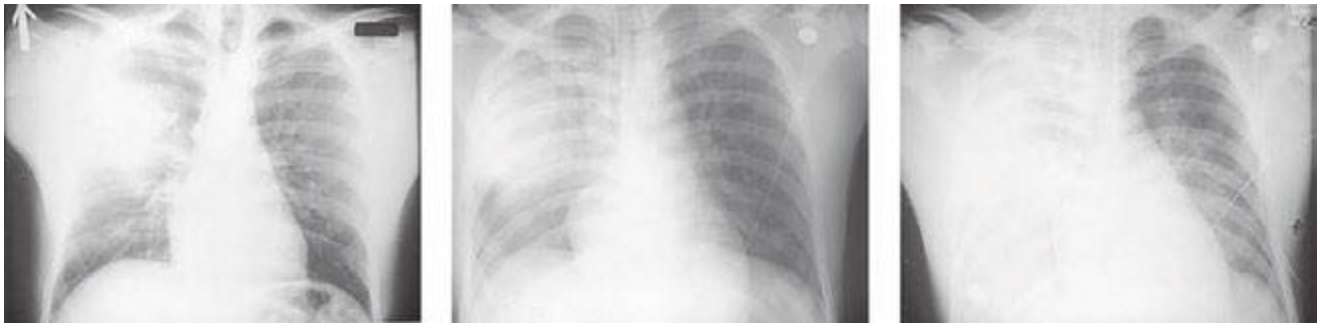

FIGURE 196-3 **Sequential chest radiographs of a patient with fatal primary plague pneumonia.** ***Left:*** Upright posteroanterior film taken at admission to the hospital emergency department on the third day of illness, showing segmental consolidation of the right upper lobe. ***Center:*** Portable anteroposterior film taken 8 h after admission, showing extension of pneumonia to the right middle and right lower lobes. ***Right:*** Portable anteroposterior film taken 13 h after admission (when the patient had clinical adult respiratory distress syndrome), showing diffuse infiltration throughout the right lung and patchy infiltration of the left lower lung. A cavity later developed at the site of the initial right-upper-lobe consolidation. *(Reprinted with permission from DT Dennis, GL Campbell: Plague and other Yersinia infections, in Harrison's Principles of Internal Medicine, 17th ed., AS Fauci et al [eds]. New York, McGraw-Hill, Chap. 152, 2008.)*

lymphadenopathy. Asymptomatic pharyngeal carriage of *Y. pestis* can also occur in close contacts of patients with pneumonic plague.

LABORATORY DIAGNOSIS

Because of the scarcity of laboratory facilities in regions where human *Y. pestis* infection is most common, and because of the potential significance of *Y. pestis* isolation in a nonendemic area or an area from which human plague has been absent for many years, the WHO recommends an initial presumptive diagnosis followed by reference laboratory confirmation (Table 196-1). In the United States, comprehensive national diagnostic facilities for plague have been in place since a federal Laboratory Response Network (LRN; *www.bt.cdc.gov/lrn/*) was set up in 1999 to detect possible use of biological terrorism agents, including *Y. pestis*. Routine diagnostic clinical microbiology laboratories that are included in this network as sentinel-level laboratories use joint protocols from the Centers for Disease Control and Prevention (CDC) and the American Society for Microbiology to identify suspected *Y. pestis* isolates and to refer these specimens to LRN reference laboratories for confirmatory tests (*http://www.asm.org/index.php/issues/sentinel-laboratory-guidelines*). *Y. pestis* is designated a "Tier 1 select agent" under the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 and subsequent executive orders; the provisions of this act, the Patriot Act of 2001, and related executive orders apply to all U.S. laboratories and individuals working with *Y. pestis*. Details of the applicable regulations are available from the CDC.

Yersinia species are gram-negative coccobacilli (short rods with rounded ends) 1–3 μm in length and 0.5–0.8 μm in diameter. *Y. pestis* in particular appears bipolar (with a "closed safety pin" appearance) and pleomorphic when stained with a polychromatic stain (Wayson or Wright-Giemsa; Fig. 196–4). Its lack of motility distinguishes *Y. pestis* from other *Yersinia* species, which are motile at 25°C and nonmotile at 37°C. Transport medium (e.g., Cary-Blair medium) preserves the viability of *Y. pestis* if transport is delayed.

TABLE 196-1 WORLD HEALTH ORGANIZATION CASE DEFINITIONS OF PLAGUE

Suspected case	Compatible clinical presentation ***and*** Consistent epidemiologic features, such as exposure to infected animals or humans and/or evidence of fleabites and/or residence in or travel to a known endemic focus within the previous 10 days
Presumptive case	Meeting the definition of a suspected case ***plus*** **Putative new or reemerging focus:** ≥2 of the following tests positive • Microscopy: gram-negative coccobacilli in material from bubo, blood, or sputum; bipolar appearance on Wayson or Wright-Giemsa staining • F1 antigen detected in bubo aspirate, blood, or sputum • A single anti-F1 serology without evidence of previous *Y. pestis* infection or immunization • Polymerase chain reaction (PCR) detection of *Y. pestis* in bubo aspirate, blood, or sputum **Known endemic focus:** ≥1 of the following tests positive • Microscopic evidence of gram-negative or bipolar (Wayson, Wright-Giemsa) coccobacilli from bubo, blood, or sputum sample • A single anti-F1 serology without evidence of previous plague infection or immunization • F1 antigen detected in bubo aspirate, blood, or sputum
Confirmed case	Meeting the definition of a suspected case ***plus*** • Identification of an isolate from a clinical sample as *Y. pestis* (colonial morphology and 2 of the 4 following tests positive: phage lysis of cultures at 20–25°C and 37°C; F1 antigen detection; PCR; *Y. pestis* biochemical profile) ***or*** • A fourfold rise in anti-F1 antibody titer in paired serum samples ***or*** • In endemic areas when no other confirmatory test can be performed, a positive rapid diagnostic test with immunochromatography to detect F1 antigen

Source: Interregional Meeting on Prevention and Control of Plague, Antananarivo, Madagascar, 7–11 April 2006 *(www.who.int/entity/csr/resources/publications/WHO_HSE_EPR_2008_3w.pdf)*.