PATTERN OF FUNGAL COLONIZATION IN CRITICALLY ILL PEDIATRIC PATIENTS IN AIN SHAMS PEDIATRIC ICU

Thesis

Submitted for partial fulfillment of
Master Degree in Pediatrics

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2009

دراسة شكل المستعمرات الفطرية فى الرعايه المركزه بمستشفى الاطفال بجامعة عين شمس

رسالة
توطئة للحصول على درجة الماجستير
فى طب الاطفال

مقدمة من
طبيبه / سماح عبد القادر محمد عبد المجيد
بكالوريوس الطب و الجراحه
جامعة عين شمس(٢٠٠٤)

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INTRODUCTION

Although fungal infections in healthy hosts remain relatively rare events, the risk for such infections rises significantly in immunodeficient patient who undergo invasive life saving procedures such as cancer treatment and organ transplantation ***(Trick et al., 2002).***

Critically ill injured patients are immune suppressed, invasively monitored and exposed to microbial pathogens at the time of injury and while residing in ICU ***(Golan, 2005).***

The incidence of nosocomial infection by Candida species has surged over the past decade, from the eighth to the forth most common cause of nosocomial blood stream infection in the general hospital population ***(Playford, 2006).***

Resistant strains now prevalent in ICU include; candida species (C.Albicans - C.Parapsilosis - C.Glabarata - C.Tropicalis - C.Lusitaniae - C.Krusei), and Non candida species which include; (Scedosporium - Coccidiodes - Aureobasidium -Acremonium - Aspergellas - Fuseriam - Mucor - Rhizopus - Cryptococcus). Non candida fungemia, although a rare event, carried an extremely high mortality rate, as 6 of 9 patients died ***(McNeil et al., 2001).***

Candida species were the most frequently isolated organism from any sites and comprise 85% of total number of cultures ***(Ostrosky et al., 2003).***

Risk factors for invasive candidasis and candidaemia include prior antimicrobial therapy, venous and urinary catheters, ICU admission, parenteral nutrition, major surgery, immunosuppressive therapies ***(Fleck et al., 2007).***

Once fungal infection is confirmed, species level identification is in most cases an effective method for prediction of antifungal susceptibility ***(Pfaller, 2007).***

Hypothesis

Colonization of fungal strains are most frequently increased in critically ill ICU pediatric patients

AIM OF THE WORK

To determine the pattern of colonization of fungal strains in patients admitted in pediatric ICU in Ain Shams University Hospital and associated predisposing factors.

CRITICALLY ILL PATIENTS

Intensive Care Medicine or critical care medicine is a branch of medicine concerned with the provision of life support or organ support systems in patients who are critically ill and who usually require intensive monitoring ***(Halpern et al., 2000).***

Patients requiring intensive care usually require support for hemodynamic instability (hypertension/hypotension), airway or respiratory compromise (such as ventilator support), acute renal failure, potentially lethal cardiac dysrhythmias, and frequently the cumulative effects of multiple organ system failure. Patients admitted to the intensive care unit not requiring support for the above are usually admitted for intensive/invasive monitoring ***(Kahn et al., 2006).***

Ideally, intensive care is usually only offered to those whose condition is potentially reversible and who have a good chance of surviving with intensive care support. A prime requisite for admission to an Intensive Care Unit is that the underlying condition can be overcome. Therefore, treatment is merely meant to win time in which the acute affliction can be resolved ***(Manthous et al., 2006)***.

Common equipment in an intensive care unit (ICU) includes mechanical ventilation to assist breathing through an endotracheal tube or a tracheotomy; hemofiltration equipment for acute renal

failure; monitoring equipment; intravenous lines for drug infusions(fluids or total parenteral nutrition), nasogastric tubes, suction pumps, drains and catheters; and a wide array of drugs including inotropes, sedatives, broad spectrum antibiotics and analgesics ***(Hanson et al., 2006).***

In general there are eight categories of diseases and disorders that are regarded as medical justification for admission to an ICU. These categories include disorders of the cardiac, nervous, pulmonary, and endocrine (hormonal) systems, together with postsurgical crises and medication monitoring for drug ingestion or overdose. Cardiac problems can include heart attacks (myocardial infarction), shock, cardiac arrhythmias (abnormal heart rhythm), heart failure (congestive heart failure or CHF), high blood pressure, and unstable angina (chest pain). Lung disorders can include acute respiratory failure, pulmonary emboli (blood clots in the lungs), hemoptysis (coughing up blood), and respiratory failure. Neurological disorders may include acute stroke (blood clot in the brain), coma, bleeding in the brain (intracranial hemorrhage), such infections as meningitis, and traumatic brain injury (TBI). Medication monitoring is essential, including careful attention to the possibility of seizures and other drug side effects ***(Brilli et al., 2001)***

Management of Critically ill:

A- Basic life support=CPR

Pediatric Resuscitation Update:

The majority of cardiac arrest in children results from a progression of shock and respiratory failure to cardiac arrest. The goal for resuscitation is to urgently reestablish substrate delivery to meet the metabolic demands of vital organs ***(Ludwig and Lavelle, 2006)***.

First, the airway is assessed, then breathing, and finally circulation. If there is an abnormality at any step of this A-B-C assessment, intervention must be initiated to stabilize the patient (***Donoghue et al., 2005).***

Airway:

Evaluation:

The first priority in basic and advanced life support is evaluating the airway. To assess upper airway patency, the provider should look, listen, and feel whether there is adequate breathing. The provider should look for chest rise, listen for breath sounds and air movement, and feel the movement of air at the nose and mouth. Clinical signs of an airway obstruction include breathing difficulty, the inability to speak or breathe, a silent cough, or poor air exchange ***(Ralston et al., 2006)***.

Management:

Simple measures to restore airway patency include positioning, suctioning, relieving a foreign-body airway obstruction, and the use of airway adjuncts. More advanced interventions, include endotracheal intubation. Rather than waiting for respiratory arrest, those who do not exhibit adequate breathing should receive rescue breaths. It is recommended to try ''a couple of times'' to deliver two effective rescue breaths. The health care provider should administer 12 to 20 breaths per minute for infants and children. ***(Newth et al., 2004)***

Breathing:

Evaluation:

The assessment of breathing includes an evaluation of the respiratory rate and effort, lung sounds, and pulse oximetry. Normal respiratory rates depend on the age of the patient. Abnormal lung sounds include stridor, grunting, gurgling, wheezing, and crackles ***(Hoffman et al., 2006)***

Management:

Once an advanced airway is in place, respirations should be administered simultaneously with chest compressions, at a rate of 8 to 10 per minute. Hyperventilation is not recommended, as it can actually be harmful. Increased respiratory rates cause an increased intrathoracic pressure, thereby decreasing venous return and coronary perfusion pressure. This has been shown to decrease survival rates ***(Aufderheide and Lurie, 2004)***

Table (1): Expected respiratory rates, according to age

Age, y	Breaths, per min.
<1	30-60
1-3	24-40
4-5	22-34
6-12	18-30
13-18+	12-16

(Ralston et al., 2006)

Circulation:

Evaluation:

The assessment of cardiovascular function includes heart rate and rhythm, blood pressure, peripheral and central pulses, capillary refill time, and skin color and temperature. Hypotension represents a state of shock, either due to hemorrhage, sepsis, or cardiac failure. The heart rhythm can initially be determined as being regular or irregular.. Various rhythm disturbances, or arrhythmias, can be recognized to initiate appropriate interventions. The important dysrhythmias to recognize are ventricular fibrillation. Ventricular tachycardia, pulseless electrical activity (PEA) and supraventricular tachycardia. A delayed capillary refill time, greater than 2 seconds, may be a result of dehydration, shock, or hypothermia ***(Park et al., 2001)***

Management:

The management recommendations for cardiovascular function include obtaining IV access, performing cardiac compressions, defibrillation, and the administration of drugs for rhythm disturbances ***(Sharieff et al., 2003)***.

Table (2): Expected systolic and diastolic blood pressures according to age

Age Diastolic BP	Systolic (mm Hg)	BP (mm Hg)
0d	60-76	30-45
1-4d	67-84	35-53
1mo	73-94	36-56
3mo	78-103	44-65
6mo	82-105	46-68
1y	67-104	20-60
2y	70-106	25-65
7y	79-115	38-78
15y	93-131	45-85

(Donoghue et al., 2005).

Table (3): Expected heart rates, according to age

Age	Rate	(mean)
0 – 3 mo	80-205	(140)
3 mo - 2 y	75-190	(130)
2y – 10 y	60-140	(80)
> 10 y	50-100	(75)

(Ludwig and Lavelle, 2006)

Intravenous access:

Intravenous or intraosseous routes are preferred for vascular access and for the administration of all drugs. Lipophilic drugs may be administrated at higher doses through the endotracheal tube. These drugs include ‘‘LEAN’’: lidocaine, epinephrine, atropine, and narcan ***(Efrati et al., 2003)***

Compressions:

Effective chest compressions are crucial in improving survival and provide blood flow to vital organs. The American heart association (AHA) now recommends ‘‘push hard and push fast.’’ Interruptions in compressions should be limited to less than 10 seconds for interventions such as placing an advanced airway or defibrillation. Rhythm checks should be performed every 2 minutes, or 5 cycles of CPR ***(Ashton et al., 2002).***

Defibrillation:

A single shock should be administered at a dose of 2 J/kg, followed by immediate CPR ***(Martens et al., 2001).***

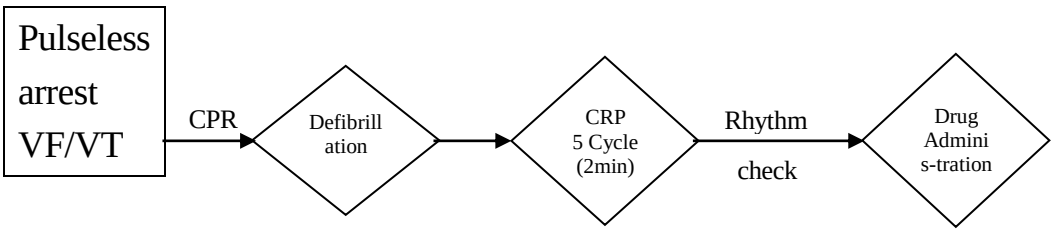

Fig. (1): Sequence of resuscitation, in pulseless with ventricular fibrillation (VF) and ventricular tachycardia (VT)

Drugs:

Drug delivery should not interrupt CPR. Amiodarone is the preferred drug for treatment for pulseless arrest, since it is more effective. Lidocaine is only recommended when amiodarone is unavailable ***(Dorian et al., 2002).***

B- Prolonged life support:

Postresuscitative care:

In general, it is recommended to maintain a normal body temperature in post-resuscitative care of neonates and children. Recent evidence is insufficient to recommend the routine use of systemic or selective cerebral hypothermia after resuscitation. However, it is important to avoid hyperthermia, especially in very-low-weight infants and hypoxic-ischemic events ***(Holzer et al., 2005)***.

Mechanical Ventilatory Support:

Most patients with sepsis syndrome have a component of respiratory failure that frequently leads to acute lung injury (ALI) or acute respiratory distress syndrome (ARDS) and the need for mechanical ventilation ***(Eisner et al., 2001).***

The patients ventilated with small tidal volume had a 31% mortality, whereas in patients treated with larger tidal volume, mortality was 39.8%. These patients had both improved respiratory function and decreased multiple organ dysfunction syndrome(MODS). The mechanism whereby this lung-protective ventilation strategy decreased mortality is not entirely clear, but it is thought to be due to decreased pulmonary cytokine release into the systemic circulation. Ventilation of injured lungs with large tidal volumes leads to cytokine release into the alveolar and intravascular space and potentiates lung injury ***(Savel et al., 2001).***

Identification of Patients with Severe Sepsis:

Sepsis is a serious medical condition characterized by a whole-body inflammatory state (called a systemic inflammatory response syndrome or SIRS) caused by infection. The body may develop this inflammatory response to microbes in the blood. It occurs in 1%-2% of all hospitalizations and accounts for as much as 25% of intensive care unit (ICU) bed utilization. It is a major cause of death in intensive care units worldwide, with mortality rates that range from 20% for sepsis to 40% for severe sepsis to >60% for septic shock ***(Dellinger and Levy., 2008)***

Severe sepsis occurs when sepsis leads to organ dysfunction, low blood pressure (hypotension) or insufficient blood flow (hypoperfusion) to one or more organs (causing, for example, lactic acidosis, decreased urine production or altered mental status). Organ dysfunction results from sepsis-induced hypotension (< 90 mmHg or a reduction of ≥ 40 mmHg from baseline) and diffuse intravascular coagulation, among other things ***(Lockhart et al., 2008)***

The recent consensus conference recommended adoption of the PIRO model to more effectively identify and track patients with sepsis. a PIRO indicates predisposition, infection, response, and organ dysfunction. Predisposition refers to genetic predisposition or contribution from coexisting illness. Infection represents different responses to different organisms in diverse patients. Response describes the inflammatory markers made by a variety of cells, which may allow early identification of the deleterious response to infection. Organ dysfunction identifies the interaction of diverse organs in leading to multiple organ dysfunction.