Metagenome of Covid19 patient from Bangladesh corroborates the anaerobic colonization enabled by SAR-Cov2 with a novel, hard to culture, bacteria - *Lawsonella clevelandensis* - that is implicated in disease by causing abscesses

Sandeep Chakraborty

Letter

I have hypothesized [1] that SARS-Cov2 [2, 3] enables anaerobic bacteria (Prevotella, et al) to colonize the lungs disrupting homeostasis. This finds resonance in the ‘forgotten disease’ Lemierre’s Syndrome [4–9, 9, 10], caused by anaerobic bacteria enabled by Epstein Barr Virus [11, 12]. Common symptoms include ARDS, septic shock, blood clots and arterial stroke [?, 13–17]. A key difference is that Lemierre’s Syndrome originates in the jugular vein, while Covid19 starts from the lungs (possibly making it easier to treat).

Here, metagenome from a Covid19 patient in Bangladesh (Accid:PRJNA633241) is analyzed (Table 1). While, bacterial load is low (and this might be due to removal of reads), it corroborates the anaerobic domination with a novel anaerobic bacteria - *Lawsonella clevelandensis* - being implicated.

***Lawsonella clevelandensis* - hard to culture anaerobic bacteria that causes abscesses**

Lawsonella clevelandensis is a Gram-positive, partially acid-fast, anaerobic ‘difficult to identify by conventional methods, leading to inappropriate treatments’ [18]. The case reported is the 3-week evolution of a breast nodule in 29-year-old woman. Cultures obtained from surgical drainage of the abscess went through a prolonged incubation period of 10 days, after which colonies were observed, and *Lawsonella clevelandensis* was confirmed by molecular methods. The therapy was changed to amoxicillin-clavulanic acid, and the abscess was successfully resolved without recurrence. Also, recently liver abscess was reported in a patient with rheumatoid arthritis [19]. Once again, cultures failed to grow the bacteria, and 16S rRNA PCR gene sequencing analysis confirmed *Lawsonella clevelandensis*. Treatment was changed to amoxicillin/clavulanic acid, and abscesses went away completely in 4 weeks. Another case of a 2-year-old girl (infected spinal dermoid cyst) caused by *Lawsonella clevelandensis* (surgical drainage followed by prolonged course of antibiotics), which again faced culturing issues [20].

Thus, inspite of low bacterial load, metagenome of a Covid19 patient from Bangladesh (most likely a child, since it was done in Child Health Research Foundation) shows the potential of anaerobic colonization, which I hypothesize is the cause of disease severity in Covid19.

Table 1: **Bacterial reads in a patient from Bangladesh (PRJNA633241)** While, bacterial load is low (and this might be due to removal of reads), it corroborates the anaerobic domination with a novel anaerobic bacteria - *Lawsonella clevelandensis* - being implicated. FAC-ANE=facultatively anaerobic (aerobic, but capable of switching to fermentation if oxygen is absent).

NReads	Bacteria	Type	Diseases
57	Staphylococcus	FAC-ANE	Boils, impetigo, food poisoning, cellulitis, and toxic shock syndrome found in abscesses [21] diphtheria toxin [22] chronic blepharitis and endophthalmitis [23]
41	Lawsonella	anaerobic	
27	Corynebacterium	aerobic	
15	Cutibacterium	obligateanaerobic	
14	Pseudomonas	FAC-ANE	pneumonia, meningitis and bloodstream infection [24] oral cavities of HIV-infected children [25] novel species [26] endocarditis [27]
10	Escherichia	FAC-ANE	
6	Haemophilus	FAC-ANE	
5	Lautropia	FAC-ANE	
5	Nocardioides	aerobic	pneumonia, bacteremia [28] rare cases of meningitis, osteomyelitis, and periodontal disease [29] Inhalation or respiratory anthrax new genus found in lung of a parakeet in Basel,Switzerland [?] the most radiation-resistant bacteria [30] new genus [31] novel species [32] nitrogen-fixing bacterium [33] periodontal disease [34]
3	Finegoldia	anaerobic	
3	Sphingomonas	aerobic	
3	Streptococcus	FAC-ANE	
3	Veillonella	obligateanaerobic	aspiration pneumonia, lung abscess, pulmonary empyema, etc [35,36]
2	Bacillus	FAC-ANE	
2	Basilea	aerobic	
2	Deinococcus	aerobic	
2	Lachnoanaerobaculum	anaerobic	
2	Methylovorus	aerobic	
2	Niveispirillum	cyanobacteria	
2	Porphyromonas	obligateanaerobic	
2	Scytonema	cyanobacteria	
1	Prevotella	obligateanaerobic	

References

1. Chakraborty S (2020). Sars-cov2 enables anaerobic bacteria (Prevotella, et al) to colonize the lungs disrupting homeostasis - symptoms (ARDS, septic shock, blood clots, arterial stroke) finds resonance, with key differences, in the ‘forgotten disease’ Lemierre syndrome, caused by anaerobic bacteria enabled by Epstein Barr virus. doi:10.31219/osf.io/usztn. URL osf.io/usztn.
2. Perlman S (2020). Another decade, another coronavirus.
3. Wu F, Zhao S, Yu B, Chen Y, Wang W, et al. (2020) Complete genome characterisation of a novel coronavirus associated with severe human respiratory disease in Wuhan. *China bioRxiv* 24.
4. Potter M, Drysdale H, Price P, Buck A (1988) Disseminated intravascular coagulation with fusobacterium necrophorum septicaemia. *Postgraduate medical journal* 64: 155–156.
5. Page Y, Comtet C, Tardy B, Zeni F, Thevenet D, et al. (1990) Disseminated intravascular coagulation in fusobacterium necrophorum septicemia. *Scandinavian journal of infectious diseases* 22: 743–747.
6. Hagelskjaer L, Prag J, Malczynski J, Kristensen J (1998) Incidence and clinical epidemiology of necrobacillosis, including lemierre’s syndrome, in denmark 1990–1995. *European journal of clinical microbiology and infectious diseases* 17: 561–565.
7. Hlibczuk V (2007) Lemierre’s syndrome complicating bacterial pharyngitis in a patient with undiagnosed factor xii deficiency. *The Journal of emergency medicine* 32: 365–369.
8. Khan A, Ganesan S, Arora M, Hussain N (2013) Life threatening complication of sore throat: Lemierre’s syndrome. *The Indian Journal of Pediatrics* 80: 1059–1061.
9. Rae J, Misselbrook K (2017) Lemierre’s syndrome—a rare cause of disseminated sepsis requiring multi-organ support. *Journal of the Intensive Care Society* 18: 329–333.
10. Surapaneni BK, Omar H, Iguina MM, Suarez M (2020) Fusobacterium necrophorum septicemia leading to lemierre’s syndrome in an immunocompetent individual: A case report. *Cureus* 12.
11. Boz G, Iskender S, Caylan R, Aydin K, Koksall I (2005) A case of lemierre’s syndrome following epstein–barr virus infection. *Anaerobe* 11: 185–187.
12. Chacko E, Krilov L, Patten W, Lee P (2010) Lemierre’s and lemierre’s-like syndromes in association with infectious mononucleosis. *The Journal of Laryngology & Otology* 124: 1257–1262.
13. Thachil J, Tang N, Gando S, Falanga A, Cattaneo M, et al. (2020) Isth interim guidance on recognition and management of coagulopathy in covid-19. *Journal of Thrombosis and Haemostasis* .
14. Tang N, Li D, Wang X, Sun Z (2020) Abnormal coagulation parameters are associated with poor prognosis in patients with novel coronavirus pneumonia. *Journal of Thrombosis and Haemostasis* .
15. Cui S, Chen S, Li X, Liu S, Wang F (2020) Prevalence of venous thromboembolism in patients with severe novel coronavirus pneumonia. *Journal of Thrombosis and Haemostasis* .
16. Kollias A, Kyriakoulis KG, Dimakakos E, Poulakou G, Stergiou GS, et al. (2020) Thromboembolic risk and anticoagulant therapy in covid-19 patients: Emerging evidence and call for action. *British Journal of Haematology* .
17. Leisman DE, Deutschman CS, Legrand M Facing covid-19 in the icu: vascular dysfunction, thrombosis, and dysregulated inflammation. *Intensive Care Medicine* : 1.

18. Favila Menezes M, Sousa MJ, Paixão P, Atouguia J, Negreiros I, et al. (2018) *Lawsonella clevelandensis* as the causative agent of a breast abscess .
19. Zamora JAG, Alvarez MR, Henry Z, Baracco GJ, Dickinson G, et al. (2020) Liver abscess caused by *lawsonella clevelandensis* in a patient with rheumatoid arthritis: A case report and literature review. IDCases : e00734.
20. Kumaria A, Lucas E, Crusz S, Howarth S, Cartmill M (2018) *Lawsonella clevelandensis* causing spinal subdural empyema. British journal of neurosurgery : 1–3.
21. Bell ME, Bernard KA, Harrington SM, Patel NB, Tucker TA, et al. (2016) *Lawsonella clevelandensis* gen. nov., sp. nov., a new member of the suborder corynebacterineae isolated from human abscesses. International journal of systematic and evolutionary microbiology 66: 2929–2935.
22. Murphy JR (1996) *Corynebacterium diphtheriae*. In: Medical Microbiology. 4th edition, University of Texas Medical Branch at Galveston.
23. Limb D (2019) *Propionibacterium acnes* in shoulder surgery. Orthopaedics and Trauma 33: 188–191.
24. Wahl B, O'Brien KL, Greenbaum A, Majumder A, Liu L, et al. (2018) Burden of *Streptococcus pneumoniae* and *Haemophilus influenzae* type b disease in children in the era of conjugate vaccines: global, regional, and national estimates for 2000–15. The Lancet Global Health 6: e744–e757.
25. Rossmann SN, Wilson PH, Hicks J, Carter B, Cron SG, et al. (1998) Isolation of *Lautropia mirabilis* from oral cavities of human immunodeficiency virus-infected children. Journal of clinical microbiology 36: 1756–1760.
26. Dubourg G, Sankar S, Rathored J, Lagier JC, Robert C, et al. (2016) Noncontiguous finished genome sequence and description of *nocardioides massiliensis* sp. nov. gd13t. New microbes and new infections 10: 47–57.
27. Hussein K, Savin Z, Shani L, Dickstein Y, Geffen Y, et al. (2014) Infective endocarditis caused by *finnegoldia magna* following aortic dissection repair: a case report and data evaluation. The American journal of case reports 15: 554.
28. Cunningham MW (2000) Pathogenesis of group a streptococcal infections. Clinical microbiology reviews 13: 470–511.
29. Bhatti MA, Frank MO (2000) *Veillonella parvula* meningitis: case report and review of *veillonella* infections. Clinical infectious diseases 31: 839–840.
30. Yuan M, Zhang W, Dai S, Wu J, Wang Y, et al. (2009) *Deinococcus gobiensis* sp. nov., an extremely radiation-resistant bacterium. International journal of systematic and evolutionary microbiology 59: 1513–1517.
31. Hedberg ME, Moore ER, Svensson-Stadler L, Hörstedt P, Baranov V, et al. (2012) *Lachnoanaerobaculum* gen. nov., a new genus in the lachnospiraceae: characterization of *lachnoanaerobaculum umeaense* gen. nov., sp. nov., isolated from the human small intestine, and *lachnoanaerobaculum orale* sp. nov., isolated from saliva, and reclassification of *eubacterium saburreum* (prévot 1966) holdeman and moore 1970 as *lachnoanaerobaculum saburreum* comb. nov. International journal of systematic and evolutionary microbiology 62: 2685.
32. Doronina N, Kaparullina E, Trotsenko YA (2011) *Methylovorus menthalis*, a novel species of aerobic obligate methylobacteria associated with plants. Microbiology 80: 713.

33. Cai H, Wang Y, Xu H, Yan Z, Jia B, et al. (2015) *Niveispirillum cyanobacteriorum* sp. nov., a nitrogen-fixing bacterium isolated from cyanobacterial aggregates in a eutrophic lake. *International journal of systematic and evolutionary microbiology* 65: 2537–2541.
34. Diaz PI, Slakeski N, Reynolds EC, Morona R, Rogers AH, et al. (2006) Role of oxyr in the oral anaerobe *Porphyromonas gingivalis*. *Journal of bacteriology* 188: 2454–2462.
35. Nagaoka K, Yanagihara K, Morinaga Y, Nakamura S, Harada T, et al. (2014) *Prevotella intermedia* induces severe bacteremic pneumococcal pneumonia in mice with upregulated platelet-activating factor receptor expression. *Infection and immunity* 82: 587–593.
36. Larsen JM (2017) The immune response to *Prevotella* bacteria in chronic inflammatory disease. *Immunology* 151: 363–374.