REVIEW ON ZOONOTIC STREPTOCOCCOSIS

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SUMMARY: Streptococcus species including (S. canis, S. dysgalactiae subsp. dysgalactiae, S. equi subsp. zooepidemicus, S. suis and mammalian S. agalactiae, S.halichoeri, S.iniae, and S. suis), gram positive cocci in the family Streptococcaceae. Almost all species of mammals and birds, as well as many poikilotherms, carry one or more species as commensals on skin or mucosa. These organisms can act as facultative pathogens, often in the carrier.
Streptococcus pyogenes, is a pathogen of public health significance, infecting 18.1 million people worldwide and resulting in 500,000 deaths each year. The pathogen causing GAS diseases is commonly transmitted via respiratory droplets, skin sores or through contact with contaminated material or equipment. It was highly prevalent in developing countries, and among indigenous populations and low socioeconomic areas in developed countries. Childrens of, the immunocompromised and elders are at risk of S. pyogenes and the associated sequelae, with transmission rates being higher in schools, kindergartens, hospitals and residential homes. This was attributed to overcrowding and the higher level of social contact in these settings. So that, the prevention and control measures should be, the improvement of living conditions, as well as personal hygiene, and control practices should be emphasized in high-risk settings.
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1. INTRODUCTION

Members of the genus Streptococcus cause mild to severe bacterial illnesses in humans and animals. These organisms typically colonize one or more species as commensals, and can cause opportunistic infections in those hosts. However, they are not completely host-specific, and some animal-associated streptococci can be found occasionally in humans (PHAC, 2011). Many zoonotic cases are sporadic, but organisms such as S. equi subsp. zooepidemicus or a fish-associated strain of S. agalactiae have caused outbreaks, and S. suis, which is normally carried in pigs, has emerged as a significant agent of streptoccoccal meningitis, septicemia, toxic shock-like syndrome and other human illnesses, especially in parts of Asia(Altonen et al.,2020). Streptococci with human reservoirs, such as S. pyogenes or S. pneumoniae, can likewise be transmitted occasionally to animals (Abbott et al., 2010). These reverse zoonoses may cause human illness if an infected animal, such as a cow with an udder colonized by S. pyogenes, transmits the organism back to people. Occasionally, their presence in an animal may interfere with control efforts directed at humans. For instance, recurrent streptococcal pharyngitis in one family was cured only when the family dog, which was also colonized asymptomatically with S. pyogenes, was treated concurrently with all family members (Abbott et al., 2010).

2. Etiology

There are several dozen recognized species in the genus Streptococcus, Gram positive cocci in the family Streptococcaceae (Barkham., 2019). Almost all species of mammals and birds, as well as many poikilotherms, carry one or more species as commensals on skin or mucosa. These organisms can act as facultative pathogens, often in the carrier (Acha, 2003).

3. Nomenclature and identification of streptococci

Hemolytic reactions on blood agar and Lancefield groups are useful in distinguishing members of the genus Streptococcus(Carter, 2005). In clinical laboratories, an isolate may be reported only to this level (e.g., group C streptococcus), without identifying its species. Many acute streptococcal diseases are caused by beta-hemolytic

streptococci, which completely lyse the red blood cells surrounding the colony (Agnew and Bernes, 2007). Alpha-hemolytic organisms cause a partial or greening hemolysis, associated with the reduction of red cell hemoglobin. A third group is not hemolytic, a characteristic sometimes termed gamma-hemolysis. Because it is often of little value to distinguish alpha-hemolysis from gamma- hemolysis, the latter two groups may simply be called non-beta-hemolytic. Lancefield grouping is based on the serological identification of cell wall antigens and, in group B streptococci, capsular antigens (Aiello and Moses, 2016). The 20 Lancefield serogroups are identified with the letters A to H and K to V. Some species of Streptococcus have no traditional Lancefield group antigens. Each Lancefield group can contain more than one streptococcal species, and the members of some species can belong to more than one Lancefield group. However, sometimes a single pathogenic species predominates in a Lancefield group, which has become nearly synonymous with that organism. For instance, S. pyogenes is, by far, the most common beta-hemolytic group A streptococcus in humans, and group A streptococcus generally indicates this organism (Chanter, 2002). Likewise, group B streptococcus is often used as a synonym for S. agalactiae in people or animals, though there are minor beta-hemolytic group B streptococci, such as S. troglodytidis(Ariznababarreta et al., 2002).

4. Zoonotic species of Streptococcus

Most streptococcal illnesses in people are caused by species normally maintained in humans, such as S. pneumoniae, S. pyogenes or human-adapted strains of S. agalactiae (Balters, 2000). As of 2020, zoonotic streptococci documented in people include S. canis (Lancefield group G; beta-hemolytic), S. dysgalactiae subsp. dysgalactiae (Lancefield groups C and L; alpha-hemolytic, beta-hemolytic or nonhemolytic), S. equi subsp. zooepidemicus (Lancefield group C; beta-hemolytic), S. halichoeri (Lancefield group B; non-hemolytic), S. iniae (no Lancefield group antigens; beta-hemolytic), S. suis (Lancefield group D-related; non-beta-hemolytic) and some animal-associated genotypes of S. agalactiae (Lancefield group B; mostly beta-hemolytic)(Barkham, 2019). Other organisms have also been proposed as zoonotic (e.g., S. porcinus, animal-adapted.

S. gallolyticus subsp. gallolyticus), and it is possible that many animal streptococci might be able to infect humans under some circumstances (Barkha , 2019). S. suis has at least 35 serotypes. A limited number of serotypes, such as 2, 3, 7 and 9, seem to cause most illnesses in pigs. Serotype 2 is found most often in human cases, but other organisms, including serotypes 5 and 14, have also been isolated. Certain genetically divergent S. suis isolates are referred to as S. suis-like, and new names (S. orisratti, S. parasuis, S. ruminantium) have been proposed for some of them (Biornsdottir et al., 2017).

Reverse Zoonoses Organisms maintained in people, including S. pyogenes, S. pneumoniae and human-adapted genotypes of S. agalactiae, are isolated occasionally from asymptomatic or sick animals (reverse zoonoses). They can be transmitted back to people from this source, and can sometimes spread between animals (Biornsdottirs, et al.,2017).

6. Species Affected

6.1 Streptococcus agalactiae

Cattle are important reservoir hosts for S. agalactiae. This organism is also common in dromedary camels. There are reports of S. agalactiae or group B streptococcus in many other species such as small ruminants, llamas, horses, pigs, dogs, cats, rabbits, rodents (including guinea pigs), marine mammals (dolphins, seals), fish, reptiles (crocodiles, snakes, emerald monitors) and frogs(Blunden et al.,1994; Fuller et al., 2001). Some organisms, including those in sick crocodiles and farmed frogs, were thought to have come from humans. Fish-associated S. agalactiae are most often reported in farmed freshwater and marine fish, but they have been found in free-living fish. Some of these organisms might come from people (Carter, 2005; Guerreiro et al.,2013). The ST283 genotype of S. agalactiae, which has repeatedly caused human illnesses, seems to be maintained in fish. However, its reservoir has not yet been definitely identified, and it is possible that this organism is transferred from humans to fish (e.g., in sewage), or that another source is the actual reservoir (Chanter, 2002).

6.2 Streptococcus canis

S. canis is usually found in dogs and cats, but it has been detected occasionally in other animals including cattle, horses, mink, foxes, rodents and rabbits(Chennapragadass et al.,.,2018).

6.3 Streptococcus dysgalactiae subsp. dysgalactiae

S. dysgalactiae subsp. dysgalactiae is most common in cattle, but it can also infect small ruminants, pigs, dogs, horses, vampire bats (Desmodus rotundus) and other hosts(CiszewskiM et al.,2016).

6.4 Streptococcus equi subsp. zooepidemicus

S. equi subsp. zooepidemicus is a common commensal and opportunistic pathogen in horses. Guinea pigs, pigs and monkeys also seem to be carriers, and it has been isolated from many other species including horses, cattle, sheep goats, pigs, South American camelids, dogs and other canids, cats and other felids, ferrets, guinea pigs, nonhuman primates, seals and birds(Cobo- Angel et al.,2018; Hlebowicz et al., 2019).

6.5 Streptococcus halichoeri

S. halichoeri seems to mostly occur in marine environments. It was originally found in grey seals (Halichoerus grypus) but it has been isolated from other marine mammals (e.g., a Steller sea lion, Eumetopias jubatus) and fish (herring). Reports from terrestrial species include cases in a European badger (Meles meles) and dogs. This organism infected captive mink (Neovison vison), blue foxes (Vulpes lagopus) and raccoon dogs (Nyctereutes procyonoides) during an outbreak that might have originated from fish in their diet. The source of the organism for other terrestrial hosts is uncertain (Danmallam and pimenov etal., 2019; Jordal et al.,2015).

6.6 Streptococcus iniae

S. iniae mainly seems to be a fish pathogen. Infections have been reported in more than 20 species of wild and farmed fish including rainbow trout (Oncorhynchus mykiss), coho salmon (O. kisutch), tilapia (Oreochromis spp.), yellowtail (Seriola quinqueradiata), red drum (Sciaenops occellatus), bass and European seabream; however, some species including common carp (Cyprinus carpus), Channel catfish (Ictalurus punctatus) and goldfish (Carassius auratus) seem to be resistant (Delannoy et al., 2013;Kittang et al.,2017).

S. iniae has also caused clinical cases in captive Amazon freshwater dolphins (Inia geoffrensis) and a captive bottlenose dolphin (Tursiops truncatus). It was found in a group of sick bullfrogs (Rana castesbeiana) that suffered from recurrent bacterial infections, as well as in fruit bats (Pteropus alecto). Experimental infections were established in laboratory mice (De Giudice et al., 2018).

6.7 Streptococcus suis

S. suis is mainly a pathogen of suids, and is maintained in both domestic pigs and wild boar. It has been isolated occasionally from other species such as cattle, sheep, goats, bison, cats, dogs and horses, and appears to be common in some groups of wild rabbits (Oryctolagus cuniculus) in Europe and chickens in Vietnam. Rabbits and chickens seem to carry different S. suis genotypes than pigs(Downar ,2001; Koh etal.,2020).

7. Geographic Distribution

The organisms maintained in domestic animals - S. canis, S. dysgalactiae subsp. dysgalactiae, S. equi subsp. zooepidemicus, S. suis and mammalian S. agalactiae - are widespread and probably exist wherever their usual hosts can be found. The predominant serotypes of S. suis differ between regions, which may influence the incidence of disease in pigs and humans. S. iniae has, to date, mainly been reported in North America, the Caribbean, parts of Asia (e.g., Japan, China, Singapore, Taiwan), Australia and the Middle East (Downar , 2001;Koh et al., 2009). S. halichoeri has been documented in parts of Europe and South Korea, and might also be widespread. S. agalactiae ST283 seems to occur mainly in Asia but was recently identified in farmed fish in South America (Dumk et al., 2017).

8. Transmission

Members of the genus Streptococcus occasionally act as primary pathogens, but more often they are part of the normal flora of animals and humans, typically on the upper respiratory tract, urogenital tract or other mucous membranes, mammary gland or skin (Dutkiewicz et al.,2017). These organisms sometimes cause opportunistic infections, often in the carrier, but their transmission between hosts does not necessarily result in disease. Streptococci are often transmitted during close contact, but aerosols may occasionally play a role, and some organisms have been acquired in undercooked pork products (e.g., S. suis, S. equi subsp. zooepidemicus), horsemeat (S. equi subsp. zooepidemicus) or fish (S. agalactiae ST283 and probably S. halichoeri) or unpasteurized dairy products (S. equi subsp. zooepidemicus and other organisms)(Eklund et al., 2020)..

S. iniae often seems to infect humans through skin abrasions and punctures while they are cleaning fish. How it spreads between fish is incompletely understood; however, they can be infected either orally or via exposure to contaminated water baths, with or without abrasions, in the laboratory. Organisms that become established in

wounds can disseminate to internal organs. Streptococci can be transmitted on fomites, and they may persist for a few days to months in the environment, especially in organic material under moist, cool conditions. At 25°C (77°F), S. suis remained viable for about a week in pig feces and for almost 2 weeks in decomposing carcasses, but for less than a day in dust. At 4°C (39°F), it persisted in carcasses for 6 weeks and in dust or feces for a few months (Facklam, 2002).

10. Infections in Animals

10.1 Incubation Period

The incubation period varies with the condition. Some streptococcal infections become apparent within a few days to a week or more, while toxic shock-like syndrome can develop into a serious illness within hours(Fukushimay et al., 2017).

10.2. Clinical Signs

10.2.1 Streptococcus agalactiae

S. agalactiae is a common cause of subclinical mastitis in cattle. In some regions, it also seems to be fairly common in clinical or subclinical mastitis in sheep and goats, and ithas been found in numerous diseases in camels ranging from skin and soft tissue infections to mastitis and caseous lymphadenitis (pelkonens et al.,2013). In China, this organism was responsible for a severe, life-threatening illness in rabbits characterized by fever, acute respiratory distress, paddling and convulsions. S. agalactiae has also been detected in mastitis in horses, an abscess in a llama, endocarditis in a dog, neonatal septicemia and other illnesses in dogs and cats, necrotizing fasciitis in crocodiles, and other conditions(Fuldem et al., 2013; Pinho et al 2013).

10.2.2 Streptococcus canis

S. canis is an opportunistic pathogen that mainly affects dogs and cats. It can cause a variety of diseases including skin and soft tissue infections, arthritis, reproductive disease, mastitis, pneumonia, septicemia and streptococcal toxic shock-like syndrome, as well as cervical lymphadenitis in 3-6 month old kittens and otitis externa in dogs(Okwumabae et al.,2017). In cats, this organism sometimes causes neonatal septicemia. Affected kittens appear normal at birth but gain weight slowly and usually die when they are around 7-11 days of age. Death is often preceded by a transient fever, and some animals may have a swollen, infected umbilicus. More than one kitten in a litter can be affected but the whole litter does not usually become sick. Streptococcal toxic shock-like syndrome, which can affect both dogs and cats, is a severe, febrile illness characterized by an acute onset, rapid progression and high mortality rate . Its clinical signs in dogs may include extreme weakness, vomiting, a non-productive cough, stiffness, rigidity, rapid uncontrolled muscle fasciculations, intense pain, and hemorrhagic

signs such as bloody sputum, epistaxis and bloody diarrhea. The time from the onset of clinical signs to death can be as short as 7 hours. S. canis can cause illnesses in other species (e.g., cattle with mastitis), but this seems to be infrequent (Fuller et al.,2001).

10.2.3. Streptococcus dysgalactiae subsp. Dysgalactiae

S. dysgalactiae subsp. dysgalactiae is usually associated with clinical or subclinical mastitis in cattle, but it has been detected in other conditions in this species, including severe cellulitis and toxic shock-like syndrome. Some reports of S. dysgalactiae subsp. dysgalactiae in other hosts described mastitis in sheep and goats, suppurative polyarthritis in lambs, septicemia in fish and dogs, and septicemia and encephalitis in vampire bats (Gottaschalk et al., 2010).

10.2.4 Streptococcus equi subsp. Zooepidemicus

S. equi subsp. zooepidemicus can affect many species, often as an opportunistic pathogen. In horses, this organism sometimes invades the upper respiratory mucosa and lymph nodes after a viral infection, and may mimic strangles. It can also cause lower respiratory disease including pleuropneumonia, especially in young horses(Goyette-Desjardines et al., 2014). These respiratory infections are opportunistic; however, the ST209 genotype caused an epidemic of respiratory illness in Iceland, apparently as theprimary pathogen. Affected horses developed a mucopurulent nasal discharge and dry cough, which sometimes persisted for weeks. Although mortality was overall low, a few animals died of pneumonia or sepsis. Some other conditions that can be caused by S. equi subsp. zooepidemicus in horses are skin and soft tissue infections (e.g., abscesses), mastitis, cervicitis, metritis, placentitis with abortions, and foal septicemia. S. equi subsp. zooepidemicus is also an important pathogen in guinea pigs.

Opportunistic infections can result in cervical lymphadenitis, which is characterized by draining abscesses in the cervical lymph nodes and occasionally other organs, and may progress to torticollis, pneumonia or septicemia in some animals(Nhung et al., 2020). It can also cause small uterine abscesses, which may affect fertility, or epidemics of septicemia and acute pneumonia with high mortality rates. This organism can cause various illnesses in dogs (e.g., septicemia, pneumonia, wound infections, streptococcal toxic shock-like syndrome), but it is particularly important as an agent of hemorrhagic pneumonia, either alone or with other respiratory pathogens. Hemorrhagic pneumonia may begin with nasal discharge, moist cough and fever, and can progress to depression, anorexia, tachypnea, and in many cases, hemorrhagic nasal discharge or hematemesis. Affected dogs often develop severe respiratory distress and deteriorate rapidly, commonly dying within 24-48 hours, though milder cases limited to nasal discharge and pharyngitis are possible. Some cases were identified after sudden death(Guerreiro et al.,2013). There are occasional reports of S. equi subsp. zooepidemicus in other animals. In 1994, this organism caused a serious epidemic among pigs in Indonesia and also spread to monkeys. Syndromes reported in affected animals included polyarthritis, bronchopneumonia, pleuritis, diarrhea, epicarditis, endocarditis and meningitis. Most sick animals died within a few days(Netto et al., 2011). Although the outbreak subsided, the organism continued to circulate in this area, including in healthy carriers. A similar outbreak occurred in pigs in China in 1975, and unrecognized cases might occur elsewhere. Other examples of illnesses caused by S. equi subsp. zooepidemicus are an outbreak of mastitis in sheep; abscesses, pneumonia, metritis and endocarditis in ferrets; septicemia in poultry and small mammals; and fatal meningoventriculitis in a captive snow leopard, possibly linked to feeding horsemeat(Hashikawas etal., 2004).

10.2.5 Streptococcus halichoeri

S. halichoeri has caused wound infections and systemic illnesses in gray seals. This organism was detected in a postmortem sample from a decomposed Steller sea lion, but whether it had any role in the animals death was uncertain. It was found concurrently with Arcanobacterium phocae, another marine organism, during a novel disease outbreak termed fur animal epidemic necrotic pyoderma (FENP) affecting farmedmink, blue foxes and raccoon dogs in Finland(Hoyer-Nielsen et al., 2018). The contribution of S. halichoeri to this disease was uncertain, as the primary pathogen appeared to be A. phocae; however, S. halichoeri was found in other bacterial infections in these animals, including pneumonia, metritis, conjunctivitis and dermatitis, either alone or with other pathogens. Additional reports of S. halichoeri in terrestrial mammals include a case of fatal pyogranulomatous pleuropneumonia and severe pericarditis in an injured wild European badger at a rehabilitation facility; a cerebral infection in a black bear; an outbreak of otitis media in dogs that responded poorly to standard treatment; and abscesses, postsurgical infections and other superficial infections in dogs. Mixed infections were common in the cases in dogs, but S. halichoeri was the sole agent in the badger(Jensen and Kilian ,2012).

10.2.6 Streptococcus iniae

S. iniae mainly seems to affect fish. Meningoencephalitis, panophthalmitis, skin lesions and necrotizing myositis are common syndromes in farmed fish. Wild tropical reef fish with S. iniae septicemia became moribund with only a few signs that included respiratory distress, occasional petechiae around the fins, and erratic swimming. In freshwater dolphins, this organism has been isolated from single or multiple subcutaneous abscesses, as well as a case of septicemia with encephalitis, subcutaneous abscesses and pneumonia(Jordal et al., 2015).

10.2.7 Streptococcus suis

S. suis tends to cause sporadic cases of polyarthritis or peracute meningitis and septicemia in suckling pigs, or, more often, acute meningitis and other illnesses in recently weaned and growing animals. Pigs with meningitis may have subtle signs at first (squinting, ears back), followed by ataxia, unusual posture (e.g., dog sitting), blindness, nystagmus, convulsions and other neurological signs. Labyrinthitis, otitis interna and otitis media may lead to deafness and vestibular dysfunction. It can also cause other syndromes in pigs, such as endocarditis, myocarditis, abortions and abscesses(Kalimuddins et al., 2015). S. suis can occasionally cause illnesses in other species, with reports of meningitis, arthritis, bronchopneumonia, peritonitis, abortion or septicemia in cattle; meningitis, pneumonia, guttural pouch infection or osteomyelitis in horses; pneumonia, meningoencephalitis or dermatitis in cats; endocarditis in a lamb; meningitis in bison; sudden death or urinary tract infection in dogs; and septicemia in birds. Some of these animals were coinfected with other pathogens but S. suis was the sole agent in others(Keirstead et al., 2014).

10.3. Post Mortem Lesions

The gross lesions depend on the syndrome and tissues affected, and may include abscesses, cellulitis or skin lesions; signs of arthritis, osteomyelitis, endocarditis, mastitis, lower airway inflammation, pneumonia, pleuritis, enteritis and other conditions; and/or generalized signs of septicemia. Abortions are usually associated with placentitis(Muckle etal., 2010). Hemorrhagic pneumonia and severe pleural effusion, often with blood-stained froth in the nasal cavity and airways, are the major lesions in dogs with hemorrhagic pneumonia caused by S. equi subsp. zooepidemicus. Intracranial edema and severe hemorrhagic panophthalmitis are reported to be the most consistent gross lesions in fish infected with S. iniae. Some fish may also have mild peritonitis, ascites, and scattered hemorrhages or petechiae in the body cavity and around the anal zone. Common necropsy lesions in pigs infected with S. suis are patchy erythema of the skin, lymphadenopathy, enlargement of the spleen, arthritis with excessive clear or turbid fluid, and, in some cases, fibrinous polyserositis. The brain may look grossly normal in cases of meningitis, or there may be congestion, edema, and excess clear or cloudy CSF. The lungs are sometimes consolidated and may have signs of fibrinopurulent or interstitial bronchopneumonia(kings et al., 2002).

10.4. Diagnostic Tests

A presumptive diagnosis of streptococcosis is supported by finding Gram positive cocci in pairs or chains in stained smears from affected tissues, exudates, blood or cerebrospinal fluid (CSF). Streptococcal toxic shock-like syndrome is usually identified by the clinical signs, though confirmed by bacterial isolation. The definitive diagnosis is usually made by culturing the organism. Streptococci can be identified by their colony morphology, hemolysis patterns on blood agar, biochemical reactions and serology(kittang etal., 2017;Moreno etal.,2015).

10.5 Treatment

Streptococcal illnesses are treated with antibiotics, especially beta-lactams, macrolides and quinolones. Additional measures, such as surgical debridement of necrotic tissues, may sometimes be necessary. Supportive treatment, administered quickly, is critical for streptococcal toxic shock-like syndrome(CDC, 2005;Lee etal., 2016).

10.6 Control and prevention

It can be difficult to prevent animals from becoming colonized asymptomatically with streptococci; however, stressors and other factors that predispose animals to illness (e.g., overgrown teeth in guinea pigs) should be minimized, wounds should be kept clean, and good hygiene including good milking technique should be practiced. Good water quality and decreased fish density may reduce the severity of outbreaks caused by S. iniae on fish farms(Las Heras et al., 2002). S. equi subsp. zooepidemicus outbreaks in guinea pigs usually occur when sick animals are added to a healthy colony or naïve animals are mixed with asymptomatic carriers. Guinea pigs with enlarged cervical lymph nodes should be removed from the colony or treated until the abscesses have healed(Koh et al., 2009;Leal et al., 2019). Depopulation may be necessary in some colonies with widespread clinical signs. All-in/all-out management of pigs, with cleaning and disinfection of the premises between groups, can be helpful against S. suis. In herds where this organism is an issue, pigs should be observed closely for signs of illness and treated promptly with antibiotics. Prophylactic antibiotics have also been employed, but there is a risk of generating antibiotic-resistant strains. Vaccines are available for a few organisms. Killed autogenous or commercial S. suis vaccines for pigs may decrease the incidence of disease, but do not eliminate the infection from the herd. These vaccines are serotypespecific; universal vaccines against all variants of this organism are not currently available. Commercial vaccines are used for S. iniae in some regions, and autogenous vaccines for S. equi subsp. zooepidemicus were made at one time for guinea pigs (the availability of the latter vaccines is currently unclear) (Kormam and Boers , 2004).

10.7 Morbidity and Mortality

Streptococci are carried asymptomatically by a significant number of healthy animals, and typically cause opportunistic infections. However, some organisms can act as primary pathogens. They include the S. equi subsp. zooepidemicus strain associated with hemorrhagic pneumonia in dogs; the ST209 genotype of this organism that caused an epidemic of equine respiratory disease in Iceland in 2010; and probably the organisms that caused outbreaks among pigs in China and Indonesia in 1975 and 1994, respectively. Most outbreaks of hemorrhagic pneumonia in dogs occur in kennels, though sporadic cases are also seen. Morbidity and mortality rates vary with the syndrome. S. canis can cause high mortality in newborn kittens when it first enters a cattery but this usually drops to less than 5% within a year unless the cats are immunosuppressed. Litters from young queens are affected most often. Mortality of 30- 50% has been reported in outbreaks of S. iniae meningoencephalitis among farmed fish,

and S. agalactiae caused 42% mortality in rabbits during an outbreak in China. Hemorrhagic pneumonia in dogs is frequently fatal(Kuusi et al., 2006; Lacave et al.,2016). Deaths were uncommon during the equine respiratory disease epidemic caused by S. equi subsp. zooepidemicus ST209 in Iceland; however, morbidity was high, with this organism spreading to almost the entire population of 77,000 animals. S. suis causes sporadic clinical cases in some herds of pigs, and outbreaks in others. Outbreaks seem to mainly occur in large, intensively managed herds. Newborn piglets may become infected with this organism during delivery or from the dam soon after birth, but most infections are spread between weaned pigs by asymptomatic carriers, resulting in the colonization of up to 60-100% of this age group. Whether pigs develop clinical signs is influenced by the serotype of S. suis, stressors such as poor ventilation and overcrowding, and the age of the pigs. About 2-15% of the herd is affected in most cases, but concurrent diseases or poor management can result in higher morbidity, occasionally > 50%. Mortality is usually around 5% but it may reach 20% in untreated animals(Lacasta et al., 2008;Kuusi etal.,2006).

11.Conclusion

Streptococcus causes different spectrum of human and animal infections, ranging from pharyngitis and pyoderma, to life threatening immunological complications such as acute rheumatic fever, rheumatic heart disease, post streptococcal glomerulonephritis, toxic shock syndrome and necrotizing fasciitis. The burden of group A streptococcus disease is due to Rheumatoid Heart Disease which follows group A streptococcus pharyngitis. Streptococcus pyogenes, (colloquially named group A streptococcus (GAS)), infections and their sequalae represent a significant public health issue. This primarily occurs through respiratory droplets, and contact with skin sores or contaminated material or equipment. The incidence of GAS diseases is particularly high in school-aged children, and this should be the focus of intervention strategies So, community-based preventive measures need to be strengthened. Making GAS diseases notifiable at the national level would help to inform public health and research initiatives to reduce the impact of these diseases. Moreover, action should be taken to ensure everyone has access to quality healthcare, as early diagnosis and treatment can reduce the transmission window for GAS and prevent disease complications

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