Qualitative Comparison of Conventional and Oblique MRI for Detection of Herniated Spinal Discs

Doug Dean
Mid Project Presentation
ENGN 2500: Medical Image Analysis
Outline

• Brief Review of the Problem
• What has been done
  • Data Collection
  • Results
• Plan for completing project
  • What more needs to be done
  • Timeline
Review of Problem

• Difficult to identify herniated discs and spinal stenosis using conventional (2D) MRI techniques

• These conventional methods result in patients condition being misdiagnosed.

“Conventional MRI”: Images acquired along one of three anatomical planes
Axial, T2-weighted Image: Cervical Foramen is directed at 45 degrees with respect to coronal plane.

3D reconstructive CT Image shows that the cervical foramina are directed downward around 10-15 degrees with respect to axial plane.
Orientation of Images

Conventional MRI: Sagittal Protocol

Oblique MRI: Sagittal Protocol
Timeline

- **Week 1 (4/11-4/16)**
  - Work on developing MR imaging protocols and sequences
  - Recruit volunteers (~4-5 volunteers)
- **Week 2 (4/17-4/23)**
  - Continue developing imaging sequences and begin data acquisition at the MRI facility
  - Will be assisted by Dr. Deoni
- **Week 3&4 (4/24-5/7)**
  - Continue data acquisition if needed (early in the week)
  - Analysis of Images: Hand contours of ROI’s and comparison of MRI protocols
  - Mid Project Presentation: Describe the imaging protocols, present data that had been acquired from previous week, describe what still needs to be done.
- **Week 5&6 (5/8-5/16)**
  - Continue analysis of MRI protocols. Determine which technique is best for detection of cervical foramina. Base these conclusions on the SNR and CNR measurements as well as the segmentation
  - Final Project Presentation
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Pulse Sequences (Imaging Protocol)

The following imaging sequences have been developed on the MR scanner (used in Shim, Lee, Park, et al):

- **Fast Spin Echo Sequence:**
  - Sagittal T\(_1\) weighted images:
    - TR: 500ms
    - TE: 10ms
    - Matrix Size: 320x224
    - Echo Train Length: 3
    - FOV: 240mm
    - NEX: 4
  - Sagittal T\(_2\) weighted images:
    - TR: 3500ms
    - TE: 110ms
    - Matrix Size: 320x224
    - Echo Train Length: 30
    - FOV: 240mm
    - NEX: 4
  - Axial T\(_2\) weighted images:
    - TR: 4000ms
    - TE: 110ms
    - Matrix Size: 320x224
    - Echo Train Length: 18
    - FOV: 160mm
    - NEX: 4

Slice Thickness: 3.0mm
Spacing: 0.5mm

Thursday, April 28, 2011
Recruitment

• 5 adults have been recruited
  • Age range: 35-56
  • 2-3 of them have had either back pain or other back problems in the past
  • Currently trying to schedule them to come in for a scan. This has been dependent upon their working schedules and the schedule of the MRI scanner

• Participants are able to comfortably relax in the scanner, either watch a movie, listen to music or sleep
Preliminary Images/ Data

- Data from 1 participant collected

- Data acquisition with these particular sequences take a very long time. Unable to acquire a full volume of data because of this.

- Scanning takes place in evening hours and is dependent upon schedules of participants

- Scans have been “scheduled” for Friday and Saturday and the beginning of next week
More Images
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Future Work and Project Completion

• Finish Data acquisition (4-5 more participants)

• Have doctors contour the foramen and look for stenosis or herniation with the different MR protocols

• Compare which protocol (conventional or oblique) gives better results for looking at the neural foramen
Updated Timeline Until End of Project

- Rest of this Week and Next week (4/28-5/7)
  - Continue data acquisition. Planning on scanning this Friday evening and Saturday. Plan on finishing data acquisition by Wednesday (5/4)
  - Send/Meet with Doctors for for hand contours of the foramen.
- 5/7-5/16
  - Continue analysis of MRI protocols. Determine which technique is best for detection of cervical foramina. Base these conclusions on the SNR and CNR measurements as well as the hand contours from the Radiologists and Orthopedic Surgeon.
  - Final Project Presentation
References


