
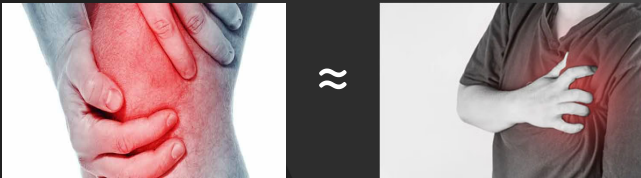


Microbes, crystals and many myths:
The acutely inflamed joint in the ED

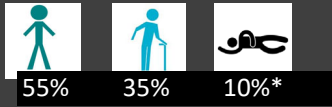


Tim Bongartz
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Septic arthritis? Acute coronary syndrome?




Septic arthritis:
prognosis



55% 35% 10%*

*40-50% bacteremia

Kaandorp et al., Arthritis Rheum 1997



48 y/o female with rheumatoid arthritis and a 2-day hx of right knee pain

PMHx: 14 year hx of RA, on Enbrel and prednisone 5mg daily

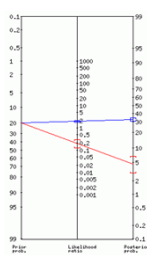
Vitals: Afebrile, pulse 98BPM, BP 135/82, RR 16

Exam: right knee warm, swollen, limited ROM but weight bearing

Clinical decision making: integrating probabilities

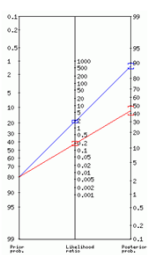
Sensitivity 90%
Specificity 53%

Pre-test Likelihood: 20%



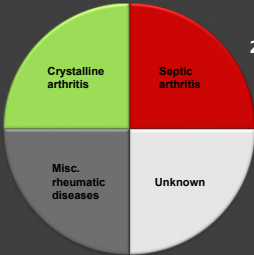
Sensitivity 90%
Specificity 53%

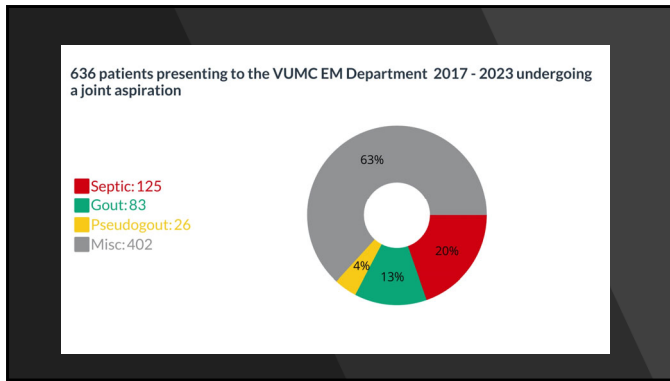
Pre-test Likelihood: 80%



Causes of inflammatory arthritis in the ED

Ernst et al., South Med J. 2010
Jeng et al., American J. of EM 1997






Clinical risk factors of septic arthritis

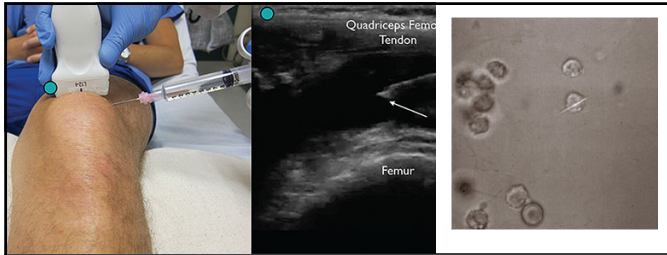
Diabetes mellitus	RR 4.1
Rheumatoid arthritis	RR 2.8
Recent joint surgery	RR 6.9
Skin infection	RR 3.6

Margaretten et al., JAMA 2007



Acute mono and oligoarthritis : basic tests


- **Blood:**
CBC, Electrolytes, blood cultures, serum uric acid (?), procalcitonin (?), CRP (?)
- **Synovial fluid analysis:**
Cell count and diff., crystal analysis gram stain/cultures, glucose (?), Lactate (?)
- **X-ray**



Arthrocentesis
(you are allowed to use US guidance - it's not a sport)

Quadriceps Femur Tendon
Femur

The image shows a three-panel view of an arthrocentesis procedure. The left panel shows a clinician performing the procedure on a patient's knee. The middle panel is an ultrasound image showing the needle's path relative to the femur and quadriceps femur tendon. The right panel is a microscopic view of synovial fluid showing several large, negatively birefringent, rhomboid-shaped crystals characteristic of calcium pyrophosphate dihydrate (CPPD).



Septic arthritis: microbiological analysis of SF

1. In sterile container: culture and Gram stain (~20-40% sensitivity)
2. Send cell count and crystals separately from culture
3. Inoculate BacTEC™ bottles ??

The image shows a rack of various colored test tubes, representing the collection of synovial fluid for microbiological analysis.




Blood

- WBC: 8600/mcl
- CRP: 44 mg/l
- Procalcitonin 0.2 ng/ml

Synovial fluid

- Leukocytes: 26500/mcl
- SPMNC: 95%
- Crystals: negative
- Gram stain: negative
- Glucose 35 mg/dl


The image shows a close-up of a patient's knee joint, which appears slightly swollen and red, consistent with the clinical findings of septic arthritis.



What now?

- 1) Start the patient on Vancomycin and Rocephin, consult ortho, admit
- 2) Start on prednisone 20mg, discharge with strict return precautions, arrange f/u with Rheumatology
- 3) Start on NSAID, discharge with strict return precautions, arrange f/u with Rheumatology
- 4) Let the 1st year Ortho resident decide for you

Myth 1: relax, there is no fever...

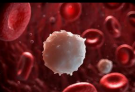
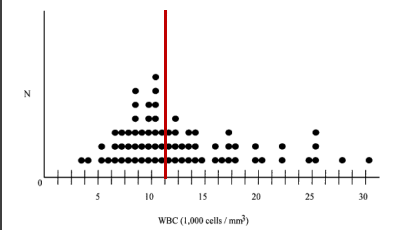


56-43% Prevalence of temperature <37.5 in septic arthritis

LR for septic arthritis if patient is febrile **0.67-1.13**

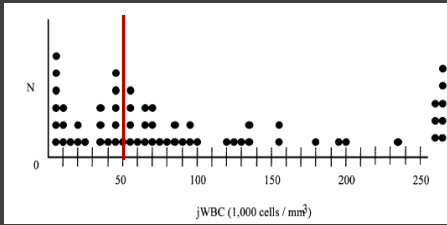
Margaretten et al., JAMA 2007
Couderc et al., CJEM 2015

Myth 2: relax, the WBC is normal

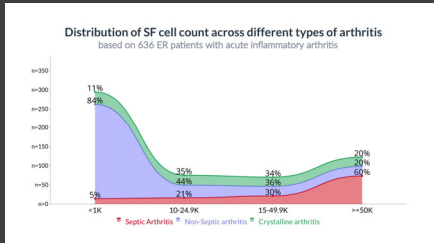
Li et al., Acad Emerg Med. 2004

Myth 3: relax, the synovial cell count is low...



Li et al., Acad Emerg Med. 2004

Myth 3: relax, the cell count is low...



Myth 3: relax, the cell count is low...

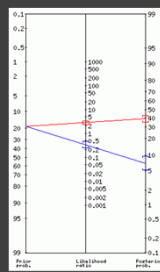
Synovial white cell count

- <25 000/mcl LR 0.3 (0.33)
- ≥25 000/mcl LR 2.9 (2.80)
- >50 000 LR 7.7 (4.23)


Synovial polymorphonuclear cells

- ≥90% LR 3.4
- <90% LR 0.3

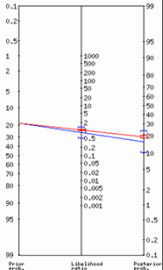
Margaretten et al., JAMA 2007




Myth 3: relax, the cell count is low...



10.000-25.000/mcl: LR 0.8 (!)



Anything else that could help us?



Uric acid and/or CPPD crystals in the septic joint: 1.5-21%

Shah K et al., J Emerg Med 2007
Papanicolas L et al., J Rheumatol 2012


Anything else that could help us?



Serum-CRP in septic arthritis

	Sensitivity (95% CI)	Specificity (95% CI)	+LR	-LR
CRP ≥ 10mg/l	0.78 (0.59,0.97)	0.40 (0.21,0.59)	1.3	0.55


Morgenstern et al., J Rheum 2018

Anything else that could help us? 

Serum-Procalcitonin in septic arthritis



	Sensitivity	Specificity
Procalcitonin \geq 0.5 ng/ml	35 – 91%	80-100%


Based on 6 studies that used a threshold of \geq 0.5 ng/ml Walinga et al., Bone Joint J 2021

Anything else that could help us? 

Synovial Glucose

Sensitivity


Glucose level of \leq 32.4 mg/dl Omar et al., Clin Rheumatol 2017		100 %
Glucose level \leq 40.0 mg/dl Dey et al., Rheumatology 2023		59 %

Anything else that could help us? 

Synovial Glucose

	Sensitivity (95% CI)	Specificity (95% CI)	+LR	-LR
Glucose \leq 40mg/dl	0.59 (0.48,0.69)	0.86 (0.75,0.92)	4.21	0.48


Dey et al., Rheumatology 2023

Anything else that could help us? 

Synovial Lactate

	Sensitivity (95% COI)	Specificity (95% COI)	+LR	-LR
Lactate ≥ 5mmol/l	0.56 (0.32,0.78)	0.77 (0.67,0.84)	2.43	0.57
Lactate ≥ 10mmol/l	0.36 (0.22,0.53)	0.99 (0.96,1.00)	36	0.65

Purely ED based cohorts: sensitivity lower, specificity estimates similar Dey et al., Rheumatology 2023


Anything else that could help us? 

Biofire® Joint Infection Panel

39 Targets (15 gram positive, 14 gram negative, 2 yeast, and 8 antimicrobial resistance genes)


	Sensitivity	Specificity
For "on-panel organisms"	91.7	99.8
For any septic arthritis	56-69%	100%

Hoffmann et al., Infect Dis Ther 2023



<u>Blood</u>	
• WBC:	8600/mcl
• CRP:	44 mg/l
• Procalcitonin	0.2 ng/ml

<u>Synovial fluid</u>	
Leukocytes:	26500/mcl
SPMNC:	95%
Crystals:	negative
Gram stain:	negative
Glucose	35 mg/dl



Septic arthritis: microbiological spectrum (in %)

MSSA	41.5
MRSA	17.9
Strep	17.1
Gram-neg	7.8
Polymicrobial	8.2

Ross. J et al., OFID 2020

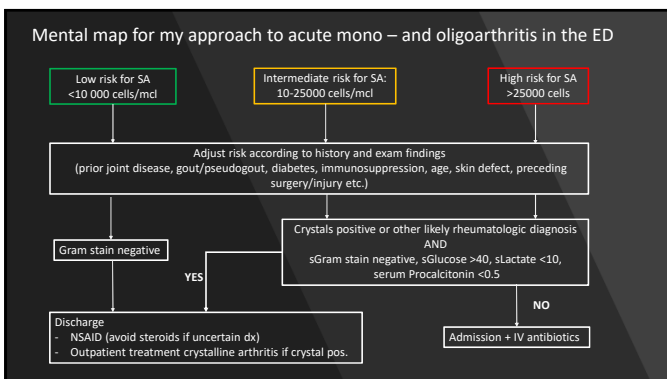


Septic arthritis: treatment

IV-antibiotics:


- Vancomycin (25mg/kg) +/-
- Ceftriaxone 2g (if (?) risk factors present: immunosuppression, IV drug use, diabetes etc.)

Orthopedic consultation: lavage (?)



Disclosures

none



The European Bone & Joint Infection Society

Guideline for management of septic arthritis in native joints (SANJO) 2023

- No clinical parameter/exam finding can exclude or confirm SANJO
- (CRP) has neither the sensitivity nor specificity to confirm or exclude SANJO
- Low synovial white blood cell count (< 25 000 cells μL^{-1}) decreases post-test probability, but it cannot exclude SANJO
- Gout and pseudogout may also increase levels of white blood cell count in the joint. Nevertheless, the presence of crystals does not rule out SANJO
