Using Natural Language Processing for Vancomycin Induced Nephrotoxicity

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About Me

- Second Year at Columbia University
- Studying Biomedical Engineering
- This is my first Informatics internship
Why does this matter

- Vancomycin is an antibiotic
- The use of Vancomycin has increased sharply
- 100-Fold increase since the 80s

- “...aggressive drug dosing aimed at curbing the trend of reducing microbial sensitivity is associated with higher incidence of AKI.”
- “…10-20 % and 30-40 % of patients following conventional and high doses of vancomycin therapy, respectively.”
How to find the people

- There are models
  - But they use structured data
  - But that’s not where the data is..

- If we find them
  - Different antibiotic
The Solution: NLP

- Info Extraction
  - Words to data

- Machine learning to identify
  - Parts of speech
  - Sentence structure
  - Meaning of the information?
The Difficulty

- Why not do a keyword search?
  - Not that easy
- A Diagnosis of elimination, spanning multiple days and clinician notes
- Muddy data because of patients
  - Severe Infection?
  - Diabetic?
- Dehydrated?
- Heart Failure?
- Vasculitis?
- Enlarged Prostate?
- Tumor?
- NSAID?
The Tools

- Clinical Language Annotation and Modeling Pipeline
  - CLAMP
  - Keywords
  - Temporal relation
  - Negation
  - Discern tests and their values
  - Export all of that into a mySQL database
The Tools Cont

- Two Flavors:
  - Total Dictionary
  - Expert Derived
- Unified Language Medical System (UMLS)
REASON FOR VISIT: Acute kidney failure.

HISTORY OF PRESENT ILLNESS: The patient is a 68-year-old Korean gentleman with a history of coronary artery disease, hypertension, diabetes and stage III CKD with a creatinine of 1.8 in May 2006 corresponding with the GFR of 40-41 mL/min. The patient had blood work done at Dr. XYZ's office on June 01, 2006, which revealed an elevation in his creatinine up to 2.3. He was asked to come in to see a nephrologist for further evaluation. I am therefore asked by Dr. XYZ to see this patient in consultation for evaluation of acute on chronic kidney failure. The patient states that he was actually taking up to 12 to 13 pills of Chinese herbs and dietary supplements for the past year. He only stopped about two or three weeks ago. He also states that Tricor was added about one or two months ago but he is not sure of the date. He has not had an ultrasound but has been discussed with prostatic hypertrophy by his primary care doctor and placed on Flomax. He states that his urinary dribbling and weak stream had not improved since doing this. For the past couple of weeks, he has had dizziness in the morning. This is then associated with low glucose. However the patient’s blood glucose this morning was 123 and he still was dizzy. This was worse on standing. He states that he has been checking his blood pressure regularly at home because he has felt so bad and that he has gotten under 100/60 on several occasions. His pulses remained in the 60s.

ALLERGIES: None.

MEDICATIONS: Imdur 20 mg two to three times daily, nitroglycerin p.r.n., insulin 70/30 40/45 units daily, Zetia 10 mg daily, ? Triglide
The Tools Cont.

- Literal Petabytes
- PHI
- Amazon workspaces remote desktop

- Scalability
- EC2
A Little Comparison

- **My Mac**
  - 2.3 GHz Intel Core i7 Processor
  - 16 GB of memory

- **Amazon**
  - 3.6 GHz Intel Xeon Scalable Processors
  - 96 of them...
  - 192 GB of memory
Part 2: Creation of the Cohort

- Model require efficacy tests
- Me, MIMIC, and Many Tables
Future Steps

- Narrow and Confirm the Cohort
- Run CLAMP on the EC2 Server
- Create a comprehensive list of those affected

- Far Future Steps
  - DNA Tests
  - Patient interviews
  - Other...
What did I learn

- So, so, so much
- The eternal joy of de-bugging code I didn’t write
- mySQL, database Java
- The minutiae of comp-sci
Questions?

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