CASE REPORT

ANAEROBIC SPIRAL SHAPED RODS *ANAEROBIOSPIRILLUM SUCCINICIPRODUCENS*

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It is a case of bacteremia with anaerobic, spiral-shaped gram-negative rods, *Anaerobiospirillum succiniciproducens* in a patient with chronic liver disease. This infection had led to fatal outcomes in the patient. Prompt and precise microbiological diagnosis may lead to proper treatment and the auspicious outcome of these infections.

Keywords: Anaerobic spiral shaped rods; Spiral shaped rods; Anaerobiospirillum; Bacteremia

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INTRODUCTION

Anaerobic spiral shaped gram-negative rods were identified as new genus *Anaerobiospirillum* in 1976 by David *et al*, who isolated these spiral rods from the throat and feces of beagle dogs.[1] The first case of human infection was reported 5 years later in 1981 by Rifkin *et al*.[2] After that, there were sporadic cases of human infections but mostly with septicemia and a high mortality rate.

These infections usually occurred in patients with chronic medical conditions or with immunosuppression. In addition, the identification of bacterium remained the major throbbing issue. Owing to the similar morphology, *Anaerobiospirillum* species can be misidentified as *Campylobacter* species which requires a different type of antibiotic to treat.[3,4] With the introduction of the latest advancements in the identification systems, there is hope to more promptly and decorously identify the bacterium.[5–8]

CASE

An 80-year-old gentleman presented in emergency with a history of poor oral intake, generalized body weakness for last 1 month, and decreased level of consciousness for 2 to 3 days. He was a known case of chronic liver disease with cirrhosis and last year admitted with abdominal ascites. On physical examination, the patient was vitally stable with a distended abdomen. Other than this the systemic examination was unremarkable.

The patient was admitted to the medical ward with a diagnosis of decompensated chronic liver disease with Child score B and hepatic encephalopathy. Intravenous piperacillin-tazobactam was started. Later he was shifted to the intensive care unit (ICU) due to the low Glasgow Coma Scale. In ICU, the patient went to cardiopulmonary arrest and expired on the same day.

Patient had deranged liver function tests, renal function tests and coagulation profile with low platelets (Table-1). Blood culture (BactecTM FX bottles, BD Diagnostics) was also sent from the emergency ward. Anaerobic blood culture bottle had flagged positive after 2 days of incubation. Gram stain from the bottle showed gram negative spiral shaped rods (Figure-1). Blood was subculture on sheep blood agar and chocolate agar and incubated aerobically (O_2 and 5% CO_2) and on Brucella Agar and Sheep Blood Agar and incubated anaerobically. There was no growth aerobically but anaerobically incubated sheep blood agar showed growth of trans-lucid, circular, convex, and non-hemolytic colonies.

Gram staining from a colony suspension revealed the same spiral shaped Gram-negative bacteria observed in the original blood culture bottles (Figure-1). The isolate was oxidase and catalase negative and motile. Though gram stain morphology was confusing with *Campylobacter* species however anaerobic growth and negative oxidase and catalase tests were differentiating characteristics.

Furthermore, Vitek 2 NH (BioMérieux) also gave inconclusive identification. This isolate was sent to the reference laboratory (Bioscentia, Germany) for further identification. They identified this isolate as *Anaerobiospirillum succiniciproducens* on the basis of 16S-rRNA-gene polymerase chain reaction and sequencing.

Table-1: Laboratory Results

Description	Result	Reference Range #
Complete blood count		
Hemoglobin	16.3 g/dl	14-18
Hematocrit	47.6%	38-52
Platelet ↓	137 10^9/L	150-450
White blood cell	10.48 10^9/L	4-11
Neutrophils	83.4%	
Lymphocytes	7.5%	
Monocytes	7.5%	
Eosinophils	0.1%	
Basophils	0.1%	
Coagulation Profile		
Prothrombin Time ↑	17.889 seconds	9.4-14.3
APTT ↑	37.228 seconds	25-42
International Normalized Ratio ↑	1.594	< 1.4
Renal Profile		
Sodium ↓	124 mmol/L	136-144
Potassium ↑	6.6 mmol/L	3.6-5.1
Chloride ↓	94 mmol/L	101-111
Creatinine ↑	285.4 mmol/L	57-113
Blood Urea Nitrogen ↑	51.1 mmol/L	2.9-7.1
Liver function test		
Total bilirubin ↑	70.4 µmol/L	61-79
Direct bilirubin ↑	41,7 µmol/L	1.7-8.6
Alanine aminotransferase	31 U/L	17-63
Aspartate aminotransferase	35 U/L	15-41
Blood Urea Nitrogen	68 U/L	32-91
Gamma-glutamyl transferase ↑	108 U/L	7-50

↑: High, ↓: Low, APTT: Activated partial thromboplastin time

Reference ranges are taken from manufacturer's instructions after doing verification studies in the local population according to College of American Pathologist (CAP) guidelines and laboratory policies and procedures

DISCUSSION

Anaerobiospirillum spp infections are infrequent but it can lead to serious consequences. Therefore, it is imperative to acquire more information about this organism's characteristics as well as disease progression and management. In our analysis of different cases (Table-2), the mean age is 55y (range 17–81). The male to female ratio is 4:13. Bacteremia (n=15, 88%) is the commonest infection. The most common co-morbid are cigarette smoking, diabetes, hypertension, chronic heart disease, chronic liver disease, alcohol usage, obesity, and non-Hodgkin lymphoma. Association to an animal was found in three cases**.** Common symptoms are fever, abdominal pain, diarrhea, and malaise. McNeil MM *et al* had reported in their analysis of case series of 22 patients that the mean age of infection was 58.6y with common maladies like alcohol usage, malignancy, diabetes mellitus, and dental caries. However commonest symptoms were gastrointestinal (n=17, 77%).[17]

Anaerobiospirillum species were reported as part of the normal gut flora of dogs and cats[1, 8] but in our analysis, it is difficult to assess the association as many cases provide no information about the animal contact. The eleven cases in which information was available three had the close contact with animals (Table-2). However, no animal was tested for this microorganism. McNeil MM *et al* reported animal contact in (n=3, 14%) of their cases.[17]

Major issue with *Anaerobiospirillum* species is a lack of prompt and correct identification. Its spiral shape can easily mislead to wrong identification as *Campylobacter* species or other spirochetes which lead to the initiation of inappropriate antibiotic usage, in the end, leading to clinical failure. As done in our case, mostly cases are identified on the basis of polymerase chain reaction and sequencing but in cases[5,7,8,10] they used matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF) for rapid detection of the organism. So, the acquisition of new technologies can help to combat the hurdle of delay in rapid diagnosis and prompt treatment. However, Schaumburg F *et al* reported inconclusive diagnosis with MALDI-TOF in his case isolate.[10]

The limitation of our case report is that we couldn't able to perform antimicrobial susceptibility testing in this isolate. However due to difficulty in identification and susceptibility testing drug sensitivity was reported only in 3 cases, number 3, 6, and 8 (Table-2). It was generally susceptible to penicillin, amoxicillin/clavulanate, second and third generation cephalosporins, carbapenems, and fluoroquinolones, resistant to clindamycin, and variable results with metronidazole.[2,6,10]

Table-2: Review of diagnosis and treatment outcome of patients with *Anaerobiospirillum* spp. infections

Case	Age/ gender	Diagnostic specimen /method	Associated diseases/Animal contact	Current symptoms/diagnosis	Treatment/Outcome	Reference
1	73/F	Blood/Culture n 16S rRNA sequencing	Diabetes, cigarette smoking, hypertension / no animal contact	Cerebrovascular attack	Pip-tazo/ Death	4
2	40/F	Blood/ MALDI-TOF	Diabetes, liver cirrhosis/cat bite	Hepatic encephalopathy	Penicillin then amoxicillin-clavulanate / Cured	8
3	25/F	Blood/Culture n gas liquid chromatography	Malignancy / no animal contact	Malignancy (type not mention), fever, chills, generalised myalgia, cough, abdominal cramps n diarrhea	Amoxicillin-clavulanate/ Cured	6
4	39/M	Blood/ Culture, MALDI-TOF 16S rRNA sequencing	Alcohol, cigarette smoking, assaulted/ no animal contact	Sepsis n pyomyositis	Vancomycin n cefepime, amp-sulbactem then amoxicillin-clavulanate/ /Cured	7
5	81/M	Blood/ Culture n 16S rRNA sequencing	Squamous cell carcinoma of cheeks (surgery n radiotherapy 15 y back, Poor dentition, cough / no animal contact	Pneumonia	Levofloxacin/Cured	3
6	71/M	Peri prosthetic tissue / Culture n 16S rRNA sequencing	Chronic heart disease, chronic kidney disease, obesity, high cholesterol / cat bites	Prosthetic joint infections	Amoxicillin-clavulanate/ Cured	10
7	58/F	Blood, ovarian mass /Culture	Chronic heart disease, chronic hepatitis C, obesity, benign ovarian mass/animal contact was not mention	Perforated ovarian mass with peritonitis	Pip/tazo, azithromycin n vancomycin/ Death	11
8	75/M	Blood/Culture n gas liquid chromatography	Hypertension, athero-sclerotic cardiovascular disease, deafness/ animal contact was not mention	Bilateral vision loss for 2 weeks	Clindamycin n gentamicin/Death	2
9	46/M	Blood/Culture n reference method is not mention	None/no animal contact	Compound fracture of ulna n radius after injury with heavy cables n wound was contaminated with dirty sea water	Intravenous benzyl pencillin,metronidazole, cefamandole n gentamicin/multiple debridement plus below elbow amputation/Cured	15
10	61/M	Blood/ Culture n 16S rRNA sequencing	None/no animal contact	Fall from roof with kidney injury n fever	Amp-sulbactam then amoxicillin-clavulanate /Cured	14
11	65/M	Blood, peri prosthetic joint tissue/ Culture, MALDI-TOF 16S rRNA sequencing	Rheumatoid arthritis, bilateral hip arthroplasties, non-ischemic cardiomyopathy with a heart transplant 10 years ago / dog breeder	Progressive left hip pain and frank purulence on hip aspiration	Ceftriaxone n wound debridement/Cured	9
12	48/M	Blood/ Culture n 16S rRNA sequencing	HIV, Non-Hodgkin lymphoma Chemotherapy, gastric ulcers/ animal contact was not mention	Diarrhea n fever	Ticarcillin-clavunate/Death	13
13	57/M	Blood/ Culture n 16S rRNA sequencing	Non-Hodgkin lymphoma, chemotherapy, splenectomy/ animal contact was not mention	Fever, malaise, non-productive cough	Ticarcillin-clavunate, gentamicin n ciprofloxacin/Cured	13
14	53/M	Blood/ Culture n 16S rRNA sequencing	Alcoholic liver disease / animal contact was not mention	Epigastric pain, hematemesis n malena	No ab/esophageal varices repair/Cured	13
15	41/M	Stool/ Culture n 16S rRNA sequencing	None/No animal contact	Abdominal pain n diarrhea	Not mention/Cured	12
16	17/M	Blood/ Culture n 16S rRNA sequencing	Acute lyphoblastic leukemia/ animal contact was not mention	Fever n diarrhea	Imipenem/Cured	16
17	81/M	Blood/ Culture n 16S rRNA sequencing	Chronic liver disease and cirrhosis/No animal contact	Hepatic encephalopathy	Pip/tazo/Death	Our case

M: Male, F: Female, MALDI-TOF: Matrix-assisted laser desorption/ionisation time-of-flight mass spectrometry, Pip-tazo: Piperacillin-tazobactem: ab, antibiotics

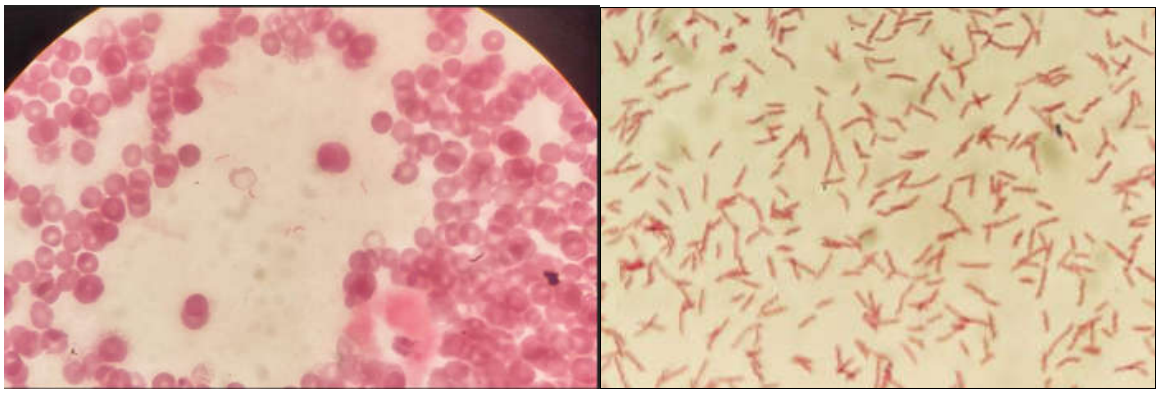

Figure-1 Magnification x 100, Left; gram stain from anaerobic blood culture bottle showing spiral shaped gram-negative rod. Right; gram stain from culture plate showing spiral shaped gram negative Gram stain is made from our patients' blood culture sample

CONCLUSION

Anaerobiospirillum spp infections especially septicemia can lead to serious consequences. Therefore, it is imperative to acquire more information about this organism's characteristics as well as disease progression and management.

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