Case report

Vaginal delivery in the 30+4 weeks of pregnancy and organ donation after brain death in early pregnancy

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SUMMARY

A 28-year-old woman suffered a traffic accident resulting in severe head injuries with deleterious prognosis. Diagnostics further revealed a hitherto unknown pregnancy, at suspected week 9. Based on the patient's wish to donate organs, brain death protocol confirmed irreversible loss of brain function. Yet, vital pregnancy rendered organ transplantation impossible. Multiple ethical and legal issues arose, from invalidation of established legal care after brain death to the delivery of a healthy child after trauma and long-term critical care. After medicolegal and ethical counselling, pregnancy was sustained, and the goal of organ donation postponed. Critical care focused on foetal homeostasis. At 30+4 weeks, a viable girl was born via assisted vaginal delivery. Postpartal organ donation resulted in heart, kidney and pancreas transplantation. The case emphasises the medical, legal and ethical challenges to combine two apparently diametrical goals: the successful full-term pregnancy and the fulfilment of a patient's wish to donate organs.

BACKGROUND

This case highlights multiple medical, legal and ethical challenges in dealing with brain death during pregnancy. It shares features of already published cases but possesses unique challenges with respect to ethical conflicts. Further, it is the most extended critical care treatment in such a scenario reported so far, resulting in spontaneous labour with an apparently healthy newborn. The outcome is reassuring with both normal postnatal development for the newborn (discharge after 7 weeks of paediatric intensive care unit) and successful organ donation by the brain-dead mother.

In summary, this case report may serve as an encouraging decision-aid to put all efforts into critical care if the latter is presumably in accordance with the patient's will.

CASE PRESENTATION

A 28-year-old Caucasian woman suffered a serious traffic accident. With an initial Glasgow Coma Scale of 3, preclinical resuscitation and ongoing cardiorespiratory instability, the patient was transferred to a level 1 trauma centre. On admission, she presented with traumatic subarachnoid haemorrhage, right-sided carotid occlusion, left-sided carotid dissection, craniocervical dissociation and severe intrathoracic, intra-abdominal and bone injuries. Primary diagnostics had additionally revealed a hitherto

unknown pregnancy (first trimester, approximately week 9). The patient was in a relationship, but not married to the putative biological father.

INVESTIGATIONS

On day 3 after the accident, MRI of the neurocranium revealed profound infarctions, diffuse axonal injury and diffuse myelon lesions at the cervicomedullary junction. On day 5, intracranial pressure increased despite intense conservative treatment. In absence of invasive treatment options due to the devastating extent of cerebral damage, comprehensive discussions with family members and an ethics committee consultation resulted in the intention to switch to palliative treatment. On that occasion, family members reported the patient's strong will to donate organs in case of brain death based on the experience of life-saving organ donation to a member of her family.

On day 8 after admission, the patient presented signs of cerebral herniation with both pupils dilated and unresponsive to light. Diagnosis of brain death was confirmed according to valid recommendations by the German Chamber of Physicians¹ including clinical examination and additional electrocerebral silence (flat electroencephalogram). After brain death, the established legal care through patient's relatives became invalid. Furthermore, the existing vital pregnancy rendered organ donation impossible.

After extensive discussions with the guardianship court, legal care for both the patient and the fetus could be arranged for the presumed father of the child and the patient's sister. In accordance with medicolegal counselling, critical care treatment was continued to preserve pregnancy and—as a subordinated goal—to sustain the option of organ donation after delivery.

Thorough interdisciplinary discussion took place regarding the potential fetal risk due to radiation exposure. An expert assessment estimated prior radiation exposure to the fetus as 73 mSv. Such antenatal level is expected to result in an additional lifetime risk for lethal cancer of less than 1.1% (conservative assessment), an additional risk for childhood cancer of below 0.59%, as well as an additional risk of heritable defects of 0.15%. In summary, these figures were interpreted as indicating no relevant threat based on the radiation exposure. Throughout the subsequent treatment, any further iatrogenic radiation exposure was avoided.

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An interdisciplinary (critical care, anaesthesia, obstetrics, neonatology) contingency plan for delivery was developed and appropriate precautions and actions instituted. These were subsequently adjusted to the respective gestational age.

TREATMENT

During gestation, primary focus was the preservation of homeostasis and organ function, in order to provide best available medical care for the fetus. Due to extensive brain damage and herniation, the patient developed a primary hypopituitarism including severe diabetes insipidus, hypothyroidism and adrenocorticotrophic hormone deficiency. Treatment included hormonal substitution with desmopressin, L-thyroxine and hydrocortisone as well as symptomatic treatment of polydipsia and hyponatremia. After initial low-dose norepinephrine infusion, the patient was haemodynamically stable throughout the stay.

Controlled ventilation presented no major complications. Recurrent bacterial pulmonary and urinary infections were treated with antibiotics when symptomatic and after consultation with microbiologists, neonatologists and obstetricians, considering antibiotic susceptibility testing as well as potential harm for the fetus. Enteral nutrition included vitamins to meet needs of pregnancy. Ventilation and oxygenation were adapted to mimic physiological changes in pregnancy, such as oxygen saturation >98%. Haemoglobin levels were kept at >100 g/L (6.21 mmol/L) through iron substitution. Throughout gestation, obstetricians closely monitored fetal development. Intermittent ultrasound checks showed continuing fetal growth along the lower percentiles, normal fetal movements, organ development, amniotic fluid volumes and Doppler sonography of the umbilical artery. Regularly performed fetal heart rate tracings at the later stages of the pregnancy showed cardiotocograms (CTG) without pathological findings. Routine prenatal tests for immune status and rhesus factor were performed. Prophylactic induction of fetal lung maturation with 2×12 mg betamethasone was performed at 24th week, near presumed date of viability of the fetus, and was repeated once in the 30th week of pregnancy.

At 30+4 weeks, sudden maternal hypertension refractory to medication, tachycardia and mild proteinuria prompted the suspected diagnosis of acute pre-eclampsia and indication for an urgent caesarean section. At that time, fetal position was stable (breech position), heart action positive, no signs of placental abruption or premature membrane ruptures visible; CTG was initially uneventful but waned during preparations. Ultrasound scan displayed the fetal head deep in the pelvis. Vaginal examination revealed the fetal rump on the pelvic floor and further descending, prompting the decision for an assisted vaginal birth of a female child.

OUTCOME AND FOLLOW-UP

The child presented with an APGAR score of 7, 8 and 9 after 1, 5 and 10 min, respectively. The preterm required a short period of ventilatory support due to respiratory distress but further course was uneventful. Seven weeks later, the age-appropriate developed girl was discharged from hospital.

Based on the relative's feedback up to the publication of this case report (more than 1 year after birth), the development of the child had been uneventful.

Following delivery, the patient's relatives and legal guardians reaffirmed the patient's wish to donate organs. The national transplant coordination was informed and organ explantation prepared. The next day, both kidneys, heart and pancreas were procured and considered suitable for transplantation.

After organ explantation, the relatives again had the opportunity to two times per day farewell, although from a formal point of view death had occurred weeks before.

DISCUSSION

This case highlights multiple medical, legal and ethical challenges in brain death during pregnancy (cf. Burkle *et al*²). It shares features of published cases,³ but possesses unique challenges with respect to ethical conflicts.

According to relatives, the patient had clearly stated her wish to donate organs. While the diagnosis of brain death was required to pursue the goal of organ donation, it also led to invalidation of the legal guardianship. In their case presentation, Gopcevic *et al* did not conduct brain death diagnostics until after delivery, thus circumventing this legal limbo. In our case, a guardianship was ultimately successfully re-installed (including a legal registrar) also assuming care of the unborn child. (For the legal justification, cf. AG Würzburg.⁴)

Furthermore, the pregnancy was unknown or not communicated prior to the trauma. According to the relatives, the patient's stance on the prospect on children was unclear. In German law, a pregnancy (for reasons other than medical) can only be terminated in accordance with the mother's will that is self-declared following appropriate counselling. This decision must be a personal one and cannot be assumed by a legal guardian based on a 'presumed patient's will'. Thus, organ donation was no option until after delivery or intrauterine death of the fetus and subsequent curettage.

As the pregnancy was around 9 weeks at the time of trauma, successful pregnancy and delivery would require extensive critical care for months, of a patient already proclaimed brain-dead. Aside from medical challenges (meeting requirements for positive fetal development, maintaining organ homeostasis in a patient with pituitary dysfunction for such extended period, treatment of recurrent infections), the circumstances put a heavy strain on the critical care team. Counselling by a trained mediator was offered repeatedly and interprofessional supervisions took place, thus ensuring the commitment of the care team for the prolonged period of critical care.

The contingency plan developed with obstetricians and neonatologists on milestones and treatment including an algorithm for sudden events (ie, minimal gestational age for caesarian section) proved crucial for the successful realisation. It included an algorithm for alarming appropriate staff, an algorithm for transfer to the OR as opposed to delivery in bed on the intensive care unit and task delegation for the care of mother and child, among other logistics.

Moreover, close contact to and inclusion of the patient's relatives in decision-making throughout the duration of the stay were essential to ensure support of the care team and minimise the risk for social crises. Further, in view of the ethical and medico-legal explosiveness of the case, a press release was prepared with the Medical Director of the University Hospital and in alignment with the head of the legal department, in case of public awareness and media coverage.

Ultimately, both goals, the birth of a viable child, and the fulfilment of the patient's wish, the organ donation, could be achieved. To our knowledge, this is the most extended critical care treatment in such a scenario reported so far, resulting in spontaneous labour and subsequent organ donation. Esmaeilzadeh *et al* found in their systematic review a maximal duration of organ support of 107 days, the earliest gestational age at diagnosis was 13 weeks. Of 30 cases described, only 12 survived the neonatal period.⁵

Interestingly, the present case is not the first to describe a spontaneous delivery after brain death with hypopituitarism,⁶ yet without organ donation.

Of note, in the cited case, confirmation of the brain death (by means of the standard apnoea test) was postponed to the postnatal period (98th hospital day). Interestingly, and unlike the accepted procedure in Germany, it was stated that subsequently “the mother was transferred to a local hospital and died approximately 1 year after brain death”.⁶ The latter description emphasises the heterogeneous handling of such challenging situations, as well as a differentiation between the concepts of ‘brain death’ versus ‘dying’. Comparison of cases found in the literature highlights differences in medical decision-making based on existing locoregional legal situations⁷ as well as religious or cultural opposition of the concept of brain death,⁸ which renders any general recommendation on how to proceed in a clinical scenario presented here invalid.

Learning points

- ▶ Successful delivery of a vital child and postpartum organ donation after brain death during pregnancy are not mutually exclusive.
- ▶ Vaginal delivery after maternal brain death is feasible.
- ▶ A multidisciplinary approach including contingency plans is necessary.
- ▶ Early involvement of legal authorities is advisable to navigate through the necessities of legal and guardianship court’s requirements.
- ▶ Close contact to and inclusion of the patient’s relatives in decision-making throughout the period of care is essential to ensure support and avoid crises in the interprofessional care team.

In summary, while severe brain injury resulting in brain death is by definition a lethal condition, the presented case shows that despite hormonal disarrangement and prolonged critical care treatment, a patient may still have the ability to give spontaneous birth to a healthy newborn. Furthermore, brain death during pregnancy and organ donation may turn out not to be conflicting goals, after all.

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