Challenges in prevention and case management of tinea capitis.

An example from a primary school outbreak in 2013.

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Content

- Background and epidemiology
- The outbreak alert
- Outbreak investigation:
  - Aim
  - Methods
  - Results
  - Conclusions
  - Recommendations
Tinea capitis

• Fungal scalp infection
  • Dandruff in patches
  • Bald patches
  • Swelling or sores (kerion)

• Dermatophytes
  • Human-to-human
  • Animal-to-human
  • Soil-to-human

• Oral antifungal treatment

• Prepubertal children
Epidemiology of tinea capitis in Europe

Incidence decreasing since 1950’s
- Griseofulvin
- Better surveillance

Mainly animal-to-human

Tourism and migration
- Shift towards human-to-human in urban regions
- Increased incidence
Epidemiology of tinea capitis in Belgium

1999 – 2004: *M. audouinii* in 71% of cases*

Since 2000 increase in outbreaks
- schools
- day care centres

Not notifiable in Belgium

* As reported by the Unit for Mycoses of Institute of Public Health (IPH)
Primary school outbreak, Antwerp, Belgium, 2013

- First case in school (1)
- Feb 2013
- School doctor detects first case (2)
- Mar 2013
- Teachers suspect more cases (3)
- Apr 2013
- Official request for support (4)
- May 2013
- Dermatologist diagnosed *Microsporum canis* infection
  - = animal-to-human transmitted
  - → no control measures in school
- Contact school doctor (3)
- School doctor requests support from Agency for Care and Health (4)
The request for support in this outbreak

School doctor contacted Agency for Care and Health, Antwerp:

- Outbreak management
  - Advice
  - Additional epidemiological investigations
  - Additional laboratory investigations

⇒ Start of the outbreak investigation
Aim of the outbreak investigation

- Determine the extent and pathogen
- Evaluate follow up of treatment recommendations
- Describe risk factors

In order to:

- Control the outbreak
- Formulate recommendations for controlling and preventing future outbreaks
Case definition and case finding

Case definition:
Pupil
- Tinea capitis clinically diagnosed by physician after referral by school doctor

Case finding:
24th May 2013
Clinical screening of all pupils during school visit
  ⇒ referral to physician in case of symptoms

Treatment recommendation for physicians:
- Prescribe oral treatment if tinea capitis
Data collection and descriptive epidemiology

Data collection:
- Demographics, symptoms, treatment prescribed
- School records, physicians, school doctor, teachers
- No questionnaire

Description of cases:
- Age
- Gender
- Symptoms
- Treatment prescribed by the physician
Cohort study

Retrospective cohort study:
- Including all pupils
- Identification of risk factors

Analysis:
- Attack rates
- Adjusted risk ratios (log binomial regression)
Specimen collection

- 3 weeks after school screening
- Symptomatic pupils
- "Tooth brush" method
- Section of Mycology & Aerobiology, Scientific Institute of Public Health

+ Local laboratory data available through physicians
Early control measures

24 May 2013

Note for all parents:
• Clean pillows, combs, …
• Take symptomatic animals to vet

27 May 2013

Cleaning of school, including stuffed animals, clothes…
Results: Descriptive

Attack rate
19 tinea capitis cases on 291 pupils → Attack rate = 6.5%

Description of cases
• 5-13 years, median 8
• 13 (68%) boys
• 14 (73%) prescribed oral treatment
• Symptoms: dandruff in patches to bald patches
Risk factors for tinea capitis infection in a primary school outbreak, Antwerp, 2013.

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Adjusted relative risk</th>
<th>P value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contaminated sibling</td>
<td>11</td>
<td>&lt;0,001</td>
<td>5,4-22,5</td>
</tr>
<tr>
<td>Contaminated class mate</td>
<td>4,6</td>
<td>0,004</td>
<td>1,6-12,8</td>
</tr>
</tbody>
</table>

No association with age, gender, class, nationality, language spoken at home.
## Microbiology results

<table>
<thead>
<tr>
<th>Specimens collected in study</th>
<th>Physicians</th>
<th>Number of results</th>
</tr>
</thead>
<tbody>
<tr>
<td>(N=15)</td>
<td>(N=3)</td>
<td></td>
</tr>
<tr>
<td><em>M. audouinii</em></td>
<td>Negative</td>
<td>1</td>
</tr>
<tr>
<td><em>M. audouinii</em></td>
<td><em>M. canis</em></td>
<td>2*</td>
</tr>
<tr>
<td><em>M. audouinii</em></td>
<td>/</td>
<td>3</td>
</tr>
<tr>
<td>Negative</td>
<td>/</td>
<td>9</td>
</tr>
</tbody>
</table>

* Including index case
**Microsporum audouinii**

- Human to human transmitted

- Microscopically resembles *Microsporum canis* → laboratory experience needed
Limitations

Specimen collection
  • No asymptomatic carriers
  • 3 weeks after case finding

Case definition based on clinical diagnosis
Conclusions

1. Quarter of cases did not receive the required oral antifungal treatment.

2. Intrafamilial transmission had a bigger impact than transmission between classmates.

3. Misdiagnosis occurred and contributed to the spread of the outbreak.
Recommendations

1. Development of *guidelines* for physicians on case management of tinea capitis.

2. Placement of additional focus on *prevention of intrafamilial transmission*.

3. Involvement of *specialised mycology laboratories*.
Acknowledgements

Infectious Disease Control Antwerp
Koen De Schrijver

Centre for Student Guidance Het Kompas
Goedele Andries

EPIET
Pawel Stefanoff
Mycology & Aerobiology
“Tooth brush” method

max. 21 days (25°C)

Subculture on appropriate media (25°C)

Results after appearances of morphological characteristics (up to 21 days)
“Tooth brush” method

max. 21 days (25°C)

Subculture on appropriate media (25°C)

Results after appearances of morphological characteristics (up to 21 days)
Classical identification (ID)

- Correlation of clinical manifestations of infection and observation of macro- and microscopic properties
  - experienced technologists, morphological characteristics

- DNA sequence-based ID \textit{(gold standard)}
  - expensive and time-consuming

Both restricted by slow growth of dermatophytes (up to 3 weeks)
MALDI-TOF MS identification
(Matrix Assisted Laser Desorption/Ionisation Time-Of-Flight Mass Spectrometry)

ID dermatophytes:
- Improve accuracy
- Decrease analysis time
**Dermatophyte culture**  
(Sabouraud chloramphenicol)  
3 days, 25°C

**MALDI-TOF MS**  
Direct deposit  
W or W/O 70% formic acid  
Valid result?  
7 days, 25°C

**MALDI-TOF MS**  
Protein extraction  
Valid result?  
14 days, 25°C

**MALDI-TOF MS**  
Protein extraction

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**Use of a robust and extensive databank**  
195 reference strains, 58 species  
BCCM/IHEM fungal collection  
CHU Timone, Marseille

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Method validated in Packeu A, De Bel A, L'Ollivier C, Ranque S, Detandt M and Hendrickx M

Fast and accurate identification of dermatophytes by MALDI-TOF mass spectrometry: validation in the clinical lab.  
J Clin Microbiol. 2014 Sep;52(9):3440-3
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MALDI-TOF MS
Protein extraction

14 days, 25\(^\circ\) C
Valid result?

At least 3 out of four spots: same ID (LogScore mean \(\geq 1.7\))
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(Sabouraud chloramphenicol)
3 days, 25°C

MALDI-TOF MS
Direct deposit
W or W/O 70% formic acid
7 days, 25°C
Valid result?

MALDI-TOF MS
Protein extraction
14 days, 25°C
Valid result?

MALDI-TOF MS
Protein extraction
MALDI-TOF MS approach

max. 21 days (25° C)

Subculture on Sabouraud chloramphenicol

Results after max. 14 days (MALDI-TOF MS approach)

present outbreak: results after direct deposit methodology (3 incubation days of subcultures at 25° C)

Microsporum audouinii
Conclusion

Tinea capitis:

• Early identification of the causative agent via MALDI-TOF MS approach – (a)symptomatic carriers

• Early identification of the source, initiation of a proper treatment and restriction of the outbreak
Acknowledgements

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