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CASE REPORT

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The Management of a Thirteen Weeks Pregnant Woman Rendered Brain-Dead Following a Ruptured Aneurysm

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Abstract

Introduction: The current lack of clear guidelines on how to manage cases of brain-dead pregnant patients makes this topic controversial and extremely difficult to deal with for both medical and ethical reasons. This report deals with such a situation.

Case presentation: A twenty-seven years old woman, thirteen weeks pregnant, with a ruptured brain aneurysm was admitted to an Intensive Care Unit. She presented with loss of all brain functions, but somatic support was sustained to enable the delivery of her baby.

Conclusion: The case report gives a detailed account of the management of the mother before the successful delivery of her baby. It indicates the need for ongoing contributions to the debate on this delicate subject area to establish guidelines on how to manage brain-dead pregnant patients.

Keywords: brain-death, somatic support, pregnancy, foetus, ethics

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Introduction

Permanent and irreversible loss of all brain functions is legally considered as equivalent to the death of a patient. It is mostly caused by unexpected primary brain damage due to spontaneous bleeding or traumatic brain injury, making it even more tragic. It often affects people with no prior history of chronic illnesses who are fully functional.

After a patient is declared brain-dead, according to Polish law, the continuation of therapy is futile and unethical; therefore, mechanical ventilation is ceased leading to cardiac arrest. Under Polish law, an exception to this rule is when the patient is considered as a potential organ donor [1]. There is another, exceptionally rare and not well-defined exception, and that is when the patient is a pregnant woman, and consequently, the life of a foetus is directly dependent on maintaining the mother's biological functions. Lacking any clear legal instructions or medical guidelines, based on the available medical literature, it seems that maintaining the mother's life functions [2-4] to attempt to save a child can be both medically and ethically justifiable [5-8].

This case report describes and discusses the course of hospitalisation of a pregnant woman presenting clinical signs of brain death following a brain haemorrhage, undertaken to deliver her unborn child [9].

Case presentation

A twenty-seven years old, thirteen weeks pregnant woman was admitted to a local hospital due to a sudden loss of consciousness. The patient was found unconscious by her family at home and the estimated time from the collapse to the admittance to the hospital was approximately four hours. A computed tomography (CT) scan showed a subarachnoid and intracerebral haemorrhage in the left cerebral hemisphere. A subsequent computed tomography angiography (CTA) demonstrated a large fusiform aneurysm of the left middle cerebral artery.

The hospital lacked a neurosurgical department and therefore the patient was transported by medical air transport to a large, multi-speciality hospital where an urgent craniotomy and clipping of the aneurysm was undertaken. The time from the diagnosis of the burst aneurysm to the operation was approximately another four hours. After the surgery, the patient was admitted to the Intensive Care Unit (ICU).

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At the time of admittance to the multi-speciality hospital, the neurological state of the patient was extremely severe, recorded during the initial examination as four points on the Glasgow Coma Scale (GCS). After the surgery, the patient's state deteriorated to three points on the GCS; there were no pupillary light reflex and no reaction to painful stimuli to the cranial nerves.

Initially, during the ICU stay, the patient presented with cough reflexes and intermittent spontaneous breaths of four to six breaths per minute, but these ceased on the eleventh day of hospitalisation in the ICU.

A subsequent CT scans (Figure 1) showed vast areas of cerebral infarction, which correlated with the patient's clinical state. At this point, the patient presented with all the clinical signs of brain death [9], but due to the knowledge that her pregnancy was developing normally, the procedure of declaring brain death was halted, and comprehensive therapy was continued. The treatment initiated at the ICU consisted of ventilatory support, cerebral vasospasm prevention, antimicrobial prophylaxis, deep vein thrombosis prophylaxis, ulcer prevention, enteral and parenteral nutrition.

Throughout the ICU hospitalisation, the patient developed significant clinical problems which can be divided into those which directly resulted from the cessation of brain function and those unrelated to brain dysfunction.

Complications related to brain dysfunction included a lack of function of the hypothalamic-pituitary axis. Doses of up to 200 μg daily of levothyroxine (Berlin-Chemie AG, Berlin, Germany) given orally, and up to 300 mg daily of hydrocortisone (PharmaSwiss Česká Republika s.r.o., Prague, Czech Republic) given intravenously, were used to substitute for the dysfunctional thyroid and adrenal cortex.

Lack of production of vasopressin resulted in central diabetes insipidus, which caused the production of urine of over ten litres daily. Desmopressin (Ferring GmbH, Kiel, Germany) in doses of 0,5-1 μg, given intravenously, when diuresis exceeded 600 ml per two hours, as well as hypo-osmolar solutions for hypernatremia management, which at times exceeded 200 mmol/l.

Given the prognosis of the patient, a percutaneous tracheotomy was performed on the twelfth day of ICU hospitalisation.

After the second week of hospitalisation in the ICU, the patient presented with acute pancreatitis. A temporary break from enteral feeding was undertaken, and the patient received parenteral nutrition. Eventually, pancreatitis subsided, and intestinal function was restored. However, to meet the caloric and nutritional requirements the patient received both enteral and parenteral nutrition until the end of hospitalisation.

Ventilator-associated pneumonia (VAP) is a known complication in cases of prolonged respiratory support. In this case, the patient was ventilated for about one hundred and one days. Bronchoalveolar lavage (BAL) was performed every two weeks or if clinical signs of pulmonary infection were present. Two months after the admission to the ICU, a pathogenic colonisation of the airways was detected, which eventually resulted in reoccurring infections that met the criteria of sepsis. In addition to VAP, urinary tract infections were observed. While initially, the detected pathogens were of "wild" strain, the prolonged antibiotic treatment produced some highly resistant bacteria which included *Pseudomonas aeruginosa* from *BAL*, *Enterococcus faecalis* from blood cultures and *Enterococcus faecium* from urine cultures. *Enterococcus faecalis* was detected on the seventy-first day of hospitalisation, and *Pseudomonas aeruginosa* and *Enterococcus faecium* were detected on eighty-eighth day of hospitalisation.

Pseudomonas aeruginosa was resistant to carbapenems and fluoroquinolones, and *Enterococcus faecalis* showed a high-level of aminoglycoside resistance (HLAR). *Enterococcus faecium* was resistant to vancomycin (VRE).

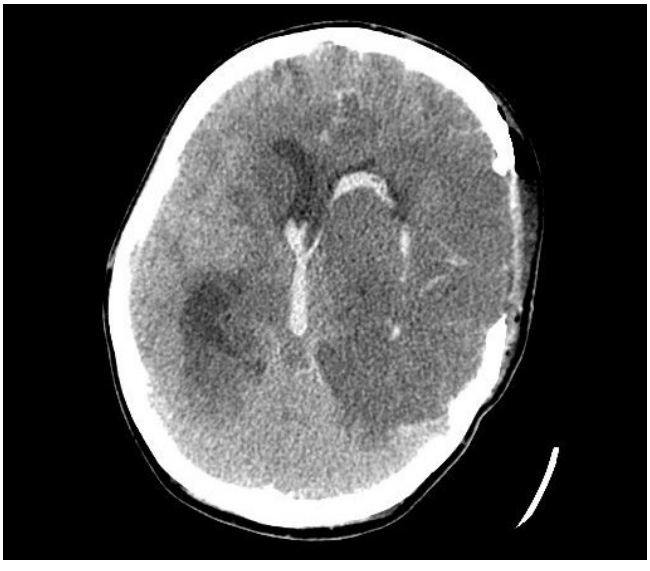

Fig. 1. A postoperative CT scan showing a massive stroke in the left hemisphere. A stroke in the right hemisphere, as well as blood in the ventricular system, are visible.

The choice of antibiotics was predicated primarily on their efficacy against the isolated bacteria rather than their safety of use in pregnancy. Beta-lactams were considered the drugs of choice.

The following regime was followed: Ceftriaxone (Polpharma SA, Starogard Gdański, Poland) 2 x 2 g intravenously, from first to ninth day, piperacillin with tazobactam (Pfizer Europe Ma Eeig, Bruxelles, Belgium) 3 x 4.5 g, intravenously, from tenth to nineteenth day, ceftazidime (Polpharma SA, Starogard Gdański, Poland), 3 x 2 g intravenously, from sixty-second to seventy-fifth day, and meropenem (AstraZeneca UK Ltd, Macclesfield, Cheshire, United Kingdom) 3 x 1 g intravenously, from seventy-seventh to ninety-first day.

For the *Candida albicans* infection, fluconazole (Fresenius Kabi Polska Sp. z.o.o., Warsaw, Poland) 1 x 400 mg intravenously, from eighty-fifth to the one hundred and first day, was used.

Consultants gynaecologists and obstetricians managed the course of the pregnancy. On the eightieth day of hospitalisation, at twenty-four weeks of pregnancy, betamethasone (MSD Polska Sp. z.o.o., Warsaw, Poland), 2 x 12 mg intramuscularly was given over 24 hours to stimulate the development of the foetus's respiratory system. At the time the estimated weight of the foetus was around 500 grams. Cardiotocography was used, and in the ninety-ninth day of hospitalisation, at twenty-seventh weeks of pregnancy, decelerations were observed, and a decision was made to deliver the child by caesarean section.

A female child was delivered, initially in a critical condition, with a birth weight of 830g. The child's Apgar scale was 4, 7, 7, 9, 9 points at the 1st, 5th, 10th, 15th, and 30th minute. She had developed typical complications of a preterm child, including respiratory distress syndrome and retinopathy. The child was ventilated for twenty-six days and then required non-invasive ventilation for another twenty-nine days. Surfactant was used in order to treat the respiratory distress syndrome. Unsurprisingly, the child developed an early infection for which meropenem was administered over fourteen days in a different department, with success. The newborn required parenteral nutrition, additionally to enteral nutrition up to the fourteenth day postpartum. Eventually, the child spent eighty-nine days in the neonatal ICU before being discharged home.

At a follow-up session, the father reported that, at six months of age, the child's condition was stable, and she was gaining weight and developing properly. The baby is under the ambulatory care of a paediatrician and ophthalmologist.

On the one-hundredth day of hospitalisation, an angiography of the mother's brain arteries showed no blood flow in the cerebrum. Following the Minister of Health's notice, the procedures to establish brain death were undertaken. On the one-hundredth and first day of hospitalisation, a thorough medical examination and apnoea testing were undertaken and resulted in the medical committee pronouncing the patient dead.

Discussion

There are few cases reported in the literature of reports of the pregnancy management of brain-dead patients, in a persistent vegetative state or a coma. Providing treatment for such patients is demanding for both medical and ethical reasons. An interdisciplinary approach and cooperation of doctors of different specialities, including anaesthesiologists and intensive care specialists, gynaecologists, endocrinologists, neurologists and neurosurgeons, are required to provide appropriate treatment and care.

Undoubtedly, ethical issues present most problems. A fundamental question is whether there exists a point in gestational age from which, if brain-death of a mother occurs, a child has a realistic chance of being born alive and relatively healthy. In a systematic analysis of thirty similar cases from years 1982-2010, the mean gestational age at the time of brain injury was twenty-two weeks [5]. In a different analysis of forty-three cases, from years 1976-2015, one trial reported that the foetus was 6-week old at the time of the mother's brain injury [7]. The mother was not brain-dead but in a persistent vegetative state. The baby was delivered, and though initially was in a critical state, it eventually progressed to a relatively healthy state.

At present, no legal regulations are asserting at what gestational age the vital functions of the mother should be maintained. Nonetheless, it seems that with the progress of neonatal intensive care, this boundary is moving towards the maintaining of the vital functions of the mother in cases of increasingly younger foetuses.

This problem raises many issues, and it especially shows in somewhat inconsistent sentences of the courts. In 2014, the Irish High Court ruled that maintaining life functions of a brain-dead, fifteen -week pregnant woman should not be continued and can be lawfully

withdrawn. Paradoxically, this ruling was given in a country with one of the strictest anti-abortion laws in Europe. The Court argued that the foetus had no realistic chance of being born alive, and thus continuing the treatment would expose it to unnecessary pain and suffering [10]. In 2016, a study was conducted in the US to establish whether there are in-hospital protocols on management of brain-dead, pregnant patients [11]. From a study of three hundred and seventeen different protocols, one categorically excluded declaring brain death in a pregnant patient, nine defined exceptional circumstances in which this procedure can be done; eight stated that brain death could be recognised when the foetus is considered beyond saving, which usually meant the gestational age below 24 weeks. Two hundred and eighty-nine protocols did not precisely define a state indicative of a brain-dead pregnant patient, and three hundred and five failed to designate who is authorised to decide on the prospects of the foetus in such cases.

Conclusion

The present case, together with similar other reported cases in the medical literature, shows that the matter of management of a brain-dead patient, is very challenging and calls for a unique and individual approach.

The current report outlines in detail, a methodology of care and treatment which resulted in the safe delivery of a child whose mother suffered irreversible brain damage due to a ruptured brain aneurysm when the foetus was thirteen weeks old.

Until more robust meta-analyses are forthcoming, and consequently guidelines are constructed, decisions in these cases should be carefully made and include consideration of both medical and ethical aspects as well as the opinions of the family and the Court.

Conflict of Interest

None

Acknowledgement

A written consent from the family was obtained in order to publish this article.

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