

Research on methicillin resistant staphylococcus aureus nursing essay



The topic for this piece of work is Methicillin-resistant *Staphylococcus aureus* (MRSA). This area of research was chosen due to the science and medical aspect behind this very interesting topic.

MRSA is a topic of great importance for the general public but also for health professionals, e. g. nurses and doctors. Although it wasn't until recently that MRSA was named a "superbug", the medical community remained calm when people found out about it, as they had been aware of the bacterium since the early 1960's. It is common knowledge that the most frequently found home of MRSA is medical health centres and nursing homes. The author of this medical journal is mostly concerned with the challenges and threats MRSA poses to her, as she works in a hospital where the majority of the patients are the elderly. [2]

Firstly, MRSA was researched in depth to all aspects, e. g. symptoms, treatment, and prevention methods. The information was bulky and helpful allowing for fully detailed knowledge and understanding of the subject.

Secondly, the information was collaborated and mixed together to create a full and informative graded unit on the subject of MRSA. This collaboration of information allows not only for the reader to get a detailed introduction to MRSA, but also gives the reader an idea of what MRSA is and how treatment has developed since the discovery in 1961. The use of several resources meant that the information in the text was not only the most relative but the most informative.

Thirdly, and finally, the HND: Applied Science Course was used not only to aid and boost the already present science and medical aspects of MRSA, but <https://assignbuster.com/research-on-methicillin-resistant-staphylococcus-aureus-nursing-essay/>

to aid in the problem solving characteristics required in the graded unit. Such subjects as Fundamental Chemistry, Information Technology, Biochemistry, and Presentation Skills were used to better the understanding of MRSA and improve the layout and design of the graded unit.

What is MRSA?

Shown below is a tiny cluster of bacteria known as Methicillin-resistant Staphylococcus aureus (MRSA) seen under a microscope. MRSA is a common skin bacterium caused by Staphylococcus aureus (sometimes called, Staph) that is resistant to a wide range of antibiotics. [3], [4]

[5]: MRSA under the microscope

The name “Methicillin-resistant” means that the bacteria are not affected by the antibiotic methicillin, and a number of other antibiotics such as penicillin and cephalosporin, which used to be the common drugs to kill the Staph bacteria. There are a number of different MRSA strains, around 16, all with varying degrees of resistance to methicillin. [3]

Staphylococcus aureus (SA) is a commonly occurring bacterium that has been around, for thousands of years and the discovery of MRSA in the early 1960s. Around a third of the world’s population carries MRSA harmlessly on the skin, nose or throat (especially in folds like the armpit or groin). [3], [6]

MRSA is most commonly found in hospitals, due to the fact that there are higher numbers of infected surfaces and people in a hospital. The highest number of patients in a hospital or normally elderly who are sicker and weaker than the general population, which makes them more susceptible to

infection due to a weaker immune system. Since around a third of the world's population is colonized by MRSA, the potential for infection is incredibly high. A person becomes infected when the organism invades the skin or deeper tissues and multiplies. [6], [7]

During the early 20th century, 45% of the world's population were not living beyond 65 years old, with infectious diseases being the leading factor to this low life expectancy. Due to the discovery of penicillin by Alexander Fleming in 1928, and the manufacturing of the antibiotic, the fight against infectious diseases – including infections caused by *Staphylococcus aureus* – was able to begin. Unfortunately, just a decade later *Staph aureus* became resistant, not only to penicillin, but also new antibiotics such as: erythromycin, streptomycin, and tetracycline. [8]

In 1960, the newest and most effective chance of controlling and stopping *Staph aureus* was Methicillin. But this antibiotic that had once been the only weapon against *Staph aureus* was short lived and soon joined the other antibiotics that were now ineffective and useless in fighting *Staph aureus*. In the late 1970's the first outbreak of MRSA was reported in hospitals in eastern Australia, and by the 1980's MRSA had emerged all over the world. [8]

It can be seen in the graph; MRSA Figures of Isolates per year in Europe; that certain countries are suffering from MRSA a lot greater than others. For example, the Nordic Countries (Denmark, Finland, Iceland & Sweden) and also The Netherlands have the least outbreaks of MRSA per annum.

Countries such as Malta, Greece, Ireland and the UK all suffer each year from

high numbers of MRSA sufferers or colonized individuals. It can be seen from the graph that the worst outbreak of MRSA was in Malta in 2001 with more than 50% of the individuals tested being sufferers, whilst in the same year Iceland had no reports of any MRSA outbreaks. The reason for Malta's high percentage of MRSA carriers in 2001 could have been due to a lack of knowledge and understanding of the bacterium. Another possible reason for the high percentage could be that not enough procedures or policies regarding MRSA were available or even in place. The following two years MRSA in Malta declined to around 40% of tested individuals being carriers, which show that policies had been put into place after the outbreak in 2001. [9]

[9] - MRSA Figures of Isolates per year in Europe

The extremely low percentages of MRSA carriers in The Nordic Countries and The Netherlands could be due to these countries having many policies advising and informing people in the community and patients and doctors in medical facilities of the dangers of MRSA and the simple methods on avoiding the bacterium. In the graph below it shows that The Netherlands tested 1238 people per annum for the bacterium MRSA, with less than 3% each year between 2000-2003 being carriers of the bacteria, which is seen to be around only 37 people. [9]

The spread of MRSA throughout Europe is a serious problem that seems to affect almost all countries severely. The graph shows how easily MRSA can fluctuate from country to country, and from year to year. If more policies and better education on the subject of MRSA were available not only to hospitals

but to the community in the UK then it is possible that the carrier percentage in Britain will decrease, but until such action is taken the British population will suffer not due a to lack of medical care but to lack of education.

Symptoms

The symptoms of an infection due to MRSA can vary greatly, all depending on what part of the body is infected. MRSA can infect a wide range of body tissues and organs, which makes MRSA the “ Superbug” that it is. [10]

Although there are a large number of symptoms of MRSA, there are only two types of infection: Skin infection and Bloodstream infection. Below is a table, of the type of symptoms common to each of the infections. [10], [11]

[11]: Symptoms of MRSA related to infection type

Skin Infection

Bloodstream Infection

Boils

Endocarditis

Abscesses

Osteomyelitis

Styes

Septic Shock

Impetigo

Septicaemia

Carbuncles

Meningitis

The longer that any of these symptoms continue untreated, can greatly increase the risk of a widespread infection in the body. Shown below is the damage that some of these symptoms can cause to a person. [12], [13]

[12]: Impetigo [13]: Abscess

Although MRSA can lead to all of the above symptoms, without treatment, it normally starts as a reddish blotch or pimple on the skin. This leads onto an MRSA lesion [14] forming, which is the first and most noticeable stage to identifying an MRSA infection. [15]

[14]: MRSA lesions

However all these symptoms can't be identified without certain lab tests. Usually before diagnosis of MRSA has occurred but the symptoms of a staph infection are visible, doctors and nurses will treat the patient's infection as a common staph infection, and prescribe antibiotics that would have no effect on MRSA. This delay in diagnoses of MRSA could result in the patient having to stay longer in a medical facility or worse the delay could allow the infection to get worse and infect the blood and the heart. Therefore the longer it takes to diagnose MRSA, means that patients will suffer more and the problems in the NHS and other health services shall continue to be unresolved.

Causes of MRSA

MRSA can be transmitted by direct contact with a person carrying MRSA on their skin, e. g. individuals who are colonized with MRSA can pass the bacteria through a variety of direct contact from a simple hand-shake to a kiss from a loved one.

The transmission of MRSA can also take place through indirect contact. This form of transmission is just as common as direct if not more. A person can be infected by MRSA by touching any surface, e. g. a pedestrian walker button, which is likely to have an incredibly high number of people touching it everyday and all-day, and with around a third of the worlds population being carriers the chance of being infected is high. Hot spots for indirect contact are door handles, game controllers, keyboards, sheets and towels.

The final and least likely form of transmission is by airborne infection.

An airborne contaminant is the least likely form of spreading as it is more likely that a skin to skin contact will take place with the colonized or infected individual carrying MRSA. An airborne contaminant can be spread when sheets in a room are thrown around the place when making the bed. As the duvet is fanned skin particles are flown into the air causing the infection to become airborne and allows for easy transmission.

The way in which MRSA can be transmitted and individuals contaminated depends on where the infection was acquired. The key areas of MRSA spread are; the health-care system and the community in any country, and because these two are the major hot spots it means they can be categorized.

Healthcare-Acquired MRSA and Community-Associated MRSA are these two categories.

CA-MRSA (Community-Associated-MRSA)

CA-MRSA can easily be spread in any enclosed space, especially any crowded or unsanitary condition. Outbreaks of CA-MRSA are more than common in prisons around the world - with American and European countries being the worse - as well as in military training facilities.

The high number of MRSA sufferers in any prison can be seen as a problem for any country. The over populated state and the lack of space and hygiene could be resolved by an increase in the size of prisons or a decrease in number of prisoners in a prison. Although the problem seems easy to fix the strain on any country to fix this problem can be seen as over-whelming.

CA-MRSA has affected sports teams, athletes and gyms. The bacterium spreads easily through cuts and abrasions and skin-to-skin contact. Sharing towels or athletic equipment increases spreading infection among athletes.

This problem can be resolved by equipment being cleaned after use and towels not being shared.

CA-MRSA can be dangerous in children and young adults, causing a widespread infection when it enters the body through a cut or scrape.

Children may be more susceptible to infection due to their immune systems not being fully developed.

The spread of MRSA and the realities of who is most at risk of contracting the infection all come under as the Causes of MRSA, because each directly links to how the person becomes infected. The environment that a person exists in can majorly affect their chances of being infected by MRSA, for example, hospitals. If a person is spending the majority of their time or even visiting for a short period of time, their presence in an environment like a hospital will greatly increase the potential of infection.

HA-MRSA (Hospital-Acquired-MRSA)

The reason that hospitals are seen as the “ hot spot” of MRSA infection is because the majority of people there are ill. For any individual that suffers from a medical condition like HIV or cancer, that weakens the immune system, the chance for infection is increased exponentially. [16]

HA-MRSA can normally enter through an entry point into the body, such as a surgical wound or a catheter.

This can sometimes be a major problem for some patients and can resolve in death. Abscess's normally form to control and heal the infection. For most HA-MRSA infections not much can be done to resolve the problem except to make sure that medical staff are kept constantly aware of how vital hygiene is when dealing with patients.

The patients tend to be older, sicker and weaker than the general population, making them more vulnerable to infection from HA-MRSA.

These are some of the few problems that nothing can be done about. The age of a person isn't a major factor unless the patient is older as their immune systems are weaker they are prone to disease and infection.

Hospitals are filled by many patients, doctors and nurses, so HA-MRSA can easily be contracted, through direct contact with other patients or staff, or through contaminated surfaces and through an airborne contaminant. [17]

This can be resolved by making sure contact with infected individuals is limited and the staff, made to contact is also limited. Surfaces in any medical care facility should always be sanitised and kept clean.

The “superbug” that is MRSA can be seen as a never ending problem because MRSA infection can arise in the community, which I feel will not eliminate the stress on hospitals but instead increase it. Even if hospitals were to have better control methods and better policies addressing the problem of MRSA, the outside world could not continue to keep surfaces completely clean, with door handles being constantly used. The problem seems to be more like a never ending round-about instead of a quick sprint to resolving the spread of MRSA.

Screening for MRSA

Screening for MRSA is an effective and safe method to find out if a person is a carrier of MRSA. Screening for MRSA before a person enters an environment like a hospital can greatly decrease the chance for a carrier to become infected or to infect others, as the staff at the hospital can remove as much of the bacteria as possible through a simple treatment. [18]

The screening process is simple and involves no injections. Instead several swabs are taken at the most common carrier sites of the bacteria; the anterior nares (nose), the axilla (armpit), and the perineum (groin) are all tested. If any skin lesions were seen or noticed they would also be tested, due to them being one of the first signs of an MRSA infection. [19]

There are three ways of testing the swabs taken from a suspected carrier of MRSA. These include:

Polymerase Chain Reaction (PCR)

PCR is a method for producing large amounts of specific DNA or RNA fragments of defined length and sequence from small amounts of primers. The reaction is not only efficient and specific, but is also very rapid and extremely sensitive. Uses for the reaction include disease diagnosis, detection of difficult-to-isolate pathogens, and the direct detection of MRSA from nasal swab samples. [20]

PCR can be seen as the quickest of the three methods as it removes all the tedious work of having to count up the colonies on an agar plate and it doesn't involve having to wait for several days for the results like an enrichment broth. PCR is also a very simple procedure. [21]

PCR is also the most costly of the three, which although is a negative quality it isn't a major factor when testing to see whether someone is infected by MRSA.

Enrichment Broth Cultures

An enrichment culture is a medium with specific and known qualities that favors the growth of a particular micro-organism [22]

The major pro with Enrichment Cultures is that they give an easy way in which to isolate pure cultures of scarce microbial types.

The two biggest cons when using Enrichment Cultures is that they very easily become contaminated, which can be seen as very big negative when trying to isolate a MRSA. [21]

Direct Plating

Direct Plate counting is a method used to count the number of cells in a sample.

Once the cells to be counted have been isolated, they are dilute; due to the fact that too many cells will cause the Petri dish to be so populated with colonies, that it would be impossible to count. After the cells have been diluted, they are incubated on an agar medium until colonies form. It is now that the cells are counted. [21]

Direct Plating can be seen as the method with the most negatives. Sampling error is the most obvious negative as it refers to the uneven spread of the sample on the agar plate. This is a serious negative as it can hinder the end results. Another negative is that it has little effect on cells that do not split, as it hinders the final count. Through all of Direct Plating's negatives it is still seen as the best available method for identifying viable cells. [21]

All three types of screening and testing methods are valid and useful for different end results needed. It can be seen from the information that Enrichment Cultures and Direct Plating are not as quick and effective as PCR. Though PCR is flawed by the cost the pros can easily be seen to outweigh this small negative. I believe PCR is the best method for testing for the presence of MRSA, as it gets the results quick and easily and avoids all the tedious work of counting cells.

Prevention Methods

Hand Hygiene

By having good hand hygiene the risk of spreading MRSA can be reduced greatly. Hands and wrists should be washed thoroughly using an antiseptic hand wash or simple dispenser soap. Cross-contamination and spread of MRSA in hospitals is being tackled by using special anti-microbial hand washing products and alcohol-based antiseptic agents. Hand hygiene is essential even if disposable gloves have been worn. Hand hygiene procedures must always be performed before leaving the room (even if there has been no direct contact with the patient, e. g. when serving food, airing the room or making the bed).

The diagram below shows the proper method to washing hands effectively.

[23]

[23]: How to wash hands properly

Precautions

Infection control precautions can be seen as obvious things in preventing cross contamination. The following precautions should always be carried out at all times and with all patients and medical staff.

Cover all cuts, abrasions and lesions - especially those on hands and forearms with a waterproof dressing.

Maintain hand hygiene

Before and after dealing with each patient

Before handling food

Following bed making

After handling blood and bodily fluids and also items contaminated with blood or bodily fluids

Dispose of waste safely

Isolate patients with a known or suspected infection

Use disposable gloves and aprons when dealing with patients, blood, bodily fluids and the making of beds. [7]

Education

The continuous education of all health-care staff members is an essential part of any MRSA control scheme, as well as making sure up-to-date information is always available and known.

The education of patients is also vital to controlling MRSA infections. The Department of Health Services: Centres for Disease Control and Prevention (CDC) offers a link to an MRSA patient information sheet. Such information as this can be seen as extremely helpful as it answers the most common asked questions regarding MRSA. [24]

All the possible prevention methods boil down to maintaining excellent hygiene. By keeping your environment, your personal care items, and yourself clean you can reduce the risk of contracting MRSA. It is imperative to follow the directions laid out by staff when you are in hospitals, nursing homes, and gyms, as these locations can carry an increased risk of MRSA infection. [25]

Treatment

The treatment of MRSA, in today's world is more difficult than ever. MRSA being a superbug means that it is resistant to a wide range of antibiotics. With such antibiotics as Methicillin, Penicillin and Cephalosporin being among the many antibiotics that have no affect on MRSA. When MRSA was first discovered to be resistant against methicillin a number of other treatments were devised so as to stop the outbreak of the bacteria. Although the alternative antibiotics were affected for a while, MRSA became resistant to them also. This meant that new drugs had to be made so as to control MRSA from becoming a worldwide pandemic.

The manufacturer of such drugs as Chlorhexidine hydrochloride, Vancomycin Hydrochloride and Linezolid meant that MRSA had a chance of being controlled.

[26]: Comparison of Vancomycin and Linezolid

Vancomycin

Linezolid

Mechanism of Action

Cell wall synthesis inhibitor

Protein synthesis inhibitor

Dosage Form Availability

Intravenous

Intravenous

Oral

Adverse Events

Red man syndrome

Rash

Nephrotoxicity

Ototoxicity

Bone marrow suppression

Mitochondrial toxicity: neuropathies and lactic acidosis

Serotonin syndrome

Routine Therapeutic Drugs Monitoring Performed

Yes

No

The table above shows a comparison between two drugs that are used to treat MRSA. From the table it is clear to see that both treatments offer adverse effects. With Vancomycin only being able to be administered intravenously (IV) while Linezolid can be administered by IV or orally. The number of adverse effects is greater for Vancomycin suggesting that Linezolid is the better method for treatment of MRSA.

[27]: Linezolid [28]: Vancomycin Hydrochloride

The images above show the complexity of the Linezolid and Vancomycin Hydrochloride and how they are structured.

Isolation of a patient/person suffering from MRSA is seen as an alternative treatment. The isolation of a person is extreme as it means confining them to one room in a separate ward. The advantage of such an extreme treatment is that, the physical barrier between the infected and the uninfected acts as a disturbance stopping the further transmission of the bacteria. The other advantage is that the separation gives a clear psychological message to the sufferer that they are infected and have a huge potential to infect those around them. With any advantage comes a disadvantage, with isolation having one huge disadvantage. The psychological damage that isolation can have on an individual can leave them so lonely that they begin to distrust those around them. The individual can become so independent that they see

no need for help from others and this can lead to a long and lonely existence. [29]

Available Aid

There are many sources of aid, available for those who are colonised, infected or related to someone with MRSA. MRSA sufferers and their families who are feeling the pressures of living with MRSA can retreat from their ordinary lives, of people asking things like “are you ok” and “do you need any help”, online. Through such support groups as MRSA Action UK, a registered charity with the aim of helping and supporting not only the sufferers of MRSA but their families also, the stress of being a sufferer of MRSA can be relieved. MRSA Action UK not only acts as a charity to make the general population aware of the superbug but also offers links to other sites which give information and further support for anyone who needs it.

MRSA Resources is an online discussion board, where people who have MRSA, have lost someone to MRSA, or just want to talk about the subject, are able to. The discussion board allows for people to share not only the information they have found on the internet or in books and newspapers but also allows them to connect on a personal level where they can share their own personal experiences with MRSA.

Conclusion

The prevention and controlling methods for MRSA infections is dependent on the approach and high standards of which healthcare workers abide by, as well as, strong leadership to highlight the dangers of an MRSA infection.

Standard precautions, e. g. hand hygiene, together with isolation, and

education are key to the prevention and control of MRSA. The overall welfare and safety of a person is of the up most importance, and measures undertaken to control MRSA shouldn't interfere with the already established care of patients. Therefore, it can be seen that the investment in more isolation rooms in hospitals and increased hygiene care throughout the world can reduce the potential of MRSA infections.

MRSA can be seen as a major problem for health services throughout the globe, as it decreases mortality rates, increases morbidity rates and causes patients to stress over the possible symptoms.

It is essential to have a well-structured and clear policy on infection control in hospitals and educational facilities to stop or at least stunt the spread of MRSA as well as other infectious bacterium. As well as a clear policy educational programmes and leaflets on infectious control should be made available at request as well for the training of nurses, all to aid in the understanding of MRSA.

In any medical facility it is nurses who are in immediate contact with many patients over prolonged periods of time. With this in mind it means that the hygiene of nurses should be maintained continuously at a high standard. Not only should they keep their hygiene high when dealing with patients but also with relatives and visitors to the hospital.

In spite of all the possible improvements that have been established and stated in this graded unit, the problem of MRSA control and eradication still seem to be a subject that will never be resolved. Though hospitals could improve hygiene and lower the potential of HA-MRSA, the potential threat of <https://assignbuster.com/research-on-methicillin-resistant-staphylococcus-aureus-nursing-essay/>

increased CA-MRSA is always a possibility due to community hygiene being impossible to control or establish a policy to which CA-MRSA would be effected by.

Glossary

(All glossary definitions were taken from the internet, from several different sites).

Abscess – an accumulation of pus in a body tissue, usually caused by a bacterial infection.

Airborne – in or carried by the air.

Antibiotics – a chemical substance derivable from a mold or bacterium that can kill microorganisms and cure bacterial infections.

Bacteria – bacteria are tiny, single-celled organisms that live in the body. Some can cause illness and disease and some others are good for you.

Bloodstream infection – a condition in which bacteria enters the blood, which can occur through a wound or infection, or through a surgical procedure or injection.

Boils – an inflamed, raised area of skin that is pus-filled; usually an infected hair follicle.

Carbuncles – skin lesion typically caused by *Staphylococcus aureus*, and resembling a boil with multiple heads.

Catheter - a hollow, flexible tube inserted into the body to put in or take out fluid, or to open up or close blood vessels.

Cephalosporin - any of a class of natural and synthetic antibiotics developed from *Cephalosporium* fungi.

Chlorhexidine hydrochloride - an anti-microbial agent.

Colonized - the presence and multiplication of microorganisms without tissue invasion or damage. The infected individual demonstrates no signs or symptoms of infection, while the potential to infect others still exists.

Culture - the growing of microorganisms in a nutrient medium (such as gelatine or agar).

Endocarditis - inflammation of the endocardium and heart valves.

Endocardium - lining of the interior surface of the heart's chambers.

Erythematous - a reddening of the skin.

HIV - (Human immunodeficiency virus) a retrovirus that attacks helper T cells of the immune system and causes acquired immunodeficiency syndrome (AIDS); transmitted through sexual intercourse or contact with infected blood.

Impetigo - a highly contagious skin infection caused by bacteria, usually occurring around the nose and mouth.

Intravenous (IV) - a dose of medicine administered from a drip, down through a hollow needle inserted into a patient's vein.

Isolation - the act of isolating something; sets something apart from others.

Linezolid - a synthetic antibiotic used for the treatment of serious infections caused by Gram-positive bacteria that are resistant to several other antibiotics.

Meninges - the three membranes that surround and protect the spinal cord and brain.

Meningitis - inflammation of the meninges; usually caused by infection by a microorganism.

Methicillin - antibiotic drug of the penicillin family used in the treatment of certain staphylococcal infections.

Mitochondrial toxicity - a condition in which the mitochondria of a body's cells become damaged or decline significantly in number.

MRSA - (Methicillin-resistant Staphylococcus aureus) a serious and potentially fatal infection caused by Staphylococcus aureus bacteria that is resistant to the broad-spectrum antibiotics commonly used to treat it.

Nephrotoxicity - damage to the kidneys produced by drugs or other substances.

Osteomyelitis - the inflammation of bones and bone marrow because of an infection, usually caused by bacteria.

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Ototoxicity – toxic to the organs of hearing or balance or to the auditory nerve.

Pandemic – an epidemic that is geographically widespread; occurring throughout a region or even throughout the world.

Penicillin – an antibiotic used to cure or stop the spread of certain infections, due to its ability to inhibit the growth of certain bacteria.

PCR – method of amplifying or copying DNA fragments that is faster than cloning.

Red man syndrome – an infusion reaction to vancomycin, causing flushing of the skin and an erythematous rash on the upper body.

Septicaemia – a life-threatening condition in which bacteria multiply in the blood and produce toxic materials; commonly known as blood poisoning.

Septic shock – a life-threatening condition in which tissues become damaged and blood pressure drops due to bacteria multiplying and producing poisons in the blood.

Serotonin syndrome – a potentially life-threatening adverse drug reaction that may occur following therapeutic drug use.

Skin infection (Dermatitis) – inflammation of the skin.

Staphylococcus aureus – potentially pathogenic bacteria found in nasal membranes, skin, hair follicles, and peritoneum of warm blooded animals.

They may cause a wide range of infections and intoxications.

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Styes - a pus-filled abscess in the follicle of an eyelash; caused by a bacterial infection.

Superbug - a strain of bacteria that is resistant to all antibiotics.

Vancomycin - an antibiotic effective against some bacterial infections.