Infectious Diseases:
Tips for Bedside Diagnosis

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There are no shortage of reasons why investment in and commitment to bedside diagnosis are on the decline. The lure of lab tests, the temptation of technology, and the urge to image, along with the protocolized patterns of care in which workups are put in place even before a patient is assessed, are but a few explanations. Discomfort with one's own bedside skills is another.
According to the 2015 US National Academy of Medicine (NAM)’s quality report, *Improving Diagnosis in Health Care*, diagnostic errors represent a major public health problem ...

Diagnostic Error in Medicine Conference
November 10-13, 2019 Washington, DC.
April 28-30, 2019; Melbourne, Australia
A Definition of Medical Error

- ...a diagnosis that was unintentionally delayed (sufficient information was available earlier), wrong (another diagnosis was made before the correct one), or missed (no diagnosis was ever made) ...

- Cognitive errors:
  - Faulty knowledge
  - Faulty data gathering (Most common)
  - Faulty synthesis

“Tips for Bedside Diagnosis”

- Objectives:
  - Provide tips for diagnosing infectious diseases
  - Improve history and examination skills
  - Discuss diagnostic reasoning

- Methods:
  - Present instructive clinical vignettes of my patients, patients I encountered during bedside teaching rounds and conferences, and the medical literature.
  - We can learn by our errors.
Inadequacies of Physical Examination as a Cause of Medical Errors and Adverse Events: A Collection of Vignettes

Abraham Verghese, MD, Blake Charlton, MD, Jerome P. Kassirer, MD, Meghan Ramsey, MD, John P.A. Ioannidis, MD, DSc

- Solicited responses from 208 physicians
- Most errors in the physical examination that lead to consequences are related to not performing an examination.

“We made too many of the wrong mistakes.”

- Yogi Berra. A Baseball Legend known for his malapropisms as well as pithy and paradoxical statements.
Case Presentation

- A Micronesian man in his mid twenties
- CC: Severe headache
- HPI: He had been diagnosed with IgA nephropathy and hypertension.
- 2 weeks PTA, he noted a progressive onset of a generalized headache, nausea and vomiting.
- On the morning of admission, he was awakened by severe headache. He came to the ED and was admitted.
Case Presentation

- ROS: Otherwise unremarkable
- Past History:
  - MVA requiring laparotomy and splenectomy 5 years PTA.
  - IgA nephropathy with CRF
- Examination:
  - T 36.9 C, HR 65, R 20, BP186/121, O2 100%
  - He was alert and oriented but in moderate distress due to his headache.
  - The remainder of the examination was unremarkable.
Initial Differential Diagnosis

- Hypertensive Emergency
- R/O intracranial bleed
- R/O meningitis
- Acute exacerbation of chronic renal failure due to hypertension

Clinical Course:
- Severe headache and hypertension persisted for several days despite intensive intravenous anti-hypertensive therapy; the creatinine increased to 6.6 mg per dL.
Further Testing for Secondary HTN

- He undergoes an extensive laboratory evaluation for causes of secondary hypertension.

- Multiple imaging studies suggested pheochromocytoma. Lab studies ordered

- CT abdomen shows 2 masses c/w pheo.
Patient Update Day 3

- Hypertension and severe headache persist
- BP max doses of beta-blocker, ACEI
- Develops rigor, T max 104 F,
  - CXR - no infiltrate, UA - normal
  - WBC - 18,300
- Has extensive evaluation for fever.
  - Concern for tumor fever, e.g. lymphoma
- Broad spectrum antibiotic Rx
- Biopsy considered
Further Testing for Secondary HTN

- He undergoes an extensive laboratory evaluation for causes of secondary hypertension.
- Multiple imaging studies suggested pheochromocytoma. Lab studies ordered.
- PH splenectomy reconsidered.

- Scans >
CT coregistered 99mTc labeled heat-denatured erythrocyte SPECT spleen scan showing activity in the two masses seen on our patients CT scan.

Accessory Spleen
Back to the case - day 4

- **Sub-Intern student visit:**
- “Patient asks for pain medication for his left upper jaw toothache. Chewing makes his headache worse.”

- **Additional history**
  - Patient says he had a chronic toothache.
  - He had a severe toothache 1 mo. PTA.
    - ED visit at another hospital for toothache. Told to see a dentist, but he failed to do so. (unable to pay).

- **Student is instructed to examine the teeth.**
- **Needs a tongue depressor.**
How many medical personnel does it take to obtain a tongue depressor?

- MD begins oropharyngeal exam ...
- Searches patient’s room cabinet ...
- Searches for nurse ...
- Nurse goes to center of ward ...
- Opens “Omnicanell” central dispenser ...
- Selects tongue depressor ...
- Returns to room, gives to Physician
Omnicell Supply and Pharmacy Dispenser for Hospital Ward
Omnicell Supply Dispenser
“... inventory levels controlled ... costs are reduced”
6-inch Tongue Depressor, Senior, N/S
$6.60 for box of 500 = 1.32 cents each
Patient update: day 6

- Dental consult:
  - Severe caries with fracture L upper molar with dental abscess.
- The tooth was extracted.
- Headache and fever resolved.
- BP improved; placed on oral antihypertensive agents and discharged.
Bottom Line:

- Hawaii hospital charges (2010) for this admission = $59,558.08
  - Does not include physician fees
- Amount collected = $0
  - "self pay"
- Hospital looses money
What went wrong with this patient’s care?

- Initial impression framed as “headache.”
- Use the patient’s terms; perhaps “face or jaw pain” instead of headache.
- Ask for exacerbating and relieving factors: “pain worse with chewing.”
- Ask patient what is causing his pain: “toothache makes my head hurt.”
- Careful with anchoring bias when Rx fails.
The “Complete History and Physical Exam”

- Many texts preface diagnostic steps with the need to do a “complete H&P.
  - A learning tool for Medical Students.
    - But too time-consuming and inefficient for Residents and Internists
    - “10 point ROS negative” is not convincing
    - Medical Records become templated and inaccurate.
  
- Better to perform a **Hypothesis Generated H&P** based on patient's symptoms, focusing on relevant review of systems and physical exam.
SOCRATES: A mnemonic to characterize symptoms

- Site
- Onset
- Character
- Radiation
- Associated symptoms
- Timing (duration, course, pattern)
- Exacerbating and relieving factors
- Severity
A Young woman with recurrent syncope

- An otherwise healthy young woman was admitted because of recurrent syncope for several days.
- An extensive medical evaluation determined that she had psychogenic syncope due to an upcoming overseas deployment.
A physician passing by heard her in a bout of coughing. Further questioning revealed:

- A bout of strong coughing preceded each syncopal episode.

What further questions should we ask?
Young woman with recurrent syncope

- She was a pediatric nurse.
- She had cared for a child with pertussis a several weeks earlier.
- Her cough was preceded by rhinitis.
- Likely diagnosis. Hospital (employee) acquired pertussis with cough syncope

Mechanism of syncope after coughing.

- Syncope from coughing was found to be common and to result from an acute diminution of supply pressure of blood to the brain. The violence of the coughing was the determining factor, Subjects who coughed continuously without drawing breath were shown to have circulatory changes which were exaggerated examples of the effects of the Valsalva maneuver.

SHARPEY-SCHAFER, BMJ Oct 17, 1953
Syncope Patient: What went wrong?

- Inadequate history of patient’s syncope
  - Ask “what were you doing when you fainted”
- Lack of knowledge of situational syncope:
  - Micturition
  - Gastrointestinal stimulation
  - Cough, sneeze
  - Post-exercise
- Unaware of patient’s occupation (pediatrics)
  - Recent exposure to pertussis patient
Case: A Clinical Evaluation Exercise

- The subject patient had an endoscopy proven gastroesophageal tear c/w a Mallory Weiss tear. He vomited blood but denied a preceding bout of vomiting or retching.
- However, during the CEX patient described a preceding bout of forceful hiccupping.
- The resident’s oral and written presentation omitted the hiccupping symptom.
- Patient said he had described hiccups to the admitting team and GI consultants. But they also omitted this symptom in their records.

Hiccups: An unappreciated cause of the Mallory Weiss syndrome

- A Report of 3 patients who had severe hiccups before hematemesis; none had preceding retching typically associated with MW tears.
  - 1 patient had a total of 5 episodes, all preceded by forceful hiccupping.

- Although all these patients described intense bouts of hiccups before hematemesis, their physicians ignored this feature.

- Forceful hiccups are contractures of the diaphragm similar to retching and can cause MW tears.

What went wrong with this case

- “You can’t see (feel, hear) what you don’t know.”
- In the H&P, describe the patient’s symptoms or exam findings, even if you don’t recognize or understand them.
- A more experienced physician may know the significance.
- Or Google the symptoms.
A woman admitted for abdominal pain

- A middle-aged woman with diabetes and a vague history of chronic bowel disorder was admitted for several days of fever and abdominal pain.
- ED ordered abdominal CT that showed an area of “panniculitis of abdominal wall without fluid” in LLQ.
- Exam by ward team, ID, and surgeon found no fluid. Dx “bacterial panniculitis”
- Lesion about 10 cm similar to image >
Woman admitted for abdominal pain

- When seen on rounds, the lesion had marked fluctuance indicating presence of fluid, likely pus. Team requested reassessment for drainage.
- Repeat visits: ID and Surgery again denied need for I&D bases on CT
- Fever and broad spectrum antimicrobial therapy was continued; fever persisted.
- Several days later the nurse noted thick pus draining from the lesion and soiling the bedding.
- Final Dx: MSSA furuncle “boil”
Abdominal pain: What went wrong?

- Patient’s symptoms were identified as fever and “abdominal pain.”
- This led to search for intraabdominal source of pain and fever. CT exam missed fluid collection.
- Consultants favored the CT exam over the physical exam.
- Most likely she was trying to indicate pain on the abdomen.
- Lesson. Think anatomically in 3 dimension: Pain skin & subcutaneous tissue (cellulitis), fascia, muscle, peritoneum or internal organs.
Recurrent Cellulitis

- Mid-aged woman complains of rapid onset of fever and chills followed by painful red left leg.
- She had same symptoms on left leg several months ago.
- Diagnosis?
Recurrent Cellulitis After Saphenous Venectomy for Coronary Bypass Surgery

- Five patients had 20 episodes of acute cellulitis, occurring in the lower extremity with the venectomy.
- Presented with high fever and
- The appearance of the lesions, presence in one case of obvious associated lymphangitis, and prompt response in three instances to therapy with penicillin alone all suggest group A streptococcal infection
- Cause: probable local compromise of lymphatic drainage, direct bacterial invasion

Advice from Dermatologists

Most acute lower leg cellulitis is due to streptococcal infection

A diagnosis of bilateral lower leg cellulitis is likely to be incorrect

Antistreptolysin-O titre is extremely useful to confirm the cause of cellulitis but is unreliable in the first week

In resistant cases of streptococcal cellulitis, clindamycin is the best antibiotic choice

Treatment of associated tinea pedis and persistent oedema is critical to reduce the risk of recurrent episodes

Cox NH. Clinical Medicine vol 2 no. 1 Jan-Feb 2002
What is the role of physical examination in diagnosis of cellulitis and soft-tissue infections?

- No drainage/abscess but with lymphangitis, raised indurated border, peau d'orange appearance (streptococci more likely)
- Abscess, draining wound, penetrating trauma (S. aureus likely)
- Blisters and sores on face or extremities suggest impetigo due to streptococci or staphylococci, usually in children
- Crepitus (gas-producing organisms, such as anaerobic bacteria or gram-negative bacillus)
- Foul odor (anaerobic microorganisms), sweet odor (Pseudomonas or clostridial species)
- Assess for less severe forms involving subcutaneous tissue (cellulitis) or epidermis and dermis (erysipelas) versus necrotizing fasciitis in deeper tissue planes (fascia, muscle) that requires hospitalization and can threaten limbs
Cellulitis and Soft Tissue Infections
My experience with the Saigon Medical School: “An Experiment in International Medical in South Viet Nam (1966-1975)”

“The Vietnamese faculty, a dignified, proud group with their own education in France, an academic hierarchy based on the French system ... found themselves committed by the realpolitik of the war to an American aid program that defined that the medical school be reorganized into an American-style academic medical school.”

Chief of Medicine invites me to visit
Medical Grand Rounds!

- A young man with RHD involving multiple valves and staphylococcal bacteremia
- I detect a swollen calf, Homans sign.
- Diagnosis?
Describes 3 case of staphylococcal pyomyositis in immigrants from the tropics.

All had recent blunt muscle trauma but no obvious source of staphylococcal infection.
How did I miss this probable case of tropical pyomyositis?

I was unaware of the disease.

Availability bias: DVT common in hospital patients.

But:

- Patients’ new problems are often related to a pre-existing disease. (known feature of the disease, treatments, Dx. procedures).
- Should be aware of metastatic infection in bacteremia to almost any site.
Pyomyositis: Report of 18 Cases in Hawaii

- Most were healthy young men or boys, and eight had never traveled abroad.
- Fever, muscle pain & swelling, leukocytosis were common, but only 7 had erythema or fluctuance.
- Muscle may be woody-hard, tumor-like.
- Mimicked cellulitis, muscle hematoma, thrombophlebitis, appendicitis, neoplasm.
- 12 had non-penetrating muscle injury and 13 had pyoderma, suggesting that bacteria invade injured muscle via the bloodstream or lymphatic system.

Pyomyositis Images

- CT image of the thighs of a Micronesian boy who had recent blunt trauma to leg

- Surgical specimen of Samoan boy with en bloc resection for suspected rhabdomyosarcoma

A Polynesian man with acute weakness

- A 27-year-old Polynesian man was admitted because of chronic diarrhea and 1 day of bilateral leg weakness.
- 3 mos. PTA he began having 2-3 loose bowel movements per day, which increased to 3-5 times per day one week PTA.
- One day PTA he had generalized weakness. On the morning of admission he was too weak to get out of bed and was admitted.
- Exam: Muscle strength: 3/5 legs, 4/5 arms.
- Serum potassium 2.2 mEq/L
- Your Diagnosis?
Polynesian man with acute weakness

- His hypokalemia was initially attributed to intestinal losses. His weakness resolved within an hour after replacement of potassium chloride.
- On the day after admission, further questioning revealed that, in addition to increased frequency of bowel movements, he had noticed several months of increased appetite, heat intolerance, sweating, irritability, palpitations, dyspnea.
- For the past month he had noticed leg weakness.
Polynesian man with acute weakness

- Examination:
  - HR: 108 beats/min, temp 37.1 C, BP 152/83 mm of Hg, RR 24/min.
  - A fine tremor of the acanthosis nigricans on the neck and axillae.

- Your Diagnosis?
Polynesian man with acute weakness

- However, the hypokalemia seemed disproportionate to his modest intestinal symptoms, and further investigation led to the diagnosis of Thyrotoxic Periodic Paralysis.
- TTP, sometimes referred to as hypokalemic thyrotoxic periodic paralysis, is an uncommon but well described complication of hyperthyroidism particularly among young Asian males.
- TPP also occurs in Micronesians, Polynesians.

Hawaii Medical Journal. 2007. 66:60-3,
Polynesian man with acute weakness

- Why was this diagnosis delayed?
- The patient’s symptoms were described as “diarrhea”, which can cause hypokalemia.
- Diarrhea is medically defined as 3 or more watery stools per day.
- This patient was having frequent formed bowel movements, unlikely to cause potassium loss.
- Frequent bowel movements is a better term, and is a feature of hyperthyroidism.
- Gastroenterology researchers formally categorize stools...\footnote{J Clin Endocrinol Metab. 1992 Sep; 75(3):745-9.}
<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>Separate hard lumps, like nuts (hard to pass)</td>
</tr>
<tr>
<td>Type 2</td>
<td>Sausage-shaped but lumpy</td>
</tr>
<tr>
<td>Type 3</td>
<td>Like a sausage but with cracks on the surface</td>
</tr>
<tr>
<td>Type 4</td>
<td>Like a sausage or snake, smooth and soft</td>
</tr>
<tr>
<td>Type 5</td>
<td>Soft blobs with clear-cut edges</td>
</tr>
<tr>
<td>Type 6</td>
<td>Fluffy pieces with ragged edges, a mushy stool</td>
</tr>
<tr>
<td>Type 7</td>
<td>Watery, no solid pieces, entirely liquid</td>
</tr>
</tbody>
</table>

A 65-year-old man presented with a 3-week history of progressive fatigue and had become forgetful and confused. He had no abnormalities on cardiac, pulmonary, or abdominal examination. Creatinine 3.6

LP OP 29 cm water

Head CT & MRI reversible encephalopathy syndrome (PRES)

Contrast-enhanced MRI of the head and cervical, thoracic, and lumbar spine revealed no clinically significant stenosis or cord abnormality.
Ultrasound: a markedly distended bladder with an estimated residual urine volume of 1785 ml after voiding. A urinary catheter was placed, yielded 2900 ml of clear urine.

Symptoms and imaging findings resolved.

Final diagnosis obstructive nephropathy leading to a hypertensive emergency and PRES.
...critical of the normal abdominal examinations that missed the very large distended bladder.

Palpation and Percussion would have detected the bladder obstruction.

Editors reply:

We agree that the dependence of modern physicians on laboratory and imaging studies almost certainly makes the time to diagnosis longer than it would be with a physical evaluation by a skilled clinician.
Abdominal Percussion

- Markedly enlarged liver & spleen: Leishmaniasis

- Examples:
  - May be seen in lymphoma, leukemia, portal hypertension, et al.

- Often missed with palpation.

Percussion of the Abdomen

- Tympany is normally present over most of the abdomen in the supine position. Unusual dullness may be a clue to an underlying abdominal mass:
  - Liver
  - Spleen
  - Kidneys
  - Bladder
  - Uterus
  - Various tumors

http://medinfo.ufl.edu
Percussion for liver tenderness

- Liver tenderness can be an early sign of infections involving the liver.
- Careful punch tenderness, similar to examining the kidneys for pyelonephritis, can be an early clue to liver inflammation.
- Examples:
  - Viral hepatitis, liver abscess, leptospirosis, malaria, et al.
- Ascites can be detected when there is ...
Shifting Dullness
A 19-yr-old man with fever

- A 19-year-old man was well until 4 days
  PTA: rapid onset of fever, headache, neck pain, nausea, vomiting, diffuse myalgia and dry cough.

- ED visit: CXR showed right lung infiltration; pneumonia was diagnosed and he was treated with ceftriaxone 2g IV

  - DC for follow-up by his physician
Later that day he noted increased dyspnea, and began coughing blood.

He was admitted to the hospital

Social Hx: A greens worker at Kauai golf course. No alcohol, drugs, or tobacco, recent travel, sick contacts or local disease outbreaks.
Directed History and Exam

- No animal exposure
- No recent dengue outbreak
- Swam in Waimea River 2 weeks PTA
- No sinus or upper airway signs or symptoms
- No rash, skin lesions, petechiae
- No urine RBC casts
Chest Radiograph on admission
Chest Radiograph Day 2
Course

- DDx included multiple causes of diffuse alveolar hemorrhage (DAH) and kidney disease. (Pulmonary-renal syndrome)
- Goodpasture Syndrome rare (1/million/yr)
- Many special lab studies were all negative
- Kidney biopsy:
  - Pathology unremarkable was unremarkable
  - Caused retroperitoneal hemorrhage
- Total CK was elevated 600
Course

- 2nd leptospirosis IgM ELISA serology +
- Discharged home on day 14
- Final Diagnosis:
  - Acute leptospirosis with diffuse pulmonary hemorrhage, renal insufficiency, and possible rhabdomyolysis
Leptospirosis Case: What went wrong?

- Lack of knowledge of the many manifestations of leptospirosis.
  - Lack of literature including leptospirosis in DDx of DAH
    - Ignored history of swimming river.
    - Failure to seek early Infectious Diseases consultation.
    - MDs need to learn diseases in their locale.
A case of Pulmonary Lepto

www.infectiousdiseasenews.com/200305/wyd.asp
Injected icteric sclerae perhaps diagnostic. “suffusion” = injected
 Conjunctival suffusion with subconjunctival hemorrhage in a patient with leptospirosis

Diagnostic Clues to Weil Disease

- Abrupt onset fever with chills common
- Myalgia often remarkable, but may clear in few days (elicit this Hx)
- Hx. of exposure common, but not invariable.
- Conjunctival injection common.
- CPK often elevated.
- Leukocytois, platelets decreased.
- DAH seems common in Hawaii.
- A good sign for lepto ...
WARNING!
LEPTOSPIROSIS
HEALTH HAZARD
FRESH WATER STREAMS AND MUD POSSIBLY POLLUTED WITH BACTERIA
SWIM OR HIKE AT YOUR OWN RISK
FOR MORE INFORMATION CALL HAWAII DEPARTMENT OF HEALTH
22 year old athlete

- HPI: several weeks of malaise, fever, leg pain and emesis, noticed dark urine, 10 lb weight loss. Symptoms started 3 days after a new tattoo.
- Social: Athletic. Hunts wild pigs
- Exam: Temp 101.7, HR 110, BP 138/78, RR20,
- General: mild distress with shaking chill.
- mildly icteric.
- Slightly red, warm calves, which were very tender to palpation.
Leptospirosis

“Conjunctival suffusion and muscle tenderness, most notable in the calf and lumbar areas, are the most characteristic physical findings but may occur in a minority of cases”

Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases, 8th Ed. Gompf SG. Leptospirosis. Medscape; June 2013
Final Diagnosis

- BC positive for *Staphylococcus aureas*
- Staphylococcal endocarditis
- Multiple muscle abscesses in calves and several other muscles (Tropical Pyomyositis)
- How did I miss this Diagnosis?
  - I used *fast thinking and anchoring*. I should have asked “what else could it be.” (*analytical thinking*)
  - I omitted the history of a tattoo 3 days prior which was a likely source of infection
  - Pay attention to events just preceding onset.
Patient Vignette (QMC late 2013)

- Mid-age woman with malignant leiomyoma of uterus, complicated by ureteral obstruction and UTI requiring stents, is admitted for repeat chemotherapy.
- On exam she is chronically ill and lethargic.
- Labs show severe neutropenia.
- CT of abdomen reveals enlarging uterine mass with foci of air and a right perinephric abscess.
- Interventional radiology drains abscess.
Mid-age woman with malignant leiomyoma

- Abscess drainage:
- Findings: Foul smelling, pale fluid removed and sent to laboratory.
  - How do you order the microbiology request?
How to order the microbiology request?

- Indicate source of fluid so lab knows it is from a usually sterile body fluid, e.g., percutaneous drainage, CSF, pleural fluid, etc.
- Place in the correct container (ask lab)
- Person obtaining the procedure must ensure prompt delivery to the lab
- Gram stains are a rapid diagnostic test.
- At QMC Gram stains are sent off campus and take a day to report; so order all gram stains “stat.” Stat tests are done at QMC and reported same day. Gram stains can be reviewed here by team physicians.
Clinical Course

- She becomes septic and is empirically treated with imipenem, ciprofloxacin and metronidazole.
Perinephric abscess

“miscellaneous culture” results:

- **Gram Stain:**
  - 1+ WBC
  - 3+ Gram + Cocci
  - 4+ Gram + Rods
  - 2+ gram – Rods
  - 1+ yeast

- **Culture:**
  - 2+ *Candida albicans*
  - 2+ *Enterococcus sp.* Pan-sensitive
Clinical Course

- After culture results returned, treated with vancomycin, cefepime and caspifungin
  - No coverage for anaerobic bacteria
- Patient, develops septic shock and expires.
- No autopsy requested.
Comments

- Perinephric abscess, “miscellaneous culture” results:
  - 2+ *Candida albicans*
  - 2+ *Enterococcus sp.* Pan-sensitive

- Blood culture positive for *Candida*

- The “miscellaneous culture” does not culture for anaerobes; additional methods required.

- Anaerobic cultures take days; identification and susceptibility testing is complex.

- Check pus for putrid or foul odor.

- Order aerobic & anaerobic cultures of pus from most normally sterile sites.
Final Diagnosis

- Perinephric abscesses usually originate in the kidney.
  - Anaerobic infections of the kidney are rare
- Perinephric abscess can also stem from bacteremia (e.g., Staphylococcus)
- Or from adjacent infection.
- The subject patient had an extensive necrotic pelvic tumor containing gas, suggestive of a pelvic anaerobic infection that spread to adjacent perinephric space.
- The important clues are the foul odor and the Gram stain morphology
History Anaerobic Bacteria

- Altemeier, in the late 1930s, isolated anaerobic bacteria from 96 of 100 appendicitis patients.
- He also noted that putrid discharge was found exclusively in the presence of infections involving anaerobic bacteria and that these were also the only organisms to produce the characteristic odor both in vivo and in vitro.
- Foul odor is due to volatile fatty acid production typical of many anaerobes.

Anaerobic Bacterial Infections

- Anaerobic bacteria are infrequent pulmonary pathogens, but may cause serious disease.
- Clues for anaerobic pneumonia include aspiration risks, putrid discharge, indolent course, and necrotizing pneumonia.
- Putrid discharge as sometimes found with lung abscess or empyema cases is considered diagnostic of anaerobic infection because these agents, ... are the only microbes that produce the short-chain volatile fatty acids responsible for this distinctive odor.
- Treatment includes drainage of pleural collections and antimicrobials, including clindamycin or a β-lactamase/β-lactamase inhibitor.

John G. Bartlett MD
Infectious Disease Clinics of North America, 2013-03-01, Volume 27, Issue 1,
Anaerobic infectious lung diseases

- 68-year-old man with a several-weeks of cough, blood in the sputum, 6.8-kg weight loss; otherwise in good health.
- He had extensive tooth decay and gingival inflammation.
- Also causes indolent empyema.
- A risk of aspiration

An important clue to anaerobic infections

- Anaerobic bacteria inhabit gingival crevices.
- Gingivitis allows increased anaerobes.
- Increased numbers increase risk of anaerobic infections of lung, brain, neck etc.
- Rarely included in H&P notes, or perhaps just “poor dentition.”

meth mouth
Bedside Diagnosis of Anaerobic Infections

- Infections at particular sites, especially those proximal to mucosal surfaces with indigenous anaerobic flora, particularly in the GI tract, the female genital tract, or the oral cavity. Anaerobes are often associated with tissue necrosis and abscess formation.

- The presence of a foul odor or gas is highly suggestive as well, although the absence of these factors does not rule out anaerobic infection.

- Often polymicrobial, Gram stain of exudates showing a polymicrobial flora and organisms with morphologic features of anaerobes are indicative of anaerobic infection.
Legionella pneumophila Pneumonia

- Infection in a 42-yr-old man which led to the diagnosis of acute leukemia.

Some Pneumonia Learning Points

- IDSA, ATS, and the NIH recommend testing for Pneumococcal and *Legionella* infection in all patients with severe CAP or those who require hospitalization.

- Early diagnosis of pneumonia is important.

- Rapid diagnostic tests for infection, e.g., sputum Gram stain, urinary antigen tests, etc,
  - Order STAT! Done in the hospital lab within hours.

- Routine ordered tests are sent to DLS main lab and are not available until the next day.

- National Institute for Health and Care Excellence. Pneumonia in adults: Diagnosis and management. [https://www.nice.org.uk/guidance/cg191](https://www.nice.org.uk/guidance/cg191)
Rapid Tests for Pneumonia Pathogens

Diagnosis: Other testing

**Urinary antigen tests**
- *S. pneumoniae & L. pneumophila* serogroup 1
- 50-80% sensitive, >90% specific in adults
- Pros: rapid (15 min), simple, can detect *Pneumococcus* after abx started
- Cons: cost, no susceptibility data, not helpful in patients with recent CAP (prior 3 months)

Sepsis in an 88-year-Old Okinawan-American Man with New-Onset Asthma
An 82 yr Okinawan man with dyspnea

- Born & raised Hawaii, visited Okinawa as child, Italy WW II
- 1 yr. PTA diagnosed as asthma; treated with bronchodilators and prednisone; symptoms progressed, mental status worsening.
- Hospitalized, given high dose steroids for asthma.
Patient Examination

- Afebrile
- Alert, moderately dyspneic
- Bibasilar rhonchi
- Remainder of exam unremarkable
- Dx: Asthma/COPD exacerbation
- Treated with higher doses of corticosteroids and antimicrobial agents
Chest film on admission: diffuse interstitial infiltrates
Patient Examination

- Remains afebrile
- 2nd day: abdominal distension, sepsis, coma, respiratory failure; intubated
Chest film 2 days later
Your assessment and plan

- Differential Diagnosis?
- Management?
- BAL sputum sent for bacterial cultures and cytology.
Similar case

- Kalb RE, Grossman ME. 1986; JAMA. 256:1170-1

Abdomen

Skin biopsy with larvae
Cytology exam of BAL: Diagnosis?
CSF normal except for 1 motile larva (est. 400 X 15 micron)
Diagnosis

- Probable pulmonary strongyloidiasis manifesting as asthma for 1 yr.
- Acut disseminated *Strongyloides stercoralis* infection induced by high-dose corticosteroid therapy for asthma
  - Invasion of gut, skin, lung, CSF
  - No CSF inflammation
- Sepsis due to probable parasite-induced enteric bacteremia
Acute Strongyloidiasis in an American soldier.

- 1993: 12 soldiers had 1 month of duty in rural areas of Laos & Vietnam.
- Extensive soil exposure
- A week after return, 2 developed diarrhea, pruritic rash, intense eosinophilia.
- Strongyloides larvae easily detected in stool.
A SERIES OF UNFORTUNATE STRONGYLOIDES-RELATED EVENTS Abigail Santos, MD¹, Erin Crossey, MD², Therese Posas-Mendoza, MD³, James Joyner, MD⁴, Heath Chung, MD

64 year-old man with vasculitis on chronic steroids...was re-admitted for acute respiratory failure...and diffuse alveolar hemorrhage (DAH) ... Repeat bronchoscopy was performed and microscopy of BAL this time revealed Strongyloides larvae. Ivermectin was initiated and steroids were discontinued, however patient continued to clinically deteriorate and ultimately expired.

Strongyloides infection is presumed to have been chronic and subclinical given patient was from an endemic region with no recent travel and no GI symptoms.
Strongyloidiasis Cases in Hawaii

- *Strongyloides stercoralis (S.s.)*: an intestinal helminth endemic in tropics, but not Hawaii.
- Infection is lifelong and diagnosis is difficult.
- Larvae may disseminate in steroid Rx hosts.
- Four cases of dissemination at QMC 1996-98:
  - All were immigrants from Asia-Pacific region
  - 3 fatalities; hospital costs $157-350,000
- A QMC review of clinical serodiagnostic studies found latent infections in 10-40 % of Micronesians, non-Hawaiian Polynesians, Filipinos, SE Asians.

Disseminated Strongyloidiasis (DS)

- True incidence of DS in developed world is uncertain.
  - Problem of under-diagnosis:
    - Physician’s lack of knowledge
    - Syndrome often non-specific
    - Lack of patient geographic Hx
    - Low index of suspicion
    - Insensitivity of routine diagnostic tests
    - 50% Dx at autopsy; low autopsy rates
- Often fatal in spite of treatment.
Strongyloidiasis: Prevention

- Before hi-dose steroid or other immunosuppressive therapy, e.g. transplantation:
  - Take immigration & travel Hx
  - Serodiagnostic screening of patients who resided in endemic areas, e.g. immigrants, veterans.
  - If sero +, ivermectin Rx 7d; rep. monthly
  - ID consultation

- If steroid therapy needed acutely, begin ivermectin therapy while awaiting serodiagnostic test results.
Endophthalmitis-lLiver abscess case in a Micronesian with diabetes
Seven cases of pyogenic liver abscess associated with septic endophthalmitis during a recent four-year period. The causative organism was a pure culture of *Klebsiella pneumoniae*. Chest roentgenographic examination showed pulmonary embolization in four patients, purulent meningitis in one patient, and suspicious prostatic abscess in one patient. Internists, should be alert to endophthalmitis whenever a patient with pneumoniae or liver abscess complains of ocular symptoms.
A 68-year-old man of Korean ethnicity with type 2 diabetes mellitus ...

... presented with acute-onset fever, abdominal pain, right eye visual disturbance, and hypotension. Cultured Klebsiella with specific mucoid colonies types associated with virulence.
Klebsiella Liver Abscess in Hawaii

- Here in Hawaii we are seeing the Klebsiella liver abscess with metastatic infection to eyes, lung, CNS resembling the cases seen in Taiwan.

- One occurred in a visiting Caucasian tourist who had Klebsiella bacteremia with metastatic brain abscesses, lung abscesses, and bilateral panophthalmitis.
CONCLUSION
Tips for Diagnosing Infections

- Who is the patient? Chronic diseases, occupation, activities, travel, country of origin, etc.

- Clarify the symptoms the patient describes:
  - Use the patient’s words.
  - What improves/worsens, severity (SOCRATES)
  - Think anatomically.

- What is the chronology of the acute illness?

- “How did your problem begin”

- Tell the patient’s story.
Tips for Diagnosing Infections

- Create an acute problem list of all the remarkable symptoms and signs, abnormal labs, imaging, etc.

- Symptoms: A + B + C = Diagnosis

- Create a differential Dx. for all the above.
  - Don’t leave anything out.
  - Don’t have parts left over.
  - Consider the pros and cons for each DDx.
2019
ACP Hawai‘i Chapter
Scientific Meeting

Theme:
“The Art of Being an Internist”
Artificial language: a language devised for … some more specific purpose … but not the native speech of its users.
- Ex. Physicians convert patients’ symptoms into medical terminology.
- ICD-10 contains codes for diseases, signs and symptoms, abnormal findings, complaints

Artificial intelligence: a branch of computer science dealing with the simulation of intelligent behavior in computers … the capability of a machine to imitate intelligent human behavior.
- use ICD codes: risk of garbage in, garbage out!
Diagnosis: Painting by Numbers?

- Artificial intelligence using artificial language e.g., ICD codes may be like painting by numbers.
Art: another definition:

- a skill acquired by experience, study, or observation
- an occupation requiring knowledge or skill. *Internal Medicine*

- Thank you!