

How to use critical thinking skills to approach a neurological case

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Critical thinking skills

- Basic knowledge
- Scientific method
 - Reasoning based
 - Data gathering
 - Hypothesis formation
 - More data to support or reject the hypothesis
 - Minimize the biases
- Practicing steps by steps regularly
- Developing skill by good scientific practice not memorize

Steps of clinical evaluation

- History taking
- Physical examination
- Investigation
- Treatment
- Follow up

- *'If you have thirty minutes to see a patient, spend twenty-eight Minutes on the history, two minutes on the examination, and No time on the skull X-ray or EEG'*

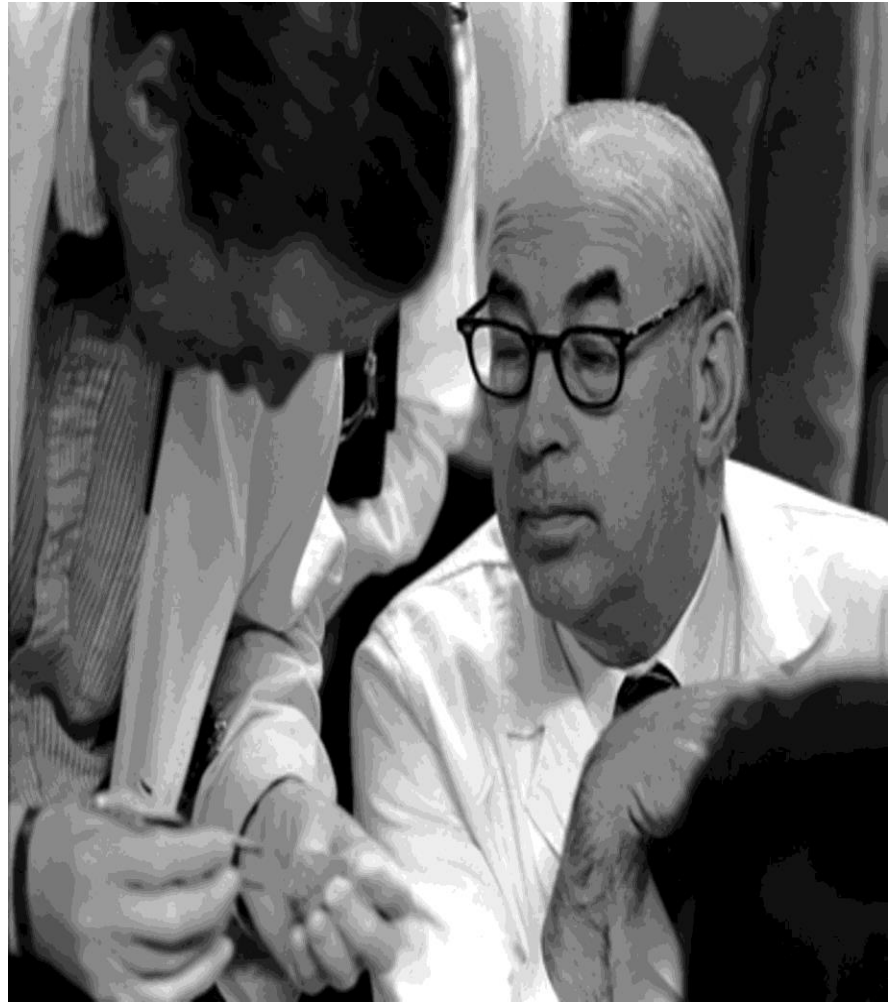
– Adolph Sahs,
- *'No doctor can be omniscient. There will always be patients with rare conditions that the doctor is not familiar with. Keeping an open mind about potential diagnoses and listening carefully to the patient's story is important'*

- Claude Bernard
- *'Different from all other medical specialties, save perhaps psychiatry, the neurologist is heavily dependent on listening to and interpreting what the patient tells us... If you don't know what is happening by the time you get to the feet you are in real trouble'*

–Jerome Posner,
- *Teaching begins with the responsibilities of a physician and ends with the concept that diagnosis is established at the bedside, not at a computer terminal*

- Herbert Fred

- Neurology is learned “ stroke by stroke



C Miller Fisher

Practice of clinical neurology

- Neurology learning requires
 - Acquisition of extensive “ book knowledge ”
 - Neuroanatomy
 - Neurophysiology
 - Neuropathology
 - Neuropharmacology
 - etc
 - Searching literature
 - Critical appraisal
- Practice of clinical neurology is indeed ultimately learned case by case, patient by patient

William Osler

- To study the phenomena of disease without books is to sail an uncharted sea, while to study books without patients is not to go to sea at all.



Clinical Learning

- Problem-based learning
- Inquiry learning
- Clinical reasoning
- Development of hypothesis and plan to prove or disprove it
- Holistic-approached

Clinical training

- Communication skills
- Perceptual skills
- Reasoning skills
- Manual / Procedural skills
- Management skills

Scientific Process

- Science proceeds from observation to creation of hypothesis
- Creation of hypothesis is always selective
- Observation needs a chosen critical issue of the problem

Scientific Process & Reasoning

- Data or problem collection
- Categorization of data
- Prioritization of problem
- Analysis of problem
- Making hypothesis
- Planning to prove or disprove the hypothesis
- Finding linkage among various problems

Definition of Clinical Reasoning

- Clinical reasoning is a scientific method
- Method consists of
 - Collection , processing, and interpreting patient informations from the patient's history, physical exam, test results as well as serial observations
 - Creation of patient' story
 - Developing an action plan in management of the patient
- Clinical Reasoning enhances acquisition and storage of knowledge through repeated exposure to real case examples
- Clinical Reasoning helps the learner develop memory schemes for representing and relating clinical problems.

Basic Requirements for Clinical Reasoning

- Anatomy
- Physiology
- Pathology
- Symptomatology
- Clinicopathological Correlation
- Epidemiologic data
- Biostatistics
- Commonsense
- Unbiased mind

Two-Process Model of Clinical Reasoning

- Type 1 (Intuitive) processes
 - Experience -based techniques for problem solving, learning, and discovery giving solutions which is not guaranteed to be optimal(Heuristics)
 - Pattern recognition
 - Short cut
 - Fast process
 - Usually used by experts most of the time
- Type 2 (Rational) processes
 - Hypothesis and deductive clinical reasoning (Hypothetical- Deductive Reasoning)
 - Deliberate (intentional or planned)
 - More reliable
 - Slower
 - Should be used by all physicians

Hypothetical- Deductive reasoning

- Akin to the scientific principle,
- Works from general to specific.
- Develop hypotheses to explain a patient's clinical problem
- Generate rank-ordered list of differential diagnoses
- Apply collected information to test the hypotheses in order to try and confirm or exclude a hypothesis.

Heuristics

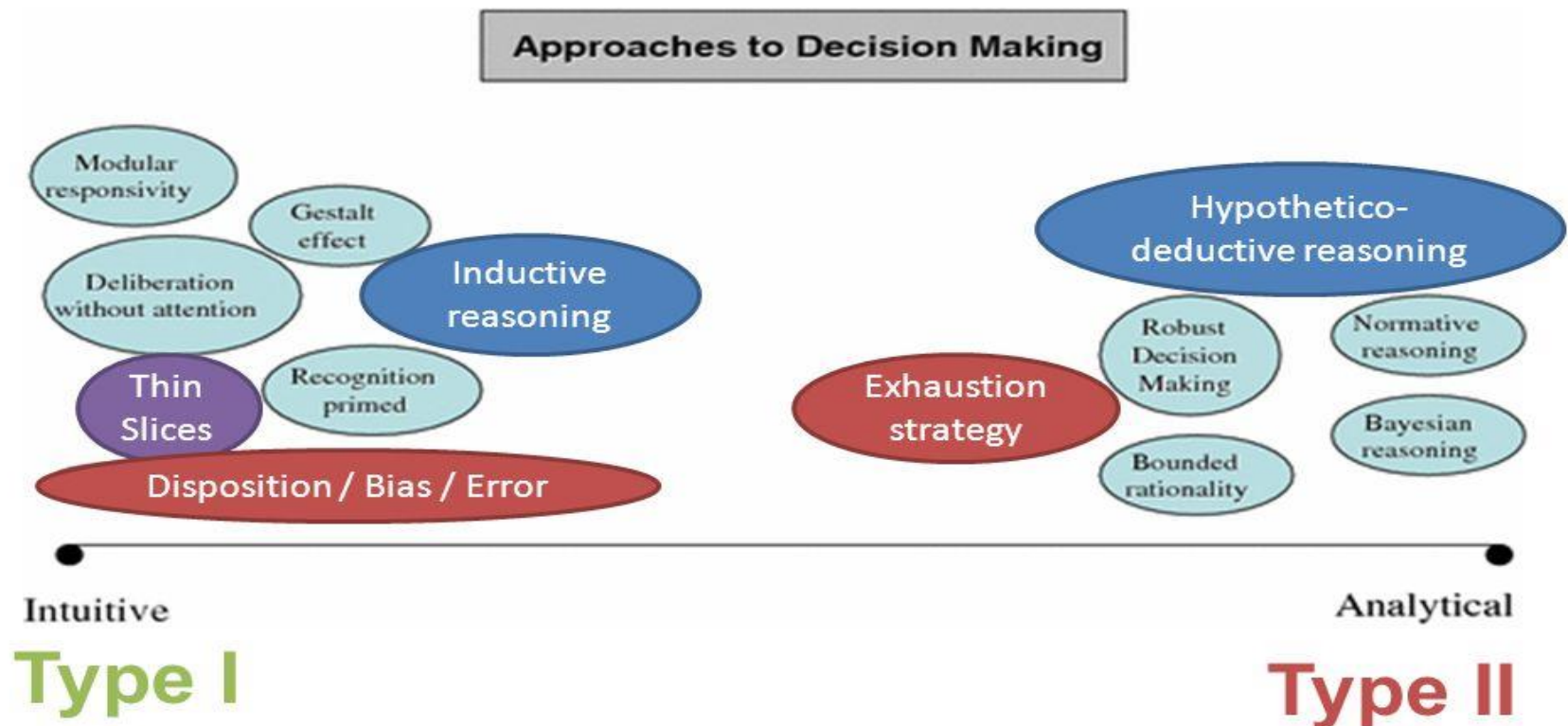
- Shortcuts or experience-based techniques that help physicians in rapidly synthesizing clinical information to come to a diagnosis or a ranked set of potential diagnoses.
- Shortcuts are not only common but are necessary, because they lead to correct diagnoses in an efficient time frame
- Ultimate goal of correcting errors in neurological diagnosis is not to eliminate the use of heuristics, but to become aware of ones having inherent pitfalls and to have access to a menu of corrective strategies.

Common heuristic, biases and corrective strategies

Heuristic or Phenomenon	Pitfall	Corrective Strategies	Clinical Maxims	Illustrative Studies
Framing Effects:	Being swayed by subtle wording to focus on certain aspects of a case more than others	Examine case from alternative perspectives and re-evaluate different pieces of clinical information	Deliberately consider from another angle: <i>"Let's play devil's advocate" or "Let's re-review elements of the history"</i>	Cartmill, R.S.V. & Thornton, J.G; <i>Lancet</i> , 1992 McNeil et al; <i>NEJM</i> , 1982
Anchoring Heuristic:	Relying on initial impressions and not adjusting diagnostic probabilities properly with new data	Formally estimate probabilities in light of new data or second opinion; look up selected probability data on Pubmed; do this with <i>own</i> patient as you would when giving second opinion	<i>"If the patient is not responding to treatment or is worsening, is one possibility that this is the wrong diagnosis? Have I properly weighed key clinical data in making a diagnosis?"</i>	Tversky and Kahneman; <i>Science</i> , 1974
Availability Heuristic:	Judging by ease of recalling past cases based on recency or impact	Verify with legitimate statistics from the literature	<i>"Am I unduly influenced by my experience with one memorable or recent case?"</i>	Salem-Schatz et al; <i>JAMA</i> , 1990
Representativeness Heuristic:	Ignoring prior probabilities and base rate frequencies of different diagnoses that seem to match the patient's pattern of presentation	Formally incorporate prior probability into considerations; look up literature on prevalence and occurrence of diseases	Pay attention to base rates: <i>"If you hear hoof beats, think about horses not zebras."</i>	Kahneman & Tversky; <i>Psychol Review</i> , 1973
Blind Obedience:	Showing undue deference to authority or technology	Look up diagnostic test performance characteristics in medical literature using Pubmed or other sources	<i>"Does a negative value on a test definitively rule out a disease? How common are false positives?"</i>	Woolf & Kamerow; <i>Arch Intern Med</i> , 1990

Adapted from Redelmeier DA. *Ann Int Med* 2005;142:119 (Table)

Clustering of approaches on an intuitive-analytical continuum

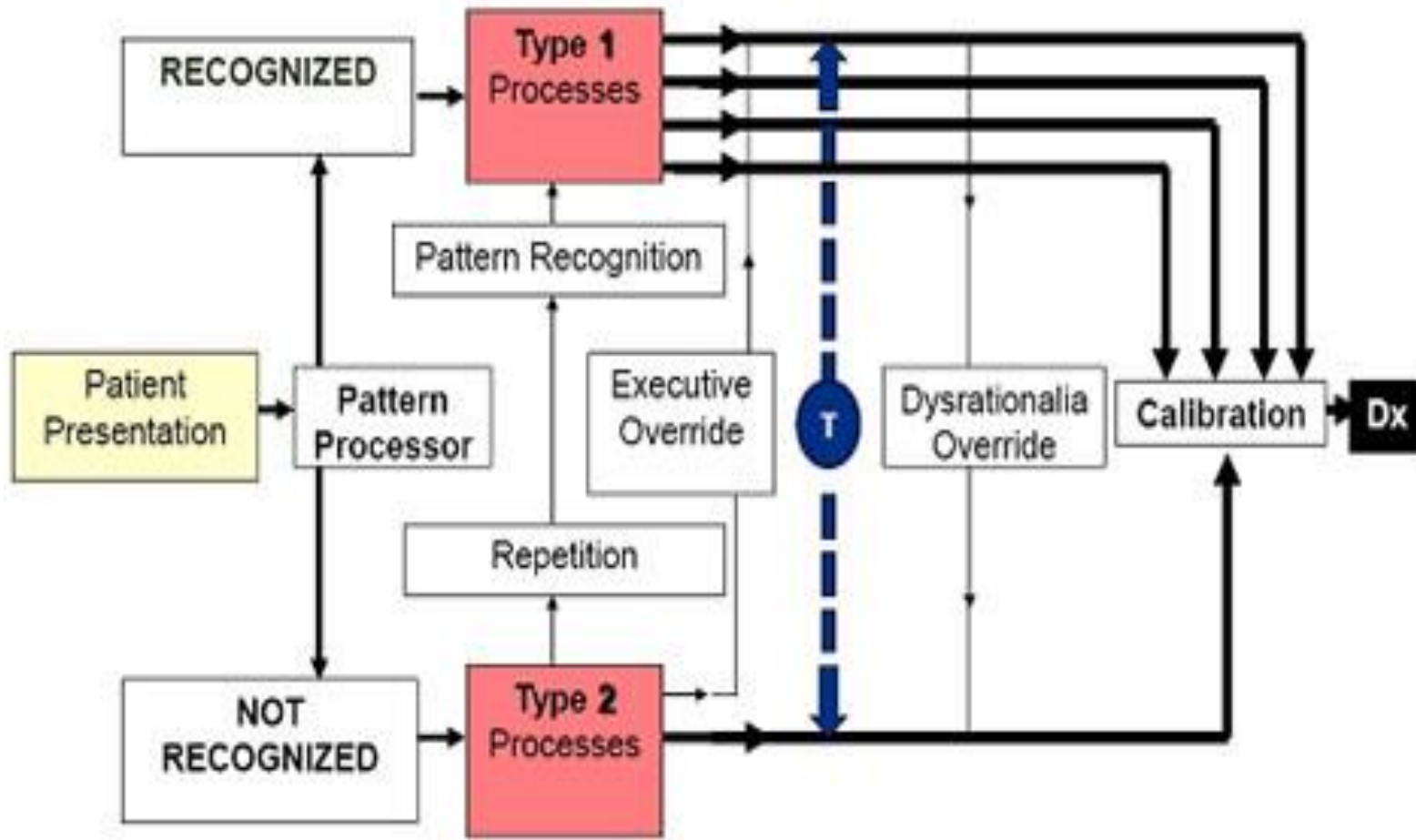


Over view of clinical reason model

Repetitive operation of Type 2 leads to Type 1 (**recognition**)

Type 2 processing can override Type 1 (**rational override**)

Type 1 processing can override Type 2 (**dysrational override**)



History taking

- Listen ! , Listen to your patient .
- He is telling you the diagnosis .



William Osler

Traditionally method of history taking

- Acquires elements of the history in sequential separate categories
 - History of the Present Illness : starts with describing
 - Underlying disease
 - Chief complaint
 - Past Medical History
 - Family History
 - Social History
 - Review of Systems.
- After gathering each bit of history in this separate manner students are asked to integrate the acquired data into a whole.

Current proposal method of history taking

- Combination of simultaneous problem solving and hypothesis generating and testing.
- As early as first hearing the chief complaint, the clinician
 - Begins immediately to head toward a formation of diagnostic hypothesis
 - Evaluates each of several competing diagnostic hypotheses.
 - For each diagnostic possibility, the provider specifically seeks and selects elements from other areas of the history, namely from
 - Past medical history
 - Family history
 - Social history
 - Review of systems
 - These informations may lead one toward, or away, from each possible diagnosis.

Nierenberg R. The chief complaint driven medical history: implications for medical education. *Int J Med Educ* 2017; 8: 205–6

Current proposal method of history taking

- Chief complaint and guided by a differential diagnosis.
- Certain specific questions, chosen to separate diagnostic possibilities are chosen to arrive at the most relevant diagnoses quickly
- Information may be obtained through
 - Patient or caregiver
 - Listening
 - Asking
 - Reading
 - Data sources
 - Searching
 - Critical appraisal

Nierenberg R. The chief complaint driven medical history: implications for medical education. *Int J Med Educ* 2017; 8: 205–6

Obtain and filter information

- Priority and steps of history taking
 - Anatomy of syndrome
 - Physiology of syndrome
 - Detail characters of syndrome
 - Clinical course
 - Others eg. Precipitating factors
- Other observation sensory input (e.g., visual, olfactory, tactile)

History of headache

- **Location of pain**
 - Localized
 - Unilateral
 - Diffuse
 - Constant
 - Spreading
 - Radiation of pain
 - Migration
 - Shifting
 - Secondary pain
 - myofascial pain
 - allodynia
- **Natural history of pain wave**
 - Fluctuation, constant,
 - Symptom free period
 - Time of day
 - Associated symptoms

History

- Characters of pain
 - Neuralgic
 - Throbbing
 - Dull aching
 - etc.
- Severity of pain
- Precipitating and aggravating factors
- Relieving factors & response to medications
- Other neurological & systemic symptoms

Problems in history taking physician aspects

- Clarification of the syndrome
- Priority setting
- Conceptual frame-work of the syndrome
- Searching more informations
 - Inquiring learning
 - Detective mind
 - Critical thinking
 - Evidence-based

Conceptual frame-work of the syndrome

- Headache
 - Primary
 - Secondary
- Vertigo
 - Peripheral
 - Central
- Coma
 - Intracranial
 - Diffuse meningeal
 - Diffuse parenchyma
 - Focal
 - Extrcranial
- Myelopathy
 - Extrinsic
 - Intrinsic
- etc.

Problems in history taking patient aspects

- Circumstance
 - Base-line education social economic
 - Physical
 - Illness
 - Confusion
 - Pain
 - Mental
 - Phobia
 - Anxiety
 - Depression
- Memory
- Major or specific vs minor or nonspecific syndrome
- Sequence
- Patient own believe , hypothesis,
- Focus on previous diagnosis and treatment and past medical history

Summarization of the problem

- Define the problem
 - Clear
 - Concise
 - Accurate
 - Focused
- Course of the problem
- Propose the hypothesis
- Plan for collection of necessary informations

Basic interpretation of clinical data

- Clinical problem

- Symptom
 - Subjective → pain
 - Objective → jaundice
- Sign
 - Objective
- Anatomy of clinical problem
 - Define as accurate as possible

Basic Interpretation of Clinical Data

- Clinical course

- Component of clinical course

- Onset
- Duration
- Termination

- Type of clinical course

- Transient - episodic
- paroxysmal
- Relapsing – remitting
- Chronic progressive

- Modifying factor

- Medication
- ADL
- Exercise
- Sleep - wake

Multiple problems

Relation of current problems

Anatomical

Physiological

Previous and recent problems

Organic and functional problems

Other problems

Financial

Culture

etc.

Hypothesis and deductive clinical reasoning

Formulate an initial set of hypotheses.

- Identified problems
- Set hypothesis based on
 - Frame work of the syndrome
 - Anatomy of the syndrome
 - Physiology of the syndrome

Obtain additional information as directed by
initial hypotheses

- Initial small set of hypotheses forms a framework for additional focused information gathering.
- This process is repeated and refined.

Formulate a final diagnosis/hypothesis (Based on the above mentioned steps) and test the final diagnosis/hypothesis

- Test against positive and negative findings and standard criteria for description of a disease process.
- Working diagnoses for patient are finalized only after they are assessed for their adequacy in explaining all positive, negative, and normal clinical findings.
- Pathophysiologic reliability of the diagnosis is a check on the reasonableness of causal linkages between clinical events, ascertained from use of basic science knowledge.
- Does the diagnosis fit with cause and effect? Is the diagnosis consistent with pathophysiologic principles?

Consider other possible diagnoses

- Diminish the possibility of premature closure, by assume your working diagnosis may be incorrect and then consider alternative diagnose
- Evaluate the process
 - Stop
 - Think
 - Review

Laboratory Tests

- Related to present problems
- Screening laboratory tests
- Routine laboratory tests
- Follow up laboratory tests
- Steps for multiple tests
 - Sensitivity and specificity of tests
 - Availability of tests
 - Possible schedule for tests

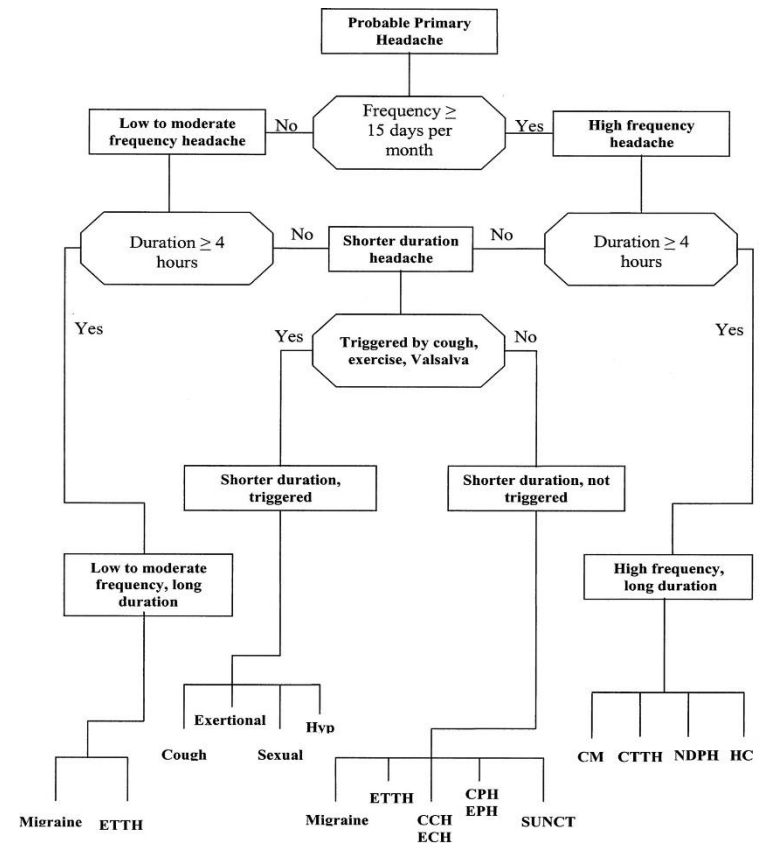
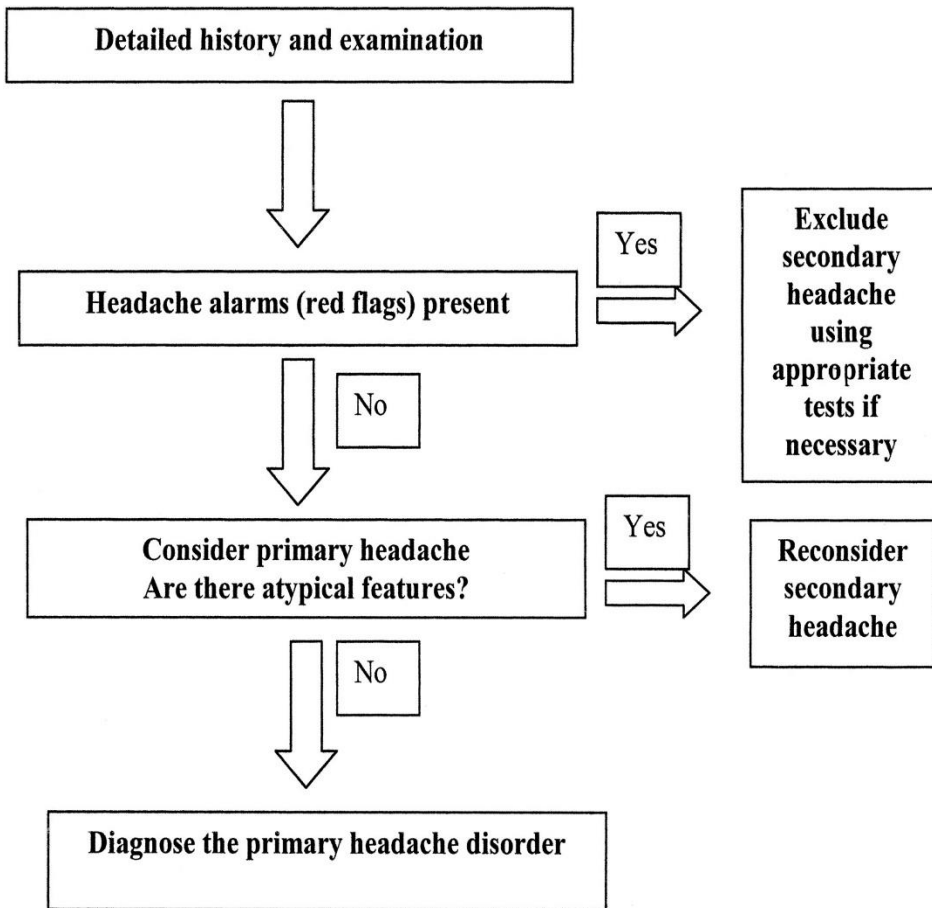
Investigations or diagnostic tests

- Rational use of diagnostic tests
 - Validity of results of studies on the test;
 - Diagnostic properties of the tests\
 - Applicability of the test in the clinical setting
- Diagnostic properties of tests
 - Sensitivity
 - Specificity
 - Positive - negative predictive values
 - Likelihood ratios
- Cost
- Availability

Common Pitfalls

- Inadequate collection of data
- Inappropriate use of soft data e.g. epidemiologic data
- Early diagnosis of functional disorder when signs and investigations are negative
- Expectation of more information from investigations
- Use inappropriate tests
- Miss interpretation of tests
- Choice of approach according to “treatable disease”

R. B. Lipton, M. E. Bigal, T. J. Steiner, S. D. Silberstein and J. Olesen . Classification of primary headaches. Neurology 2004 ;63 : 3





Secondary Headache Red Flags “SSNOOP”

Systemic symptoms (fever, weight loss) or

Secondary risk factors: underlying disease (HIV, systemic cancer)

Neurologic symptoms or abnormal signs (confusion, impaired alertness, or consciousness)

Onset: sudden, abrupt, or split-second (first, worst)

Older: new onset and progressive headache, especially in middle-age >50 (giant cell arteritis)

Previous headache history or headache progression: pattern change, first headache or different (change in attack frequency, severity, or clinical features)

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ผู้ป่วยชายไทย อายุ 45 ปี

- **CC:** ตามัวสองข้าง 2 เดือนก่อนมาโรงพยาบาล
- **PI:** 2 เดือนก่อนมาโรงพยาบาล สังเกตว่าตามัวมากขึ้น ลักษณะมัวเท่าๆกันทั้งภาพ ความสว่างไม่ลดลง สีไม่ซีด ไม่มีภาพบิดเบี้ยว ไม่มีจุดลอยไปมา ไม่มีแสงไฟกระพริบ ไม่ปวดตา ไม่ปวดศีรษะ ไปตัดแว่นสายตาแล้วดีขึ้นเล็กน้อย อาการค่อยๆ เป็นมากขึ้น ไม่เห็นภาพซ้อน ไม่ชาหน้า ร่วมกับมีอาการปวดต้นคอบริเวณแนวกลางลำคอ เป็นๆหายๆ บางครั้งปวดลงไปที่แขนซ้าย บริเวณด้านหลังและด้านข้างของแขน ไอ่แล้วจะปวดแขนมากขึ้น มีอาการชาเล็กน้อยบริเวณเดียวกัน

Hypothesis from history where is the lesion ?

- Bilateral visual impairment
 - Bilateral occipital lesion
 - Toxic metabolic cause –visual pathway
 - Increased intracranial pressure
 - Mass
 - Meningeal process
 - Chiasmatic lesion
 - Optic nerve
 - Ocular lesion
- Pain
 - Neck
 - Posterior fossa
 - Meningeal lesion
 - Increased intracranial pressure
 - Cervical lesion
 - Arm
 - Root pain

Relationships of symptoms

- Anatomical relationships
 - Meningeal process
 - Focal intracranial and cervical lesion
- Physiological relationships
 - Simultaneous events in subacute progression favour meningeal lesion
 - Infiltrative or subacute infection in nature

Search for causes from history

What is the lesion ?

- Possible anatomical lesion
 - Meningeal lesion with root lesion
 - Infiltrative disease
 - Focal meningitis or arachnoiditis
 - Multifocal mass lesion
 - Meningeal plus focal mass lesion
- Possible cause
 - Subacute progression
 - Hematologic malignancy
 - Metastatic solid tumor
 - Infection

Plan for physical examination

Verification of the information from history

- General examination
 - Evidences of hematologic or solid malignancy
- Neurological examination
 - Evidences of
 - Increased intracranial pressure
 - Focal intracranial lesion
 - Meningeal lesion
 - Root lesion

General physical examination

- GA: a middle-aged Thai muscular man with normal consciousness
- Vital signs: BT 36.8 C PR 90/min BP 121/90 mmHg RR 16/min
- HEENT: not pale, no icteric sclerae, no palpable lymph node
- Heart: regular, normal S1S2, no murmur
- Lung : clear, equal breath sound both lungs
- Abdomen : soft, not tender, liver and spleen can't be palpated. liver span 8 cm
- Extremities: no pitting edema

Neurological examination

- Consciousness : alert, follow command
- CN:
 - CN I - Normal
 - CN II
 - VA: 20/20-2 both eyes normal VF by confrontation test
 - No RAPD, blurred disc (Rt > Lt), no venous pulsation
 - pupil 3 mm RTLBE..
 - CN III, IV, VI EOM: limit Rt abduction 80% Lt abduction 90%
 - CN V-XII Normal
- Motor : normal tone, Gr V all
- DTR: 1+ all except for Lt tricep, Lt brachioradialis, both knees and ankles which were 0
- Sensory:
 - Decrease at Lt forearm which was consistent with C6-C7 dermatome
- Cerebellar signs – Neg.
- Meningeal sign – Neg.

Anatomical localization

Possible etiology

- Increased intracranial pressure without localizing signs
 - Meningeal process
 - Mass in silent area
- Multiple incomplete asymmetrical root infiltration
 - Meningeal process
- Meningeal process is most likely
- Etiology – infiltrative hematologic malignancy

Past history

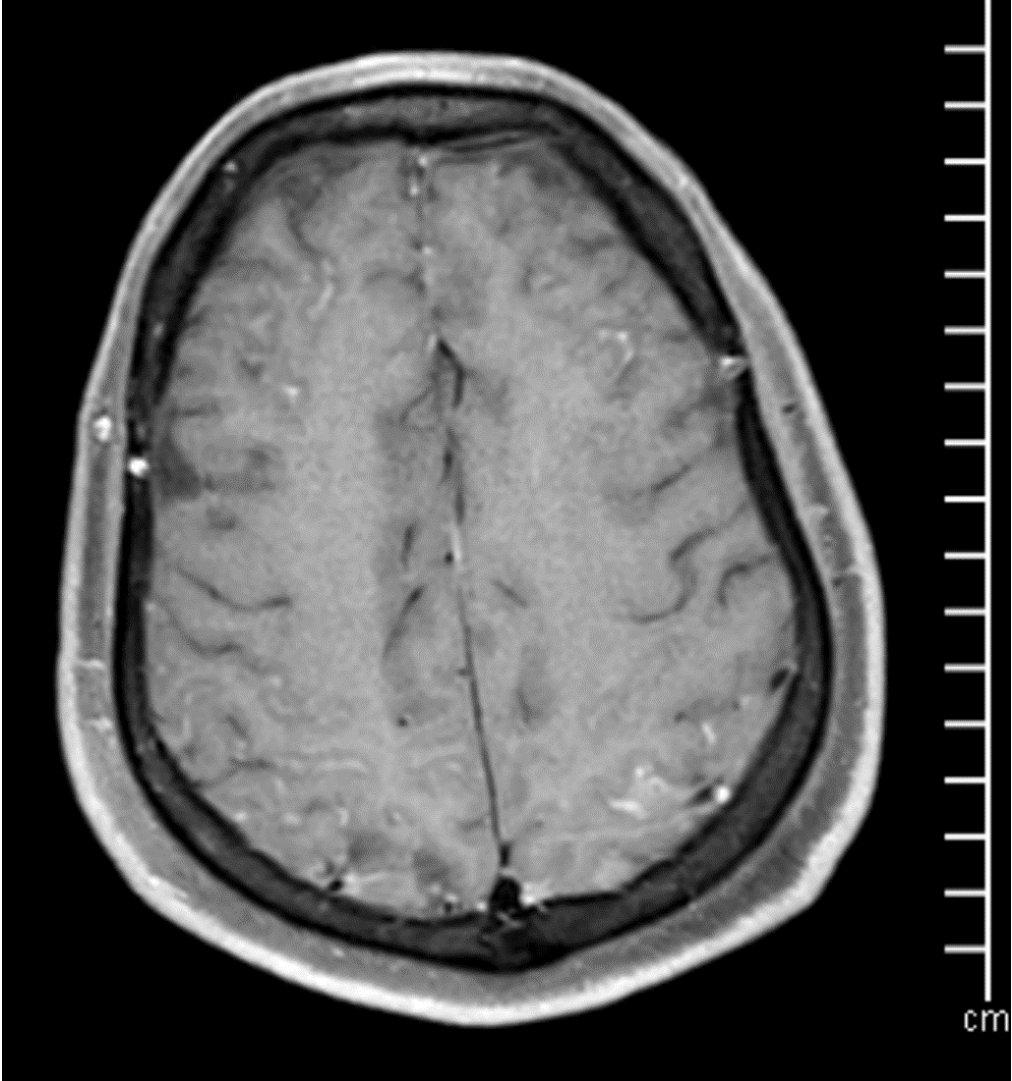
- AML, intermediate risk, (May 57)
- Induction chemotherapy (7+3 regimen) 25-31/5/57 partial response
- Re-induction chemotherapy (7+3 regimen) 4-10/7/57 complete response
- Consolidation chemotherapy (HiDAC x 3 cycle) last 25/10/57 then loss follow up
- Millitary TB (induction chemotherapy complication) Rx 2IRZE/4IR completed course of treatment
- Inferior wall STEMI (1/57)
- Hypertension

Current medication

- ASA (81mg) 1x1 oral pc
- atorvastatin (40mg) 1x1 oral hs
- fenofibrate (100mg) 1x1 oral pc
- carvedilol (6.25mg) 1x2 oral pc
- enalapril 5mg 1x1 oral pc
- amlodipine 10mg 1x1 oral pc

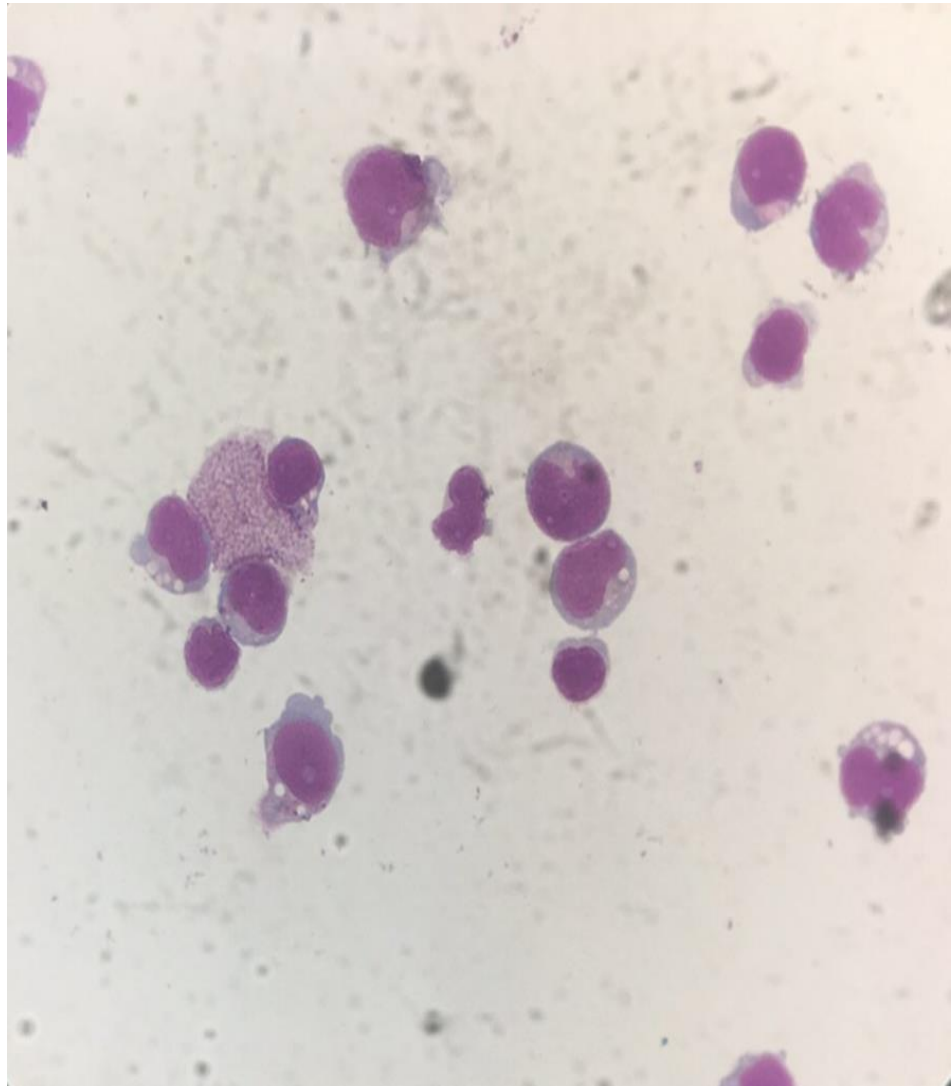
Investigation

- Routine laboratory
- Neuroimaging
- Lumbar puncture









CSF analysis

- OP/CP = 28/17 mmH₂O
- Clear colorless CSF
- Cytology : myeloblast
- Gram, AFB, indian ink - neg
- Chemistry normal

- Thirty years of residents and students continue to ask questions, the answer to which I do not always know.
- While humbling, it keeps me young.



ST Augustine and the Seashell ,
Peter Paul Ruben

- ST Augustine was walking by the seashore one day contemplating and trying to understand the mystery of the Holy Trinity
- He saw a small boy running back and forth from the water to a spot on the seashore.
- The boy was using a sea shell to carry the water from the ocean and place it into a small hole in the sand.
- The Bishop of Hippo approached him and asked, “My boy, what are doing?”
“I am trying to bring all the sea into this hole,” the boy replied with a sweet smile.
“But that is impossible, my dear child, the hole cannot contain all that water” said Augustine.
- The boy paused in his work, stood up, looked into the eyes of the Saint, and replied, “It is no more impossible than what you are trying to do – comprehend the immensity of the mystery of the Holy Trinity with your small intelligence.”

Herbert L. Fred, MD, MACP, is Emeritus Professor of Medicine, McGovern Medical School, Houston, Texas



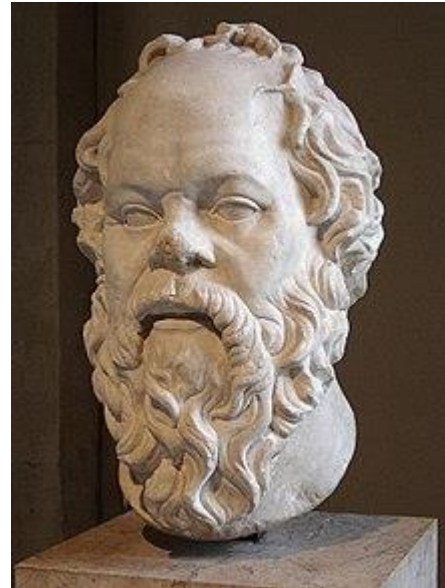
- Dr. Fred will always
 - Ask the question that you forgot,
 - Point out the physical finding that you overlooked, or
 - Note the subtle deficiencies in your clinical approach that differentiate between merely good medical care and excellent medical care.
- He is the angel on your shoulder who elicits guilt when you allow technology to make a diagnosis in your stead, and he is the talented teacher who bestows the skills that make that technology less necessary.

Herb Fred everyday reminders

- All patients are interesting, but not all doctors are interested.
- Anybody can treat, but not anybody can diagnose.
- Spoon-feed knowledge goes out with the next bowl movement , but self-acquired knowledge stick.
- Some doctors make the same mistake over and over again and call it “experience”
- Common sense is not uncommon
- The standard of care is substandard.
- There is no defense against honesty
- Never lower your standards, sacrifice your principles, or sell your integrity.
- Thinking is painful, time-consuming, and difficult. That ‘ why most people avoid it.
- To learn medicine ,
 - All you need is
 - A patient
 - A medical library
 - Someone who knows more medicine than you do
 - Then you, as you read about each thing that your patient complains of or exhibits, you uncover more and more “ new” things to read about.
 - Your knowledge will grow and grow, but your educational journey will never end.

Socrates

- I can't teach anybody anything.
- I can only make them think .



A bust of Socrates in the Louvre

Thank you for your attention

Clinical Reasoning in Bedside Evaluation from History taking to Optimized Investigation in Neurology

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Clinical Reasoning Steps

- 1. Patient's story
- 2. Data acquisition
 - Information may be obtained primarily through listening., reading, visual imagery)
 - Other sensory input (e.g., tactile, olfactory) may be obtained.
 - Includes pertinent positives and negatives from the history, focused physical exam and targeted investigations

Clinical Reasoning Steps

- 3. Accurate problem representation:
 - A brief summary where patient specific details are translated into appropriate medical terminology
 - Include the Key/forceful features(History, physical exam, and tests, pathophysiology, illness course, memorable cases, recent readings, pearls)
- 4. Illness scripts:
 - A narrative structure for recalling the key attributes of a typical case presentation of a condition or a diagnosis
 - Build knowledge stores retrieved by clinical presentations

Clinical Reasoning Steps

- 5. Hypothesis generation, prioritization and evaluation:
 - Hypothesis is generated early in the encounter.
 - Based on cues acquired from the patient by adequate observation and attentive listening.
 - More than one hypothesis is almost always needed, as the best evaluation of a hypothesis is by comparison with alternatives
 - Compare and contrast two plausible hypotheses and prioritize among the competing options.
 - Compare/contrast different illness scripts with the patient's problem representation looking for best match

Hypothesis Generation

- 1. Hypothetical- Deductive Reasoning:
 - Develop hypotheses to explain a patient's clinical problem
 - Rank -ordered list of differential diagnoses is generated)
 - Apply collected information to test the hypotheses in order to try and confirm or exclude a hypothesis
- 2. Compare and Contrast (Pattern recognition) (as you advance from novice to expert you will be using this type of reasoning more often)
 - Pattern recognition: matching the patients problem representation to an appropriate illness script
 - Verify, reject and refine hypothesis by additional observation, exam, test etc

Test the final diagnosis/hypothesis (Hypothesis Evaluation)

- Perform an analysis of hypotheses by probabilistic and cause-effect means.
- Hypotheses are refined by cause-effect analysis to apply principles of pathophysiology (basic science concepts) and determine if a hypothesis is based upon a sound scientific basis.
- Test against positive and negative findings and standard criteria for description of a disease process.
- Working diagnoses for patient are finalized only after they are assessed for their adequacy in explaining all positive, negative, and normal clinical findings.

Synopsis

- Various steps may not be immediately recognizable or flow in the same sequence in the context of actual clinical reasoning.
- Experts apply pattern recognition with non-analytic cognitive processing during the initial phases and then analytic processing in hypothesis testing
- Novices have to use analytic processing in hypothesis through out the process
- Two forms of reasoning are complementary contributors to the overall accuracy of the clinical reason process
- Persons who use both perform better than persons using either non-analytic or analytic approaches alone

Perform an analysis of hypotheses by probabilistic and cause-effect means.

- Hypotheses are refined by **cause-effect analysis** to apply principles of pathophysiology and determine if a hypothesis is based upon a sound scientific basis.
- **Evidence-based medicine** is another description of this process. If tests are performed, such as laboratory tests, calculated results for test sensitivity, specificity, positive predictive value, and negative predictive value are useful in analysis

Hypothetical- Deductive reasoning

- Akin to the scientific principle,
- Works from general to specific.
- Develop hypotheses to explain a patient's clinical problem
- Generate rank-ordered list of differential diagnoses
- Apply collected information to test the hypotheses in order to try and confirm or exclude a hypothesis.

Nature of Clinical Reasoning Tasks

- Problem
 - Must be sorted from patient concern
 - May not be the same as doctor concern
 - Caution : may be biased by patients – suspect or explain the cause and mechanism of disease based on their belief
- Availability of data
 - Correct data
 - Hidden data – addict, sexual problems, HIV
 - Unreliability – inconsistent
 - Detail VS overall picture
 - Observational data from witness, caregiver, relatives

Nature of Clinical Reasoning Tasks

- Choice of physician in approaching the problem
 - Chronological approach VS Appropriate focused clinical approach
- Appropriate focused clinical approach
 - Quick diagnosis
 - Treat emergency conditions
 - Treat severity

Nature of Clinical Reasoning Tasks

- Early – mild – recovering disease
 - Clinical picture may not be clear
 - Symptoms VS signs
 - Symptoms → pathophysiological changes → early disease e.g. focal headache
 - Signs → anatomical changes → late disease e.g. cranial neuropathy
 - Pathological damage may not occur or mild and reversible
- Late - chronic - severe - progressive disease
 - Clinical picture is overt
 - May be complicated with disease or treatment complication
 - Pathological damage may be severe and irreversible

Nature of Clinical Reasoning Tasks

- Low specificity of data
 - Novice VS expert
 - Expert should be able to simplify and teach novice when the available data is minimal
 - Be careful about bias
- Time constrain
 - Appropriate management of time in various situations
 - IPD
 - OPD
 - Emergency room

Nature of Clinical Reasoning Tasks

- Conflicting data
 - Severe symptoms without signs
 - Disease with major pathophysiological change without anatomical change e.g. migraine, epilepsy
 - Psychiatric disease
 - Overt signs without symptoms
 - Very chronic progressive lesion
 - Previous stable possible unrelated lesion
 - Episodic disease

Process of Clinical Reasoning

- Process of clinical thinking
 - Effect (clinical syndrome) → to cause
 - VS
 - Possible cause (risk) to → the effect (clinical syndrome)
 - Commonsense – usually not common
 - Severe unilateral headache in hypertension
 - Past experience
 - Syndrome approach
 - Skills for searching medical information

Guarding Angle

- Archangle Raphael and Tobia
- Pietro Perugino



Clinical Practice

- Communication skills
- Perceptual skills
- Reasoning skills
- Manual / Procedural skills
- Management skills

Clinical Learning

- Problem-based
- Inquiry learning
- Development of hypothesis and plan to prove or disprove it
- Holistic-approached

Steps of clinical evaluation

- History taking
- Physical examination
- Investigation
- Treatment
- Follow up

Steps in Clinical Process

- Program learning process → develop skill, good exercise for clinical reasoning
- Flexible process → difficult to develop skill

Strategies for Clinical Reasoning

- Three principle cognitive strategies
 1. Pattern recognition – exophthalmos in thyrotoxicosis - no further information needed
 2. Exploration or provisional diagnosis – hemiplegic gait – explore other supportive information of stroke
 3. Systemic screening – dizziness few or non-specific available cues – systematic search of information

Steps in Clinical Evaluation

- History taking
- Physical examination
- Investigation
- Treatment
- Follow-up

Proposed Hypothesis

- Data from anatomy of symptoms
- Data from pathophysiology of symptoms (clinical course)
- Possible major pathological causes
 - Congenital
 - Trauma
 - Tumor
 - Vascular
 - Infection, inflammation, autoimmune
 - Degenerative
- Possible mechanism
 - SLE – multiorgan inflammation
 - Multiorgan toxicity
- Rare disease
 - Should be critically considered

Collection of More Necessary Data

- Extension of nearby anatomical symptom or sign (determine extent of disease)
- Collection more possible information for fulfilling the diagnostic criteria of the disease
- Probe possible mechanism of the disease
 - Underlying disease
 - Systemic review
 - Risk factor review
 - occupations
 - habit
 - sanitation
 - psychosocial problems
 - genetic factors

Correlation Among Clinical problems

- Anatomical correlate
 - Close anatomical relation – frontal headache and visual loss related by anterior cranial fossa
 - Possible anatomical relation – cranial nerve and spinal nerve related by subarachnoid space
- Pathophysiology
 - Temporal profile
 - Pathophysiological
 - related acute, subacute, chronic
 - remitting, relapsing
- Possible mechanism
 - Multisystem involvement
 - Complication of primary disease
 - Iatrogenic disease
 - Intercurrent disease

History Taking

- Present illness
- Past medical illness
- Social history
- Family history

Physical Examination

- Focus physical examination
- Screening physical examination
- Physical finding
 1. Relevant to present illness
 2. Reflect
 - underlying disease
 - previous illness
- Complete physical examination ?

Laboratory Tests

- Related to present problems
- Screening laboratory tests
- Routine laboratory tests
- Follow up laboratory tests
- Steps for multiple tests
 - Sensitivity and specificity of tests
 - Availability of tests
 - Possible schedule for tests

Blind Assessment

- Diagnostic tests
 - Imaging
 - Other tests
- History taking
- Physical examination
- Treatment and evaluation

Treatment

- Specific treatment
- Symptomatic treatment
- Palliative treatment
- Therapeutic diagnosis
- Evidence based treatment

Follow up

- Short term follow up
- Long term follow up
- Prognosis
- Choice of various indicators
- Appropriate time of follow up
- Natural history

Common Pitfalls

- Inadequate collection of data
- Use data in an inappropriate sequence
- Inappropriate use of soft data e.g. epidemiologic data
- Early diagnosis of functional disorder when signs and investigations are negative
- Expectation of more information from investigations
- Choice of approach according to “treatable disease”

Some skills for Clinical Teaching

- Get a commitment – student center
- Probe for supporting evidence – clinical reasoning
- Teach general rules – practical scientific approach
- Reinforce what was right
- Correct mistakes

Transform of a neurologists

- Steps in transformation
 - To hear the stories of patients suffering from neurologic disease
 - To see the clinical effects of precise lesions firsthand.
 - To search the key informations from the literatures
 - To discuss these findings with one' s clinical teachers at the bedside
- These are experiences that transform students of neurology into clinical neurologists
- Scientifically repeated clinical experiences transform a clinical neurologist into a distinguished neurologist

obtaining a medical history

- Clear
- Concise
- Accurate
- Focused

Specific questions

- Use specific questions to point toward or away from a diagnostic possibility
- Find , use and learn specific differentiating features to compare and contrast potential diagnoses for a given complaint.
 - Through the process of composing questions to next ask, learn to discover and articulate which elements of the illness, are most important
 - learn which questions have the highest yield in separating one possible diagnosis from another.

Nierenberg R. The chief complaint driven medical history: implications for medical education. *Int J Med Educ* 2017; 8: 205–6

Error in diagnostic process

- Generation of very unlikely hypothesis (novelty)
- Premature closure of hypothesis generation
- Unwarranted fixation on a hypothesis : twisted all data in an attempt to fit it
- Rule out syndrome : due to poorly focused history taking

The Virtual Patient Structure

Initiating the session

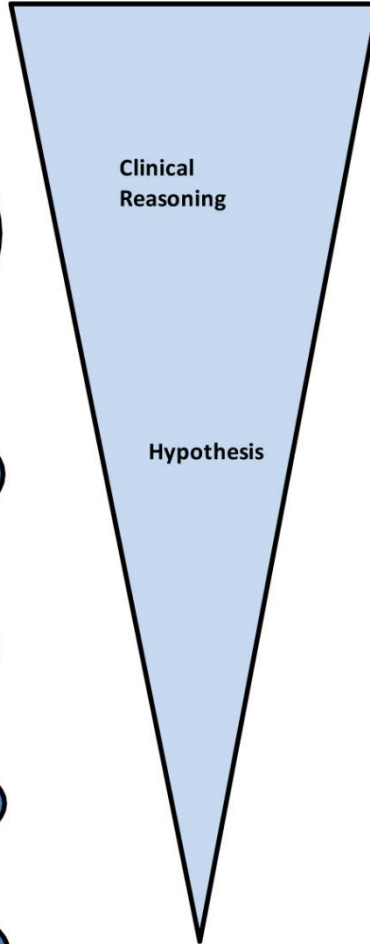
Gathering information
The student's strategy,
history taking

Physical examination

Preliminary diagnosis

Explanation and
planning

Closing the session



Communication and Clinical Skills

Patient

Doctor

Initial rapport

The patient's pre-
understanding
The patient's ideas, concerns
and expectations,
The patient's unique
experience of
illness

The doctor's pre-
understanding,
The doctor's ideas, concerns
and expectations
The doctor's agenda

Collaboration between patient and
doctor during the physical examination

Shared understanding and involvement
in decision making

Follow-up and Farewell

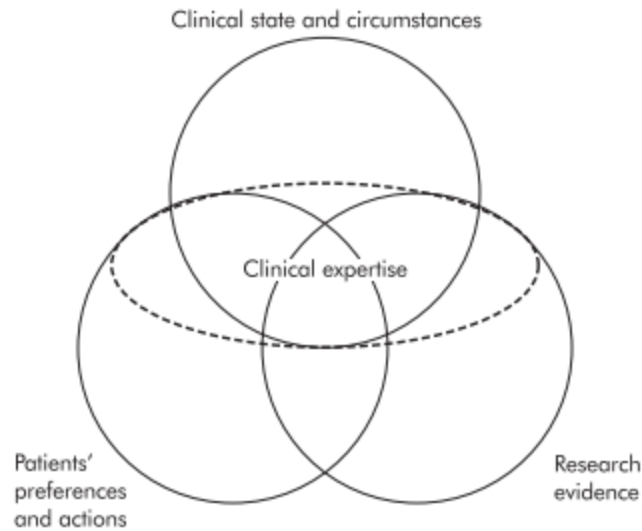


Figure 2 An updated model for evidence-based clinical decisions.

Haynes RB, Devereaux PJ, Guyatt GH . Clinical expertise in the era of evidence-based medicine and patient choice. *Evid Based Med*2002 7: 36-38

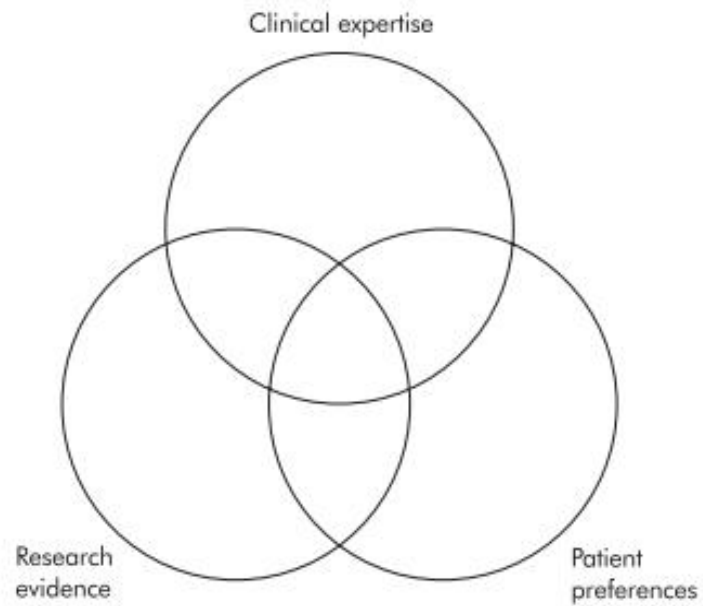
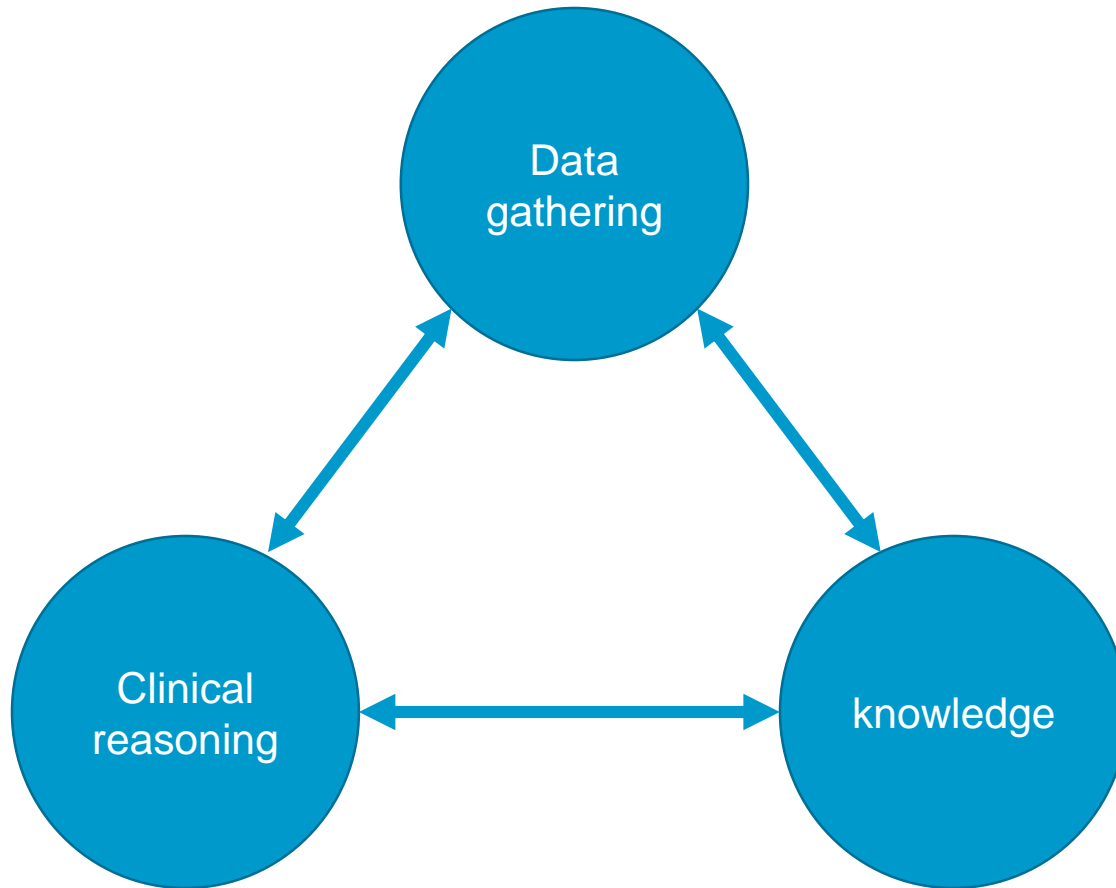
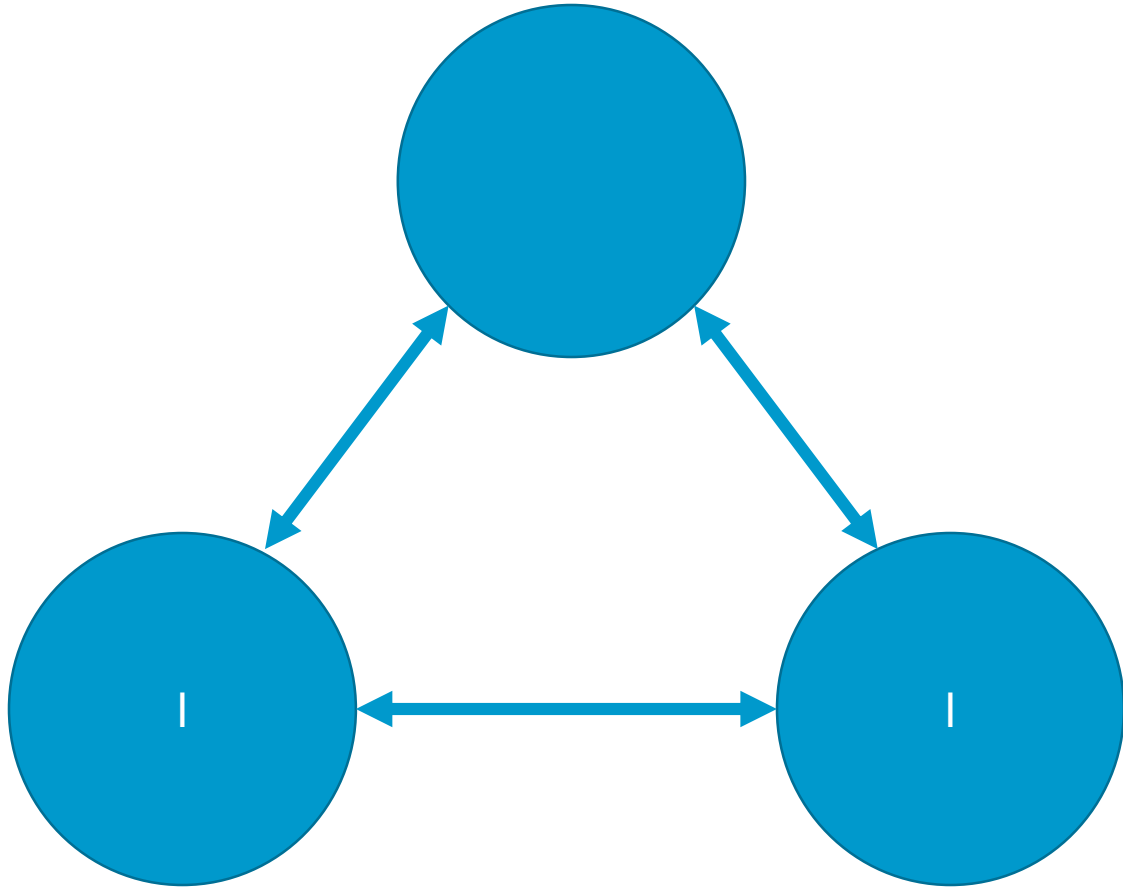


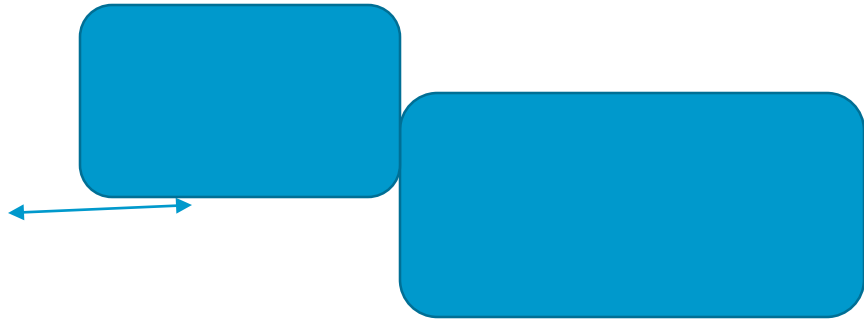
Figure 1 Early model of the key elements for evidence-based clinical decisions

Haynes RB, Devereaux PJ, Guyatt GH . Clinical expertise in the era of evidence-based medicine and patient choice. *Evid Based Med*2002 7: 36-38

Conceptual framework







Clinical and Diagnostic Reasoning

University of IOWA health care