

## Microbiology Nuts & Bolts: Don't Believe Everything You Read in the Papers

Dr David Garner  
Consultant Microbiologist  
Frimley Park Hospital NHS Foundation Trust

[www.microbiologynutsandbolts.co.uk](http://www.microbiologynutsandbolts.co.uk)



## Aims & Objectives

- To work through an interactive outbreak
- To understand the process of investigating an outbreak
- To understand the complexities involved in investigating outbreaks

[www.microbiologynutsandbolts.co.uk](http://www.microbiologynutsandbolts.co.uk)



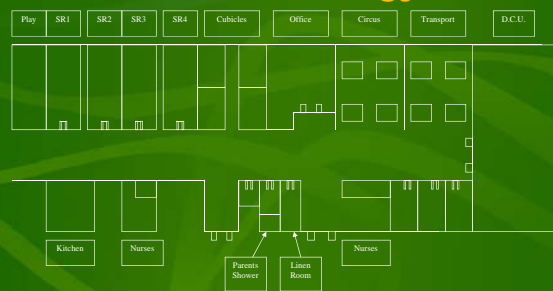
## Background

- Nottingham University Hospitals NHS Trust
- Tertiary referral paediatric oncology unit
  - Approximately 80 new referrals per year
  - Majority haematological malignancies and brain tumours (special research interest)

[www.microbiologynutsandbolts.co.uk](http://www.microbiologynutsandbolts.co.uk)



## Paediatric Oncology Unit



[www.microbiologynutsandbolts.co.uk](http://www.microbiologynutsandbolts.co.uk)



## Case 1

- 5 year old boy
  - Family from India, born in UK
  - Acute Lymphoblastic Leukaemia
  - In remission 3 months
  - Admitted 24<sup>th</sup> Sept with febrile neutropaenia
  - Started IV Ceftazidime and Gentamicin as per hospital protocol
  - 28<sup>th</sup> Sept Still febrile, started fitting

[www.microbiologynutsandbolts.co.uk](http://www.microbiologynutsandbolts.co.uk)



## Question 1

- If you could perform one investigation what would it be?
  1. Blood culture
  2. Lumbar puncture
  3. MRI brain
  4. C reactive protein
  5. CT head

[www.microbiologynutsandbolts.co.uk](http://www.microbiologynutsandbolts.co.uk)



## Question 1

- If you could perform one investigation what would it be?
  1. Blood culture
  2. Lumbar puncture
  3. MRI brain
  4. C reactive protein
  5. CT head

www.microbiologynutsandbolts.co.uk



- MRI brain scan 29<sup>th</sup> Sept
  - “At least 3 discrete lesions in right temporal and parietal lobes, and tiny lesions in the left paracentral lobules”
  - “Fluid secretions and inflammatory changes in the paranasal sinuses”

www.microbiologynutsandbolts.co.uk



## Question 2

- What would you do next?
  1. Change antibacterials
  2. Add an antifungal
  3. Biopsy the sinus lesions
  4. Start anti-mycobacterial treatment
  5. Biopsy the brain lesions

www.microbiologynutsandbolts.co.uk



## Question 2

- What would you do next?
  1. Change antibacterials
  2. Add an antifungal
  3. Biopsy the sinus lesions
  4. Start anti-mycobacterial treatment
  5. Biopsy the brain lesions

www.microbiologynutsandbolts.co.uk

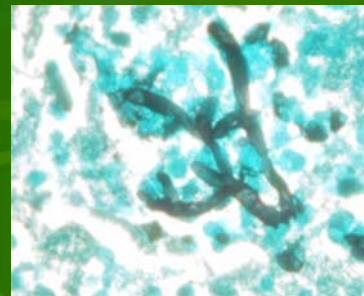


- Resection biopsy 29<sup>th</sup> Sept
  - Culture negative on conventional microbiological techniques

www.microbiologynutsandbolts.co.uk



## Histopathology



www.microbiologynutsandbolts.co.uk

Courtesy of Dr Keith Robson, Dept. of Histopathology, NUH NHS Trust



### Question 3

- What is the diagnosis?
  1. Invasive aspergillosis
  2. CNS relapse of ALL
  3. Nocardiosis
  4. Mucormycosis
  5. Mycobacterial infection

www.microbiologynutsandbolts.co.uk



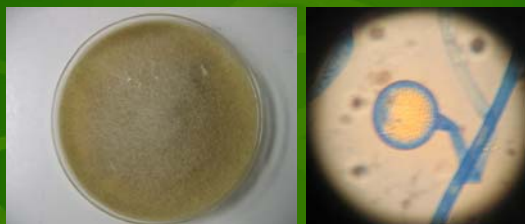
### Question 3

- What is the diagnosis?
  1. Invasive aspergillosis
  2. CNS relapse of ALL
  3. Nocardiosis
  4. Mucormycosis
  5. Mycobacterial infection

www.microbiologynutsandbolts.co.uk



### What should have grown....



www.microbiologynutsandbolts.co.uk



- Diagnosis invasive fungal infection, possibly mucor
- Started treatment with intravenous AmBisome 5mg/kg
- Repeat MRI 9<sup>th</sup> Oct
  - Lesions doubled in size

www.microbiologynutsandbolts.co.uk



### Question 4

- What would you do?
  1. Continue current therapy
  2. Change to voriconazole
  3. Change to posaconazole
  4. Add antibacterials back in
  5. Add antimycobacterials

www.microbiologynutsandbolts.co.uk



### Question 4

- What would you do?
  1. Continue current therapy
  2. Change to voriconazole
  3. Change to posaconazole
  4. Add antibacterials back in
  5. Add antimycobacterials

www.microbiologynutsandbolts.co.uk



- Further surgical resection of lesions
- Changed to posaconazole
- Histology slides sent to Dr Elizabeth Johnson at the Mycology Reference Laboratory in Bristol
  - Histology confirmed as mucormycosis


www.microbiologynutsandbolts.co.uk 

## Case 2

- 15 year old boy
  - Newly diagnosed ALL
  - Transfer from a DGH in North Nottinghamshire
  - Difficult social circumstances
  - Infection at site of Venflon 24<sup>th</sup> Oct
    - Large black necrotic lesion unresponsive to Ceftazidime and Flucloxacillin

www.microbiologynutsandbolts.co.uk 

- Progression of respiratory signs unresponsive to antibacterials with cavitation on USS
- Developed problems with speech (expressive dysphasia) and balance
- MRI brain scan 26<sup>th</sup> Oct & 2<sup>nd</sup> Nov
  - Multiple cerebellar lesions, lesion in left occipital lobe
  - Secretions in various sinuses


www.microbiologynutsandbolts.co.uk 

- Possible opportunistic infection
- Started AmBisome
- Biopsy of skin lesion 1<sup>st</sup> Nov
  - Sent to histology

www.microbiologynutsandbolts.co.uk 


## Question 5

- What would you do next?
  1. Call an outbreak meeting
  2. Phone the local paper
  3. Change Case 2 to Posaconazole
  4. Screen all of the patients for opportunistic infections
  5. Close the ward to admissions

www.microbiologynutsandbolts.co.uk 

## Question 5

- What would you do next?
  1. Call an outbreak meeting
  2. Phone the local paper
  3. Change Case 2 to Posaconazole
  4. Screen all of the patients for opportunistic infections
  5. Close the ward to admissions

www.microbiologynutsandbolts.co.uk 

- Histology looked at urgently
  - Confirmed fungal infection, possibly mucor
- Case 2 very unwell, may not survive, changed to Posaconazole
- Unable to surgically resect as technically too dangerous

www.microbiologynutsandbolts.co.uk



## Question 6

- Is this an outbreak?
  1. Yes
  2. No
  3. Don't know

www.microbiologynutsandbolts.co.uk



## Question 6

- Is this an outbreak?
  1. Yes
  2. No
  3. Don't know
- 2 cases of rare fungal infection linked by time and place

www.microbiologynutsandbolts.co.uk



## Questions to ask

- What might be the likely source of infection in these children?
- What do we do about a recent decision to put all high risk children onto the ward where these two cases have occurred?
- Is there a precedence that might help us?
- Have any of the Infection Control team or Microbiologists ever dealt with a mucor outbreak before?

www.microbiologynutsandbolts.co.uk



## Environment

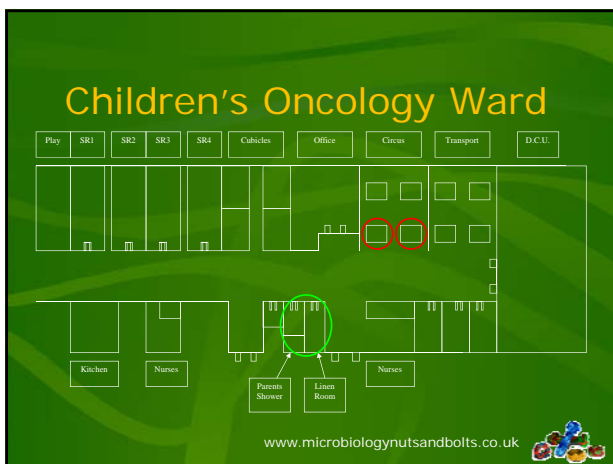
- Throw away comment "oh, by the way, you do realise we have a problem with a leaking shower on the children's oncology ward?"
- How many people can you fit in a shower cubicle?
  - 4 (at least)
    - Consultant microbiologist
    - 2 Infection control nurses
    - Ward manager

www.microbiologynutsandbolts.co.uk



www.microbiologynutsandbolts.co.uk





### Question 7

- What do you do next?
  1. Call an outbreak meeting
  2. Seal off the shower area
  3. Seal the linen room
  4. Cover the corridor damage
  5. Panic!

www.microbiologynutsandbolts.co.uk

### Question 7

- What do you do next?
  1. Call an outbreak meeting
  2. Seal off the shower area
  3. Seal the linen room
  4. Cover the corridor damage
  5. Panic!

www.microbiologynutsandbolts.co.uk

- Who would you invite to the outbreak meeting?
- How would you protect other children?
- How are you going to investigate the hypothesis that the water damage is the source?

www.microbiologynutsandbolts.co.uk

## Outbreak Meeting

- Infection Control Team including technician (BMS 2)
- Consultant Microbiologists
- Consultant paediatric oncologists
- Ward Manager
- Domestic supervisor
- Laboratory representative
- Press office
- Paediatric Clinical Director
- Estates

www.microbiologynutsandbolts.co.uk



## Protecting Other Children

- Containment
- Patient movement
- Environmental contamination
- Case finding
- Prophylaxis

www.microbiologynutsandbolts.co.uk



## Containment

- Doors closed and sealed.
- No ventilation to other areas of hospital
- Damaged plaster covered in boarding and edges sealed with silicon
- Levels in area should drop if no further seeding or air flow

www.microbiologynutsandbolts.co.uk



## Patient Movement

- Review of all ward patients by consultant oncologists
- All "high risk" i.e. on intensive chemotherapy moved to a separate ward
- Situation explained in person to all parents

www.microbiologynutsandbolts.co.uk



## Environmental Contamination

- Full deep clean of the ward, using all available domestic and nursing staff.
- Complete linen change
- Change all curtains
- Normal hypochlorite clean
- Do after high risk patients moved off ward
- Re-commission different ward to provide temporary accommodation for oncology and neurosurgery patients.

www.microbiologynutsandbolts.co.uk



## Case Finding

- How would you go about case finding for invasive fungal infection?
  - Radiology
  - Galactomannan,  $\beta$ -glucan
  - Clinical symptoms
- Decision, no active case finding but early pre-emptive treatment with antifungals in all patients on ward from 4 weeks before first case.

www.microbiologynutsandbolts.co.uk



### Question 8

- Would you give prophylaxis?
  1. Yes
  2. No

www.microbiologynutsandbolts.co.uk



### Question 8

- Would you give prophylaxis?
  1. Yes?
  2. No

www.microbiologynutsandbolts.co.uk



### Prophylaxis

- Who to give prophylaxis to?
- What antifungal to use?
- How long to give for?

www.microbiologynutsandbolts.co.uk



### Prophylaxis

- Ambisome
  - Expensive
  - Nephrotoxic (esp. with other chemotherapy agents)
  - Not clinically therapeutic in Cases 1 and 2
- Posaconazole
  - Cheaper
  - Greater efficacy against zygomycetes
  - Unlicensed and no dose for children at time (or adults!)
  - Clinical trials suggest well tolerated
- Discussion with manufacturer: Posaconazole
- 15 High Risk children identified

www.microbiologynutsandbolts.co.uk



### Environmental Sampling

- Need to investigate whether ward is source of infection.

www.microbiologynutsandbolts.co.uk



### Question 9

- What form of environmental sampling would you use?
  1. Air sampling
  2. Swabs
  3. Settle plates
  4. Touch plates
  5. I wouldn't do environmental sampling

www.microbiologynutsandbolts.co.uk





### Question 9

- What form of environmental sampling would you use?
  1. Air sampling?
  2. Swabs?
  3. **Settle plates**
  4. Touch plates?
  5. I wouldn't do environmental sampling

www.microbiologynutsandbolts.co.uk



### Environmental Sampling

- Combination of settle plates, air sampling and swabs or scrapings from plaster.
- Incubated for 48 hours at 30°C in air
- Counted colonies and identified moulds using morphological characteristics on macro and microscopic examination

www.microbiologynutsandbolts.co.uk



### Environmental Sampling Results: Presence of Zygomycetes

At Time of Outbreak

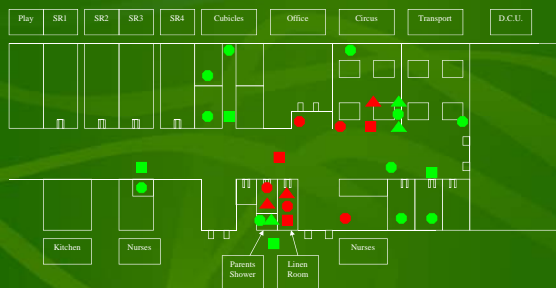
www.microbiologynutsandbolts.co.uk



### Key

- Positive Settle Plate
- Negative Settle Plate
- Positive Air Sample
- Negative Air Sample
- ▲ Positive Swab or Scrape
- ▲ Negative Swab or Scrape

www.microbiologynutsandbolts.co.uk



www.microbiologynutsandbolts.co.uk

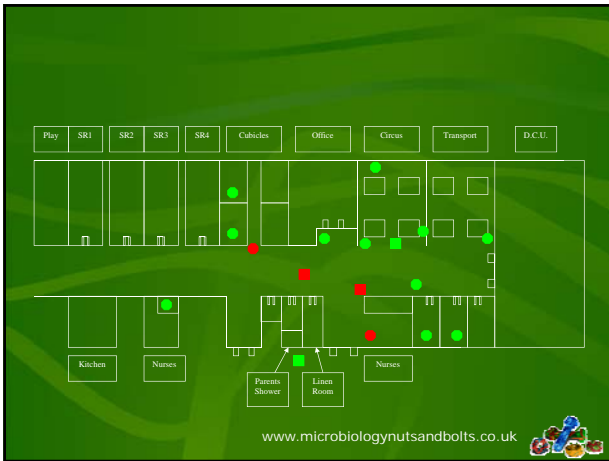


### Environmental Sampling Results: Presence of Zygomycetes

72 Hours After Infection Control

www.microbiologynutsandbolts.co.uk

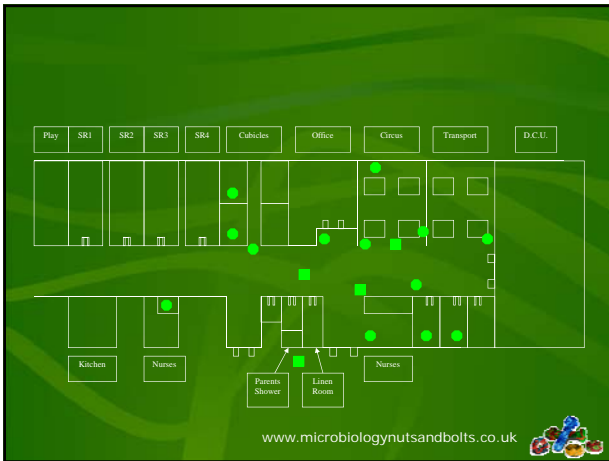




**Environmental Sampling Results:**  
**Presence of Zygomycetes**

1 & 3 Weeks After Infection Control

www.microbiologynutsandbolts.co.uk



**Outcome**

www.microbiologynutsandbolts.co.uk

**Cases**

- Case 1
  - Remained well at home
  - Continued on Posaconazole for duration of leukaemia (2 years)
  - Lesions reduced in size and eventually resolved completely
  - Cost = £73,000

www.microbiologynutsandbolts.co.uk

- Case 2
  - Slow clinical improvement over months
  - Speech abnormalities and cerebellar signs now completely resolved
  - Still had difficult social circumstances
  - Treat for duration of leukaemia (3 years)
  - Cost = £109,500

www.microbiologynutsandbolts.co.uk

## Total Cost of Posaconazole

- Prophylaxis £42,000
  - Case 1 £72,000
  - Case 2 £109,500
  - Total £223,500
- No further cases of mucormycosis

www.microbiologynutsandbolts.co.uk



## What if Using AmBisome?

- Prophylaxis £126,000
  - Case 1 £144,000
  - Case 2 £547,500
  - Total £817,500
- But these are only the drug costs!
- Plus: IV only, therefore inpatient therapy, need IV line, risk of infection, lack of efficacy etc, etc...

www.microbiologynutsandbolts.co.uk



## Warning!

www.microbiologynutsandbolts.co.uk



**QMC is hit  
by fungal  
outbreak**  
**Child seriously ill as ward is  
closed for decontamination**

www.microbiologynutsandbolts.co.uk



## Apparently...

- Children at QMC had been attacked by a brain eating fungus!
- It came from a storeroom cupboard!
- The cupboard had been cordoned off!
- 300-400 children would have to be recalled for tests!
- It sounds like a story worthy of a Hollywood epic!

Always have a press statement ready to go!

www.microbiologynutsandbolts.co.uk



## Outbreak Conclusions

- Probably ward acquisition of invasive fungal disease
- Untested use of Posaconazole a success in treatment & prophylaxis
- Both cases did well
- Environmental sampling is very useful when carefully directed

www.microbiologynutsandbolts.co.uk





Just when you thought it was safe to go back in the water...!

[www.microbiologynutsandbolts.co.uk](http://www.microbiologynutsandbolts.co.uk)



## A red herring or something more...?

Dr David Garner  
Consultant Microbiologist  
Frimley Park Hospital NHS Foundation Trust

[www.microbiologynutsandbolts.co.uk](http://www.microbiologynutsandbolts.co.uk)



## Case

- 5 years old
- Acute Lymphoblastic Leukaemia
- UK ALL97(99) chemotherapy protocol
- Presented with febrile neutropaenia
  - Rigors with central venous catheter (CVC) use
- Treated with Ceftazidime, Gentamicin and Teicoplanin as per protocol

[www.microbiologynutsandbolts.co.uk](http://www.microbiologynutsandbolts.co.uk)



## Day 3

- Blood cultures signalled positive
  - Gram film = Gram positive coccus
  - Tube coagulase = negative
- Antibiotics continued as still febrile and neutropaenic
- Continues to be symptomatic with CVC use
  - Oncologist reluctant to remove CVC

[www.microbiologynutsandbolts.co.uk](http://www.microbiologynutsandbolts.co.uk)



## Day 4

- Blood cultures
  - After 24 hours incubation
  - No growth aerobically or anaerobically
  - Plates reincubated as per laboratory SOP

[www.microbiologynutsandbolts.co.uk](http://www.microbiologynutsandbolts.co.uk)



## Question 1

- How would you manage the child at this stage?
  1. Continue current therapy pending further results
  2. Remove the CVC
  3. Change the teicoplanin to vancomycin
  4. Add an antifungal
  5. Change ceftazidime to meropenem

[www.microbiologynutsandbolts.co.uk](http://www.microbiologynutsandbolts.co.uk)



## Day 5

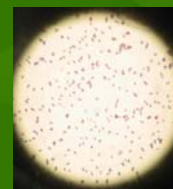
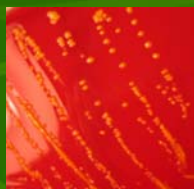
- Very scanty growth aerobically
  - Catalase negative
  - Gram film = Gram positive coccus
- Decision to reincubate for enough growth for laboratory identification
- What do the audience think the organism might be?
- However.....

Plates not incubated overnight but left on open bench by mistake

www.microbiologynutsandbolts.co.uk



- Healthy growth aerobically at room temperature
  - Orange pigmented organism
  - Gram film = Gram positive coccobacilli
- What is the presumptive identification of the bacteria?



www.microbiologynutsandbolts.co.uk



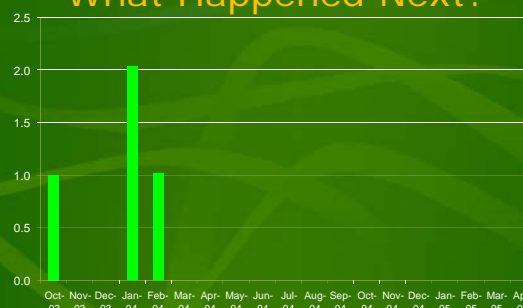
## Day 7

- API coryne = *Rhodococcus* species
- Patient changed to Vancomycin + Rifampicin
- White cell count recovers & fever settles
- Treated for 2 weeks for presumed line infection
- Organism confirmed as *Rhodococcus* spp. by 16sRNA by reference laboratory
- Patient remained well with CVC *in situ*

www.microbiologynutsandbolts.co.uk



## What Happened Next?



www.microbiologynutsandbolts.co.uk



## Question 2

- How would you manage this situation?
  1. Declare an outbreak and start investigating
  2. Review CVC policy
  3. Change empirical antibiotic policy for febrile neutropaenia
  4. Wait and see
  5. No idea what the heck is *Rhodococcus*?

www.microbiologynutsandbolts.co.uk



## *Rhodococcus* spp.

- Actinomycete genus
- Term first used in 1891 by Zopf
- Redefined in 1977 to include strains resembling but not included in genera *Nocardia*, *Corynebacterium* and *Mycobacterium*.
- Aerobic, Gram positive, non-motile, mycolate-containing, nocardioform actinomycetes.
- Recently split into *Rhodococcus*, *Dietzia* and *Gordona*.

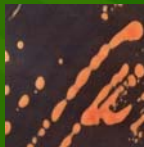


www.microbiologynutsandbolts.co.uk



## Rhodococcus sp.

- Environmental organism
  - Soil, rock, boreholes, groundwater, marine sediments, animal dung, guts of insects and healthy and diseased animals and plants.
- Commercial potential
  - Ability to degrade complex hydrocarbons (Exxon Valdez oil spill)
  - Synthesises surfactants & flocculants
- Pathogenic potential
  - Literature review showed only a handful of cases of infection worldwide, no common themes



www.microbiologynutsandbolts.co.uk



## Question 3

- How would you manage this situation?
  1. Declare an outbreak and start investigating
  2. Review CVC policy
  3. Change empirical antibiotic policy for febrile neutropaenia
  4. Wait and see
  5. Still no idea even though I now know what Rhodococcus is?

www.microbiologynutsandbolts.co.uk



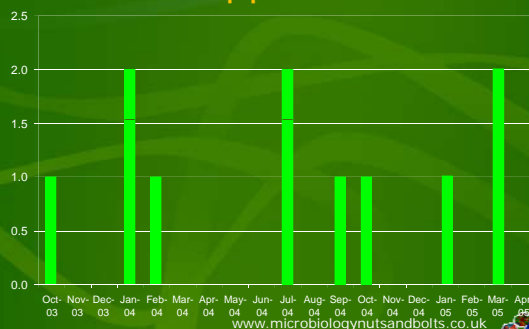
## The Great Wiggly Bag Debate!

- What is a wiggly bag?
  - A small cloth bag worn on a strap around the neck to keep the end of your wiggly in
  - Wiggly = CVC in child friendly terms!
- No departmental policy for cleaning these
- Most were filthy and hadn't been washed for 2 years!
- Simple cleaning policy adopted
- Rate of infection on the unit dropped
- Hurray!

www.microbiologynutsandbolts.co.uk



## What Happened Next?



www.microbiologynutsandbolts.co.uk



## What Happened Next?

- October 2003 to September 2005:
  - 11 definite cases of infections with Rhodococcus like organisms
  - 5 possible cases
  - All in paediatric oncology (no other speciality)
  - All CVC Infections
- Only 19 other patients had culture positive CVC infections since Oct 2003

www.microbiologynutsandbolts.co.uk



## 11 Rhodococcus Infections

- Rhodococcus spp. 8
- Dietzia spp. 2
- Gordonia terrae 1
- 8 Antibigrams
  - All (100%) resistant to trimethoprim
  - 7 (86%) resistant to mupirocin
  - 2 (29%) resistant to erythromycin
  - All (100%) sensitive to vancomycin and rifampicin

www.microbiologynutsandbolts.co.uk



## Question 4

- Do we have an outbreak?
  1. Yes
  2. No

www.microbiologynutsandbolts.co.uk



- Our conclusion:
  - We do have an outbreak
  - 11 cases of similar organisms in a specific small patient population linked by time and place
  - But isolates are not identical!

www.microbiologynutsandbolts.co.uk



## What else do we know about *Rhodococcus* spp.?

- Pathogenicity
  - Unclear
  - Related to other Nocardioforms?
    - Early neutrophil mobilisation retards infection until lymphocyte-mediated cytotoxicity and activated macrophages effect definitive response.
    - Risk factors organ transplantation & lymphoreticular neoplasia

www.microbiologynutsandbolts.co.uk



## *Rhodococcus* sp.

- *R. equi*
  - Horse pathogen, causing necrotising pneumonia with systemic dissemination and death
  - Human infection in immunocompromised, especially HIV but also occasionally described in leukaemia and lymphoma, necrotising pneumonia, dissemination and death.
- Other *Rhodococcus* spp.
  - Rare cases described, all in HIV
    - 10 CVC infections and 2 endocarditis

www.microbiologynutsandbolts.co.uk



## *Rhodococcus* spp. Outbreaks

- Richet *et al* 1991 NEJM
  - 7 cases of *Rhodococcus (Gordona) bronchialis*
  - Sternal wound infections following coronary bypass grafting
  - Attributed to a nurse heavily colonised with the bacteria (as were her dogs!)
  - Redeployment of the nurse terminated the outbreak

www.microbiologynutsandbolts.co.uk



## Question 5

- What do you think might be the source of this outbreak?

www.microbiologynutsandbolts.co.uk



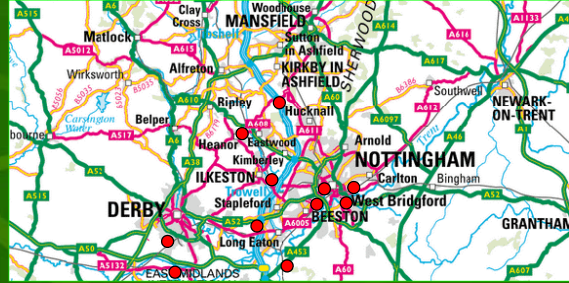
## Outbreak Investigation

- Geography
- Patient demographics
- Case reviews
  - Underlying malignancy
  - Chemotherapy protocols

www.microbiologynutsandbolts.co.uk



## Geography



www.microbiologynutsandbolts.co.uk



## Geography

Area	No. Rhodococcus	% Rhodococcus	No. Oncology Patients	% Oncology Patients
Leicestershire	0	0	22	11
N Derbyshire	0	0	2	1
N Lincolnshire	0	0	11	5
N Nottingham	3	27	21	10
Nottingham	3	27	67	33
S Derbyshire	4	36	58	29
S Lincolnshire	0	0	15	7
Out of Region	1	9	13	6

www.microbiologynutsandbolts.co.uk



## Demographics

- Average Age 10 years
  - Range 3 – 16½
- Male:Female                      6:5

www.microbiologynutsandbolts.co.uk



## Case Reviews

- Febrile Neutropaenic Episodes
  - Average No.                      5
  - Range                                      0 - 9
- Antibiotics within 3 months
  - Ceftazidime                              8
  - Gentamicin                                8
  - Co-trimoxazole                        5
  - Fluconazole                              5
  - Flucloxacillin                            1
  - Pentamidine                            1

www.microbiologynutsandbolts.co.uk



## Case Reviews

- Time from line insertion to infection
  - Average time 11 months
  - Range 1 – 36 months, wide spread
- Line use
  - TPN    3
- Other diet supplements                      5
- Children all been in different areas of unit at different times
- No common member of the hospital or community oncology team

www.microbiologynutsandbolts.co.uk





## Underlying Disease

Disease	Rhodococcus positive	% Rhodococcus	Oncology Patients	% Oncology Patients
ALL	7	65	33	16
AML	1	9	12	6
Other leukaemia	0	0	1	0
Hodgkin's disease	0	0	14	7
NHL	2	18	13	6
Other	2	18	136	65

www.microbiologynutsandbolts.co.uk



## Chemotherapy

- UK ALL 97(99) 5
- UK ALL 2003 4
- AML 12 1
- Oral only, low intensity 1
- All involve combinations of similar classes of drugs
- More intense than other regimens?

www.microbiologynutsandbolts.co.uk



- Rhodococcus problem presented at a National Paediatric Microbiology meeting
  - No other centres seeing this
  - No other centres are missing this
- This is a Nottingham problem!

www.microbiologynutsandbolts.co.uk



## Question 6

- Why is Rhodococcus more common in Acute Lymphoblastic Leukaemia?
  1. ALL is more immunosuppressive than other cancer
  2. Children more predisposed to *Rhodococcus* spp.
  3. UKALL chemotherapy protocols are more immunosuppressive than any others
  4. Children with ALL in Nottingham are all exposed to a common source
  5. Something else missed so far predisposes to Rhodococcus infection

www.microbiologynutsandbolts.co.uk



## Investigation

- Meeting called with paediatric oncology team
- Discussion with environmental microbiologists around country as to ideas of potential source
- No obvious way forward

www.microbiologynutsandbolts.co.uk



## Question 7

- What would you do next?
  1. Call an outbreak meeting involving agencies outside of the hospital
  2. Close the unit to new patients
  3. Put all of the children on prophylactic antibiotics
  4. Relocate the patients to allow for refurbishment of the ward
  5. Wait for further cases and hope that a source becomes apparent


www.microbiologynutsandbolts.co.uk



- We chose to wait and see what happens while we tried to think of a way forward
- Main suspicion was that there is a source within the paediatric oncology unit environment but where?
  - No obvious visible damage or building work
  - Only "dirty" water source is a canal that runs approximately 50m from the hospital but is 5 floors below the ward and no air inlet near this area

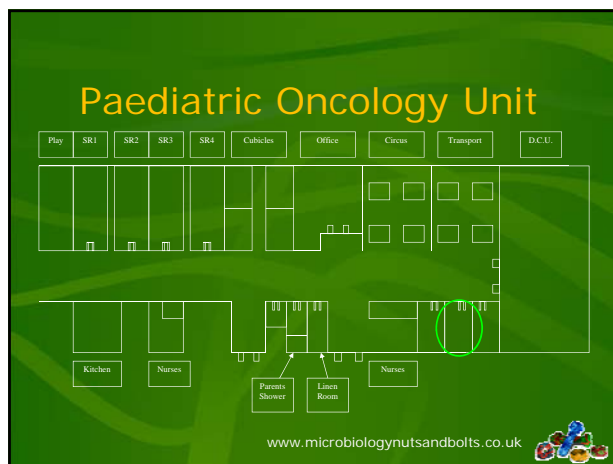
www.microbiologynutsandbolts.co.uk 

- Infection control committee meeting September 2005
  - Discussion about generally high rate of line infections in paediatric oncology and that many are environmental organisms.
  - Senior member of Estates Dept. wondered if air to oncology ward was HEPA filtered.
  - According to other Estates personnel present only the day case unit was and the filters were checked and changed regularly.

www.microbiologynutsandbolts.co.uk 


- Later that day
  - Message from Estates Dept.
    - Air to treatment room on oncology ward does actually have a HEPA filter (air flow directly onto surface where IV drugs drawn up!)
    - No record of this HEPA filter being checked or changed since the hospital was opened 25 years earlier!
    - The filters will be changed as soon as new ones arrive

www.microbiologynutsandbolts.co.uk 



### Investigation of HEPA Filters

- Surface divided into sectors
- Sampled with moist sterile swab on surface then probed into filter
- Plated to homemade "Rhodococcus media" blood agar containing trimethoprim, aztreonam and amphotericin B
- Incubated 72 hours aerobically at room temperature

www.microbiologynutsandbolts.co.uk 

## Results

- Orange colonies on plates from all sectors of treatment room HEPA filter
- No orange colonies on plates from all sectors of Day Case Unit HEPA filter
- Orange colonies identified using API coryne as *Rhodococcus* sp.
- No genetic comparison done

www.microbiologynutsandbolts.co.uk



## Hypothesis

- HEPA filters are the source of *Rhodococcus* sp.
- *Rhodococcus* sp. specifically suited to colonising CVCs (degrade rubber and produce biofilms)
- *Rhodococcus* sp. are able to exploit defects in lymphoreticular immunity allowing persistent infection or colonisation of CVCs
- Co-trimoxazole given to all of the highest risk patients allowed the *Rhodococcus* sp. to out compete other organisms
- Removing the HEPA filters should abort the outbreak (removed October 2005)

www.microbiologynutsandbolts.co.uk



## The Swiss cheese effect

- Failure to replace HEPA filters
- Organism suited to colonising CVCs
- Specifically susceptible patient population
- Selective pressure from antimicrobial prophylaxis



www.microbiologynutsandbolts.co.uk



## Outcome

- No further cases since October 2005
  - Concluded that HEPA filters were source
- Patients
 

– Antibiotics alone (Vanc + Clari)	7
– Line removed	3
– Died	1

www.microbiologynutsandbolts.co.uk



## Conclusion

- Cases of *Rhodococcus* central line infections being seen in Nottingham paediatric oncology patients
  - 1 death, 3 Line removals
- Difficult diagnosis
- Keep going at a problem and eventually the answer becomes apparent
- Environmental sampling can help to prove the source if carefully thought out

www.microbiologynutsandbolts.co.uk



Any Questions?

www.microbiologynutsandbolts.co.uk



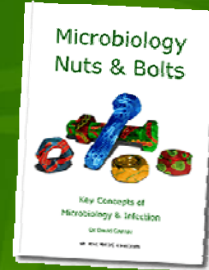
## Thanks

- To all of the outbreak team who managed to get all of this sorted out within a few hours on Friday afternoons
- Especially Mitch Clarke, Infection Control Nurse & Karren Machin Infection Control Biomedical Scientist, Nottingham University Hospitals NHS Trust

[www.microbiologynutsandbolts.co.uk](http://www.microbiologynutsandbolts.co.uk)



## Any Questions?



[www.microbiologynutsandbolts.co.uk](http://www.microbiologynutsandbolts.co.uk)

