

Anaerobic Blood Culture Media Change Increases Isolation of Anaerobic Blood Stream Infections

Rebecca Zadroga, MD^{1,2}; Richard Gottschall¹; Glen T. Hansen, PhD^{1,2,3}

¹Hennepin County Medical Center, Microbiology, ²University of Minnesota, Div of Infectious Disease;

³University of Minnesota, Div of Pathology



Hennepin County Medical Center



UNIVERSITY OF MINNESOTA

ABSTRACT

Background: Obligate anaerobes are uncommonly isolated from blood cultures, usually comprising from 0.4-4% of overall positive growth[1, 2], but are associated with high mortality, with rates as high as 50% reported[3]. Our hospital changed from BacT/Alert FN medium to BACTEC Lytic anaerobic medium in 2011. This study identifies differences in isolation rates of obligate anaerobes prior to and after the change of blood culture media.

Methods: Blood culture media switch occurred on 2/1/2011. All obligate anaerobes isolated for 2 years prior to and 2 years after blood culture media was changed (2/1/2009-2/1/2011 and 2/1/2011-2/1/2013) were evaluated. Overall culture positivity and obligate anaerobe isolation was tabulated. *Propionibacterium* sp. isolates were excluded from the analysis because all isolates were considered contaminants and likely to have overestimated any effect seen.

Results: A total of 56,404 cultures were collected over the 4 year period. Overall culture positivity rate in 2009-2010 was 3,184/29,762(10.7%) and 3,146/26,642(11.8%) from 2011-2012(p<0.0001). The contamination rate was 3.6% for 2009-2010 and 4.0% for 2011-2012. The number of obligate anaerobes isolated was 58/3,184(1.8%), affecting 53 patients in 2009-2010 and 101/3,146(3.2%), affecting 88 patients from 2011-2012(p=0.0005). The most common organisms isolated were *Bacteroides* sp, *Clostridium* sp, and *Fusobacterium* sp with 43, 31, and 9 cases respectively throughout the study period. There was no statistical difference in specific organism identification between time periods.

Conclusions: The overall number of positive cultures and obligate anaerobes isolated increased after the change in blood culture media from BacT/Alert FN to BACTEC Lytic. Anaerobe isolation nearly doubled (1.8% to 3.2%) but not at the expense of contaminants, as this rate remained flat.

Glen Hansen, PhD
Email: glen.hansen@hcmcd.org
Rebecca Zadroga, MD
Email: rebecca.zadroga@hcmcd.org

INTRODUCTION

Obligate anaerobes are uncommonly isolated from blood cultures, usually comprising from 0.4-4% of overall positive growth[1, 2]. However, anaerobic sepsis is associated with a high mortality rate, with rates as high as 50% reported in some series[3]. Obligate anaerobe isolation in blood cultures may be related to many factors, including exposure to prior antimicrobials and type of blood culture media utilized. Two commonly used, FDA approved anaerobic blood culture media are BACTEC Lytic and BacT/Alert FN. *In vitro* data has demonstrated that BACTEC Lytic has faster time to detection for anaerobic organisms than does BacT/Alert FN media [4]. Our hospital changed from BacT/Alert FN media to BACTEC Lytic anaerobic media in 2011. This study aims to identify differences in isolation of obligate anaerobes prior to and after the switch of the media and describe the clinical scenarios of the positive cultures. There is a paucity of data on whether different anaerobic media can affect clinical decision making, and this study aims to facilitate the acquisition of this data in the future.

METHODS AND MATERIALS

All blood cultures obtained hospital wide prior to 2/1/2011 were collected in BacT/Alert FAN aerobic and BacT/Alert FN media. After 2/1/2011, all blood cultures were collected in BACTEC Plus aerobic and BACTEC Lytic anaerobic bottles. Blood culture ordering, processing, or recommended volume of collection did not change after new media implementation. All cultures isolated exclusively in the anaerobic media for 2 years prior to the media switch and 2 years following media switch (2/1/2009-2/1/2011 and 2/1/2011-2/1/2013) were reviewed. Only obligate anaerobes were included in the study. Overall culture positivity, differences in isolation of obligate anaerobes over the 2 study periods, and individual obligate anaerobe species isolated were evaluated. All *Propionibacterium* sp. isolates were considered contaminants and therefore excluded from the analysis. Their inclusion would have overestimated any potential clinical effect seen. Contamination rates were calculated to insure differences in yield were not due to increased contaminant isolation.

RESULTS

A total of 56,404 cultures were collected over the 4 year period. Overall culture positivity rate in 2009-2010 was 3,184/29,762(10.7%) and 3,146/26,642(11.8%) from 2011-2012(p<0.0001).

The overall contamination rate was 3.6% for 2009-2010 and 4.0% for 2011-2012, which was not statistically significant. The number of obligate anaerobes isolated in 2009-2010 was 58/3,184(1.8%), affecting 53 patients. From 2011-2012, a total of 101/3,146(3.2%) obligate anaerobes were identified, affecting 88 patients (p=0.0005). Patient characteristics did not vary between study time points(Table 2).

Table 1. Anaerobe Blood Cultures Before and After Media Switch

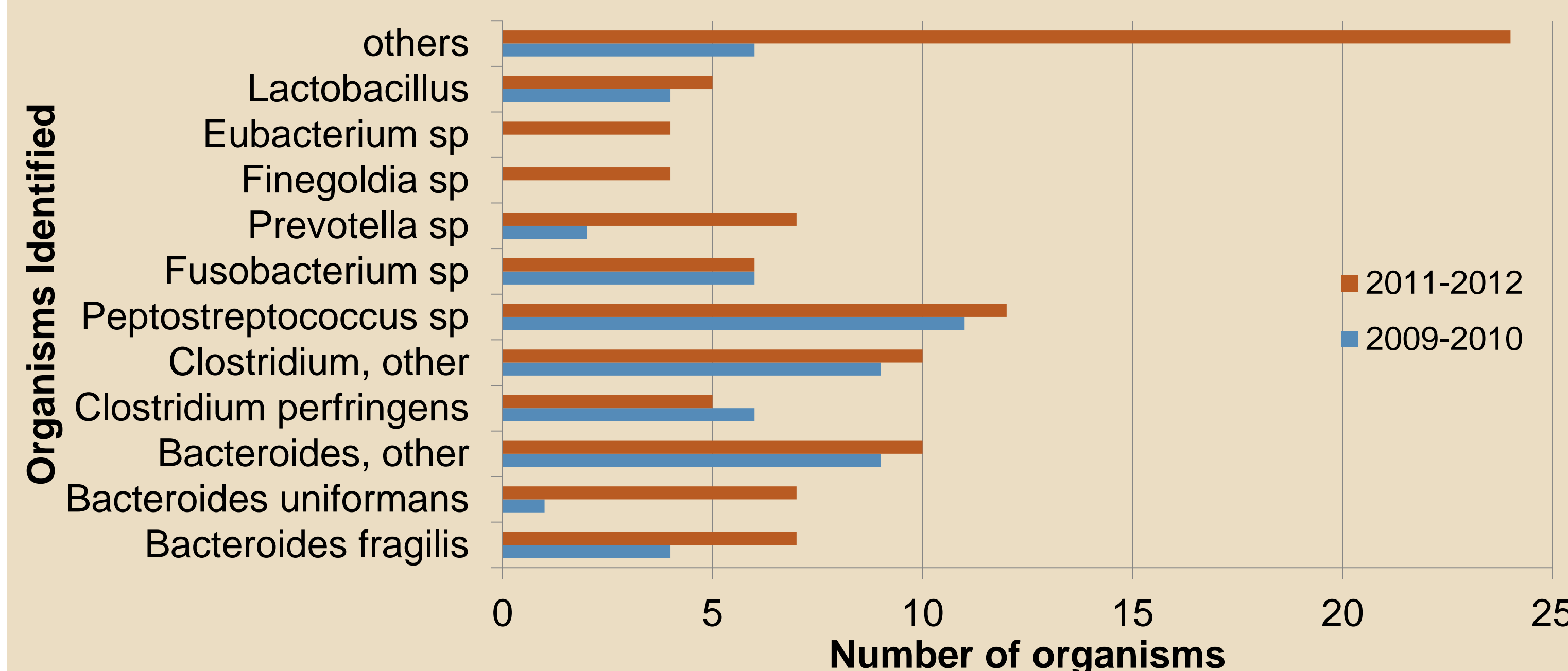
	2009	2010	Total 2009-2010	2011	2012	Total 2011-2012
Total # of cultures collected	15,727	14,035	29,762	14,189	12,453	26,642
Total cultures positive*	1,781 (11%)	1,403 (10%)	3,184 (11%)	1,890 (13%)	1,256 (10%)	3,146 (12%)
Total Obligate Anaerobes Isolated+	30 (1.7%)	28 (2.0%)	58 (1.8%)	50 (2.6%)	51 (4.1%)	101 (3.2%)

P values compare 2009-2010 period to 2011-2012 period:

*p<0.0001, *p=0.0005

The most commonly isolated organisms were *Bacteroides* sp, *Clostridium* sp, and *Fusobacterium* sp with 43, 31, and 9 cases respectively throughout the study period. There was no statistical difference in specific organism identification between time periods, although from 2011-2012 *Finegoldia* and *Eubacterium* were identified, which were absent from 2009-2010. Not all anaerobes were completely speciated, so it is possible some organisms that were not fully identified could have included these species. Other species which are frequent contaminants such as *Lactobacillus* and *Peptostreptococcus* were found equally between both study time periods, suggesting the increased isolation was not due to increased contaminant isolation.

Organisms Isolated over the 2 Study Periods



Other organisms identified: *Brevindomonas diminuta*, *Eggerthella lenta*, *Anaerococcus prevotti*, *Veionella* sp, *Bifidobacterium* sp, Anaerobic Gram + Rods NOS, Anaerobic Gram + Cocci NOS, not otherwise identified anaerobes

Table 2. Patient Characteristics	feb2009-jan2011 (n=31)	feb 2011-Jan2013 (n=31)
Additional contaminants identified	12(39%)	14(45%)
Location Drawn		
Cardiac/Renal Unit	7(23%)	2(6%)
ED	11(35%)	18(59%)
Medical & Surgical Wards/clinics	4(13%)	5(16%)
Intensive Care	9(29%)	6(19%)
Clinical Diagnosis		
Intraabdominal infection	9/19(47%)	9/17(53%)
Other anaerobic infection	6/19(32%)	4/17(24%)
Unpredictable site	4/19(21%)	4/17(23%)
Antibiotic dosed prior to culture collection	6/19(32%)	8/17(47%)
Anaerobic coverage	5/6(83%)	4/8(50%)

A random sampling of patients (n=62) from both time points were evaluated to identify differences in patient characteristics. Clinically determined contaminants, and clinical diagnosis, were similar between both time points. In ¼ of the cases, the source of the anaerobic infection was not predictable by the clinical context. Antibiotics were given prior to culture collection in less than half the cases. Patient characteristic were similar throughout the study period and did not explain the differences in blood culture yield.

DISCUSSION

After the change in blood culture media from BacT/Alert FN to BACTEC Lytic, there was an increase in overall bacterial isolation and obligate anaerobe isolation. Anaerobe isolation nearly doubled (1.8% to 3.2%) but not at the expense of contaminants, as this rate remained flat, either when identified clinically or by microbiologic definitions. Neither medium has antimicrobial removal components, eliminating this as a possible confounder. No significant differences in patient characteristics were identified that could explain the differences in the findings, suggesting there may be some property inherent to the BACTEC media which facilitates anaerobe growth.

The most commonly isolated organisms include the *Bacteroides*, *Clostridium* and *Fusobacterium* genera, which are likely pathogenic to humans. With the change in media, different organism families were identified, suggesting the BACTEC media may facilitate isolation of more fastidious anaerobes. It is not known if these findings translate into a difference in mortality, length of stay, or clinical practice. Further study is required.

CONCLUSIONS

- With institution of the BACTEC Lytic medium there was:
 - An increase in overall culture positivity over the study period
 - A doubling of the obligate anaerobes isolated (1.8% vs 3.2%)
 - Increased isolation of distinct Genera of anaerobes
- Clinical diagnosis of the affected patients were similar throughout the study period, excluding this as a confounder.

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