

## Control of Construction - Associated Nosocomial Invasive Aspergillosis Outbreak at Kuwait Cancer Control Centre

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**Abstract:** Outbreaks of nosocomial invasive aspergillosis may occur in association with construction/renovation activities. Outbreak of Nosocomial invasive aspergillosis had been declared at July 2010 at Kuwait Cancer Control Centre coinciding with different construction and renovation activities. A total of four cases of aspergillosis were identified. An urgent meeting of a multidisciplinary team comprising infection control staff, clinicians, hospital deputy director, engineering department staff and the director of nursing staff was established with subsequent implementation of different control measures including: Sealing of construction sites with impermeable barriers, face-masking of patients with N95 mask, frequent wet cleaning around construction area and posaconazole antifungal prophylaxis for high risk patients.

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**Keywords :** Aspergillosis; Outbreak; Construction

### Introduction:

Nosocomial outbreaks of aspergillosis are a well known complications of construction, demolition or renovation activities in or near hospital wards housing immune-suppressed patients<sup>(1)</sup>.

Construction activities inside hospitals may cause aspergillus spores aerosol pollution which resulted from disturbance of settled aspergillus spores or disrupting a locus of growth. These aerosolized spores will be carried by air to be inhaled by immune compromised patients (malignancies receiving intensive immunosuppressive, allogeneic haematopoietic stem cell transplants or solid organ transplants) causing pulmonary aspergillosis that may proceed to invasive disease<sup>(2)</sup>.

Invasive aspergillosis is difficult to diagnose and treat. Moreover it has high mortality rate ranging from 25% to 90% in spite of new therapies, so prevention of such a condition is of a high priority in managing at risk patients during construction activities<sup>(3,4)</sup>.

Ideally several preventive measures must be undertaken in the pre-planning stage for imminent hospital construction in order to protect at risk patients from exposure to aspergillus spores. These measures include demolition, construction and ventilation measures, infection control measures and chemoprophylaxis<sup>(5)</sup>.

This article is conducted in order to highlight our successful experience in managing and controlling construction - associated invasive

aspergillosis outbreak at Kuwait Cancer Control Centre (KCCC) during the year 2010 with the following objectives :

To describe aspergillosis outbreak that occurred at KCCC

To describe the measures that was taken to control this outbreak

### Methods

#### Setting

Kuwait Cancer Control Centre (KCCC) is 200 bed hospital. It is the only specialized oncology centre in Kuwait serving all population residing Kuwait, whether Kuwaiti or of other nationality; approximately 3.5 million according to 2009 census<sup>(6)</sup>.

KCCC provides inpatient medical oncology, haematology, surgical, radio-diagnosis, laboratory and radiotherapy services in addition to outpatient clinics for most of the previous services.

The inpatient haematology wards are located at the first and the second floors of the old building while the inpatient medical oncology wards are located at the first and the second floors of the new building, the third floor of the new building accommodates autologous bone marrow transplant patients (BMT).

The inpatient hematology wards are serviced by standard air filtration with pre-filters to remove large particulate matter using standard deep-bed filters, which are checked and washed monthly and replaced

annually. While the inpatient oncology and autologous BMT wards are served by high efficiency particulate air (HEPA) filter .

Fluconazole 200 mg daily (antifungal prophylaxis) was administered to patients with leukemia and undergoing to induction treatment and to patients with high grade lymphoma receiving aggressive therapy.

### **Construction and Renovation Works at KCCC**

Construction period extended from the first of June up to the end of November in an area connecting the old building with the new one. The following works were done: replacement of ceiling, demolition, electrical rewiring, floor works, building walls, joinery, painting, plumbing and plastering.

### **Definitions of Aspergillosis Cases**

According to European Organization for Research and Treatment of Cancer (EORTC) definitions <sup>(7)</sup>. Proven invasive fungal infections: Histopathologic or cytopathologic examination showing hyphae from needle aspiration or biopsy-specimen with evidence of associated tissue damage (either microscopically or unequivocally by imaging) or positive culture result for a sample obtained by sterile procedure from normally sterile and clinically or radiologically abnormal site consistent with infection, excluding urine and mucous membranes, Probable invasive fungal infections : At least 1 host factor criterion and 1 microbiological criterion and 1 major (or 2 minor) clinical criteria from abnormal site consistent with infection , Possible invasive fungal infections : At least 1 host factor criterion and 1 microbiological or 1 major (or 2 minor) clinical criteria from abnormal site consistent with infection.

### **Laboratory and Radiological Work- up**

The identified cases were subjected to the following:

- 1- Polymerase chain reaction (PCR) for identification of Aspergillus fungus type from positive filamentous fungus sputum samples was performed at Kuwait Faculty of Medicine.
- 2- Galactomannan antigen assay was performed at Kuwait Faculty of Medicine.
- 3- Fungal culture for sputum at Ibn Sina Hospital laboratory (Kuwait).
- 4- CT scan for chest and sinuses at Kuwait Cancer Center .
- 5- Tissue biopsy at Ibn Sina Hospital Histopathology laboratory.

### **Data Collection:**

Medical files, laboratory reports and nursing notes of the identified cases were reviewed in

addition to reviewing that of hematology, medical oncology and BMT patients treated prior to the outbreak.

### **Administrative Consideration:**

A permission from the Director of the Kuwait Cancer Center and the Director of Infection Control Directorate of Kuwait, Ministry of Health for collecting and releasing the data of this research was taken.

### **Outbreak Description and Management:**

Aspergillosis Outbreak was declared at 11 July after identification of two cases of aspergillosis and after revealing that there is no previous reported invasive aspergillosis cases in the last four years infection control departments' surveillance reports .

A total of four cases of aspergillosis were identified between 23 June 2010 and 25 November 2010; one proven, two probable and one possible case according to EORTC definitions (Table 1&Figure1). *Aspergillus terreus* was identified in the sputum of three case, while Galactomannan assay was positive among 2 cases only. The identified cases were prospectively followed up by active surveillance.

Immediately after declaring the outbreak a multidisciplinary team comprising infection control staff, clinicians, hospital deputy director, engineering department staff and the director of nursing staff was established. Then an urgent meeting of this team was held on, during this meeting the situation was described and discussed in details. After that and in accordance with guidelines published by the Healthcare Infection Control Practices Advisory Committee of the CDC <sup>(8,9)</sup> , recommendations and procedures to control the situation were clearly settled ,outlined and assigned to all the meeting personnel.

These measures included the following : establishing airtight barrier around the construction area , using of negative pressure ventilation in the construction area, covering the air supply and exhaust vents in the construction zone, redirection of construction traffic to be away from patient area through the back doors of the hospital , regular removal of construction debris from the construction site in sealed containers, frequent cleaning around the construction area more than usual using wet mop. Using N95 face masks for patients during their transport near the construction area.

Active daily surveillance of infections in patients who are at increased risk for aspergillosis infection was performed by infection control personnel in addition to daily following up of

implementation of the multidisciplinary team recommendations.

As the construction period was long extended from June up to November; Posaconazole was given to patients stratified by their treating clinicians to be

at high risk ( autologous and allogenic bone marrow transplant patients during neutopenic period , prolonged neutopenia more than 14 days after chemotherapy ). Posaconazole is a new triazole drug that recently showed efficacy for fungal prophylaxis in high-risk patients<sup>(10,11)</sup>.

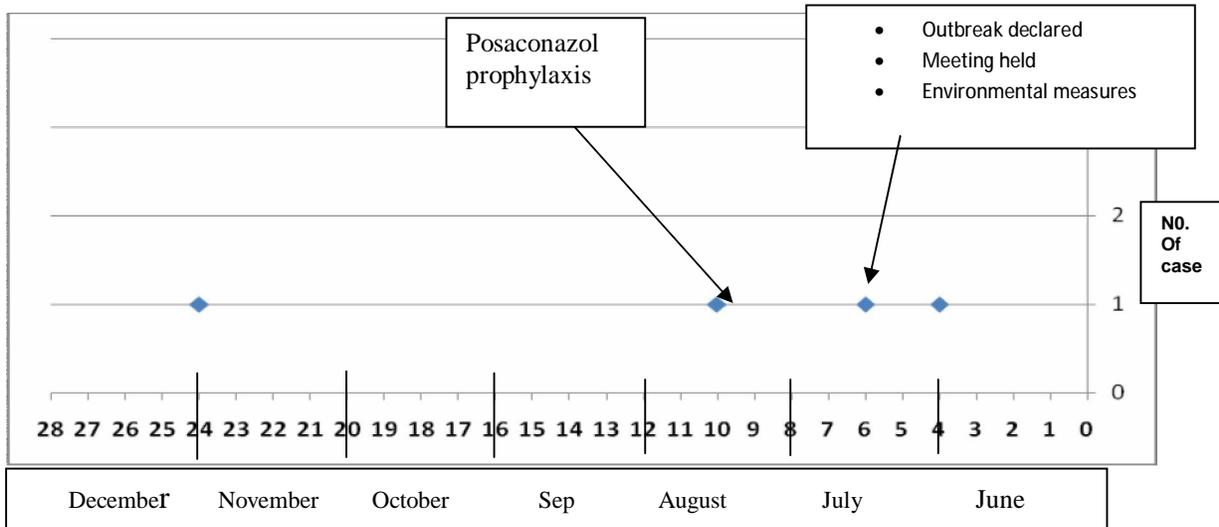


Figure (1): Timeline of invasive aspergillosis outbreak

Table (1) Clinical, Radiological and Laboratory Data of Invasive Aspergillosis Cases

case	EORTC definition	Underlying disease	Chemotherapy /radiotherapy	Neutopenia period	Clinical symptoms	CT chest-CT sinuses	Pathology/Microbiology/molecular	outcome
1	possible	AML	3 cycles	>14days	Moderate respiratory symptoms	Multiple nodular consolidations in the lung parenchyma Pan sinusitis with mucosal thickening	Sputum Culture negative Galactomannan negative	Alive and underwent for allotransplant
2	proven	Non hodjeki lymphoma	2 cycles	3days	Severe respiratory symptoms	CT was not done CXR: Rt. sided pneumonia	Sputum Culture positive Galactomannan positive Positive brain pathology	Deceased.
3	probable	Refractory AML	3 cycles	>14days	Moderate respiratory symptoms	Consolidation involving the Rt. upper lobe with multiple enlarged sup. Mediastinal L.N and hilar L.N	Sputum Culture positive Galactomannan positive	alive
4	probable	CNS lymphoma	radiotherapy	No	Severe respiratory symptoms with respiratory failure	Consolidation and three cavities involving Rt. upper and lower lobes	Sputum Culture positive Galactomannan negative	Deceased with multi-organ failure

EORTC: European Organization for Research and Treatment of Cancer; CT: computed tomography; AML: acute myeloid leukemia CXR: chest radiograph

## Discussion

Construction in or around hospitals is a never-ending phenomenon in modern-day healthcare. Construction, renovation and demolition are the main causes of nosocomial aspergillosis outbreaks<sup>(1)</sup>. Different construction and renovation activities started at different areas of KCCC without implementation of preliminary preventive measures to reduce the risk of aspergillosis. Construction period extended from June up to November 2010.

After declaring aspergillosis outbreak at July 2010 and establishing a multidisciplinary prevention and control team, different measures were implemented to contain the situation. These measures included environmental sealing of construction areas, masking, wet cleaning, reducing unnecessary traffic through affected areas. Regular follow up of the implementation of the preventive measures was held daily by infection control team to ensure that construction sites were sealed well, doors and windows remained shut, and cleaning was adequate.

At this outbreak four cases of aspergillosis were identified during the follow up period that extended from time of outbreak declaration (11 July 2010) up to three months after finishing construction (1<sup>st</sup> week of March 2011) as the incubation period of aspergillosis is not well defined and may extend up to three months<sup>(12,13)</sup>. Two of the reported cases died; one from CNS aspergillosis and the other from multi-organ failure.

This outbreak was not our first experience regarding aspergillosis; during the year 2005, three probable cases of invasive pulmonary aspergillosis were reported at hematology ward during construction of a new nearby hospital building. One of the cases died and the others survived and the outbreak was controlled after the application of different preventive and control measures.

Moreover our finding is consistent with many invasive aspergillosis outbreaks that had been described worldwide in different cancer centers; Spanish cancer hospital (2000)<sup>(14)</sup>, Israel cancer Hospital (2001)<sup>(15)</sup>, Jabalpur Cancer Hospital (2002, India)<sup>(16)</sup>, Japanese Cancer Centre (2003)<sup>(17)</sup>, Geelong cancer Hospital (2006, Australia)<sup>(18)</sup>, etc.

Regarding air sampling for aspergillus fungus, we did not perform it as its role is controversial. Air sample collection provides a "snapshot" for what is occurring in the air at the time of sample collection missing peaks in fungal spores. Moreover outbreaks of invasive aspergillosis with negative air-sampling data have been described previously<sup>(1,19)</sup>.

We gave Posaconazole as an antifungal prophylaxis for high risk patients during the period of construction (200 mg 3 times daily), none of them developed aspergillosis however we diagnosed one

patient as a probable case of aspergillosis. This patient was suffering from chronic renal failure with central nervous lymphoma and was not on posaconazole prophylaxis as he was not classified as high risk patient.

After construction activities were finished, clinicians re-established Fluconazole as a routine antifungal.

As education of medical staff on the basic infection control measures particularly at outbreak times may prevent the occurrence of such event in the first place in the future<sup>(20)</sup>. Different aspergillosis educational sessions were prepared and conducted by infection control team with the help of KCCC Staff Development Unit. These sessions involved; health care workers, cleaning staff supervisors and engineering department staff.

## Conclusion:

Hospital construction work is a clear risk factor for development of aspergillosis. A multidisciplinary approach involving clinicians, hospital management and engineering personnel with a proper plan is essential in prevention and control of nosocomial aspergillosis outbreaks.

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