The Next MRSA

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Objectives

By the end of this educational module, the learner will be able to:

Recognize at risk populations for Acinetobacter infections

Verbalize methods by which Acinetobacter is spread

Verbalize methods to control the spread of Acinetobacter

Opening

A nurse at Bethesda Medical center leaves works feeling unwell. Within 24 hours she is hospitalized and on a respirator, her diagnosis: Acinetobacter. It was determined that she acquired the infection from a patient. She quickly dies from the illness, and little attention is paid to it.

An outbreak of Multi-Drug Resistant Acinetobacter struck in Arizona with 236 cases logged in just 2 months. Reported at the state level, the outbreak was again ignored at the national level.

As early as 2003, American soldiers in Iraq were testing positive for Acinetobacter baumanni at Walter Reed Medical Center, Landstuhl, and the hospital ship Comfort. Most of the amputations from the war are not coming from the trauma, but the subsequent infection that follows. If they are lucky, an amputation is the best-case scenario, if they are unlucky they wind up with kidney failure, or death. The bacteria is now infecting civilian hospitals as some soldiers return as unsuspecting carriers of the bacteria, with no symptoms of illness, but the ability to pass the pathogen on to others. Again, little is said by

the military or the government to warn them about this potentially deadly bacterium that many are already calling the next MRSA. Medical scientists who are watching the problem fear that the outbreaks could become pandemic.

The bacterium is rapidly making its way into hospitals in all parts of the globe. The bacterium is highly resistant to almost all antibiotics, and its characteristics make it difficult to eradicate. Some facilities have had to shut down whole units for terminal cleaning to curtail outbreaks. Literature has documented the mortality rate for infection from AB to be as high as 70% in some areas (Cisneros, et.al., 1996).

Medical science is no stranger to multi-drug resistant bacteria. The problem of both hospital acquired and community acquired MRSA is common in the news. C diff is endemic in ever increasing numbers. The problem isn't going to go away, and the antibiotics are not able to fight it. What options are left?

Identification

Acinetobacter family comprises 17 named and 14 unnamed species. Identification of the organism down to the species level is difficult in a normal microbiology lab. Specific species isolation is often done by genetic fingerprinting of the bacteria by DNA or RNA technology. For this reason, the acinetobacter are usually grouped into three categories:

- *Acinetobacter calcoaceticus-baumanii complex*: glucose-oxidising nonhemolytic, (A.baumannii can be identified by OXA-51 typing) **This is the species most relative to our discussion.**
- *Acinetobacter lwoffii*: glucose-negative nonhemolytic
- *Acinetobacter haemolyticus*: hemolytic (Wikipedia)

Characteristics

Acinetobacter baumannii (AB) is a pathogenic, opportunistic infection which has been recently receiving gaining attendion due to its ability to cause significant complications and increased mortality in hospitalized individuals and in a few cases has caused death in apparently healthy persons. Another worry among scientists and health care professionals is the emergence of multi-drug resistence amoung the AB species. These multi-resistant strains are often referred to as MDRAB. MDRAB is the most revalent pathogen within the acinetobacter family. One interesting feature of the AB pathogen is its ability to receive and donate genetic material from other pathogens, which quickly leads to the replication of more MDRAB and other drug resistant pathogens.

Acinetobacter is Greek for the word motionless, and they have no means of self motility.

AB can survive independently in the environment under dry conditions for times varying between 6 to 25 days (Wendt, et.al, 1997). It has also been found to live in warm, moist environments such as wound irrigation devices and respirator tubing.

AB is a gram negative aerobic non-fermantative baccili. AB can exhibit quite variable characteristics upon Gram staining, so it is an unreliable testing measure for the organism.

AB is found in several different sources, soil, water, sewage, some food items, medical equipment, and even healthy human skin

Occurrence

Acinetobacter baumannii is currently the third most common organism isolated in septic patients who are immunocompromised (Joshi, 2006).

In Israel, where MDRAB has reached epidemic proportions, it is the first or second most common cause of sepsis in the ICU's. Once established, it is very difficult to control, Israel has been successful in using strict infection control measures to control MRSA, however they have made no difference with MDRAB. Complicating matters even further is that MDRAB tends to be polyclonal; in other words, you have multiple variants of the same strain, making it harder to eliminate (Wachter, 2006).

MDRAB has infected hundreds of soldiers in the Iraq war, causing more loss of life and limbs than the original injuries themselves. At first, it was though that the organism was present in the soil, but soil samples tested negative. Further investigation revealed that the organism was rampant in field hospitals in which the soldiers were receiving treatment, making it a noscomial infection.

In the last 10 years, the occurrence of MDRAB has almost quadrupled (ASM). The infection is most frequently found in patients 19-64 years of age and is more frequently found in larger hospitals than in smaller ones, however MDRAB has been found in all types of patients and care settings.

Complicating Cofactors

Noscomial infections account for almost all infections in hospitals that are not evident upon the patient's admission. Within a few hours of exposure, the patient's flora begins to take on the characteristics of the surrounding bacterial pool, with colonization of hospital bacteria developing in the lungs, urinary tract,

and on the skin. Most infections that become evident after the first 48 hours of hospitalization are considered noscomial. Infections that become evident after discharge are considered noscomial if they are acquired during the hospital stay. Risk factors for noscomial infections can be divided into three categories, iatrogenic, organizational, and patient-related (Nguyen, 2007).

- “Iatrogenic risk factors include pathogens on the hands of medical personnel, invasive procedures (eg, intubation and extended ventilation, indwelling vascular lines, urine catheterization), and antibiotic use and prophylaxis.
- Organizational risk factors include contaminated air-conditioning systems, contaminated water systems, and staffing and physical layout of the facility (eg, nurse-to-patient ratio, open beds close together).
- Patient risk factors include the severity of illness, underlying immunocompromised state, and length of stay.”(Nguyen,2007).

The American soldiers who have become victims of the Acinetobacter experienced all three categories of risk factors as a result of needing medical care. Medical facilities near the front lines are understaffed and under supplied. Becoming overwhelmed with patients is noted to be a factor in lapses of infection control standards. Conditions are crowded as soldiers wait to receive care. The soldiers with severe or fatal acinetobacter infections were noted to be severely wounded and had lengthy hospital stays.

Mode of Transmission

MDRAB can enter the body through a wound, urinary, or central venous catheter, and respiratory tubes. Colonizitation of the bacteria within the body causes very little threat as long as the host remains healthy; but they can transmit the organism form person-to-person, and place-to-place. The bacteria can also be contracted by touch or by contact with objects, which are contaminated with the bacteria.

Susceptibility

Usually its victims are immunocompromised, very young or elderly. Patients with compromised immune systems such as transplant patients, diabetics, or people with immune disease are at risk. MDRAB can cause pneumonia; it secretes toxic enzymes that can damage tissues, cause multisystem organ failure, and meningitis. In fact, pneumonia infections with acinetobacter are more common than other types of infections (ASM).

In addition, patients who are on ventilator support or have open wounds seem to be particularly susceptible to the virus. Admission to an intensive care unit is a risk factor as well. Patients who are admitted to long term care centers also tend to have higher than average numbers of MDRAB cases and the mortality rate for those patients can be as high as 80-90%.

Treatment

Patients who test positive for acinetobacter need to be treated if active signs of infection are present. Patients may be colonized with the bacteria without showing any symptoms of illness; colonization does not need to be treated. However, these patients should be closely monitored; 21 to 39 percent of patients who are colonized with hospital acquired bacterial species will go on to become infected (ASM). If the patient is having elevated white counts, fever, delirium, purulent wound drainage or other signs of active infection, then therapy should be started. However, negative cultures do not mean that the patient is not colonized with acinetobacter (Johns Hopkins, 2004).

Mainstream treatments for acinetobacter are Imipenem and Meropenem. However, these medications may not be an option in people who are allergic to penicillin or who have compromised renal function. Acinetobacter may be resistant to these medications in some cases.

Colistin and polymyxin B have also been used to treat acinetobacter infections, although they have been noted to be ineffective against acinetobacter as well. Colistin is an older drug that has not had frequent use in recent years and it does have some severe side affects such as causing damage to the kidneys. Acinetobacter has shown susceptibility to some combination therapy agents such as rifampin and colistin, with additions of ampicillin type medications, however their application to successful and long-term clinical use has yet to be established.

One interesting older treatment that is meeting with success in treating acinetobacter infection is phage therapy. Phage therapy was first practiced by Russian scientists before antibiotics were discovered. Phage therapy was beginning to enjoy increasing acceptance as a viable treatment option in the United States, until it was abandoned in favor of the wonder drug penicillin. Phage therapy is still widely practiced today in the Soviet state of Georgia, where it is often used as a first line treatment in infections.

Bacteriophages (phages) are viruses that can attack and kill bacteria without causing disease or illness. Phages are highly specific in that each phage type will only kill one type of bacteria. They are one of the most abundant life forms outnumbering bacteria ten to one. Phages attach themselves to bacteria; insert the contents of their DNA into the cell, taking over its operations. The bacteria is converted into a factory for the replication of more bacteriophages. When the bacterial cell bursts, up to a 100 new phages are released, which go on to infect

other phages. This process continues until there are no more bacterial cells present (Hanlon, 2005).

Phages can be administered orally, topically, rectally, injected, or inhaled. They can be given as a single phage therapy or as a 'cocktail' against multiple bacteria species. Phage therapy has many advantages over antibiotics; drug resistance is not an issue as the action of phages is completely different. We have been exposed to bacteriophages since birth, so allergic or adverse reactions are not likely. In addition, phages do not disrupt the normal bacterial flora of the intestinal tract; so pseudomembraneous colitis and other intestinal antibiotic complications are not an issue either. Bacteriophages are readily available from within the environment, so it is easy and relatively cheap to produce them (Hanlon, 2005).

Control

The costs of an outbreak of acinetobacter are staggering and lead to increased inpatient hospitalization days. Johns Hopkins medical center has adopted a policy on dealing with acinetobacter cases. They have also published guidelines for the control of acinetobacter. The measures that they use to control acinetobacter include: isolation precautions for infected or colonized patients, reinforcement of hand hygiene, cohorting of patients, cohorting of staff, environmental disinfection, antimicrobial control, and unit closure.

As with any infectious organism the first and most important means toward prevent the spread of the organism is handwashing. Like anything else handwashing must be done correctly and thoroughly enough to be effective.

Due to the number of transfers from other facilities that arrive with acinetobacter infections, all patients who enter as a transfer from another facility are screened for acinetobacter. Surveillance cultures include sputum (if possible), cultures of any wounds present, and skin swabs of the antecubital fossa (some facilities use axilla or groin swabs). Any patient admitted from a transfer facility with open wounds or pneumonia is automatically placed on contact precautions until the results of surveillance cultures are obtained.

At Johns Hopkins, patients who test positive for acinetobacter are placed in private rooms on Maximum isolation precautions. If private rooming is not possible then patients are cohorted with other MDRAB patients. Maximum isolation includes gown and gloves when entering the room; masks are worn if contact with respiratory droplets is reasonably possible, such as with suctioning or maintenance of ventilator tubing. Masks are also worn if the patient has had a positive sputum culture for acinetobacter and for all wound care procedures. Eye protection should be worn if splashing is likely to occur.

Johns Hopkins recommends that all MDRAB patients have a one to one nurse to patient ratio unless the same nurse can reasonably care for two positive MDRAB patients and those patients are cohorted in the same location. Nurses caring for MDRAB patients should not care for patients who are acinetobacter negative. If this is not possible then the nurse should practice reverse isolation with the non-MDRAB patient and wear a new gown and gloves for that patient's care as well. Nurses caring for patients that are MDRAB positive should not enter the room of a patient who is MDRAB negative if that patient is immunocompromised, the patient has a tracheostomy, or wounds. Nursing should perform procedures such as phlebotomy whenever possible to limit the number of persons necessary to enter MDRAB positive patient rooms.

When teams of physicians must care for MDRAB patients and non-MDRAB patients, the MDRAB positive patients should be seen last and personnel entering the room should be limited to only essential team members. Those personnel should gown, glove, and wear mask (if needed) immediately prior to entering the patient's room and remove the gown, gloves, and mask immediately upon exiting the room. Additionally, if that physician is performing an invasive procedure on the patient, such as debridment of a wound, or line placement; then the physician should wear scrubs or clothing and gown, gloves, and mask during the procedure and then change into clean clothing or scrubs after the procedure but before seeing non-MDRAB patients. If it is not possible for the physician to change clothing after a procedure on a MDRAB patient, then he should practice reverse isolation for the rest on the shift and wear a clean gown and gloves into each patient room afterwards (Johns Hopkins, 2004).

Guidelines for speech, occupational, and physical therapy include that only one therapist per discipline should see the patient with MDRAB and should not see patients who are MDRAB negative. If this is not possible, then MDRAB positive patients should be seen at the end of the day. Patients with MDRAB who have to leave the room for wound care treatment will be seen at the end of the day after non-MDRAB patients have already been seen.

For respiratory therapists, the guidelines differ slightly due to the nature of the specialty. For respiratory therapists it is impossible for a therapist to see non-MDRAB patients first and MDRAB positive patients last, so only one therapist can see the MDRAB positive patients. Ventilators used by MDRAB positive patients will be reprocessed after patient use according to the manufacture's guidelines.

Patients needing portable x-rays should have their tests performed last after all other MDRAB negative patients have had their x-rays performed. The technician must gown, glove, and if indicated mask before entering the room and pay special attention to isolation precautions and handwashing. All equipment that is taken into the room must be disinfected after use.

Environmental Control

Personnel assigned to cleaning services should only clean the rooms of MDRAB positive patients on a single shift. They should not enter the rooms of non-MDRAB positive patients. The rooms should be cleaned on a daily basis using disposable or MDRAB dedicated equipment. Water used for cleaning or mopping should be discarded after each patient room is completed. Mop heads should be disposable or bagged and sent to laundry and changed after each patient room. Mop handles should be wiped down with a hospital approved disinfectant.

Terminal cleaning must occur when a MDRAB positive patient is discharged or transferred to another room, before the room is reoccupied by another patient. The curtains must be changed and floors and walls mopped or cleaned by wet disinfection. All room equipment and furniture such as tables, chairs, telephone, and IV equipment must be cleaned and disinfected. Curtains, sheets, and fabric items are bagged and sent to laundry for processing.

Whenever possible, disposable equipment should be used in the care of MDRAB positive patients. Any equipment or machines that are not disposable should be cleaned with hospital-approved disinfectants and according to manufactures recommendations prior to use on another patient.

If the MDRAB positive status of the patient is known prior to the patient's admission to the room, all supply cabinets should be relocated outside the patient room. The minimum number of supplies should be taken into the room at any one time. All supplies that are taken into the room must remain in the room, and be discarded upon patient discharge. If a patient is found to be MDRAB positive after admission, the supplies in the cabinets are to be discarded upon patient discharge, and the cabinet cleaned with disinfectant during terminal cleaning.

Patient movement within the hospital

Necessary patient procedures should be performed at the bedside whenever possible. When transport is unavoidable, personnel transporting the patient should wear a gown and gloves. The person wearing isolation clothing should not touch anything in the environment and should be accompanied by a staff member who remains "clean" (does not touch patient or other staff member) to open doors and operate elevator. Designated stretchers and wheelchairs should be used for the transport of MDRAB positive patients or they must be cleaned with a hospital-approved disinfectant immediately after use and before use by another patient. If the transfer occurs with the patient bed or equipment, such as IV pole, then the equipment is wiped down with disinfectant prior to the transport. The receiving department of the hospital should be notified of the patient's

isolation status prior to initiating transport. The receiving testing or procedure area should be thoroughly cleaned and disinfected after the MDRAB positive patient leaves the area.

The MDRAB positive patient should remain inside their room whenever possible. When ambulation is necessary to the patient's recovery, the patient's nurse or designated therapist should ambulate the patient with a physician order. Ambulation should occur with a minimum of contact with the hospital environment and other patients. The patient should not ambulate without being accompanied by staff. Any wounds should contain drainage by being covered with clean dressings. The patient should wear a clean gown, and if the drainage is contained in the patient sputum, a mask. Assisting staff should wear a clean gown and gloves and a mask/eye protection if there is any risk of splash contamination. If the patient needs assistive devices to ambulate, then they should be dedicated to the patient and stored in the patient's room. The patient should return to the room immediately after ambulation.

Visitors

Persons and family members who visit an MDRAB positive patient should abide by isolation precautions. All persons in the patient's room should wear gown, gloves, and if the patient is MDRAB sputum positive, a mask. Eye protection should be worn as well if splashing is likely to occur. When visitors leave, isolation protection is removed inside the room and handwashing is performed or alcohol based hand sanitizers are used. If visitors follow isolation precautions, then there is no need for their restricted movement within the hospital.

If family members stay with the patient and sleep in the room, not wearing isolation protection, then clothing must be changed before exiting the patient's room. Disposable scrubs can be used if a change of clothing is not available. Hand hygiene must be performed. If these precautions cannot be followed, then visitors must leave the patient's room and proceed directly out of the hospital without visiting other patients or common areas of the hospital.

Conclusion

MDRAB is becoming an increasing problem as more hospitals are reporting cases and outbreaks. MDRAB is causing untold numbers of dollars in additional health care cost for treatment and complications. More importantly, the bacteria is causing a high rate of death in patients who develop the infection, others who do recover do so after months of extreme illness.

The most effective measures against MDRAB go back to basics in medical care. Hand hygiene, the most effective measure in the control of noscomial infection, is still neglected by healthcare workers. Strict infection control measures like hand hygiene and isolation precautions are going to be essential in the containment of

MDRAB. Early identification of MDRAB cases are also going to prove pivotal in the control of the organism. Early detection and recognition allows for earlier institution of isolation precautions and maximizes containment. The final element in the picture is the establishment and adherence to environmental control and disinfection procedures.

Quality assurance is needed at every level of the medical care system, from administration to housekeeping. Infection control is not just one event, it involves a series of opportunities for breaks in the system of prevention and every measure to safeguard that system needs to be implemented.

As the spread of MDRAB continues the public as well as patients, need to be educated about the spread of the organism. Proper information and facts will prevent complications, spreading the illness, and keep MDRAB patients from facing the misconceptions of an ill informed public.

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