

Spontaneous Pneumomediastinum, Pneumopericardium and Pneumorrhachis as potential complications of 2009 pandemic influenza A (H1N1) virus infection in healthy children

Case Report

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Abstract: We report on two cases of spontaneous pneumomediastinum and pneumopericardium, in one case associated with pneumorrhachis, occurring in two children suffering from the novel influenza H1N1 virus infection. At the admission both children presented with fever, violent dry cough, dyspnea and tachypnea. Radiological studies showed sizeable pneumomediastinum and pneumopericardium in both patients. One of the patients also a pneumorrhachis. Children were initially treated by intravenous broad-spectrum antibiotics, antipyretics and a cough sedative. Oral Oseltamivir (60 mg twice daily for 5 days) was administered after the diagnosis of influenza A (H1N1) virus infection. Patients' clinical condition quickly improved and children were discharged with a partial resolution of their radiological findings. Although these conditions are usually self-limiting and without respiratory or systemic consequences, their prompt recognition in children with H1N1 influenza virus infection is essential to establish fast and adequate therapy mainly related to the control of cough and the commencement of antiviral treatment.

Keywords: *Influenza virus infection • Pneumomediastinum • Pneumopericardium • Pneumorrhachis*

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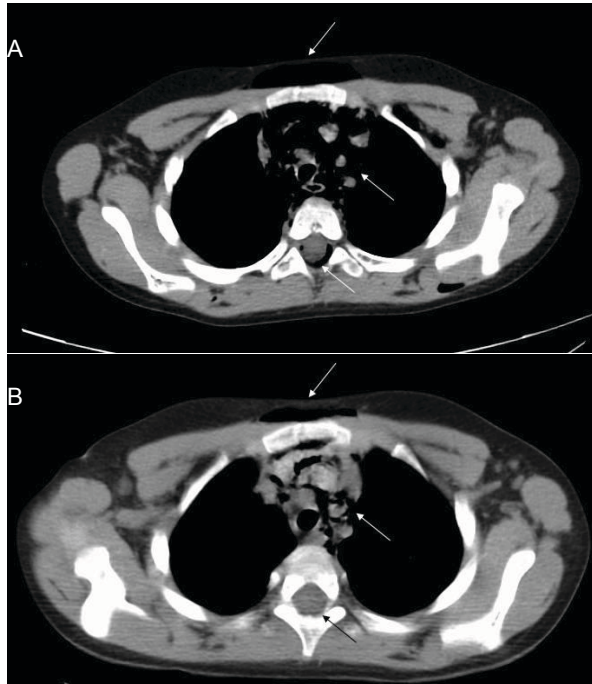
1. Introduction

In the last year, the world has been facing a new pandemic caused by an H1N1 influenza virus, the so-called H1N1/09 virus, which contains a unique combination of gene segments that has never been identified in humans or animals [1]. The novel influenza A H1N1 virus was identified as the main cause of the sudden outbreak of several febrile respiratory infections ranging from self-limited to severe illness both in children and adults. Children may be more liable to catch an H1N1 infection presenting with fever, violent cough, dyspnea, and bilateral patchy pulmonary shadows upon the inspection

of the chest radiograph [2]. Moreover, when patients are younger than 2 years of age they are at higher risk of being hospitalized [3]. The most common complications of H1N1 influenza virus included pneumonia, bacterial super-infections, and exacerbations of underlying medical conditions [4]. Normally healthy children could experience severe complications of such an infection. We report two previously healthy children affected by the 2009 H1N1 influenza virus who displayed spontaneous pneumomediastinum and pneumopericardium, in one case associated with pneumorrhachis.

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Figure 1. Chest axial Computed Tomography (CT) images showing: A. pneumomediastinum, pneumopericardium, pneumorrhachis and subcutaneous air (see arrows) B. partial resolution of pneumomediastinum, pneumopericardium and complete resolution of pneumorrhachis after 5 days from patient's admission.



2. Case Reports

2.1. Case 1

A previously healthy 7-year-old boy presented to the emergency room with a chief complaint of fever lasting one day with accompanying cough. On physical examination he had fever (38°C), persistent dry cough, dyspnoea and tachypnoea, prominent expansion of the abdomen when breathing and subcutaneous emphysema in the left side of his neck and upper chest. On chest auscultation the normal breath sounds were reduced and moist crackling rales were audible in the lower left lobe. Blood pressure was 130/80 mmHg, pulse was normal in force and rhythm (heart rate 130 beats/min). Arterial blood gas analysis showed: pH 7.47, pO₂ 82.4 mmHg, pCO₂ 29.6 mmHg; white blood cell count revealed lymphopenia (lymphocyte count 580/ml); C-reactive protein level was increased (54 mg/ml, normal values < 5 mg/ml). At the admission a chest radiograph was performed revealing pneumomediastinum and widespread subcutaneous emphysema, suspected apical pneumothorax and bilateral increase of lung density. A subsequent chest Computed Tomography (CT) scan showed a sizeable pneumomediastinum with

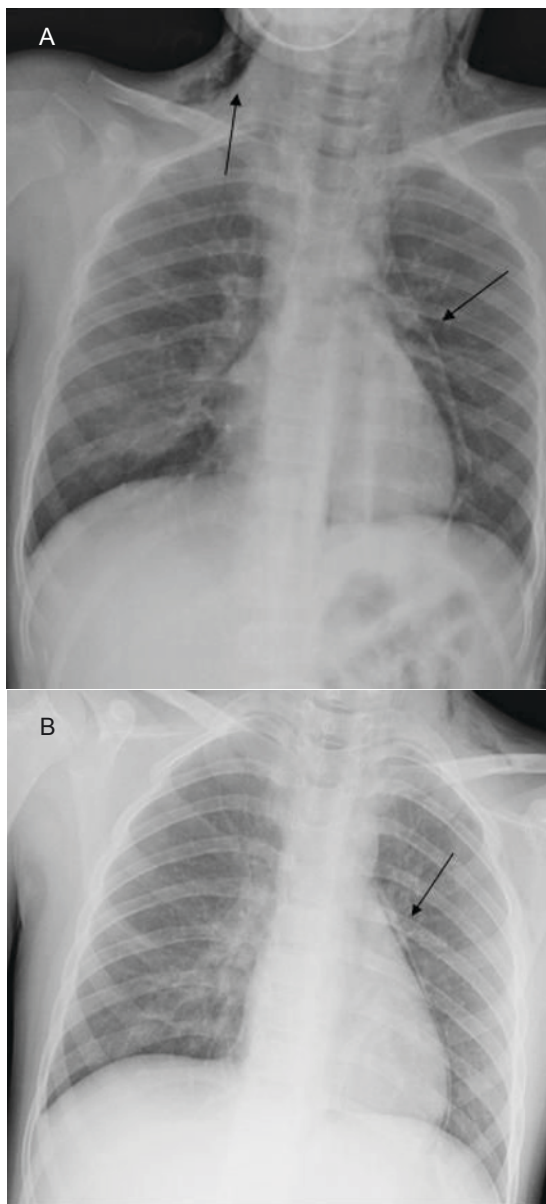
subcutaneous air, associated with pneumopericardium and pneumorrhachis (Figure 1A). Since his clinical conditions were deteriorating and his dyspnea was worsening (percutaneous oxygen saturation 88% breathing room air), the child was referred to our Pediatric Intensive Care Unit (PICU) where oxygen supplementation through venti-mask (0.5 FiO₂) was supplied. The patient was initially treated by intravenous Amoxicillin-Clavulanate and Clarithromycin, antipyretics, a cough sedative (cloperastine fendizoate), and maintenance intravenous fluids. The following day, since the diagnosis of influenza A (H1N1) virus infection was confirmed by Real Time Polymerase Chain Reaction (RT-PCR) on a naso-pharyngeal-swab specimen, oral Oseltamivir (60 mg twice daily for 5 days) was administered. The patient's clinical conditions quickly improved with progressive decrease of oxygen need and the child was discharged from the PICU 4 days after his admission. A control chest CT scan showed a partial resolution of both pneumomediastinum and pneumorrhachis after 5 days from his admission (Figure 1B).

The child's opinion was very difficult to obtain, due to his clinical condition, but his parents approved our decisions and signed an informed consent form.

2.2. Case 2

A 9-year-old boy was presented to the emergency room complaining of a non productive cough along with dyspnea which began 24 hours prior to arrival. Upon clinical examination he presented with dyspnea, tachypnea, fever, and violent cough. Chest auscultation revealed scattered fine and medium wet crackles in the right lower lobe along with reduced bronchovesicular sounds. Blood pressure was 81/49 mmHg, heart rate 144 beats/min. Arterial blood gas analysis showed: pH 7.37, pO₂ 76.1 mmHg, pCO₂ 39.5 mmHg; the white blood cell count was increased (Total Leukocyte Count 14.350/ml) with neutrophilia (neutrophil count 11.810/ml); C-reactive protein level was increased (27 mg/ml; normal values < 5 mg/ml). The first chest radiograph revealed an air-space consolidation involving the right middle and lower lobes. After a few hours the patient complained of chest pain. Clinical examination revealed extensive subcutaneous emphysema involving his neck. The chest X-ray confirmed the presence of the subcutaneous emphysema and showed pneumomediastinum and pneumopericardium (Figure 2A). Because of the progressive worsening of his respiratory pattern and the decrease in percutaneous oxygen saturation (82% breathing room air), we started oxygen supplementation via venti-mask (0.5 FiO₂) as soon as the child was referred to our PICU. At the admission the patient was

Figure 2. Chest X ray showing: A. pneumomediastinum, pneumopericardium and subcutaneous emphysema (see arrows) B. partial resolution of both pneumomediastinum and pneumopericardium after 3 days from patient's admission.



initially given broad-spectrum antibiotics (Amoxicillin-Clavulanate and Clarithromycin), a cough sedative (cloperastine fenzisoate), and maintenance intravenous fluids. The next day, pandemic influenza A (H1N1) virus was identified by RT-PCR in the naso-pharyngeal swab specimens and antiviral treatment with oral Oseltamivir (60 mg twice daily for 5 days) was started. In a few hours we saw him rapidly improving and showing no more need for oxygen supply. He was discharged from the PICU 1 day after his admission. A control chest x-ray

showed a partial resolution of both pneumomediastinum and pneumopericardium after 3 days from patient's admission to the PICU (Figure 2B).

The child's opinion was very difficult to obtain, due to his clinical condition, but his parents approved our decisions and signed an informed consent form.

3. Discussion

Spontaneous pneumomediastinum following influenza H1N1 virus infection is extremely rare and in literature there are a few reports on this association [2,5-6]. To the best of our knowledge, at the moment, this is the first case of pneumorrhachis associated with H1N1 infection, while no association with other influenza virus infection is reported in literature.

Spontaneous pneumomediastinum, pneumopericardium, and pneumorrhachis are uncommon entities *per se* indeed [7]. The former often results from rupture of pulmonary alveoles bordering bronchioles or pulmonary vessels and might be triggered by asthma, respiratory infections and several circumstances involving a Valsalva maneuver, such as coughing or vomiting [8].

Pneumopericardium is an uncommon but potentially serious condition and its leading cause is mechanical ventilation, diagnostic and therapeutic procedures or traumatic lesions, although cases have also been reported in association with asthma and community-acquired pneumonia [9]. Pneumorrhachis represents an exceptional imaging finding caused by various etiologies, mainly traumatic and iatrogenic [10]. Almost exceptionally, pneumorrhachis is found in combination with air distribution in other compartments and cavities of the body, particularly with pneumothorax, pneumomediastinum, or subcutaneous emphysema, as a consequence of violent coughing due to bronchial asthma or acute bronchitis [11-13]. An elevated respiratory rate can induce lung hyperinflation, a predisposing factor for peribronchovascular sheaths lesions induced by cough; through the direct communications at hilar level, the air-leak can progress to mediastinal, retroperitoneum and, especially, perirrachidic space, as in the two reported cases.

The coexistence of pneumomediastinum, pneumopericardium, and pneumorrhachis in H1N1-infected children may reflect some pathologic findings in the respiratory airways of such patients. Recently, it has been reported that influenza A virus infection attenuates the cough threshold of children, mainly in children with asthma [14]. The enhanced cough response following influenza A virus infection is probably mediated by

damage to the airways epithelium and may explain the rupture of the respiratory tract in previously healthy children, as reported in our patients.

In conclusion, although these conditions are usually self-limiting and without further respiratory consequences, their prompt recognition in children

affected by this novel pandemic influenza is essential to establish fast and adequate therapy, mainly related to control of cough and starting antiviral treatment.

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