Han G. Ngo, B.S.[1], Girish B. Nair, M.D.[2], Sayf Al-Katib, M.D.[3]

OAKLAND UNIVERSITY WILLIAM BEAUMONT

Impact of Structured Reporting Template on the Quality of HRCT Radiology Reports for Interstitial Lung Disease

Han G. Ngo, B.S.[1] , Girish B. Nair, M.D.[2] , Sayf Al-Katib, M.D.[3]

[1]Oakland University William Beaumont School of Medicine, Rochester, MI, USA.

[2]William Beaumont Hospital,, Division of Pulmonary and Critical Care Medicine, Royal Oak, MI, USA.

[3]William Beaumont Hospital,, Department of Diagnostic Radiology and Molecular Imaging, Royal Oak, MI, USA.

Purpose

To assess whether structured reporting template produces **higher quality reports** for high-resolution CT (HRCT) exams of suspected interstitial lung disease, as compared to the conventional unstructured dictation.

Introduction

Structured reports have been shown to improve report clarity, completeness, and consistency compared to conventional unstructured reports in many areas of radiology, including breast imaging,[1] rectal cancer staging MRI,[2] an pulmonary embolism CT angiography[3] (Fig. 1). However, **research evaluating the role of structured reporting in HRCT exam for interstitial lung disease is lacking.**

Interstitial lung disease (ILD) encompasses a group of diseases with many subtypes, with idiopathic pulmonary fibrosis (IPF) being the most common subtype characterized by the lungs losing their elastic properties due to unknown etiology. Although there are well-established guidelines for making the diagnosis of IPF on HRCT studies,[4] uncertainty occurs when any of the key imaging features is overlooked or underreported. There is a great need to increase the likelihood of making a radiographic diagnosis of IPF when possible as it can eliminate the need for surgical lung biopsy and slow the decline in pulmonary function through timely initiation of antifibrotic therapies. The use of a structured reporting template may be beneficial as it can serve as a checklist to ensure that all important imaging features are included in the evaluation of ILD.

Unstructured Radiology Report from CT of the Abdomen and Pelvis	Structured Radiology Report from CT of the Abdomen and Pelvis
Findings The lung bases are clear. The heart size is normal. No pericardial or pleural effusion. The liver is normal in size and morphology. No intra- or extrahepatic biliary ductal dilatation. There is a normal CT appearance of the gallbladder. The spleen is normal in size and morphology. The pancreatic parenchyma is unremarkable; no pancreatic ductal dilatation. Adrenal glands are unremarkable. In the kidney left upper pole, there is a 2.7 3 2.1-cm heterogeneously high-attenuating mass (series 4, image 27). Right kidney is normal. No calculi. No hydroureteronephrosis. Visualized stomach and small bowel is normal. Colon is unremarkable. No free fluid or free air. No pathologically enlarged lymph nodes. The uterus is not visualized. No concerning adnexal masses. No free fluid. No osseous destructive lesions. Atherosclerotic calcification of the abdominal aorta and branch vessels. No aneurysmal dilatation. **Impression** Indeterminate right kidney mass is most likely a renal cell carcinoma. Oncocytoma and lipid-poor angiomyolipoma are differential diagnostic considerations.	**Findings** Lung bases: Clear. No concerning nodules. Liver: Normal in size and morphology. No intrahepatic biliary ductal dilatation. Gallbladder and biliary tree: Normal CT appearance of the gallbladder. No common duct dilatation. Spleen: Normal in size and morphology. Pancreas: Normal CT appearance. Adrenal glands: No nodules. Kidneys: In the left upper pole, there is a 2.7 3 2.1-cm heterogeneously high-attenuating mass (series 4, image 27). Right kidney is normal. No calculi. No hydroureteronephrosis. Bowel: Visualized stomach and small bowel is normal. Colon is unremarkable. Mesentery/peritoneum: No free fluid or free air. Lymph nodes: No pathologically enlarged lymph nodes. Pelvis: The uterus is not visualized. No concerning adnexal masses. No free fluid. Musculoskeletal: No destructive osseous lesions. Vasculature: Atherosclerotic calcification of the abdominal aorta and branch vessels. No aneurysmal dilatation. **Impression** Indeterminate right kidney mass is most likely a renal cell carcinoma

Fig 1. A comparison of unstructured report vs. structured report side by side, adapted from the "Radiology Report Value Equation" article published in the RadioGraphics.[5] journal, Vol. 38, No. 6

Methods

- *Design:* **Retrospective chart review** of HRCT reports at a multicenter health system before and after the intervention. IRB #2020-157
- *Intervention:* An **ILD disease-specific template** (Fig. 2) was introduced in 12/2020. Its use was **voluntary**.
- *Data collection:* Data was collected in 6-month period intervals before (06/2019 – 11/2019) and after (01/2021 – 06/2021) the intervention.
- *Measures:* Primary outcome measure was the **completeness of HRCT reports** graded based on the documentation of ten descriptors. The secondary outcome measure assessed the **use of which descriptor(s) had improved as a result of the intervention.**
- *Statistical Analysis:* Analysis performed using SAS 9.4. Lilliefors-Kolmogorov-Smirnov test was used to compare the mean completeness scores between the pre- and post-intervention groups. Categorical data was compared using Chi-square tests (or Fisher tests if cell count <5). All *p* values were 2-sided and a *p* <0.05 was considered to indicate statistical significance.

HRCT OF THE THORAX WITHOUT CONTRAST: {Order Date}

INDICATION: {Patient Age} old {Patient Gender}. {Reason For Study}.

COMPARISON: {Date}

TECHNIQUE: High resolution contiguous 1.5 mm axial images of the chest were obtained in a supine {and prone/decubitus} position. {Expiratory noncontiguous images were obtained.} No intravenous contrast was administered.

FINDINGS: (Limitations: Motion/Streak)

LUNG PARENCHYMA: {Clear/Atelectasis/Apical scar} {Nodules: Stable/Benign}
INTERSTITIAL LUNG OPACITIES: {None/Minimal/Mild/Moderate/Severe}
ZONAL DISTRIBUTION: {NA/upper/mid/lower/diffuse}
AXIAL DISTRIBUTION: {NA/peripheral/central/diffuse}
RETICULATION: {None/Minimal/Mild/Moderate/Severe}
GROUNDGLASS: {None/Minimal/Mild/Moderate/Severe}
HONEYCOMBING: {None/Minimal/Mild/Moderate/Severe}
BRONCHIECTASIS: {None/Minimal/Mild/Moderate/Severe}
EMPHYSEMA: {None/Minimal/Mild/Moderate/Severe}
COMPARISON TO PRIOR: {Stable/Mild/Moderate/Severe/New/NA}
OTHER: {Air Trapping: None/present} {Free Text}

PLEURA: {Effusion: None/Bilateral/Right/Left}
LARGE AIRWAYS: {Normal/Secretions}
HEART: {Size: Normal/Mild/Moderate/Severe} {Coronary calcification: None/Mild/Moderate/Severe/Stent}
PULMONARY ARTERY: {Normal/Enlarged}
THORACIC AORTA: {Normal caliber} {Atherosclerosis: None/Mild/Moderate/Severe}
LYMPH NODES: {Normal/Reactive/Granulomatous calcifications}
ESOPHAGUS: {Caliber: Normal/mild/moderate/severe} {Hiatal hernia: Small/Moderate/Large}
DIAPHRAGM: {Normal}
OTHER FINDINGS: {None/Thyroid Nodule}

UPPER ABDOMEN: {Normal}
MUSCULOSKELETAL: {Normal}

IMPRESSION:
FIBROSIS: {None/Minimal/Mild/Moderate/Severe} {Summary}
HRCT PATTERN: {UIP/Probable/Indeterminate/Alternative}
COMPARISON TO PRIOR: {Stable/Mild/Moderate/Severe/New/NA}

UIP pattern: Subpleural basal predominant, often heterogeneous. Honeycombing with or without peripheral traction bronchiectasis.

Probable UIP pattern: Subpleural basal predominant distribution, often heterogeneous. Reticular pattern with peripheral traction bronchiectasis. May have mild groundglass opacity.

Indeterminate for UIP: Subpleural basal predominant. Subtle reticulation; may have mild groundglass opacity or distortion. CT features and/or distribution that do not suggest any specific etiology.

Alternative diagnosis: Finding suggestive of another diagnosis including lung cysts, mosaic attenuation, predominantly groundglass opacity, profuse micronodules, centrilobular nodules, consolidation, peribronchovascular distribution, upper/midlung distribution

*Raghu G, et al. Diagnosis of Idiopathic Pulmonary Fibrosis. An Official ATS/ERS/JRS/ALAT Clinical Practice Guideline. Am J Respir Crit Care Med. 2018 Sep 1;198(5):e44-e68. doi: 10.1164/rccm.201807-1255ST.

Fig. 2: ILD disease-specific template created by our radiologist group and implemented in this study. NA = not applicable; UIP = usual interstitial pneumonia.

Results

The final study consisted of 521 and 557 reports for the pre- and post-intervention groups respectively. After the intervention, **21% (118/557) of reports used the template.**

Primary Outcome Measure

Pre-intervention (n=521) vs. Post-intervention (n=557):
The mean completeness score of pre-intervention group was 9.20 (*SD* = 1.08) and post-intervention group was 9.36 (*SD* = 1.03) with a difference of -0.155, 95% CI [-0.2822, -0.0285, $p < 0.0001$].

Unstructured Reports (n=439) vs. Template Reports (n=118) within the Post-intervention Group:
The mean completeness score of the unstructured reports was 9.25 (*SD* = 1.07) and the template reports was 9.93 (*SD* = 0.25) with a difference of -0.677, 95% CI [-0.7871, -0.5671, $p < 0.0001$].

Secondary Outcome Measure

Quality Measure	Pre-intervention (n = 521)	Post-intervention (n = 557)	*p* value
Comparison exam date	502 (96.4)	542 (97.3)	0.3705
Indication of exam	521 (100)	554 (99.5)	0.2501
Technique	469 (90.0)	538 (96.6)	<0.0001*
Severity of fibrosis	474 (91.0)	515 (92.5)	0.3774
Description of fibrosis	518 (99.4)	556 (99.8)	0.3584
Presence of bronchiectasis	483 (92.7)	525 (94.3)	0.3025
Presence of honeycombing	408 (78.3)	474 (85.1)	0.0039*
Distribution of fibrosis	520 (99.8)	555 (99.6)	1.0000
Change from previous exam	479 (91.9)	491 (88.2)	0.0385*
Differential diagnosis	423 (81.2)	465 (83.5)	0.3235

Table 1: Reporting frequencies for ten descriptors before and after the intervention. * indicates the difference in the reporting frequencies is statistically significant. Two descriptors improved significantly: *presence of honeycombing* from 78.3% to 85.1% (p <0.0039) and *technique* from 90% to 96.6% (p <0.0001).

Discussion

- In spite of the relatively low uptake of the disease-specific template, the use of structured reporting template **significantly improved** the quality of radiology reports. Comparison of the mean completeness scores between the unstructured and template reports within the post-intervention group further confirmed the effect of the template.
- Two descriptors improved significantly: ***presence of honeycombing*** and ***technique*** (Table 1).
- Interestingly, the *change from previous exam* was the one descriptor that decreased in reporting frequency after the intervention. A second review of all the reports revealed that template users misunderstood this subheading of the template and reported the comparison date (e.g., 03/01/2021) rather than the actual description of what have changed since the previous exam.
- The relatively low uptake of the template could be due to multiple factors:
  1. the voluntary nature of participation
  2. lack of experience and familiarity with structured reporting
  3. perception that structured templates result in longer time to report and decreased radiologist autonomy
  4. lack of experience with the new template by trainees in the department.

Conclusion

There are benefits to shifting to structured reporting for HRCT examinations of suspected ILD. Further research on how to improve the voluntary uptake of a disease-specific template is needed to help increase the acceptance of structured reporting among radiologists.

Contact:
Han G. Ngo, B.S.
Email: hngo@oakland.edu
Disclosures: None

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