Université d'Ottawa | University of Ottawa

Is Structured Reporting More Accurate Than Conventional Reporting in CT Reporting of the Abdomen and Pelvis?

A M Almuslim, MBBS; J G Ryan, MD; A Murtaza, MD

uOttawa

www.uOttawa.ca

Université d'Ottawa | University of Ottawa

Purpose

- The purpose of this research is to determine if there is a difference in the accuracy or completeness of free style reporting vs. structured reporting with itemized contents in CT scans of the abdomen and pelvis

uOttawa

www.uOttawa.ca

Université d'Ottawa | University of Ottawa

Materials and Methods

- The study was approved by the institutional review board of the Ottawa Hospital. Being an intradepartmental quality assurance study, patient consent was not required
- Emergency Department CT scans of the abdomen and pelvis were reviewed retrospectively over a period of one month
- A sample size of 90 cases was chosen based on strict inclusion criteria

uOttawa www.uOttawa.ca

Université d'Ottawa | University of Ottawa

Inclusion Criteria

- Only studies of adult patients (> 18 years) referred for the first time for enhanced CT scan of the abdomen and pelvis were included
- Studies with only abdominal CT scan, only pelvic CT scan and studies without intravenous contrast were excluded
- Studies with previous abdominal or pelvic CT scans available on The Ottawa Hospital PACS were also excluded

uOttawa www.uOttawa.ca

Université d'Ottawa | University of Ottawa

Annotation of Cases

- The selected cases were notated to have been issued either a structured report or non structured report as the initial and official interpretation
- The template report designed for mandatory use by the Medical Imaging trainees of The Ottawa Hospital (TOH) was used as our structured report reference
- The template used default statements to describe normal findings in each subheading in the report

uOttawa www.uOttawa.ca

Université d'Ottawa | University of Ottawa

Annotation of Cases

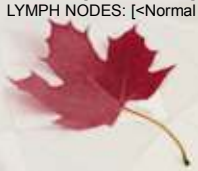
- Voice recognition dictation software was used to overwrite the default statements when the subheading is abnormal
- Any original report not using our reference was considered free-flowing report. Original reports using personal template reports were considered free-flow reports as well

uOttawa www.uOttawa.ca

Université d'Ottawa | University of Ottawa

Our Reference Template

CT SCAN OF THE ABDOMEN AND PELVIS WITH INTRAVENOUS CONTRAST
INDICATION: []
TECHNIQUE: Oral contrast was[< not>] administered. Volume acquisition from top of diaphragm to ischial tuberosities reconstructed in 5mm axial slices.[< Standard 3 mm coronal slices from volume data.>]
COMPARISON: [<Enhanced CT of the abdomen and pelvis dated>][<>].
LIVER : [<Normal uniform attenuation. No significant hepatic nodule>].
BILIARY TREE: [<Unremarkable gallbladder>].[< The bile ducts are not dilated>].
PANCREAS : [<Normal shape and parenchymal attenuation>].
GI TRACT : [<Unremarkable stomach>].[< Unremarkable small bowel>].[< Unremarkable colon and rectum>].
SPLEEN : [<Normal size>].
LYMPH NODES: [<Normal size and distribution of nodes in the abdomen and pelvis>].



uOttawa

www.uOttawa.ca

Université d'Ottawa | University of Ottawa

Our Reference Template

PERITONEUM: [<No ascites and no worrisome nodule>].
AORTA, VENA CAVA: [<Unremarkable>].
ADRENALS : [<Normal>].
KIDNEYS : [<Unremarkable>].
URINARY BLADDER: [<Unremarkable>].
["PScribe Insert Uterus" or "PScribe Insert Prostate"]
BONES AND SOFT TISSUES: [<No aggressive bony lesion>].[< No significant soft tissue nodule>].[<>]
LUNG BASES: [<Normal appearance of left and right lungs bases included at the top of the series>].
IMPRESSION:
1.[].[<>]

uOttawa

www.uOttawa.ca

Université d'Ottawa | University of Ottawa

First Phase of Study

- The first phase of the study was generating a second report for each case
- Three participants including a staff radiologist with over 10 years of experience and two abdominal imaging fellows were randomly assigned 30 cases each
- The team generated a free-flow report for the patients with original structured report and structured report for patients with original free-flow report

uOttawa www.uOttawa.ca

Université d'Ottawa | University of Ottawa

First Phase of Study

- All of the researchers used the hospital speech recognition system and were blinded to the original report
- At the end of phase one, each study had two reports; a structured and a non-structured report

uOttawa www.uOttawa.ca

Université d'Ottawa | University of Ottawa

Second Phase of Study

- Quantitive and qualitative analysis was performed by a body imaging fellow
- Scoring for quantitative analysis included: addressing the clinical question in the report, number of positive findings reported, number of positive findings missed and number of pertinent negative findings documented

uOttawa www.uOttawa.ca

Université d'Ottawa | University of Ottawa

Second Phase of Study

- The ability to satisfactorily address the physician's query was scored on a Likert-type scale of 1(poor performance) to 5 (excellent performance)
- The significance of positive or pertinent negative findings was scored on a scale of 1-5 based on clinical relevance

uOttawa www.uOttawa.ca

Second Phase of Study

- Score of 0 was awarded for any finding not mentioned in the report. Findings which were missed were given a negative score using the same scale

Université d'Ottawa | University of Ottawa

Clinical Significance Scoring Scale

Score	Significance	Examples
1	Incidental finding of no clinical significance	Fatty liver, incidental hepatic and renal cysts
2	Incidental finding with potential but unlikely clinical relevance	Asymptomatic gall stones, asymptomatic renal stones, absence of hydronephrosis
3	Clinically relevant findings	Symptomatic gall stones, symptomatic renal stones, appendicolith in appendicitis, absence of collection

uOttawa www.uOttawa.ca

Clinical Significance Scoring Scale

Score	Significance	Examples
4	Semi-urgent	Acute uncomplicated appendicitis, acute uncomplicated cholecystitis, liver metastasis, ureteric calculi
5	Critical findings	Ruptured appendicitis, Acute calculous cholecystis with choledocholithiasis

Université d'Ottawa | University of Ottawa

Second Phase of Study

- For qualitative analysis, all the reports were evaluated by the following features: accuracy, completeness and clarity
- Each of these was scored on a Likert-type scale ranging from 1(poor performance) to 5 (excellent performance)
- Accuracy was scored taking into account the number of positive findings reported or missed

uOttawa www.uOttawa.ca

Université d'Ottawa | University of Ottawa

Second Phase of Study

- If a report failed to comment on positive finding relevant to the clinical question, it was deemed to be less accurate.
- Completeness was scored taking into account the ability to document all positive, critical or incidental findings as well as pertinent negative findings

uOttawa www.uOttawa.ca

Université d'Ottawa | University of Ottawa

Second Phase of Study

- Clarity was assessed based on the subjective perception of unambiguous presentation of findings especially in the final impression
- Wilcoxon signed rank tests were used in analyzing the data in addition to calculation of means and percentages

uOttawa www.uOttawa.ca

Results

- We analyzed the reports of 89 studies. One study was excluded because its original report used our reference template report with few modifications
- 64 studies had structured reports as their official and initial interpretation
- 25 studies used free non-structured style for their official reports

Université d'Ottawa | University of Ottawa

Qualitative Assessment

- 100% of structured reports addressed the clinical query satisfactory (score 5). 98.88 % of non-structured report addressed the clinical query. Only one free report did not address the clinical question (Score1), neither in the body nor in the impression
- The maximum number of positive findings in a single free report was 11, and in a single structured report was 10

uOttawa www.uOttawa.ca

Université d'Ottawa | University of Ottawa

Qualitative Assessment

- At least two positives were reported in 86.52% of free reports and 87.64% of structured reports

uOttawa www.uOttawa.ca

Université d'Ottawa | University of Ottawa

Positive Findings

- Between the free and structured reports, for each of the 5 score levels, none of the differences in proportions of reports reporting at least one finding were found to be statistically significant

uOttawa www.uOttawa.ca

Université d'Ottawa | University of Ottawa

Positive Findings

	Structured	Non-structured
Total positives	298	298
Score 1	132 (44.30%)	127 (42.62%)
Score 2	81 (27.18%)	87 (29.20%)
Score 3	60 (20.13%)	60 (20.13%)
Score 4	23 (7.72%)	22 (7.38%)
Score 5	2 (0.67%)	2 (0.67%)

uOttawa www.uOttawa.ca

Université d'Ottawa | University of Ottawa

Pertinent Negative Findings

- There were no statistically significant differences found in proportions of each of the two types of reports having at least one finding at each of the score levels Score 2 through Score 5

uOttawa www.uOttawa.ca

Pertinent Negative Findings

	Structured	Non-structured
Total pertinent negatives	37	43
Score 2	1 (2.70%)	1 (2.33%)
Score 3	12 (32.43%)	17 (39.53%)
Score 4	23 (62.16%)	24 (55.81%)
Score 5	1 (2.70%)	1 (2.33%)

Université d'Ottawa | University of Ottawa

Missing Findings

- The difference between free and structured reports for proportion missing a finding of score 1 was not found to be statistically significant
- Free reports showed 5 misses: 1 of Score 1, 3 of Score 2, and 1 of score 3
- Structured reports showed 4 misses: 3 of Score 1, and 1 of Score 4

uOttawa www.uOttawa.ca

Qualitative Assessment

- None of the differences between free and structured reports - for proportions scoring 5 for each of accuracy, completeness, and clarity - were found to be statistically significant

Université d'Ottawa | University of Ottawa

Qualitative Assessment

Measure	Structured	Non-structured
Percent with 5 for accuracy	87.64	80.90
Percent with 5 for completeness	87.64	87.64
Percent with 5 for clarity	91.01	87.64

Qualitative Assessment

- Due to the skewed nature of results, Wilcoxon signed-rank tests were used to check for differences in location for the distributions of each of these three scores for the two types of reports. No significant differences were found
- Although the means for clarity were different, this difference was not statistically significant

Université d'Ottawa | University of Ottawa

Qualitative Assessment

Mean	Structured	Non-structured
Accuracy	4.79	4.79
Completeness	4.87	4.87
Clarity	4.89	4.79

uOttawa www.uOttawa.ca

Discussion

- Although structured reports have several benefits, they do not improve report accuracy or completeness
- Johnson et al and more recently Tirumani et al showed decrease accuracy of structured reports because of difficulty in adapting to the reporting system and because of missed default statement inclusions in standardized reports

Université d'Ottawa | University of Ottawa

Discussion

- LH Schwartz et al showed that the majority of radiologists and referring physicians favor structured reports as means of communication
- Their study was based on Cancer treatment practice. They used similar structured report as ours without the standard lexicon

uOttawa www.uOttawa.ca

Discussion

- Although our hospital is a cancer treatment center, our study was based on emergency practice and most of the oncology cases were excluded
- Only two cancer patients were included in our study, both of their structured reports showed better clarity
- This might suggest that the structured reports have no benefits over free reports in emergency practice

Université d'Ottawa | University of Ottawa

Discussion

- Instead, the advantages of structured reports are clearer in the oncology population. In addition, it is not clearly necessary to use a standard lexicon
- In our opinion the next appropriate step is the use of structured report in cancer based practice without the standard lexicon

uOttawa www.uOttawa.ca

Discussion

- AJ Johnson et al suggested that the standard lexicon use is constraining and time consuming and might have affected the quality of structured reports, particularly their completeness
- LH Schwartz et al commented that the available systems are not yet optimal for their work flow. Such available systems are not used in our practice as well

Université d'Ottawa | University of Ottawa

Limitations of our study

- Retrospective
- Generated reports are artificial compared to the original official reports
- The second reports were not generated by the same radiologist who read the initial official report. This could introduce interobserver variablility

Université d'Ottawa | University of Ottawa

Limitations of our study

- The exclusion of most of the oncology cases in which, the structured reports were better in clarity and in addressing the clinical query

uOttawa www.uOttawa.ca

Université d'Ottawa | University of Ottawa

Conclusions

- The structured reports do not increase the accuracy or completeness of radiology reports in abdominal and pelvic CT imaging in the emergency department
- They potentially have better clarity than conventional free-flowing reports. This is noticeable in reporting oncology cases

uOttawa www.uOttawa.ca

Conclusions

- We recommend evaluating the potential advantages of itemized structured reporting in CT scans for the initial assessment and follow up of the oncology population

Université d'Ottawa | University of Ottawa

References

- Dunnick NR, Langlotz CP. The Radiology Report of the Future: A Summary of the 2007 Intersociety Conference. J Am Coll Radiol: 2008;5: 626-629.
- Johnson AJ, Chen MYM, Swan JS, Applegate KE, Littenberg B. Cohort Study of Structured Reporting Compared with Conventional Dictation. Radiology: 2009; 253 (1): 74-80.
- Langlotz CP. Structured Reporting: Are We There Yet? Radiology 2009; 253: 23-25.
- Hall FM. The Radiology Report of the Future. Radiology 2009; 251: 313-316.

uOttawa www.uOttawa.ca

Université d'Ottawa | University of Ottawa

References

- Schwartz LH, Panicek DM, Berk AR, Li Y, Hricak H. Improving communication of diagnostic radiology findings through structured reporting. Radiology 2011;260(1):174–181
- Sree Harsha Tirumani MBBS, MD. Structured vs Nonstructured Reporting: Does Structured Reporting Increase the Accuracy of Ultrasonography Reports in Abdominal Imaging SSQ07-08, RSNA 2011

uOttawa www.uOttawa.ca

Université d'Ottawa | University of Ottawa

Contact Information

Ahmed Almuslim, MBBS , FRCR
aalmuslim@cheo.on.ca
binmuslim@gmail.com
Clinical Fellow
Diagnostic Imaging
University of Ottawa
Children's Hospital of Eastern Ontario
401 Smyth Road, Ottawa, ON K1H 8L1

uOttawa www.uOttawa.ca