

Five Viral and Bacterial Coinfection in A 17-Month-Old Girl: A Case Report

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Background: The present case reported a coinfection of five viral and bacterial organisms in a 17-month-old girl, who had not been vaccinated against measles, which further added to the complication of the disease management. The authors believed that the present study makes a significant contribution to the literature because sensitive cases such as a 17-month-old girl with compromised immune state without appropriated vaccinations in a hospital can result in contracting further infections and increase the treatment challenges. Therefore, this case warrants more attention and a proactive approach from the community and physicians in general.

Case Report: This study reports a case of a 17-month-old girl who had severe septic shock caused by coinfection with five viruses and bacteria. Following the infections, the patient developed septic shock that eventually improved with respiratory support, shock management, antibiotic therapy, and supportive treatment. It also was noticed that she had not been vaccinated appropriately. The suitable treatment was performed based on close monitoring of the signs and symptoms and identifying the causative organisms.

- Main symptoms: Following the infections, the patient had severe pneumonia and developed septic shock.
- Diagnosis: The patient was diagnosed with septicemia due to *Staphylococcus aureus* and coinfection with measles, influenza A, and adenovirus.
- Treatment: Anti-infection by vancomycin and gentamycin, anti-shock by noradrenaline and dopamine, immune system support, isolation, and infection control.

Conclusion: From the present case report, the authors can conclude that vaccination, isolation, and infection control are important for the prevention of coinfection.

Keywords: Coinfection, viruses, bacteria, hospital-acquired infection.

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A coinfection of viruses and bacteria has become a serious issue in many hospitals in the developing countries. These cases are usually severe and require complex managements. Here, the authors reported a case with severe coinfection due to viruses and bacteria. Although coinfection is the prognostic factor in infectious diseases, coinfection of five viruses and bacteria has rarely been reported in the literature.

Specially, the present case survived because of the suitable treatment, which was performed based on close monitoring of the signs and symptoms and identifying the causative organisms.

The authors believed that the present case study is a positive contribution to the literature because the case reports of a 17-month-old girl with anti-vaccination trend of patient's family that lead to coinfection resulting in increased treatment challenges. Hence, more attention and a proactive approach will be warranted for the community and physicians in general.

In conclusion, immunization, infection control, and isolation are important in mitigating coinfection due to viruses and bacteria in children.

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Table 1. Clinical and laboratory features and treatment at the National Children's Hospital

Day/month	Clinical signs and symptoms	Causes	WBC ($\times 1,000/\text{mm}^3$)	Neutrophils	Lymphocyte	Platelet ($\times 1,000/\text{mm}^3$)	CRP (mg/L)	Treatment
8/1	From 5 to 8/1/2019: high fever and rash	RT-PCR measles (+) on 10/1	3.7	25.7%	63.1%	123	7.8	Vancomycin + ceftriaxone + azithromycin
13 to 15/1	Tachypnea, rales in both lungs, and measles rash on day 6 of measles	EBV IgG (+) EBV IgM (+)	1.67	41.3%	28.2%	86	15.8	Vancomycin + meropenem Gammaglobulin $\times 1$ bottle $\times 2$ days
17/1	Fever, tachypnea, rales in both lungs, poor feeding	RT-PCR adenovirus (+) <i>Staphylococcus hominis</i> (+) in three blood culture samples	6.79	5.9%	55.5%	379	15.5	Colistin + levofloxacin + linezolid, ribavirin, leukokine $\times 3$ days
20/1	Respiratory failure, SpO ₂ 85-90%, tachycardia, weak pulse, blood pressure of 105/62 mmHg, and reduced mild fever shock	<i>Pantoea</i> spp. (+) in blood culture CMV IgM and IgG (+)	25.67	19.57 (76.3%)	2.60 (10.1%)	497		Mechanical ventilation with PC-SIMV, FiO ₂ : 100%, PIP 25 cm H ₂ O, PEEP 5 to >6 cm H ₂ O Respiratory rate: 36/minute Noradrenaline 0.2-0.4 $\mu\text{mol/kg/minute}$ + dopamine 10 $\mu\text{mol/kg/minute}$ Colistin+levofloxacin+Zyvox (linezolid), ribavirin

WBC=white blood cell; CRP=C-reactive protein; SpO₂=saturation of peripheral oxygen; RT-PCR=real time polymerase chain reaction; EBV=Epstein-Barr virus; CMV=cytomegalovirus; IgM=immunoglobulin M; IgG=immunoglobulin G; PC-SIMV=pressure controlled-synchronize intermittent mandatory ventilation; FiO₂=fraction of inspired oxygen; PIP=peak inspiratory pressure; PEEP=positive end expiratory pressure

Case Report

Ethic approval

The research upon which this article is based had received ethical clearance from the Hai Phong Medical and Pharmacy University. The approval (1283/QD-YDHP) was made in November of 2017.

Patient information

A 17-month-old girl who lived in the mountain province of the Middle of Vietnam was admitted because of fever at the National Children's Hospital on December 24, 2018. She was the second child with a history of normal delivery, full-term weight of 2.6 kg at birth, malnutrition grade 1, and was not vaccinated against measles.

The socio-economic status of her family was medium. The father was a driver and the mother stayed at home. There had no abnormal history of medical and psychosocial of patient's family.

The patient had high fever for 11 days before admission in the Infectious Department. The fever was persistent high-grade temperature of 39°C to 40°C with a poor response to acetaminophen. Additionally, she had a small cellulitis at the forehead and rashes all over the body. Her blood culture revealed a *Staphylococcus aureus* antibiotic multi-resistance sensitive with cephalosporin III. Subsequently, she was treated with ceftriaxone, gentamycin,

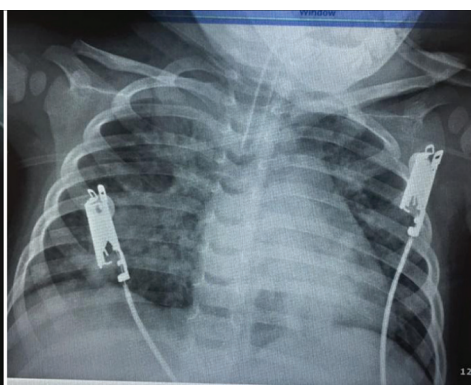
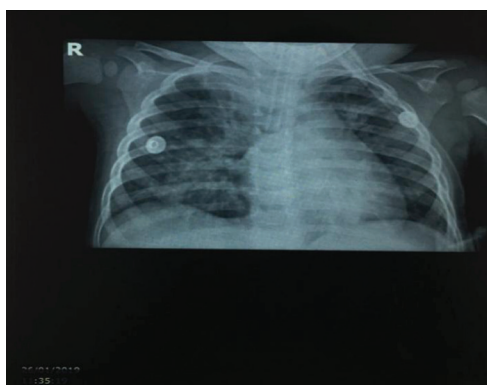
cefoperazone, and acetaminophen. After five days of treatment, the fever had resolved.

However, three days later, she had a cough, a runny nose, and a fever of 39°C to 40°C. The Influenzae A virus test was positive. Therefore, she was transferred to the National Children's Hospital.

Following 11 days of treatment, she was diagnosed with a coinfection of influenzae A. The possibility of upper and lower respiratory tract infections was obvious from the signs and symptoms. A chest X-ray revealed infiltrations mostly to the right side. Apart from antibiotics, she was given oseltamivir.

Fifteen days after hospitalization (day 26 of the disease), the patient experienced recurrent fever. Clinical examination revealed signs and symptoms of pneumonia. On the day after, she had rash and the real time polymerase chain reaction (RT-PCR) for measles was positive. Due to the measles, the number of white blood cell, especially neutrophils, decreased and made the immune system was weaker.

On day 6 of the measles infection, the patient developed septic shock (January 20, 2019) and the results of three blood cultures and one RT-PCR endotracheal fluid were positive with *Staphylococcus hominis* and adenovirus. Although she was treated with antibiotics and gammaglobulin, her condition



Chest X-ray on December 24, 2018: influenza A infection

Chest X-ray on January 20, 2019: after developing shock

Figure 1. The changes in chest X-ray during clinical treatment.

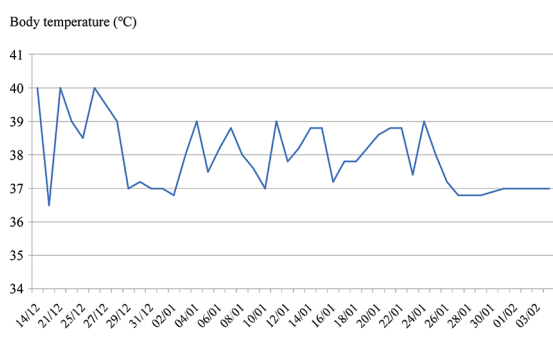


Figure 2. The variations in the body temperature of the patient during hospital stay.

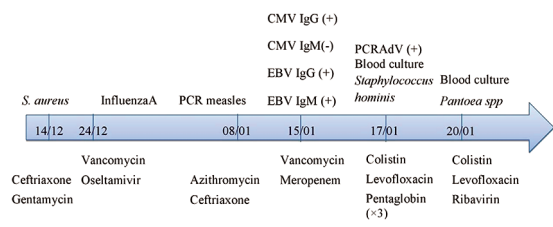


Figure 3. Microbiology results and treatment progress.

RT-PCR=real time polymerase chain reaction; EBV=Epstein-Barr virus; CMV=cytomegalovirus; IgG=immunoglobulin G; AdV=adenovirus

worsened. The patient was intubated and treated with noradrenaline and dobutamine for three days.

Antibiotics (colistin, vancomycin, and levofloxacin) and filgrastim were indicated. After three days of shock management, the patient recovered. Furthermore, she required mechanical ventilation for more five days before she full recovered. The immune status was reinvestigated, and no abnormalities were noted.

On January 27, 2019 (day 45 of disease), the patient got better and was discharged on February 4, 2019 with a diagnosis of pneumonia-septicemia due to *S. aureus*, coinfection of influenza A, measles, adenovirus, and Epstein-Barr virus (EBV).

The summary of her clinical, laboratory features, and treatment at National Children's Hospital are shown in Table 1.

The changes in her chest X-ray during the clinical treatment are shown in Figure 1.

The variations in body temperature of the patient during her stay at the hospital is shown in Figure 2.

The microbiology results that determined using RT-PCR of the patient's nasopharyngeal blood culture, and treatment progress are shown in Figure 3.

Discussion

Measles is a highly contagious viral disease. It is a major cause of death among children globally, despite the availability of a safe and effective vaccine⁽¹⁾. Here, the authors report a case with septicemia due to *S. aureus* in the Nghe An General Hospital in the middle of Vietnam. The patient was diagnosed with a coinfection of influenza A with signs and symptoms of pneumonia. Since pneumonia could modify the function of the respiratory system, increasing the probability of infection, the immune system response could have been suppressed. Moreover, it is more difficult to identify influenza infection in patients with previous septic conditions due to unclear signs and symptoms. Coinfection with influenza is considered as a cause of nosocomial infections. Properly identifying the causes including coinfection and nosocomial infections would allow appropriate treatment and choice of antibiotics. This in turn will generate better outcomes.

Hospital visit has been the largest risk factor for measles infection in patients⁽²⁾. In the present case, the patient experienced fever, rashes, and positive RT-PCR test for measles. The indicator of white blood cell, especially neutrophils decreased on day 26 of the illness.

Measles associated immune suppression might have increased the susceptibility for other viral infections and increased the frequency of multiple viral infection⁽³⁾. It is suitable for the present case that on the day 6 of measles, the patient was still febrile and had respiratory failure. Patient had *S. hominis* from positive blood culture and adenovirus from positive endotracheal fluid RT-PCR. Furthermore, in the present case, the girl had *S. aureus* and EBV.

Measles can lead to the suppression of the immune system and increase the possibility of acquiring adenovirus type 7^(4,5). Adenovirus type 7 is one of the common infections in children with measles. However, in the present study, the patient was not screened for this type of adenovirus.

Adenovirus coinfection with measles can make for prolonged fever and pneumonia, and result in the death of the patients⁽⁶⁾. Therefore, early detection of measles with RT-PCR has been recommended⁽⁷⁾. A report in 2014 by the National Children's Hospital included that adenovirus was a main cause of coinfection and adenovirus coinfection with measles associates with high mortality rate⁽⁶⁾.

Notably, patients without measles vaccination can acquire different viruses and bacteria in the hospital. Commonly, they could suffer pneumonia due to adenovirus, influenza A, measles, cytomegalovirus (CMV), EBV, and *S. aureus*^(3,7,8). Such infection can progress more severely, and patients can go into shock. Respiratory support, shock management, antibiotic therapy, and supportive treatments were indicated and helped in resolving the infection in the present patient (Figure 2).

Coinfection of five viruses and bacteria in a hospital setting of a 17-month-old girl without appropriate vaccination had led to the child's serious condition. The clinical picture was complicated. Close monitoring of the signs and symptoms helped in recognizing the new infection, and early identification of the causative organisms helped in the administration of the suitable treatments.

Conclusion

Vaccination is important to prevent certain infectious diseases in people. Isolation is vital to prevent hospital acquired infection.

What is already known on this topic?

Measles is a highly contagious viral disease, especially in unvaccinated children. Measles can lead to the suppression of the immune system and increase the possibility of acquiring coinfection, especially with virus and bacteria. Nosocomial infection is a major cause of severe condition and death among children globally.

What this study adds?

This report described a rare case of coinfection of five viruses and bacteria in the patient, which survived after 45 days of hospitalization.

The findings support the important role of vaccination, isolation, and infection control for the prevention of coinfection.

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Conflicts of interest

All authors declare that there are no conflicts of interest regarding to the publication or financing interest of this article. All authors declare that they permit the reproducing of pre-published information.

Patient perspective

The patient could share their perspective on the treatments they received anytime.

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