Evaluation of the Diagnostic Approach to Native Spondylodiskitis

A single center retrospective cohort study

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Background

- Current approaches for diagnosis of native spondylodiskitis are variable, as is the yield of image-guided spinal biopsy.
- The sensitivity of image-guided biopsy cultures varies between 30% and 91%.[1,2]
- The combination of microbiologic and histopathologic analysis of spinal biopsy has been shown to improve overall diagnostic yield.
- We aim to describe the current approach to the diagnosis of native spondylodiskitis at our institution, including those diagnoses based on blood cultures with or without spinal biopsies, and the sensitivity of the biopsy. We also aim to identify predictors of a positive biopsy culture.

Methods

- Retrospective cohort study at the University of Kansas Medical Center, from Jan 1, 2007 to July 31, 2017.
- Inclusion: age of >18, imaging suggestive of spondylodiskitis, with either a positive blood culture and/or a spinal biopsy culture or histopathology.
- Exclusion: those with historical diagnoses or surgical site infections.
- Descriptive data was collected via HERON, ICD-9/10 codes, or chart review of the electronic medical record (EPIC). Data managed via REDCap.[3]
- Histopathology was the gold standard test for sensitivity and specificity calculation.
- A biopsy episode was considered positive if any one of multiple specimens it included resulted positive on cultures.
- Descriptive statistics, chi-square test, logistic regression models were used.

Figure 1: Patient selection and outcomes with blood cultures and biopsy culture with/without histopathology (HP)

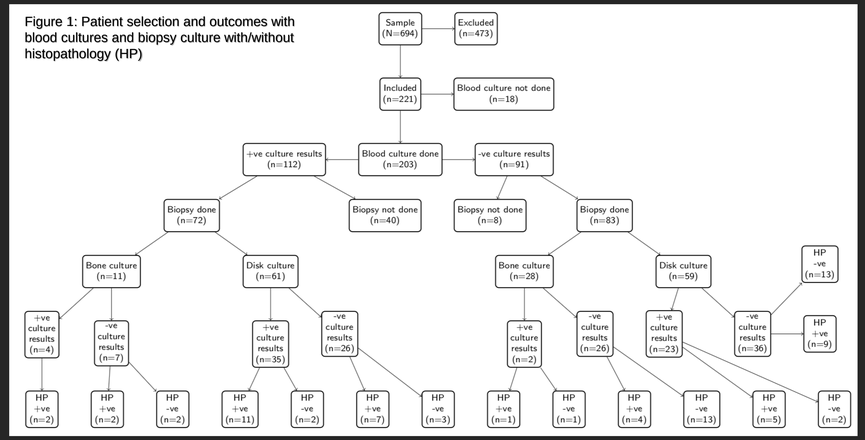
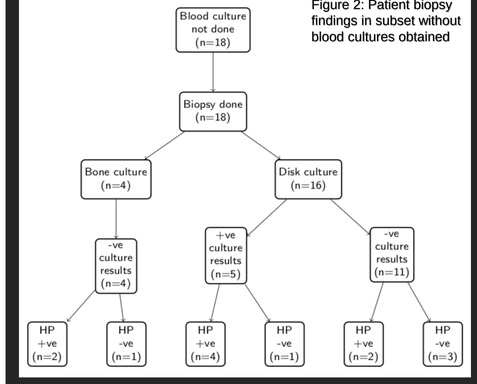


Figure 2: Patient biopsy findings in subset without blood cultures obtained



Results

- Over two thirds of our initial identified population were excluded due to diagnoses made outside of our institution or surgical site infections.
- Of those included, 173 (78.3%) had biopsies performed.
- Sensitivity of bone culture was 27.3%, with a specificity of 91.7%.
- Sensitivity of disk culture was 52.6%, with a specificity of 75.0%.
- A single biopsy episode sensitivity was 48.9%, and specificity was 80.8%. Disk culture had a higher yield than bone culture.
- On the logistic regression model, only a positive blood culture was predictive of a positive biopsy culture, with OR 3.42 (95% CI 1.63 – 7.20, p=0.0012).
- In patients with a negative biopsy culture, histopathology adds an estimated 15 – 43% yield in establishing the diagnosis of native spondylodiskitis by sensitivity analysis.
- 23 subjects had a second spinal biopsy, which added 26% yield.
- Prior antibiotics numerically (not statistically) decreased the biopsy yield, with OR 0.49 (95% CI 0.20 – 1.19, p=0.11).

Results

Table 1: Descriptive baseline characteristics with univariate analysis for predictor of positive biopsy culture.

Demographics & Comorbidities		Overall n=221 (%)	Univariate Analysis*		
			Positive biopsy culture, n=69 (%)	Negative biopsy culture, n=102 (%)	p-value
Age (mean)		60.18 (13.4)	57.77 (14.41)	60.25 (12.51)	0.23
Sex	Male	138 (62.4)	46 (66.7)	62 (60.8)	0.53
	Female	83 (37.6)	23 (33.3)	40 (39.2)	
Diabetes mellitus	Yes	103 (46.6)	33 (47.8)	45 (44.1)	0.75
	No	118 (53.4)	36 (52.2)	57 (55.9)	
Malignancy	Yes	34 (15.4)	13 (18.8)	16 (15.7)	0.74
	No	187 (84.6)	56 (81.2)	86 (84.3)	
HIV	Yes	5 (5.1)	3 (8.8)	2 (4.4)	0.65
	No	93 (94.9)	31 (91.2)	43 (95.6)	
Immunosuppressed	Yes	33 (14.9)	12 (17.4)	14 (13.7)	0.66
	No	188 (85.1)	57 (82.6)	88 (86.3)	
Alcoholism	Yes	22 (11.5)	7 (10.8)	11 (12.8)	0.90
	No	170 (88.5)	58 (89.2)	75 (87.2)	
IV drug use	Yes	19 (11.0)	7 (11.5)	10 (13.0)	0.99
	No	154 (89.0)	54 (88.5)	67 (87.0)	
Indwelling vascular catheter	Yes	42 (19.0)	15 (21.7)	19 (18.6)	0.76
	No	179 (81.0)	54 (78.3)	83 (81.4)	

Results

Table 2: Interventions and diagnostics, with univariate analysis for predictor of positive biopsy culture.

Diagnostics		Overall n=221 (%)	Univariate Analysis*		
			Positive biopsy culture, n=69 (%)	Negative biopsy culture, n=102 (%)	p-value
Blood culture result	Positive	112 (55.2)	39 (60.9)	32 (36.0)	<0.01
	Negative	91 (44.8)	25 (39.1)	57 (64.0)	
Organism in blood culture	*Staphylococcus aureus*	63 (56.2)	22 (56.4)	16 (50.0)	0.84
	Staphylococcus lugdunensis	3 (2.7)	2 (5.1)	1 (3.1)	
	Other	46 (41.1)	15 (38.5)	15 (46.9)	
Biopsy site	Cervical	8 (3.6)	1 (1.4)	7 (6.9)	0.15
	Thoracic	49 (22.2)	17 (24.6)	31 (30.4)	
	Lumbar	116 (52.5)	51 (73.9)	64 (62.7)	
Prior antibiotics (within 2 weeks of the diagnosis)	Yes	150 (67.9)	49 (71.0)	71 (69.6)	0.98
	No	71 (32.1)	20 (29.0)	31 (30.4)	
Imaging modality	MRI	167 (75.6)	57 (82.6)	75 (73.5)	0.25
	CT	38 (17.2)	9 (13.0)	17 (16.7)	
	PET scan	3 (1.4)	1 (1.4)	1 (1.0)	
	Nuclear med/Tc99/WBC scan	8 (3.6)	1 (1.4)	5 (4.9)	
	X-ray	4 (1.8)	0 (0.0)	4 (3.9)	

*Table 1 and 2: Only patients who had a spinal biopsy are included in the univariate analysis. 173 patients had biopsies done, but 2 patients had only histopathology and no cultures performed.

Conclusion

- Bone culture has a lower yield than disk culture.
- Disk culture has only 52% sensitivity.
- Histopathology of spinal biopsy adds an estimated 15 – 43% yield to the first biopsy, and a second biopsy adds 26% yield.

References:

[1] Michel SC, Pfirrmann CW, Boos N, et al. Ct-guided biopsy of subchondral bone and intervertebral space in suspected spondylodiskitis. AJR Am J Roentgenology. 2006;186:977-980.

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