

The IR Radlex Project: An Interventional Radiology Lexicon—A Collaborative Project of the Radiological Society of North America and the Society of Interventional Radiology

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Abbreviations: ACR = American College of Radiology, RSNA = Radiological Society of North America

AS images, imaging reports, and medical records move online, radiologists need a unified language to organize and retrieve them. Standardized terminology is increasingly vital to the practice of medicine, as this enables

the information in reports to be understood unambiguously by people and machines. Many of the benefits of clinical information technology cannot be realized unless information is recorded using standard terms in a structured format. Unfortunately, almost all radiology reports are produced as unstructured text narratives rather than in a structured format, thereby hampering radiologists' ability to participate in the ongoing changes in our health care system, which are increasingly driven by information technology. Radiologists currently use a variety of terminologies and standards, but no single lexicon serves all of their needs. RadLex is a controlled terminology for radiology—a single unified source of radiology terms that is designed to fill this need. The purpose of RadLex is to provide a uniform structure for capturing, indexing, and retrieving a variety of radiology information sources, such as teaching files and research data. This may facilitate a first step toward structured reporting of radiology reports. This will also permit mining of data for participation in research projects, registries, and quality assurance.

The RadLex project is sponsored by the Radiological Society of North America (RSNA), which has enlisted the collaboration of other key radiology organizations, including the American College of Radiology (ACR) as well as subspecialty societies, to develop a comprehensive radiology lexicon. It has

been designed to satisfy the needs of software developers, system vendors, and radiology users by adopting the best features of existing terminology systems while producing new terms to fill critical gaps. RadLex also provides a comprehensive and technology-friendly replacement for the ACR Index for Radiological Diagnoses (1). Rather than "reinventing the wheel," RadLex unifies and supplements radiology terms in other lexicons, such as the ACR Index (<http://acr.org>), SNOMED (<http://snomed.org>), the Unified Medical Language System (<http://www.nlm.nih.gov/research/umls/>), the Fleischner Society Glossaries, and the Digital Imaging and Communications in Medicine standard (1–6). The terms are freely available on the Internet with cross references to these other lexicons and standards at <http://radlex.org>.

BACKGROUND

In 2005, six RadLex organ system committees were formed by the RSNA in collaboration with more than 30 radiology professional and standards organizations, including ACR, Digital Imaging and Communications in Medicine, and Integrating the Healthcare Enterprise. During 2006, each of these committees met twice to discuss and approve anatomic and pathologic terms. As a result of these deliberations, more than 7,500 terms were released publicly in November 2006.

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In 2007, six additional committees were recruited, each focusing on a specific imaging modality. These modality committees defined terms to describe the devices, imaging examinations, and procedure steps performed in radiology. This modality effort is called the RadLex Playbook because it is intended to describe the tasks that can be performed in the radiology department—the radiology “playbook.” The Playbook is an initiative complementary to the Uniform Protocols for Imaging in Clinical Trials initiative, which aims to foster the ongoing development of widely acceptable, consistent imaging protocols and quality control procedures across multiple sites and modalities (7). The goal of the Playbook is to ensure that, when a protocol is standardized, manufacturers will harmonize the nomenclature and parameters of their equipment. The interventional radiology (IR) RadLex project is part of RadLex. In January 2007, Dr. Gary Becker and Dr. John Cardella put the IR RadLex project into motion on behalf of the Society of Interventional Radiology. Dr. Sanjoy Kundu chairs the Society of Interventional Radiology (SIR) IR RadLex/lexicon and RSNA IR RadLex committees. Over a 3-month period, an international committee of interventional radiologists was assembled to establish the IR RadLex Committee. During the subsequent 6 months, terms and descriptions were compiled using multiple resources. These included IR textbooks, SIR quality improvement standards documents, and recent research. The IR RadLex project was completed in November 2007 and approved by the SIR Executive Council. Playbook terms are now available on the RadLex Web site, together with a new version of anatomy and pathology terms.

Significant adoption of RadLex is already occurring, including by radiology decision support and reporting vendors, and translations into German, Spanish and Portuguese. There have been more than two dozen RSNA scientific abstracts and exhibits related to RadLex in the past 3 years. RadLex is supported both by the National Institute of Biomedical Imaging and Bioengineering and by the cancer Biomedical Informatics Grid project, a large National Institutes of Health-sponsored effort to develop unified computing infrastructure for clinical trials.

History

For several decades, the ACR’s Index for Radiological Diagnoses (ie, the ACR Index) has served as an indexing system for radiology teaching files (1). The ACR Index was originally developed to categorize and organize the image-based interesting cases collected by radiologists, most often in paper folders on office shelves. As radiology clinical practice and education move online and into electronic storage, there is an increasing need for an indexing system that works in the digital and online world. The RSNA RadLex project is designed to address that need. One of the starting points for the organization of RadLex is the ACR Index, which includes both an Anatomical Field and a Pathological Field. In RadLex, these fields are only two of many terms that can be used to describe radiology information.

LEXICON ORGANIZATION

To understand the scope of RadLex, it is helpful to review the overall organization of the lexicon.

RadLex Terms

Each RadLex term is comprised of several basic elements. Each term is required to have a *unique identifier*, which enables its use in electronic communications; a *name*; and a *relationship* to at least one other term in the lexicon (e.g. “is a”, “part of”, or “branch of”). Some terms also have a *definition*, which clarifies its meaning and intended use; a *source*, which identifies any publications, committees, or other terminology systems from which it was developed; or *comments* that clarify a particular aspect of a term, such as how it should be used.

IR RadLex Terminology

There has been specific terminology created for the IR RadLex unique to interventional radiology. **Table 1** shows example terms describing the preliminary “procedure step.”

Sample IR Procedure Using the IR RadLex

Table 2 shows an example involving use of the IR RadLex in a percutaneous liver biopsy for a focal mass.

Table 1
Example Terms Describing the Preliminary “Procedure Step”

ISA:	Interventional procedure step
ATT:	Target anatomic location [DEF: anatomic location of the finding being treated] {RadLex anatomic location} Finding being treated {RadLex finding} Interventional procedure anesthesia type {RadLex anesthesia type} Interventional procedure sedation depth {RadLex sedation depth} Image guidance modality {RadLex imaging modality}

Note.—Key to understanding RadLex text files is as follows: Indentation indicates a parent-child relationship between terms. The three-letter codes at the beginning of line describe the relationship between the parent term and the child term. (eg, ISA, child is a type of the parent; ATT, child is an attribute of the parent). These relationships carry over to subsequent lines of the file until a new code appears. The codes in square brackets list additional attributes of terms (eg, DEF, definition; COM, comment). Synonyms are listed after the preferred term on the same line, separated by semicolons. Boldface indicates key terms being defined. Curly brackets indicate possible values of an attribute. Curly brackets containing “RadLex” followed by a term name indicate the value of this attribute can be that term name or any of its offspring in the RadLex tree. The raw IR RadLex files can be viewed on the SIR Web site at <http://sirweb.org> under the Clinical Practice Guidelines section. The entire RadLex lexicon can be viewed at <http://radlex.org>.

APPLICATION TO IR

The IR RadLex will enable rich indexing of online teaching materials and clinical data. When procedures are uniformly indexed, clinical and teaching materials are more likely to be found and used by students, trainees, researchers, and radiologists seeking continuing education opportunities. A uniform method of indexing will permit data mining for clinical research and registries, auditing of types of procedures and outcomes, and qual-

Table 2
Sample IR Procedure Using the IR RadLex: Percutaneous Liver Biopsy for a Focal Mass

Procedure step

Interventional procedure step

Target anatomic location

Liver: right lobe: segment 8

Finding being treated

Focal liver mass

Interventional procedure anesthesia type

Local anesthetic: 2% xylocaine: 8 mL

Interventional procedure sedation depth

Moderate sedation: 2 mg

midazolam, 50 µg fentanyl

Image guidance modality

US

Obtain access procedure step

Organ system access location

Percutaneous: liver

Cutaneous access location

Subcostal

Interventional approach

access technique

Transhepatic

Needle stylet: yes with notch

Needle Tip type

Bevel needle tip

Needle diameter: 18 gauge

Needle length: 10 cm

Biopsy procedure step

Biopsy instrument type

core biopsy gun

Number of samples: 3

ity assurance regardless of location or site of practice. Interventional radiologists in different parts of the world will be able to communicate regarding procedures using a common language and vocabulary. The IR RadLex may

also facilitate structured IR procedure reporting in the future.

FUTURE DIRECTIONS

RadLex has completed the initial development phase, comprising largely term acquisition. However, to make it more useful, additional knowledge must be added to RadLex. During the next few years, RadLex will begin acquiring representative images to provide a more explicit definition of RadLex terms. English definitions will also be provided to reduce potential ambiguity by users of RadLex terms. It will also be important to begin making links from RadLex to related terms in other lexicons. Both the National Library of Medicine and the National Cancer Institute distribute comprehensive thesauri of clinical terms. Both these organizations have indicated preliminary interest in including the new elements of RadLex into their thesauri. The RadLex project will also establish links to the ACR Index. Later this year, the lexicon will be distributed through BioPortal, an effort by the National Center for Biomedical Ontology, to distribute terminology systems like RadLex on the internet (<http://www.bioontology.org/ncbo/faces/index.xhtml>, http://www.bioontology.org/ncbo/faces/pages/ontology_list.xhtml). BioPortal will provide a set of Web services that will enable developers to create RadLex-enabled applications, such as text indexing, Web search, and terminology-enhanced voice recognition. The IR RadLex will continue to be updated over time, reflecting new techniques

and technologies being developed in interventional radiology.

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References

- Langlotz C. RadLex: a new method for indexing online educational materials. *Radiographics* 2006; 26:1595–1597.
- American College of Radiology. Index for radiological diagnoses, fourth ed. Reston, VA: ACR, 1992.
- Cimino JJ. Desiderata for controlled medical vocabularies in the twenty-first century. *Methods Inf Med* 1998; 37:394–403.
- Chute CG, Cohn SP, Campbell JR. A framework for comprehensive health terminology systems in the United States: development guidelines, criteria for selection, and public policy implications. ANSI Healthcare Informatics Standards Board Vocabulary Working Group and the Computer-Based Patient Records Institute Working Group on Codes and Structures. *J Am Med Inform Assoc* 1998; 5:503–510.
- Rosse C, Mejino JL Jr. A reference ontology for biomedical informatics: the foundational model of anatomy. *J Biomed Inform* 2003; 36:478–500.
- Siegel E, Channin D, Perry J, Carr C, Reiner B. Medical Image Resource Center 2002: an update on the RSNA's Medical Image Resource Center. *J Digit Imaging* 2002; 15:2–4.
- American College of Radiology. Uniform Protocols for Imaging in Clinical Trials. Available at: <http://upict.acr.org>. Accessed July 2, 2008.