Efficacy of Some Antiseptics and Disinfectants: A Review

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ABSTRACT

Antiseptics and Disinfectants are widely used in hospitals and other health care centers to control the growth of microbes on both living tissues and inanimate objects. Different pathogens responded different antiseptics and disinfectants. Antibacterial effects of the antiseptics and disinfectants were also concentration dependent.

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INTRODUCTION

Antiseptics and disinfectants are used extensively in hospitals and other health care centers to control the growth of microbes on both living tissues and inanimate objects. They are essential parts of infection control practices and aid in the prevention of nosocomial infections [1]. But a common problem is the selection of disinfectants and antiseptics because different pathogens vary in their response to different antiseptics or disinfectants [2].

Many hospitals are still using phenolic disinfectants, while their use is being discouraged throughout advanced countries. Toxicity issues have led to discontinued use of gluteraldehydes in some developed countries [3] but, in developing countries, they are used very frequently. Phenolic compounds are relatively tolerant of anionic and organic matter. They are absorbed by rubber and plastics and leave a residual film. This residual film may cause irritation to the skin [4]. A collaborative study by Rutala and Cole (1987) documented the facts that randomly selected Environmental Protection Agency (EPA) registered phenolic detergents and quaternary ammonium compounds do not consistently meet the manufacturer's bactericidal label claims [5]. Phenol compounds at concentration of 2-5% are generally considered bactericidal, tuberculocidal, fungicidal and virucidal against lipophilic viruses [6].

Over the last few years alcohol-based hand disinfectants have become widely available within health care, providing an alternative means of achieving good hand decontamination. In the hospital setting their advantage over soap and water is that they can be applied in transit to the next patient or task and therefore may help improve compliance with hand decontamination. Within the community setting they provide a suitable alternative to hand washing, particularly where there may be inadequate hand washing facilities [7]. It is well known that hand hygiene is a crucial factor in the control of health care-acquired infections (HCAIs) [8]. This is because hands may readily become contaminated with transient micro-organisms during the delivery of health care. Transient flora such as *Staphylococcus aureus* are micro-organisms colonizing the superficial outer layers of the skin, and may be readily removed by hand washing [9]. Equally, where hand hygiene is poor these micro-organisms may be transmitted from the hands of one patient to another. Hands contaminated by the hospital environment can also contribute to HCAIs [8].

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Traditionally soap and water, either plain soap or soap incorporating an antimicrobial agent such as chlorhexidine gluconate, have been used for hand washing in an effort to reduce HCAIs [9]. More recently a number of alcohol-based hand rubs/gels have also become widely available in health care, providing health care workers with another range of hand decontamination products. Their introduction raises a number of issues, such as indications for use, efficacy and potential for skin damage.

Although the importance of hand washing is generally accepted as a preventative measure to decrease transmittance of disease, a study conducted by The New England Journal of Medicine in 1992 reported hand washing compliance was only 30%-48% in an intensive-care unit (Case, 2006).The U.S. Food and Drug Administration (FDA) has set up a system of loose standards for effective antiseptic products, but there is no legally binding document that forces manufacturers to comply.

Throughout the past thirty years or so, the use of antiseptic products, in and out of the healthcare system, has increased. Many consumers place trust in antiseptics every day, but how effective are these sanitizers?

Products containing antimicrobial agents that kill, inhibit or reduce the number of Micro-organisms on the skin are topical antiseptics [10]. Although normal flora can display agonistic affects, where one organism forms a symbiotic relationship with another organism, the flora may also serve as a source of infection for the host. There are two types of normal flora on the skin: transient and resident flora. Resident flora can be persistently found on the skin; while transient floras are contracted from the external environment [10]. The current standards for antiseptic products only require the elimination of transient microorganisms. Antiseptic products have been found to eliminate bacteria in two ways. The use of active ingredients found in the actual product and the washing, rinsing and drying process help to eliminate flora on the hands. The most effective way active ingredients kill the flora is by breaking down the bacterium's cell membrane [10].

Recently, the FDA has divided into healthcare antiseptics, food handler antiseptics and consumer antiseptics. It has also been decided that all antiseptic products that include antimicrobial labeling, i.e. kills the germs that cause body odor, are drugs and are required to demonstrate[11] .

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Recently, in vitro and in vivo studies have tested the reduction of transient bacteria. *In vitro* studies observe the number and movement of organisms as well as the potential for the development of resistance [13]. *In vivo* test methods look at other aspects, such as patient-to-patient contamination, and whether or not there is adequate bacterial reduction through tests that mimic actual use. Hands are contaminated, washed, and then the number of flora is noted. Within all antiseptic products, there is an active chemical agent (called a biocide) responsible for the destruction of microorganisms. These active ingredients include alcohol, iodine, triclosan, chlorohexidine gluconate, benzalkonium chloride, triclocarban, and para-chloro-meta-xylenol, and triclosan [11]. Leave-on and washes contain alcohol, benzalkonium chloride, and benzethonium chloride. Benzalkonium chloride used as disinfectant on some important foodborne pathogens [12]. Yet, although all of these biocides may be used by manufacturers, only two active ingredients have been recognized as safe and effective by the TFM. These active ingredients are 60-95% alcohol and 5-10% povidone-iodine [11,13].

Researchers are still working towards a conclusion on which method of antiseptic use is most effective, hand gels that do not require water or soap and water. In a recent amendment to the TFM, it was established that ethanol (60-90%), an active ingredient in hand gels, fell into Category I: safe and effective [14]. Although, if the hands are heavily soiled, it is not suggested that alcohol-based products replace regular soap and water. In response to a study done by Sickbert-Bennett (2005) stating that alcohol-based hand rubs are generally ineffective, it has been suggested that an increase in the percentage of ethanol may improve the effectiveness of these products [15]. Regardless, it can be argued that in the case of heavily soiled hands, regular soap and water cannot be replaced.

One of the most important issues with continuing the use of antiseptics is the potential antibacterial resistance these microorganisms may acquire. Sheldon's (2005) article discusses how microorganisms can become resistant to the active ingredients found in antiseptic products. In vitro tests were performed to determine whether or not susceptibility is a factor. Researchers found two different ways that bacteria can become insusceptible to biocides. For intrinsic insusceptibility, the composition of the cell wall begins to deteriorate and the microorganism undergoes physiological adaptation [16]. Acquired insusceptibility to biocides occurs when the bacteria have mutated in some way. Although the insusceptibility of these microorganisms has

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not been directly observed at the genetic or molecular level, phenotypic observations reveal changes in the outer membrane of the bacteria.

The real concern is that biocides may stop working altogether. Researchers and the FDA suggest that biocides be monitored in the future, so that if a strong resistance occurs, decisions can immediately be made on whether this substance is more of a risk rather than a benefit. In an FDA literary search, they found that other studies examining bacterial resistance (besides Sheldon's research) revealed a reduced susceptibility to biocides as well [16].

3.1. MECHANISMS OF ACTION

Considerable progress has been made in understanding the mechanisms of the antibacterial action of antiseptics and disinfectants. By contrast, studies on their modes of action against fungi, viruses, and protozoa have been rather sparse. Furthermore, little is known about the means whereby these agents inactivate prions. Whatever the type of microbial cell (or entity), it is probable that there is a common sequence of events. This can be envisaged as interaction of the antiseptic or disinfectant with the cell surface followed by penetration into the cell and action at the target site(s). The nature and composition of the surface vary from one cell type (or entity) to another but can also alter as a result of changes in the environment. Interaction at the cell surface can produce a significant effect on viability (e.g. with glutaraldehyde), but most antimicrobial agents appear to be active intracellularly. The outermost layers of microbial cells can thus have a significant effect on their susceptibility (or insusceptibility) to antiseptics and disinfectants; it is disappointing how little is known about the passage of these antimicrobial agents into different types of microorganisms. Potentiating of activity of most biocides may be achieved by the use of various additives, as shown in later parts of this review.

In this section, the mechanisms of antimicrobial action of a range of chemical agents that are used as antiseptics or disinfectants or both are discussed. Different types of microorganisms are considered, and similarities or differences in the nature of the effect are emphasized [17].

3.2. General Methodology

A battery of techniques is available for studying the mechanisms of action of antiseptics and disinfectants on microorganisms, especially bacteria. These include examination of uptake, lysis

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and leakage of intracellular constituents, perturbation of cell homeostasis, effects on model membranes, inhibition of enzymes, electron transport, and oxidative phosphorylation, interaction with macromolecules, effects on macromolecular biosynthetic processes, and microscopic examination of biocide-exposed cells. Additional and useful information can be obtained by calculating concentration exponents (n values) and relating these to membrane activity. Many of these procedures are valuable for detecting and evaluating antiseptics or disinfectants used in combination.

Similar techniques have been used to study the activity of antiseptics and disinfectants against fungi, in particular yeasts. Additionally, studies on cell wall porosity may provide useful information about intracellular entry of disinfectants and antiseptics. Mechanisms of antiprotozoal action have not been widely investigated. One reason for this is the difficulty in culturing some protozoa (e.g., Cryptosporidium) under laboratory conditions. However, the different life stages (trophozoites and cysts) do provide a fascinating example of the problem of how changes in cytology and physiology can modify responses to antiseptics and disinfectants. Some of these procedures can also be modified for studying effects on viruses and phages (e.g., uptake to whole cells and viral or phage components, effects on nucleic acids and proteins, and electron microscopy). Viral targets are predominantly the viral envelope (if present), derived from the host cell cytoplasmic or nuclear membrane; the capsid, which is responsible for the shape of virus particles and for the protection of viral nucleic acid; and the viral genome. Release of an intact viral nucleic acid into the environment following capsid destruction is of potential concern since some nucleic acids are infective when liberated from the capsid, an aspect that must be considered in viral disinfection [17].

3.3. Chemicals used as disinfectants

3.3.1. PHENOLS

Phenols are among the oldest established active disinfectant substances. Originally derived from coal tar, they were extensively used in the early 20th century and still play a major role in the disinfectant armory today. In the United Kingdom and Ireland, over 30% of disinfectants used in veterinary applications are based on phenols. However, in Germany, only 7% of veterinary disinfectants are phenolic [18].

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Phenol itself is rarely used now, as it is highly toxic and corrosive, but the higher homologues (cresols, xylenols and ethylphenols) are still used. Phenols have a wide spectrum of activity against bacteria, viruses, fungi and mycobacteria, while their sporicidal activity is minimal. Phenols have poor surface activity and have therefore traditionally been formulated in soap solutions to increase their penetrative power. The choice of soaps which may be used is very limited: the sodium or potassium salts of castor oil, linseed oil or resin acids have generally been used for this purpose. Soaps based on tallow, tall oil or oleic acid markedly decrease the activity of phenols. Phenolic disinfectants are divided into three categories, as described below.

Clear soluble phenols

'Clear solubles' are so- called as they yield a clear, opalescent solution in distilled water. They essentially consist of cresol, xylenol,o-ethylphenol (alone or in combination) dissolved (20-30%) in a liquid soap. Ethyl alcohols or glycols may also be included in the formula. Such products are effective under conditions of heavy soiling and are therefore among the products of choice where such conditions exist. Clear solubles are incompatible with acids or strong alkalis. Acids break down the soap, and alkalis convert the phenol to the phenate ion, which is less effective than the phenol molecule and can cause resinification, resulting in loss of activity. Products based on cresol are corrosive to skin, but those based on xylenols or higher phenols are less corrosive. Clear soluble have a low concentration exponent and are almost as bactericidal as bacteriostatic; they must therefore be used at the recommended concentration or their activity will be lost.

White fluid

'White fluid' phenols are produced by making a colloidal solution of a low Boiling point tar acid fraction and so-called 'neutral' oil (a complex eutectic mixture of naphthalene, dimethylnaphthalenes, acenaphthene and other aromatic hydrocarbons) in water. This is usually made in a colloid mill or in a homogeniser, but ultrasonics can also be used. A small amount of soap is usually added and the emulsion is held together by a colloid protectant (usually glue or casein). White fluids have a distinct advantage over nearly all other types of disinfectant in that they can be diluted with seawater or brackish water without breaking down or losing their activity (nearly all the navies of the world formerly used these disinfectants). They are effective

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in conditions of heavy soiling and have a wide spectrum of microbicidal activity. White fluid phenols have been used extensively for terminal disinfection in farm buildings. However, they are toxic and have a tarry odour, and if the emulsion breaks down they can leave tarry deposits.

Black fluid phenols

'Black fluid' phenols are based on a tar fraction of higher boiling-point than that used for the white fluids. This tar fraction is a complex mixture of higher homologues of phenol, naphthols, indanols, anthracols, etc. It is quite insoluble in water and must therefore be solubilised in 'neutral' oil. This mixture is then solubilised with a soap solution or an ethoxylated castor oil sulphonate; glycerols or glycols may also be added. The high boiling-point tar acids used in these products do not have the same wide spectrum of activity as those used in the white fluids.

These products are effective against a wide range of Gram-negative and Gram-positive bacteria, but are relatively ineffective against *Pseudomonas spp*. and mycobacteria, and are not effective against lipophobic viruses. However, their level of fungicidal activity is quite high. Black fluid phenol products are effective in conditions of heavy soiling. They form white emulsions when diluted and have a tarry odour. By formulating tar acids in combination with sulphonic acids and acetic acid, highly bactericidal, fungicidal and virucidal products have been formulated for farm use. Formulations have also been developed using triethanolaminedodecylbenzene sulphonate as an emulsifier. One phenol worthy of special mention is o-phenylphenol. This can be incorporated into clear soluble products and is quite often used in combination with halogenated phenols to enhance their activity. It is less toxic and less corrosive than most other phenols. Formulating with phenols requires great care, as the activity of the formulation relies on both oil/water partition and micelle concentration [19] .

3.3.2. IODINE-BASED COMPOUNDS

Iodine itself is not very soluble and is generally too toxic, corrosive and staining for use as a microbicidal active, although it is among the most active disinfectant substances known. In the early 20th century, iodine was used extensively as an antiseptic, in solutions in which the iodine was dissolved in alcohol and potassium iodide. These tinctures of iodine were found to be too irritative to skin and mostly fell into disuse. Iodine was discovered to be reactive with neutral

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polymers, particularly polyvinyl pyrrolidine, to yield a product which has found extensive use as a surgical hand-wash and antiseptic. Iodine was also found to react with ethoxylated surfactants to produce iodophors. These iodophors are usually stabilised with either acids or acidic buffers. They have an extremely wide spectrum of activity against bacteria, spores, mycobacteria, fungi and viruses, and have found extensive use in the veterinary field. Iodophors have a low temperature coefficient compared to most other products, and therefore work almost equally well at low and high temperatures. Iodophors cannot be mixed with other products, nor can they be used in alkaline conditions. They can cause staining if not used properly [19].

3.3.3. ALCOHOLS

Although some alcohols have been extensively used as skin disinfectants, they are not particularly active. Ethyl alcohol, isopropyl alcohol and M-propyl alcohol are most active at 70% concentration and retain some activity down to approximately 10%. However, alcohols have found extensive use as solvents and have been used in formulations of disinfectants in combination with phenols, halogenated phenols, QACs and Chlorhexidine. Alcohols have the advantage of evaporating quickly and leaving no residues; they have therefore been used as spray disinfectants in the food industry. Terpene alcohols also have some germicidal properties and have been used in combination with halogenated phenols in so-called 'pine fluids'. Phenoxyethanol and phenylethyl alcohol have also been used in formulations to increase activity against *Pseudomonas sp.* [19].

3.3.4. Hydrogen peroxide

Hydrogen peroxide has good antibacterial properties and has been used in formulations at 5-20%. It is not very fungicidal, and the organisms which contain catalase are resistant to low concentrations. Hydrogen peroxide is a very reactive material, is not very stable and is destroyed by alkalis. To increase stability, the pH is adjusted to approximately 5 and phosphonates are added. Hydrogen peroxide has found intensive use in sterilising cardboard packaging used for milk. The breakdown products are water and oxygen, thus rendering hydrogen peroxide particularly suitable for this purpose.

Of the other peroxygen-based products, peracetic acid has found use in food processing and

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dairying. It is presented in a mixture with acetic acid and hydrogen peroxide. Peracetic acid has an acrid odour but kills all types of microorganisms, including spores, and is active in the presence of soiling matter.

Many other peroxygen compounds (e.g. percarbonate perlactate, persuccinate perbenzonate and pervalerate) have microbicidal properties, but they are generally unstable and have found little use in the disinfectant industry. Sodium and potassium monopersulphates have the property of producing chlorine from salt solutions and peroxide in acid solution. This property has been used in powdered disinfectant formulations, one of which has been extensively used for veterinary disinfection. Sodium metaperiodate has been added to some formulations to increase activity, as it has chelating powers for some heavy metals [19].

3.3.5. CHLORHEXIDINE

Chlorhexidine is a cationic biguanide, available in concentrations up to 4% as a topical agent used as a skin cleanser and mouthwash. Skin preparations of 0.5% -4% are marketed under the trade names Hibiclens and Hibistat. It is also marketed as a mouthwash in a 0.12% solution under the trade name Peridex. There is very little human experience with poisonings, as these concentrations do not appear to be significantly toxic. Chlorhexidine is poorly absorbed from skin or the gastrointestinal tract. Therefore, most effects noted have been primarily local. Low concentration solution ingested or applied to the skin can cause mild local irritation. Contact dermatitis, urticaria and anaphylaxis have followed repeated skin exposures to this agent [20, 21, 22]. Corneal injuries have been described in several cases after inadvertent exposure of the eyes to the 4% concentration. These injuries have resulted in permanent corneal scarring [23]. Esophageal burns have reported in a single case after ingestion of a large quantity of a 20% solution of this agent [24].

3.4. SOME COMMON BACTERIA RESPONSIBLE FOR NOSOCOMIAL INFECTIONS

3.4.1. *Staphylococcus aureus*

Staphylococcus aureus is a Gram-positive coccal bacterium that is frequently found in the human respiratory tract and on the skin. It is positive for catalase and nitrate reduction. Although S.

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aureus is not always pathogenic, it is a common cause of skin infections (e.g. boils), respiratory disease (e.g. sinusitis), and food poisoning. The emergence of antibiotic-resistant forms of pathogenic *S. aureus* (e.g. MRSA) is a worldwide problem in clinical medicine.

S. aureus is the most common species of staphylococcus to cause Staph infections and is a successful pathogen due to a combination of nasal carriage and bacterial immuno-evasive strategies. *S. aureus* can cause a range of illnesses, from minor skin infections, such as pimples, impetigo,boils (furuncles), cellulitis folliculitis, carbuncles, scalded skin syndrome, and abscesses, to life-threatening diseases such as pneumonia, meningitis, osteomyelitis, endocarditis, toxic shock syndrome (TSS), bacteremia, and sepsis. Its incidence ranges from skin, soft tissue, respirator y, bone, joint, endovascular to wound infections. It is still one of the five most common causes of nosocomial Infections and is often the cause of postsurgical wound infections. Each year, Some 500,000 patients in United States' hospitals contract a staphylococcal infection.

S. aureus is responsible for many infections but it may also occur as a commensal. The presence of *S.aureus* does not always indicate infection. *S. aureus* can survive from hours to weeks, or even months, on dry environmental surfaces, depending on strain. *S. aureus* can infect tissues when the skin or mucosal barriers have been breached. This can lead to many different types of infections including furuncles and carbuncles (a collection of furuncles).

S. aureus infections can spread through contact with pus from an infected wound, skin-to-skin contact with an infected person by producing hyaluronidase that destroys tissues, and contact with objects such as towels, sheets, clothing, or athletic equipment used by an infected person. Deeply penetrating *S. aureus* infections can be severe. Prosthetic joints put a person at particular risk of septic arthritis, and staphylococcal endocarditis (infection of the heart valves) and pneumonia.

3.4.2. *Streptococcus pyogenes*

Streptococcus pyogenes or Group *A. Streptococcus* is a spherical, Gram-positive bacterium. *S. pyogenes* displays streptococcal group A antigen on its cell wall and typically produces large zones of beta-hemolysis (the complete disruption of erythrocytes and the release of hemoglobin) when cultured on blood agar plates, so it is also called group A (beta-hemolytic)Streptococcus

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(GABHS or GAS). Streptococci are catalase-negative. Under ideal conditions, *S. pyogenes* has an incubation period around 1–3 days [2]. It is an infrequent, but usually pathogenic, part of the skin flora.

An estimated 700 million infections occur worldwide each year. While the overall mortality rate for these infections is 0.1%, over 650,000 of the cases are severe and invasive, and have a mortality rate of 25%. Early recognition and treatment are critical; diagnostic failure can result in sepsis and death.

S. pyogenes is the cause of many important human diseases, ranging from mild superficial skin infections to life-threatening systemic diseases. Infections typically begin in the throat or skin. The most striking sign is a strawberry-like rash. Examples of mild *S. pyogenes* infections include pharyngitis (strep throat) and localized skin infection (impetigo). Erysipelas and cellulitis are characterized by multiplication and lateral spread of *S. pyogenes* in deep layers of the skin. S. *pyogenes* invasion and multiplication in the fascia can lead to necrotizing fasciitis, a life-threatening condition requiring surgery. Infections due to certain strains of *S. pyogenes* can be associated with the release of bacterial toxins. Throat infections associated with release of certain toxins lead to scarlet fever. Other toxigenic *S. pyogenes* infections may lead to streptococcal toxic shock syndrome, which can be life-threatening.

S. pyogenes can also cause disease in the form of post infectious *"non pyogenic" (*not associated with local bacterial multiplication and pus formation) syndromes. These autoimmune-mediated complications follow a small percentage of infections and include rheumatic fever and acute post infectious glomerulonephritis. Both conditions appear several weeks following the initial streptococcal infection.

Rheumatic fever is characterized by inflammation of the joints and/or heart following an episode of streptococcal pharyngitis. Acute glomerulonephritis, inflammation of the renal glomerulus, can follow streptococcal pharyngitis or skin infection.

3.4.3. *Salmonella typhi*

Salmonella typhi causes typhoid fever. Typhoid fever acute infectious disease caused by a specific serotype of the bacterium *Salmonella typhi*. The bacterium usually enters the body

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through the mouth by the ingestion of contaminated food or water, penetrates the intestinal wall, and multiplies in lymphoid tissue; it first entersinto the bloodstream within 24 to 72 hours, causing septicemia (blood poisoning) and...Human disease: Bacterial diseases...*Clostridium botulinum*), the elaboration of an endotoxin, a harmful chemical substance that is liberated only after disintegration of the micro-organism (as in typhoid, caused by *Salmonella typhi*), or the induction of sensitivity within the host to antigenic properties of the bacterial organisms.

3.4.4 *Escherichia coli*

E.coli is a Gram-negative, facultative anaerobic, rod-shaped bacterium of the genus Escherichia that is commonly found in the lower intestine of warm-blooded organisms (endotherms).

Most *E.coli* strains are harmless, but some serotypes can cause serious food poisoning in their hosts, and are occasionally responsible for product recalls due to food contamination. The harmless strains are part of the normal flora of the gut, and can benefit their hosts by producing vitamin K2, and preventing colonization of the intestine with pathogenic bacteria. *E. coli* and other facultative anaerobes constitute about 0.1% of gut flora, and fecal–oral transmission is the major route through which pathogenic strains of the bacterium cause disease.

Cells are able to survive outside the body for a limited amount of time, which makes them potential indicator organisms to test environmental samples for fecal contamination. A growing body of research, though, has examined environmentally persistent *E.coli* which can survive for extended periods outside of a host.

3.4.5 *Pseudomonas aeruginosa*

Pseudomonas aeruginosa is a Gram negative bacteria that is commonly found in the environment e.g. soil, water and other moist locations. *Pseudomonas aeruginosa* is an opportunistic pathogen. The bacteria takes advantage of an individual's weakened immune system to create an infection and this organism also produces tissue-damaging toxins. *Pseudomonas aeruginosa* causes urinary tract infections, respiratory system infections, dermatitis, soft tissue infections, bacteremia, bone and joint infections, gastrointestinal infections and a variety of systemic infections, particularly in patients with severe burns (35.7%) [26], in

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cancer and AIDS patients who are immunosuppressed.

Pseudomonas aeruginosa is primarily a nosocomial pathogen. According to the CDC, the overall incidence of *P. aeruginosa* infections in US hospitals averages about 0.4 % (4 per 1000 discharges), and the bacterium is the fourth most commonly-isolated nosocomial pathogen accounting for 10.1% of all hospital-acquired infections. Within the hospital, *P. aeruginosa* finds numerous reservoirs: disinfectants, respiratory equipment, food, sinks, taps, and mops. This organism is often reintroduced into the hospital environment on fruits, plants, vegetables, as well by visitors and patients transferred from other facilities. Spread occurs from patient to patient on the hands of hospital personnel, by direct patient contact with contaminated reservoirs, and by the ingestion of contaminated foods and water.

3.4.6 *Proteus bacilli*

Proteus is a genus of Gram-negative Proteobacteria. *Proteus* bacilli are widely distributed in nature as saprophytes, being found in decomposing animal matter, sewage, manure soil, and human and animal feces. They are opportunistic pathogens, commonly responsible for urinary and septic infections,often nosocomial. Three species—*P. vulgaris*, *P. mirabilis*, and *P. penneri*— are opportunistic human pathogens. *Proteus* includes pathogens responsible for many human urinary tract infections. *P. mirabilis* causes wound and urinary tract infections. Most strains of *P. mirabilis* are sensitive to ampicillin and cephalosporins. *P. vulgaris* is not sensitive to these antibiotics. However, this organism is isolated less often in the laboratory and usually only targets immunosuppressed individuals. *P. vulgaris* occurs naturally in the intestines of humans and a wide variety of animals, and in manure, soil, and polluted waters.

P. mirabilis, once attached to the urinary tract, infects the kidney more commonly than *E. coli*. *P. mirabilis* is often found as a free-living organism in soil and water. About 10–15% of kidney stones are struvite stones, caused by alkalinization of the urine by the action of the urease enzyme (which splits urea into ammonia and carbon dioxide) of *Proteus* (and other) bacterial species.

Future Prospectives:

Multiple nosocomial outbreaks have resulted from inadequate antisepsis or disinfection.

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Inadequate skin antisepsis may result from a lack of intrinsic antimicrobial activity of the antiseptic, a resistant pathogen, over dilution of the antiseptic, or the use of a contaminated antiseptic. The inadequate disinfection of medical devices or environmental surfaces may result from a lack of intrinsic antimicrobial activity of the disinfectant, an incorrect choice of a disinfectant, a resistant pathogen, over dilution of the disinfectant, an inadequate duration of disinfection, a lack of contact between the disinfectant and the microbes, or the use of a contaminated disinfectant. So in future the advance methods like silver nano particles or other metal–particles should come in practice or plants based phytochemicals [27] as antiseptic and disinfectants to avoid such microbial infection.

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