The Implementation of PACS Accessible Quality Assurance Tools to Facilitate Communication Between Radiologists and Technologists

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Purpose of PACS QA Tools

• Prior to implementation, there was no universal method for classifying and quantifying errors, which occur during radiologic image acquisition.

• Reporting errors required time-consuming emails or phone calls, interrupting workflow.
Purpose of PACS QA Tools

• Due to time constraints, many small errors went unreported.

• This system maintains a permanent record of all submissions and the intervention performed by the supervisors in response to each submission.

How It Works: The radiologist selects the icon
The radiologist fills out a brief form

Methods

• The PACS QA tools were instituted within the MSK Division at the Hospital of the University of Pennsylvania in August 2012 and department-wide in January 2013.

• After implementing the tool, two radiologists reviewed the MRI feedback obtained over an 8 month period to identify trends.
Methods

• This data was discussed with the section chiefs for body MRI, neuroradiology and MSK, and within each section one intervention was designed based on the data.

• The interventions selected were:
  – MSK: Use of appropriate-sized (Beekley) markers for imaging small body parts
  – Body MRI: Poor fat saturation
  – Neuroradiology: Reversed axial scanning (whereby axial images scroll in the opposite direction of expected thereby complicating comparison to old studies)

Methods

• The 3 interventions were discussed at the technologists’ monthly meeting in December 2013.

• Radiologists within each section were encouraged to report all instances of these issues.

• Subsequently, the PACS feedback data was reanalyzed post-intervention to determine effect.
Methods

• As an additional post-intervention measure to assess technologist compliance with MSK Beekley marker usage, one radiologist reviewed:

  – 25 consecutive MRIs of small body parts obtained between October 2012 to January 2013

  – 25 consecutive MRIs of small body parts obtained between December 2013 to February 2014

Results

• There were 875 submissions to the PACS MRI QA tool between August 2012 and March 2014.

• The data were categorized as shown on the following slide.

• Submissions by department were: 480 by MSK, 289 by neuroradiology, and 106 by body MRI.
Feedback Categorization

Positive Feedback
- Protocol and Image Acquisition issues
- Wrong protocol
- Missing sequence
- Sequence parameters off (fat sat pre and post a common issue in all sections)

Positioning/RTH
- Area of interest not well covered
- Sequence at wrong obliquity or position
- FOV too large
- Marker not used appropriately

Submission to PACS Issues
- Images flipped in PACS
- Confusing organization of sequences
- Mislabeled sequences
- Laterality issues
- Backwards scanning
- Data Inaccuracy (patient name, etc)

Image Quality
- Poor quality NOS
- Motion
- Metal artifact
- SNR
- Poor fat sat
- Coil issue
- Aliasing

Contrast related

Miscellaneous

Total MRI Feedback By Month

[Graph showing volume of PACS QA Feedback by Section]
Some QA issues are unique to certain sections (backwards scanning in neuroradiology, flipped images in MSK).
Other QA issues are relatively universal (missing sequences).
Positive feedback accounted for approximately 10% of overall feedback.

Interventions by Section

1. MSK: Beekley Marker Usage
2. Body MRI: Poor Fat Saturation
3. Neuro: Reverse Axial Scanning
1. MSK: Beekley Marker Usage

- Smaller and thinner than Vitamin E markers
- Produce less distortion of the underlying anatomy
- Clearly visible on both T1 and T2 sequences (unlike Vitamin E markers which are difficult to visualize on T2).

http://www.beekley.com/MRI/MRSPOTS.asp

1. MSK: Beekley Marker Usage

Correct Marker

Incorrect Marker
1. MSK: Beekley Marker Usage

- Use of Beekley markers was started in late summer of 2012

- MSK staff began using the new QA tool specifically to inform the MRI supervisor regarding the use of incorrect skin markers in September of 2013

- The Technologists were reminded at their monthly meeting in December 2013 to use MR spot Beekley markers for MRIs of small body parts.

1. MSK: Beekley Marker Usage

Results

- In the review of studies performed before intervention, incorrect skin markers were observed in 8/25 MR studies.

- In the review of studies performed after intervention, incorrect skin markers were observed in 1/25 MR studies.
2. Body MRI: Poor Fat Saturation

Slide (modified) from PowerPoint presented at MRI technologist monthly meeting in December 2013

Checking FS prior to Injection on Abdomen MRI

- There have been several cases this past month where the gad runs on abdomens have not been fat saturated.
- Body MR asked that we please pay closer attention in the future.
- This occurs more often with obese patients on the 3T’s.
- On all T1 VIBE Pre’s you will now have to confirm frequency settings to help eliminate this problem.

2. Body MRI: Poor Fat Saturation

- The PACS QA tool helped to identify the issue of poor fat saturation.
- The data was used to design an intervention.
- Anecdotally, the intervention has resulted in lower frequency of poor fat saturation.
- The improvement is not reflected in the PACS QA data, which is easily explained by underreporting prior to intervention and accurate reporting after the intervention.
3. **Neuro: Reverse axial scanning**

- Axial brain MRIs, which scroll in the opposite direction from prior exam complicated review of tumor and multiple sclerosis follow up cases.

- The PACS QA tool helped to identify the issue.

- This led to a meeting with the PACS vendor.

- Reverse axial scanning was found to be work station dependent (i.e. on one work station images show up inverted and on another in proper sequence).

- This likely relates to user/workstation settings.

- The PACS vendor and PACS administrator are working on a solution.

- Other PACS providers provide a tool, which allows manual inversion of scrolling sequence, which would be one potential solution.
Limitations

• While volume of submissions has been high thus far, it is uncertain whether this will remain true over time.

  — Continuing to analyze the data and prove to the radiologists that their feedback is resulting in improved quality is likely the best method to maintain compliance.

Limitations

• The PACS QA tool is best for identifying trends and designing interventions.

  — Using the PACS QA tool in isolation to measure post-intervention outcomes is limited by the tendency of increased reporting once an issue is brought to light.
Limitations

• The PACS QA tool has not been used in a punitive manner.

  – Since the QA tool provides a permanent record of all errors, and the identities of those involved, the data could theoretically be applied in a punitive manner. This can be addressed on an institutional level.

Conclusion

• A PACS accessible QA tool is an efficient method for radiologist communication with technologists.

• While not meant to replace other forms of communication, it facilitates the communication of small errors and potential areas of improvement, which might otherwise go unreported.
Conclusion

• By analyzing the feedback data, one can identify trends, design interventions, and measure effect, with the overall goal of improving imaging quality within the department.

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