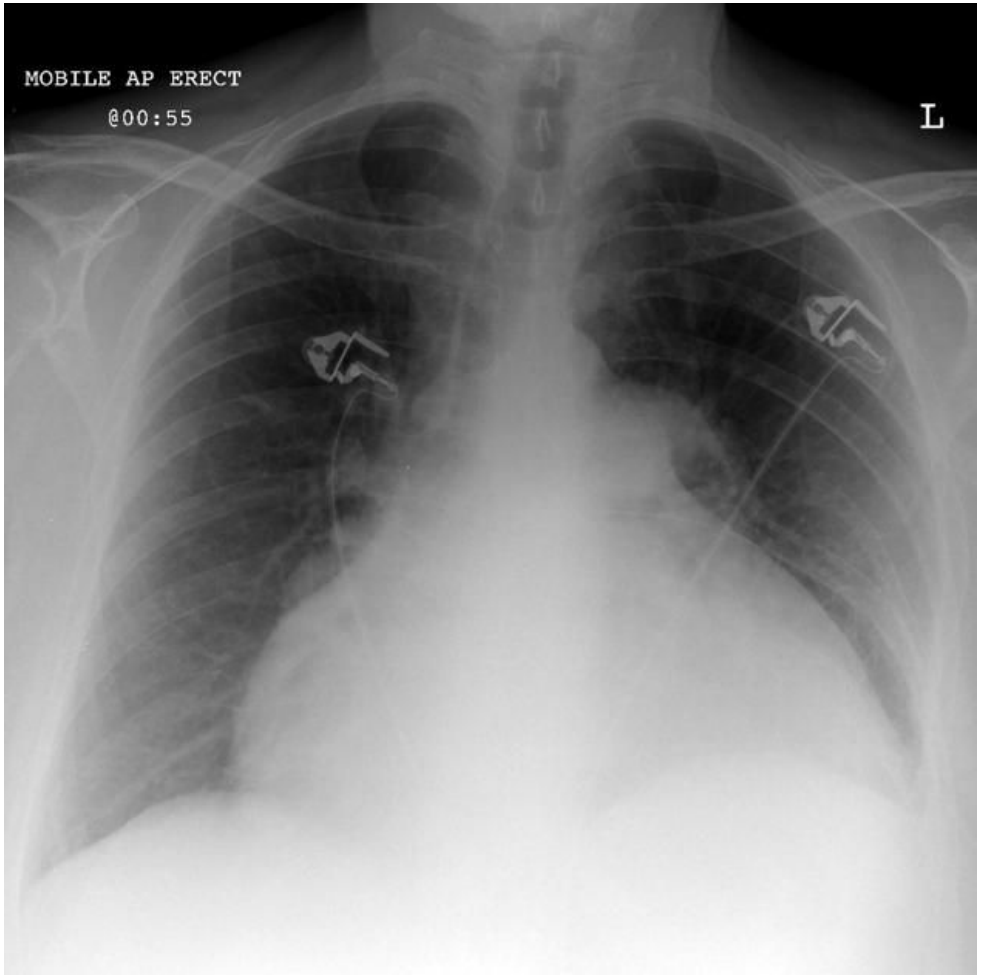
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Final diagnosis?!

Cardiac tamponade due to pericardial effusion

- Patient outcome: Taken to OR for drainage and pericardial window
- Unclear etiology, possibly idiopathic or uremic 2/2 ESRD

Cardiac tamponade due to pericardial effusion

- Physiology: Compression of cardiac chambers as fluid builds in pericardial sac.
  - Decreased venous return > decreased LV filling > decreased LV stroke volume > decreased cardiac output
- Etiology:
  - Infectious: Viral, bacterial, fungal, parasitic
  - Autoimmune: RA, SLE, sjogren's
  - Malignancy
  - Structural: Aortic dissection with rupture, myocardial rupture, post- cardiac injury syndromes
  - Myocarditis: Vaccines, trauma
  - Iatrogenic: Watchman's procedure, CPR, Pacemaker, radiation, drugs
  - Idiopathic

Cardiac tamponade due to pericardial effusion

- Clinical manifestations:
  - Cardiogenic shock/hypotension, dyspnea, tachycardia
  - Beck's triad (distant hear sounds, hypotension, inc'd JVP)
  - JVP: 100% of patients
  - Pulsus paradoxus >10mmHg: 98% of patients
  - Diminished heart sounds: 36-84% of patients
  - Pericardial rub: 23% of patients
- Diagnostic findings:
  - EKG: Low voltage or electrical alternans
  - CXR: enlarged cardiac silhouette
  - Echo: Pericardial effusion (commonly), septal shift with inspiration and diastolic collapse of RA and RV
- Treatment: Pericardiocentesis or pericardial window

Diagnostic Autopsy

- *How did that feel to work through this in a slower method?*
- Which diagnostic errors did we experience?
  - Errors in data collection, data interpretation, and data synthesis
- Did we get the correct diagnosis?
- How quickly did we get to the right diagnosis?
- How could we have gotten there sooner based on the available data?

Designing a clinical reasoning curriculum

Project needs and rationale

- Nationally, most ER residencies have training on diagnostic error, but most less than 4 hours per year (Lewis et al., 2019)
- ACGME milestones “deliberate practice and coaches others to minimize clinical reasoning errors” (ACGME, 2019, p. 7)
- At Middlesex, 100% of residents report dedicated clinical reasoning training is important, but only 40% receive the training they desire prior to implementation of clinical reasoning curriculum

Poll

How many hours of dedicated training did you receive for clinical reasoning and diagnostic error in your medical school and residency combined?

a. 0-1 hours
b. 2-5 hours
c. 6-10 hours
d. Greater than 10 hours

Project goals

Goals: Residents will…

- apply clinical reasoning techniques to daily practice
- recognize and address biases and cognitive errors in diagnosis
- build diagnostic schemas for commonly seen medical problems

Project implementation and educational strategies

Led 3 weekly, one-hour, virtual conference sessions to teach this curriculum

1. Topic overview- key terms including diagnostic error, biases, schemas
    - Lecture and small group discussions
2. Building diagnostic schemas for chest pain, abdominal pain, shortness of breath
    - Modeled schemas, team learning for building and sharing their schemas
3. Case-based discussions using designed schemas and illness scripts
    - Utilized “master” schema from groups from session 2
    - Worked through “clinical unknown case” for problem based learning
    - Performed diagnostic autopsy

Conclusion

- Correct definition of diagnostic schema improved from 7 to 12 out of 13 responses (p= 0.018)
- Correct definition of illness script improved from 4 to 12 out of 13 response (p= 0.0009)
- How would you rate your comfort with clinical reasoning on a scale from 1-5 before and after these sessions
- Avg score improved from 2.7 to 3.5 (p= 0.0003)
- Future goal: Incorporate teaching into daily education

Take home

- Our job is incredibly hard, but it's important we do it right
- Create and update your **problem representation** ("fancy one-liner")
- Systematically run your problem representation against your **illness scripts**
- **Diagnostic schemas** can change and grow over time
- Work through a diagnosis with the same rigidity you read an EKG
- Practice your diagnostic skills daily
- You are all capable of implementing this curriculum

Continued learning

- Podcasts:
  - The clinical problem solvers, The curbsiders (the cribsiders, the curious clinician, TEACH), IM Reasoning
- Apps:
  - The Human Diagnosis Project (my personal favorite), Figure 1
- Journals:
  - Case Records of Mass Gen, AAFP/Dynamed/Uptodate (for building illness scripts)
- Books:
  - Kahnaman's *Thinking, Fast and Slow*, Groopman's *How Doctors Think*, Ericsson's *Peak*, McGee's *Evidence-Based Physical Diagnosis*

Thank you

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Questions

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