Multimedia Radiology Reports Are More Efficient In Tumor Burden Assessment

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Purpose

Tumor burden assessment process in cancer patients under clinical trials is objective, requires identification and measurement over time of metastatic selected target lesions on cross sectional images. Most of the oncologists at the NIH Clinical Center use RECIST 1.1 (Response Evaluation Criteria In Solid Tumors) to assess therapeutic response. They used to either extract measurements buried in text only radiology reports or measure independently, resulting in inefficiency, duplicated efforts, hence discrepancies and errors.

We improved report content and tumor burden assessment using multimedia reporting and a radiologist assistant and show hyperlink usage in body CT radiology reports during our first year of experience with multimedia radiology reporting.

Radiology Report comparison

Traditional Text-only report

FINDINGS:

Chest CT:
Mediastinum: Small mediastinal adenopathy for example subcarinal measuring 2.6cm by 1.6cm in series 2n slice number 27. Also, there is a right hilar adenopathy measuring approximately 5 cm on its long diameter. There is another lymph node more inferiorly measuring about 2cm by 1.8. No pericardial or pleural effusions. Lung window portion of this examination demonstrates Unchanged lung nodules for example right upper lobe measuring 1.2cm by 1 cm is its shortest diameter. Heart and great vessels are apparently unremarkable.
Abdomen: Celiac artery and SMA origins are enhanced normally. Pancreas is normal, right kidney and left kidney are seen without appareant abnormalities. Right and left adrenal are normal.
Liver parenchyma has similar hypodensity to the prior study. Retroperitoneal periaortic regions have tiny lymph nodes, non measurable.
Pelvis: Along central pelvis, all structures look normal; whereas, sidewalls show an anterior pelvic mass unchanged on size compared with prior pelvic examination.
Osseous structures: there is a lucency in the left iliac bone with sclerotic
margins unchanged.

IMPRESSION:

1. Unchanged lung nodules
2. Stable mediastinal and hilar adenopathy/masses
3. Stable anterior pelvic wall mass
4. No new soft tissue mas

Report Structure
Narrative
Itemized

Quantitative data
Plain text
Hyperlinks

*Additional features**
Key images, tumor report

Multimedia-Enhanced Radiologist Report (MERR)

FINDINGS:
Chest CT:
Lungs, pleurae: Unchanged lung nodules for example right upper lobe (0.8 cm x 0.4 cm) (series 4, image 84)

Mediastinum, heart, great vessels: Unchanged mediastinal adenopathy for example subcarinal (2.5 cm x 1.4 cm) (series 2, image 27) and right hilar adenopathy for example (5.1 cm x 2.4 cm) (series 2, image 32) and (2.1 cm x 1.4 cm) (series 2, image 25)

Abdomen CT:
Lymph nodes, abdominopelvic vascular: unremarkable

Liver, spleen, biliary, gallbladder, pancreas: unremarkable

GU Kidneys, ureters, adrenal glands: unremarkable

GI Small and large bowel, mesentery, peritoneum: unremarkable

Pelvic CT: Central pelvis, sidewalls: Unchanged anterior pelvic wall mass.
Osseous structures, spine, body wall, soft tissues: unremarkable

IMPRESSION:

1. Unchanged lung nodules
2. Stable mediastinal and hilar adenopathy/masses
3. Unchanged anterior pelvic wall masses
4. No evidence of new soft tissue mass

**Not shown*

Figure 1. Left side: Narrative structured report, with measurements that need to be hunted for extraction. Right side: Multimedia report, in a more itemized structure with links of the measurements annotated in the images. Providing a easier, faster and clearer way to extract quantitative valuable information for radiology reports.

Methods and Materials

We estimated time needed to extract target lesion measurements from multimedia and text-only reports of CT scans from patients with metastatic genitourinary cancer enrolled in two therapeutic trials.
Also, we assessed radiologist hyperlink usage after our PACS upgrade in Feb 2015.

Multimedia-Enhanced Radiology Report

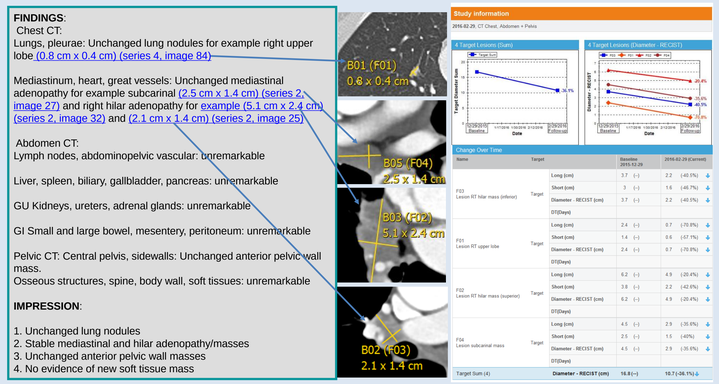

Figure 2. (a) Sample multimedia radiology report where hyperlinked measurements direct (arrows from report links to CT images) oncologists to each measured lesion (3D location, lesion, series, and image). The radiologist dictates the word “hyperlink” following a PACS measurement that automatically imports it along with series and slice number, saving time and reducing errors. The hyperlinks and annotations in co-registered images direct radiologists to measure target lesions (4 in this case: F01, F04, F02 and F03) on the next follow-up exam for consistency.

(b) The table reflects each lesion’s metadata, including measurement, lesion name, series and image number, with automated RECIST calculation that can be exported digitally, obviating handwriting. Numbers indicating lesion size changes over time are converted into a spatial relationship (graph) that the radiologist/oncologist can see at a glance.

Preliminary Results

Hyperlink usage by radiologists in the year following the PACS upgrade that included hyperlink capability, increased from 5% in February 2015 to 88% in April 2016. Universal adoption by body radiologists support improved efficiency.

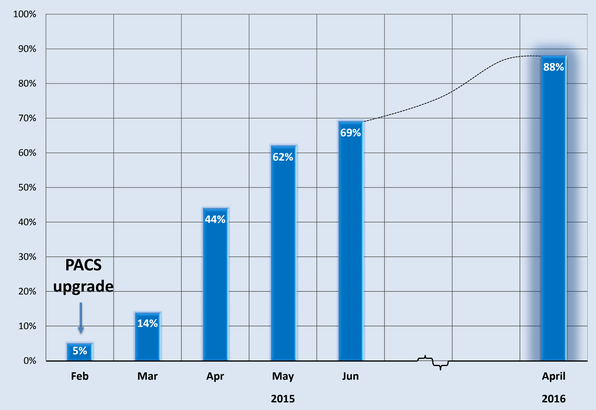

Figure 3. Percentage of hyperlink usage by body CT radiologists at NIH Clinical Center after the incorporation of this capability (PACS upgrade)

Conclusion

Multimedia radiology reports that include hyperlinks that direct clinicians to annotated images, tables of measurements with automated assessment calculations that are exportable and graphs showing tumor burden over time, are more informative and efficient for radiologists and oncologists.

Radiologists quickly adopted universal use of hyperlinks in multimedia radiology reports, supporting time savings.

References

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