Radiologic Identification

RCPA Update 2019
Dr Thomas Ruder
Clinical Director Radiology
Background

Source/Figure: S Ferrara, unsplash.com
Paranasal sinuses

Unknown male

Known patient

Source/Figure: NDHB Hospital PACS
Milestones – 1927

First radiologic identification

AM x-ray 1918

PM x-ray 1926

Source/Figure: Culbert WC & Law FM, JAMA (1927)
Milestones – 1943
First dental radiologic identification

AM dental x-ray

PM dental x-ray

Source/Figure: Brogdon BG, Forensic Radiology (1st ed. 1998)
Milestones – 1949
First use of x-ray for DVI

Source/Figure: https://www.thestar.com, Toronto Star Archives
Milestones – 1980

Radiologic identification widely known

This machine compares the skeleton of everyone who wants to enter the bin to my own x-ray. Simply dressing up as me will no longer be enough to get in!

Great idea!
Milestones – 1993

First use of PMCT for identification

AM CT 1990

PMCT 1991

Source/Figure: Reichs KJ, FSI (1993)
Milestones – 2007
Recognition of power of PMCT for ID

Source/Figure: Sidler M, FSI (2007)
Milestones – 2009
First use of PMCT for DVI

Source/Figure: O'Donnell C, FSI (2010)
Milestones – since 2013

International consensus statements

Source/Figure: JoFRI 2013-2018
ISFRI 2019 | MAY 16TH – 18TH IN BERLIN

Willkommen! And Bienvenue! Welcome! This is one of the most famous phrases from the musical “Cabaret” inviting you to Berlin at the beginning of the 20th century. In my role as convenor of the ISFRI 2019, I am pleased to address these words to you at the beginning of the 21st century. I am cordially inviting you to the combined 8th annual meeting of the International Society of Forensic Radiology and Imaging and the 14th annual meeting of the International Association of Forensic Radiographers in Berlin, Germany from May 16th – 18th 2019.

Continue reading  Registration now open!

www.isfri2019.de
www.isfri.org
Radiologic identification

Summary after 100 years

- Single case ↔ mass fatality incident
- Presumed ID ↔ true unknown
- Anthropology ↔ comparative ID
- Radiographs ↔ CT
Radiologic identification
How is it done?

- Scenario?
- ID status?
- Experts available?
- AM records?
- PM imaging?
Paranasal sinuses

Unknown male

Known patient

Source/Figure: NDHB Hospital PACS
Paranasal sinuses

Paranasal sinus CT identification

- 4 readers
- 25 AMCT : 100 PMCT (23 pairs)
- 3 AMCT images/case provided
- Reader reformatted PMCT

→ Accuracy

Source/Figure: Ruder TD, Eur J Radiol (2011)
Paranasal sinuses
Set AMCT images

Source/Figure: Ruder TD, Eur J Radiol (2011)
Paranasal sinuses

Manual MPR

Source/Figure: Ruder TD, Eur J Radiol (2011)
Paranasal sinuses

Set AMCT images vs PMCT reformats

Source/Figure: Ruder TD, Eur J Radiol (2011)
## Paranasal sinuses

### Results and discussion

<table>
<thead>
<tr>
<th>Source/Figure: Ruder TD, Eur J Radiol (2011)</th>
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<table>
<thead>
<tr>
<th></th>
<th>CT</th>
<th>TP (23)</th>
<th>FP</th>
<th>TN (77)</th>
<th>FN</th>
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<td>Army physician</td>
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<td>0</td>
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</table>
Paranasal sinuses
Faster reformat with standard image

Source/Figure: Ruder TD, JoFRI (2016); Brun CN, FSI (2017)
Paranasal sinuses
Suitable for old, non-isotropic CTs

Source/Figure: Ruder TD, JoFRI (2016); Brun CN, FSI (2017)
Paranasal sinuses

Source/Figure: Amazon.com
Dental identification

Initial challenges and criticism

Source/Figure: Ruder TD, JoFRI (2016)
Dental identification

Validation of PMCT dental identification

- 5 readers
- 114 dental AMRX : 115 PMCT (98 pairs)
- Levels of confidence
- Number of concordant features

→ Accuracy, 3x correlations

Source/Figure: Ruder TD, JoFRI (2016)
## Dental identification

### Results and discussion

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# Dental identification

## Results and discussion

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<th>Nr.</th>
<th>Features</th>
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**Accuracy:** RX:CT $92\% \geq$ RX:RX $85-93\%$
## Dental identification

### Results and discussion

**Accuracy:** RX:CT 92% ≥ RX:RX 85-93%

<table>
<thead>
<tr>
<th>Correlation</th>
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<th>Confidence</th>
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<td>Accuracy</td>
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<tr>
<td>Confidence</td>
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→ Confirmation bias
Change of practice

Levels of confidence

Interpol/ABFO

Positive ID
Probable (Interpol)
Possible ID
Insufficient evidence
Exclusion

Source: Interpol DVI Guide 2018 Annexure 12; abfo.org; Figures: Ruder TD, JoFRI (2016)
Other ways of radiologic ID

No ante-mortem head CT?

Source/Figure: Dr Gary Hatch, University of New Mexico (USA) and University of Zurich (Switzerland)
Other ways of radiologic ID

No ante-mortem CT?

Source/Figure: (left & middle) University of Zurich (Switzerland); (right) Heimer J and Ruder TD, FSMP (2017)
# Radiologic identification

<table>
<thead>
<tr>
<th>SINUS</th>
<th>DENTAL</th>
<th>REST</th>
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<tr>
<td>• Scientific</td>
<td>• DVI</td>
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<td>• Intuitive</td>
<td>• Experience</td>
<td>• Everything</td>
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<td>• Skull to</td>
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<tr>
<td>• Underused</td>
<td>• Team</td>
<td>• Toes</td>
</tr>
<tr>
<td>• Single cases</td>
<td>• Access</td>
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</tr>
</tbody>
</table>
What you should remember for your next ID case

• PMCT powerful tool for ID
• AM images limitation and inspiration
• DVI: experience with task & tool
• Interdisciplinary team work

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