**Corynebacterium**

**Introduction**

The genus Corynebacterium is a diverse group of bacteria in humans and also includes animal and plant pathogens. These bacteria are Gram-positive, non-motile, aerobic, and rod-shaped bacteria that fall under the class known as actinobacteria (Guaraldi et al., 2014).  Corynebacteria are also catalase positive, non-spore-forming and can either be straight or slightly curved with ends that are clubbed. The club appearance of these bacteria is due to the inorganic phosphate stored in them which when stained such as by special techniques they form metachromatic granules hence the club shape.corynebacterium species are considered to be of the normal human flora and may be found on the skin, gastrointestinal tract as well as mucous membranes. These bacteria are recognized as pathogens due to the infections and diseases they cause in humans such as diphtheria (Bernard, 2012). This essay discusses the corynebacteria bacteria including the different species of these pathogens, their defining characteristics and the types of diseases and infections caused the bacteria.

**The Genus Corynebacterium**

Corynebacterium bacteria, as discussed above, are recognized as pathogens due to the diseases and infections they cause in human beings. They are widely recognized as causing opportunistic diseases in human beings under certain circumstances such as in patients with prosthetic devices, patients who are immune-compromised and also those patients who have stayed in hospitals or nursing homes for a long time (Bernard, 2012). The major pathogen in this group is the Corynebacterium diphtheria which is the primary cause of diphtheria. Other pathogens under this group include Corynebacterium pseudotuberculosis and Corynebacterium ulcerans. Due to the fact that these bacteria are disease-causing pathogens in human beings, it is important to ensure that clinicians take every precaution when dealing with patients to ensure that these bacteria are not passed to the patients. Since corynebacteria are found as part of normal skin flora in human beings, they are common contaminants of clinical materials (Bernard, 2012). Clinicians, therefore, have a responsibility to make sure that they make every effort to identify these bacteria in sterile body sites such as blood culture and also from the collected clinical material.

The genus Corynebacterium has 88 validly published species of which 53 species of this bacteria are either occasional or rare causes of diseases and infections in human beings or diseases and infections that are transmitted to human beings through zoonotic contact. The remaining 35 species are found in animals and birds, water, the environment and foodstuffs. Some of the species are also found in synthetic materials and this explains why people with synthetic body parts are at risk of contracting infections arising from Corynebacterium (Bernard, 2012). Of these species of bacteria, many of them are considered to be medically relevant and are part of the human skin flora. This includes species such as Corynebacterium *amycolatum*, Corynebacterium *jeikeium* and other lipophilic species. Most of these species are also considered to be resistant to multiple classes of drugs hence fatal more so in people whose immune system has been compromised. This explains why diseases such as diphtheria were once considered to be fatal.

**Types of Corynebacterium Pathogens**

The genus Corynebacterium is made up of a group of different bacteria which include both animals and plant pathogens, and also includes saprophytes. Some of these corynebacterium bacteria groups occur as part of the normal flora in humans and exist in most anatomic sites such as nares and skin (Guaraldi et al., 2014). There are different pathogens under the Corynebacterium group as discussed above. These include corynebacterium diphtheria, corynebacterium pseudotuberculosis, and Corynebacterium ulcerans which cause disease and infections in both humans and animals. These four subspecies have small differences in terms of their biochemical properties such as the way they metabolize nutrients and their colonial morphology.

**Corynebacterium Diphtheria**

Corynebacterium diphtheria is the causative agent responsible for diphtheria (Guaraldi et al., 2014). Diphtheria is a disease that is usually spread from one person to another through close contact. It is a potentially lethal disease that mainly affects the upper respiratory tract tissues in human beings. Respiratory diphtheria usually presents with a swollen bull neck together with a pseudomembrane in the respiratory tract. The pseudomembrane is considered as the main sign of the disease and may extend to other areas such as the trachea and the bronchi. Such spread of the pseudomembrane may cause severe blockage of the airflow hence causing respiratory problems.

Once the Corynebacterium diphtheria infects part of the respiratory system, they multiply on the infected part and the toxigenic strains end up producing diphtheria toxin. The diphtheria toxin is then absorbed into the blood circulation system where the toxin is circulated to tissues and other body organs such as adrenal glands, the kidney and also the central nervous system (Guaraldi et al., 2014). Death would result from suffocation by inflammation from the effects of the diphtheria toxin on the respiratory tract. The disease was once a leading cause of death across the globe but its spread was curbed through effective immunization programs that used toxoid molecules. The bacteria or the pathogens may be passed through the respiratory droplets that are produced when sneezing or coughing. The bacteria may also be found in other body secretions and other contaminated material. In endemic areas such as tropical areas, Corynebacterium diphtheria may be passed from one person to another through skin contact (Guaraldi et al., 2014). Where the skin lesions are infected, they can serve as a reservoir for Corynebacterium diphtheria. It is also worth noting that skin infections are more contagious than infections through respiratory droplets.

The pathogenicity of Corynebacterium diphtheria usually involves the invasion of the pathogen on the tissues of the throat and the production of the diphtheria toxin by the bacteria. The toxin plays a crucial role in the colonization of the throat leading to bacteria proliferation (Jamal et al., 2017). The diphtheria toxin is only produced by those strains of the Corynebacterium diphtheria that are lysogenized by a certain Beta phage. The phage cycle is necessary because it ensures the development of the structural gene that is necessary for the production of the toxin molecule. The three strains of the Corynebacterium diphtheria namely gravis, intermedius and mits are all involved in the colonization of the throat. They also produce the diphtheria toxin although there are differences in the ability of the strains to produce the toxin in terms of the quantity and rate of production.  The diphtheria toxin is solely responsible for the consequences that arise from a diphtheria infection. The incubation period for diphtheria ranges from two to five days (Jamal et al., 2017). The disease commences quite fast and the pseudo-membrane also develops fast hence affecting the entire pharynx, nose and the buccal cavity. There is also the non-toxigenic Corynebacterium diphtheria which also causes several infections including severe tonsillitis, persistent sore throats, invasive diseases such as septic arthritis and osteomyelitis.

**Corynebacterium Ulcerans and Corynebacterium Pseudotuberculosis**

Corynebacterium ulcerans also causes infections in human beings as well as animals and such infections can be fatal. Corynebacterium ulcerans can cause infections such as diphtheria especially for human beings who have close contact with animals. Corynebacterium ulcerans causes zoonotic diphtheria in adults. This pathogen is mainly carried by animals especially cattle. Due to this reasons, people who consume raw milk or have contact with the waste of the cattle or close contract are said to be at a greater risk of getting infected with the bacteria (Jamal et al., 2017). People infected with Corynebacterium ulcerans may show signs of skin lesions that are similar to those cause by cutaneous diphtheria. Corynebacterium ulcerans is also considered as a causative agent of pneumonia independent of the production of diphtheria toxin. Sometimes children who have been immunized against diphtheria may get corynebacterium ulcerans infections. There is also the Corynebacterium pseudotuberculosis which is the etiological agent of caseous lymphadenitis in animals such as goats as well as sheep. It is also responsible for diseases such as pneumonia, mastitis, arthritis and hepatitis. The pathogen is known to cause ulcerative lymphangitis in cattle, camels, buffaloes and other animals and also lymphadenitis in horses (Guaraldi et al., 2014).

**Non-Diphtheritic Corynebacteria**

Most of the corynebacteria species discussed above are considered to cause diphtheria infections in human beings. However, there are also non-diphtheritic corynebacteria that also exist in human beings as well as animals (Ramana et al., 2014). These non-diphtheritic corynebacteria can either be commensals or saprophytes which can be in animals, the environment and also human beings. These non-diphtheritic corynebacteria are considered to have biotechnological significance in the production of amino acids and vitamins which are vital elements in human beings. Clinical microbiology laboratories consider these bacteria as contaminants of human specimens especially when they are isolated from such specimens. The pathogenicity of non-diphtheritic corynebacteria in human beings is still in debate due to reports that indicate that non-diphtheritic corynebacteria are associated with human infections such as infections associated with prosthetic devices, septic arthritis, meningitis, brain abscess, peritonitis and urinary tract infections (Ramana et al., 2014). Such infections are common in immune-compromised or debilitated patients. Although non-diphtheritic corynebacteria are considered to be medically important in the production of vitamins and amino acids, recent reports indicating that these bacteria are also responsible for causing infections in human beings have led to their recognition as potential pathogens. Recent studies have shown that some types of non-diphtheritic corynebacteria such corynebacteria striatum have become multi-drug resistant bacteria species and are responsible for the outbreak of nosocomial infections (Ramana et al., 2014).

**Corynebacterium Resistance of Antibiotics**

Studies show that there is an increase in the number of infections associated with the species of Corynebacterium. There is a large group of microorganisms led by Corynebacterium diphtheria which have human-pathogenic significance. Strains of these species are known to cause diphtheria in human beings by producing strong exotoxine (Olender, 2013). The development of modern diagnostic methods of diagnosing diphtheria and immunization have helped reduce the spread of diphtheria and have also reduced the number of cases of people with the disease. The treatment offered to people with infections caused by Corynebacterium is taking effective antibiotic therapy. Recently, however, there are reports of the occurrence of strains with high resistance to antibiotics among corynebacterium species especially those that are common in patients with immune-deficiency.  The multidrug-resistant strains include Corynebacterium jeikeium, corynebacterium amycolatum, Corynebacterium striatum among others (Olender, 2013). These strains have been found to resist three groups of antibiotics which include macrolides, steptogramins and lincosamides. The development of strains that are resistant to antibiotics shows a kind of evolution in the Corynebacterium species. Such resistance coincides with the increase in the number of infections attributed to the Corynebacterium species.

Due to the rise of multidrug-resistant strains of Corynebacterium species, clinical microbiology laboratories now isolate these antibiotic-resistant strains from the clinical materials. Despite such measures meant to protect human beings from infections caused by these strains, there are questions as to the mode of treatment to be used for infections caused by the group of Corynebacterium strains that are resistant to drugs (Olender, 2013). These concerns are aggravated by the fact that these infections are associated with cases that are difficult to diagnose and in most cases, the patients suffering from these infections also happen to have chronic illnesses and other diseases which suppress the immune system. It is worth noting that one of the factors that increase the risk of infections associated with Corynebacterium species is long hospitalization. This means that patients with chronic illnesses are at a significantly high risk of contracting these infections which are drug resistant.

The solution to this conundrum has been conducting research that focuses on the sensitivity of these bacteria to antibiotics. Such information is crucial in the treatment of infections which arise from the resistant strains. The development of vaccines against these bacteria is also a key solution in dealing with the Corynebacterium strains that are resistant to drugs. Vaccination ensures that these infections do not occur in the first place hence there is no need for drug therapy since the patients are vaccinated (Olender, 2013). Such vaccination procedures are particularly important in patients whose immune system has been suppressed. This is more so in patients with chronic illnesses who have to stay for long in hospitals hence exposing them to the risk of infection with Corynebacterium species.

**Conclusion**

Corynebacterium are a diverse group of bacteria that affect human beings, animals as well as plants. Some of the major species under this group of bacteria are Corynebacterium diphtheria, Corynebacterium pseudotuberculosis, and Corynebacterium ulcerans. Corynebacterium diphtheria is the main cause of diphtheria in human beings which is an infectious disease that affects a person’s respiratory system. Respiratory diphtheria begins with a swollen bull neck due to the pseudomembrane which is the leading sign of diphtheria. Once the bacteria multiply on the infected area, the toxigenic strains produce diphtheria toxins which interfere with the respiratory system. The rate of diphtheria infection today is considerably low due to immunization. There are also other species of the Corynebacterium which are Corynebacterium pseudotuberculosis, and Corynebacterium ulcerans which are more common in animals. They can, however, also cause diphtheria infections in human beings through close contact with animals or through contact with animal products such as raw milk. Although the rate of corynebacterium infections have decreased over time, patients whose immune system has been suppressed due to the chronic illnesses are at risk of getting infections by these bacteria.

**References**

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