講者簡歷

Henry Mandin, MD, Professor

Institution: Internal Medicine, University of Calgary, Faculty of Medicine, Canada
e-mail : henry.mandin@calgaryhealthregion.ca

l963 – M.D., University of Alberta
2001 – Doctor of Science, Honorary Degree, U. East Anglia
l968 – FRCPC, Royal College of Physician and Surgeons Canada
l970 – Nephrology Fellow, U. of Texas, SW Medical School, Dallas

PROFESSIONAL POSITIONS HELD:

1970 – 2008	Active Medical Staff, Foothills Hospital
1970 – 73	Assistant Professor, Dept. of Medicine, Univ. of Calgary
1973 – 79	Associate Professor, Dept. of Medicine, Univ. of Calgary
1979 –	Professor, Dept. of Medicine, Univ. of Calgary
1976 – 88	Chief, Nephrology Div., Dept. of Medicine, Univ. of Calgary
1975 – 88	Director, Renal Program, Foothills Hospital
1980 – 88	Chief, Div. of Renal Medicine, Dept. of Medicine, Foothills Hospital
1988 – 96	Assoc. Dean, Undergraduate Medical Education, Faculty of Medicine, Univ. of Calgary
1997 – 04	Chair, Committee on Objectives, Medical Council of Canada
1997 – 04	Editor, Medical Council of Canada Objectives Book
1998 – 03	Program director, Nephrology, University of Calgary and Foothills Hospital

2003 – 04 Member, USMLE Step 3 Material Development Committee for Computer-based Case Simulations, National Board of Medical Examiners

2004 – 06 Associate Editor, America College of Physicians P.I.E.R.

2006 – Scientific Advisor, Neuro Therapeutics Pharma

2007 – Consultant for Curriculum, Texas Tech University. Accredited by LCME

2008 – Consultant for Curriculum, A. T. Still University. Accredited by COCA

ADMINISTRATIVE RESPONSIBILITIES

International:

Chair, Program Committee, Fourth Biennial Conference of the IAMSE, July 17-20, 1999, Georgetown University School of Medicine, Washington D. C.,

Board of Directors, International Assoc. of Medical Science Educators, 1998 - 2003

Consultant, University of East Anglia, Proposal for Medical School, 1999;

UEA Medical School approved, Tony Blair announcement, June 16, 2000.

Consultant, A. T. Still University, Mesa, Arizona 2006 – 2009

Consultant, Texas Tech University School of Medicine 2006 – 2009

2003 - 04 Member, USMLE Step 3 Material Development Committee for Computer-based Case Simulations, National Board of Medical Examiners

2004 - 2006 Associate Editor, America College of Physicians P.I.E.R. (Physicians' Information and Education Resource)

National:

Chair, Medical Council of Canada Committee on Objectives 1997 – 2004

Editor, Objectives for the Qualifying Examination, MCC 1997 – 2004

IMG e-learning Oversight Committee on Cultural, Legal, Ethical, and Organizational aspects of practice in Canada 2004 – 2006

VISITING PROFESSOR:

1980 – 1981 Yale University School of Medicine

1996 – 1997 University of Ottawa

2003 – 2006 Sun Yat-sen University, P.R. of China

PETER H. HARASYM, PhD

UNIVERSITY EDUCATION

PhD University of Alberta, 1980
Major: Educational Measurement and Evaluation, Minor in Computer Assisted Learning

MEd University of Alberta, 1969
Major: Educational Psychology, Minor in Computer Assisted Learning

BEd University of Alberta, 1966

BSc University of Alberta, 1965
Major: Zoology, Minor in Chemistry

ACADEMIC APPOINTMENTS

- Professor, July 1, 1997- Present, Department of Community Health Sciences, Faculty of Medicine, University of Calgary, Calgary, Alberta
- Professor, July 1, 1997, Department of Educational Psychology, Faculty of Education, University of Calgary, Calgary, Alberta
- Professor, July 1, 1997-1998, Office of Medical Education, Faculty of Medicine, University of Calgary, Calgary, Alberta
- Associate Professor, 1987 – 1997, Department of Educational Psychology, Faculty of Education, University of Calgary, Calgary, Alberta
- Associate Professor, 1987 – 1997, Department of Community Health Sciences, Faculty of Medicine, University of Calgary, Calgary, Alberta
- Associate Professor, 1982 – 1997, Office of Medical Education, Faculty of Medicine, University of Calgary, Calgary, Alberta
- Assistant Professor, 1972 – 1982, Office of Medical Education, Faculty of Medicine, University of Calgary, Calgary, Alberta
- Educational Psychologist, 1977 – 1980, Office of Medical Education, Faculty of Medicine, University of Calgary, Calgary, Alberta

International:

- Oct. 20 to Nov 3rd 2007, Iran-- Invited World Health Organization Medical Educational Consultant to present a two week workshop on adopting the Clinical Presentation Curriculum at selected Universities of Excellence in Iran.
- Kaohsiung, Taiwan, January 2007, Workshop titled “Basic Principles in Development Quality Licensing Exams” Workshop at the Kaohsiung Medical University.
- Tzu Chi University, College of Life Sciences, Hual, January 2007 Workshop/Presentation titled “Curricular Reform”. 5 day workshop

- Taipei Medical University, Wan-Fang Medical, January 2007. Current Trends in Medical Education. Presentation titled “Advances in Medical Education from a North American Perspective”.
- Cheng Kung University Medical College, January 2007. Tears and Cheers during Curriculum Reform. Presentation titled “Curricular Reform – a success story at the Aga Khan Medical School, Karachi, Pakistan”.
- Vientiane, Laos, January 2007, Workshop assignment titled “Introduction Workshop on Student Assessment”. Sponsored by the University of Calgary, Faculty of Medicine, International Health Program.
- Laos, Jan 17-29th 2006, Workshop assignment titled "Basic Principles of Student Assessment". Sponsored by the University of Calgary, Faculty of Medicine, International Health Program.
- Aga Khan University, Karachi, Pakistan November, 2006, Invited External Reviewer of Undergraduate Medical Education Program.
- Tabriz, Iran 2005, World Health Medical Education Consultant. Invited guest speaker for 7th Annual conference on Medical Education. Presentations included: An Introduction to the Clinical Presentation Curriculum, The Unique Features of the Clinical Presentation Curriculum, Clinical Presentations: the creation of scheumes and germinal objectives.
- May 17-25 2005, Tehran, Mashad and Tabiz, World Health Organization: Educational consultant for Iran.
- June 13 – 23, 2004, Tehran and Isfahan
- October 3 – 7, 2005, Tainan, Taiwan, Cathay General Hospital
- International Consultant, 3 groups (China, Laos, Korea), 2000 – 2002, 2005
- The Zamboanga Medical School Foundation: International Consultant/Faculty - 2000-2003.

- Reviewer of 4 Masters in Medical Education thesis projects of Faculty members at the Zamboanga Medical School Foundation Inc., Zamboanga, Philippines, March, 1999.
- World Health Organization: Educational consultant for The First national Workshop on the Development of Medical Education Baghdad – Iraq, December 9-11, 1997.
- Consult to assess student evaluations, International Medical College, Kaula Lampur, Malaysia, October 15, 1997.
- Reviewer of 14 Masters in Medical Education thesis projects of Faculty members at the Zamboanga Medical School Foundation Inc., Zamboanga, Philippines, September 28-October 5, 1997.
- Ukraine: Invited by OSVITA (Canadian Government Aid Program) as a Medical Education Consultant to Ukrainian Minister of Health, Ukrainian State Medical University (Kiev), and Advanced Training Institute for Physicians, Kiev, 1995.
- Arabian Gulf University, Bahrain: Invited speaker at Symposium on Assessment and Evaluation in Undergraduate Education, May 1995.
- Zamboanga Medical School, Zamboanga, Philippines: Invited speaker at a Symposium on Medical Education in Mindanao, April 1995
- Zamboanga Medical School Foundation, Zamboanga, Philippines: Four-week consultation assisting in the establishment of a new Medical School in Zamboanga City, August-September, 1994.
- World Health Organization: Organized and hosted a two week Study Tour and Workshop on Research and Evaluation in Medical Education for six government and university officials from Iran, September, 1993.
- World Health Organization: Two-week consultation in Iran advising on the establishment of a new Masters degree program in Medical/Health Personnel Education, February, 1993
- University of Ulsan, Two-week consultation at College of Medicine, Seoul, Korea, February, 1993.
- World Health Organization: Consultation to initiate a Community-Oriented Medical Education Program in the Islamic Republic of Iran, February, 1992.
- World Health Organization: King Saudi University, Riyadh, Saudi Arabia, “A New Computerized Student Evaluation System”, March 1988.

National

- Canadian Chiropractic Examining Board 2001-2002
- Canadian Academy of Sport Medicine 2001-2002
- Canadian Academy of Sport Medicine “A Psychometric Analysis of the Canadian Academy of Sports Medicine Diploma Examinations (February 6, 1994)”
- Canadian Academy of Sport Medicine “A Psychometric Analysis of the Canadian Academy of Sport Medicine Diploma Examination (February 14, 1993)”
- Royal College: Item Analysis of Internal Medicine Multiple-Choice Questions (1992)
- Consultant to Director of Medical Council of Canada Q5 Project, 1990 to present
- Consultant to Canadian Federation of Chiropractic Regulatory Board, 1990-92
- Hughes Aircraft, Medical Image Database, 1993
- Medical Council of Canada on scoring of Q4 “key features” approach in assessment of clinical competence, 1988-90
- Medical Council of Canada regarding setting of standards on LMCC, 1990.
- Serge Brache Consulting, Ontario, Microcomputer teaching materials titled “Basic Hydraulics”, 1985
- MicroFutures Research Group, design of an authoring system for interactive systems, 1985.
- Okanagan College of Nursing on assessment of student performance, 1985.

The Solutions in Resolving Curricular Problems

2009 International Medical Education Conference
June 6, 2009
4F Conference Hall, Taipei Medical University

UNIVERSITY OF CALGARY

Peter H. Harasym, PhD
Professor, Department of Community Health Sciences, Faculty of Medicine

Outline

- Advanced educational information
  - Cognitive psychology
  - Teacher training
  - Student challenges
  - Curricular models

Outstanding Performance

- Summary

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Outline

- Advanced educational information
  - Cognitive psychology
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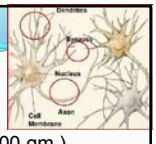
The Brain (trivia)

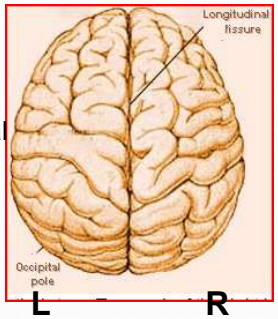


- Weight: (average) = 3 pounds (1300 - 1400 gm.)
- % of body's oxygen consumed = 25%
- % of body's glucose burned (average) = 70%
- % of body's nutrients consumed = 25%
- Number of neurons = 100 billion
- Number of neural connections = approx.1 million billion
  (# of seconds in 31,688 trillion years)
- Neuroplasticity: the nerves and their connections are constantly being altered (i.e., change in response to experience, demands, and age)
- The most important organ in the body!
  - (Woody Allen believes the brain is the second most important organ)

Kenneth A. Wesson, 2007

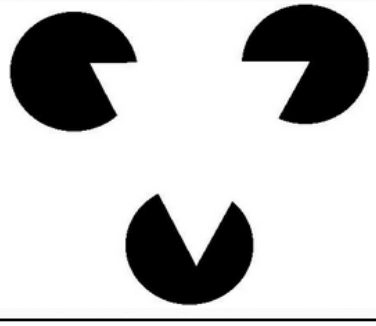
The Brain

Language
Logical
Mathematical
Sequential
Factual
Detailed



Emotional
Spatial
Intuitive
Holistic
Musical
Creative

Search for meaning

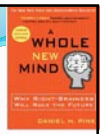


Challenge

- Which part of the human face is most emotionally expressive?
  - A. Right side (not symmetrical)
  - B. Left side (not symmetrical)
  - C. Both left and right equally (symmetrical).
  - D. Top half (symmetrical)
  - E. Bottom half (symmetrical)

Sackheim et. al. (1978)

The Whole Brain



- Excellence in problem-solving demands analysis, planning, synthesis, focus, determination, emotion, passion, and desire – a coordination of the capabilities of both the L and R hemispheres.
- Patients with disconnected L and R hemispheres cannot make simple decisions (e.g., what would you like to eat for supper – is a struggle)
- Given complex problems/challenges, activation of the whole brain (being in the "zone") increases the probability of displaying outstanding performance.
- Over stimulation/arousal of either the L (logical / analytical / rational) or the R (emotional) increase the odds of poor performance and improper decisions / behaviours.

Implications for education

- Herrmann (1990) strongly criticized traditional educational practices as too L brain focused.
  - too much focus on memorization, logical and sequential reasoning skills.
  - aptitude tests (MCATs, SAT, GMAT, etc.) used in admission are highly focused on the activities of the left hemisphere

Ned Herrmann, The Creative Brain, North Carolina, 1990.

Preferred activities

- Left hemisphere:
  - Collecting data, listening to informational lectures, reading textbooks, judging ideas based on facts/criteria and logical reasoning.
  - Following directions, repetitive detailed homework problems, time management and schedules.
- Right hemisphere
  - Listening to and sharing ideas, looking for personal meaning, sensory input, and group study.
  - Looking at the big picture, taking initiative, simulations (what if questions), visual aids, appreciate beauty of a problem, brainstorming, and being sensitive to emotions

Medical Education

- Brain's full potential based on L and R sides complementing and collaborating with each other.
- Clearly, teaching-learning approaches should encourage "whole-brain participation."
- The doctor who is able to integrate such skills as, language, logic, critical thinking, visual-spatial awareness, creativity, compassion, empathy into their professional development and clinical practise is one whom I will refer to as a "whole-brain physician"

Right brain learning

- Picture/visual/spatial learning and problem-solving is a powerful cognitive process that occurs in the R side of the brain
  - Albert Einstein used "highly visual thought experiments"
- Imagination, visualization, intuition, creativity, and emotional intelligence are all R brained activities that desire greater attention in medical education.

Outline

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  - Teacher training
  - Student challenges
  - Curricular models
- Summary

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Programme for International Student Assessment (PISA)

- Finland ranked No.1 in the PISA's 2006 survey in the area of science, followed by Hong Kong and Canada
- In Finland, all school teachers receive their training at universities and are certified after obtain a Master's degree
- The number of applicants for teaching greatly outnumbers the teaching spots available.
- Teachers are well paid and hold high status within the work force

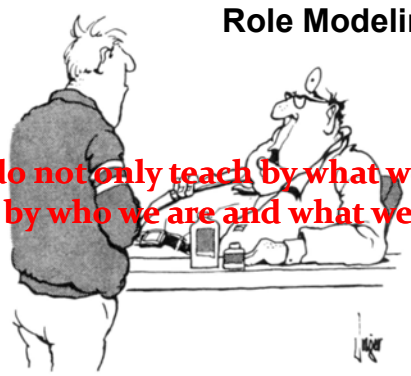
Finish Teachers

- Teaching qualifications are prescribed by law and vary for different kinds of teachers.
- These national requirements guarantee that the standard of teacher education remains high.
- All teaching have clearly defined objectives
- The curriculum emphasizes doing (problem-solving)
- Learning activities reflect a balance between left and right brain activities

Teacher Qualifications

- Many countries (e.g. Japan) are trying to mimic the Finish educational system
- To maximize performance, the coach/teacher/tutor must be highly trained and dedicated.
- In medicine, many teachers teach the way they were taught (i.e., they have no formal training)
- There is a need to elevate the qualification, training and reward of teachers in medical education- some are even poor role models.

Role Modeling



We do not only teach by what we say, but by who we are and what we do!!

"Are you eating properly and getting plenty of exercise?"

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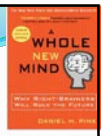
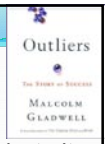
Challenge



- According to the latest research, IQ accounts for what portion of career success?
  - A. 60% - 50%
  - B. 49% - 30%
  - C. 29% - 20%
  - D. 19% - 10%
  - E. 0% - 9%

E. 4% - 10% p. 58
L brained measures

What does matter?



- Imagination, visualization, intuition, creativity, joyfulness, emotional-intelligence, and social dexterity (R brained activities).
- In addition, time on task makes a very large difference.
- Knowledge is Power Program (KIPP) – a wonder school in New York Bronx area.
- ¾ are African American or Hispanic that come from single-parent homes
- Yet, 90% of KIPP graduates get scholarships to private or parochial high schools
- 80% go on to college/university

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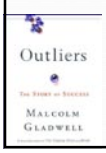
California Achievement Test

Achievement at the end of school year

CLASS	1st grade	2nd grade	3rd grade	4th grade	5th grade
Low	329	375	397	433	461
Middle	348	388	425	467	497
High	361	418	460	506	534

361-329=42 534-461=73



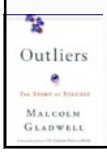
The difference between achievement of students from poor and rich families almost 2X at the end of the 5th grade p. 257

California Achievement Test

Achievement during school year (post – pre test)

CLASS	1st grade	2nd grade	3rd grade	4th grade	5th grade	TOTAL
Low	55	46	30	33	25	189
Middle	69	43	34	41	27	214
High	60	39	34	28	23	184

184-189=-5



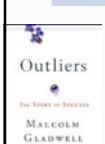
During the school year the students from low and high social economic families had almost equal achievements.

California Achievement Test

Achievement during summer holidays (post – pre test)

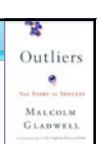
CLASS	After 1st	After 2nd	After 3rd	After 4th	TOTAL
Low	-3.67	-1.70	2.74	2.89	0.26
Middle	-3.11	4.18	3.68	2.34	7.09
High	15.38	9.22	14.51	13.38	52.49

52.49-0.26=52.23



During the summer holidays the students from high social economic families continued to learn (camps, books to read, etc. p 158)

KIPP school



- School starts at 7:30 am and ends at 5:00 pm
- After 5:00 pm there is homework clubs, detention, sports teams and the day ends at 7 pm
- Saturday students are in school from 9 am to 1 pm
- In summer, KIPP students get three extra weeks of school in July
- Removing lunch and recess, KIPP students spend 50% to 60% more time learning than the students in the public school system.

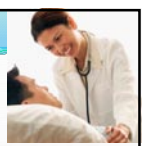
Time on Task

- High performance & outstanding achievement is directly related to time on task
- Outstanding performers are highly focused, spend more time on task, use deliberate practise, have highly qualified mentors/teachers/tutors/coaches, are passionate and desire to be their very best.
- Success/outstanding performance can be enhanced and encouraged in all students.

Schmidt et. al. (2009)

- Time on task does not mean time spent only in lectures.
- Recent study examined 10 generations of students enrolling in the 8 Dutch medical schools between 1989 and 1998.
- Overall, the active-learning curricula graduated on average 8% more students per year, and these students graduated on average 5 months earlier than their colleagues from conventional curricula.
- Students in active-learning curricula spent 1/6X in lectures/week and 1.33X more time in independent study.

Overview



- Activation of whole brain
- Teacher qualification
- Time on task
- Active vs. passive learning
- Curriculum????
  - how content is sequenced and organized
  - integration of basic and clinical sciences

Outline

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UNIVERSITY OF CALGARY

Academic Medicine 74: 154-164 (1999)

Medical curriculum reform in North America, 1765 to the present: a cognitive science perspective

FJ Papa and PH Harasym

Since 1765, five major curricular reform movements have catalyzed significant changes in North American medical education. This article describes each reform movement in terms of its underlying educational practices and principles, inherent instructional problems, and the innovations that were carried forward. When considering the motivating factors underlying these reform movements, a unifying theme gradually emerges: increasing interest in, attention to, and understanding of the knowledge-base structures and cognitive processes that characterize and distinguish medical experts and novices. Concurrent with this emerging theme is a growing realization that medical educators must call upon and utilize the literature, research methods, and theoretical perspectives of cognitive science if future curricular reform efforts are to move forward efficiently and effectively. The authors hope that the discussion and perspective offered herein will broaden, stimulate, and challenge educators as they strive to create the reform movements that will define 21st-century medical education.

Curricular models

106
80
20
20

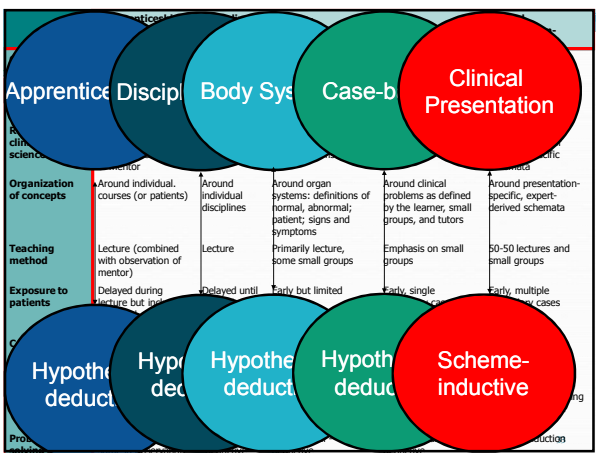
1765 - Ap nticeship-b
1871 - Di ine-based
1951 - Sy n-based
1971 - Ca based (PB
1991 - Cl al presenta n-based

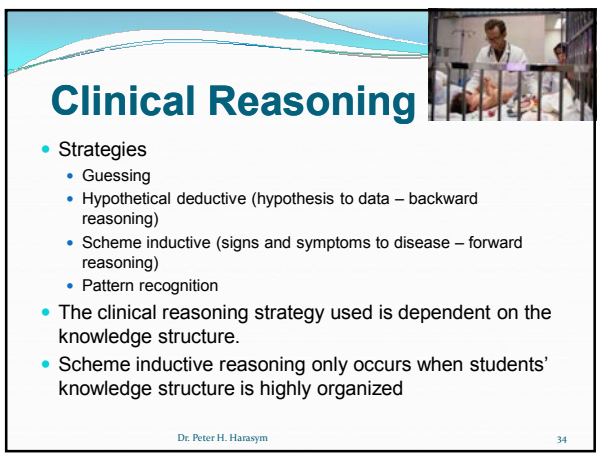
Retained +s & removed -s

Medical educ. research

	Apprenticeship-Based	Discipline-Based	System-Based	Case-Based	Clinical Presentation-Based
Organization of course content	Around subject (or patient)	Around discipline	Around organ systems	Around clinical cases	Around 120 clinical presentations
Controllers of content	Faculty/mentor	Departments	Topic committee	Curriculum committee	Curriculum committee
Relation of clinical to basic sciences	Separated during lecture; merged during observation of mentor	Separated	Interdigitated 50-50 within context of organ systems	Integrated within context of clinical cases	Integrated 50-50 within context of problem-specific schemata
Organization of concepts	Around individual. courses (or patients)	Around individual disciplines	Around organ systems: definitions of normal, abnormal; patient; signs and symptoms	Around clinical problems as defined by the learner, small groups, and tutors	Around presentation-specific, expert-derived schemata
Teaching method	Lecture (combined with observation of mentor)	Lecture	Primarily lecture, some small groups	Emphasis on small groups	50-50 lectures and small groups
Exposure to patients	Delayed during lecture but included in clinical observation	Delayed until clerkships	Early but limited	Early, single exemplary cases	Early, multiple exemplary cases
Cognitive skills emphasized	**Memorizing**	**Problem solving (HD)**	**Problem solving (HD)**	**Problem solving (HD)**	**Problem-solving (SI)**
Primary learning guides	Lecture notes and textbooks	Lecture notes and textbooks	Learning objectives and textbooks	Learning objectives and clinical problems	Teaching and learning objectives, expert schemata
Problem-solving	None in lectures;	Hypothetical	Hypothetical -	Hypothetical -	Scheme-induction

	Apprenticeship-Based	Discipline-Based	System-Based	Case-Based	Clinical Presentation-Based
Organization of course content					
Controllers of content					
Relation of clinical to basic sciences					
Organization of concepts					
Teaching method					
Exposure to patients					
Cognitive skills emphasized	**Memorizing**	**Problem solving (HD)**	**Problem solving (HD)**	**Problem solving (HD)**	**Problem-solving (SI)**
Primary learning guides	Lecture notes and textbooks	Lecture notes and textbooks	Learning objectives and textbooks	Learning objectives and clinical problems	Teaching and learning objectives, expert schemata
Problem-solving					





Hypothetico-deductive reasoning

- Early generation of hypotheses
- Typically 2 – 5 hypotheses
- Hypotheses drive further enquiry
- Additional information used to refute/confirm hypotheses

Diagnose the ungulate

Elk

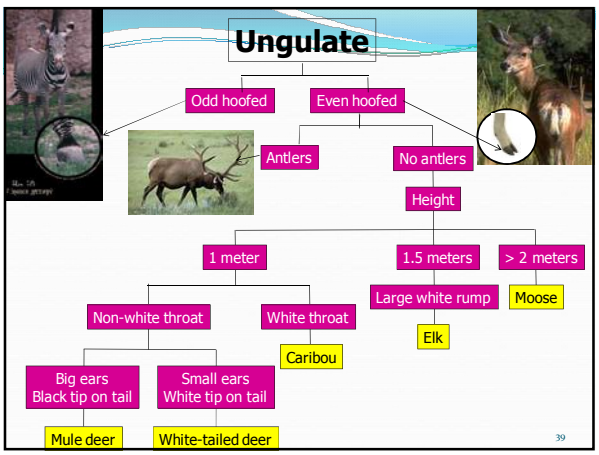
Moose

Antelope

Caribou

Doe

Deer



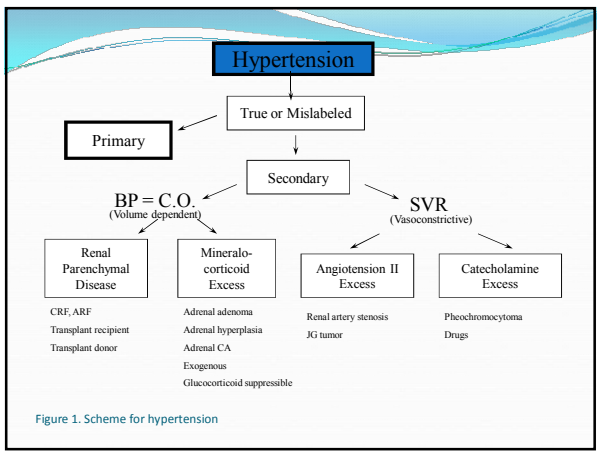


Figure 1. Scheme for hypertension

Outline

- Advanced educational information
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Dr. Peter H. Harasym

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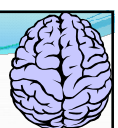
The Whole Brain



- The brain is made up of two hemispheres with different cognitive functions
- Most medical educational institutions select students based on L brain achievement (MMI)
- The tasks and services within the medical profession necessitate maximizing and developing student cognitive activities in both hemispheres.
- Research indicates that correct decisions are made when both L and R hemispheres (rational and emotional) are activated
- Seeing the whole picture and filling in the parts and their relationship is a coordinated R and L brain activity.

Teacher qualification

- Maximum performance in students is dependent on faculty qualifications
- Faculty not only create the learning environment, guide the students learning, but are important role models
- There is a greater need for faculty development in basic scientists and physicians working within medical schools
- All teachers should be certified as master teachers.

Time on task

- Students will learn whatever they spend their time on
- The most important tasks of a physician are diagnostic competence, patient management, and working as a member of a health team.
- Unfortunately, there is a tendency to fill students' heads with knowledge – knowledge by itself is useless. What students do with their knowledge in helping patients with their health problems is far more important.
- There is a greater need to prepare students to think and behave like experts – most medical schools expect students to evolve into experts through experience and little quidance.

Curricular models

- There has been an evolution of curricular models in the last 250 years (apprenticeship, disciplinary, body systems, case-based, and clinical presentation)
- Each new model overcame short comings in the preceding model and added strengths.
- The most recent Clinical Presentation model has several advantages:
  - covers the entire domain of medicine,
  - greater balance between L and R brain cognitive activities,
  - recognizes the importance of organized knowledge,
  - provides students with a holistic picture (scheme), and
  - an expert's forward reasoning strategy for clinical problem-solving

Conclusion

- Advanced educational information
  - Cognitive psychology
  - Teacher training
  - Student challenges
  - Curricular models

Outstanding Performance

- Summary

UNIVERSITY OF CALGARY

Henry Mandin MD, FRCPC, DSc (Hon)
International Medical Education Conference, Taipei Medical University
June 6, 2009

GUIDING PRINCIPLES FOR PLANNING A CURRICULUM

"BEME": from Speculation to Science

"Today, the world is in the midst of an extraordinary outpouring of scientific work -- on the processes of thinking and learning -- on the development of competence --- a new theory of learning is coming into focus that leads to very different approaches to the design of curriculum ---"

How People Learn, National Academy Press, 2000

Guiding Principles for Planning Professional Curricula

- Review existing curriculum, literature
- Identify ideal professional attributes
- Develop an educational philosophy
- Deduce curricular objectives from desirable practice-based behaviors
- Identify the science of 'clinical' practice
- Assign priority to problem solving
- Establish evaluation methods

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Review

- Review existing curriculum, other curricula
- Review literature/documents/reports
  - Training of Doctors Blueprint, 1994.
    - Objectives of UME in The Netherlands
  - GPEP, GMC, WHO, Med School Obj Project
  - Advisory comm, med training, Euro comm
  - *Outcome studies*
- Opinions: faculty, students, community

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Professional Attributes

- Medical expertise
- Communicators
- Collaborators
- Scholars
- Managers
- Professionals
- Health advocates
  - CanMeds 2000

Objectives for Curriculum: *"Rule of Thumb #1"*

Principles governing physicians' professional attributes are transferable. Such skills can be derived generically from various disciplines and translated into applications for specific medical domains (e.g. legal skills from *'Law'*, ethical principles from *'Ethics'* may be applied to any medical domain).

Ethics: CP 'Genetic Concerns' Resource Allocation

- Generic Objectives
  - Make costly health care resources available in a fair, equitable manner without discrimination.
- Translated Objective
  - Access to prenatal genetics services for all is critical. Unless genetic screening is supported financially, it may become limited to the affluent. This creates the risk that genetic disability will become a marker of social class.

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Philosophy

- Definition
  - "General laws that furnish a rational explanation of anything."
- Medical education philosophy
  - "The general law that furnishes a rational explanation of how medical students best learn to become excellent physicians."

Examples of Medical Education Philosophies

- Departmental curricula: "Basics first"
  - Isolated disciplines
- Systems curricula: "Integration"
  - Multi-discipline
- PBL curricula: "Discovery learning"
  - Inter-discipline, minimal guidance
- CP curricula: "Big picture/CP Structure"
  - Trans-discipline, task-based guided instruction

"Basics First"/"Bottom Up"

- *'Part-to-part'⇒'part-to-whole'*
- "Common sense with which pedagogical sense coincides, places the basic before -- medical sciences on the theory that --- [students'] progress will be expedited." Flexner, 1925
- Based on 'cases/diagnoses'

Integration: multi-discipline

- System-based curriculum
  - Case Western Reserve: 1952
    - 2 years normal + 2 years abnormal system function
    - Based on 'cases/diagnoses'
  - University of Calgary: 1970
    - Normal and abnormal system function
    - Harden: step 9/11

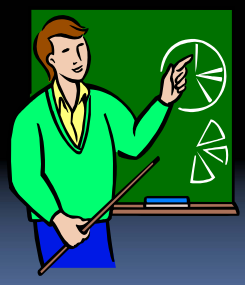
PBL Curricula: 1970's

- 'Discovery learning'
  - Minimal guidance
    - "--- the goal is to inculcate problem- solving skills --- " (hypothetico-deductive reasoning)
    - " --- knowledge mastery is only a secondary agenda ---" Eva, Neville, Norman Acad Med 1998
  - Sciences integrated with 'cases'; 'case-based'
  - *Small group learning*, minimal guidance

"Big Picture/CP Scheme"

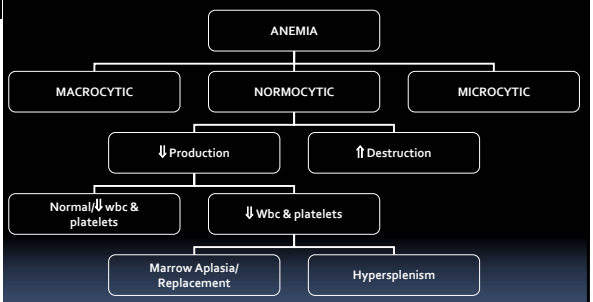
Anderson, West, & Wolff, 1991

- Direction of learning is 'wholes-to-part' then 'part-to-whole' (top down)
- Schemes (mental pictures of the whole) are pre-requisites to learning



"Task-based": Organization of Medical Knowledge

- 'Textbook knowledge structure'
  - Knowledge categorization found in most textbooks and medical schools' curricula
- 'Task structure' Taylor, 1976
  - Knowledge categorization used by practitioners in their thinking
- "Clinical Presentations (CP)" 125 ± 5
  - Hierarchical structures/"Schemes"

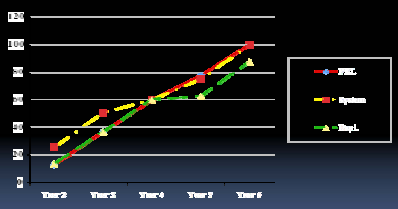


"CP" Curricula: 1994

- Guided Learning
  - Content teaching simultaneously with
  - Learning strategy (made explicit)
    - Basic concepts process worksheets (recent)
    - Clinical process worksheets (recent)
    - Worked case examples in small groups with guidance
  - Scaffolding-relevant procedures
    - Show how to 'chunk'/reduce information
    - Construct collaborations and routines

Clinical Examination Performance

40 students/curriculum yr./school (612 students)
(Schmidt et al, Acad Med 1996)



Curriculum Influence on USMLE1

Univ.	Years	Curric.	Result	Sig.
Harvard	1989 – '90	Dep vs PBL	No diff.	
Wake Forest	1992 – '98	"	No diff.	214/208 P = 0.21
M.S.U.	1986	"	No diff.	
Rush	1984 – '88	"	No diff.	
SIU.	1993 – '97	"	No diff.	
U. of N.M.	1983 – '92	"	504/456 521/455	p < 0.0001 p < 0.01
U. of Missouri		"	PBL better	

Guided/Minimally-guided Instruction

Kirschner et al Educational Psych 2006; 41: 75 - 86

"Controlled experiments almost uniformly indicate that when dealing with novel information, learners should be explicitly shown what to do and how to do it."

Cognitive Architecture Research

- Ignoring cognitive structure is ineffective
- Must reference
  - working memory (4 ± 1 items for 30 seconds)
  - long-term memory (LTM)
  - intricate relations between them
- Guided instruction is effective/efficient in supporting learning

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Comprehensive Professional Curricula

"---I have promoted assembling databases that rely on descriptions of the professional's activity, with emphasis on performance in the context of ***professional situations.***"

LaDuca, 1994

'Clinical Presentation' Taxonomy

"The manner in which the human body translates an infinite amount of abuse, damage, or harm is finite and stable over time; there are 125 ± 5 clinical presentations or situations of any consequence."

Available Taxonomies

- Departmental
  - Basic & Clinical sciences (3262 cases)
- System-based
  - Normal & abnormal system function (3262)
- PBL (80 – 400/3262 cases)
- Clinical Presentations (125 ± 5)

List of Institutions & Clinical Presentations/Situations/Tasks

- Medical Schools
  - U. of Calgary – "Clinical Presentations"
  - University of Glasgow
  - University of Florida (Gainesville)
  - University of East Anglia
  - Cambridge University (Graduate entry program)
  - University of Manchester – "ICS"
  - U. of Dundee – "Task-based learning"
  - A. T. Still University, Mesa, Arizona
  - Texas Tech, El Paso
- Examination Boards
  - Med Council of Canada – "Clin Pres"
  - Australian Medical Council

"Case/Content Specificity"

"The finding of case specificity does indeed raise a significant problem for curriculum planning in medical education, for it suggests that the extent of transfer from problem to problem is less than a case-oriented curriculum appears to require for justification." Elstein, Shulman, & Sprafka, 1978

Dilemma of Content Specificity

If cases are carefully and deliberately selected (*while others are omitted*), medical schools should warrant their students' competence at graduation only in the problems and cases that make up the curriculum.

Elstein et al p. 293

Guiding Principles for Planning Professional Curricula

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Comprehensive Professional Curricula

"---knowledge essential for safe practice can be defined by analysis of the array of ***professional situations*** constituting the practice model."

LaDuca, 1994

Objectives for Curriculum Content: "*Rule of Thumb 2*"

Knowledge objectives for medicine cannot be determined from disciplines without relation to a specific domain. From each basic science and clinical discipline, deduce and integrate objectives according to desirable outcomes for each domain.

Basic Concepts PWS

Sub-goals (Phases)	Heuristics	Learning tasks
Horizontal levels of the 'scheme'	A method for solving a problem for	Scheduled/nonsched.
	which no formula exists, based on informal methods or experience, and	Compulsory/non comp.
	employing a form of trial & error iteration.	

NBME Basic Science Exam

Teaching & Learning in Medicine 2004:16; 116 - 122

Guiding Principles for Planning Professional Curricula

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Medical Problem Solving Patel

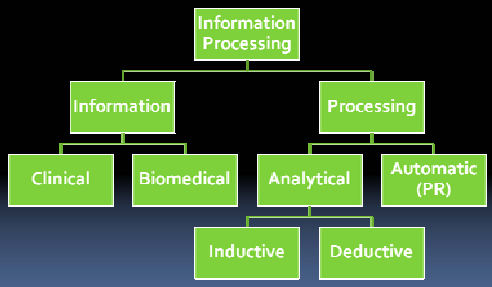
- Data gathering
- Diagnosis

} Dynamic task: (information processing)

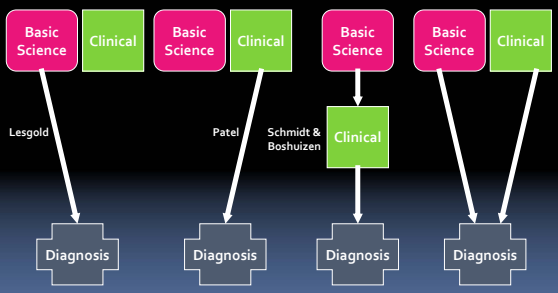
- Therapeutic plan
- Patient management

} static task

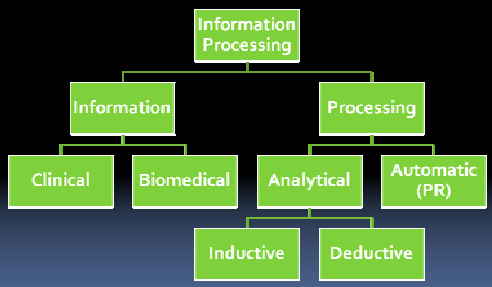
Information Processing



Basic Science & Diagnostic Reasoning Acad Med 2005; 80: 765 - 773



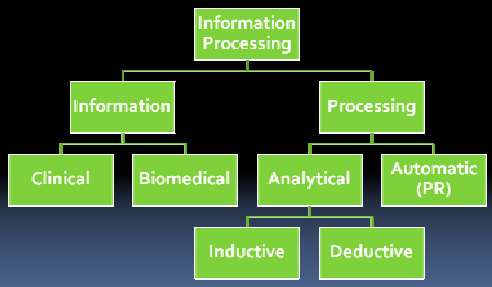
Information Processing



Expert Information Processing: Analytical *and* Automatic McLaughlin, Schmidt, Rikers

- Context
  - ⇧Context ⇒ PR; ⇩ context ⇒ analytical
- Task difficulty
  - Simple ⇒ PR; Complex ⇒ 'chunking' ⇒ analytical
- Clinical domain
  - Visual ⇒ PR; A – B/Electrolyte ⇒ analytical

Information Processing



Variables Associated with the Odds of Diagnostic Success

Variable	Comparison	Adjusted OR [95% CI]	*p* value
Straightforward task	Difficult task	18.96 [2.19, 163.82]	0.008
Extended match format	Short answer format	4.47 [1.0, 20.2]	0.05
Hypothetico-deductive reasoning	Other strategies (Scheme - inductive & PR)	0.17 [0.03, 0.82]	0.028

Adv Health Sci Educ Theory Pract: Heemskerk, Norman, Chou, Mintz, Mandin, McLaughlin 2007

Clinical Reasoning

- There is no content-independent strategy
- Strategies access & apply structured knowledge from LTM
- Instruction focus: knowledge structure needed , NOT how to use strategies

Knowledge structure & diagnostic reasoning strategy

- Conceptual framework/hierarchal 'scheme' ⇒ *scheme – inductive reasoning*
- Experience (> 10 yrs) & exemplars ⇒ *automatic/PR* (driven by similarity)
- Instruction organized on 'schemes' for clinical presentations will result in superior diagnostic problem solving

Clinical Presentation (CP) Curriculum

- 120 CP's organized into 'schemes' that integrate basic, social, & clinical sciences
- Sm. group learning, guidance, feedback
  - Schemes, Process worksheets, Wked examples
  - Deliberate/mixed practice
  - Inductive reasoning
- Judicious use of all learning strategies

"CP": Medical Education in the 20th & 21st Century

- Flexner: Science era
- Integration: Systems
- PBL: Minimal guidance
  - Small groups
  - H – D reasoning
  - Case-linked sciences
  - Knowledge gaps
  - Transfer difficulty
- Basic science (CP-linked)
- Integration (step 9 ⇒ 11)
- Guided instruction
  - Small groups
  - Inductive reasoning
  - Schemes, PWS, WCE
  - Comprehensiveness
  - Transfer: deliberate practice

Curricular reform and clinical presentation curriculum in Taiwan

Charity TC Tsai (蔡淳娟), MD, PhD
Taipei Medical University - Wan Fang Hospital

Outline

- Why change?
- What change in North America ?
- What change in Taiwan ?
- Clinical Presentation Curriculum in Taiwan
- Reflection

Why change?

If it is not broken, don't fix it!

Curricular problems

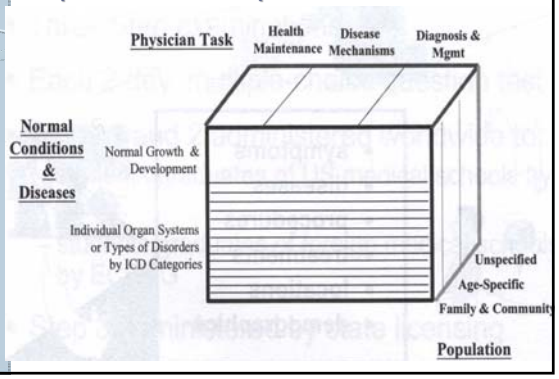
- Redundancies, duplications, and irrelevant information
- Lack of integration between basic, clinical, humanities, and biopsychosocial sciences.
- Too much emphasis on memorization and recall
- Difficult to meaningfully sequence content
- Knowledge gaps
- Information overload
- Reduced learning by teaching out of context
- Too much lecturing (passive learning)
- Excessive class time

Solutions for resolving curricular problems

- Re-categorization, create a new blueprint
- Create new courses, with new names, that help integrate basic, clinical, and behavioral sciences.
- Identify the needs : based on students, faculty,

Create a new course

Step 2 USMLE blueprint-- Prof. LB Gardner



Outline

- Why change?
- What change in North America ?
- What change in Taiwan ?
- Clinical Presentation Curriculum in Taiwan
- Reflection

Curricular models

- 1765- Apprenticeship-based (師徒制)
- 1871- Discipline-based (學科制)
- 1951- Body System-based (器官系統制)
- 1971- Problem-based (PBL制)
- 1991- Clinical presentation-based (臨床表現制)

Peter H. Harasym, PhD

Clinical presentation curriculum

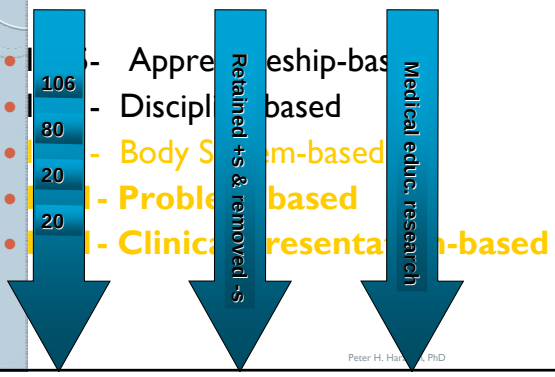
- Limited number of ways that patients present to physicians
  - (120 ± 5 clinical presentation)
- Examples
  - Chest pain
  - Edema
  - Unconscious patient
  - Painful limb
  - Fever and chills
  - Hypertension
- Unique problem-solving strategy for each presentation

Dr. Peter H. Harasym, Ph.D.

Characteristics of Five Curricular Models, North American Medical Education, 1795 to the Present

Characteristic	Curricular Model				
	Apprenticeship-based (1765-)	Discipline-based (1871 -)	System-based (1951 -)	Problem-based (1971 -)	Clinical-presentation-based (1991 -)
Organization of course content (skills, knowledge, attitudes)	Around subject	Around discipline	Around organ systems	Around clinical cases	Around 120 clinical presentations
Controllers of content	Faculty	Departments	Topic committee	Curriculum committee	Curriculum committee
Relationship of clinical to basic sciences	Separated; emphasis on clinical work	Separated; emphasis on basic sciences	Interdigitated 50-50 within context of organ systems	Integrated within context of clinical cases (emphasis on clinical)	Integrated 50-50 within context of problem-specific schemata
Organization of concept formation	Around individual courses	Around individual disciplines	Around organ systems; definitions of normal, abnormal; patient; signs and symptoms	Around clinical problems as defined by learner, small groups, and tutors	Around presentation-specific, expert-derived schemata
Teaching method(s)	Lecture	Lecture	Primarily lecture, some small groups	Emphasis on small groups	50-50 lectures and small groups
Timing of patient/case exposure	Delayed	Delayed until clerkships	Early but limited	Early, single exemplary cases	Early, multiple exemplary cases
Cognitive skill(s) emphasized	Rote memorization	Critical thinking	Problem solving	Problem solving	Categorization

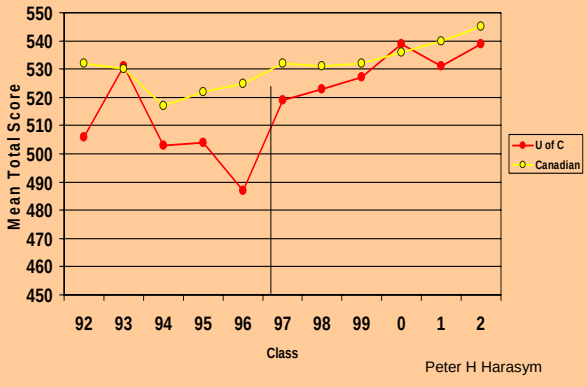
A. Curricular models



- 1765- Appre eship-bas
- 1871- Discipl based
- 1951- Body S m-based
- 1971- Proble based
- 1991- Clinica resenta n-based

Peter H. Ha PhD

Performance on LMCC Total: 1992-2002



Peter H Harasym

Performance on LMCC – Clinical Reasoning: 1994-2002

Peter H Harasym

List of Institutions (adopt Clinical Presentation Curriculum)

- U of Calgary
- University of Glasgow
- University of Florida (Gainesville)
- University of East Anglia
- Cambridge University (Graduate entry program)
- Medical Council of Canada
- Australia Medical Council
- University of Manchester – "ICS"
- U of Dundee – "Outcome-based learning"

Dr. Peter H. Harasym, Ph.D.

SPICES: Dundee University

Items	SPICES
Orientation	**S**tudent-centered ⟷ Teacher-centered
Content	**P**roblem-based ⟷ Information-gathering
Organization	**I**ntegrated ⟷ Discipline-based
Clinical training	**C**ommunity-based ⟷ Hospital-based
Flexibility	**E**lectives ⟷ Uniform
Environment	**S**ystematic ⟷ Apprenticeship

Outline

- Why change?
- What change in North America ?
- What change in Taiwan ?
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Curricular evaluation

1. Curricular map
2. Content arrangement
3. Criteria for graduation

4. Implementation	Year ?	Year ?	Year ?
Teaching hours/week			
Electives courses(%)			
Teaching methods: Lecture(%) PBL & small group(%) Other(%)			

Medical Curricula of 11 Medical Schools in Taiwan-賴其萬：調整醫學系課程建議報告書

- 基礎醫學課程：
  - 基礎醫學課程鮮少有臨床醫學老師參與規劃，而基礎醫學和臨床醫學老師之間缺乏溝通，致使**整合課程無法落實**。
  - 實驗課程? 大體解剖課程/實驗? 寄生蟲學?
- 臨床醫學課程：
  - 學校一般對附設醫院培訓內容無法介入、管控
  - 醫學生在臨床實習的期間大多並未實際參與病人照顧

台大醫學系課程

年	科目	年	科目	年	科目
三	大體解剖學及實驗	四	臨床藥理學小組討論	五	醫學遺傳學一
三	組織學	四	臨床醫學總論二	五	放射線學概論
三	生理學甲	四	臨床醫學總論三	五	麻醉學概論
三	解剖及生理小組討論	四	藥理學	五	臨床病理討論一上
三	流行病學	四	藥理學實驗	五	臨床病理討論一下
三	環境與健康	四	病理學甲	五	門診醫學及急診醫學
三	衛生政策與健康保險	四	病理學實驗甲	五	家庭、社會與醫療
三	胚胎學	四	病理學小組討論	五	內科學
三	神經生物學	四	臨床醫學總論一	五	外科學
三	微生物學及免疫學甲	四	檢驗醫學	五	小兒科學
三	微免及神經生物小組討論				
三	問題導向學習				

2009/05/30---http://www.med.ntu.edu.tw/uploadimages/course.htm

陽明大學醫學系

三年級

- Introduction to Clinical Medicine
- Cardiovascular
- Pulmonary
- Endocrine & Metabolism
- Gastrointestinal
- Brain & Behavior
- Musculoskeletal & Rheumatology
- Integument
- Allergy, Immunology & Infection
- FERGU
- Hematology & Oncology

四年級

- Introduction to Clinical Medicine
- Cardiovascular
- Pulmonary
- Endocrine & Metabolism
- Gastrointestinal
- Brain & Behavior
- Musculoskeletal & Rheumatology
- Integument
- Allergy, Immunology & Infection
- FERGU
- Hematology & Oncology

高雄醫學大學:2004年起整合課程會議，2005年(2003年入學班)施行

2年級（8）

消化系統、內分泌新陳代謝、精神與社區健康醫學、大體解剖學實驗、生殖與性醫學、特殊感官系統、腎臟泌尿系統、呼吸系統

3年級（15）

麻醉學、臨床病理討論、口腔醫學概論、實證醫學、急診重症醫學、法醫學、醫學倫理與法律、放射線腫瘤學、成長發育與生理恆定、血液及腫瘤學、心臟血管系統、感染與宿主免疫反應、肌肉骨骼關節學、神經系統、導論

4年級（10）

急診醫學、家庭醫學、老人醫學、牙醫學概論、醫學遺傳學、核子醫學、神經學、精神醫學、臨床免疫風濕學、放射線治療學

高醫Sample: 神經系統

一、 神經解剖學
二、 神經生理學
三、 神經藥理學
四、 神經胚胎學
五、 神經組織學
六、 神經微生物學
七、 神經病理學
八、 神經影像學
九、 神經麻醉學
十、 神經學
十一、 神經外科學
十二、 神經復健學

輔仁大學醫學系

三年級課程(97 學年)

1 週~2 週	3~6 週	7~12 週	13~17 週	1 週~6 週	7~12 週	13~17 週
基礎醫學概論	基礎臨床醫學整合入門單元	心臟血管單元	呼吸及循環單元	泌尿單元	胃腸單元	內分泌及生殖單元
基礎醫學實驗						
資源學習						
臨床技術學(一)						
胚胎學						
寄生蟲學含實驗						

四年級課程(97 學年)

1 週~6 週	7~12 週	13~18 週	1 週~5 週	6~11 週	12~17 週
神經運動單元(一)	神經運動單元(二)	婦產及小兒單元	感染及免疫單元	血液單元	精神行爲及重症單元
組織與病理學實驗					
臨床技術學(二)					
大體解剖學實驗			生死學		
			實驗診斷學		

Summary

Model		Unit	Period	Note
台大醫學院醫學系				
Traditional	Discipline-based	13, 10, 10, 9 disciplines	醫三 ~ 醫六	Lecture
高雄醫學大學醫學系				
Ottawa University	Organ System	24 systems, 9 disciplines	Year 2-4	Lecture
陽明大學醫學系				
University of British Columbia University of Missouri-Columbia School of Medicine	橫向整合 (horizontal integration)	三年級: 基礎醫學整合(12 blocks) 四年級:臨床醫學整合(11 blocks)	醫三 醫四	Lecture (H) Lab (H) PBL (H) 醫三 48.9% 35.8% 15.3% 醫四 71.2% 10.5% 18.2% 9/11 個blocks每週有兩次PBL (7-8人/組)
輔仁大學醫學系				
McMaster	PBL + ? (藥理、寄生蟲、胚胎學、大體)	7,6 blocks	醫三 醫四	PBL, Lecture, Lab

Outline

- Why change?
- What change in North America ?
- What change in Taiwan ?
- Clinical Presentation Curriculum in Taiwan
- Reflection

The first attempt of CPC in Taiwan

- Background:
  - The Paradigm shift :"outcome-based "
  - The accumulation of medical cognition research
  - Taiwanese context: short of faculty manpower, the weakness of lacking problem-solving abilities
  - A newborn medical school--- Mackay Memorial Medical School preparation project in 2003
- A curriculum design workshop in 2004

第三年 一般醫學整合課程

9 月	10 月	11 月	12 月	1 月	2 月	3 月	4 月	5 月	6 月
人體的結構 (Morphology)			人體的功能 (Function)		Human and disease (1.5)		Principle of medicine (2)		MSK (1.5)
Dr. in the society					Medical skill program				
Language and culture (Manderine)			Practice of PBL		Interperonal skill program				
SSM I									

第四年 一般醫學整合課程

9 月	10 月	11 月	12 月	1 月	2 月	3 月	4 月	5 月	6 月
CV (3)			Respiratory (1.5)	Immune/ Infection (1.5)		Renal (2)		Endocrine (2)	
Medical skill program									
SSM II									
Research methods and evidence-based medicine									

第五年 一般醫學整合課程

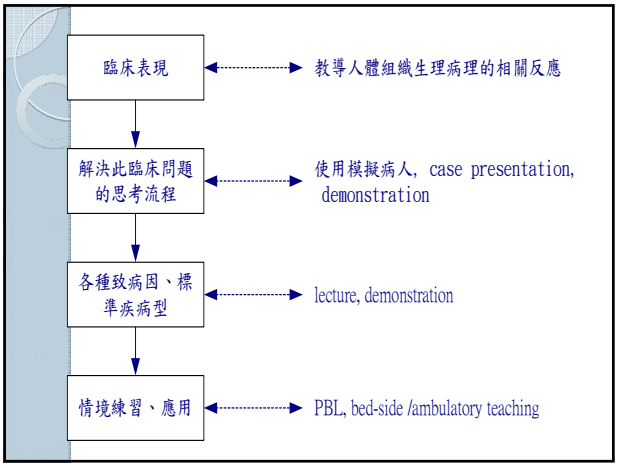
9 月	10 月	11 月	12 月	1 月	2 月	3 月	4 月	5 月	6 月
Blood /Oncology (1.5)		Reproductive (2.5)		GI (2)		Mind and Neuro (2.5)		Human development (1.5)	
Medical skill program									
SSM II									

第六年 Clinical rotation：臨床實習 + SSM III 含 2 個月 elective program

Sample of Mackay Project

4. **Medical Skill Program**

4.1. Culture, Health, Wellness
4.2. Communication
4.3. Bioethics
4.4. End of Life (臨終醫學)
4.5. Medical skills (Problem-solving skill:從history taking, collecting data, diagnosis到treatment與追蹤)
4.6. Physical Examination
4.7. Well physicians (做個身心健全的醫師)

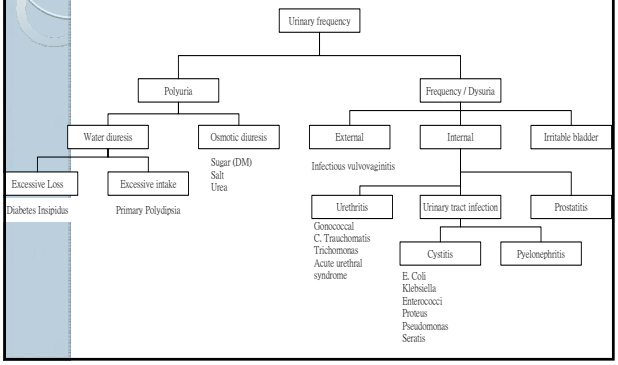


RENAL - ELECTROLYTES SYSTEM

Anatomy/ Embryology
Pharmacology
Patho-Physiology/ Population health/ Genetics

1) Urinary Retention, Obstruction, Abnormal image findings
2) Dysuria, Frequency
3) Scrotal Mass (Testicular Pain)
4) Haematuria
   4.1) Hematuria, Extrarenal
   4.2) Hematuria, Intrarenal;Extraglomerular
   4.3) Hematuria, Glomerular
5) Proteinuria
6) Generalized Edema
7) Renal Failure, Acute/ Chronic
8) Polyuria
9) Hypertension
   9.1) Pregnancy Associated Hypertension
   9.2) Malignant Hypertension
   9.3) Hypertension in the Elderly
   9.4) Hypertension in the Pediatric Age Group
10) Abnormal Serum Sodium Concentration
   10.1) Hyponatremia
   10.2) Hypernatremia

Sample scheme



CP Curriculum Implementation Workshop

Henry Mandin MD, FRCPC, DSc (Hon)
International Medical Education Conference
Taipei, June 6 & 7, 2009

1. Group all 120 CP's into courses
2. Name courses (include skills, other)
3. Sequence all courses
4. Develop 'schemes' for 120 CP's
5. Develop basic science PWS & obj.
6. Develop clinical PWS & objectives
7. Develop worked case examples

Objectives for Workshop

SCHEMES

A scheme is a mental categorization of knowledge that includes an organized way of understanding & responding to a complex situation.

A scheme is useful for both learning (storage of information in LTM) and a search strategy for its retrieval (inductive reasoning).

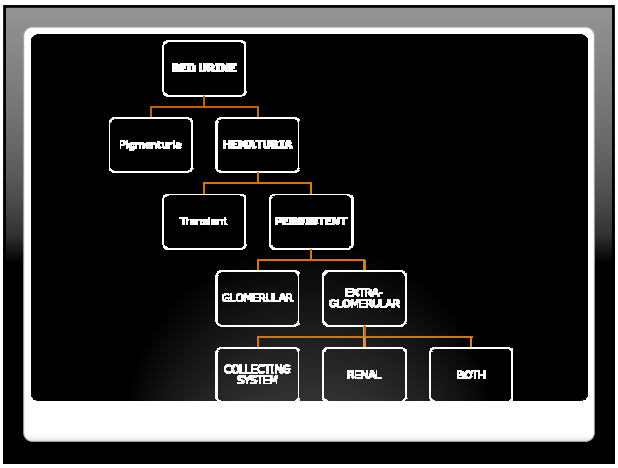
Definition of "Scheme"

- Promote learning
  - Comprehend information
  - "Chunk" information: ⇓ memory load
  - Organize information
- Advance diagnostic problem solving
  - Alternatives juxtaposed in a logic tree
  - "Tests" exclude alternatives, adopt rest
  - Recycle

Function of Schemes

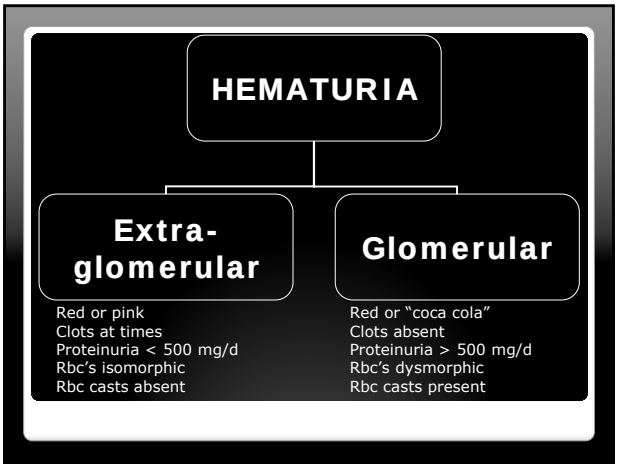
- Clinical experts
- Concept sorting
  - Clinical sub – experts
  - Basic science faculty
- Compare
- Consensus

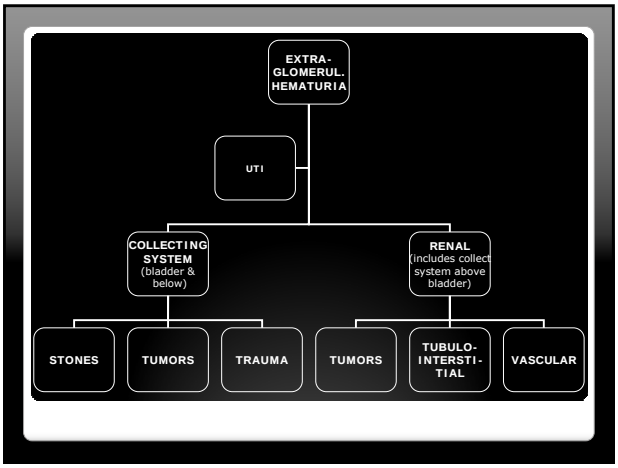
How to Develop a 'Scheme'

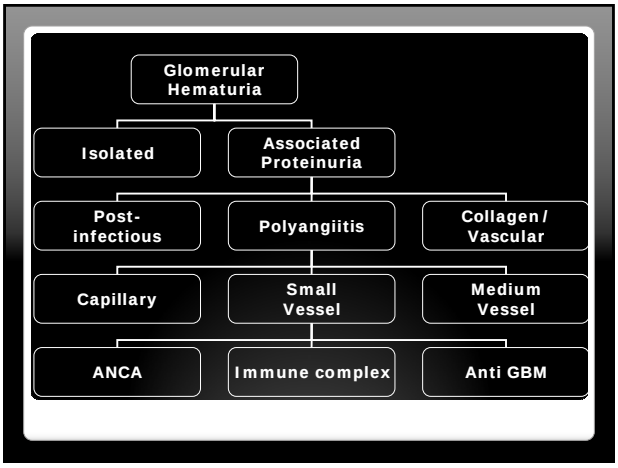


- **Simple and easy to remember**
  - **2 - 3 categories per level, never > 4**
  - **3 - 4 levels for each scheme**
  - **if > 4 levels required, create 2 schemes**
- **Optimize step numbers**
  - **Too few: lower performance**
  - **Too many: lower performance / time; ⇓ transfer**

Ideal Schemes







- **Diff. diag. of red urine**
  - AIN
  - A-V malformation
  - Bladder carcinoma
  - CIN
  - Cystitis
  - Hemoglobinuria
  - Medullary sponge kidney
  - Myoglobinuria
  - Nephrocalcinosis
  - Nephrolithiasis
  - Papillary necrosis
  - PCKD 1
  - PCKD 2
  - Prostatitis
  - Pyelonephritis
  - Reflux
  - Renal cell carcinoma
  - Renal infarction
  - Sickle cell disease
  - Transitional cell carcinoma
  - Trauma

Organization, "Chunking"

- Renal parenchyma
  - Tumors
    - Renal cell carcinoma
    - Transitional cell
  - Tubulo-interstitial
    - AIN, CIN,
    - Cystic (PCKD 1 & 2, MSK)
    - Nephrocalcinosis
    - Pyelonephritis
    - Reflux
  - Vascular
    - AV malformation
    - Papillary necrosis
    - Renal infarction
    - Sickle cell disease
- Renal collecting system
  - Tumors
    - Bladder
    - Ureteral transitional cell
  - Trauma
  - Infection
    - Cystitis
    - Prostatitis
  - Stones
- Pigments
  - Hemoglobinuria
  - Myoglobinuria

Organization, "Chunking"

Acetazolamide
Acute renal failure
Adrenal insufficiency
ASA ingestion
Chronic renal failure
Diarrhea
Ethylene glycol ingestion
Fanconi's syndrome
Ileal conduit

Ketoacidosis
Lactic acidosis
Methanol ingestion
RTA type 1
RTA type 2
RTA type 3
RTA type 4

1. Drag clinical scenario to 1 of the group boxes below.
2. Enter label for each group above the list.
3. Each group may be subdivided repeatedly upon completion.

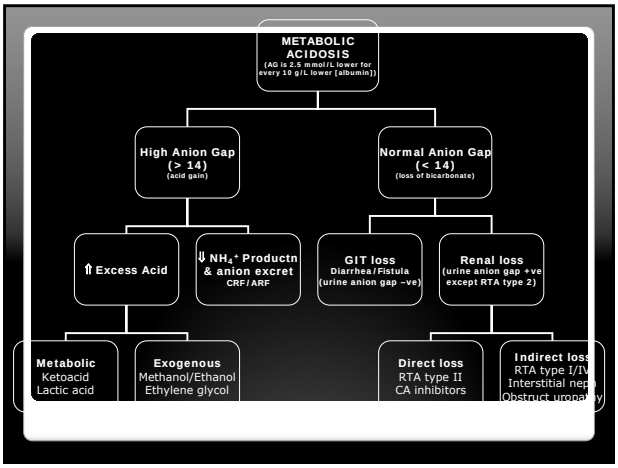
Anion gap | Non-anion Gap

Add new group

Metabolic Acidosis

Divide the following clinical scenarios into groups & name those groups.

Complete

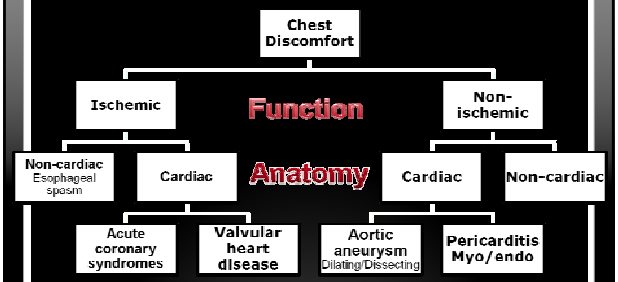


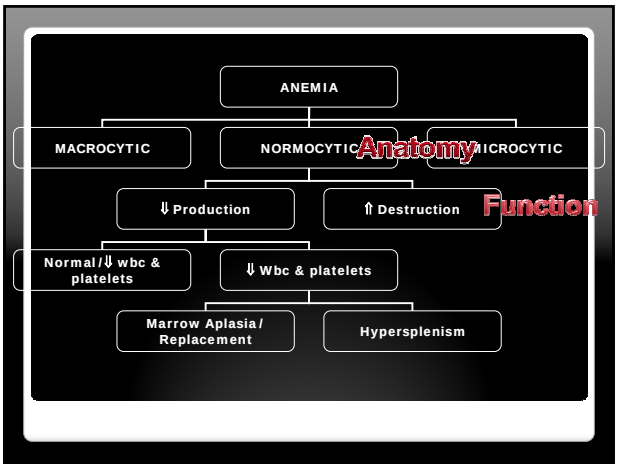
- Promote learning
  - Comprehend information
  - "Chunk" information: ⇓ memory load
  - Organize information: hierarchies
- Advance diagnostic problem solving
  - Alternatives juxtaposed in a logic tree
  - "Tests" exclude alternatives, adopt rest
  - Recycle

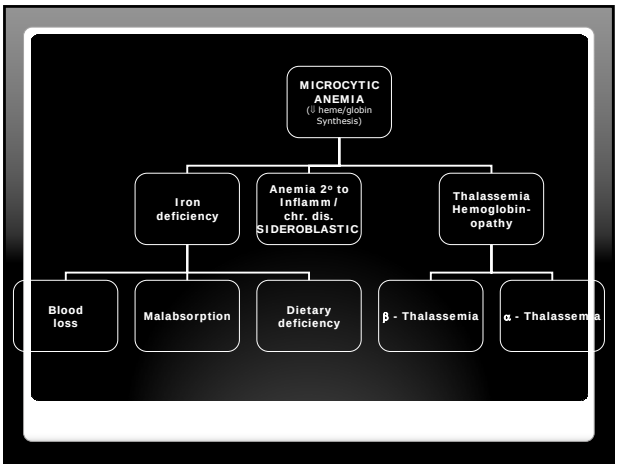
Function of Schemes

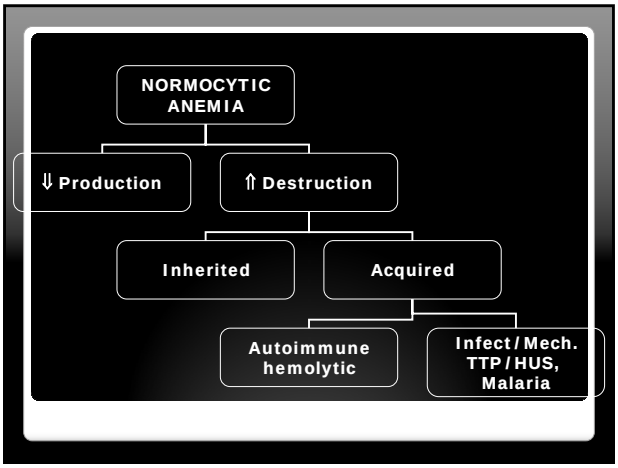
- Promote learning
  - Comprehend: basic science concepts
  - Information: organized, "chunked", into hierarchical conceptual categories
  - ⇓ memory load: Simple/easy to remember
- Aid problem solving
  - Mirror encoding specificity
- Aid transfer with practice

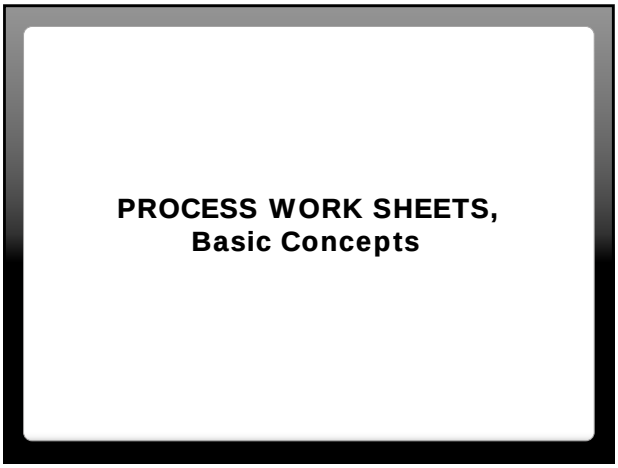
Ideal Schemes

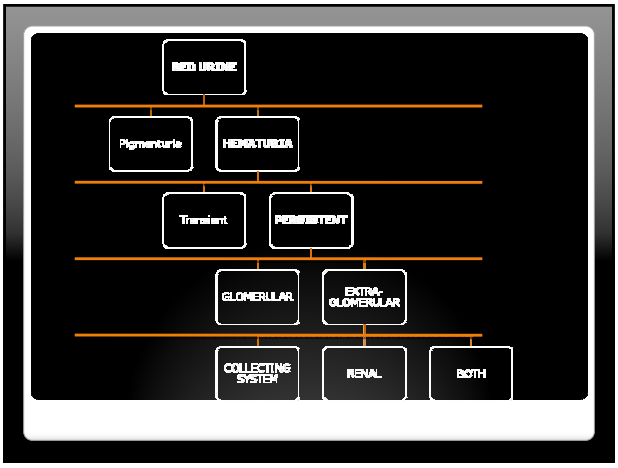


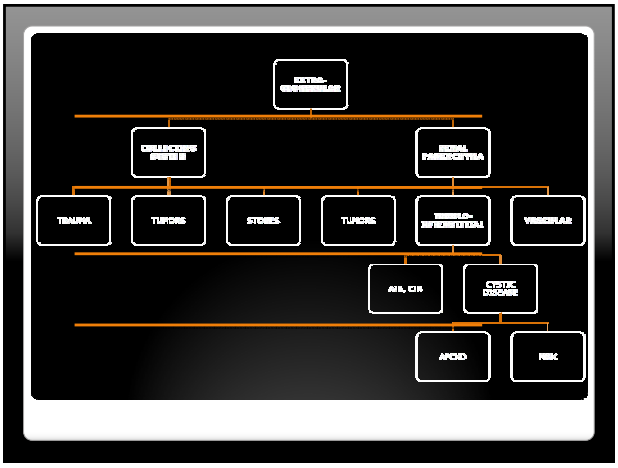

ANEMIA
MACROCYTIC
NORMOCYTIC
MICROCYTIC
Anatomy
Function
⇓ Production
⇑ Destruction
Normal / ⇓ wbc & platelets
⇓ Wbc & platelets
Marrow Aplasia / Replacement
Hypersplenism


MICROCYTIC ANEMIA
(⇓ heme/globin Synthesis)
Iron deficiency
Anemia 2° to Inflamm / chr. dis.
SIDEROBLASTIC
Thalassemia Hemoglobin-opathy
Blood loss
Malabsorption
Dietary deficiency
β - Thalassemia
α - Thalassemia


NORMOCYTIC ANEMIA
⇓ Production
⇑ Destruction
Inherited
Acquired
Autoimmune hemolytic
Infect / Mech. TTP / HUS, Malaria


PROCESS WORK SHEETS,
Basic Concepts


RED URINE
Pigmenturia
HEMATURIA
Transient
PERSISTENT
GLOMERULAR
EXTRA-GLOMERULAR
COLLECTING SYSTEM
RENAL
BOTH


TRAUMA
TUMORS
STONES
TUNORS
VASCULAR
CYSTIC DISEASE

Sub-goals (Phases)	Heuristics	Obj./Learning tasks
Pigmenturia/Hematuria	A problem solving method	Scheduled/nonsched.
Hematuria: Transient/Persistent	for which no formula exists;	Compulsory/noncomp.
Hematuria: Glom./Extraglomerular	it is based on informal methods	
Extra-Renal/ Collecting/Both	or experience; or	
Renal: Mass/TI/Vascular	employing trial & error	
Collecting: Stones/Mass/Trauma		
Both: Trauma/Stones		
Glom: Isolated/Proteinuria		
Glom: Primary/Secondary		

SAP: Basic Concepts PWS

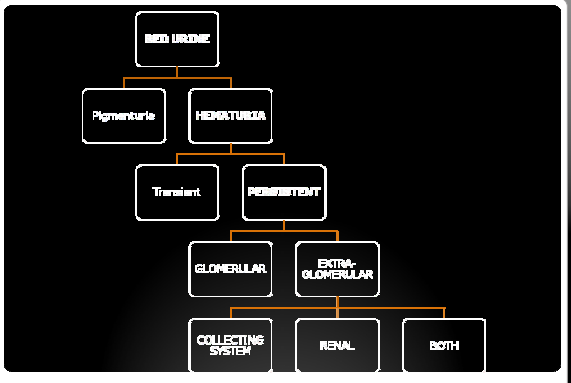
Sub-goals (Phases)	Heuristics	Obj./Learning tasks
Pigmenturia/Hematuria	Endog/exog pigments, biochem. myo/hemoglobin, urinalysis	Scheduled/nonsched.
Hematuria: Transient/Persistent	Infection/inflamm., exercise effect, microbiol.	Compulsory/noncomp.
Hematuria: Glom./Extraglomerular	Glomerular/Tub Histology/EM/Phys.	
Extra-Renal/ Collecting/Both	Macroscopic Anatomy/Physiology	
Renal: Mass/TI/Vascular	Pathology: tumors/cysts/TI/Vasc	
Collecting: Stones/Mass/Trauma	Stones: risks, physiology/biochem.	
Both: Trauma/Stones	Imaging: stones/trauma/masses (opaque/non/soft/hard)	
Glom: Isolated/Proteinuria	Immun/Phys, Glom. barrier/tubul	
Glom: Primary/Secondary	Pathology: proliferative/non	

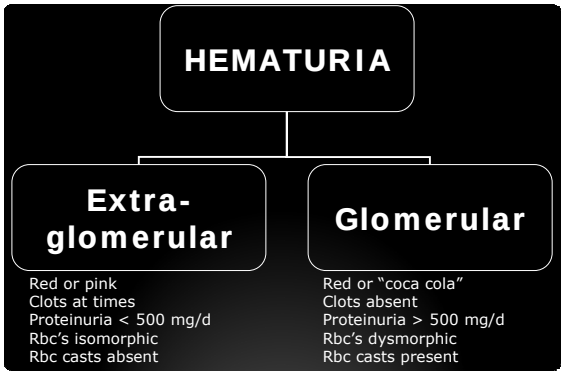
SAP: Basic Concepts PWS

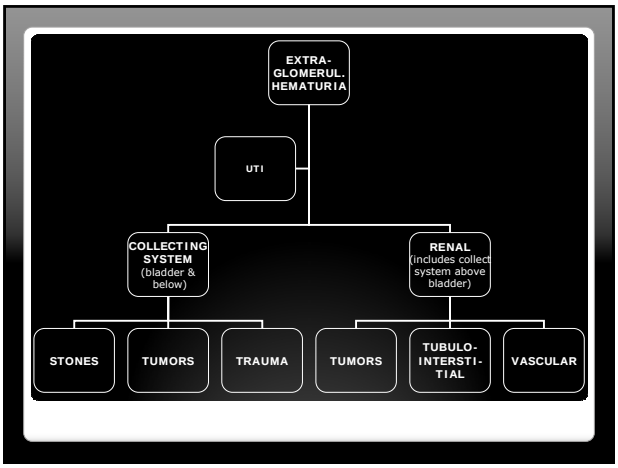
- Write basic science objectives
- Select learning experiences
- Develop clinical PWS
- Write clinical objectives

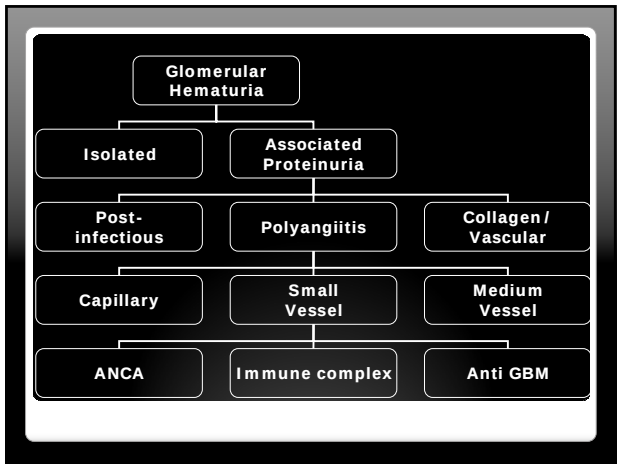
SAP: Basic Concepts PWS

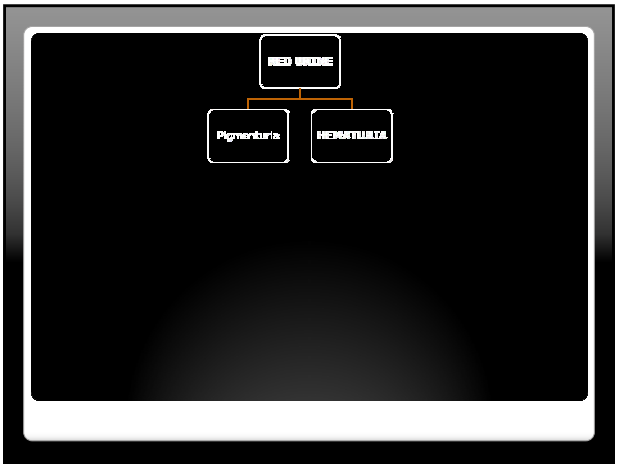
PWS, Clinical

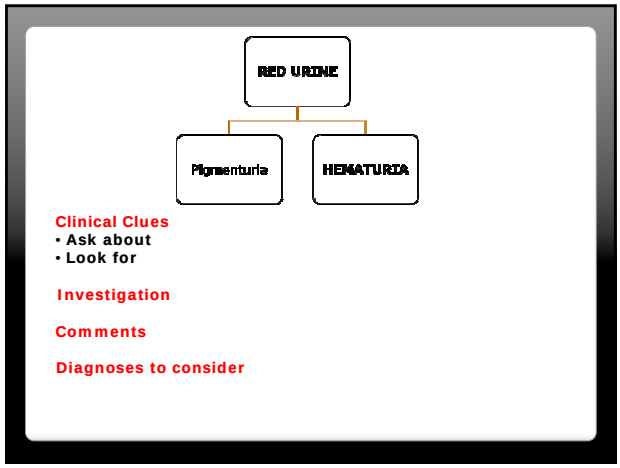





EXTRA-GLOMERUL. HEMATURIA
UTI
COLLECTING SYSTEM (bladder & below)
RENAL (includes collect system above bladder)
STONES
TUMORS
TRAUMA
TUMORS
TUBULO-INTERSTI-TIAL
VASCULAR


Glomerular Hematuria
Isolated
Associated Proteinuria
Post-infectious
Polyangiitis
Collagen / Vascular
Capillary
Small Vessel
Medium Vessel
ANCA
Immune complex
Anti GBM


RED URINE
Pigmenturia
HEMATURIA


RED URINE
Pigmenturia
HEMATURIA
Clinical Clues
• Ask about
• Look for
Investigation
Comments
Diagnoses to consider

LIST OF CLINICAL PRESENTATIONS

1. ABDOMINAL DISTENSION
   - 1.1. ASCITES
   - 1.2. ILEUS (Bowel Obstruction)
2. ABDOMINAL MASS
   - 2.2. ADRENAL MASS
   - 2.3. HEPATOMEGALY
   - 2.4. SPLENOMEGALY
   - 2.5. HERNIA
   - 2.6. RENAL MASS
3. ABDOMINAL PAIN (see also #008 Blood in Urine - Hematuria)
   - 3.2. ACUTE ABDOMINAL PAIN SYNDROMES
   - 3.3. CHRONIC ABDOMINAL PAIN SYNDROMES
   - 3.4. ANORECTAL PAIN
   - 3.5. CHILDREN
   - 3.6. FLANK PAIN
4. ALLERGIC REACTIONS/ATOPY – see also #009Ba Anaphylaxis
5. ATTENTION DEFICIT/HYPERACTIVITY IN CHILDREN
   - 5.2. ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD)
   - 5.3. LEARNING DISORDERS
   - 5.4. BEHAVIOR DISORDERS
6. BLOOD FROM GASTROINTESTINAL TRACT
   - 6.2. UPPER/HEMATEMESIS
   - 6.3. LOWER/HEMATOCHEZIA/MELENA
7. BLOOD IN SPUTUM (HEMOPTYSIS/LUNG CANCER PREVENTION)
8. BLOOD IN URINE (HEMATURIA)
9. BLOOD PRESSURE ABNORMAL
   - 9.2. HYPERTENSION
   - 9.3. HYPERTENSION IN CHILDHOOD
   - 9.4. HYPERTENSION IN THE ELDERLY
   - 9.5. MALIGNANT HYPERTENSION
   - 9.6. PREGNANCY ASSOCIATED HYPERTENSION
   - 9.7. HYPOTENSION/SHOCK
     - 9.7.1. ANAPHYLAXIS
10. BREAST DISORDERS
    - 10.2. FEMALE (BREAST LUMP/PAIN/DISCHARGE/PREVENTION)
    - 10.3. GALACTORRHEA
    - 10.4. MALE (GYNECOMASTIA)
11. BURNS
12. CALCIUM/PHOSPHATE/MAGNESIUM ABNORMAL, SERUM
    - 12.2. HYPERCALCEMIA
    - 12.3. HYPOCALCEMIA
    - 12.4. HYPOPHOSPHATEMIA/FANCONI SYNDROME
    - 12.5. HYPERPHOSPHATEMIA
    - 12.6. HYPOMAGNESEMIA

13. **CARDIAC ARREST/RESPIRATORY ARREST**
14. **CHEST DISCOMFORT/PAIN/ANGINA PECTORIS**
15. **COAGULATION ABNORMALITIES**
    - 15.1. **BLEEDING TENDENCY/BRUISING**
    - 15.2. **HYPERCOAGULABLE STATE/CLOTTING**
16. **CONSTIPATION**
    - 16.1. **ADULT CONSTIPATION**
    - 16.2. **PEDIATRIC CONSTIPATION/ENCOPRESIS**
17. **CONTRACEPTION**
18. **COUGH**
19. **CYANOSIS/HYPOXIA**
    - 19.1. **CYANOSIS/HYPOXIA/APNEA IN CHILDREN**
20. **DEFORMITY/LIMP**
21. **DEVELOPMENT DISORDER/DELAY – see also #005B**
22. **DIARRHEA**
    - 22.1. **ACUTE DIARRHEA**
    - 22.2. **CHRONIC DIARRHEA**
    - 22.3. **PEDIATRIC DIARRHEA**
23. **DIPLOPIA (double vision)**
24. **DIZZINESS/VERTIGO**
25. **DYING PATIENT/BEREAVEMENT**
26. **DYSPHAGIA/DIFFICULTY SWALLOWING**
27. **DYSPNEA, DYSPNEA AND/OR ABNORMAL X-RAY**
    - 27.1. **DYSPNEA, ACUTE**
    - 27.2. **DYSPNEA, CHRONIC**
    - 27.3. **DYSPNEA/RESPIRATORY DISTRESS, PEDIATRIC**
28. **EAR PAIN**
29. **EDEMA/ANASARCA/ASCITES**
    - 29.1. **GENERALIZED**
    - *29.2.* **UNILATERAL/LOCALIZED**
30. **EYE REDNESS**
31. **FAILURE TO THRIVE**
    - 31.1. **ELDERLY**
    - 31.2. **INFANT/CHILD**
32. **FALLS**
33. **FATIGUE**
34. **FRACTURES/DISLOCATIONS/JOINT INJURIES**
    - 34.1. **FRACTURES, NON-TRAUMATIC**
    - 34.2. **FRACTURES, TRAUMATIC**
35. **GAIT DISTURBANCES/IMBALANCE/ATAXIA**
36. **GENETIC CONCERNS**
    - 36.1. **AMBIGUOUS GENITALIA/SEXUAL DETERMINATION/DIFFERENTIATION**
    - 36.2. **DYSMORPHIC FEATURES**
    - 36.3. **PRE-CONCEPTION EVALUATION AND COUNSELING**

37. GLUCOSE, SERUM ABNORMAL/DIABETES MELLITUS/POLYDIPSIA
    37.1. HYPERGLYCEMIA
    37.2. HYPOGLYCEMIA
38. HAIR AND NAIL DISORDERS (ALOPECIA)
39. HEADACHE
    39.1. INCIDENTAL SELLAR MASS
40. HEARING LOSS/DEAFNESS
41. HEMOGLOBIN ABNORMAL
    41.1. ANEMIA/PALLOR
    41.2. POLYCYTHEMIA
42. HIRSUTISM AND VIRILIZATION
43. HOARSENESS/SPEECH AND LANGUAGE ABNORMALITIES
44. HYDROGEN ION CONCENTRATION, ABNORMAL SERUM
    44.1. METABOLIC ACIDOSIS
    44.2. METABOLIC ALKALOSIS
    44.3. RESPIRATORY ACIDOSIS/ALKALOSIS
45. INFERTILITY
46. INCONTINENCE/URINE/STOOL
    46.1. URINE
    46.2. STOOL
    46.3. PEDIATRIC
47. IMPOTENCE/SEXUAL DYSFUNCTION
48. JAUNDICE
    48.1. NEONATAL JAUNDICE
49. JOINT PAIN
    49.1. MONO-ARTICULAR (ACUTE, CHRONIC)
    49.2. POLY-ARTICULAR (ACUTE, CHRONIC)
    49.3. PERIARTICULAR
50. LIPIDS, ABNORMAL SERUM
51. LIVER FUNCTION TESTS ABNORMAL, SERUM
52. LUMP/MASS, MUSCULO-SKELETAL
53. LYMPHADENOPATHY
    53.1. MEDIASTINAL MASS/ HILAR ADENOPATHY
54. MENSTRUAL CYCLE, ABNORMAL
    54.1. AMENORRHEA
    54.2. DYSMENORRHEA/PRE-MENSTRUAL SYNDROME
    54.3. OLIGOMENORRHEA/ABNORMAL GENITAL TRACT BLEEDING
55. MENOPAUSE
56. MENTAL STATUS, ALTERED
    56.1. COMA/IMPAIRED CONSCIOUSNESS
    56.2. CONFUSION/DELIRIUM
    56.3. DEMENTIA/MEMORY DISTURBANCES
57. MOOD DISORDERS
    57.1. BIPOLAR DISORDERS
    57.2. DEPRESSED MOOD/DEPRESSION
58. MOUTH/ORAL DISORDERS

59. MOVEMENT DISORDERS/TIC DISORDERS
60. MURMUR/EXTRA HEART SOUNDS
    - 60.1. DIASTOLIC MURMUR
    - 60.2. HEART SOUNDS, PATHOLOGICAL
    - 60.3. SYSTOLIC MURMUR
61. NECK MASS/GOITER
    - 61.1. HYPERTHYROIDISM
    - 61.2. HYPOTHYROIDISM
62. NEWBORN, DEPRESSED
63. NON-REASSURING FETAL STATUS (FETAL DISTRESS)
64. NUMBNESS/TINGLING/ALTERED SENSATION
65. PAIN
    - 65.1. NOCICEPTIVE
        - 65.1.1. VISCERAL
        - 65.1.2. SOMATIC
            - 65.1.2.1. GENERALIZED PAIN DISORDERS
            - 65.1.2.2. LOCAL PAIN, SHOULDER/HAND/WRIST
            - 65.1.2.3. LOCAL PAIN, HIP/KNEE/FOOT/ANKLE
            - 65.1.2.4. LOCAL PAIN, SPINAL/OSTEOPOROSIS
            - 65.1.2.5. LOCAL PAIN, SPINE/LOW BACK PAIN
            - 65.1.2.6. LOCAL PAIN, SPINE/NECK/THORACIC
            - 65.1.2.7. LOCAL PAIN, MYALGIA/SPASM/CRAMPS
    - 65.2. NEUROPATHIC
        - 65.2.1. SYMPATHETIC - COMPLEX REGIONAL PAIN SYND.
        - 65.2.2. CENTRAL/PERIPHERAL
66. PALPITATIONS (ABNORMAL ECG - Arrhythmia)
67. PANIC AND ANXIETY
68. PEDIATRIC EMERGENCIES: INFANT/CHILD, ACUTELY ILL
    - 68.1. CRYING/FUSSING CHILD
    - 68.2. FLOPPY INFANT/HYPOTONIA
69. PELVIC MASS
70. PELVIC PAIN
    - 70.1. PELVIC PAIN, ACUTE
    - 70.2. PELVIC PAIN, CHRONIC
71. PERIODIC HEALTH EXAMINATION/GROWTH AND DEVELOPMENT
    - 71.1. NEWBORN ASSESSMENT/NUTRITION
    - 71.2. INFANT & CHILD IMMUNIZATION
    - 71.3. PRE-OPERATIVE MEDICAL EVALUATION
    - 71.4. WORK-RELATED HEALTH ISSUES
    - 71.5. PAP SMEAR/SCREENING/PREVENTION
72. PERSONALITY DISORDERS
73. PLEURAL ABNORMALITIES
74. POISONING

75. POPULATION HEALTH/DETERMINANTS
    - 75.1. HEALTH STATUS and INTERVENTIONS
    - 75.2. OUTBREAK MANAGEMENT
    - 75.3. HEALTH OF SPECIAL POPULATIONS
    - 75.4. ENVIRONMENT
76. POTASSIUM CONCENTRATION, ABNORMAL SERUM
    - 76.1. HYPERKALEMIA
    - 76.2. HYPOKALEMIA
77. PREGNANCY
    - 77.1. ANTEPARTUM CARE
    - 77.2. INTRAPARTUM/POSTPARTUM CARE
    - 77.3. OBSTETRICAL EMERGENCIES
78. PREGNANCY LOSS
79. PREMATURITY
80. PROLAPSE/PELVIC RELAXATION
81. PROPTOSIS/PTOSIS
82. PROTEINURIA
83. PRURITUS
84. PSYCHOTIC PATIENT/DISORDERED THOUGHT
85. PULSE ABNORMALITIES/DIMINISHED/ABSENT/BRUITS
86. PUPIL ABNORMALITIES
87. RENAL FAILURE
    - 87.1. ACUTE (Anuria/Oliguria/ARF)
    - 87.2. CHRONIC
88. SCROTAL MASS/SCROTAL PAIN
89. SEIZURES (Epilepsy)
90. SEXUAL MATURATION
    - 90.1. ABNORMAL
    - 90.2. NORMAL
91. SEXUALLY CONCERNED PATIENT/GENDER IDENTITY DISORDER
92. SKIN ULCERS/SKIN TUMORS (BENIGN/MALIGNANT)/PREVENTION
93. SKIN RASH, MACULES
94. SKIN RASH, PAPULES/BLISTERS (BOILS)/DERMATITIS±FEVER
    - 94.1. CHILDHOOD COMMUNICABLE DISEASES
    - 94.2. URTICARIA/ANGIOEDEMA
95. SLEEP/CIRCADIAN RHYTHM DIS/SLEEP-APNEA SYND/INSOMNIA
96. SMELL AND TASTE DYSFUNCTION
97. SODIUM CONCENTRATION, ABNORMAL SERUM
    - 97.1. HYPERNATREMIA
    - 97.2. HYPONATREMIA
98. SORE THROAT/INFECTIONS OF UPPER RESPIRATORY TRACT
    - 98.1. COMMON COLD
    - 98.2. SINUSITIS
99. STATURE, ABNORMAL
    - 99.1. SHORT STATURE
    - 99.2. TALL STATURE

100. STROKE±APHASIA/PREVENTION
041B TRANSIENT ISCHEMIC ATTACKS
041C APHASIAS
101. STRABISMUS &/OR AMBLYOPIA
102. SUBSTANCE ABUSE/DRUG ADDICTION/WITHDRAWAL
102.1. PERFORMANCE DRUGS
103. SUDDEN INFANT DEATH SYNDROME (SIDS)
104. SUICIDAL BEHAVIOR/PREVENTION
104.1. SUICIDAL BEHAVIOR (ADOLESCENT)
104.2. SUICIDAL BEHAVIOR (ADULT)
105. SUPRA-SELLAR MASS
106. SYNCOPE/FAINTNESS
107. TEMPERATURE, ABNORMAL/FEVER AND/OR CHILLS
107.1. HYPERTHERMIA
107.2. FEVER OF UNKNOWN ORIGIN
107.3. FEVER IN A CHILD/FEVER IN A CHILD LESS THAN 3 WEEKS
107.4. RECURRENT INFECTIONS (IMMUNOCOMPROMISED HOST)
107.5. HYPOTHERMIA
108. TINNITUS
109. TRAUMA, MULTIPLE/ACCIDENTS/PREVENTION
109.1. ABDOMINAL INJURIES
109.2. BITES, ANIMAL/INSECTS
109.3. BONE/JOINT INJURY
109.4. CHEST INJURIES
109.5. COLD INJURIES
109.6. DROWNING
109.7. EYE INJURIES
109.8. FACE INJURIES
109.9. HAND INJURIES
109.10. HEAD TRAUMA/BRAIN DEATH/TRANSPLANT DONATION
109.11. NERVE INJURIES
109.12. SKIN WOUNDS/REGIONAL ANAESTHESIA
109.13. SPINAL TRAUMA
109.14. TENDON/MUSCLE TRAUMA
109.15. URINARY TRACT INJURIES
109.16. VASCULAR INJURIES
110. URINARY FREQUENCY
110.1. DYSURIA &/OR PYURIA/URETHRAL DISCHARGE/STD's
110.2. POLYURIA/POLYDIPSIA
111. URINARY OBSTRUCTION/HESITANCY/PROSTATE CA/SCREENING
112. VAGINAL BLEEDING, EXCESSIVE/IRREGULAR/ABNORMAL
113. VAGINAL DISCHARGE/URINARY SYMPTOMS (Cervicitis, Dysmen.)
113.1. SEXUALLY TRANSMITTED DISEASES (STDs)
113.2. VULVULAR LESIONS

114. VIOLENCE, FAMILY
- **114.1. CHILD ABUSE/PHYSICAL/EMOTIONAL/SEXUAL/SELF-INFLICT**
- **114.2. ELDERLY ABUSE**
- **114.3. RAPE/VIOLENCE AGAINST WOMEN**
- **114.4. ADULT ABUSE/SPOUSE ABUSE**

115. VISUAL DISTURBANCE/LOSS
- **115.1. ACUTE VISUAL LOSS/TRANSIENT**
- **115.2. CHRONIC VISUAL LOSS**

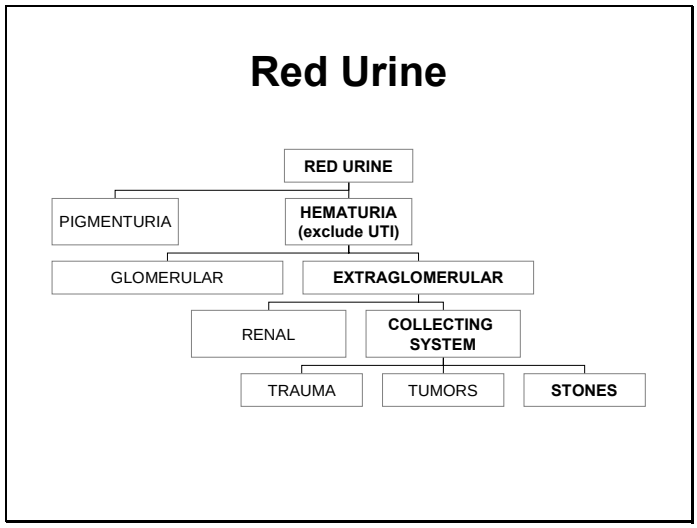
116. VOMITING/NAUSEA
- **116.1. VOMITING/NAUSEA, PEDIATRIC**

117. WEAKNESS/PARALYSIS/PARESIS/LOSS OF MOTION
- **117.1. PARAPARESIS**
- **117.2. MONOPARESIS**
- **117.3. HEMIPARESIS**
- **117.4. QUADRIPARESIS**
- **117.5. DISTAL/PROXIMAL/RESTRICTED**

118. WEIGHT, ABNORMAL
- **118.1. WEIGHT GAIN/OBESITY**
- **118.2. WEIGHT LOSS/EATING DISORDERS/ANOREXIA**
- **118.3. LOW BIRTH WT. (INTRAUTERINE GROWTH RETARDATION)**

119. WHEEZING/RESPIRATORY DIFFICULTY (Asthma)
- **119.1. LOWER RESPIRATORY TRACT DISORDERS**
- **119.2. UPPER RESPIRATORY TRACT DISORDERS**

120. WHITE BLOOD CELLS, ABNORMALITIES OF



HEMATURIA: denotes blood in the urine which may be visible or microscopic. Visible or gross hematuria is the appearance of red or brown urine, a change that can be produced by as little as 1 ml of blood per liter of urine.

Microscopic hematuria: blood (either red blood cells or hemoglobin) in the urine discovered on urinalysis (> 2 rbc/hpf in centrifuged urine) or dipstick done for other purposes.

Clinical Clues

- **Ask about**
  - **Transient or persistent, since transient hematuria, especially in younger patients may be of no consequence. If older (> 50 years), investigation is required.**
  - **Whether red urine is grossly visible or microscopic (found on urinalysis or dipstick done for other purposes)?**
  - **Menstruation, post-partum state, suggestive of contamination.**

Investigations

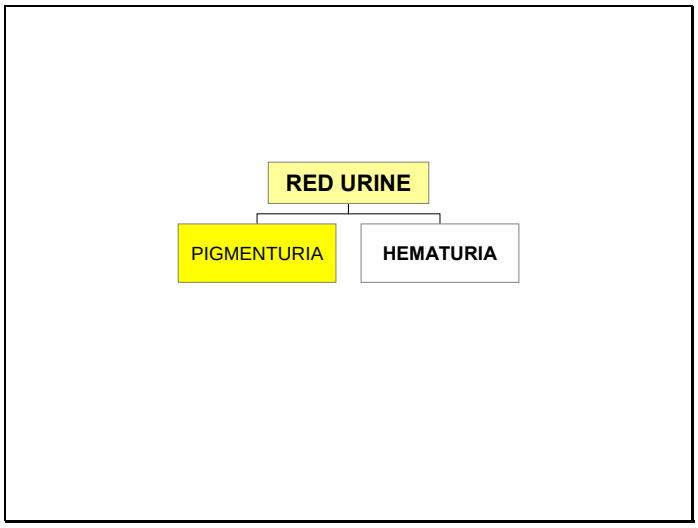
- **Urine sediment examination under the microscope is the gold standard for detection of hematuria. E.g. semen found in the urine after ejaculation may cause a positive heme reaction on dipstick.**

Comments

- **Hematuria approach: first ensure that the problem is true hematuria rather than pigmenturia.**
- **False positive results may occur when urine pH > 9 or contamination with oxidizing agents used to clean perineum. Therefore a positive dipstick test must always be confirmed by microscopic urinalysis. A negative dipstick generally excludes abnormal hematuria.**
- **Hematuria itself is not dangerous hemodynamically (the underlying cause may be dangerous: e.g. tumors). If clots are present (indicative of brisk bleeding), ureters may become obstructed.**

Diagnoses to consider

- **Pigmenturia**
- **Hematuria**



PIGMENTURIA OR HEMATURIA

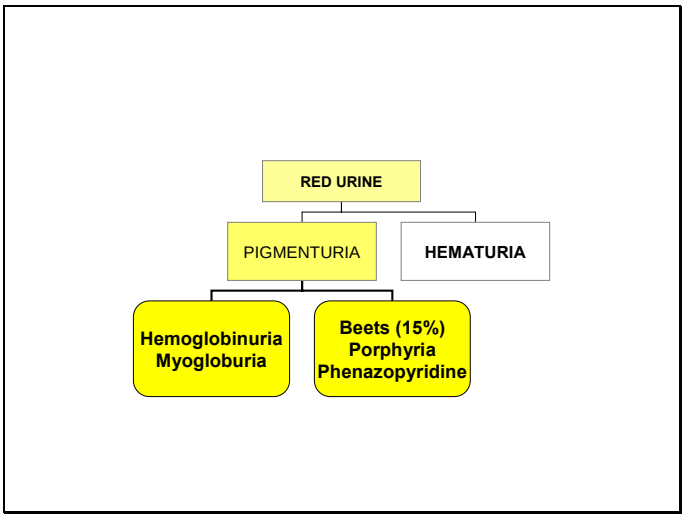
Clinical Clues

Investigation

- **Urine sample is centrifuged and both the supernatant and the urine sediment are observed for color.**
- **If the supernatant is clear and the red color is in the sediment, then hematuria is present and pigmenturia is excluded.**
- **If the red color is in the supernatant and the sediment is not colored, then pigmenturia is present and hematuria is excluded.**
- **Absence of rbc's on microscopic examination of the urine sediment confirms that hematuria can be excluded.**

Diagnoses to consider

- **Pigmenturia**
  - **Endogenous pigments (hemoglobin or myoglobin)**
  - **Exogenous pigments (beets, porphyria, phenazopyridine)**
- **Hematuria**



PIGMENTURIA: ENDOGENOUS PIGMENTS OR EXOGENOUS PIGMENTS

Clinical clues

- **Ask about**
  - **Pallor, lack of energy, palpitations, suggestive of anemia**
  - **Muscle pain or weakness, suggestive of rhabdomyolysis**
  - **Ingestion of beets, suggestive of excretion of betalaine/betanin, especially if ingested concurrently with foods high in oxalates (spinach, rhubarb, oysters).**

Investigation

- **The supernatant is tested for heme with a urine dipstick.**
- **If the supernatant is heme positive, then hemoglobin or myoglobin is present in the supernatant and rbc's are absent on microscopic examination of the centrifuged urine (for an approach to these problems see "Anemia" and "Rhabdomyolysis")**
- **If the supernatant is heme negative, then the possible causes for the presence of color are relatively few: porphyria, phenazopyridine intake, Betalaine contained in beets (only about 15% of people on beets produce red urine), vegetable dyes, urates, Serratia marcescens infection, and Phenolphthalein.**

- **Serum CK: if elevated, consistent with rhabdomyolysis**
- **Peripheral blood smear for schistocytes, reticulocyte count, serum LDH, haptoglobin, abnormal in hemolytic anemia.**

Evidence

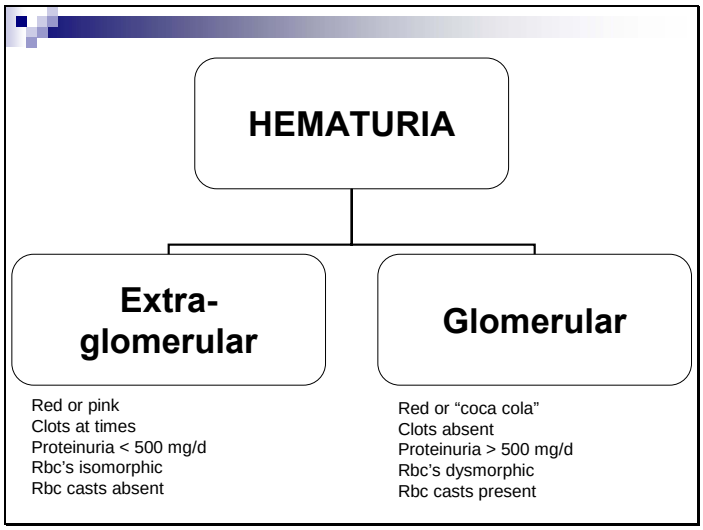
- **Woolhandler, S, Pels, RJ, Bor, DH, et al. Dipstick urinalysis screening of asymptomatic adults for urinary tract disorders. I. Hematuria and proteinuria. JAMA 1989; 262:1214.**

Comment

- **Increased intestinal absorption of betalaine from the ileum is the abnormality in subjects affected by 'beeturia'.**
- **Betalaine is protected by reducing agents such as oxalate and decolorized by ferric ions, HCl, and colonic bacteria. As a consequence, beeturia is more likely to occur in**
  - **Iron deficiency anemia (if corrected, beeturia is eliminated)**
  - **Achlorhydria due to pernicious anemia**
  - **Ingestion of foods high in oxalates along with beets**
- **Because hemoglobin is larger than myoglobin (mol. wt. = 69,000) and is protein bound to haptoglobin, it is poorly filtered. Only the unbound dimmer is filtered (mol. wt. = 34,000) and hemoglobinuria occurs only after filtered load exceeds proximal reabsorption (total hemoglobin concentration > 100 – 150 mg/dL). This amount of hemoglobin results in red to brown color in the plasma.**
- **Myoglobin is smaller (mol. wt. = 17,000) and is not protein bound. It is easily filtered and excreted. Plasma remains a normal straw color.**

Diagnoses to consider

- **Pigmenturia**
  - **Exogenous**
  - **Endogenous**
- **Hematuria**



HEMATURIA: EXTRAGLOMERULAR OR GLOMERULAR

Clinical clues

- **Ask about**
  - **History of a recent upper respiratory infection, suggestive of glomerular disease (post-infectious GN or IgA nephropathy)**
  - **History of renal disease in the family (e.g. hereditary nephritis or polycystic kidney disease).**
  - **Flank pain, radiating to the groin (suggestive of calculus, papilla, or blood clot)**
  - **In older (> 40 – 50 yrs.) patients, history of tumors of urinary tract in family, since even transient but isomorphic hematuria requires exclusion of tumors.**

Investigation

- **Urinalysis: brown/cola-colored urine, red cell casts, protein excretion > 500 mg/day (in microscopic hematuria), most red cells having a dysmorphic appearance, consistent with glomerular hematuria**

- **Red or pink urine, clots, no protein or protein excretion < 500 mg/day, isomorphic rbc and no casts, all are consistent with extra-glomerular hematuria; if infected, may also have wbc & bacteria**

Comments

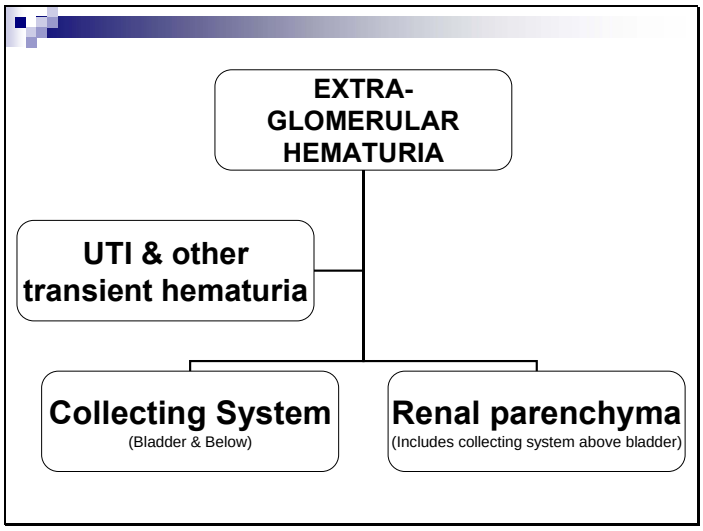
- **There are two reasons for distinguishing glomeruli as the source of bleeding from extra-glomerular sources. First, it is important prognostically. Second, it is beneficial to optimize the subsequent evaluation. Patients with clear evidence of glomerular hematuria do not need to be evaluated for potentially serious urologic disease and as a consequence can avoid a multiplicity of invasive, expensive procedures such as cystoscopy.**

Evidence

- **Fairley, KF, Birch, DF. Hematuria: A simple method for identifying glomerular bleeding. Kidney Int 1982; 21:105.**
- **Pollock, C, Pei-Ling, L, Gÿory, AZ, et al. Dysmorphism of urinary red blood cells value in diagnosis. Kidney Int 1989; 36:1045.**
- **Topham, PS, Harper, SJ, Furness, PN, et al. Glomerular disease as a cause of isolated microscopic haematuria. Q J Med 1994; 87:329.**

Diagnoses to consider if glomerular hematuria is excluded

- **Extra-glomerular hematuria**
  - **Infection of the urinary tract**
  - **Hematuria originating in renal parenchyma and above bladder**
  - **Hematuria originating in bladder and below**
- **Glomerular hematuria**



Clinical clues

- **Ask about**
  - **Whether hematuria is transient or persistent, transient being suggestive of infection, trauma, exercise, fever, stones, endometriosis, thromboembolism, etc.**
  - **Hesitancy, dribbling (BPH), dysuria, pyuria, ⇑ frequency, urgency, supra-pubic discomfort, suggestive of infection.**
  - **Fever (> 38ºC), flank pain, and nausea or vomiting suggest upper tract infection (pyelonephritis).**
  - **Cyclic hematuria in association with menses may represent urine contamination or endometriosis of urinary tract.**
  - **Bleeding from multiple sites suggests a bleeding disorder or excessive anti-coagulation.**
  - **Vigorous exercise or trauma suggests origin of hematuria**
  - **Age: if the patient is >40 years, tumors have to be excluded**
  - **Although hematuria caused by stones/calculi is usually transient, on occasion the hematuria is prolonged/recurrent, to be discussed under hematuria according to site.**
- **Look for**
  - **Suprapubic or/and costovertebral angle tenderness**

Investigation

- **Repeated urinalyses to determine whether hematuria is transient or persistent as well as microscopic examination of centrifuged urine: hematuria, pyuria, wbc casts, bacteruria suggests infection**

Comments

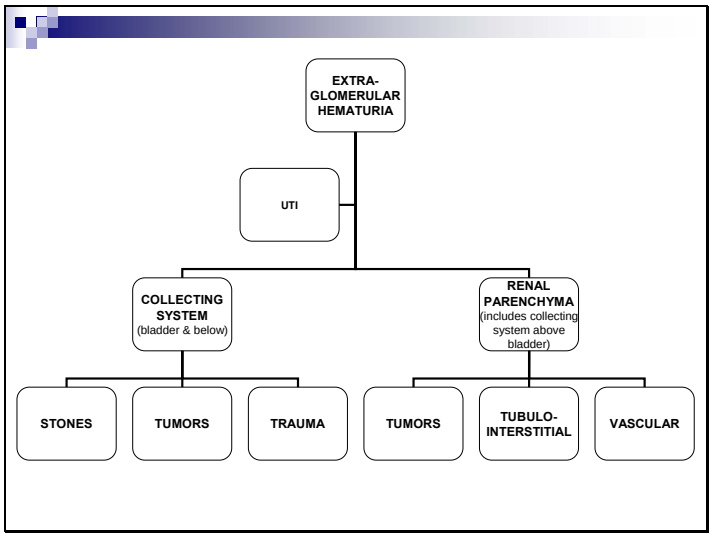
- **Persistent hematuria, may be a symptom of an underlying disease that on occasion is life threatening & requires investigation.**
- **Patients with bladder tumor may present as a urinary tract infection.**
- **Patients with BPH may present with urinary infections. It is uncertain whether BPH alone leads to hematuria (the cellular proliferation of BPH is associated with ⇑ vascularity and new vessels are fragile).**
- **If hematuria is transient rather than persistent, the most common cause is infection of the urinary tract. Consequently, the pragmatic approach is to exclude this possibility before embarking on more extensive investigations (follow-up required if > 40 years).**
- **In women, if hematuria is related to menses, exclude urine contamination from vaginal bleeding or endometriosis of the urinary tract.**
- **Other benign causes of transient hematuria to be excluded are exercise-induced (glomerular hematuria), or trauma (direct trauma to kidney and/or collecting system or exercise bladder trauma).**

Evidence

- **Hooton, TM, Scholes, D, et al. A --- risk factors for symptomatic urinary tract infection in young women. N EJM 1996; 335:468.**
- **Abarbanel, J, et al, D. Sports hematuria. J Urol 1990; 143:887.**

Diagnoses to consider

- **Extraglomerular hematuria**
  - **Renal parenchyma including collecting system above bladder**
    - **Tumors (renal cell, transitional**
    - **Tubulointerstitial {calculi, (AIN/CIN), cysts (PCKD, MSK)}**
    - **Vascular: papillary necrosis, infarction, AV malformation**



EXTRAGLOMERULAR HEMATURIA: RENAL/UPPER COLLECTING SYSTEM

Clinical clues

- **Ask about**
  - **Renal disease in family, suggestive of PCKD, sickle cell (in blacks), etc.**
  - **Flank pain radiating to groin suggest calculus, papilla, clot.**
  - **Diabetes mellitus ± infection, SS/SA disease, analgesic nephropathy, obstructive nephropathy ± infection, suggestive of papillary necrosis.**
  - **Hematuria, abdominal mass, pain, and weight loss suggest renal cell carcinoma; hematuria from cancer suggests invasion of the collecting system; if bleeding severe, it leads to clots and "colicky" discomfort when cancer is in the kidney.**
  - **Acute onset of flank or abdominal pain, fever, nausea and vomiting suggest renal infarction**
  - **History of trauma, medication review for AIN from drugs**
- **Look for**
  - **Renal cell cancer may present as an abdominal/flank mass, usually non-tender, moves with respiration, scrotal varicocele, usually left-sided, hypertension, fever**
  - **PCKD also presents as an abdominal/flank mass**

- Flank or abdominal tenderness, acute elevation in blood pressure, signs of extra-renal embolization (such as skin lesions or focal neurologic deficits) suggest renal infarction.

Investigation

- Sterile pyuria, wbc casts ± hematuria, suggestive of TB, analgesic nephropathy or other interstitial diseases
- Cbc for anemia of chronic disease or erythrocytosis
- Serum calcium for hypercalcemia, abnormal liver function tests
- Non-contrast-enhanced helical CT scan is the gold standard for examination of the renal parenchyma, for stones, as well as other causes (or IVP for medullary sponge kidney or ultrasonography)
- Elevated LDH level, renal isotope scan to exclude renal infarction
- If all other possibilities are excluded, the rare entity of AV malformation may require angiography for diagnosis

Comments

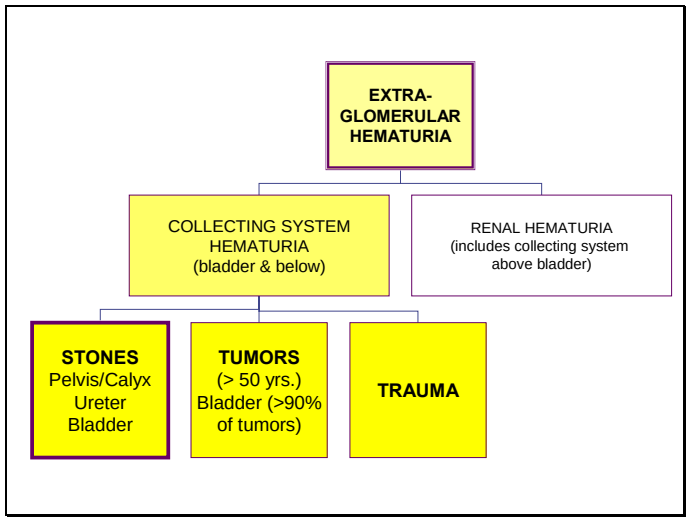
- Hypertension in renal infarction is mediated by angiotensin .
- Although stones are shown in the diagram under the lower collecting system, clearly stones may reside anywhere along the collecting system tract from the collecting tubules as medullary nephro-calcinosis, to the pelvis, ureters, and eventually bladder.

Evidence

- Corwin HL, Silverstein MD. The diagnosis of neoplasia --- : A decision analysis. J Urol 1988; 139:1002.

Diagnoses to consider

- Collecting system hematuria.
  - Stones (pelvix, calyx, ureter, bladder)
  - Tumors
  - Trauma



EXTRAGLOMERULAR HEMATURIA, LOWER COLLECTING SYSTEM CAUSES

Clinical clues

- **Ask about**
  - **Supra-pubic pain, intermittent, gross, painless hematuria, present throughout micturition in men over the age of 50 or patients with specific risk factors such as prolonged heavy phenacetin use, smoking, exposure to dyes, or long-term cyclophosphamide, suggestive of bladder cancer.**
  - **Dysuria, frequency, and urgency**
  - **Initial hematuria, occurring primarily at the beginning of the stream, is usually predictive of a urethral source.**
  - **Terminal hematuria, blood appearing towards the end of voiding, generally originates from the bladder neck or prostatic urethral area**
  - **Hematuria throughout voiding can originate from anywhere in the urinary tract including the bladder and ureters.**
- **Look for**

Investigation

- **Cystoscopy (± retrograde pyelography to examine ureters) recommended in patients at risk for bladder cancer**

- **Urinary cytology (especially if bladder cancer suspected)**

Comments

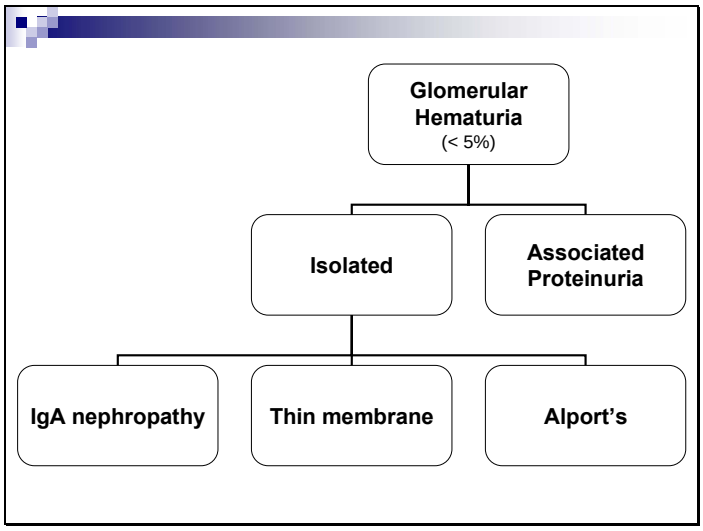
- **Although stones are shown in the diagram under the lower collecting system, clearly stones may reside anywhere along the collecting system tract from the collecting tubules as medullary nephro-calcinosis, to the pelvis, ureters, and eventually bladder.**
- **Causes of hematuria originating in the bladder or below are better uncovered by cystoscopy. Cystoscopy may reveal urethral diverticula/strictures, bladder tumors, bladder stones, and bladder inflammation.**

Evidence

- **Khadra, MH, Pickard, RS, Charlton, M, Neal, DE, et al. A prospective analysis of 1,930 patients with hematuria to evaluate current diagnostic practice. J Urol 2000; 163:524.**
- **Sarnacki, CT, McCormack, LJ, Kiser, WS, et al. Urinary cytology and the clinical diagnosis of urinary tract malignancy: a clinicopathologic study of 1400 patients. J Urol 1971; 106:761.**

Diagnoses to consider

- **Glomerular hematuria**
  - **Isolated glomerular hematuria**
    - **IgA nephropathy**
    - **Thin membrane disease**
    - **Alport's**
  - **Glomerular hematuria associated with proteinuria**



GLOMERULAR HEMATURIA: ISOLATED OR ASSOCIATED WITH PROTEINURIA +

Clinical clues

- **Ask about**
  - **Recent upper respiratory infection (< 5 days) with previous similar episodes, episodes of gross hematuria on a background of microscopic hematuria, suggestive of IgA**
  - **Absence of edema or other systemic symptoms**
  - **Family history of hematuria, hearing difficulties, renal failure (mostly in males), suggestive of Alport's**
- **Look for**
  - **Absence of edema, hypertension, suggestive of thin membrane disease or early IgA**

Investigation

- **Persistent hematuria on repeated urinalyses**
- **Absence of protein excretion > 1.5 g/day, no renal insufficiency**
- **Urinalysis: brown or cola-colored urine, red cell casts on occasion, majority of red cells having a dysmorphic appearance**
- **Dysmorphic appearance: rbc morphology differs from distinctive uniform and round red cells (similar to peripheral blood smear) seen with extra-renal bleeding. Dysmorphic appearance refers to red cells**

with blebs, budding, and loss of membrane, resulting in variable red cell shape and smaller red cell size. This appearance is seen with renal lesions particularly, not only glomerular diseases. Diagnosis is more certain when all cells (or almost all) are either normal or clearly dysmorphic. If both cell types are present, the origin of the hematuria is less certain unless red cell casts are also present.

- The type of dysmorphic cell is of diagnostic importance. In particular, dysmorphic red cells alone may be predictive of only renal bleeding while acanthocytes (ring forms with vesicle shaped protrusions) may be most predictive of glomerular disease.
- Elevated IgA levels in serum suggest IgA more likely
- Renal biopsy is only definitive way to make correct diagnosis, but is not usually indicated; skin biopsy may be helpful

Comments

- Red cell injury leading to dysmorphic appearance may be due both to mechanical trauma as the cells pass through rents in the glomerular basement membrane and osmotic trauma as the cells flow through the different nephron segments.
- Regular follow-up is essential, since disease progression can occur. This is particularly true with IgA nephropathy since patients first seen with isolated hematuria can progress with the development of proteinuria, hypertension, &/or renal insufficiency) over many years.

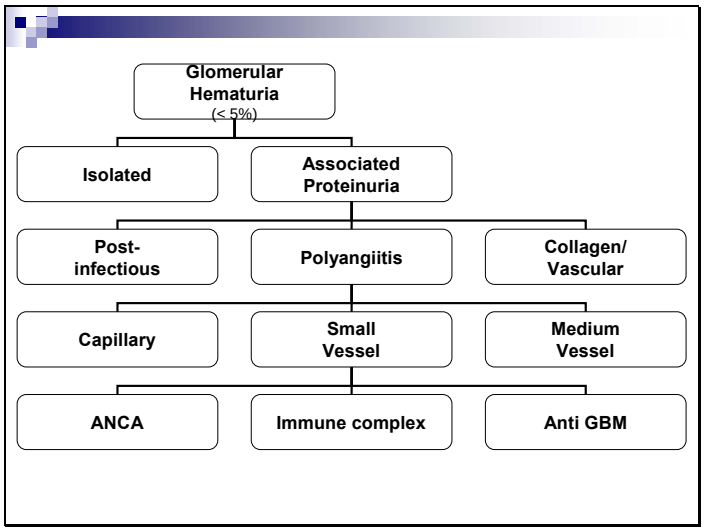
Evidence

- Pollock, C, Pei-Ling, L, Gÿory, AZ, et al. Dysmorphism of urinary red blood cells value in diagnosis. Kidney Int 1989; 36:1045.
- Auwardt, R, Savige, J, Wilson, D. A comparison of the clinical and laboratory features of thin basement membrane disease (TBMD) and IgA glomerulonephritis (IgA GN) Clin Nephrol 1999; 52:1.

- **Hudson, BG, Tryggvason, K, Sundaramoorthy, M, Neilson, EG. Alport's syndrome, Goodpasture's syndrome, and type IV collagen. N Engl J Med 2003; 348:2543.**

Diagnoses to considerComment

- **Hematuria, glomerular, associated proteinuria**
  - **Post-infectious**
    - **Viral**
    - **Bacterial**
  - **Polyangiitis**
  - **Collagen disease**



GLOMERULAR HEMATURIA/PROTEINURIA+: POST-INFECTION OR POST-INFLAMMATORY

Clinical clues

- **Ask about**
  - **History of hepatitis B, C, HIV, infectious endocarditis, ventriculo-atrial shunt, chronic visceral abscess, or other chronic infection.**
  - **History of streptococcal infection (with pharyngitis ≈ 10 days previously or with skin infection ≈ 21 days previously)**
  - **Confusion, headaches, anuria/oliguria, bloody diarrhea, rash, fever, seizures, coma, weight loss, suggestive of angiitis.**
  - **Patients with all types of inflammatory rheumatic diseases may develop vasculitis. Symptoms may include myalgias, arthralgias, red eyes, diplopia, skin rash (vesicular, palpable purpuric, ulcerative, and hemorrhagic lesions), numbness, chest discomfort, etc**
  - **Patients with SLE have innumerable symptoms, including fatigue, fever, weight loss, arthritis/arthralgia, skin rash, and renal involvement**
- **Look for**
  - **Hypertension, edema**

- **Findings of associated condition (e.g. hepatitis, infectious endocarditis, visceral abscess, skin infection, pharyngitis)**
- **Red eyes, rash, numbness, suggestive of collagen disease; also chest pain, pleural effusion, interstitial lung disease.**

Investigation

- **Urine brown or cola-colored, red cell casts, wbc casts, granular casts, proteinuria, most red cells having a dysmorphic appearance**
- **Serum creatinine and urea level may be elevated**
- **Urinary protein excretion often > 1.5 g/day (or equivalent protein/creatinine ratio in random urine)**
- **Abnormal serology for viral antigens, positive blood culture, or other positive bacterial cultures, low complement levels, cryoglobulins**
- **ANA, antiphospholipid antibodies, antibodies to double stranded DNA**

Comments

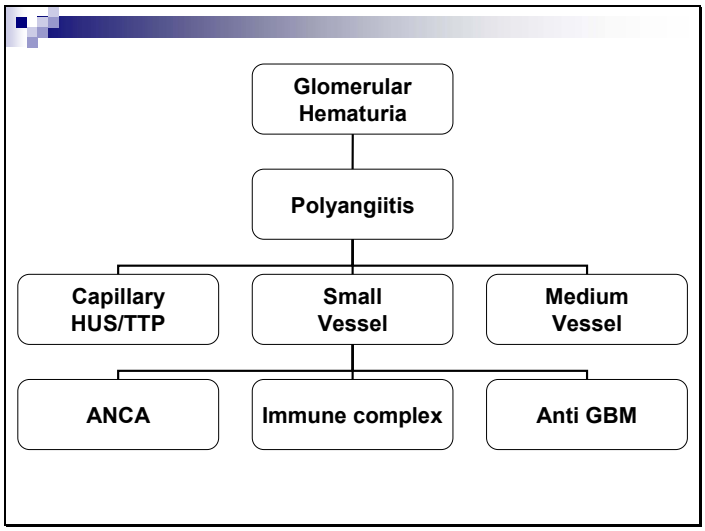
- **The etiology of GN is unknown except for infectious agents: e.g. beta streptococci in post-strept GN, hepatitis C virus in membrano-proliferative glomerulonephritis (MPGN) or mixed cryoglobulinemia.**
- **Evidence exists that most GN are a form of autoimmune disease; etiologic agents may cause GN by inducing loss of tolerance to self-antigens rather than via a direct immune response to etiologic agents as observed with serum sickness or infectious agents.**
- **Antistreptolysin O titer is elevated in only 50 percent of patients with poststrep GN following impetigo, due to inactivation by skin lipids.**
- **Virtually all inflammatory rheumatic conditions, including RA, SLE, Sjögren's, inflammatory myopathies, reactive arthritis, etc. may develop ANCA positive vasculitis and associated renal lesions.**

Evidence

- **Fries, JW, Mendrick, DL, Rennke, HG. Determinants of immune complex-mediated glomerulonephritis. Kidney Int 1988; 34:333.**
- **Rennke, HG. Secondary membranoproliferative glomerulonephritis. Kidney Int 1995; 47:643.**
- **Daghestani, L, Pomeroy, C. Renal manifestations of hepatitis C infection. Am J Med 1999; 106:347.**
- **Couser, WG. Pathogenesis of glomerular damage in glomerulonephritis. Nephrol Dial Transplant 1998; 13(Suppl 1):10.**

Diagnoses to consider

- **Polyangiitis**
  - **Capillary**
  - **Small vessel**
    - **ANCA**
    - **Immune complex**
    - **Anti GBM**
  - **Medium vessel**



GLOMERULAR HEMATURIA/PROTEINURIA+: CAPILLARY AND MEDIUM VESSEL

Clinical clues

- **Ask about**
  - **Patients with confusion or severe headache, anuria/oliguria, suggestive of HUS/TTP**
  - **Bloody diarrhea in young children (caused by Shiga toxin-producing bacteria such as E coli 0157:H7), suggestive of HUS**
  - **Development of symptoms during pregnancy or early in the postpartum period, suggestive of HUS/TTP**
  - **Certain drugs (e.g., mitomycin C, ticlopidine, quinine)**
- **Look for**
  - **fever on occasion, seizures and coma**

Investigation

- **Thrombocytopenia and microangiopathic hemolytic anemia, unexplained**
- **Urinalysis: dysmorphic red cells and rarely red cell casts may be seen in approximately 50%**
- **Serum creatinine rising daily > 30 – 50 µmol/L (0.3 – 0.6 mg/dl)**
- **Hypocomplementemia on occasion**
- **vWF cleaving protease (ADAMTS13) deficiency in some**

Comments

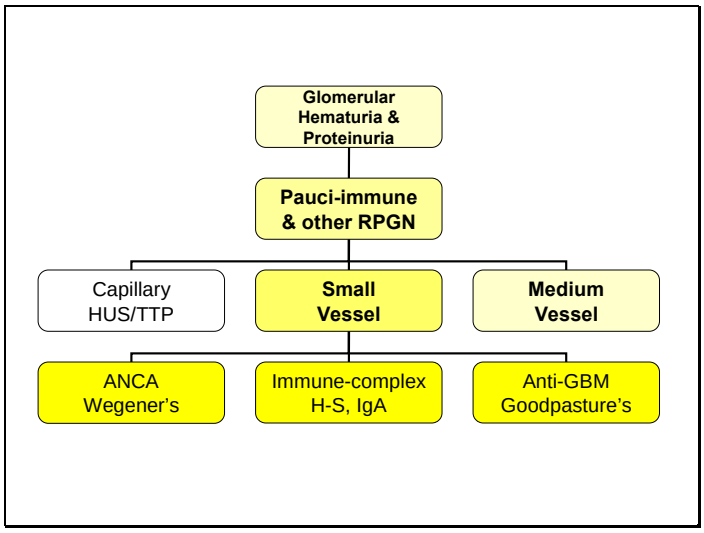
- **Urinalysis in TTP-HUS is often near normal with only mild proteinuria (usually between 1 – 2 g/day) and few cells or casts, but on occasion red cells and rarely red cell casts are seen. In view of these have common characteristics, the presence of thrombocytopenia may be the primary clue pointing toward TTP-HUS.**
- **Renal involvement is common in any of the forms of systemic vasculitis. These include classic polyarteritis nodosa (medium vessel disease), Wegener's granulomatosis, Churg-Strauss syndrome, and the hypersensitivity vasculitides (including Henoch-Schönlein purpura, mixed cryo-globulinemia, and serum sickness)**
- **The urinalysis may be relatively normal in polyarteritis nodosa (medium vessel disease, not shown on scheme).**

Evidence

- **Ruggenenti, P, Noris, M, Remuzzi, G. Thrombotic microangiopathy, hemolytic uremic syndrome, and thrombotic thrombocytopenic purpura. Kidney Int 2001; 60:831.**

Diagnoses to consider

- **Small vessel arteritis**
  - **Wegener's**
  - **Goodpasture's**
  - **Immune complex vasculitis**



GLOMERULAR HEMATURIA/PROTEINURIA+: TYPE OF VESSEL INVOLVEMENT

Clinical clues

- **Ask about**
  - **Rhinorrhea, purulent/bloody nasal discharge, oral/nasal ulcers, arthralgias, myalgias, or sinus pain, stridor, earache, hearing loss, cough, dyspnea, suggestive of Wegener's**
  - **Hemoptysis (due to an alveolar capillaritis, necrotic lesions, or endobronchial disease), and/or pleuritic pain + hematuria, suggestive of Goodpasture's or angiitis.**
  - **Abdominal discomfort, arthralgias, and purpuric rash suggest Henoch-Schonlein disease**
  - **Although rare, patients with fever, weight loss, arthralgias/ arthritis, and cutaneous vasculitis may have drug-induced (e.g. propylthiouracil, hydralazine) ANCA-assoc. vasculitis.**
- **Look for**
  - **Hypertension, arthritis, pericarditis, conjunctivitis, mononeuritis multiplex, cranial nerve abnormalities,**

Investigation

- **Pulmonary infiltrates on chest x-ray; ↑ diffusion capacity for CO**

- **Examine centrifuged urine for red cell casts, other cellular and granular casts, proteinuria, and dysmorphic hematuria**
- **Rising serum creatinine**
- **Serologic tests: Anti-GBM antibodies (if present diagnostic of Goodpasture). ANCA (antineutrophil cytoplasmic antibodies)(highly suggestive of Wegener's, or else microscopic polyangiitis (MPA), and "renal-limited" vasculitis), ANA(antinuclear antibodies)(if SLE suspected), ASOT, anti-DNAase B, or hyaluronidase or blood cultures if either poststreptococcal glomerulonephritis or bacterial endocarditis are possible.**
- **In patients with skin purpura, a skin biopsy may be valuable. (light and immunofluorescence microscopy: the combination of leuko-cytoclastic vasculitis and IgA deposition is essentially diagnostic of Henoch-Schönlein purpura.)**
- **Renal biopsy is still required to document the presence or absence of RPGN and other diagnostic possibilities.**

Rationale

- **Renal involvement is common in any of the forms of systemic vasculitis. These include classic polyarteritis nodosa, Wegener's granulomatosis, Churg-Strauss syndrome, and the hypersensitivity vasculitides (including Henoch-Schönlein purpura, mixed cryo-globulinemia, and serum sickness)**
- **Hemoptysis and hematuria are characteristic but not diagnostic of Goodpasture's syndrome. Similar findings can be seen in disorders such as systemic vasculitis (e.g. Wegener's granulomatosis), lupus, and other forms of acute glomerulonephritis that are complicated by pulmonary edema or pulmonary infection.**
- **ANCA is measured by indirect immunofluorescence or enzyme-linked immunosorbent assay (ELISA). Immuno-fluorescence is more sensitive and enzyme-linked is more specific. Optimally, ANCA**

immunofluorescence should be used to screen and ANCA enzyme-linked to confirm all positive results. ANCA targets 2 antigens, PR3 (proteinase 3) and MPO (myeloperoxidase), both located in the azurophilic granules of neutrophils and the peroxidase-positive lysosomes of monocytes. Antibodies with target specificities for PR3 and MPO are called PR3-ANCA and MPO-ANCA, respectively.

- The absence of ANCA does not exclude the diagnosis of Wegener's; the presence of ANCA does not prove the diagnosis of vasculitis.
- ANCA have been reported in virtually all inflammatory rheumatic conditions, including RA, SLE, Sjögren's, inflammatory myopathies, reactive arthritis, etc.
- Hypertension is primarily mediated by ischemia-induced activation of the renin-angiotensin system.

Evidence

- Gallagher, H, Kwan, JT, Jayne, DR. Pulmonary renal syndrome: A 4-year, single-center experience. Am J Kidney Dis 2002; 39:42.
- Savage, CO. ANCA-associated renal vasculitis. Kidney Int 2001; 60:1614.
- Couser, WG. Rapidly progressive glomerulonephritis: Classification, pathogenetic mechanisms, and therapy. Am J Kidney Dis 1988; 11:449.

BLOOD IN URINE (HEMATURIA)

Significance

Urinalysis is a screening procedure for insurance and routine examinations. Persistent hematuria implies the presence of conditions ranging from benign to malignant.

Conditions that cause hematuria

1. Transient
    a. Urinary tract infections
    b. Exercise induced
    c. Stones/Crystals
    d. Trauma (kidneys, bladder, urethra)
    e. Endometriosis
    f. Thromboembolism
    g. Anticoagulants (note that the incidence of hematuria in patients on anticoagulants is similar to that in patients not receiving anticoagulants)
2. Persistent
    a. Extraglomerular
        i. Renal
            A. Tumors
            B. Tubulointerstitial diseases (e.g., polycystic kidneys, pyelonephritis)
            C. Vascular (e.g., papillary necrosis, sickle cell disease)
        ii. Collecting system
            A. Tumors
            B. Stones
            C. Trauma
    b. Glomerular
        i. Isolated (e.g., IgA nephropathy, thin membrane disease)
        ii. Associated with proteinuria
            A. Post-infections (e.g., post-streptococcal)
            B. Pauci-immune & RPGN(e.g., Wegener)
            C. Collagen diseases (SLE)

Special goals

- Differentiate red or brown urine from hematuria, transient from persistent, and glomerular from extraglomerular hematuria.

Objectives

History and Examination

- Through efficient, focused, data gathering:
    - Determine whether the patient has true hematuria.
    - Diagnose the presence of urinary tract infections.
    - Differentiate between glomerular and extraglomerular hematuria by examination of urine sediment.

Investigation

- List and interpret critical clinical and laboratory findings which were key in the processes of exclusion, differentiation, and diagnosis:
    - Interpret reported urinalysis findings.

- Outline significance of patient's age, gender, and life style on diagnostic possibilities.

Management

- Conduct an effective plan of management for a patient with hematuria:
  - Select treatment for patients with urinary tract infections appropriate for gender, and for lower, and upper urinary tract.
  - Outline a plan for investigation of patients with recurrent nephrolithiasis.
  - Formulate a management plan (non-pharmacological) for prevention of recurrent nephrolithiasis.
  - Discuss possible strategies for the detection and prevention of urinary tract tumors.

Scientific concepts applicable to clinical condition

1. Anatomy/Histology

1.1. Explain the embryologic origin of the male and female urinary system, and demonstrate the congenital defects associated with them.
1.2. Discuss the histologic make up of all components of the urinary system, emphasizing its functional significance.
1.3. Identify the anatomical sites that can cause persistent hematuria.
1.4. Describe in detail the gross anatomic features of the kidney, ureter and urinary bladder in the male and female.
1.5. Contrast the course, parts and relationships of the male and female urethra.
1.6. Describe the perineal spaces, their contents, and the role of the fascial covering in the dissemination of bodily fluids in traumatic urethral disruption.

2. Biochemistry

3. Genetics

3.1. Explain that molecular techniques have been developed that allow the manipulation and analysis of DNA and RNA sequences.
3.2. Identify the function and use of enzymes commonly used in the manipulation of DNA and RNA.
3.3. Explain how plasmid vectors are employed in molecular cloning.
3.4. Explain that the polymerase chain reaction can be used to amplify specific DNA sequence from highly complex DNA mixtures.
3.5. Explain that nucleic acid hybridization is the basis for clinically relevant techniques such as Southern blotting and fluorscence in situ hybridization.
3.6. Explain how chromosomal abnormalities can be detected using techniques such as chromosome painting and comparative genomic hybridization.
3.7. Describe how microarrays are employed in global analysis of gene expression and genome structure.
3.8. Explain how DNA is sequenced and how advances in this technology permitted sequencing of entire genomes, including the human genome.
3.9. Explain how protein levels within cells can be quantitatively and qualitatively analyzed.

4. Immunology

4.1. Outline the role of humoral immunity and cellular immunity in glomerulonephritis and the target antigen predominantly localized in the glomerulus.
4.2. Outline the structural and functional consequences of immune deposit formation in glomeruli.
4.3. Explain the mechanisms of glomerular damage by immune events involving the complement system, polymorphonuclear cells, platelets, macrophages, oxidants and proteases.

5. Microbiology

6. Pathology

6.1. Define and compare WHO classes I through V lupus nephropathy.
6.2. Describe the diagnostic significance of subendothelial immune complex deopisiton in lupus nephropathy.
6.3. Contrast nephritis and nephrotic syndrome.
6.4. Describe the gross and light microscopic appearance of the kidney in acute proliferative (post-streptococcal) glomerulonephritis.
6.5. Describe the etiopathogenesis of acute proliferative (post-streptococcal) glomerulonephritis.
6.6. Describe the characteistis site of immune complex deposition in acute proliferative (post-streptococcal) glomerulonephritis.

6.7. Describe the significance of red cell casts.
6.8. Identify the typical light microscopic appearance of glomeruli in rapidly progressive (crescentic) glomerulonephritis (RPGN).
6.9. Discuss the etiopathogenesis and diagnostic significance of linear immunofluorescence in Goodpasture syndrome.
6.10. Define Alport syndrome and identify the typical electron micrographic change characteristic of this disorder.
6.11. Describe the EM and immunofluorescent findings in IgA nephropathy.
6.12. Identify the 'tram-track' appearance of membrano-proliferative glomerulonephritis.
6.13. Outline the relationship of dense deposit disease to C3.

7. Pharmacology

7.1. Outline the mechanisms of action, use, and adverse effects of drugs used in the treatment of hematuria (e.g. anti-microbial, anti-inflammatory, immunosuppressive, anti-neoplastic)
7.2. Outline the mechanisms of action, use, and adverse effects of drugs used in the treatment of nephrolithiasis (e.g. thiazides, amiloride, potassium citrate, etc)

8. Physiology

8.1. List and explain various clinical findings that predispose to nephrolithiasis such as hypercalciuria, hyperuricosuria, hyperoxaluria, hypocitraturia, dehydration, and pH changes.
8.2. Describe the manner in which macromolecules are prevented from entering Bowman space and the permeability changes that make entry possible.

Medical Skills

Ethics: *Consent to Investigation or Treatment*
Detailed Objectives

- To communicate clearly information relevant to informed consent (what a reasonable person would want to know in a given circumstance).
- To identify reasonable steps to ensure understanding of information: can the patient explain the medical problem and the proposed treatment or test.
- To determine free choice, and absence of coercion.

Once the presence of hematuria has been established and urinary tract infection has been excluded, it is critical to the further investigation of the patient to determine whether the hematuria is glomerular in origin or extra-glomerular. An experienced physician examining the urine sediment best accomplishes this differentiation. This information should be discussed with the patient before recommending more invasive and/or expensive investigations.

Applicable Basic Principles of Law

Physicians' Legal Liability for Negligence (or, in Québec, Civil Liability)
Detailed Objectives

- **Physicians are legally liable to their patients for causing harm through a failure to meet the standard of care that is applicable under the particular circumstances under consideration.**
- **The standard of care expected of a physician is one that would reasonably be expected under similar circumstances of an ordinary, prudent physician of the same training, experience, specialization, and standing.**

Because persistent hematuria implies the presence of conditions ranging from benign to malignant, it cannot be ignored or assumed to be benign (e.g., urinary tract infection).

STUDENT CASE

A 70-year-old African-American female with hypertension presented to the Emergency Department with blood in her urine, fever, and disorientation. For the past 5-6 months she developed incontinence, which she attributed to the aging process. She noticed some hematuria and she went to her primary care provider. She was prescribed antibiotics. Two days later she continued to have hematuria and she was referred to an urologist. Her antibiotics were changed, but she later developed fever and vomiting. She has had poor oral intake and had become disoriented. Her daughter brought her into the emergency room.

Medications: Norvasc 10mg qhs and another BP medication- does not know the name of medication.

Review of systems: 11 lb weight loss over the past 4-5 months, blood tinged rhinorrhea, no back pain and no abdominal pain

Social history: stopped smoking; used to smoke a pack of cigs q 2-3 days, does not drink alcohol and does not take illicit drugs

Physical Examination: BP 155/80, T 98.8, P 75, R 18 remainder of exam in unremarkable except for right endarterectomy scar, and dry oral mucosa

Laboratory Data: Glucose 121, BUN 65, Creatinine 4.0, WBC 12,800, Hgb 9.7, Hct 27.7, Urinalysis: appearance clear, color yellow, glucose negative, bilirubin and ketones negative, specific gravity 1.015, blood large, pH 5.5, protein trace, nitrite negative, leukocyte esterase moderate, RBC 15-20, WBC 3-5, bacteria 1+,

TUTOR CASE

A 70-year-old African-American female with hypertension presented to the Emergency Department with blood in her urine, fever, and disorientation. For the past 5-6 months she developed incontinence, which she attributed to the aging process. She noticed some hematuria and she went to her primary care provider. She was prescribed antibiotics. Two days later she continued to have hematuria and she was referred to an urologist. Her antibiotics were changed, but she later developed fever and vomiting. She has had poor oral intake and had become disoriented. Her daughter brought her into the emergency room.

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Questions.

1. What is her main clinical problem?
2. From the Hematuria worksheet, is this true hematuria and if so, is it glomerular or extraglomerular?
   (This woul be considered hematuria with the u/a showing 15-20 RBC's. It would be extraglomerular since there are no casts present in the u/a. Hematuria requires >2rbc/hpf)
3. What other data would you seek at this time?
4. What treatment would you institute? (Urine culture should be obtained. IV fluid administration and antibiotic coverage.)
5. Therapy instituted yields no improvement in her creatinine and her urine culture is negative. What would be your next step or who would you consult?

CT scan revealed a large renal stone in the right renal pelvis as well as a left ureteral stone. Urologic consult requested.

She underwent cystoscopy and ureteral stenting . Serum creatinine started going down at the time of discharge.