

## **The need for Guidelines for UK hospitals for the prevention of Nosocomial (hospital acquired) Invasive Aspergillus infection – based on work done during an outbreak at Newcastle General Hospital in 1999**

### ***Background:***

The Aspergillus Trust had an enquiry from a Spanish hospital asking whether there were any international standards for the prevention of invasive aspergillosis in hospitals. Partly as a result of this, in May 2005 the Secretary of the Aspergillus Trust interviewed Andrew Poplett, Head of Estates for Northgate & Prudhoe NHS Trust in Northumberland. He had been the engineer in charge of specialist projects, and in charge of specialist ventilation systems, for Newcastle General Hospital during the outbreak of aspergillus infection in 1999 while demolition work was being carried out there. Since then he has felt strongly that protocols in hospitals against outbreaks of aspergillus infection should be standardised throughout the country, but this does not yet seem to have taken place. It has happened in Ireland, after Mr Poplett went to Dublin to give a series of three lectures on invasive aspergillosis and precautions against it. As a result the Irish Health Service issued appropriate guidelines, still awaited in the UK. Mr Poplett also gave a series of 5 talks in Newcastle in 2000, and has recently been asked to give a presentation to the Institute of Hospital Engineers on the topic. Invasive aspergillosis is not a notifiable disease.

Three people died in Newcastle in 1999 as a result of a badly controlled hospital environment during demolition work. Three other people were treated for aspergillus infections but recovered. The people who died were already seriously ill and could have died anyway from their conditions; in addition to this post-mortems were not carried out to ascertain that aspergillus was the major culprit. Patients were not being monitored for aspergillus, however, and the Trust estates manager acknowledged NHS Estates guidelines for diseases such as aspergillus were not keeping track with the medical advances of such infections.

An NHS trust like the Newcastle one may experience about 20 cases of infection a year, but there are incidences of larger than expected numbers of people dying from invasive aspergillosis. Historic outbreaks of fatal aspergillus infection include 1974 when 8 died in the UK in 7 months, and 19 died in a 4 year period. In 1983 18 died in Lyon, France; 22 were infected over a 2 year period. Eleven died in a US military hospital in 1985, while in 1990 5 died in a Nebraska outbreak.

The spores of the aspergillus fungus are ubiquitous, found in soil, water, vegetation, dust and debris. They have a diameter 21,000 times smaller than a golf ball. They have a three miles effective range. Infection is mainly by inhalation. Multiplication and growth are strongest in warm/damp environments. Potentially fatal infection can be found in the lungs, brain, blood vessels, heart and kidneys. All people are constantly exposed to aspergillus and colonised by inhaled spores but only at risk groups develop invasive aspergillosis (IA). IA is difficult to diagnose and hard to treat. Treatment is both toxic and expensive.

Patient groups at risk include: SCIDS (severe combined immuno-deficiency syndrome, which means babies have to live in a ‘bubble’); BMT recipients (bone marrow transplant cases); patients on high dose corticosteroids; patients with solid organ transplants; adult/paediatric oncology patients; AIDS patients; burns patients; children with CGDC (chronic granulomatous disease of childhood).

Hospital areas where there is risk of infection include: Haematology, Organ Transplants, Oncology, ICU/PICU (adult and paediatric intensive care units), laboratory facilities. Laboratories where testing is done for at risk patients need to be absolutely clean.

***Aspergillus Mortality Rates:***

<b>Condition</b>	<b>Incidence of IA %</b>	<b>Mortality from IA %</b>
BMT (Acute Leukaemia)	4-9	90
Heart & Lung Transplant	3-19	93
Liver Transplant	1.5-15	77
Renal Transplant	0.5-10	70
Heart Transplant	0-24	50
AIDS	0-12	30

Mortality from Invasive Aspergillosis (Manuel R J et al J Hosp Infect; 1998; 39, 95-109)

***Newcastle General Hospital’s problems in 1999***

The hospital faced major demolition and rebuilding work over several months. Many at risk patients are treated at the hospital. Aspergillus released from building dust was identified as a potential problem to at risk patients. A Health and Safety Committee was convened to identify risks and advised:

Increased awareness

- Clinicians
- Ward staff
- Cleaning staff

Reduction of dust and spore transmission

- Hosing of dust
- Covering of refuse skips
- Stopping demolition in strong winds
- Keeping windows closed

Surveillance

- Monitoring patient samples
- Environmental monitoring

Environmental monitoring revealed heavy aspergillus contamination in PICU. This was thought to be from underground water seepage. Rainfall was low and prevailing wind direction was south-south-west during demolition allowing dust to spread across

the hospital site. Aspergillus was later found in other ward areas. Aspergillus was found in air conditioning ducts. NO ASPERGILLUS WAS FOUND IN POSITIVE PRESSURE HEPA-FILTERED OR LAMINAR FLOW PROTECTED AREAS.

***Timetable of events:***

July 98 H&S committee convened to advise on demolition.  
 29 Sept 98 Demolition started.  
 10 Nov 98 Aspergillus isolated in PICU cubicle – underground contamination suspected.  
 2 Jan 99 Patient 1 (PICU) – bowel perforation. Aspergillus isolated. Patient dies.  
 14 Jan 99 Meeting – ICU staff and Infection Control  
 27 Jan 99 Patient 2 (Oncology) develops septicaemia. Failure to respond – Aspergillus suspected.  
 3 Feb 99 Patient 2 dies.  
 5 Feb 99 Demolition stopped.  
 8 Feb 99 Multi-disciplinary Committee convened.  
 14 Feb 99 Patient 3 develops pulmonary aspergillosis – in same PICU bed as Patient 1. Aspergillus found in overhead air duct.  
 19 Feb 99 Patient 4 develops pulmonary aspergillosis.  
 28 Feb 99 Patient 4 dies.  
 Mar/Apr 99 Patients 5,6,7 develop IA – all survive.

***Patient characteristics:***

Patient	IA?	Age	Underlying disease	Ward	Outcome
1	D	2.5	Meningococcal Septocaemia	PICU	Died
2	P	47	Breast Cancer PBSCT	Oncology	Died
3	D	9	Influenza Pneumonia	PICU	Alive
4	D	16	AlloBMT (CML) - Leukaemia	CBMTU	Died
5	P	58	Cancer of Larynx	Oncology	Alive
6	P	9	Glioblastoma (type of brain tumour) PBSCT	Paediatrics Ward	Alive
7	P	57	Cancer of Oesophagus	Oncology	Alive

Key: IA = invasive aspergillosis; D = definite diagnosis; P = probably diagnosis; PICU = Paediatric Intensive Care Unit; CBMTU = Children’s Bone Marrow Transplant Unit; PBSCT = peripheral blood stem cell transplant.

***Recommendations and conclusions***

Hospital personnel with Aspergillus responsibilities

- CEO (overall responsibility)

- Head of Estates
- Responsible Officer (Aspergillus)
- Competent Persons
- Infection Control
- Clinicians

#### Communication

- Risk Assessment and Outbreak Control Teams
- Estates/Infection Control/Clinicians **MUST** talk!

#### Permanent Protection Systems

- Positive pressure HEPA-filtered environments
- Portable patient isolation units
- Cubicle protection systems
- Ward protection systems
- Dust release control
- Prevailing wind prediction modelling
- Patient transportation controlled
- Cross infection prevention/hygiene (vacuum cleaners, carpets, showers, food, dust - all sources of aspergillus)
- Patient exclusion
- External site maintenance (grounds/gardens)
- No cut flowers or plants on wards with at risk patients; sticky mats at entrances
- Avoidance of cellulose-base fireproofing in construction or renovation.

#### Design/Maintenance issues

- Ventilation design (dilution, laminar flow, air curtains, ultra clean)
- Design standards
  - ISO 14698 Bio-contamination control
  - ISO 14644 Air cleanliness
  - US FED 209 F Cleanliness classifications
  - BS 5295
  - HTM (Health Technical Memorandum) 2025

Some of the activities other than demolition which may release spores and put patients at risk:

- Removal of redundant floor coverings
- Access into false ceiling voids
- Removal of partitions
- Wall chasing
- Cutting of openings
- Maintenance of ventilation systems
- Transport of materials around the site
- External ground works
- Cleaning
- Changing of work clothes in risk areas

#### Temporary Protection/Precautions

- Dust suppression eg hosing down
- Wind direction monitoring
- Sealing of windows/air infiltration
- Covering of refuse skips
- Increased cleaning protocols
- Limiting site access/egress
- Pedestrian traffic control
- Limiting dirt transfer into clinical areas
- Reduction of latent heat gains
- Decontamination with Copper-8-quinolinolate of air-handling systems

#### Surveillance

- Patient microbiological surveillance
- Environmental surveillance
- Air sampling
- Settle plates

#### Modifying host responses

- Reducing immunosuppression if possible
- Avoiding neutropenia
- Avoiding long-term broad spectrum antibiotics
- Prophylactic antifungals

#### Other considerations

- **PLANNING IS ESSENTIAL!**
- Background monitoring – both before, during and after an outbreak, if possible
- Outbreak/Control Teams

Nosocomial invasive aspergillosis from environmental exposure is a real threat to at risk patients.

**Risks are invariably underestimated.**

**Awareness of the problem is vital.**

**Preventive measures are expensive.**

**Treatment is even more expensive.**

**Simple control measures can be effective.**

**Co-operation between professional groups is vital.**

**Remember this could happen at ANY hospital.**

**After installing protection systems and instigating other protection measures, demolition recommenced at Newcastle General Hospital in December 1999.**

**There have been no further cases of IA identified at Newcastle General Hospital since this time.**

***What questions can a patient at risk ask when going into hospital for serious surgery?***

- Could I see or have assurances that the operating theatre ventilation cleaning records are up to date and show the theatre is clean, in accordance with HTM 2025?
- Have the air flows in theatre been checked recently and been shown to be correct?
- Do the autoclave test records show the sterilisation of instruments is fully adequate and that instruments are clean, in accordance with HTM 2010?

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I would like to thank Andrew Poplett for making his work and the work of other members of the various committees which met during the incident in Newcastle available to the Aspergillus Trust. Some of those others are: B N A Crooks, A Galloway, T J Flood (Paediatric Intensivist Specialist), R Skinner, J Hale, M Verrill, B Fulton. We hope other hospital trusts may find this summary useful, and patients be informed by it.

These recommendations are far from exhaustive and those interested may wish to consult the 'National Guidelines for the Prevention of Nosocomial Invasive Aspergillosis During Construction/Renovation Activities' produced by the Scientific Advisory Committee, Aspergillus Sub-committee Members, chaired by Dr Lynda Fenelon, Consultant Microbiologist, St Vincent's Hospital, Dublin, and published in 2002 by the National Disease Surveillance Centre, 25-27 Middle Gardiner Street, Dublin 1 (ISBN 0-9540177-3-0). Architects and consulting engineers will also have publications, and be able to give presentations dealing with practicalities.