Incidence and Risk Factors for Acid-Fast Bacillus/Fungal Culture Positivity in Complex Primary, Conversion, and Revision Hip and Knee Arthroplasty

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INTRODUCTION: It is unclear if acid-fast bacillus (AFB)/fungal cultures should be routinely obtained along with standard aerobic or anaerobic cultures in hip and knee arthroplasty when there is concern for infection. The current thought is they should not be routinely obtained, but there is minimal published literature guiding this recommendation and risk factors for positivity have not been fully elucidated. Therefore, the purpose of this study was to evaluate the incidence of positive AFB/fungal cultures and determine predictive factors for positivity.

METHODS: A total of 238 knee and hip procedures were performed between January 2007 and January 2022 where intraoperative AFB/Fungal cultures were obtained. Procedures included primary total knee arthroplasty (TKA) (8), primary total hip arthroplasty (THA) (10), conversion (7 hips), first of 2-stage (41 knees, 25 hips), second of 2-stage (11 knees, 15 hips), irrigation and debridement (I&D) poly exchange (41 knees, 45 hips, 1 both), and aseptic revision (21 knees, 12 hips, 1 both). Positivity rates of intraoperative AFB/fungal cultures were calculated as binomial exact proportions with 95% confidence intervals and are displayed as percentages. Univariable generalized linear mixed models (GLMMs) estimated the unadjusted effects of demographics, individual comorbid conditions, and procedural characteristics on the logit of positive AFB/Fungal cultures.

RESULTS: The 238 knee and hip procedures recorded an overall positivity rate of 5.8% for intraoperative AFB/fungal cultures. Aseptic revisions showed the lowest rates of positivity at 3.6%, while conversions showed the highest rates of positivity at 14.3%. The positivity rates are highest among patients who are male (9.0%), of Hispanic origin (12.0%), with BMI <30 (6.4%), and a Charlson Comorbidity Index <5 (6.1%). On multivariate analysis, history of a prior infection in the same operative joint had increased odds of culture positivity (Odds ratio (OR): 3.47, 95% CI: 1.06-11.29, p-value: 0.039). Other demographic factors including age (OR: 1.01, p-value: 0.650), sex (OR: 3.07, p-value: 0.087), race (White vs. Black, OR: 0.98, p-value: 0.983; White vs. Other, OR: 2.01, p-value: 0.476), ethnicity (Hispanic vs. non-Hispanic origin, OR: 3.13, p-value: 0.195), BMI (OR: 0.98, p-value: 0.595), and Charlson Comorbidity Index (OR: 1.07, p-value: 0.431) did not show any significant influence on AFB/fungal positivity rates.

DISCUSSION AND CONCLUSION: These results suggest utility in obtaining routine intraoperative AFB/fungal cultures, given the relatively high positivity and poor predictive factors. However, it is important to note this study was performed an academic tertiary referral center and the results may not generalize to the population at large.

Table 1a. Positivity Rates For Lab Cultures by Demographic Characteristics (N=858)

		AFB/Fungal (n=238)	
	Total Sample N (%)	Sent to Lab N (%)	Positivity Rate (95% CI)
Total	**858 (100)**	**238 (28)**	**5.8 (3.3, 9.7)**
Total (excluding primary surgeries)	428 (100)	220 (51)	5.9 (3.2, 9.9)
Age, Mean (SD)	63.6 (12.1)	63.6 (12.9)	
<65 years, # (%)	438 (51)	119 (50)	5.9 (2.4, 11.7)
≥ 65 years, # (%)	420 (49)	119 (50)	5.9 (2.4, 11.7)
Sex, # (%)			
Male	386 (45)	111 (47)	9.0 (4.4, 15.9)
Female	472 (55)	127 (53)	3.1 (0.9, 7.9)
Race, # (%)			
White	625 (73)	178 (75)	5.6 (2.7, 10.1)
Black	162 (19)	37 (16)	5.4 (0.6, 18.2)
Other	71 (8)	23 (10)	8.7 (1.1, 28.0)
Ethnicity[+], # (%)			
Hispanic Origin	69 (8)	25 (11)	12.0 (2.5, 31.2)
Non-Hispanic Origin	784 (91)	210 (88)	5.2 (2.6, 9.2)
Unknown	5 (1)	3 (1)	0 (0, 70.8)*
Body Mass Index (BMI)[+], Mean (SD)	32.6 (7.9)	32.6 (8.0)	
<30, # (%)	328 (38)	94 (40)	6.4 (2.4, 13.4)
≥30, # (%)	514 (60)	142 (60)	5.6 (2.5, 10.8)
Charlson Comorbidity Index, Mean (SD)	5.0 (3.6)	4.7 (3.4)	
<5, # (%)	487 (57)	148 (62)	6.1 (2.8, 11.2)
≥5, # (%)	371 (43)	90 (38)	5.6 (1.8, 12.5)
Infection History			
Same Joint	123 (14)	57 (24)	12.3 (5.1, 23.7)
Contralateral Joint	21 (2)	5 (2)	20.0 (0.5, 74.6)

*Indicates one-sided, 97.5% Confidence Interval
[+]BMI: N=842, Ethnicity: N=853

Table 1b. Positivity Rates for Lab Cultures by Individual Comorbid Conditions (N=858)

		AFB/Fungal (n=238)	
	Total Sample N (%)	Sent to Lab N (%)	Positivity Rate (95% CI)
Comorbid Condition			
AIDS_HIV	6 (1)	3 (1)	33.3 (0.8, 90.6)
Malignancy	146 (17)	36 (15)	8.3 (1.8, 22.5)
CVD	155 (18)	30 (13)	0 (0, 11.6)*
COPD	269 (31)	71 (30)	8.5 (3.2, 17.5)
CHF	173 (20)	39 (16)	7.7 (1.6, 20.9)
Dementia	11 (1)	4 (2)	25.0 (0.6, 80.6)
Diabetes (without complication)	271 (32)	68 (29)	2.9 (0.4, 10.2)
Diabetes (with complication)	128 (15)	35 (15)	2.9 (0.1, 14.9)
Hemiplegia	14 (2)	2 (1)	0 (0, 84.2)*
Metastatic Solid Tumor	28 (3)	5 (2)	20.0 (0.5, 71.6)
Mild Liver Disease	186 (22)	39 (16)	7.7 (1.6, 20.9)
Moderate/Severe Liver Disease	25 (3)	4 (2)	0 (0, 60.2)*
MI	113 (13)	22 (9)	0 (0, 15.4)*
Peptic Ulcer Disease	43 (5)	12 (5)	16.7 (2.1, 48.4)
PVD	176 (21)	37 (16)	10.8 (3.0, 25.4)
Renal Disease	135 (16)	41 (17)	7.3 (1.5, 19.9)
Rheumatic Disease	123 (14)	28 (12)	0 (0, 12.3)*

*Indicates one-sided, 97.5% Confidence Interval

Table 1c. Positivity Rates for Lab Cultures by Surgery Type and Location (N=858)

		AFB/Fungal (n=238)	
	Total Sample N (%)	Sent to Lab N (%)	Positivity Rate (95% CI)
Surgery Type			
Primary	430 (50)	18 (8)	5.6 (0.1, 27.3)
1st of 2 stage	98 (11)	66 (28)	7.6 (2.5, 16.8)
2nd of 2 stage	83 (10)	26 (11)	7.7 (0.9, 25.1)
Conversion	15 (2)	7 (3)	14.3 (0.4, 57.9)
I&D poly exchange	140 (16)	87 (37)	4.6 (1.3, 11.3)
Aseptic revision	92 (11)	34 (14)	2.9 (0.7, 15.3)
Surgery Joint			
Knee	481 (56)	122 (51)	3.3 (0.9, 8.2)
Hip	375 (44)	114 (48)	7.9 (3.7, 14.5)
Both	2 (0)	2 (1)	50.0 (1.3, 98.7)

Confidence Intervals are Binomial exact 95% Confidence Intervals
* Indicates one-sided, 97.5% Confidence Interval Binomial exact 95% Confidence Intervals

Table 2a. Associations Between Demographics and Culture Positivity

	AFB/Fungal (n=238)	
Demographics	**Univariable OR (95% CI)**	**P-value**
Age (per year increase)	1.01 (0.96, 1.07)	0.650
Male (vs. Female)	3.07 (0.85, 11.11)	0.087
Race		
White	Referent	
Black	0.98 (0.16, 6.07)	0.983
Other	2.01 (0.30, 13.65)	0.476
Ethnicity		
Non-Hispanic Origin	Referent	
Hispanic Origin	3.13 (0.56, 17.53)	0.195
Body Mass Index (BMI)[+] (per 1-unit increase)	0.98 (0.90, 1.06)	0.595
Charlson Comorbidity Index (per 1-unit increase)	1.07 (0.91, 1.26)	0.431
Infection History		
Same Joint	3.47 (1.06, 11.29)	0.039

[+] Indicates missing values (See Table 1a)
- Not estimable due to sparse data

Table 2b. Univariable Associations Between Surgery Type and Location and Culture Positivity

	AFB/Fungal (n=238)	
	Univariable OR (95% CI)	**P-value**
Comorbid Conditions		
AIDS/HIV	-	-
Malignancy	1.54 (0.32, 7.36)	0.585
CVD	-	-
COPD	1.66 (0.47, 5.80)	0.431
CHF	1.62 (0.34, 7.88)	0.547
Dementia	8.78 (0.40, 191.15)	0.167
Diabetes (without complication)	0.32 (0.05, 2.07)	0.233
Diabetes (with complication)	0.43 (0.05, 3.93)	0.451
Hemiplegia	-	-
Metastatic Solid Tumor	6.84 (0.33, 143.07)	0.215
Mild Liver Disease	1.28 (0.27, 6.16)	0.756
Moderate/Severe Liver Disease	-	-
MI	-	-
Peptic Ulcer Disease	5.26 (0.61, 45.56)	0.131
PVD	2.40 (0.57, 10.05)	0.231
Renal Disease	1.29 (0.27, 6.06)	0.748
Rheumatic Disease	-	-
Surgery Type		
Primary	Referent	
1st of 2 stage	1.30 (0.11, 15.58)	0.836
2nd of 2 stage	0.95 (0.05, 17.75)	0.971
Conversion	3.60 (0.12, 110.80)	0.464
I&D poly exchange	0.76 (0.06, 9.30)	0.829
Aseptic revision	0.49 (0.02, 10.85)	0.653
Surgery Joint		
Knee	Referent	
Hip	2.53 (0.71, 9.02)	0.153

- Not estimable due to sparse data