TABLE 1. Characteristics and Results of Studies That Investigated Methicillin-Resistant *Staphylococcus aureus* (MRSA) Colonization Among Healthy Chinese Individuals

		Population			
Author	Year	Profession	Number	Screening	MRSA colonization, no. (%)
Ma et al[8]	2011	Medical students	2,103	Nasal	22 (10.5)
Du et al[6]	2011	Medical students	935	Nasal	28 (3.0)
Qu et al[4]	2010	Military volunteers	1,044	Nasal	0 (0.0)

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Importance of Air Particle Counts in Hospital Infection Control: Insights From a Cancer Center in Eastern India

Clean rooms are classified in a variety of different ways, which include the International Organization for Standardization classification (ISO standards 14644–1; classes 1–9), Federal Standards (FED 209E) having Imperial type classification (Class 1 to 100,000), and the Metric classification (Metric 1–7).[1,2] The Imperial Class 100 room correlates with ISO 2 and the Metric 3.5 standard and is based on airborne particle counts (APCs) of 0.5 μm/ft^3. One hundred particles of 0.5 μm dimension per cubic foot by Imperial Standards equals 3,530 particles per cubic meter.[1,2] Maintaining the quality of air in critical areas such as bone marrow transplant or stem cell transplant units, clean operating rooms, and biological safety cabinets and laminar air flow hoods is essential for maintaining standards and optimizing outcomes for the patients and staff of the hospital.

In this study we describe the importance of APCs in maintaining and monitoring air quality in a cancer center in eastern India. The methodology included monitoring air quality using a handheld air particle counter (ErgoTouch Pro; Biotest [now MerckMillipore]).[3] This equipment measures airborne particles of 6 sizes (0.3 μm, 0.5 μm, 1 μm, 3 μm, 5 μm, and 10 μm) using lasers. It samples 0.1 ft^3 of air in a single sampling time of 1 minute. The results can be reviewed with the time of the exact sampling and show both differential counts (each size) and cumulative counts (of all 6 sizes). The air particle counter gives real-time data within a minute, which is not the case with air microbial sampling or settle plate methods, which need 48 hours for bacteria and 5 days for filamentous fungi for enumeration of colony counts.[4]

In a biological safety cabinet that is working optimally, APCs of all 6 sizes (0.3 μm to 10 μm) should be zero/ft^3—both differential and cumulative.

In a high efficiency particulate air (HEPA)–filtered Class 100 operating room, during nonoperating hours, with a functional air-handling unit and optimal sufficient air changes per hour, the APCs of 0.5 μm particles are ideally less than 100 per ft^3. The Report of the Joint Working Party on Ventilation in Operating Suites advised that all operating theaters should ideally have a ventilation equivalent of 20 air changes per hour.[5] Air changes per hour are calculated by dividing air supply rate by room volume.

Each set of readings performed on a particular day also details the minimum, average, and maximum reading for each channel, along with the standard deviation and standard error of these findings. For example, on a given day in February 2015 in the 8 operating rooms of this center, the 0.5 μm counts

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were as follows: minimum, 8/ft^3; maximum, 279/ft^3; average, 104.6/ft^3; standard deviation, 80.19/ft^3; and standard error, 20.71/ft^3. Similarly, on a given day in February 2015 in the 8 stem cell transplant rooms of this center, the 0.5 μm counts were as follows: minimum, 80/ft^3; maximum, 3,447/ft^3; average, 1,320.35/ft^3; standard deviation, 1,218.5/ft^3; and standard error, 295.53/ft^3 (see Online Table 1). For the stem cell transplant unit, the recommended air quality for its protective environment calls for at least 12 air changes per hour, central or point-of-use HEPA filters (99.97% efficiency in removal of particles ≥0.3 μm diameter), positive pressure differential of at least 2.5 pascals,[6] and HEPA-filtered environment in the entire complex, with spare sets of coarse and fine filters. It is much more difficult to maintain optimal APCs in stem cell transplant rooms because of the presence of patients, caregivers, staff, and furniture. Also, generally not all surfaces are epoxy coated, and a smaller number of HEPA filters results in fewer air changes per hour than in operating rooms.

Factors affecting APCs in a given environment are cleanliness of the area, air changes per hour, and integrity of the filter units in the air-handling unit. Any abnormality in the APCs should trigger a review of cleaning practices, air velocity checks using anemometers, and frequency of air-handling unit maintenance, including cleaning and integrity of coarse and fine filters as well as the HEPA filters. The latter may be assessed using the dioctyl phthalate test. Because of concern that dioctyl phthalate may have carcinogenic properties, it has been replaced by an alternative product. Polyalphaolefin is a noncarcinogenic liquid commonly used as a replacement for dioctyl phthalate.[7]

It is expected that those premises within the regulated confines of a hospital environment that have low air particle counts would demonstrate low suspended microbial (bacterial and fungal) counts. But there are studies to suggest that the two may not always correlate.[8] The lack of correlation could be due to multiple reasons, such as calibration of instruments, quality control of culture media, inappropriate sampling, and nature of the particles (cultivable/ noncultivable). In all cases of air quality evaluation in clean areas, the physical inspection of premises must be performed so that cleanliness, infection control practices, engineering problems, and general maintenance issues can be verified, and corrective measures implemented, even before actual air quality checks are instituted.

In our practice, APCs are a primary surveillance technique for air quality monitoring, and microbial counts of air quality have been performed only when abnormal air particle counts are registered or specific pathogens have been suspected. This strategy has saved valuable time and resources and also avoided the difficulty of interpreting microbial colony counts in situations where standards are not always available or unambiguous.

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Procalcitonin Is Not Useful to Discriminate Between Infectious and Noninfectious CRP Elevation in Patients with Non–Small Cell Lung Cancer

To the Editor—Lung cancer is a leading cause of cancer-related mortality worldwide. These patients frequently encounter infection during the course of their disease. C-reactive protein (CRP) already achieves high levels in cases with lung cancer without underlying infection, so its diagnostic specificity is limited.[1,2–4] Procalcitonin (PCT) has been demonstrated to discriminate between infectious and noninfectious inflammatory reactions in critically ill patients.[1,5–9] However, clinical data regarding to the utility of PCT in cancer patients with elevated CRP are inconsistent.

Between January and October 2013, PCT and CRP values were measured simultaneously in 100 cases of 63 patients admitted to our department. All of these patients were suffering from non-small cell lung cancer (NSCLC) and presented with CRP elevation. They were evaluated by medical history and physical examination. Patient characteristics were analyzed from medical records. Written informed consent was not acquired due to the retrospective nature of this noninterventional study. All patients underwent chest X-ray and/or thoracic computed tomography as well as laboratory and lung function tests. If necessary, abdominal and/or pleural sonography was performed. A clinically defined infection was diagnosed with a clinically evident source of infection. Microbiological analyses were performed on blood samples, urine specimens, stool samples, sputum samples, bronchoscopy aspirates, or specimens from other body regions suggestive of infection (eg, paracentesis or thoracocentesis). Peripheral venous blood was obtained from all patients. PCT concentrations were measured with an enzyme-linked fluorescent assay (VIDAS B.R.A.H.M.S PCT; Brahms Diagnostica GmbH, Germany). PCT concentrations <0.5 ng/mL were considered normal. CRP concentrations were determined using the CRP latex agglutination test and turbidimetry (COBAS INTEGRA System; Roche Diagnostics, Germany). CRP concentrations <5.0 mg/L were considered normal. Student *t* test and Fisher's exact test were used for univariate analysis. Correlation between PCT and CRP levels was evaluated using Pearson correlation coefficients (positive correlation with $r > 0$). Receiver operating characteristic [ROC] curve analysis was used to determine the accuracy of discrimination between infectious and noninfectious patients (area under the curve [AUC] <0.5, no diagnostic accuracy; AUC = 0.5, low diagnostic accuracy; AUC = 0.7, moderate diagnostic accuracy; AUC = 0.9, high diagnostic accuracy). Two-sided *p*-values <0.05 were considered statistically significant.

The mean patient age was 65.6 years, and 69.8% of patients were male. Of the total cohort, 76.2% had NSCLC stage IV and 57.1% had adenocarcinoma. Infections were observed in 79% of cases (infectious group, $n = 79$); none of these patients had sepsis or febrile neutropenia. Among the infectious group of 79 patients, the majority of infections (47 of 79, 59.5%) were caused by pneumonia; 14 (17.8%) were caused by acute exacerbation of chronic obstructive lung disease, 12 (15.2%) were caused by empyema; and 4 (5.0%) were caused by urinary tract infection, and 2 had other causes. The simultaneous elevation of PCT and CRP was not associated with higher risk for infection (odds ratio, 0.8; 95% confidence interval [CI], 0.26–2.55; $P = .93$). The mean CRP value was not significantly higher in the infectious group compared with the noninfectious group (144.6 vs 108.8 mg/L; $P = .09$), whereas the mean PCT value was not significantly higher in the noninfectious group (0.37 vs 0.50 ng/mL; $P = .47$). However, correlation between PCT and CRP values was positive in both the infectious group and the noninfectious group ($r = 0.48$ and $r = 0.80$, respectively). Regarding prediction of infection in NSCLC patients, the areas under the ROC curve for PCT and CRP were 0.46 and 0.59, respectively. Thus, especially PCT was not a discriminator between having and not having infection in this patient cohort.

In clinical practice, CRP and PCT are used for the diagnosis and follow-up of infectious diseases. For the diagnosis and follow-up of sepsis, PCT is superior to CRP[5–7]; however, only few reports are available on lung cancer patients. Tulek et al[2] evaluated CRP and PCT levels in 79 histopathologically proven NSCLC patients and 20 healthy controls. High CRP levels in noninfectious NSCLC patients were mainly related to performance status and were weakly related to tumor size. These investigators concluded that adding serum PCT measurement may contribute to exclude infections in patients with NSCLC.[2] Katsuhiro et al[9] investigated a total of 121 patients with advanced lung cancer treated with chemotherapy. Blood samples were obtained on the first day of fever. CRP and PCT were measured; sputum and blood cultures were collected. PCT-positive patients showed poor outcomes on antibiotic therapy. Furthermore, PCT was able to discriminate infective fever from fever due to inflammation.[9]

The overall aim of this study was to determine the diagnostic utility of PCT to discriminate between infectious and noninfectious CRP elevation in patients with NSCLC.

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