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Infectious Diseases

TICK-BORNE DISEASES: AN EUROPEN PERSPECTIVE
Enfermedades transmitidas por garrapatas en Europa

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Abstract:
Main tick-borne diseases in Europe are reviewed with particular emphasis to emerging, zoonotic rickettsial, ehrlichial and spirochetal infections. “New” species of bacteria have been isolated from animals and ticks and are now considered emergent as a consequence of the global changing of climate, of land exploitation for human activities and ecology of ticks and infection reservoirs.

Resumen:
Se revisan las principales enfermedades transmitidas por garrapatas en Europa, haciendo especial énfasis en las infecciones zoonósicas emergentes causadas por rickettsias, ehrliquias y espiroquetas. “Nuevas” especies de bacterias aisladas de animales y garrapatas, son consideradas emergentes en la actualidad, como consecuencia del calentamiento global del clima, de la explotación del suelo debido a la actividad humana y la ecología de las garrapatas y de los reservorios de las infecciones.

Since the beginning of this century, ticks have been described as vectors of human and animal diseases, including, bacterial (spotted fever rickettsioses, recurrent fever borrelioses, tularemia, Q fever), viral and protozoan zoonoses (Parola and Raoult, 2001). Ticks are considered to be second only to mosquitoes as vectors of such diseases in the world (Sonenshine, 1991). The first demonstration that ticks were able to transmit infectious diseases was made when *Boophilus annulatus* was considered as the vector of the protozoan *Babesia bigemina*, the agent of Texas cattle fever (Smith and Kilbourne 1893).

Canine babesiosis is widely spread in Europe, and the Mediterranean is most affected (Spain, South of France, Italy, Greece, Turkey) including several continental areas in eastern Europe such as Hungary are at high risk of infection (Horvath and Papp, 1996). The protozoa is transmitted mainly by ticks *Rhipicephalus sanguineus* and *Dermacentor reticulatus*, which also act as reservoir. The prevalence of infection in canine populations is strongly affected by the relative humidity which influence the abundance of ticks in the environment. Furthermore, the yearly prevalence may range from less than 5% to ≥15% in the same endemic area as a consequence of climatic conditions (Traldi et al., 1988; Pucóni et al., 1998). Most clinical cases are diagnosed between April and May. *Babesia canis canis* and *B. canis vogeli* are the species usually found in the European dogs (Cacciò et al., 2002; Criado-Fornelio et al., 2002). *B. gibsoni* has till now only been found in imported animals.

Bacterial diseases

Since Smith and Kilbourne’s findings (1893), ticks have been identified as vectors of numerous human bacterial diseases such as *Borrelia duttonii*, the agent of Tick relapsing fever (Dutton and...
Ehrlichia. canis ehrlichioses (Parola and Raoult, 2001). Other ehrlichiae of veterinary importance, including reported in Slovenia in 1997 (Petrovec et al. Clethrionomys Europe antibodies against seroprevalences of due to the high levels of exposure to organism encountered in dogs (Segura-Porta et al., 1997). Human Granulocytic Ehrlichiosis (HGE), first described in USA (Dumler and Bakken 1998), has recognized as emerging tick-borne pathogens also in humans (Nuti et al.). Some endosymbiotic bacteria, such as a member of the Francisella genus found in Dermacentor andersoni by Niebylski et al. (1997), are transmitted transovarially but since they do not infect the tick salivary glands, they cannot then be transmitted to vertebrate hosts during blood feeding. Furthermore, some bacteria apparently can damage the tick host itself, as it has been demonstrated for R. rickettsii (Niebylski et al., 1999).

Among the numerous bacterial agents transmitted by ticks in Europe, some of them are considered as emerging in the last decades (Parola and Raoult 2001): Rickettsioses are caused by obligate intracellular bacteria belonging to the genus Rickettsia (Raout and Roux, 1997). Before 1974, only four tick-borne rickettsioses were known (R. rickettsii in the Americas, R. conorii in Europe, southwest Asia, and Africa, R. sibirica in Siberia and western Russia and R. australis in Australia) (Raout and Roux, 1997). More recently, the increased use of molecular-based identification methods has resulted in new pathogenic tick-borne rickettsiae being described (Raout and Roux, 1997; Raout et al. 1997; Nilsson et al., 1999). Examples are R. helvetica (Nilsson et al., 1999; Fournier et al., 2000), R. slovaca (Raout et al., 2002), R. mongolotimonae (Fournier et al., 2000), or the Israeli spotted fever Rickettsia (R. conorii complex) (Giammanco et al., 2003). R. Helveticia, R. slovaca, R. africae, R. aeschlimannii and the Israeli spotted fever Rickettsia have been detected in ticks from Italy (Beninati et al., 2002; Beninati et al., 2004; Giammanco et al., 2003).

The detection of antibodies against R. conorii in dogs has been used in epidemiological studies due to the high levels of exposure to R. sanguineus and to the intense antibody response to the organism encountered in dogs (Segura-Porta et al., 1998; Mannelli et al., 2003). In Italy, high seroprevalences of R. conorii has been found in several survey in healthy dogs throughout the country (30-80%), with the highest values in dogs aged more than 2 years (Melgrati et al., 1998; Mannelli et al., 2003). Though the clinical signs of infection are practically absent in dogs and dogs cannot act as a reservoir (as do ticks), seroprevalence data can useful as a sensitive indicator for the risk of infection for humans. To note that R. rickettsii, the agent of Rocky Mountain spotted fever, has never been isolated from humans, dogs or ticks in Europe, but diagnosed in patients after returning from USA (Reinauer et al., 1990).

Although ehrlichiae were known for long time as veterinary pathogens, they have recently been recognized as emerging tick-borne pathogens also in humans (Nulti et al. 1998). In particular, Human Granulocytic Ehrlichiosis (HGE), first described in USA (Dumler and Bakken 1998), has emerged in Europe. The causative agent is Anaplasma (formerly Ehrlichia) phagocytophila. In Europe the tick vector is Ixodes ricinus and the reservoirs are small rodents such as Apodemus spp. (Liz et al. 2000). The first documented human case of HGE in Europe was reported in Slovenia in 1997 (Petrovec et al. 1997), and later the A. phagocytophila agent was detected in different European countries (Parola and Raoult 2001). To date, there are no reports on the presence of E. chaffeensis or E. ewingsi in Europe, described in USA as an agent of human ehrlichiosis (Parola and Raoult, 2001). Other ehrlichiae of veterinary importance, including Ehrlichia. canis and Ehrlichia ruminantium, are widely distributed on the continent, and these organisms are known to cross-react with E. chaffeensis in serological tests. The presence of antibodies against E. canis in dogs from Italy has been reported (Buonavoglia et al. 1995).

Lyme borreliosis is caused by Borrelia burgdorferi sensu stricto, B. garinii and B. afzelii, all species within the B. burgdorferi sensu lato complex. Recently, a pathogenic role for B. valaisiana in humans has also been considered (Ryffel et al. 1999). In Europe, Apodemus spp. are considered the most important reservoirs of the bacteria. Much less is known about Lyme Borreliosis in animals than is known about the disease in humans. The most common symptom of the disease in dogs is migratory arthritis (Magnarelli et al. 1987). Other but less common symptoms reported in dogs are carditis, glomerulonephritis and neuritis (Goossens et al. 2001). B. burgdorferi infections or serologic evidence of B. burgdorferi infections have been reported in dogs in the United States (Magnarelli et al. 1987). In Europe, relatively few reports exist on Lyme borreliosis in animals. A recent study by Goossens et al. (2001) carried out in The Netherlands found no positive correlation between the seropositivity of hunters and the seropositivity of their...
huntering dogs. For this reason, direct transfer of ticks between dog and humans does not seem important and owning a dog should not be considered a risk factor for Lyme Borreliosis.

In Europe and Africa, **tick-borne relapsing fever** is caused by *Borrelia crocidurae*, *B. hispanica*, and *B. duttoni* and is transmitted by Argasid ticks of the genus *Ornithodoros* (Parola and Raoult 2001). Recently, a “Spain strain” of this spirochete was implicated in human disease (Anda et al. 1996). Moreover, the discovery of a *Borrelia* species associated with relapsing fever in hard ticks has challenged the assumption that these organisms are associated only with soft ticks (Anda et al. 1996).

**Conclusion**

Since the beginning of the 1980s, more than 15 new tick-borne bacterial diseases have been described in the world. The increasing number of pathogens recently discovered may be as a consequence of the use of new molecular biological tools, which have facilitated studies of the epidemiology of emerging tick-borne diseases all over the world. Moreover, a number of *Rickettsia*, *Borrelia*, and *Ehrlichia* have been found in ticks only, and their pathogenicity in humans or animals is yet to be determined. However, the new trend in human activity leading to increased frequentation of wilderness has increased the risk of tick infestations and infection transmission. Furthermore, the increased abundance of wild animal reservoir such as deer and rodents and the global changing of climate have resulted in a tremendous increase of tick populations, accelerating the ecological cycle of pathogenic microorganisms and in a dramatic surge in disease incidence.

**References**


