Acute Cord Compression: Most Efficient Approach to Diagnosis

INTRODUCTION

Rationale for the Ongoing Project

Background

- Acute spinal cord compression is one of the few indications for STAT MRI. Results are used to determine emergency treatment.
- Use of emergency resources (staff, technology, facilities) for non-emergent indications has been shown to increase the cost to the patients and ultimately, society.

Problems

- Spines MRI as ordered on an emergent basis for diagnosis of suspected acute cord compression is not utilized. The typical ordering of MRI’s of the brain, cervical, thoracic, and lumbar spines with contrast escalates cost substantially and results in suboptimal quality exams.

- There is a poor correlation between the “acute spinal cord compression” indication for the examination and the final radiologic diagnosis.

Preliminary work

- A retrospective study was performed to examine the efficacy of utilization of spine MRI as ordered by the ED for a suspected acute cord compression

PRELIMINARY DATA

Materials and Methods

- 70 patients that received STAT MRIs ordered between May 1, 2010 and May 31, 2011 were retrospectively reviewed.

Results

- Consultants involved included
  - Neurology/Neurosurgery
  - 40 cases No Consultation

Frequency of Acute Cord Compression Diagnosis

- Acute Cord Compression (170 cases) = 24.3%
- Degenerative Changes, Internal Cord Derangement, or Chronic Cord Compression (6970 cases) = 4.6%

MRI’s Performed by Type and Time of Day

- Identified Problems and Resulting Actions
  - Routine total spine MRI takes ~3 hours and may delay crucial treatment.
  - Superficial and non-focused MRI of complete spine and brain with without contrast is ordered for most patients despite a wide spectrum of presenting symptoms and MRI findings
  - Poor correlation between the exam indication, recorded symptoms and MRI findings
  - Most exams were ordered between 5pm and 7am.

These findings prompted interdisciplinary Institutional Review with representatives from radiology, emergency department, neurology, nursing, internal medicine, and nursing.
- A new institutional policy was formulated and approved by Medical Center Quality Committee and ultimately, Medical Center Executive Committee.

NEW INSTITUTIONAL POLICY

For Patients with Suspected ACUTE Cord Compression

- Based on clinical exam findings, the attending physician may order either a STAT focal spine MRI (C, T, or L) or (if not confident of a level) a limited STAT spine MRI (C/S, T/S, or L/S).
- The IRFCC will immediately assess sagittal images for ACUTE cord compression and if found, will obtain T2 and STIR with and without contrast as well as T1 and T2 axial and coronal to confirm.
- If the attending physician requests a complete routine spine MRI, they must consult with the Neurosurgical on-call.

For suspected sub-acute/chronic cord compression or for a mild suspicion of cord compression

- MRI should be scheduled for the next day or soon thereafter but not emergently.
- ED/ICU/Neurology/Neurosurgery will conduct education on the protocol for a non-ACUTE Cord Compression at least annually.
- The Medical Quality Committee will be responsible for the interpretation, review and revision of this Protocol.

OBJECTIVES

- Develop and evaluate a screening MRI protocol dedicated for detection of acute spinal cord compression as an emergency.
- Evaluate the efficacy of utilization of the proposed spine MRI screening protocol.

MATERIALS AND METHODS

- Patient selection
  - Patients undergoing STAT spine MRI screening protocol ordered by ED.
  - ED, Oncology, Neurology or Neurosurgery for Acute cord compression as an emergent indication.

- Imaging with MRI Screening Protocol
  - 8-channel cervical–thoracic–lumbar phased-array coil
  - Pre-contrast sagittal T1 and sagittal T2 STIR sequences.

- Definition of acute compression
  - Acute mass effect on the cord with edema.

- Imaging findings recorded:
  - Acute cord compression
  - Not acute compression

Proposed spine MRI screening protocol: 8-channel cervical–thoracic–lumbar phased-array coil and the screening protocol, consisting of non-contrast sag T1 and sag STIR (30min)

Screening Protocol Rationale

- T1W: Bony metastases tend to contrast against a normal fatty marrow.
- T2 STIR: Suppressed fat and allows MRI abnormalities such as edema, inflammation and neoplasia to stand out. Cord compression is readily identified if present.

Image Quality and Diagnostic Confidence

Comparison of image quality and diagnostic confidence between the screening and routine MRI spine (45 screening versus 30 routine exams) by two neuroradiologists:

- Score 5: excellent image quality and high diagnostic confidence
- Score 4: borderline image quality and moderate diagnostic confidence
- Score 3: poor image quality and low diagnostic confidence

RESULTS

45 patients (22 males and 23 females) underwent STAT spine MRI ordered by ED, oncology, neurology or neurosurgery for Acute cord compression between 07/01/2011 and 5/8/2012

- Mean age (±SD): 59.7±19.4 years
- Age range: 1-97 years
- Clinical indications: Acute cord compression (25 cases) and degenerative changes (4 cases) as a rule-out.

- Consultant: 13 Neurology or Neurosurgery

Frequency of Acute Cord Compression Diagnosis

- Acute Cord Compression (245 cases)
- Degenerative Changes, Internal Cord Derangement, or Chronic Cord Compression (44/35 cases)

MRI’s Performed by Type and Time of Day

Comparison of image quality and diagnostic confidence between screening and routine MRI spine

Details

- Type of Patients
  - Diagnosis
    - 7/4 Symptomatic Cord Compression
    - 2/4 Acute Cord Compression
    - 5/4 Non-Acute Cord Compression

- MRI follow up in 38 patients with screening MRI negative for cord compression
  - MRI fu obtained: 10/38 patients
  - Additional cord findings on post-contrast sequences: 9/10

CONCLUSIONS

- A limited screening protocol for identification of acute spinal cord compression (ACSC) was established in 5 hours, with a decrease in the incidence of significant motion artifact, while at the same time reducing time to imaging at least equivalent to routine spine imaging when identifying cord compression.

- Based on the available follow-up data, there was no evidence that cord compression was missed using a limited screening protocol for ACSC.

- The screening MRI demonstrated high negative predictive value for ruling out acute spinal cord compression.

- Although there did not appear to be any presentation of acute intrinsic cord injury, such as spinal cord infarct or transverse myelitis, we expect the detection rate to be less and additional imaging of this spine may be necessary. However, limited short term follow up imaging does not demonstrate any additional findings.

- MRI follow up data suggested acute subacute or chronic. In those cases, a screening MRI was helpful but did not need to be performed on emergency basis.

- 73/30 (44/35) of all exams ordered to rule out acute spinal cord compression was total spine MRI despite the randomly localized symptoms. This finding suggests that there is room for improvement in clinical assessment and localization of the lesion during neurological examination.

- Most emergency MRI’s ordered for suspected acute cord compression continue to have chronic symptoms or unrelated symptoms that would not necessitate urgent magnetic treatment. We recommend revisiting criteria for ordering this exam.

REFERENCES

- Landonier V. Advanced radiology in US emergency departments. JAMA 2011;305:146-148