Comparison of Video-Assisted Thoracoscopic Lung Biopsy vs. Bronchopulmonary Alveolar Lavage for Diagnosis of Fungal Disease in Pediatric Oncology Patients

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Introduction

- Pulmonary fungal infection is a known complication of the treatment of pediatric malignancy
- Accurate diagnosis relies on culture of fungi from pulmonary lavage fluid or open biopsy of lung parenchyma
- Minimally invasive lung biopsy techniques have decreased the morbidity/mortality of diagnostic lung biopsy procedures
- Aim: To compare diagnostic yields (DY) of bronchopulmonary lavage (BAL) lung washings vs. video-assisted thoracoscopic surgery (VATS) tissue biopsy

Methods

With IRB approval, the Oncology Registry and Electronic Medical Records at our institution were queried for pediatric oncology patients (age < 18yrs) who have had either BAL and/or VATS for assessment of possible pulmonary fungal infection as suggested by CT imaging during treatment for various malignancies from March 2005 to May 2014 for a retrospective analysis.

Demographics

Table 1.

Characteristic	All Patients (n=106)	BAL Procedures (n=116)	VATS Procedures (n=30)
Sex			
Male	55	59	15
Female	51	57	15
Race			
White	62	69	21
African American	15	15	5
Hispanic	10	12	2
Asian	2	2	0
Other	9	9	2
Unknown	8	9	0
Age at procedures			
Mean ± SD	8.8 ± 4.8	8.6 ± 4.6	9.7 ± 5.7
Median (range)	8.4 (0.3-17.9)	8.3 (0.3-17.9)	10.2 (1.7-17.5)

Results

Table 2. **Procedure count and diagnostic yield for corresponding oncological diagnosis**

Oncological Diagnosis	BAL Patients (n)	BAL Procedures (n)	BAL DY (%)	VATS Procedures (n)	VATS DY (%)
ALL	53	65	27.7	14	21.4
AML	24	24	25.0	8	62.5
Lymphoma	6	9	0.0	2	0.0
Neuroblastoma	3	3	33.3	0	n/a
Hepatoblastoma	2	1	0.0	1	0.0
Myeloid Sarcoma	2	1	100.0	1	100.0
Wilms Tumor	2	2	0.0	0	n/a
Biphenotypic Leukemia	1	1	0.0	0	n/a
Ewing Sarcoma	1	0	n/a	1	0.0
Glioblastoma	1	1	0.0	0	n/a
Inflammatory Myofibroblastic Tumor	1	0	n/a	1	0.0
Langerhan's Histocytosis	1	1	0.0	0	n/a
Lymphoproliferative Disorder	1	2	50.0	0	n/a
Malignant Neoplasm	1	0	n/a	1	0.0
Medulloblastoma	1	1	0.0	0	n/a
Myelodysplastic Syndrome	1	1	100.0	0	n/a
Osteosarcoma/Lymphoma	1	0	n/a	1	0.0
Pilocystic Astrocytoma	1	1	100.0	0	n/a
Refractory Bilineage Leukemia	1	1	0.0	0	n/a
Soft Tissue Sarcoma	1	1	100.0	0	n/a
Unknown	1	1	0.0	0	n/a

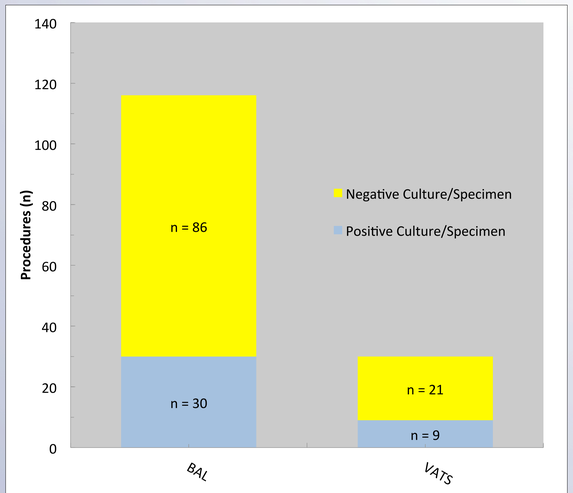

Figure 1. **106 identified patients who underwent 146 procedures**

Table 3. **Diagnostic Yields for Individual Procedures**

Overall n = 146	Total Positive Fungal Culture/Specimens / Total Procedures	27%
BAL n = 116	BAL Positive Fungal Culture/Specimens / BAL Procedures	26%
VATS n=30	VATS Positive Fungal Culture/Specimens / VATS Procedures	30%

Table 4. **Identified Fungal Species**

BAL Species identified from 30 positive culture/specimens	• *Candida albicans* (n=14) • *Candida glabrata* (n=3) • *Candida parapsilosis* • *Aspergillus niger* • *Cladosporium* • *Fusarium solani* • *Fusarium verticilloides* • *Paecilomyces* • *Penicillium* • *Phoma* • *Trichoderma* • Not otherwise specified (NOS) (n=9)
VATS Species identified from 9 positive culture/specimens	• *Aspergillus flavus* • *Aspergilus terreus* • *Cladosporium* • *Pneumonitis* • NOS (n=5)

Table 5. **Diagnostic yields for sequential procedures within 4 weeks (14 patients identified, with 1 patient responsible for 3 sets of sequential procedures)**

Sequential Procedures n =16	Total Sequential Procedures Positive Fungal Culture/Specimens / Total Multiple Procedures	63%
Sequential BAL n = 7	Sequential BAL Positive Fungal Culture/Specimens / Multiple BAL Procedures	57%
Sequential VATS n = 1	Sequential VATS Positive Fungal Culture/Specimens / Multiple VATS Procedures	100%
Sequential BAL & VATS n = 8	Positive Sequential BAL or VATS Fungal Culture/Specimens / BAL & VATS Procedures	63%

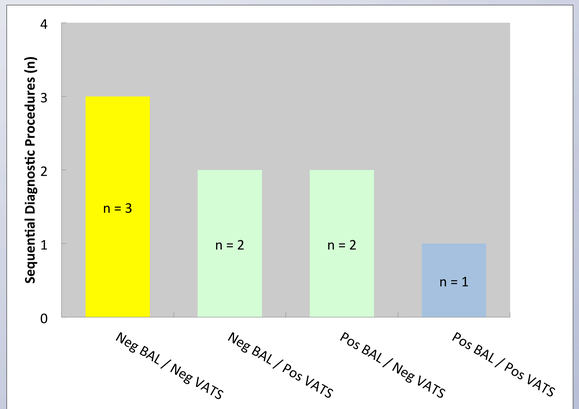

Figure 3. **Comparison of fungal culture/specimen results for sequential BAL and VATS procedures conducted on the same patient within 4 weeks. "Neg" = negative culture/specimen, "Pos" = positive culture/specimen results**

Table 6. **Sequential BAL and VATS identified fungal species**

Sequential BAL Species identified from 4 positive culture/specimens		• *Candida* (NOS) • *Candida albicans* (2) • NOS
Sequential VATS Species identified from 1 positive culture/specimen		• *Aspergillus terreus*
Sequential BAL/VATS Species identified from 5 positive culture/specimens	-BAL/+VATS	• *Aspergillus terreus* • *Cladosporium* • NOS
	+BAL/-VATS	• *Candida glabrata* • *Cladosporium*
	+BAL/+VATS	• *Candida glabrata* • *Phoma*

Conclusion

BAL and VATS procedures individually resulted in comparably low diagnostic yields for detection of pulmonary fungal infection in pediatric oncology patients; however, when these procedures are employed sequentially within 4 weeks of each other, the diagnostic yield increased substantially.

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