

## A successful cesarean section in a pregnant woman with A (H1N1) influenza requiring ECMO support

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### Abstract

A 24-year-old pregnant woman (29.4 weeks of gestation) with A (H1N1) influenza-associated adult respiratory distress syndrome was admitted to the intensive care unit. The patient was connected to femoral-jugular veno-venous extracorporeal membrane oxygenation (ECMO) 8 hours after admission. On the 7<sup>th</sup> day of ECMO support, due to the increasing threat to the life of the mother and the fetus, a decision was made to carry out a cesarean section (CS) without discontinuing the ECMO support. The CS was performed uneventfully under general anesthesia, 5 hours after the discontinuation of heparin infusion. A live, premature 1200 g female neonate was delivered. No complications occurred in the perioperative period. On the 17<sup>th</sup> day, the patient was successfully weaned off the ECMO and discharged 10 days later. The newborn was discharged from the hospital in good health 41 days after the delivery.

**Key words:** influenza, pregnancy, ECMO, cesarean section.

### Introduction

The influenza A (H1N1) virus was identified as the cause of the pandemic of 2009. As is the case with seasonal influenza, the pandemic virus A (H1N1) carried the risks of serious complications requiring treatment in an intensive care unit (ICU); pregnant and postpartum women were included in the risk group [1]. Pregnancy is associated with immunological changes, such as increased ventilatory demand as well as decreased functional residual capacity and oncotic pressure, which constitute predisposing factors for serious complications in pregnant and postpartum women when exposed to respiratory infection caused by an influenza virus [1, 2]. Primary viral pneumonia, which leads to

### Streszczenie

Ciężarna, lat 24, w 29,4 tygodniu ciąży z objawami ostrej niewydolności oddechowej dorosłych w przebiegu zakażenia wirusem grypy A (H1N1) została przyjęta na oddział intensywnej terapii. Osiem godzin po przyjęciu chorej rozpoczęto udowo-szyjne, żylna-żylna przezmembranowe natlenianie pozaustrojowe (ECMO). W 7. dobie leczenia, w związku z narastającym zagrożeniem życia matki i płodu, podjęto decyzję o wykonaniu cięcia cesarskiego (CS) bez wyłączenia ECMO. Odstawiono wlew heparyny i po 5 godzinach, w znieczuleniu ogólnym, wykonano CS. Urodziła się dziewczynka, żywa, niedonoszona, o wadze 1200 g. W okresie okołoperacyjnym nie obserwowano powikłań. W 17. dobie leczenia pacjentka została z sukcesem odłączona od ECMO, a 10 dni później wypisana do domu. Dziecko w dobrym stanie ogólnym zostało wypisane do domu 41 dni po urodzeniu.

**Słowa kluczowe:** grypa, ciąża, ECMO, cięcie cesarskie.

the development of adult respiratory distress syndrome (ARDS), is the most serious complication of influenza. The treatment of ARDS should be comprehensive and include a pharmacological strategy (anti-viral and antibiotic treatment), a non-pharmacological strategy (lung protective strategy, recruitment maneuvers, prone position ventilation), and verification of the diagnosis with a real-time reverse transcriptase-polymerase chain reaction (RT-PCR) assay, as well as a therapy adjunctive to mechanical ventilation – nitric oxide, extracorporeal membrane oxygenation (ECMO), arterial venous carbon dioxide removal, and high-frequency oscillatory ventilation. The following report describes the case of a pregnant woman who developed

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ARDS as a complication resulting from influenza A (H1N1) and was successfully treated with ECMO, during which an emergency cesarean section (CS) was performed.

### Case report

In March 2011, a 24-year-old pregnant woman (29.4 weeks of gestation), primigravida, was admitted to the ICU of a teaching hospital with symptoms of acute respiratory failure, having been transferred from the department of internal medicine of a district hospital. In anamnesis, the patient had been ill for the previous 5 days, exhibiting signs of acute upper respiratory tract infection, for which she had been treated on an outpatient basis with antibiotics and antipyretic medication. On admission to the ICU, the patient was in a critical condition, under analgosedation, intubated, and on mechanical ventilation. The mechanical ventilation settings were: controlled mandatory ventilation, volume control, fraction of inspired oxygen ( $FiO_2$ ) – 1.0, positive end-expiratory pressure (PEEP) – 5.0  $cmH_2O$ , tidal volume (TV) – 550 mL, respiratory rate (RR) – 22 per minute, with plateau pressure in the respiratory tract (Pplat) – 34  $cmH_2O$ , and compliance – 19 mL/ $cmH_2O$ . Blood pressure was 120/75 mmHg (without catecholamines), sinus tachycardia was 140 beats per minute (bpm), diuresis – 80-100 mL per hour, and body temperature – 36.6°C. Extensive crackling could be heard over both lung fields. Arterial blood gas (ABG) showed profound hypoxia with an oxygenation index  $PaO_2/FiO_2$  of 48.1, pH of 7.317, and normocapnia. The patient's plain chest PA X-ray image taken on admission to the ICU showed diffuse, almost homogeneous opacity of both lungs (Fig. 1).

Lung injury score was established at 3.25 points, which indicated a diagnosis of ARDS. Laboratory tests showed elevated levels of inflammatory response (C-reactive protein, CRP – 195.3 mg/L, N: < 10 mg/L) and infection parameters (procalcitonin, PCT – 0.49 ng/mL, N: < 0.05 ng/mL). The consulting gynecologist found no signs of threatened premature delivery. A decision was made to delay the delivery. Pneumonia was suspected as a complication resulting from the influenza A (H1N1) virus; treatment with oseltamivir, empiric piperacillin/tazobactam, and azithromycin was started. A virological examination was performed using the RT-PCR assay, giving a positive result for the presence of the influenza A (H1N1) virus. Although the parameters of mechanical ventilation were modified (TV of approximately 6 mL/kg, high Pplat (37  $cmH_2O$ ) and low compliance (17.7 mL/ $cmH_2O$ ) were observed. The ABG ( $FiO_2$  1.0) showed  $PaO_2$  of 48 mmHg,  $paCO_2$  of 48.7 mmHg, and pH of 7.304. A decision was made to place the patient on femoral-jugular veno-venous ECMO, which was commenced 8 hours after admitting the patient to the ICU. Once the ECMO was started, the patient required systemic heparinization. The ECMO flow was kept at 5.4 L/min (cardiac index – 4.56 l/min/ $m^2$ ) with 4500 revolutions per minute; protective lung ventilation was applied (pressure-controlled ventilation) with  $FiO_2$  – 0.3, Pplat – 20  $cmH_2O$ , RR – 10 per minute, PEEP – 10  $cmH_2O$ , and  $PaO_2$  kept at 70 mmHg. On the first day of ECMO support, the patient developed symptoms of acute kidney

insufficiency, and renal replacement therapy with the use of continuous veno-venous hemodiafiltration was started and maintained for three days until normal diuresis was observed. The values of inflammation and infection parameters gradually dropped. The patient received two 12 mg doses of dexamethasone separated by a one-day interval to accelerate fetal lung maturity. Fetal heart rate (FHR) monitoring was carried out every 2 hours, while cardiotocography (CTG) recordings were performed 2 times a day. On day 6 of ECMO support, an elevation in body temperature (38.8°C) and an increase in inflammation and infection parameters occurred (CRP – 131 mg/L, PCT – 0.46 ng/mL). The results of microbiological tests were negative. The antibiotic therapy was modified – piperacillin/tazobactam and azithromycin were discontinued, and empiric linezolid, cilastatin/impipenem, and fluconazole were commenced. The CTG recordings detected silent oscillation and FHR of 180 bpm. On day 7, the FHR was 190 bpm. A decision was made to perform a cesarean section (CS) without disconnecting the ECMO. The CS (30.3 weeks of gestation) was uneventfully performed under general anesthesia after a five-hour discontinuation of heparin infusion. A female neonate was delivered with Apgar scores of 2 and 5 (respectively at 1, and 5 minutes of life) and a weight of 1200 g. Endotracheal intubation and mechanical ventilation of the newborn were started immediately after delivery. The neonate was transferred to the pediatric ICU for further treatment. Heparin infusion was restarted 14 hours after completing the CS. No bleeding or thromboembolic events within the ECMO circuit were reported. On day 8, the test for the influenza A (H1N1) virus using an RT-PCR assay was repeated; the result was positive. For this reason, oseltamivir was discontinued and zanamivir inhalation was started. On day 10 of ECMO support, the patient's fever subsided. On day 14, a plain chest PA X-ray demonstrated increased aeration in the middle and upper parts of both lung fields with a regression of intra-alveolar changes. Inflammation and infection parameters returned to normal. A 15-day follow-up test was performed with the RT-PCR assay for the presence of the influenza A (H1N1) virus. The result was negative and zanamivir was discon-

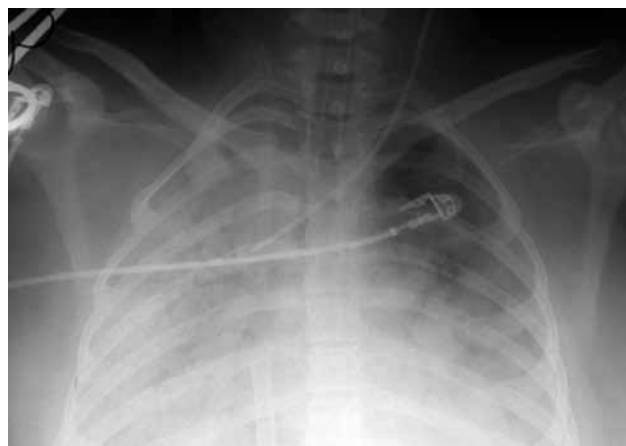
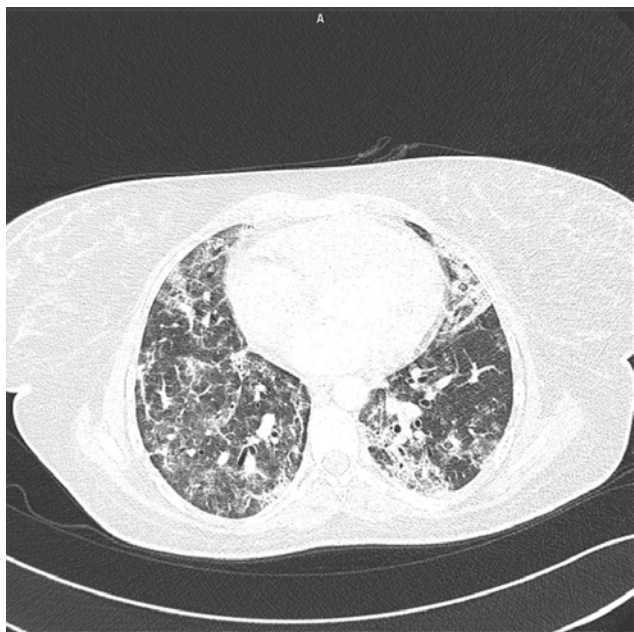


Fig. 1. Plain chest PA X-ray on admission to the ICU shows diffuse, almost homogeneous opacity of both lungs



**Fig. 2.** CT of the lungs on the 23<sup>rd</sup> day of treatment shows bilateral multilobar infiltrates and radiological symptoms of ARDS



**Fig. 3.** CT of the lungs 3 months after hospital discharge shows the regression of the changes in the lungs after treatment

tinued. On day 17, the patient was successfully weaned off the ECMO. After two more days, the patient was extubated, and empirical antibiotic therapy was discontinued. On day 23, computed tomography (CT) of the chest was performed, confirming the presence of bilateral multi-lobar infiltrates and radiological symptoms of ARDS (Fig. 2).

On day 27, the patient was discharged in good health. The newborn, having reached a weight of 2000 g, was discharged from the hospital in good health after 41 days. Three months after discharge from the hospital, the mother underwent a follow-up CT chest scan and spirometry. The CT scan revealed regression of the changes in the lungs after treatment (Fig. 3). The spirometry tests did not indicate any abnormalities.

## Discussion

Influenza A (H1N1) infection during pregnancy carries risks for the mother and the fetus. The rate of hospital admission for pregnant women with influenza A (H1N1) is higher than for non-pregnant women. During the 2009 flu pandemic caused by the A (H1N1) virus, studies showed that pregnant women were 7.2 times more likely to be hospitalized and 4.3 times more likely to be admitted to an ICU than non-pregnant women [3]. Mortality among pregnant women with influenza A (H1N1) who had required treatment in the ICU varied according to different sources from 8 to 17.6% [1, 2, 4]. In one group of patients, which included pregnant women, the conventional treatment for ARDS that developed as a result of influenza A (H1N1) was ineffective, and it was then necessary to use ECMO as a rescue therapy [4-6]. This paper presents the use of ECMO on a pregnant woman suffering from ARDS that developed as a result of influenza A (H1N1) infection. In a case such as this, starting ECMO saves the life of the mother, but exposes the fetus to

complications associated with systemic heparinization and extracorporeal circulation. Using the quickest possible intervention to deliver the fetus may shorten the ECMO use. It is, however, best to take the risk of starting ECMO, so that the child can reach a later gestational age, which increases the chance of survival. In the case described in this study, a CS was successfully performed using ECMO, and the decision to do this was taken due to the increasing threat to the life of the mother and the fetus. Previously, only one other similar case of performing a CS while using ECMO was mentioned in the scientific literature [7]. In other cases of pregnant women with influenza A (H1N1) requiring the use of ECMO that have been described to date, CS was performed either before starting ECMO or after its discontinuation [4]. The decision to perform a CS while the patient was on ECMO was not easy due to the increased risk of thrombosis from the required duration of heparin discontinuation. Major operations have been successfully performed under urgent conditions with temporary discontinuation of heparin infusion during the use of ECMO [8-10].

The case presented in this article ended with complete success for both the mother and the child. It seems that, while keeping the pros and cons fully in mind, it is worthwhile in certain situations to take the risk of performing a CS while ECMO is being administered. Certainly, the new generation of equipment for ECMO reduces the risk of complications from bleeding or thromboembolic events and makes the procedure safer.

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