

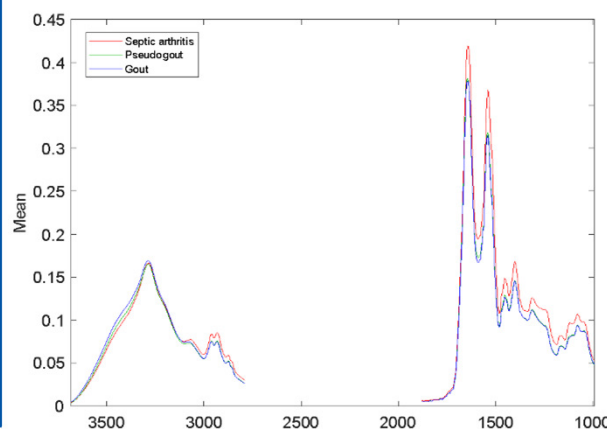
**Background:**

18 months ago, we established a **biobank of Joint Fluid Aspirates** (JFAs) from patients who presented to Northern Health for an acutely swollen joint. Our goal was to utilize **Spectroscopy** to create **spectral signatures** that could distinguish Septic arthritis from other confounding arthropathies at the Northern Hospital. We have subsequently collected **295** samples from **248** patients with our primary focus being on comparing Septic Arthritis (SA), Gout, and Pseudogout utilizing a **machine learning algorithm** on the uniquely generated spectral signatures.

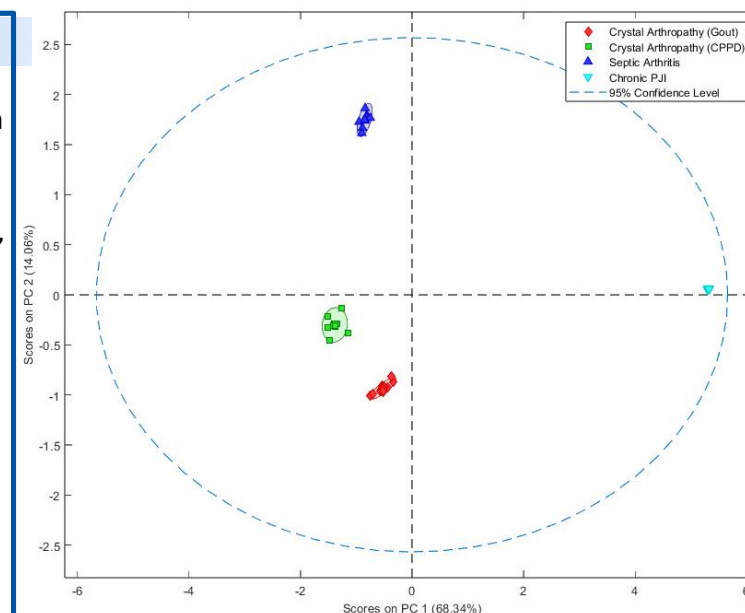
Class	Sensitivity	Specificity	Accuracy
Septic arthritis	80%	98%	88%
Pseudogout	88%	95%	92%
Gout	75%	100%	86%

Method:

1-2mL of joint fluid aspirates (JFAs) were collected following microbiological assessment from Northern Health Microbiology Laboratory. Samples were stored and analysed at the Northern Centre for Health Education Research (NCHER) laboratory. Patient demographic/clinical data, including diagnostic results of the JFAs, were recorded. JFAs were analysed utilising **Fourier Transform Infrared** and **Raman Spectroscopy** whereby each sample generated a unique spectral signature (~60 seconds). Spectroscopy is a non-destructive, chemically label-free, reproducible, and repeatable chemical analysis technology. Prior to analysis, the clinical and/or microbiological diagnosis was recorded for each sample for comparative analysis. Machine Learning Models were established using Spectral Signatures incorporating a) **Unsupervised Cluster Analysis** (CA), b) **Principal Component Analysis** (PCA) and c) **Partial Least Squares Discriminant Analysis** (PLS-DA).

**Results:**

Over 12 months, 295 JFAs were obtained from 248 patients. Of particular focus are the **22** Pseudogout, **28** Gout, and **7** native joint SA samples. The Machine Learning Models (CA, PCA and PLSDA) showed **distinct grouping** and **clear delineation of Gout, Pseudogout, and Infection** compared to one another, and to other diagnoses.

**Conclusion:**

Using these models, Spectra obtained from JFA utilising Spectroscopy, and our trained machine learning algorithm, may be used for **diagnostic classification of Gout, Pseudogout, and Native Joint Septic Arthritis with a confidence level of 95%** within the near future