ORIGINAL ARTICLE

Human Infection with a Novel Avian-Origin Influenza A (H7N9) Virus

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ABSTRACT

BACKGROUND

Infection of poultry with influenza A subtype H7 viruses occurs worldwide, but the introduction of this subtype to humans in Asia has not been observed previously. In March 2013, three urban residents of Shanghai or Anhui, China, presented with rapidly progressing lower respiratory tract infections and were found to be infected with a novel reassortant avian-origin influenza A (H7N9) virus.

METHODS

We obtained and analyzed clinical, epidemiologic, and virologic data from these patients. Respiratory specimens were tested for influenza and other respiratory viruses by means of real-time reverse-transcriptase–polymerase-chain-reaction assays, viral culturing, and sequence analyses.

RESULTS

A novel reassortant avian-origin influenza A (H7N9) virus was isolated from respiratory specimens obtained from all three patients and was identified as H7N9. Sequencing analyses revealed that all the genes from these three viruses were of avian origin, with six internal genes from avian influenza A (H9N2) viruses. Substitution Q226L (H3 numbering) at the 210-loop in the hemagglutinin (HA) gene was found in the A/Anhui/1/2013 and A/Shanghai/2/2013 virus but not in the A/Shanghai/1/2013 virus. A T160A mutation was identified at the 150-loop in the HA gene of all three viruses. A deletion of five amino acids in the neuraminidase (NA) stalk region was found in all three viruses. All three patients presented with fever, cough, and dyspnea. Two of the patients had a history of recent exposure to poultry. Chest radiography revealed diffuse opacities and consolidation. Complications included acute respiratory distress syndrome and multiorgan failure. All three patients died.

CONCLUSIONS

Novel reassortant H7N9 viruses were associated with severe and fatal respiratory disease in three patients. (Funded by the National Basic Research Program of China and others.)

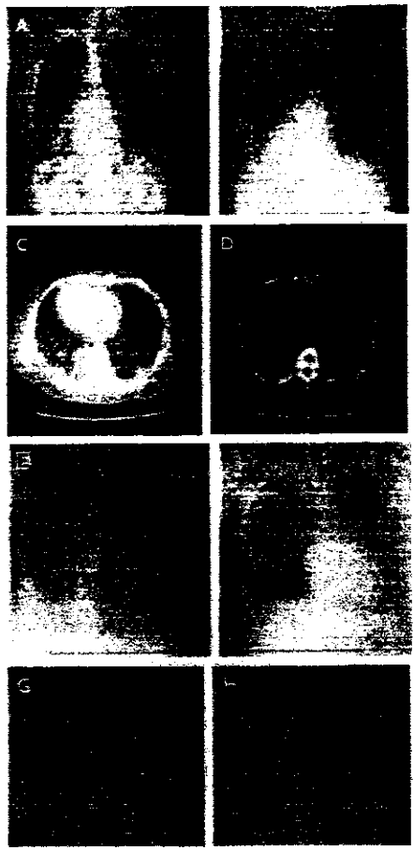

Figure 3. Chest Radiographs.

A chest radiograph (patient's heart is on the right side) of Patient 2 is shown in Panels A and B. Mild ground-glass opacity was observed on day 6 (Panel A). Bilateral ground-glass opacity and consolidation were clearly seen on day 9 (Panel B). A computed tomographic scan of the chest of Patient 1, obtained on day 7 (the day of admission), is shown in Panels C and D. Substantial bilateral ground-glass opacity and consolidation can be seen. Chest radiographs of Patient 2, obtained on day 7 and day 13 after the onset of illness are shown in Panels E and F, respectively. Bilateral ground-glass opacity and consolidation can be seen on day 7, and white lungs on day 13. Chest radiographs of Patient 3 on day 7 and day 13 after the onset of illness are shown in Panels G and H. Bilateral ground-glass opacity and consolidation can be seen on both day 7 and day 13.

Supplementary Table 3. Clinical characteristics of 3 patients infected with avian-origin influenza A (H7N9) virus (the worst findings during hospitalization)

No.	1	2	3
Maximal Temperature (°C)	40.2	39.6	39.4
Shortness of Breath	7 days after onset	7 days after onset	Five days after onset
Diarrhea	No	No	No
Lymphocyte (/mm^3)	530	190	600
Platelet (/mm^3)	78000	58000	154000
Procalcitonin (ng/ml)	0.327	0.409	0.83
LDH (u/L)	1929	1983	709
CK-MB (u/L)	27	37	41
PaO_2/FIO_2	108	80	60
Both Lungs Involvement	Yes	Yes	Yes
Consolidation	Yes	Yes	Yes
Mediastinal emphysema	No	Yes	Yes

Notes: WBC: white blood cell; CRP: C reactive protein; AST: aspartate aminotransferase; LDH: lactate dehydrogenase; CK: Creatine phosphate kinase.