



G063 Sputum smear for Gram staining: 4+ (> 25/lpf, > 10/oif) neutrophils, 1+ (1-4/lpf, <1/oif) epithelial cells, 4+ gram-positive cocci (suggestive of *S. pneumoniae*), 2+ gram-negative diplococci/cocci **Interpretation: suitable to culture**

HISTORY A simulated sputum smear with the history that it was collected from a 79-year old nursing home resident with a fever and cough being treated with levofloxacin was sent to category A, B, C, and C1 laboratories for Gram staining. It was anticipated that all laboratories would indicate that the sample was suitable for culture, report the presence of neutrophils and gram-positive cocci. The companion sample for culture, M063-3, which contained *Streptococcus pneumoniae* and *Moraxella catarrhalis* was sent to category A and B laboratories.

CMPT QA The sample contained 4+ (> 25/lpf, > 10/oif) neutrophils, 1+ (1-4/lpf, <1/oif) epithelial cells, 4+ gram-positive cocci, and 2+ gram-negative diplococci. It was created with cultures of *S. pneumoniae* and *M. catarrhalis*, the later added to mimic normal respiratory flora. The challenge was verified by internal quality control, which indicated 99% accuracy based on MIL-STD-105E¹.

GRADING (maximum grade =8) A grade of 4 was assigned to cellular component and bacterial component for a maximum grade of 8.

INTERPRETATION Only 67% (10/15) of the reference laboratories indicated “Suitable to culture”. This was consistent with the 71% (95/133) of laboratories overall that processed this sample and included a comment about the suitability of the sample for culturing (Table 1). It has previously been raised (see G061 May 2006 ADDENDUM and G043 sputum November 2004 that information of the Gram smear should always be available before the culture result, and since a critical laboratory decision has been made based on the smear, it is imperative that a smear interpretation be provided. Failure to check the suitability of the sample will be considered as a post-analytic reporting error.^{2,3}) To facilitate proper reporting, CMPT provides a simple checkbox. Of the 144 laboratories that received the slide 1 category B laboratory and 7 category C laboratories were ungraded as they indicated they do not routinely process this type of sample. Two category B laboratories that processed the sample also indicated the sample would be referred.

GRADING –Maximum grade = 8

Cellular Component: 100% (74/74) of category A, 98% (42/43) of category B, and 100% (20/20) of category C laboratories received a grade of 4/4 or 3/4.

Bacterial Component: 94.5% (70/74) of category A, 98% (42/43) of category B, and 80% (16/20) of category C laboratories received a grade of 4/4 or 3/4.

NOTE In all future sputum Gram smear challenges, a companion culture result WILL NOT be taken as inference of acceptability. Failure to report the Interpretation Component will be negatively graded.

CELLULAR COMPONENT (grade = 4) The cellular component was considered suitable for grading as all of the reference laboratories reported many neutrophils (either > 25/lpf or 3+/4+) and low numbers of epithelial cells. All laboratories that processed the sample reported many neutrophils and 134 of these laboratories reported low numbers of epithelial cells to receive a grade of 4. One category A laboratory reported 2+ epithelial cells and 1 category B laboratory reported 4+ epithelial cells. Neither of these laboratories provided a sample interpretation and both also reported ‘no growth’ on the companion sample M063-3. Table 2 summarizes the reports received and grades assigned. Based on their own reporting of epithelial cell content, neither of these samples should have been cultured, and as such, both were graded as 0.

BACTERIAL COMPONENT (grade = 4) All 15 reference laboratories reported 3+/4+ gram-positive cocci (n=12) or gram-positive diplococci (n=3) therefore this component of the challenge was considered suitable for grading. Six reference laboratories added the comment ‘suggestive of *S. pneumoniae*’ to their report.

All laboratories reported either gram-positive cocci or gram-positive diplococci with only a single laboratory reporting rare amounts of these bacteria. Some laboratories also noted the presence of other forms, but usually in much lower concentration. As such they were not considered as sufficient a deviation to warrant downgrading. Four laboratories reported the presence of yeast; in two instances, the report stated

“suggestive of *Cryptococcus*”. As no yeast were identified in any internal quality control, and no companion cultures identified yeast, and there was not opportunity for CMPT reagents to be contaminated with yeast, it is recommended that these laboratories review their staining reagents. Laboratories may return their slides to CMPT to confirm findings. Table 3 summarizes the reports received and grades assigned.

Table 1. G063 Interpretation: Suitable to culture. Results received from category A, B, C and C1 laboratories. This component was not graded.

Interpretation Report	A	B	C/C1	Total (% out of 133)	NOT-Graded
Specimen suitable to culture	53 (72%)	28 (70%)	14 (74%)	95 (71%)	(4)
No interpretation reported	21	12	5	38 (29%)	(0)
Specimens referred	0	3	8	11	(ungraded)
Total	74	43	27	144	/

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CLINICAL SIGNIFICANCE CMPT strongly supports and encourages the use of clinically informative reports including, where appropriate, the phraseology "suggestive of e.g., *S. pneumoniae*". Where more explanatory terms can be provided, CMPT supports their use, because they can provide a more informative report. Therefore, laboratories are encouraged to provide information in as clinically relevant a manner as possible, taking into account the experience and expertise of the reader. Often information provided in a manner that is understandable and interpretable by the clinician can help direct initial therapy.

For category A and B laboratories who received the companion swab, correlation between the Gram stain and culture results is important and where discrepancies occur, the smear should be reviewed and any amendments or comments can be added to the report to highlight any changes or discrepancies.

REFERENCES

1. Farnum NR. 1994. Ch. 11. Acceptance sampling. p. 305-361. *Modern Statistical Quality Control and Improvement*. Duxbury Press, Belmont, California.
2. CMPT critique G061 Sputum. Suitable for culturing. See Addendum. May 2006.
3. CMPT critique [G043](#) sputum. Suitable for culturing. November 2004.

Table 2. G063 Cellular component: Results received from category A, B, C and C1 laboratories and grades assigned.

Cells reported	A	B	C/C1	Total (% out of 136)	Grade
11-24, 10-25, .10, > 25, >100/lpf, 2+, 3+, 4+ neutrophils; +/- occ, 5, ≤ 10, < 25, 0-1, 0-3, 1/lpf, 1+ epithelial cells	73	41	20	134 (98.5%)	4
4+ neutrophils, 2+ epithelial cells	1	0	0	1	3
4+ neutrophils, 4+ epithelial cells	0	1	0	1	0
Gram smears not normally performed	0	1	7	8	ungraded
Total	74	43	27	144	

Table 3. G063 Bacterial component: Results received from category A, B, C and C1 laboratories and grades assigned.

Bacteria reported	A	B	C/C1	Total (% out of 136)	Grade
gram-positive cocci, or gram-positive diplococci , with or without pairs, chains, lancet shaped, suggestive of <i>S. pneumoniae</i> (27A, 7B) (reported as 1+/2+/3+/4+/>10, >25, > 20/oif) with or without 3+ (1C)/2+/1+ gram-negative cocci/diplococci or 2+ gram-negative diplococci suggestive of <i>Moraxella/Neisseria</i> sp.	69	33	15	117 (86%)	4
3+ /4+ gram-positive cocci and 1+/2+(1C) gram-positive coccobacilli with or without 1+ gram-negative bacilli or 1+/rare gram-positive bacilli	3	1	1	5	4
3+/4+ gram-positive coccobacilli and 4+ gram-negative cocci (1B)	0	1	1	2	3
3+ gram-positive cocci and 2+/3+ (1B) gram-positive bacilli	0	2	0	2	1
3+ gram-positive cocci, 2+ gram-positive bacilli, rare gram-negative diplococci, rare yeast cells	0	0	1	1	1
2+ gram-positive cocci, 3+ gram-positive diplococci, 1+ yeast	0	0	1	1	1
3+ gram-positive cocci and 2+/3+ (1B) gram-negative bacilli	0	4	1	5	0
Rare gram-positive cocci, 1+ gram-negative bacilli	0	1	0	1	0
3+ gram-positive cocci, few yeast "suggestive of <i>Cryptococcus</i> "	1	0	0	1	0
3+ gram-positive cocci, 3+ possible <i>Cryptococcus</i>	1	0	0	1	0
Gram smears not normally performed	0	1	7	8	ungraded
Total	74	43	27	144	