

Tick-Borne Relapsing Fever Caused by *Borrelia persica* in Traveler to Central Asia, 2019

Appendix

Appendix Table 1. Laboratory results for f the patient

Result	Reference range	2019		
		Jun 28	Jul 8	Jul 15
Laboratory parameter				
Hemoglobin (g/l)	140–175	114	126	120
Hematocrit (%)	36–48	34	36.9	36.7
Red blood cells (x 10 ¹² /L)	4.5–5.9	3.9	4.3	4.3
Platelets (x 10 ⁹ /L)	150–400	160	199	229
Leukocyte (x 10 ⁹ /L)	4.5–11	6.5	4.9	6.8
Lymphocytes (%)	25–40			22.8
Neutrophils (%)	43–76			70.4
CRP (mg/L)	<5	44	23	165
ASAT (U/L)	<40			19.4
ASAT (U/L)	<41			43.6
gGT (U/L)	<66			69.2
Creatinine (μmol/L)	<97			107
Blood microscopy				
<i>Plasmodia</i> spp./Malaria		Negative		Negative
<i>Spirochetes</i>				Positive
Serologies				
<i>Rickettsia</i> , spotted fever group	1:64			1:128
<i>Rickettsia</i> , typhus group	1:64			<1:64
<i>Orientia tsutsugamushi</i>	1:80			<1:80
<i>Coxiella burnetii</i> phase 1 IgG				Negative
<i>Coxiella burnetii</i> phase 2 IgM				Negative
<i>Coxiella burnetii</i> phase 2 IgG (U/mL)	20–30			<20
<i>Leptospira</i> spp.	1:24			<1:24
<i>Brucella</i> spp. IgG				Negative
<i>Borrelia</i> spp. IgM (U/mL)	<18			173
<i>Borrelia</i> spp. IgG (U/mL)	<10			57
<i>Borrelia</i> spp. IgM Western blot:				Borderline:
OSpC (p23)				Negative
VlsE IgM				+++
BmpA (p39)				Negative
<i>Borrelia</i> spp. IgG Western blot:				Negative
VlsE				Negative
BmpA (p39)				Negative
p38				Negative
BBA36 (iv1)				Negative
BBO323 (iv2)				Negative
Crasp3 (iv3)				Negative
pG (iv4)				Negative

Appendix Table 2. Case reports on tick-borne relapsing fever in travelers

Year	No. cases	Infection acquired in	Imported to	<i>Borrelia</i> spp.	Complications	Ref.
1982	1	Namibia	South Africa	?*	None	(1)
1984	1	Senegal	Germany	?*	None	(2)
1985	1	Cyprus	England	?*	None	(3)
1988	1	Israel	USA	?*	Jarisch-Herxheimer reaction	(4)
1991	1	Senegal	Belgium	?*	Meningoencephalitis, Jarisch-Herxheimer reaction	(5)
1991	1	Senegal	Belgium	?*	None	(5)
1999	1	Senegal	Italy	?†	None	(6)
1999	2	Gambia or Senegal	Netherlands	<i>B. crocidurae</i>	Meningitis (n = 1)	(7)
2005	1	Morocco or Spain	France	<i>B. hispanica</i>	None	(8)
2005	1	Mali	France	<i>B. crocidurae</i>	None	(8)
2005	1	Senegal or Mauritania	France	<i>B. crocidurae</i>	None	(8)
2006	1	Senegal	Italy	<i>B. crocidurae</i>	None	(9)
2006	1	Guatemala or Belize	Netherlands	?†	None	(10)
2007	1	Mali	France	?†	None	(11)
2008	4	Senegal	France	?††	Meningoencephalitis (n = 1) Jarisch-Herxheimer reaction (n = 1)	(12)
2008	1	Mali	France	?†	None	(13)
2009	1	Senegal	France	<i>B. crocidurae</i>	None	(14)
2010	1	Uzbekistan	Japan	<i>B. persica</i>	None	(15)
2010	1	Senegal	Belgium	<i>B. crocidurae</i>	Meningoencephalitis	(16)
2011	1	Uzbekistan or Tajikistan	France	<i>B. persica</i>	None	(17)
2009 - 2011	11	Senegal (n = 4), not stated (n = 7)	France	<i>B. crocidurae</i> (n = 11)	Meningitis (n = 4), Encephalitis (n = 2)	(18)
2012	1	Ethiopia	France	?‡	Radiculopathy	(19)
2015	1	Southern Africa	Germany	<i>Candidatus B. kalaharica</i>	None	(20)
2016	1	Southern Africa	Germany	<i>Candidatus B. kalaharica</i>	Jarisch-Herxheimer reaction	(21)
2017	1	USA	Japan	<i>B. miyamotoi</i>	None	(22)
2018	1	Senegal	France	?†	None	(23)

*Genotyping not yet available.
†No genotyping result reported.
‡Genotyping result inconclusive.

References

1. Rosenthal E. Relapsing fever in Cape Town. A case report. S Afr Med J. 1982;61:801–2. [PubMed](#)
2. Huber M, Eichenlaub D. Relapsing fever in a tourist to Africa [in German]. MMW Munch Med Wochenschr. 1984;126:178–80. [PubMed](#)
3. Simon JW. Tick borne relapsing fever imported into the United Kingdom. J R Army Med Corps. 1985;131:65–7. [PubMed](#) <https://doi.org/10.1136/jramc-131-02-02>
4. McNamara JJ, Kay HH. Relapsing fever (*Borrelia*) in an adolescent tourist in Israel. J Adolesc Health Care. 1988;9:421–3. [PubMed](#) [https://doi.org/10.1016/0197-0070\(88\)90042-3](https://doi.org/10.1016/0197-0070(88)90042-3)
5. Colebunders R, De Serrano P, Van Gompel A, Wynants H, Blot K, Van den Enden E, et al. Imported relapsing fever in European tourists. Scand J Infect Dis. 1993;25:533–6. [PubMed](#) <https://doi.org/10.3109/00365549309008539>

6. Chatel G, Gulletta M, Matteelli A, Marangoni A, Signorini L, Oladeji O, et al. Short report: diagnosis of tick-borne relapsing fever by the quantitative buffy coat fluorescence method. *Am J Trop Med Hyg.* 1999;60:738–9. [PubMed https://doi.org/10.4269/ajtmh.1999.60.738](https://doi.org/10.4269/ajtmh.1999.60.738)
7. van Dam AP, van Gool T, Wetsteyn JC, Dankert J. Tick-borne relapsing fever imported from West Africa: diagnosis by quantitative buffy coat analysis and in vitro culture of *Borrelia crocidurae*. *J Clin Microbiol.* 1999;37:2027–30. [PubMed https://doi.org/10.1128/JCM.37.6.2027-2030.1999](https://doi.org/10.1128/JCM.37.6.2027-2030.1999)
8. Wyplosz B, Mihaila-Amrouche L, Baixench MT, Bigel ML, Berardi-Grassias L, Fontaine C, et al. Imported tickborne relapsing fever, France. *Emerg Infect Dis.* 2005;11:1801–3. [PubMed https://doi.org/10.3201/eid1111.050616](https://doi.org/10.3201/eid1111.050616)
9. Tordini G, Giaccherini R, Corbisiero R, Zanelli G. Relapsing fever in a traveller from Senegal: determination of *Borrelia* species using molecular methods. *Trans R Soc Trop Med Hyg.* 2006;100:992–4. [PubMed https://doi.org/10.1016/j.trstmh.2005.11.002](https://doi.org/10.1016/j.trstmh.2005.11.002)
10. Heerdink G, Petit PL, Hofwegen H, van Genderen PJ. A patient with fever following a visit to the tropics: tick-borne relapsing fever discovered in a thick blood smear preparation [in Dutch]. *Ned Tijdschr Geneeskd.* 2006;150:2386–9. [PubMed https://doi.org/10.1016/j.tmaid.2007.01.002](https://doi.org/10.1016/j.tmaid.2007.01.002)
11. Gallien S, Sarfati C, Haas L, Lagrange-Xelot M, Molina JM. Borreliosis: a rare and alternative diagnosis in travellers' febrile illness. *Travel Med Infect Dis.* 2007;5:247–50. [PubMed https://doi.org/10.1016/j.tmaid.2007.01.002](https://doi.org/10.1016/j.tmaid.2007.01.002)
12. Patrat-Delon S, Drogoul AS, Le Ho H, Biziraguzenyuka J, Rabier V, Arvieux C, et al. Recurrent tick-borne fever: a possible diagnosis in patients returning from Senegal [in French]. *Med Mal Infect.* 2008;38:396–9. [PubMed https://doi.org/10.1016/j.medmal.2008.03.005](https://doi.org/10.1016/j.medmal.2008.03.005)
13. Poirier P, Lebuissou A, Menager C, Moulin F, Dupouy-Camet J. Fever in a 7-year-old girl returning from Mali. *Clin Infect Dis.* 2008;47:1442, 1490–1. [PubMed https://doi.org/10.1086/593096](https://doi.org/10.1086/593096)
14. Million M, Cazorla C, Doudier B, La Scola B, Parola P, Drancourt M, et al. Molecular identification of *Borrelia crocidurae* in a patient returning from Senegal. *BMJ Case Rep.* 2009;2009(feb19 1):bcr06.2008.0298. [PubMed https://doi.org/10.1136/bcr.06.2008.0298](https://doi.org/10.1136/bcr.06.2008.0298)
15. Kutsuna S, Kawabata H, Kasahara K, Takano A, Mikasa K. The first case of imported relapsing fever in Japan. *Am J Trop Med Hyg.* 2013;89:460–1. [PubMed https://doi.org/10.4269/ajtmh.13-0187](https://doi.org/10.4269/ajtmh.13-0187)
16. Bottieau E, Verbruggen E, Aubry C, Socolovschi C, Vlieghe E. Meningoencephalitis complicating relapsing fever in traveler returning from Senegal. *Emerg Infect Dis.* 2012;18:697–8. [PubMed https://doi.org/10.3201/eid1804.111771](https://doi.org/10.3201/eid1804.111771)

17. Colin de Verdiere N, Hamane S, Assous MV, Sertour N, Ferquel E, Cornet M. Tickborne relapsing fever caused by *Borrelia persica*, Uzbekistan and Tajikistan. *Emerg Infect Dis*. 2011;17:1325–7. [PubMed https://doi.org/10.3201/eid1707.101894](https://doi.org/10.3201/eid1707.101894)
18. Goutier S, Ferquel E, Pinel C, Bosseray A, Hoen B, Couetdic G, et al. *Borrelia crociduræ* meningoencephalitis, West Africa. *Emerg Infect Dis*. 2013;19:301–4. <https://doi.org/10.3201/eid1902.121325>
19. Socolovschi C, Honnorat E, Consigny PH, Dougados J, Passeron A, Parola P, et al. Tick-borne relapsing fever with cutaneous eschar and radiculopathy, Ethiopia. *J Travel Med*. 2012;19:261–3. [PubMed https://doi.org/10.1111/j.1708-8305.2012.00625.x](https://doi.org/10.1111/j.1708-8305.2012.00625.x)
20. Stete K, Rieg S, Margos G, Häcker G, Wagner D, Kern WV, et al. Case report and genetic sequence analysis of *Candidatus Borrelia kalaharica*, southern Africa. *Emerg Infect Dis*. 2018;24:1659–64. [PubMed https://doi.org/10.3201/eid2409.171381](https://doi.org/10.3201/eid2409.171381)
21. Fingerle V, Pritsch M, Wächtler M, Margos G, Ruske S, Jung J, et al. “*Candidatus Borrelia kalaharica*” detected from a febrile traveller returning to Germany from vacation in southern Africa. *PLoS Negl Trop Dis*. 2016;10:e0004559. [PubMed https://doi.org/10.1371/journal.pntd.0004559](https://doi.org/10.1371/journal.pntd.0004559)
22. Oda R, Kutsuna S, Sekikawa Y, Hongo I, Sato K, Ohnishi M, et al. The first case of imported *Borrelia miyamotoi* disease concurrent with Lyme disease. *J Infect Chemother*. 2017;23:333–5. [PubMed https://doi.org/10.1016/j.jiac.2016.12.015](https://doi.org/10.1016/j.jiac.2016.12.015)
23. Guiheneuf E, Desjardins N, Guiheneuf R. A diagnosis of borreliosis on a blood smear [in French]. *Ann Biol Clin (Paris)*. 2018;76:118–9. [PubMed https://doi.org/10.1684/abc.2017.1320](https://doi.org/10.1684/abc.2017.1320)