

# HIV-Associated *Pneumocystis Pneumonia* (PCP) in the Era of Combination Antiretroviral Therapy: Decline in the Sensitivity of Sputum Induction

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## BACKGROUND

Sputum induction (SI) is a sensitive and specific test to diagnose PCP. At San Francisco General Hospital (SFGH), SI has been the initial procedure to diagnose HIV-associated PCP since 1984. The reported sensitivity of SI for PCP at SFGH (using Diff-Quick, a modified Giemsa stain) is 81-82%.<sup>1,2</sup>

The combination antiretroviral therapy (CART) era began in 1996-1997 with the introduction of HIV protease inhibitors and their combination with nucleoside reverse transcriptase inhibitors. Since the CART era, the number of cases of PCP has declined. SI continues to be used, but it is unclear whether its sensitivity has been affected by the decline in PCP cases.

## OBJECTIVES

To examine the sensitivity of SI for PCP and the predictors of a positive SI among HIV-infected PCP patients in the CART era.

## METHODS

**Study Design:** Retrospective study conducted at SFGH from January 1, 1998 through December 31, 2004 (CART era).

**Subjects:** HIV-infected adult patients with PCP. Patients were diagnosed with PCP either by initial SI or, if SI was negative for *Pneumocystis*, by bronchoscopy with bronchoalveolar lavage (BAL).

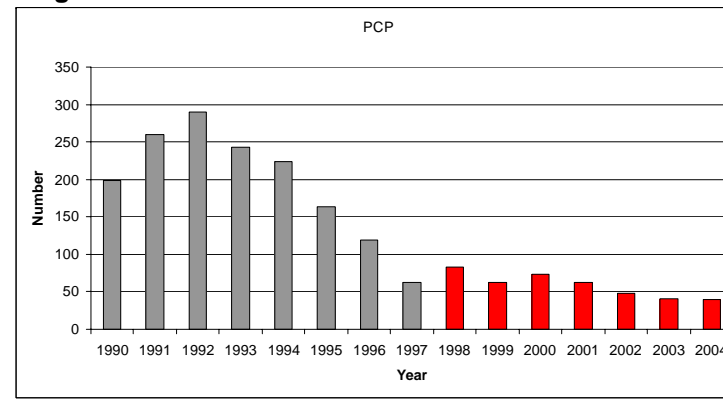
**Clinical Data:** Factors associated with HIV/AIDS and PCP, and SI and BAL results were collected through standardized chart abstraction and electronic medical records.

**Statistical Analyses:** Stata, version 8.0 (StataCorp).

## RESULTS

**PCP Cases in CART Compared to Pre-CART Era:** In the CART era, 357 HIV-infected patients were diagnosed with PCP (mean = 51 PCP cases per year, range 30-71 PCP cases). This represents a significant decline compared to the pre-CART era, 1990-1996 (mean = 214 PCP cases per year, range 119-290 PCP cases) (Figure 1).

Figure 1. Annual PCP Cases at SFGH 1990-2004



In the CART era, 321 (90%) of the 357 total cases of PCP were diagnosed by either initial SI or BAL following a negative SI; 36 (10%) of the total PCP cases were diagnosed by initial BAL, without preceding SI (e.g., patient intubated, unable to undergo SI).

**Sensitivity of Sputum Induction for PCP:** SI diagnosed PCP (SI+) in 241 of the 321 (75%) patients, while BAL following a negative SI diagnosed PCP (BAL+) in 80 (25%) patients [sensitivity = 75%].

Overall, the sensitivity of SI for PCP has declined from 1998-2002 to 2003-2004 ( $p = 0.014$ ) (Table 1).

### Sensitivity of Sputum Induction for PCP by Year

Year	1998-9	2000	2001	2002	2003	2004
SI+, n	77	54	42	29	20	19
Total, n	94	66	53	41	37	30
Sensitivity	82%	82%	79%	71%	54%	63%

PCP subjects from these two periods were similar in terms of their demographic features, HIV disease status, and PCP severity.

### Predictors of a Positive Sputum Induction:

SI+ patients had significantly higher median serum LDH values (367 IU/L vs. 322 IU/L,  $p = 0.028$ ) and median Alveolar-arterial oxygen gradients (46 mm Hg vs. 38 mm Hg,  $p = 0.021$ ) compared to BAL+ patients.

## CONCLUSIONS

In the CART era, the annual number of PCP cases diagnosed at SFGH has declined significantly.

The decline in PCP cases has been accompanied by a decline in the sensitivity of SI for PCP (2003, 2004).

The decline in sensitivity of SI for PCP appears to be unrelated to differences in subjects, HIV disease status, or PCP severity.

Studies to examine potential explanations for the declining sensitivity of SI and the role of polymerase-chain reaction (PCR) as an alternative method for PCP diagnosis are in progress.

### References

1. Ng. Arch Pathol Lab Med 1989;113:448-493.
2. Huang. Am J Respir Crit Care Med 1995;151:1866-1871.