



## ENDGAMES

## CASE REVIEW

# Acute maternal confusion and neonatal seizure postpartum

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A 32 year old nulliparous woman underwent induction of labour with dinoprostone at 41+2 weeks' gestation. Her membranes were artificially ruptured after 24 hours and she requested an epidural before augmentation of labour. A litre of Hartmann's solution was administered simultaneously with the epidural to correct any epidural-induced hypotension. A synthetic oxytocin (syntocinon) infusion (10 units/50 mL in sodium chloride 0.9%) was started at 2 cm cervical dilatation. She remained on intravenous fluid throughout her labour, receiving a further litre of fluid six hours later. At 8 cm cervical dilatation, a persistent fetal bradycardia warranted an emergency caesarean section. Estimated blood loss was 830 mL and she received 2 L of fluid intra-operatively.

She gave birth to a 3975 g baby girl with Apgar scores of 9 at one minute and 10 at five minutes. The mother received 10 units of oxytocin to achieve adequate uterine tone. A continuous infusion of 40 units of syntocinon in a litre of Hartmann's solution was also administered over four hours as per hospital protocol.

At 4 hours of age, the baby had a tonic-clonic seizure lasting 40 seconds and the mother became acutely confused. The mother was clinically euvolaemic and computed tomography of the head was normal. Blood results are shown in [table 1](#).

It later transpired the mother had drunk more than 4 L of fluid during labour, in addition to the 4 L given intravenously.

## Questions

1. What is the diagnosis?
2. What factors might contribute to the development of this condition intrapartum and postpartum?
3. How would you manage this condition?

## Answers

- 1.

## What is the diagnosis?

Dilutional hyponatraemia resulting from increased total body water with little change in total sodium.

Acute hyponatraemia (especially <125 mmol/L—profound hyponatraemia) can cause confusion and seizures resulting from brain cell oedema.<sup>1</sup>

Hyponatraemia can also cause neonatal seizures.

Low serum osmolality with a normal or high urine osmolality in a euvolaemic patient is also consistent with dilutional hyponatraemia.

NICE guidelines<sup>2</sup> recommend the use of “conservative measures” in the presence of a suspicious cardiotocography. This includes a change in maternal position and intravenous fluids if hypotensive. It is not uncommon for women to be prescribed 2–3 L of fluid throughout their labour—which does not cause symptomatic hyponatraemia in most women. However, women who continue to drink excessive volumes of oral fluid while they receive intravenous fluid are at risk of dilutional hyponatraemia, which may go unnoticed by healthcare professionals.

In pregnancy, water freely diffuses across the placenta, so fetal serum sodium and osmolality reflect those of the mother. Neonatal seizures occur in 1–5 per 1000 infants born at term.<sup>3</sup> The differential diagnosis would include hypoxic ischaemic encephalopathy, intracranial haemorrhage or infarction, infection, drug withdrawal, hypoglycaemia, and electrolyte disturbances (hyponatraemia, hypocalcaemia, and hypomagnesaemia).<sup>3</sup>

## 2. What factors might contribute to the development of this condition intrapartum and postpartum?

Excessive oral fluid intake.

Excessive intravenous fluid administration (notably hypotonic solutions).

Prolonged labour.

caesarean section.

Oxytocin boluses and infusion.

In a normal pregnancy, serum sodium decreases by 2–6 mmol/L because of the expansion of plasma volume. This reduces plasma osmolality by approximately 10 mOsm/kg,<sup>4</sup> which is maintained partly by the resetting of the osmotic threshold to a lower set point for antidiuretic hormone secretion, and which limits the ability to excrete excess water when osmolality falls. The result is susceptibility to severe hyponatraemia in the setting of high volume fluid intake.

Oxytocin is secreted from the posterior pituitary gland and is responsible for uterine contractions and the milk let-down reflex within the mammary glands during lactation. In obstetrics, syntocinon is given as a continuous infusion to stimulate and increase the frequency/strength of uterine contractions in labour. It can also be used during or after caesarean section to stimulate uterine contraction. It is diluted in sodium chloride 0.9% because of concerns regarding an increased risk of hyponatraemia when using dextrose 5%.<sup>5</sup> Oxytocin has a similar structure to antidiuretic hormone and has some antidiuretic properties. Therefore, the administration of syntocinon can increase the reabsorption of water in the collecting duct of the kidneys and can increase the risk of dilutional hyponatraemia in labouring women.<sup>6</sup>

Intravenous fluid is commonly prescribed in labour for nausea/vomiting, dehydration, pyrexia, suspicious cardiotocography with evidence of maternal hypotension, blood loss, and volume expansion during epidural regional anaesthesia. Crystalloid solutions are used in these circumstances, particularly the more “physiological” solutions such as Hartmann’s solution (sodium content: 131 mmol/L), Ringer’s lactate (130 mmol/L), or Plasma-lyte (140 mmol/L). These fluids contain lower concentrations of sodium than sodium chloride 0.9% (154 mmol/L), and therefore may exacerbate dilutional hyponatraemia. A prospective observational study of labouring women at term found that hyponatraemia (<130 mmol/L) was associated with a prolonged second stage of labour, receiving >2.5 L of fluid during labour, instrumental delivery, and emergency caesarean section for failure to progress.<sup>7</sup> However, in this study there was no substantial correlation with hyponatraemia and oxytocin administration or epidural analgesia.

3.

### How would you manage this condition?

Request specialist input from obstetric medicine, internal medicine, and/or nephrology.

Measure serum sodium if fluid balance is positive >1500 mL.

Once serum hyponatraemia is identified, request serum and urine osmolalities.

Chart the fluid balance and restrict fluid input to around 30 mL/hour.

Measure serum sodium every 6 hours until it is >130 mmol/L. Avoid an increase ≥10 mmol/L during the first 24 hours and ≥8 mmol/L every 24 hours thereafter.<sup>8</sup>

Achieving serum sodium >130 mmol/L minimises the risk of cerebral oedema and central pontine myelinolysis.<sup>8</sup>

Consider an intravenous infusion of 3% hypertonic saline over 20 minutes if there are severe symptoms such as seizure, Glasgow Coma Scale ≤8, or cardiorespiratory compromise.<sup>8</sup> However, in practice this is not usually required for intrapartum

and postpartum dilutional hyponatraemia as severe, persistent symptoms are rare due to the fast rate of resolution following postnatal diuresis. The correct diagnosis and management of hyponatraemia with fluid restriction will result in most women making a spontaneous recovery.

### Prevention

Increase awareness of the susceptibility of labouring women to severe hyponatraemia.

Discourage the use of excessive amounts of intravenous fluid and liberal oral fluid intake, and advise women to drink according to thirst.

Monitor fluid balance throughout labour in high risk women (patients on intravenous fluid, pyrexia in labour, cardiac or kidney disease). In low risk women, fluid intake can be estimated.

Recent guidance for the diagnosis and management of hyponatraemia in labour advises to measure serum sodium if the fluid balance is positive >1500 mL; however, there are currently no such recommendations in England.<sup>9</sup>

### Patient outcome

Mother and baby made a full recovery. The patient had previously thought that women should increase their oral fluid intake during labour to prevent dehydration. Serum sodium will be checked during labour in her next pregnancy if fluid balance is positive >1500 mL. The patient has been encouraged not to drink excessively in labour (instead drink to thirst) and to use isotonic drinks, rather than water.

### Learning point

Monitor fluid balance throughout labour in high risk women to prevent hyponatraemia. Discourage the use of excessive amounts of intravenous fluid and liberal oral fluid intake, and advise women to drink according to thirst. Consider measuring serum sodium if fluid balance is positive >1500 mL. The correct diagnosis and management of hyponatraemia with fluid restriction will result in most women making a spontaneous recovery.

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## Table

Table 1| Neonatal and maternal blood tests

Test	Result	Reference range
Neonatal serum sodium	118 mmol/L	132-145 mmol/L
Maternal serum sodium	124 mmol/L	132-145 mmol/L
Maternal serum potassium	3.4 mmol/L	3.5-5.0 mmol/L
Maternal serum osmolality	257 mOsm/kg	285-295 mOsmol/kg
Maternal urine osmolality	177 mOsm/kg	n/a