SNOMED CT incl. Postcoordination in Pathology

Thomas Rüdiger, Städtisches Klinikum Karlsruhe

• Snomed CT Implementation Course
• Snomed CT Authoring Course Level 1 and 2
• Lead Snomed CT Pathology and Laboratory Medicine Clinical Reference Group

• ICCR Pathology Synoptic Report Implementation Group
• Medizininformatikinitiative Kerndatensatzteam Pathologie
Pathology

Pathologen sind Lotsen der Therapie. Pathologists guide therapeuetic decisions.
Specimen

Accessioning

Grossing

Dehydration

Casting

Microtomy

Archive

Secretaries

Pathologists

Laboratory

WHO

TNM

Guidelines

Transcription

Microscopy

Dehydration

Casting

Microtomy

Staining

Immuno

In-situ

NGS

Distribution

Coverslapping
Motivation

• 10 Pathologists
  
<table>
<thead>
<tr>
<th>Procedure</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autopsies</td>
<td>50</td>
</tr>
<tr>
<td>Histology cases</td>
<td>43,000</td>
</tr>
<tr>
<td>Cytology cases</td>
<td>10,000</td>
</tr>
<tr>
<td>Immunohistochemistry</td>
<td>50,000</td>
</tr>
<tr>
<td>Molecular pathology</td>
<td>2,000</td>
</tr>
</tbody>
</table>

\[ > 50,000 \text{ Diagnoses} = \text{Decisions} \]

\[ \cdot 20\% \text{ about cancer} \]

Codable Observations

Standardization

• Intra-observer reliability
• Inter-observer reliability
• Comprehensibility
• Calculation of derived values
• Validation
  • Completeness
  • Consistency
• Computer assisted encoding
  • ICD10, ICD-O
  • Snomed CT
Different Records of a Game of Chess

Descriptive record of what happened?

To start with white moved the queen's pawn to forward two spaces. Black responded by moving a knight in front of the kings bishop's pawn. White advanced the queen's bishops pawn two spaces. Black then moved the king's-knight's pawn two spaces.

... [47 more moves in same style]

... Then black moved his king next to his rook.

What should white do next?

Formal process record of what happened?

To decide I need to understand the current situation

1. d4 Nf6
2. c4 g6
3. Nc3 Bg7
4. e4 d6
5. Be2 e5
6. dxe5 dxe5
7. Qxd8 Kxd8
8. f4 Nfd7
9. Nf3 c6
10. O-O exf4
11. Bxf4 f6
12. Rad1 Ke8
13. e5 fxe5
14. Bg3 Nc5
15. Bxe5 Bxe5
16. Nxe5 Be6
17. b4 Ncd7
18. Nf3 Ke7
19. Ng5 Nf8
20. Nxe6 Nxe6
21. Bg4 Nd7
22. Rde1 Ndf8
23. Ne4 Nd8
24. Nc5 Kd6
25. Rf6 Kc7
26. Re7 Kb8

I understand the current situation so I can decide
SNOMED CT is Not Just a Code System

- Concept
  - Unique clinical idea
- Description
  - Synonyms
- Polyhierarchy
- Attribute relationships
  - Cross-linking concepts
  - Concept model
Concept model

Concept model defines
- Valid attributes
- Attribute range

Equivalence of
- precoordinated concept
- And expression
Pathology

Order

373102004
| Specimen from breast obtained by image guided core biopsy |

Report

408643008 | Infiltrating duct carcinoma of breast (disorder) |

: 372276001 | Nottingham Combined Grade (observable entity) |

= 369791003 | Nottingham Combined Grade II: 6-7 points (finding) |
**Order: Snomed CT Concept Model - Specimen**

373102004
Specimen from breast obtained by image guided core biopsy

123038009
Specimen

- Specimen procedure: 44578009 Core needle biopsy of breast
- Specimen source topography: 76752008 Breast structure
- Specimen source morphology
- Specimen substance: 413675001 Body tissue material

**Workflow**

- Macroscopy
- Grossing scheme
- Implicit clinical question
- Standard histological procedures
- Clinical findings
- Explicit questions
- Standard histological procedures
- Histology
- Cytology
Specimen obtained by core needle biopsy

Order

Workflow

Microscopy

Rule for all core needle biopsies

Description requirements (Observables)
- 399482008 | Total number of tissue cores |
- 371476002 | Specimen size, dimension 1 |
- 371477006 | Specimen size, dimension 2 |
- 397191008 | Specimen integrity |
Specimen from breast obtained by image guided core biopsy

**Specimen source**
- topography
- structure

**Specimen**
- source

**Diagnostic perspective**

<table>
<thead>
<tr>
<th>Concept</th>
<th>Id</th>
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<tbody>
<tr>
<td>Adenoma of the nipple</td>
<td>65787003</td>
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<tr>
<td>Aggressive fibromatosis</td>
<td>47284001</td>
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<tr>
<td>Angiosarcoma</td>
<td>863926008</td>
</tr>
<tr>
<td>Apocrine metaplasia</td>
<td>81274009</td>
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<tr>
<td>Atrophy</td>
<td>13331008</td>
</tr>
<tr>
<td>Atypical hyperplasia</td>
<td>32416003</td>
</tr>
<tr>
<td>Atypical lobular hyperplasia</td>
<td>33890903</td>
</tr>
<tr>
<td>Benign fibroadenoma</td>
<td>1156873009</td>
</tr>
<tr>
<td>Benign papilloma</td>
<td>1157073002</td>
</tr>
<tr>
<td>Benign phyllodes tumour</td>
<td>16566002</td>
</tr>
<tr>
<td>Benign tubular adenoma</td>
<td>1156654007</td>
</tr>
<tr>
<td>Borderline phyllodes tumour</td>
<td>71232009</td>
</tr>
<tr>
<td>Breast implant-associated anaplastic large cell lymphoma</td>
<td>1172730009</td>
</tr>
<tr>
<td>Carcinoma</td>
<td>1187425009</td>
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<tr>
<td>Carcinoma in situ</td>
<td>1187138006</td>
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<tr>
<td>Carcinoma of salivary gland type</td>
<td>384951004</td>
</tr>
<tr>
<td>Carcinoma, metastatic</td>
<td>79282002</td>
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<tr>
<td>Chronic inflammation</td>
<td>84490006</td>
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<tr>
<td>Chronic lymphocytic inflammation</td>
<td>54727009</td>
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<tr>
<td>Columnar cell atypia</td>
<td>54565005</td>
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<tr>
<td>Comedocarcinoma, noninfiltrating</td>
<td>78197004</td>
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<tr>
<td>Cyst</td>
<td>367643001</td>
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<tr>
<td>Ductal carcinoma in situ, solid type</td>
<td>128880009</td>
</tr>
<tr>
<td>Dysplasia</td>
<td>25723000</td>
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<tr>
<td>Encapsulated papillary carcinoma</td>
<td>703545003</td>
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<tr>
<td>Fat necrosis</td>
<td>79682009</td>
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<tr>
<td>Fibrosing adenosis</td>
<td>50916005</td>
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<tr>
<td>Giant fibroadenoma</td>
<td>34882000</td>
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<tr>
<td>Granulomatous inflammation</td>
<td>6266001</td>
</tr>
<tr>
<td>Infiltrating carcinoma with ductal and lobular features</td>
<td>444057000</td>
</tr>
<tr>
<td>Infiltrating duct carcinoma</td>
<td>82710006</td>
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</tbody>
</table>

Select form (standardized reporting)
Filter or validate disorders

ICD-10
- C50.9 ??
Postcoordinated order

Order entry interface

- Core needle biopsy of breast
- Ultrasound guidance
- Vacuum assisted biopsy of lesion of breast
- Mammography imaging guidance
- Magnetic resonance imaging guidance

Right
- Upper outer quadrant of breast
- Upper inner quadrant of breast
- Lower outer quadrant of breast
- Lower inner quadrant of breast

Left
- Upper outer quadrant of breast
- Upper inner quadrant of breast
- Lower outer quadrant of breast
- Lower inner quadrant of breast

- Palpable mass
- Mammographic microcalcification of breast
- Mammographic architectural distortion of breast

Specimen from breast obtained by image guided core biopsy

373102004

Specimen

123038009

Specimen

44578009
Core needle biopsy of breast

76365002
Structure of upper outer quadrant of breast

7771000
Left

4147007
Mass

413675001
Body tissue material

7771000
Laterality

Specimen source topography

Specimen source morphology

Specimen procedure

5 x 2 x 5 x 3 = 150 permutations
Snomed CT Concept Model Specimen and Disorder

123038009 Specimen (specimen)

Order Entry

138875005 SNOMED CT Concept (SNOMED RT+CTV3)

Specimen procedure

Specimen source topography

Specimen source morphology

Specimen substance

Specimen source identity

Finding site

Associated morphology

Due to

Causative agent

Pathological Process

Report

64572001 Disease (disorder)

138875005 SNOMED CT Concept (SNOMED RT+CTV3)
Specimen from breast obtained by image guided core biopsy

123038009 Specimen

Specimen source topography

76365002 Structure of upper outer quadrant of breast

Laterality

77710000 Left

Specimen source morphology

82711006 Infiltrating duct carcinoma

Transition: Specimen → Disorder
Finding site
Associated morphology
64572001 Disease
Infiltrating duct carcinoma of upper outer quadrant of left breast

Laterality
7771000 Left

Associated morphology
82711006 Infiltrating duct carcinoma

Guidelines
Mandatory observables
• Nottingham combined grade
• Intrinsic subtype
• B-Classification

Laboratory tests for intrinsic subtype
• Estrogen receptor
• Progesterone receptor
• Her2
• Ki67

254838004 Carcinoma of breast

SNOMED CT to ICD-10 map C50.4L

SNOMED CT to ICD-O simple map 8500/3
<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tubular growth</td>
<td>&gt;75%</td>
<td>10-75%</td>
<td>&lt;10%</td>
</tr>
<tr>
<td>Pleomorphism</td>
<td>Small regular tumor cells</td>
<td>Some Pleomorphism</td>
<td>Marked Pleomorphism</td>
</tr>
<tr>
<td>Mitoses / 10 hpf</td>
<td></td>
<td>12</td>
<td>22</td>
</tr>
</tbody>
</table>
SNOMED CT is Suitable for documentation

- Granularity / Postcoordination
  - Primary documentation
  - Reporting
- Polyhierarchy / Attribute Relationships
  - Different abstractions
  - Workflow
- Description logic / Classifier
  - Implementation
- Descriptions
  - Transfer into report
  - Translation
Postcoordination

- Different aspects of the final clinical statement may be contributed by different specialities
- Reduces length of lists
- Precoordinated concepts are not flexible for primary documentation

Finding site

- Associated morphology
  - Infiltrating duct carcinoma

Laterality

- Left

Finding site

- Structure of upper outer quadrant of breast

Disease

- Infiltrating duct carcinoma of upper outer quadrant of left breast

64572001

76365002

7771000

82711006
Structured workflow – a promise for efficiency and data quality

**Chances**
- More useful reports with less resources
- Order information guides workflow
  - Validation of input
  - Calculation of derived values
- Medical history display
  - Based on disorders not time

**Work ahead**
- **Snomed CT**
  - Selection of concepts to avoid excessive precoordination
  - Definition of missing concepts
  - Computable specimen description
  - Translation
  - Terminology services
    - Postcoordination
- **Reporting requirements**
  - ICCR
    - Snomed terms currently being modelled
  - Guidelines
  - Non-malignant conditions
- **Graphical elements**
- **Dealing with uncertainty**