Level of Agreement of the microscopic analysis of joint aspirate for the diagnosis of gout

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Statement of Purpose and Literature Review

Although clinical findings and laboratory serum markers are additionally utilized, the purported gold standard test for the diagnosis of gout is microscopic analysis of joint fluid aspirate [1-8]. Gout is defined by the presence of needle-shaped monosodium urate crystals which are negatively birefringent when viewed under polarizing light parallel to the axis of the microscope lens. There is the potential for subjectivity within this definition, however, when considering that it is made by one physician looking at one sample underneath a microscope. In fact, our group has previously shown relative subjectivity with a different gold standard diagnostic test relying on microscopic analysis [9].

For patients with suspected lower extremity gout within the Temple University Health System, the physical act of the joint aspiration is typically performed by either the Rheumatology or Podiatric Surgery services with definitive microscopic fluid analysis performed by the Pathology service. However, it is common in clinical practice for the Rheumatology service to perform their own microscopic joint fluid analysis and reach their own diagnosis prior to and independent of the official report of the pathologist.

The objective of this retrospective, observational investigation was to identify the concordance of the microscopic analysis of joint aspirate for the diagnosis of gout between the Pathology and Rheumatology services within a single health care center.

Methodology

Following IRB approval, a retrospective analysis was performed utilizing a CPT code search to identify consecutive patients seen by the Temple University Hospital Department of Rheumatology for suspected lower extremity gout for which a diagnostic joint aspiration was performed. We searched for patients with a diagnosis of gout and synovial fluid on file. Patients were included if the synovial fluid sample was obtained in the respective time frame and evaluated by both rheumatology and pathology. The lower extremity was defined as the knee, ankle and/or foot. A three-year data collection period (1/2013-12/2015) was utilized.

In terms of a primary outcome measure, the initial Rheumatology service findings of the joint aspirate were compared to the final Pathology service findings. Basic descriptive statistics of percent agreement and disagreement were performed. We categorized the observed joint aspirate findings into four groups: "no crystals", "sodium urate crystals (gout)", "calcium pyrophosphate dihydrate crystals (CPPD)", or "both sodium urate crystals and calcium pyrophosphate dihydrate crystals (both crystals)". We defined "any disagreement" as findings between the two services not in the same category, and we defined "clinically significant disagreement" as when one service observed any type of crystals while the other service observed no crystals.

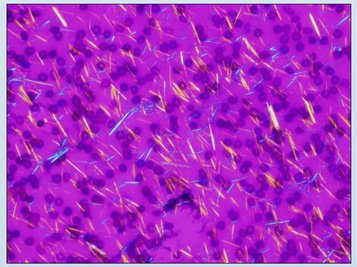
Results

We identified 54 patients who met study inclusion criteria. Thirty-five (64.81%) of these patients were male with a mean ± standard deviation (range) age of 65.39 ± 11.24 (35-94) years. Forty-two (77.77%) were black, 8 (14.81%) were Hispanic, and 4 (7.40%) were white. The analyzed joint aspirate came from the knee in all cases.

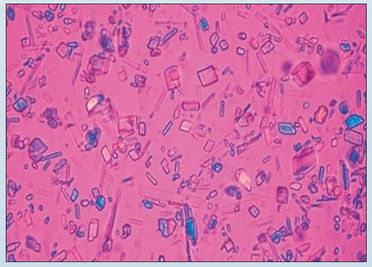
The Pathology service observed "no crystals" in 20 (37.04%) cases, "sodium urate crystals (gout)" in 28 (51.85%) cases, "calcium pyrophosphate dihydrate crystals (CPPD)" in 3 (5.56%) cases, and "both sodium urate crystals and calcium pyrophosphate dihydrate crystals (both crystals)" in 3 (5.56%) cases.

The Rheumatology service observed "no crystals" in 9 (16.67%) cases, "sodium urate crystals (gout)" in 35 (64.81%) cases, "calcium pyrophosphate dihydrate crystals (CPPD)" in 4 (7.41%) cases, and "both sodium urate crystals and calcium pyrophosphate dihydrate crystals (both crystals)" in 6 (11.11%) cases.

There was absolute agreement in findings between the two services in 35 (64.81%) cases, any disagreement in findings in 19 (35.19%) cases, and clinically significant disagreement in 11 (20.37%) cases. The Rheumatology service was more likely to observe the presence of crystals in a sample when compared to the Pathology service (83.33% vs. 62.96%; p = 0.029).



This figures demonstrates an abnormal sample of joint fluid with evidence of sodium urate crystals indicating gouty arthropathy.



This figures demonstrates an abnormal sample of joint fluid with evidence of calcium pyrophosphate dihydrate crystals, or CPPD.

Discussion

As with any scientific investigation, critical readers are encouraged to review the study design and results and reach their own conclusions, while the following represents our conclusions based on the specific results. As scientists, we also never consider data to be definitive, but do think that these results are worthy of attention and future investigation:

-We observed a higher than hypothesized rate of disagreement between the Rheumatology and Pathology services when analyzing joint fluid for the presence of gout. **In fact, in 20% of cases there was a clinically significant disagreement that would affect the diagnosis and treatment of the patient where rheumatology reported crystals and pathology did not.** This indicates a level of subjectivity to this analysis which might fall below the level of a "gold standard" diagnostic test.

-We also specifically observed that **the Rheumatology service was more likely to observe the presence of crystals in a sample when compared to the Pathology service (83.33% vs. 62.96%; p = 0.029)**. This potentially means that either pathologists are underdiagnosing gout, rheumatologists are overdiagnosing it, or some combination of the two. It is also interesting to consider that pathologists are performing an analysis with little adjuvant clinical information whereas rheumatologists are examining the patient and performing the aspiration. One might hypothesis that this clinical information could influence the pre-test probability and interpretation of the test, although that was not specifically studied with this design. We believe that this could represent an interesting avenue for future investigations.

-In conclusion, **the results of this investigation provide evidence that microscopic analysis of joint fluid aspirate might lack the accuracy and reliability to be consider a gold standard diagnostic test for gout**. We hope that these results lead to future investigations into the diagnosis and treatment of lower extremity gout.

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