Biology 275 Term Paper

Nosocomial Infections: Neonatal Intensive Care Units and the Threat of Acinetobacter baumannii

Alicia J. Wilson

Abstract

The focus of this paper is to review the history of nosocomial infections, examine nosocomial threats in neonatal units, and evaluate the future threat of Acinetobacter baumannii. Nosocomial infections have been prevalent in hospitals, and our understanding of them pre-dates the study of microbiology as a discipline. The first resistant R plasmid was discovered in the 1950’s and arose as a result of the overuse of penicillin as a preventative measure to infection.

Nosocomial infections attack people with weak immune systems, so they are a serious problem for babies born prematurely with low birth weights. Usually commuted by hospital staff already resistant to the strains, various multiply-resistant bacteria attack these patients and cause serious problems, like blood disorders, and can cause fatalities.

There are preventative measures in place to safeguard against the transmission of nosocomial infections. In the event of an outbreak, each hospital has a set of procedures and monitoring systems to evaluate the progression of the outbreak.

There is a new threat coming out of the wars in Iraq and Afghanistan, it is the bacteria Acinetobacter baumannii. This infection has already become multiply-resistant, and is affecting soldiers at an alarming rate. The soldiers are bringing the bacteria home, and the invasive bacterium is hard to combat. Fear of outbreak in hospitals against the multiply-resistant strain is a great concern for the medical community.

What is a Nosocomial Infection?

Nosocomial infections are hospital-acquired infections that currently infect approximately 2,000,000 people in the United States; that’s only 10% of hospital patents, but 1 in 136 Americans. Patients who are ill and have suppressed immune systems have a greater risk of becoming ill from bacteria and viruses in hospitals. Most nosocomial infections arise from surgical wounds, improper hand washing, air vents, and improper sterilization. Approximately one-third of hospital-acquired infections are preventable; these generally come from hospital staff interacting with patients, either through direct contact, or improperly sterilized instruments during routine examinations.

History and How Contracted

Our awareness of nosocomial infections predates the study of microbiology. Antiseptic practices in surgery arose from the discovery of a nosocomial infection. Ignaz Sammelweis linked autopsies performed by interns to childbed fever of women during labor. He instated the antiseptic practice of surgeons and interns washing their hands between surgeries, and the rate of infected and dying mothers quickly reduced.

The isolation of penicillin in the 1940’s led to a change in the common bacterial inhabitants in the hospital setting. According to Dr. Jeffrey Fisher in his book The Plague Makers, the most prevalent nosocomial infection was Staphylococcus aureus. It promoted mostly pneumonias. Penicillin caused the repression of normal S. aureus, and selection pressure- changes in the environment that cause the emergence of new strains of bacteria- caused the naturally penicillin resistant strains to emerge. The first recognition of R-plasmids and multiple-antibiotic resistant bacteria was Shigella, discovered in 1955 (Fisher 33).

With the advent and overuse of penicillin in the 1940’s, health care professionals thought they had won against nosocomial infections. That was until the penicillin-resistant strains of S. aureus took over hospitals in the 1950’s. The reemergence spawned the creation of two new antibiotics: methicillin and cephalosporin. These two antibiotics combated the new S. aureus as well as other Gram-positive bacteria, but didn’t harm Gram-negative bacteria.

Gram-negative bacteria lingered in hospitals and grew stronger as they didn’t have to compete for nutrients with Gram-positive bacteria. Two of the most common Gram-negative nosocomial infections...
are *Serratia marcescens* and *Klebsiella*, which took over hospitals and killed 30% of the patients they infected. In 1973, the discovery of an antibiotic-resistant strain of *S. marcescens* (rare cause for urinary tract infections) led to an epidemic. The CDC was called in to investigate four hospitals in a small area that had over 400 patients infected and 17 dead from *Klebsiella* and *Serratia marcescens*. Their findings led to the discovery that R-plasmids could be passed from one bacterial species to another, and they were passed on to patients via catheters and staff interaction.

**How Nosocomial Infections are Contracted in a Neonatal Intensive Care Unit?**

Neonatal intensive care units isolate newborns with major problems and extremely low birth weights. This is the perfect breeding ground for nosocomial infections because these patients have extremely weak immune systems that haven’t functioned well before entering the sterile environment. In a study regarding the prevention of nosocomial *S. aureus* bloodstream infections, it was concluded that “an intravenous immune globulin derived from donors with high titers of antibodies to surface adhesion of *S. aureus* and *Staphylococcus epidermidis*… failed to reduce the incidence of *Staphylococcus* in premature infants” (DeJonge, et. al). The infectious bacteria attacking these babies came from hospital staff, as revealed by hand sample culture growths, and a dirty stethoscope.

**Methods of Control**

There isn’t much patients can do to prevent nosocomial infections aside from washing their hands before and after eating and using the restroom. The hospital staff has the responsibility for preventing the spread of hospital acquired infections, of which *S. aureus*, *S. marcescens*, and *Klebsiella* are still the most prevalent. According to Dr. Susan Olender, measurements for control include isolation of the patient, strictly enforced hand washing practices, regular cleaning of the walls and ceilings, properly sterilizing all equipment and instruments, routine maintenance of the building which includes ventilation systems, and keeping distance between all patients.

**Acinetobacter baumannii**

The wars in Iraq and Afghanistan are causing new turmoil in the United States. Soldiers are returning home with invasive bacteria called *Acinetobacter baumannii*, and it is the newest nosocomial threat. Soldiers can be carriers of the disease without ever showing symptoms because this bacterium doesn’t act unless the host has a weakened immune system.

Dr. Burke Cunha explains that *A. baumannii* is a Gram-negative bacteria with a bacillus shape that resembles *Haemophilus influenzae*. The bacteria prefers to colonize in aquatic, aerobic and pleomorphic environments. When a patient has an outbreak, “[the infections] usually involve organ systems with a high fluid content (eg, respiratory tract, CSF, peritoneal fluid, urinary tract) manifesting as nosocomial pneumonia, infections associated with continuous ambulatory peritoneal dialysis (CAPD), or catheter-associated bacteruria” (Cunha). The expression of this bacterium on the dermis resembles burn victims’ skin.

It is difficult to differentiate between colonization and infection of *A. baumannii*, and can be transmitted easily from a carrier to another potential host. Dr. Cunha explains that people who are particularly susceptible to contracting the pathogen include patients with open wounds, meningitis, and CAPD-associated peritonitis; these patients can be misdiagnosed as having an *Enterobacter* because these bacteria are also Gram-negative bacilli and may also produce similar fluid.

**Conclusion**

Nosocomial infections are a prevalent threat that keep evolving the more global our society becomes. As a precautionary measure, more funding must be invested for the prevention and awareness of nosocomial infections and the threat of potential diseases. Unfortunately, much of the burden lies on hospital staff who do their best to remain aware that they are carriers of potentially fatal diseases.

**Works Cited and Referenced**


Gastmeier, Petra MD,a; Katrin Groneberg, MD,b,c Klaus Weist, MD,b and Henning Ruden, MD,b,c. “A cluster of nosocomial *Klebsiella pneumoniae* bloodstream infections in a neonatal intensive care department: Identification of transmission and intervention.” *American Journal of Infection Control.* Vol. 31, No. 7; 423-430.


