Socio-demographic Characteristics of Tick Bite and Erythema migrans not associated with the Diagnosis of Neuroboreliosis

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Original Article

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Abstract:

Introduction: Lyme neuroborreliosis (LNB) is a tick-borne infection caused by bacteria Borrelia burgdorferi sensu lato that accounts for 10-15% of all Lyme borreliosis cases in Europe. LNB can present with a variety of neurological manifestations. We aimed to describe the typical anamnestic, clinical and laboratory features of patients diagnosed with LNB and to describe the differences between paediatric and adult cases. Additionally, we assessed the factors associated with definite LNB.
Methods: We retrospectively evaluated data of patients with suspected LNB had undergone lumbar puncture and were admitted to the Infectious diseases department of University hospital Bratislava, Slovakia, between September 2019 and May

2022. Patients were divided into three categories according to the diagnostic criteria of European Federation of Neurological Societies: A) cases with definite LNB, B) cases with possible LNB, C) non-LNB controls.

Results: In total, 139 patients were included in the analysis. 32 individuals were classified as definite LNB, 23 as possible LNB and 84 as non-LNB controls. 55.5% were females and 35.3% were children aged<18 years. 56.3% of patients with definite LNB reported a history of tick bite, and 21.9% a history of erythema migrans (EM). Peripheral facial nerve palsy (PFNP) was the most common clinical symptom in patients with definite LNB (65.6%), followed by headache (50.0%), fever (21.9%) and radicular pain (18.8%). In a univariate and multivariable analyses neither history of tick bite nor history of EM were significantly associated with definite LNB. Factors independently associated with definite LNB in multivariable analyses were (i) age < 18 years (aOR 7.89, 95% CI 2.00-31.03, p < 0,003), (ii) female gender (OR 6.34; 95% CI 1.66-24.17, p < 0.007), and (iii) facial nerve palsy (OR 10.54; 95% CI 2.41-55.19, p < 0.002).

Conclusion: We found that peripheral facial nerve palsy is the strongest predictor of definite LNB, and that the children<18 years and females in our study were more likely to be diagnosed with LNB. Our study also suggests that anamnestic data on history of tick bite and EM contribute little to the diagnosis of LNB and that the examination of CSF is essential for the diagnosis of LNB.

Introduction

Lyme neuroborreliosis (LNB) is a tick-borne infection caused by bacteria Borrelia burgdorferi sensu lato that accounts for 10-15% of all Lyme borreliosis cases in Europe [1, 2]. In more than 90% of cases LNB presents as an acute disease with symptoms developing 2 to 10 weeks after a tick bite. As less than 40% of patients with LNB report a history of erythema migrans (EM), the primoinfection is often unnoticed [3].

LNB can present with a variety of neurological manifestations. In adults, early LNB most often manifests as a painful meningo-radiculitis, often accompanied by unilateral or bilateral paresis of the facial nerve (so-called Banwarth syndrome), [4]. In children, early LNB mostly presents as aseptic meningitis that is commonly associated with facial nerve palsy.

Aseptic meningitis occurs in most cases of early LNB. Symptoms are often milder than in meningitis caused by other pathogens [5]. The most common initial clinical symptom is headache (30-90%). Neck stiffness and meningism are observed in less than 20% of cases [6].

Cranial neuritis is common in early LNB. All cranial nerves can be affected, except of olfactory nerve. Facial nerve involvement accounts for 80% of cranial neuritis and is bilateral in about a third of cases [7-10].

Symptoms of radiculitis most often appear 4 to 6 weeks after the tick bite or appearance of EM [11]. Patients commonly describe intense, radicular pain that poorly respond to conventional analgesics and intensifies at night. Pain usually starts in the region of tick bite or EM and progress to other areas without being limited to defined dermatomes or peripheral nerves [12-14]. Three out of four patients with radicular pain develop a neurological deficit within 1 to 4 weeks, paresis is more common than sensitivity disorders [3].

Antibiotic (ATB) treatment is highly effective in early LNB. 14 to 21 days treatment regimens with penicillin, third generation cephalosporin or doxycycline is recommended [11, 15]

Symptoms of facial nerve palsy usually completely resolve within one to two months of ATB treatment [16]. Nevertheless, in 5-10% of cases a residual paresis of facial nerve is observed even several months after treatment [17, 18].

Late neuroborreliosis is a rare manifestation of LNB, accounting for approximately 5% of all LNB cases, with neurological symptoms occurring more than 6 months after the primoinfection [19]. It manifests most often as myelitis and encephalomyelitis, less often as meningoencephalitis or radiculomyelitis. The development of symptoms is progressive, and the problems are chronic in nature [3]. Late LNB does not have a typical clinical picture, so a thorough history, laboratory and imaging exams are essential to distinguish it from other diseases. In patients with late LNB, the improvement of clinical symptoms after ATB treatment is only gradual and may not be complete. However, the persistence of symptoms is not a reason for repeated ATB treatment [11].

LNB is suspected based on classic clinical symptoms and patient history. To definitively confirm the diagnosis, presence of lymphocytic pleocytosis in the cerebrospinal fluid (CSF) and the intrathecal production of Borrelia (Bb) specific antibodies is required [15]. Direct diagnostic methods such as cultivation and detection of deoxyribonucleic acid (DNA) by polymerase chain reaction (PCR) in the CSF are of negligible importance due to their low sensitivity [20].

Currently available diagnostic methods for definitive confirmation of LNB are not satisfactory. Pleocytosis may be absent in some cases and intrathecal synthesis of Bb antibodies may be negative in approximately 10-30% of patients with the disease duration of less than 6 weeks [1]. In contrast, Bb antibodies tend to persist both in the serum and in the CSF long time after ATB treatment, which complicates the distinction between active and past infection [21, 22]. Therefore, new biological markers (e.g. cytokines, proteins, peptides, metabolites, etc.) are needed, which would make the diagnosis of LNB more effective.

On the one hand, diagnosis of LNB solely based on clinical symptoms certainly leads to antibiotic over-prescription and may contribute to development of ATB resistance. On the other hand, delayed ATB treatment of LNB may contribute to prolonged persistence of symptoms and sequels.

Understanding the anamnestic, clinical and laboratory factors associated with definite LNB is essential to support clinicians in management of complex cases with suspected LNB. We aimed to describe the typical anamnestic, clinical and laboratory features of patients diagnosed with LNB, to describe the differences between paediatric and adult cases and to assess the independent factors associated with definite LNB.

Methods

This is a retrospective observational study. Patients admitted to the Infectious diseases department of University hospital Bratislava, Slovakia, between September 2019 and May 2022, with suspicion of LNB, and available CSF results, were enrolled in the study.

We divided the patients into three categories according to the diagnostic criteria for LNB recommended by the European Federation of Neurological Societies (EFNS) [15]: A) cases with definite LNB, B) cases with possible LNB, C) cases with unlikely LNB (non-LNB controls), Table 1. Patients with definite LNB met the following diagnostic criteria: had (i) typical clinical symptoms of LNB, (ii) lymphocytic or mixed pleocytosis in the CSF (total leucocytes count >5/μl), (iii) positive specific Bb antibodies in both serum and CSF, (iv) confirmed intrathecal production of Bb antibodies (AI > 1.5) or direct evidence of Borrelia DNA in the CSF detected by PCR. In addition to the clinical symptoms, patients with possible LNB met two of the three diagnostic criteria mentioned above. As a case of early possible LNB (B2), we considered patients with typical clinical symptoms, lymphocytic pleocytosis and absence of Bb antibodies in the CSF and/or in the serum, if the symptoms lasted less than six weeks. Patients who did not meet the diagnostic criteria of definite or possible LNB were classified as non-LNB controls (Table 1).

We considered one or more of the following symptoms to be relevant clinical symptoms of LNB: facial nerve or other cranial nerve palsy, radicular pain, paresis of upper or lower limbs, headache, fever, and meningism.

Demographic, anamnestic, clinical and laboratory data were obtained from the medical records. We collected data in full respect of eth-

ical principles and the Personal Data Protection Act. The study was approved by the local ethical committee. MS Excel 2013 (v15.0) for electronic data registration and analysed the data using Stata release 16.0 statistical software (Stata Corp LP, College Station, TX).

Basic descriptive statistics were used in the first step. In the second step, univariate and multivariate logistic regression were performed to evaluate the association between anamnestic, clinical and laboratory parameters and the diagnosis of definite LNB. Patients with definite LNB were compared to non-LNB controls. Patients with possible LNB were excluded from this analysis. For hypothesis testing, a p-value less than 0.05 was considered statistically significant.

Results

In total, 139 patients were included in the analysis. 32 (23%) were classified as definite LNB, 23 (17%) as possible LNB and 84 (60%) as non-LNB cases. In the group of possible LNB, 3 (13%) patients presented with typical LNB symptoms, pleocytosis, positive Bb antibodies both in CSF and serum, but with negative Bb AI. 3 (13%) patients had positive Bb antibodies and intrathecal antibody production, but pleocytosis was lacking. 17 (74%) patients fulfilled the criteria of early possible LNB (typical neurological symptoms<6 weeks, pleocytocis, absence of Bb antibodies in the CSF and/or in the serum).

Patient characteristics

Patient characteristics are summarised in Table 2. Of 139 patients, 55.5% were females and 35.3% were children aged<18 years. Median age was 33 years (range 5-87 years). 56.3% and 34.8% of patients with definite and possible LNB reported a history of tick bite, and 21.9% and 8.7% a history of EM. Interestingly, history of EM was reported by 40.0% of men, but only by 13.4% of women with definite LNB. However, the association between sex and EM in patients with definite LNB was not significant (p=0.069).

Even though children present only 35.3% of patients, they account for 65.6% of definite LNB cases. Conversely, the proportion of patients with possible LNB is significantly higher in adults (69.6%). Definite LNB was diagnosed in 30.1% of women and 15.2% of men. In the group of definite LNB, women account for 68.8% of cases.

53.1% and 56.5% of patients with definite and possible LNB were admitted to hospital within 7 days and 82.2% and 95.6% within 1 months of the apparition of the symptoms. 36.9% and 60.7% of patients from the control group were admitted within one week and one month of the start of the symptoms. 9.4%, 4.3% of patients from the definite and possible LNB group and 22.6% of controls reported the duration of the symptoms more than 6 months (Figure 1).

Clinical symptoms

Peripheral facial nerve palsy (PFNP) was the most common clinical symptom in patients with definite LNB (65.6%) and one of the most common in those with possible LNB (21.7%), followed by headache (50.0% and 26.1%), fever (21.9% and 34.8%) and radicular pain (18.8% and 8.7%). In the control group, the patients presented the most often with headache (64.3%), fever (27.4%) and meningeal signs (15.5%). PFNP accounted only for 14.3% in the control group (Table 3).

Some clinical symptoms largely differed between children and adults (Table 4). PFNP was present in 76.2% of children with definite and 57.1% with possible LNB compared to 45.1% of adults with definite and 6.3% with possible LNB. In the group of definite LNB, radicular pain was common in adults (45.5%), but rare in children (4.8%).

Laboratory parameters

As a strict case definition for definite LNB was applied, all patients in this group had CSF pleocytosis (total leucocytes count >5/μl). Pleocytosis was also registered in 87.0% of possible LNB cases, but in only 17.9% of non LNB controls (Table 5).

Raised protein levels in the CSF (>400mg/L) were registered in 71% of patients with definite, 56.5% with possible LNB and in 38.1% of controls.

Intrathecal production of specific Bb IgG antibodies was present in 95.0% of patients with definite LNB. From the three patients with Bb AI<1.5, in one there was not enough CSF for the Bb antibodies measurement, but the patient was diagnosed with positive PCR in the CSF. In two other patients, the AI was not possible to calculate due to low levels of IgG antibodies in the serum.

Borrelia PCR was only performed in 17 patients in the study and showed one positive result (5.9%).

LNB treatment and patient outcome

62 (45%) patients in the study received ATB for LNB (Figure 2). ATB were prescribed to all patients with definite LNB, 71% of children and 56% of adults with possible LNB. Surprisingly, ATB were also given to 5% of children and 24% of adults in the control group. All patients were treated with third generation cephalosporin. The mean duration of ATB treatment during hospitalisation was 13,3 days. 16 patients (25.8%) started ATB before admission to hospital and 27 (43.5%) continued with ATB after the discharge from the hospital. 85.2% continued with oral doxycycline and the mean treatment at home was 10.8 days.

19 patients (32.8%) out of 58 with known treatment outcome reported complete relief of symptoms before the hospital discharge, 35 (60.3%) reported at least partial improvement. Four patients (6.9%) – all from the non-LNB control group reported no clinical improvement. We noted significant differences of perceived relief of symptoms between children and adults (Figure 4 and 5). 40% of children and only 27.3% of adults reported complete recovery of symptoms. Children reported complete recovery only in the definite and possible LNB group (Figure 5). On the contrary, adult patients reported the complete disappearance of the symptoms mainly in the control group and none of the definite LNB patients fully recovered. However, all adults with definite LNB reported at least partial clinical improvement at the hospital discharge (Figure 4).

Factors associated with definite LNB

Univariate and multivariate logistic regression analyses were performed to identify independent factors associated with definite LNB (Table 6).

Factors significantly associated with definite LNB in univariate analyses were (i) age < 18 years (OR 5.39, 95% CI 2.17-13.34, p < 0,0001), (ii) female gender (OR 6.34; 95% CI 1.04-5.59, p < 0.039) and (iii) facial nerve palsy (OR 10.11; 95% CI 3.65-27.95, p < 0.0001).

Factors independently associated with definite LNB in multivariable analyses were also (i) age < 18 years (aOR 7.89, 95% CI 2.00-31.03, p < 0,003), (ii) female gender (OR 6.34; 95% CI 1.66-24.17, p < 0.007), and (iii) facial nerve palsy (OR 10.54; 95% CI 2.41-55.19, p < 0.002).

Discussion

Peripheral facial nerve palsy was the most common clinical symptom in patients with definite LNB and the strongest predictor of LNB in our study. Three out of four children and almost half of adults with definite LNB presented with PFNP and patients with definite LNB were 20 times more likely to present with PFNP than controls (p = 0.0001). PFNP is well known predictor of LNB, and published data suggest that LNB is responsible for 2-16% of PFNP in Europe [23-25]. In the pediatric population, the proportion of LNB among cases of PFNP is even higher [26-29]. Several authors recommend in the differential diagnosis of PFNP routine realization of lumbar puncture and examination of intrathecal synthesis of Bb antibodies, especially if the PFNP is diagnosed at the time of increased occurrence of LNB from May to October [30-32]. One of the reasons is the different management of idiopathic PFNP and LNB and the concern that corticoid treatment recommended for idiopathic PFNP may in some cases worsen the course of LNB [33, 34].

Patients with radicular pain and with limb paresis had a higher chance of being diagnosed with LNB in our study compared to controls, but this association was not statistically significant (p = 0.081 and p = 0.075). Radicular pain is a frequent symptom of LNB and affects mainly adults within the so-called Banwarth syndrome [35]. High proportion of children with definite LNB in our study underweighted the presence of this symptom typically present in adults. Also, patients with Banwarth syndrome are often treated as outpatients and those might be underrepresented in our study population composed exclusively from hospitalized patients. It is reported in the literature that hemiparesis of upper or lower in LNB occurs mainly in the context of encephalitis [36]. This form of LNB was rare in our patients and may have been underdiagnosed.

The presence of meningeal signs was not positively associated with the diagnosis of LNB (p

= 0.187). This finding is consistent with published data [37, 38] and is important for the management of LNB, as this clinical symptom is often the most important decision factor for performing the lumbar puncture.

In our study, women were overrepresented in the group of definite LNB (69%) and in the multivariable analyses female gender was significantly associated with definite LNB (OR 6.32, p=0.007). Our results are in contradiction with previously published studies documenting a higher incidence of LNB among men [6, 39].

Children< 18 years were more likely to be diagnosed with definite LNB compared to adults (OR 7.9; p = 0.003). Several authors describe a higher incidence of LNB in children than in adults [40, 41]. The authors explain the different incidence between adults and children by the higher chance of children getting a tick. However, the data in the adult population may be underestimated in our study, because of the focus on hospitalized patients, while adults are more likely to be managed as outpatients.

56.3% of patients with definite LNB reported a history of tick bite and 21.9% history of EM. Neither of these factors was positively associated with the definite LNB (p = 0.118 and p = 0.100). The occurrence of EM in our study is lower than in published studies reporting 23-38% occurrence of EM in LNB cases (11, 35-38). The finding of a significantly lower occurrence of EM among women (13.4%) compared to men (40%) is striking, as the literature indicates a more frequent occurrence of EM in females. One of the explanations may be the lower detection of EM in our female population and the associated higher rate of dissemination of Borrelia to the nervous system. Another explanation is that in the absence of EM, a diagnosis of LNB was underdiagnosed in men. Both hypotheses would partially explain the lower representation of men in the group of definite LNB in our study, which is also in contradiction with the published data. We cannot exclude the hypothesis that in our population EM occurs more often in men and LNB in women. A study with a larger number of participants would be necessary to verify this hypothesis.

Our findings also point to the limited contribution of anamnestic data on history of tick bite and EM in the diagnosis of LNB.

Conclusions

We found that peripheral facial nerve palsy is the strongest predictor of definite LNB, and that the children<18 years and females in our study were more likely to be diagnosed with LNB.

Our study also suggests that anamnestic data on history of tick bite and EM contribute little to diagnosis of LNB. Therefore, we recommend that all the patients with PFNP, but also those with other typical symptoms of LNB undergo the lumbar puncture and the examination of intrathecal synthesis of Bb antibodies regardless of anamnestic data on EM and tick bite.

We also suggest that in the absence of LP or in the absence of intrathecal production of Bb antibodies in patients with PFNP occurring less than 6 weeks after tick bite, ATB treatment of LNB is preferred to corticosteroid treatment.

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Author contribution:

AK drafted the manuscript, co-developed the study design, and participated in the data gathering and analysis and interpretation of results. KH and KG co-drafted the manuscript and participated in the data analysis and interpretation of results. All authors have read and approved the final manuscript.

Ethics declarations: Ethics approval and consent to participate: This study was carried out in concordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans and was approved by the local Ethical Committee of University Hospital in Bratislava (number 14/2022). Written informed consent for participation was obtained from all participants before enrolment to the study. No administrative permission to access the raw data used in this study was required by local authorities or hospital. The raw data were fully anonymized before its use. The investigators preserved the full anonymity of all participants.

Consent for publication: Not applicable.

Competing interests: The authors declare that they have no competing interests.

Tables and figures

Table 1 Division of patients into definite or possible LNB and non-LNB category

Category	Diagnosis	Pleocytosis	Bb AB serum	Bb AB CSF	AI
A	Definite LNB	+	+	+	+
B1	Possible LNB	+/-	+	+	+
B2*	Early possible LNB	+	+/-	-	-
C	Non-LNB controls	+	-	-	-

LNB: Lyme neuroborreliosis, Bb: Borrelia specific antibodies, AB: antibodies, AI: antibody index, CSF: cerebrospinal fluid
* Only applicable for patients with symptoms duration<6 weeks

Table 2 Patient characteristics

Characteristic	Definite LNB n=32	Possible LNB n=23	Non-LNB n=84	TOTAL n=139
Total patients, n (%)	32 (23.1)	23 (16.5)	84 (60.4)	139 (100.0)
Sex, n (%)				
Females	22 (68.7)	13 (56.5)	38 (45.2)	73 (55.5)+
Males	10 (31.3)	10 (43.5)	46 (54.8)	66 (47.5)
Age,y, median (range)	12 (5–81)	33 (7–75)	37 (5-87)	33 (5–87)
Children<18 years, n (%)	21 (65.6)	7 (30.4)	21 (25.0)	49 (35.3)
History of tick bite, n (%)	18 (56.3)	8 (34.8)	34 (40.5)	60 (43.2)
History of erythema migrans, n (%)	7 (21.9)	2 (8.7)	13 (15.5)	22 (15.9)

LNB: Lyme neuroborreliosis, n: number, y: years

Table 3 Clinical symptoms of patients according to the diagnostic category

Symptom	Definite LNB n=32	Possible LNB n=23	Non-LNB n=84
Facial nerve palsy, n (%)	21 (65.6)	5 (21.7)	12 (14.3)
Bilateral	2	1	0
Abducens nerve palsy, n (%)	1 (3.1)	1 (4.4)	4 (4.8)
Limb paresis, n (%)	3 (9.4)	2 (8.7)	9 (10.7)
Radicular pain, n (%)	6 (18.8)	2 (8.7)	11 (13.1)
Headache, n (%)	16 (50.0)	6 (26.1)	54 (64.3)
Fever, n (%)	7 (21.9)	8 (34.8)	23 (27.4)
Meningism, n (%)	4 (12.5)	6 (26.1)	13 (15.5)

LNB: neuroborreliosis, n: number

Table 4 Clinical symptoms according to diagnostic category and age group

Symptom	Definite LNB Adults n=21	<18 years n=11	Possible LNB Adults n=7	<18 years n=16
Facial nerve palsy, n (%)	16 (76.2)	5 (45.5)	4 (57.1)	1 (6.3)
Bilateral	1	1	0	1
Abducens nerve palsy, n (%)	0	1 (4.8)	0	1 (6.3)
Limb paresis, n (%)	1 (4.8)	2 (18.2)	0	2 (15.5)
Radicular pain, n (%)	1 (4.8)	5 (45.5)	0	2 (15.5)
Headache, n (%)	11 (52.4)	5 (45.5)	5 (71.4)	13 (81.3)
Fever, n (%)	5 (23.8)	2 (18.2)	2 (28.6)	6 (37.5)
Meningism, n (%)	2 (9.5)	2 (18.2)	1 (14.3)	5 (31.3)

LNB: Lyme neuroborreliosis, n: number

Table 5 Laboratory parameters according to the diagnostic category

Laboratory parameters	Result available n=139	Definite LNB n=32	Possible LNB n=23	Non-LNB n=84
CSF leucocytes > 5/μL, n (%)	139 (100.0)	32 (100.0)	20 (87.0)	15 (17.9)
CSF proteins > 400mg/L, n (%)	139 (100.0)	22 (71.0)	13 (56.5)	32 (38.1)
CSF Bb AI IgG > 1.5, n (%)	132 (95.0)	29 (100.0)	3 (13.0)	1 (1.3)
CSF Bb IgM positive, n (%)	130 (93.5)	15 (51.7)	3 (13.6)	0
CSF Bb PCR positive, n (%)	17 (12.2)	1 (50.0)	0	0
Serum IgM positive, n (%)	134 (96.5)	26 (83.9)	7 (30.4)	23 (28.8)
Serum IgG positive, n (%)	134 (96.5)	27 (87.1)	12 (52.2)	16 (20.0)
Serum IgM+IgG positive, n (%)	134 (96.5)	23 (74.2)	5 (21.7)	8 (10.0)

LNB: Lyme neuroborreliosis, CSF: cerebrospinal fluid, Bb: borrelia specific antibidies, AI: antibody index, IgM and IgG: immunoglobulins M and G

Table 6 Factors associated with definite LNB, univariate and multivariate logistic regression analyses

Variable	Non-adjusted OR	95% CI	P value	Adjusted OR	95% CI	P value
Female	6.34	1.04-5.59	0.039	6.32	1.66-24.17	0.007
Age<18 years	5.39	2.17-13.34	<0.0001	7.89	2.00-31.03	0.003
Symptoms<30 days	2.02	0.75-5.42	0.155	0.40	0.06-2.30	0.306
No history of ATB	1.25	0.46-3.41	0.658	1.55	0.29-8.26	0.607
History of EM	1.71	0.63-4.71	0.287	3.53	0.72-17.22	0.118
History of tick bite	1.99	0.88-4.47	0.090	2.67	0.83-8.59	0.100
Facial nerve palsy	10.11	3.65-27.95	<0.0001	19.84	3.60-109.4	0.001
Limb paresis	1.11	0.28-4.26	0.882	6.15	0.83-45.52	0.075
Headache	0.49	0.22-1.10	0.076	0.90	0.25-3.27	0.867
Meningism	0.66	0.21-2.12	0.484	3.78	0.50-28.58	0.197
Fever	0.69	0.27-1.76	0.431	1.21	0.20-7.49	0.835
Radicular pain	1.67	0.57-4.85	0.342	4.14	0.84-20.45	0.081

OR: odds ratio, CI: confidence interval, ATB: antibiotics, EM: erythema migrans

Figure 1 Duration of symptoms before admission to hospital, n=139

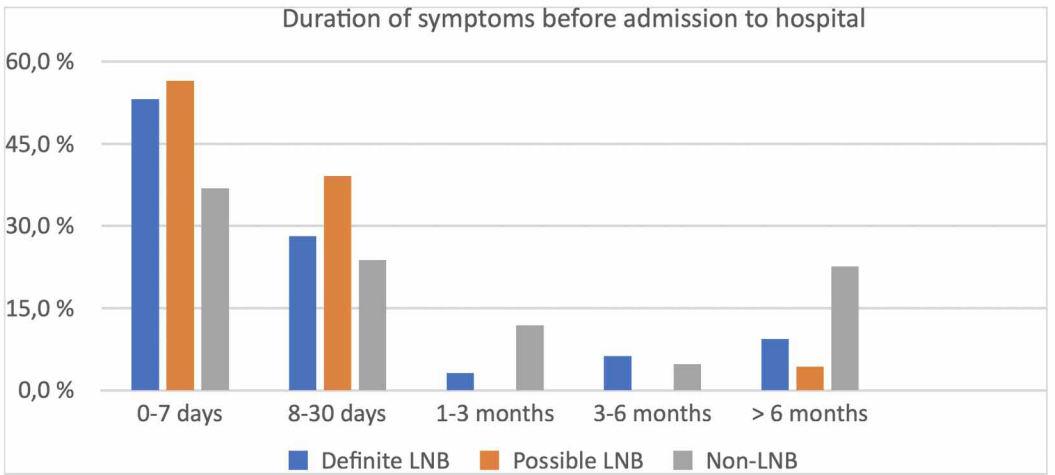


Figure 2 Patients treated with antibiotics for neuroborreliosis, n= 62

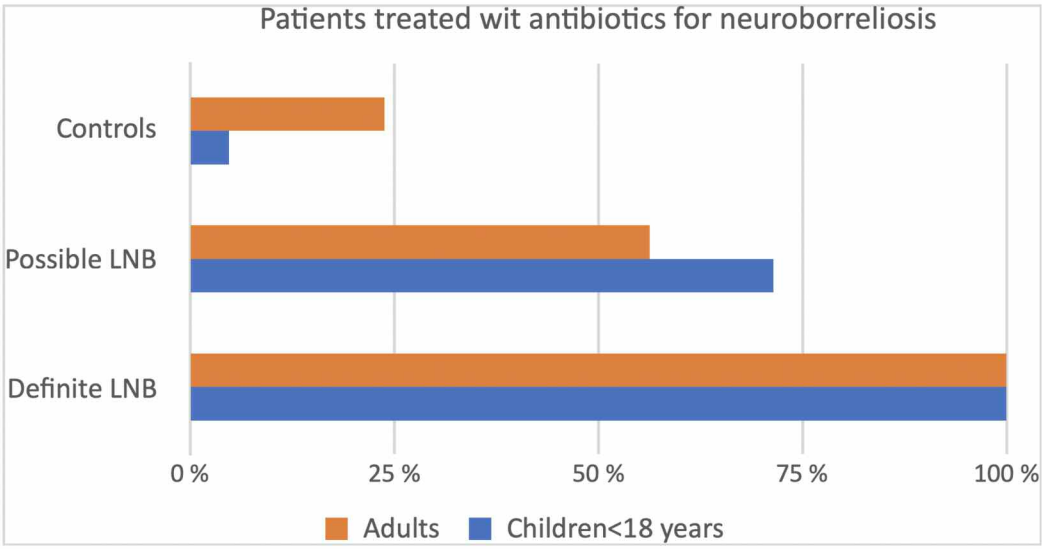


Figure 3 Symptoms improvement at hospital discharge in treated adults, n=33

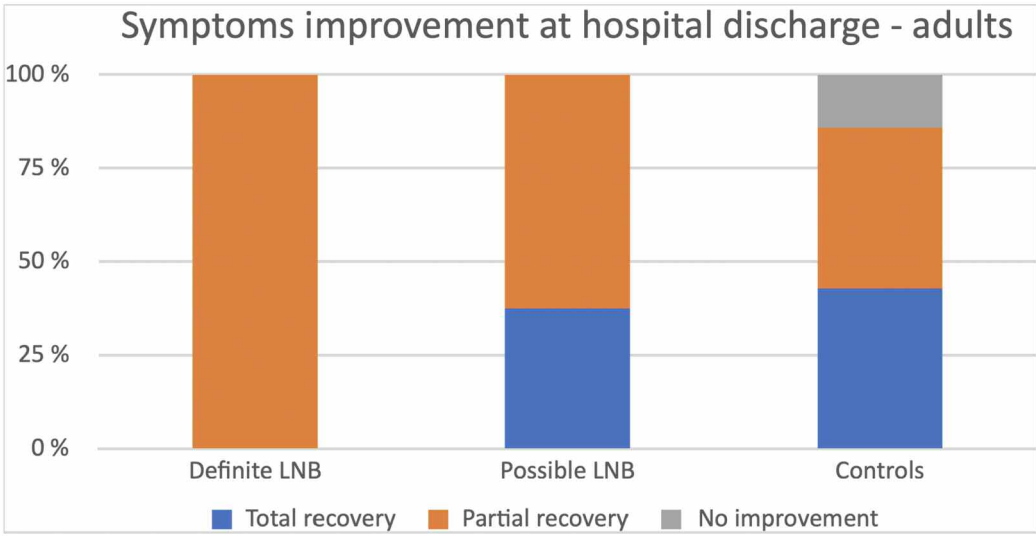
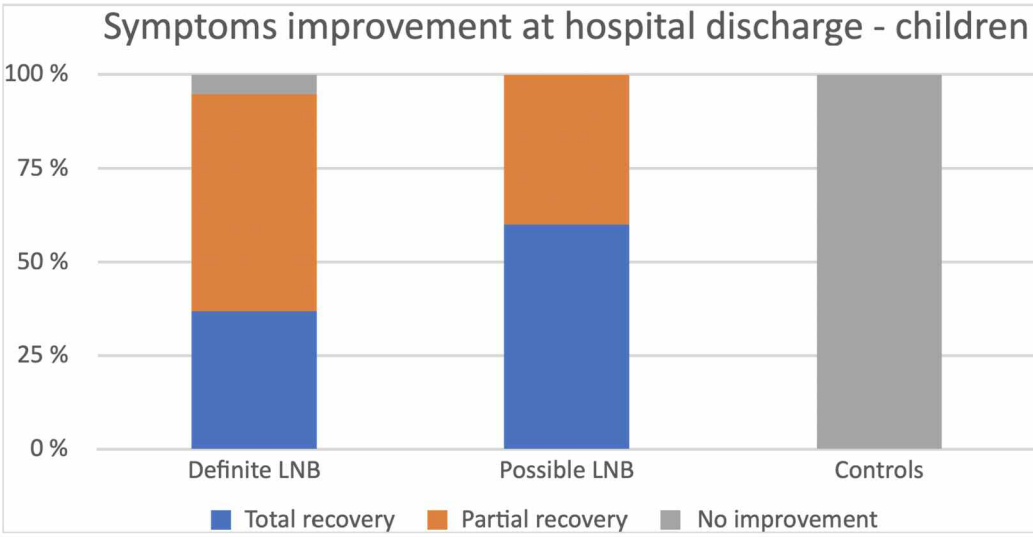


Figure 4 Symptoms improvement at hospital discharge in treated children, n=25



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