DECREASING VARIABILITY IN CT SCAN REPORTING OF EMPHYSEMA

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BACKGROUND

The pulmonary division of the department of medicine at Brigham and Women’s Hospital would like to use the COPD Gene™ CT protocol for clinical evaluations of COPD over time. This would require greater consistency of reporting of emphysema from year to year in the lung disease community and a uniform method of quantifying emphysema on CT scans. This protocol provided the motivation for developing greater agreement between subspecialty-trained radiologists, including those who did not participate as readers in the National Emphysema Treatment. The scoring of emphysema, primarily performed for research studies, had not been systematically taught to cardiothoracic imaging fellows. The establishment of reference standards first used at the COPDGene™ Imaging Workshop at the ACR Learning Center in Boston, VA, provided the needed educational resources and comparison standards to perform this Quality Assurance/Quality Improvement project.

METHODS

The National Emphysema Treatment Trial adapted visual scoring of emphysema on CT images to a formal system applied to non-contiguous HRCT images and through a training set of images increased the consistency of reporting between readers. The CT images were acquired for the NHANES (National Health and Nutrition Examination Survey) and then distributed to participating sites. The COPDGene™ Study CT images were acquired using different computed tomography scanning methods for quantifying emphysema. J Thorac Imaging 1998;13:193–198. Our data collection provides a pathway to decreasing intra- and inter-observer variability and a robust method for comparing the effect of image presentation in the subjective evaluation of emphysema. The systematic incorporation of reference standard images for comparison will be helpful for training of readers and fellows. This methodology will also be used as a clinical service to select the most reliable image presentation for a particular clinical decision.

CONFERENCE PAPER

This project provides documented practice-quality improvement supported by the American Board of Radiology for maintenance of certification. It provides standards, tools, and feedback mechanisms to support lifelong learning and improvement in patient care. Photon-counting CT of COPD classified purely based on the size of the lung emphysema was defined and may be different from classical phenotypes that are currently being studied as part of the COPDGene™ research program. A qualitative approach to interpreting clinical and research interventions for severe outcomes has been incorporated into the COPDGene™ research program. Consensus standard cases for education and guidance during interpretation of CT scans. The initial objective was to enhance feedback and adaptation to the revised standards and image displays.

RESULTS

The variability of clinical reports has been quantified and used to determine the area of greatest variability. Clinical and research readings agree for 27 of 45 CT scans. 11 scans were scored as having no emphysema, although the absence of emphysema score between clinical and research readings by almost 100%. Of note, the grouping of scans shows distinctions between mild, moderate, and severe accept the inconsistencies of descriptions reporting. Emphysema was not consistently included in the clinical report, even when significant emphysema score was greater than 30; although inconsistency was greater for mild emphysema. Of note, emphysema was present in GOLD Stage 0 cases.

CONCLUSION

Our data collection provides a pathway to decreasing intra- and inter-observer variability and a robust method for comparing the effect of image presentation in the subjective evaluation of emphysema. The ability to also disseminate changes, such as the change in lungdark used for division between the lungs, support this project as a framework for continuing professional education for maintenance of certifications for all readers. This change can be employed to increase agreement between readers for any image evaluation task including tasks that will be created in the future.

DISCUSSION - Scans in Ongoing QA

The review of cases needs to be limited to not more than 5 within the same interval of time. It would be preferable to have a case added to a clinical service schedule in order to allow the radiologist to score the case from another week. The COPDGene™ Workshop was subsequently placed in a shared network drive for easy access while performing emphysema scoring. For each subject, two different series were selected for these readings; a clinical presentation and different display presentations will be evaluated in the same manner without overwhelming the clinical service. The recent insertion of mammograms into the clinical reading stream is being used as a model in this regard. Repeated readings of cases by all of the radiologists in the division decreases the variability in reporting emphysema definitively and increases the consistent use of scoring system. The ability to also disseminate changes, such as the change in lungdark used for division between the lungs, support this project as a framework for continuing professional education for maintenance of certifications for all readers. This change can be employed to increase agreement between readers for any image evaluation task including tasks that will be created in the future.

REFERENCES


METHODS

COPDGene™ study patient CT scan received clinical reports in accordance with the radiology department policy, generally within 24 hours. Meanwhile, the interpreting thoracic radiologist also provided data entry to the COPDGene™ study that included emphysema axial coverage and severity. The visual scoring system followed procedures previously used for the National Emphysema Treatment Trial with 4 categories: 1250–2500; 2500–5000; 5000–7500; ≥7500, for each zone. Forty-five-COPDGene™ CT zones were randomly selected to represent GOLD Stages 0–3 and Stage 4. Radiology reports were reviewed and compared with the emphysema assessment performed by the same radiologist. The visual scoring system at the COPDGene™ Workshop was subsequently placed in a shared network drive for easy access to the scoring radiologists and can be easily revised without creating confusion as these standards continue to evolve. Each radiologist viewed the scans as an educational activity 1 week prior to scoring emphysema. The images can also be freely accessed while performing emphysema scoring. For each subject, two different series were selected for these readings, a clinical presentation of 1 x 10 mm axial HRCT images in B60f lung algorithm and the COPDGene™ research image display. Standardized images, presented at the COPDGene™ Workshop, were subsequently placed on a shared network drive for easy access while performing emphysema scoring.

CONCLUSIONS

Practice-Based Learning and Improvement Project for Maintenance of Certification

PROCESS

To decrease variability in CT scan reporting of emphysema, the COPDGene™ Study CT images were selected for each GOLD Stage, and each Zone. The radiologists were provided with the COPDGene™ imaging standards and a clinical case. The radiologists were then provided with feedback on their scoring. The feedback included a clinical report of the case, a Zonal Region Score Zone Reference Zone Reference

Quality Assurance

• QA comparison
• Clinical reading of emphysema
• Emphysema score
• COPDGene™ standard images
• Score emphysema research and clinical cases
• Feedback
• Decreased variability in emphysema score
• Adapt to changes in standards and images

Quality Improvement

• COPDGene™ standard images
• Score emphysema research and clinical cases
• COPDGene™ trainee
• COPDGene™ standard images
• Score emphysema research and clinical cases

25% Emphysema

50% Emphysema

75% Emphysema

Zone Reference

Quality Assurance

• QA comparison
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• Score emphysema research and clinical cases
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Quality Improvement