Can a hole be inflamed? On the handling of anatomical cavities in SNOMED CT

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Abstract and Objective

"Sinusitis" is, despite its name, not the inflammation of a nasal sinus cavity, but of the mucosa that delineates that cavity. In SNOMED CT this should be reflected, and all body cavities should be handled alike and in an ontologically well-founded way. A few basic theorems from the upper ontology GFO lead to a consistent handling of the problem. As a side effect, SNOMED CT would also have to improve the precision of its relations, replacing "finding-site" by "has-object" and "has-location" respectively.

Keywords:

SNOMED CT, Ontology, Anatomical cavities.

Methods

The representation of different body cavities in SNOMED CT, and the relation of such cavities to associated disorders and findings have been analyzed from the perspective of ontological correctness. Ontological principles regarding cavities have been identified which can help repair the detected shortcomings.

Results

In SNOMED CT, the definition of sinusitis looks like this:

Fully Specified Name: Maxillary sinusitis (disorder)
ConceptId: 70076002
Associated morphology: Inflammation (morphologic abnormality)
Finding site: Maxillary sinus structure (body structure) (1)

It remains open, whether "*Maxillary sinus structure"* means or should mean the cavity or the cavity plus all surrounding walls.

Foundations from an Upper Ontology

First of all, SNOMED CT concepts should be linked back to an "Upper Ontology" which provides categories such as "material object" and related axioms, e.g. to make sure that a material object such as a mucous membrane can not be part of an immaterial object such as a cavity. From precise definitions of spaces, boundaries and holes the following conditions can be established and logically founded:

1. *Holes have a host, they are dependent entities*
2. *The host is not part of the hole*
3. *Holes can contain a material structure*
4. *Their contents are not part of the hole, but the host of the hole can (but doesn't need to) have the contained as part.* (2)

Based on the above foundations, we can now list the conditions that SNOMED CT must fulfill in order to correctly handle references to pathological processes which are located in anatomical spaces.

A cavity can never be the object of a morphological alteration, it can only be a location. Therefore:

The relation "finding site" should be abandoned, and the relations "has_object" and "has_location" introduced instead. (3)

SNOMED CT should basically distinguish
- *body part, which is a material object and is in the range of "has_object"*
- *body region, which is a space region and in the range of "has_location"*
- *body cavity, which is a hole and is also in the range of "has_location"* (4)

The example then looks like this:

Fully Specified Name: Maxillary sinusitis (disorder)
Associated morphology: Inflammatory alteration (morphologic alteration)
has_object: mucous membrane (body part)
has_location: Maxillary sinus (body cavity) (5)

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