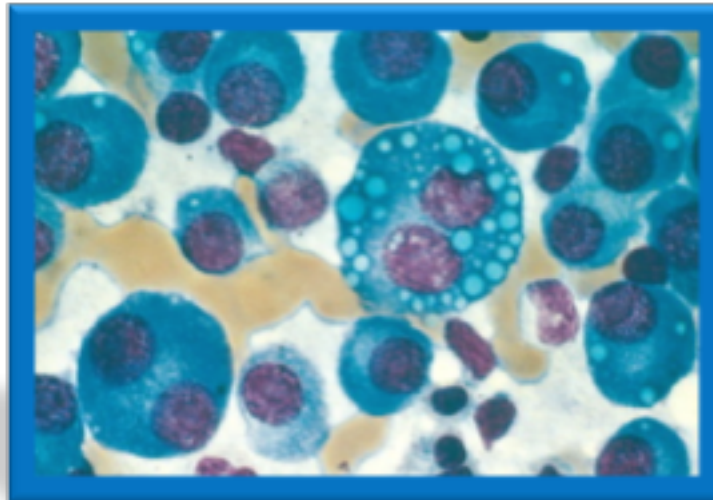
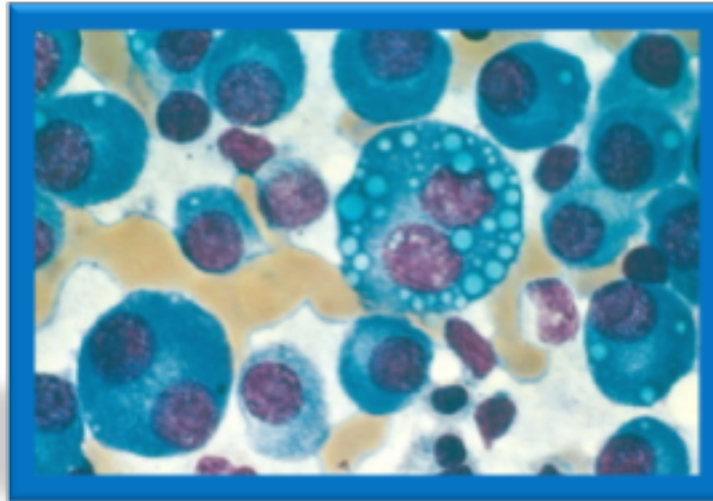


Podcast (Video Recorded Lecture Series):
Bone Tumors, Multiple Myeloma for the USMLE Step One Exam



Howard J. Sachs, MD
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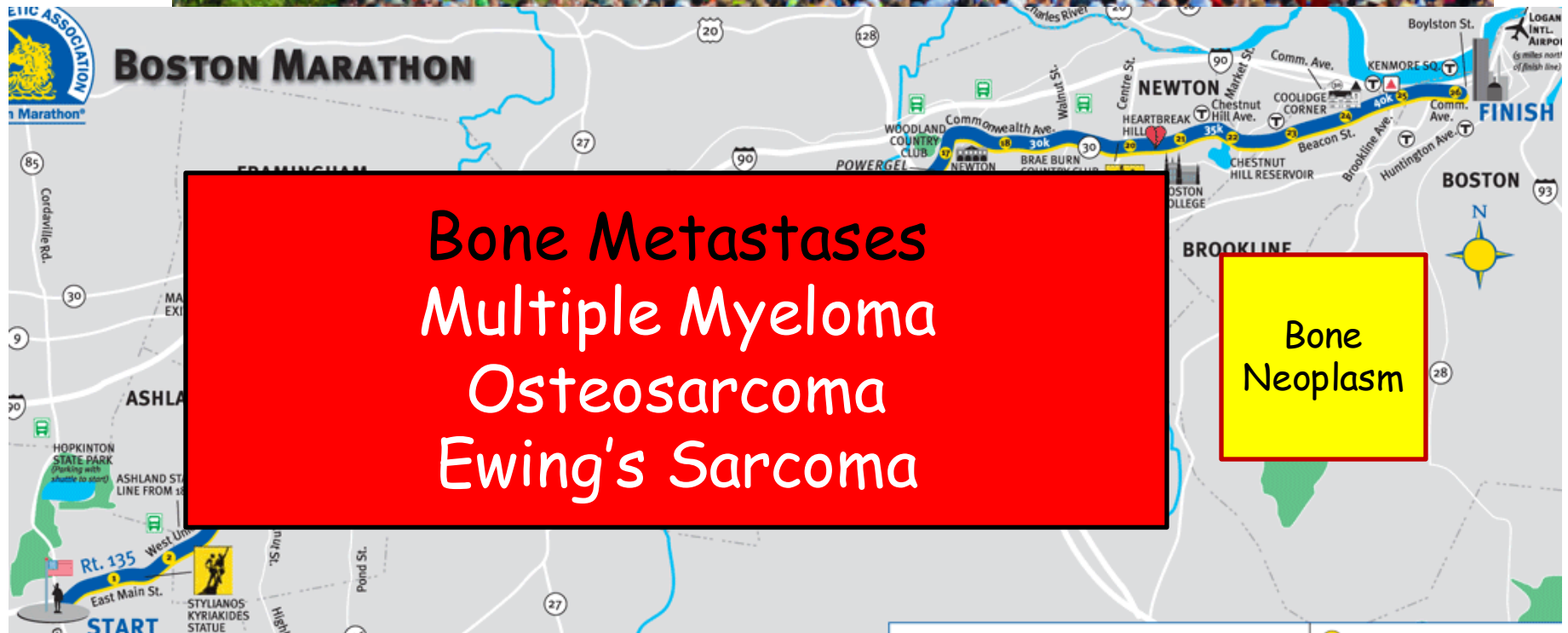
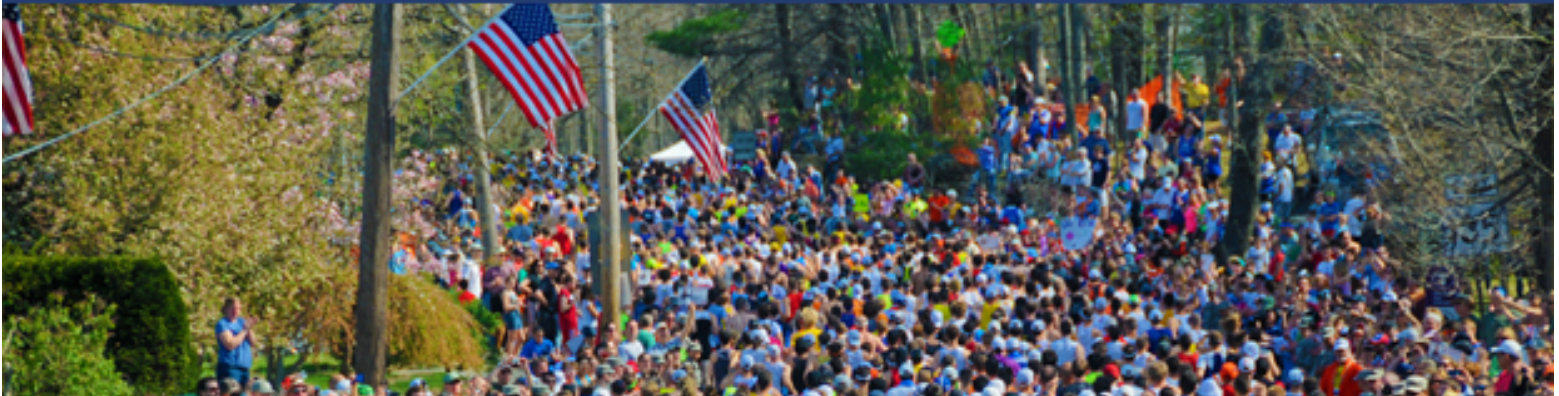
Tutorial Services

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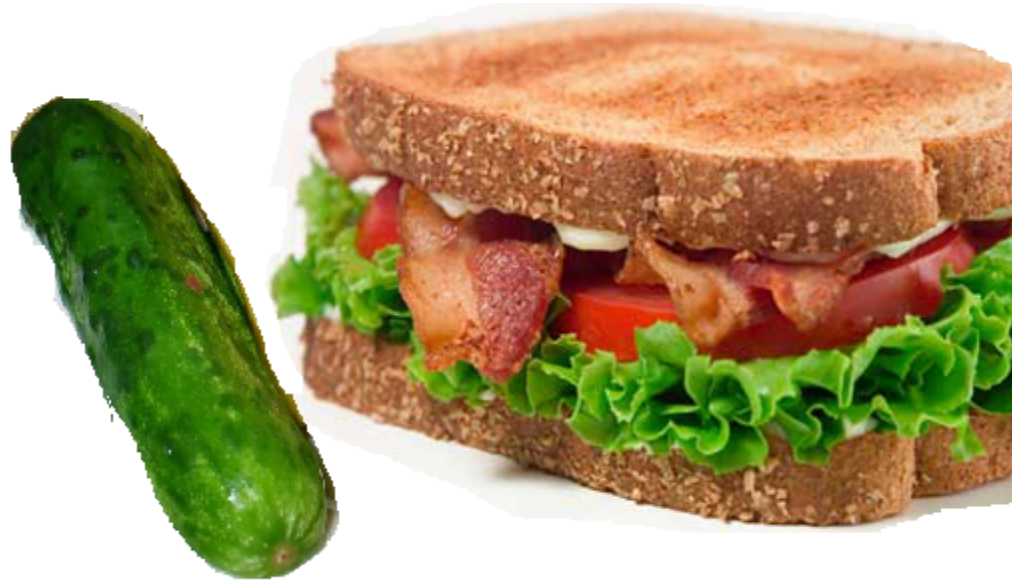
**117TH BOSTON
MARATHON**

Rheumatology Review



FH: 'My parent had bone cancer...'

B, L, T with a Kosher Pickle by Matt L Most, MD



Breast, Lung, Thyroid, Kidney, Prostate, Myeloma, Lymphoma, Melanoma

FH: 'My parent had bone cancer...'

B, L, T with a Kasher Pickle by Matt L Most, MD

Breast, Lung, Thyroid, Kidney, Prostate, Myeloma, Lymphoma, Melanoma

Bone Lesions that are...

Blastic (Sclerotic)

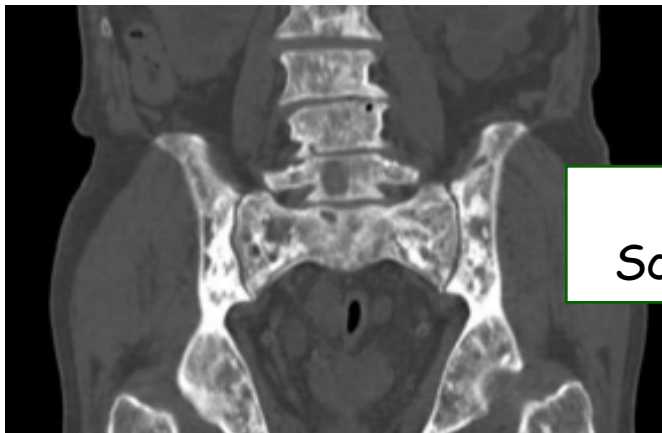
Mixed

Lytic

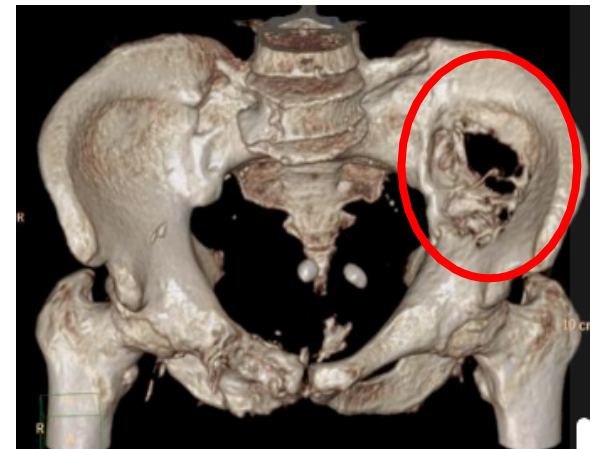
Prostate → PSA

Breast

L, K, T



Bony
Sclerosis



Which of the following is a bogus indication for ordering an SPEP in the first place?

1. Osteoporosis
2. Peripheral Neuropathy
3. Chronic Kidney Disease
4. Chronic Liver Disease
5. Chronic Obstructive Lung Disease
6. Chronic Restrictive Lung Disease
7. Normocytic Anemia
8. Bone Pain (esp in the elderly)

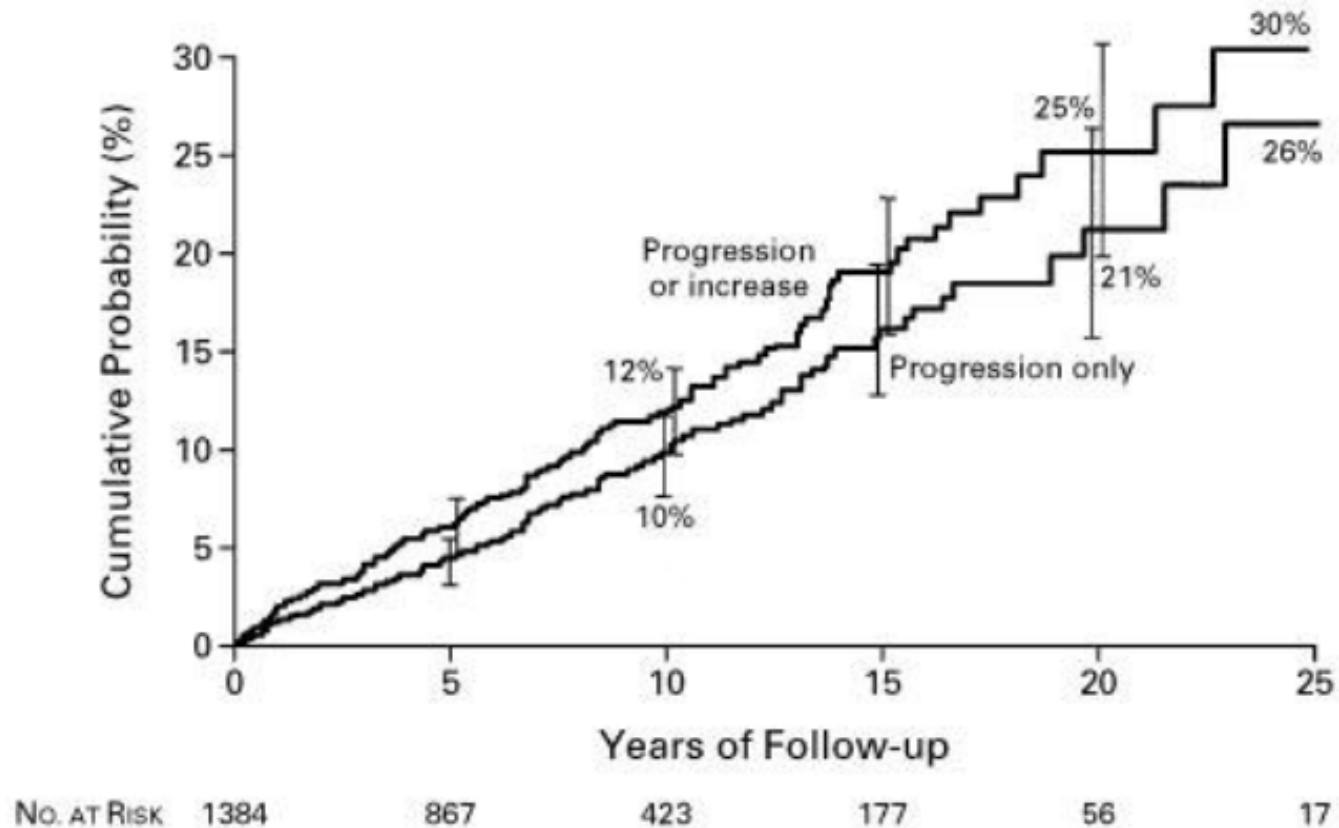
Which of the following is a bogus indication for ordering an SPEP in the first place?

1. Osteoporosis
2. Peripheral Neuropathy
3. Chronic Kidney Disease
4. Chronic Liver Disease: α -1AT, Cirrhosis (polyclonal gammopathy)
5. Chronic Obstructive Lung Disease: α -1AT
6. **Chronic Restrictive Lung Disease**
7. Normocytic Anemia
8. Bone Pain (esp in the elderly)

All the other choices are appropriate indications.
Paraproteinemia can cause any of these problems.

Probability of MGUS Progression Over Time

~ 1%/yr



Multiple Myeloma - Diagnosis

If these are MGUS criteria, what would you expect for Myeloma criteria?

M-Component \leq 3.0 g/dl

No Anemia, Bone Lesions, Hypercalcemia

< 10% Plasma Cells in Bone Marrow

Multiple Myeloma - Diagnosis

- Diagnosis Based on Several Criteria
 - $\geq 10\%$ Plasma Cells in Bone Marrow
 - Monoclonal Protein in Serum or Urine
 - One or More of Following:
 - Hypercalcemia (> 10.5 mg/dl) *Cytokine-mediated*
 - Serum Creatinine > 2.0 mg/dl *(Myeloma kidney; 3)*
 - Anemia (Hgb < 10 g/dl)
 - Lytic Bone Lesions *(skeletal survey)*

Multiple Myeloma - Diagnosis

- Diagnosis Based on Several Criteria

- $\geq 10\%$ Plasma Cells in Bone Marrow
- Monoclonal Protein in Serum or Urine
- One or More of Following:

- Hypercalcemia (> 10.5 mg/dl)
- Serum Creatinine > 2.0 mg/dl
- Anemia (Hgb < 10 g/dl)
- Lytic Bone Lesions

M-Component ≤ 3.0 g/dl

No Anemia, Bone Lesions, Hypercalcemia
 $< 10\%$ Plasma Cells in Bone Marrow

You order an SPEP (evaluation: CKD, OP, IPN, Polyarthralgia, Anemia.
Comes back with a gammopathy → What do you do?

Serial: SPEP, CBC, basic metabolic profile (Cr, Ca^{+2}), urinalysis
Low imaging threshold: Skeletal Survey

Test	Result
PROTEIN, TOTAL	7.1 g/dL
Albumin	3.9 g/dL
Alpha-1 Globulin	0.3 g/dL
Alpha-2 Globulin	0.8 g/dL
Beta 1 Globulin	0.4 g/dL
Beta 2 Globulin	0.3 g/dL
Gamma Globulin	1.4 g/dL
Protein Electrophoresis, Abnormal Band 1	0.9 g/dL
REFERENCE RANGE: NONE DETECTED	
Protein Electrophoresis, Interpretation	See Below
Evaluation reveals a restricted band (M-spike) migrating in the gamma globulin region. Consider immunofixation analysis if indicated.	
Immunofixation (IFE), Serum	See Below
IgG kappa monoclonal band present.	

Test	Result
White Blood Cell Count	8.9 th/mm ³
Red Blood Cell Count	4.30 mil/mm ³
Hemoglobin	13.8 g/dL
Hematocrit	40.0 %
MCV	92.9 fl
MCH	32.2 pg
MCHC	34.6 g/dL
RDW	13.1 %
Platelet count	243 th/mm ³

Calcium	9.7 mg/dL
Creatinine	0.79 mg/dL

Urine Color	Yellow
Urine Appearance	Clear
Urine Specific Gravity	1.009
Urine pH	6.5
Urine Protein	Negative
Urine Glucose	Negative
Urine Ketones	Negative
Urine Bilirubin	Negative
Urine Occult Blood	Negative

Does this lady have MGUS or myeloma?
Risk of MPD?

Multiple Myeloma - Diagnosis

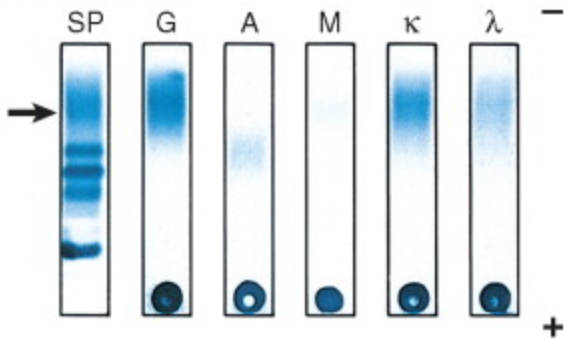
- Diagnosis Based on Several Criteria
 - ≥ 10% Plasma Cells in Bone Marrow
 - Monoclonal Protein in Serum or Urine
 - One or More of Following:
 - Hypercalcemia (> 10.5 mg/dl)
 - Serum Creatinine > 2.0 mg/dl
 - Anemia (Hgb < 10 g/dl)
 - Lytic Bone Lesions

Especially LBP in elderly...

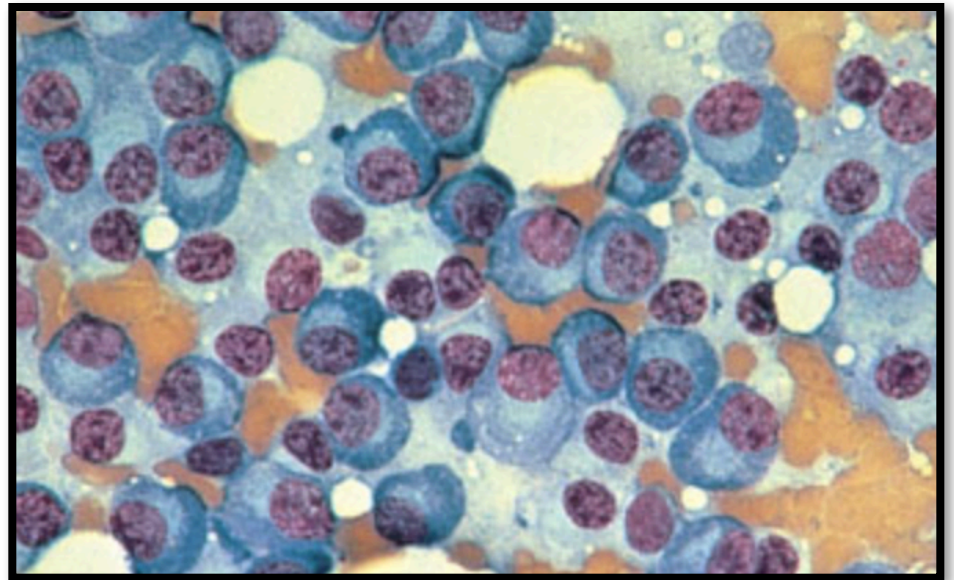
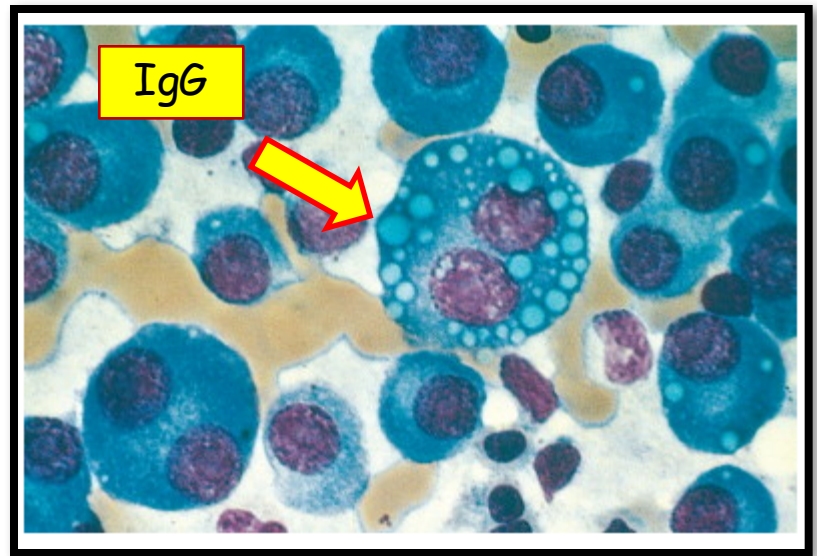
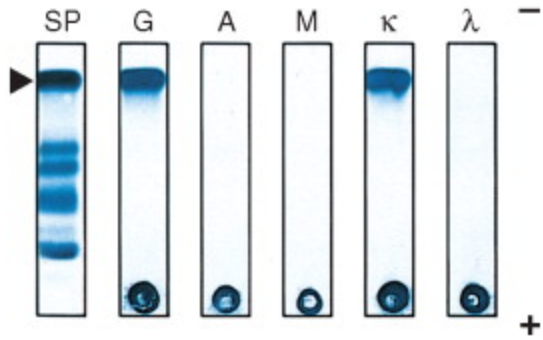
Other MM vocabulary: i) Rouleaux Formation, ii) Infection with encapsulated organisms such as S. PNA, iii) Azotemia with cast nephropathy

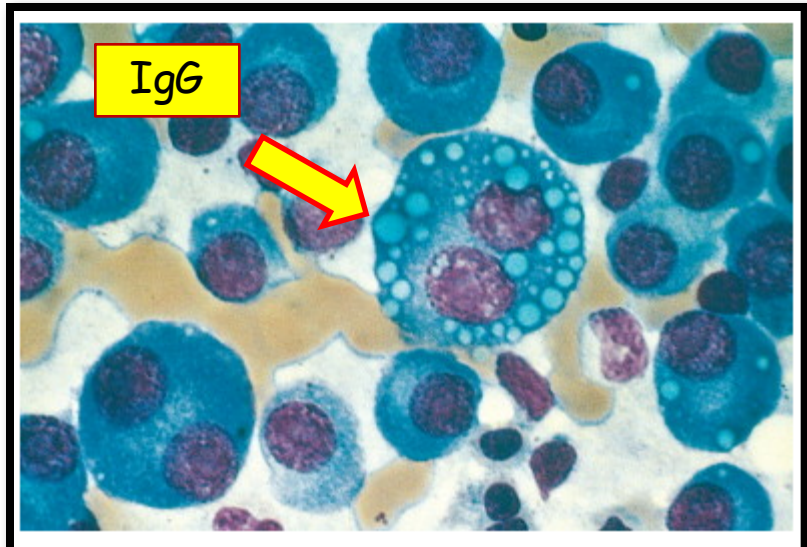
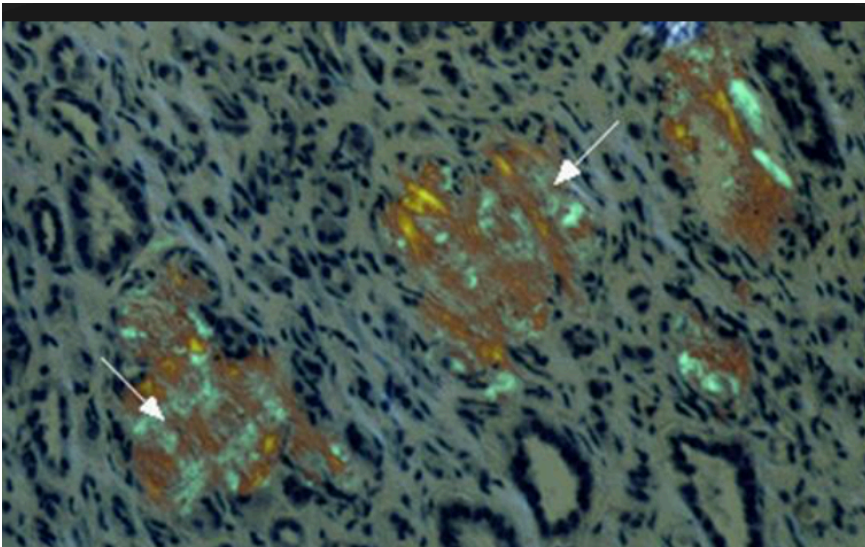
SPEP/IPEP

Normal serum



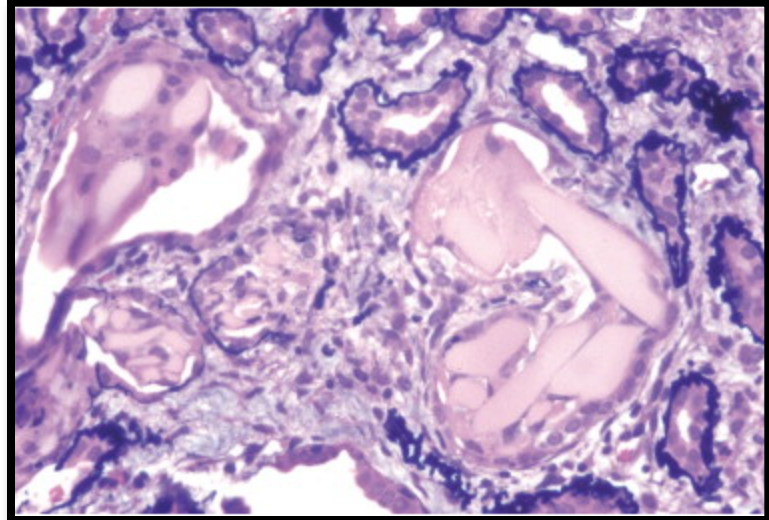
Patient serum





AL: Amyloid

Light-chain cast nephropathy
(toxic to tubule cells in high quantity)



Presentation: Elderly patient with LBP
Labs: Anemia, \uparrow Cr, \uparrow Ca²⁺. X-ray: Vertebral compression fracture.
Renal biopsy: amorphous, **eosinophilic** material clogging the collecting tubules



Why is this dude hypercalcemic?

Mechanisms of Hypercalcemia in Malignancy (choose one):

- A. Cytokines → bone destruction
- B. PTHrP
- C. 1α -hydroxylase (MΦ)



Why is this dude hypercalcemic?

Mechanisms of Hypercalcemia in Malignancy:

- A. Cytokines → bone destruction
- B. PTHrP
- C. 1α -hydroxylase ($M\Phi$)

Secretion of cytokines (IL-1, osteoclast activating factor)



Stimulates osteoclasts → 'punched out' bone lesions.

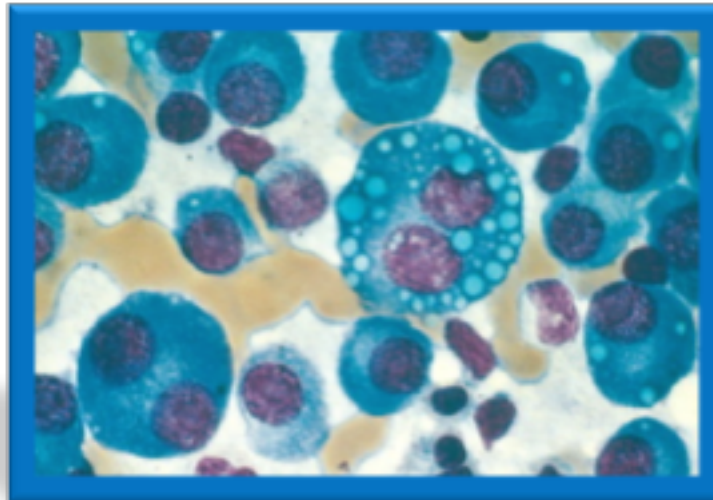


Hypercalcemia is secondary to bone destruction

What you need to know about Myeloma?

- Background
 - Distinguish from MGUS
- Pathology
 - Plasma cell neoplasm
 - If isolated and solitary → plasmacytoma
- Clinical Presentation
 - **Bone**: 'punched out' lesions, pathologic fracture (esp back in elderly)
 - **Hypercalcemia**: 2° IL-1
 - **Renal** (insufficiency)
 - Light chain cast **nephropathy** (light chains are toxic),
 - Amyloid deposits (AL); may present with **nephrotic** syndrome
 - **Heme**: Anemia, high ESR, Rouleaux formation
 - **Infection**: esp encapsulated **organisms**
- Diagnosis: Gammopathy on SPEP/IFE with associated clinical features

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