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Guideline for the Prevention, Diagnosis and Management of Hyponatraemia in Labour and the Immediate Postpartum Period

Introduction and Aim

The aim of this guideline is to provide support for the maternity team to prevent, diagnose and manage hyponatraemia

Objectives

- To ensure that there is accurate fetal surveillance through standardised fundal height (SFH) measurements of low risk women and serial growth scans for high risk women.
- To ensure that SFH measurements are plotted correctly on customised growth charts.
- To ensure that patterns of fundal height measurements suggestive of growth problems are recognised and referral for a growth scan is made.
- To ensure that problems of fetal growth on ultrasound are identified and an appropriate care plan is made.
- To ensure that there is identification of all infants born below the 10th customised centile at birth and appropriate management initiated postnatally.

Scope

This policy applies to all healthcare professionals in all locations including those with honorary contracts

Equality Health Impact Assessment	*An Equality Health Impact Assessment (EHIA) has not been completed.*
Documents to read alongside this Procedure	*Intrapartum care guideline* *Midwife Care guideline*
Approved by	*Maternity Professional Forum*
Accountable Executive or Clinical Board Director	*Jason Roberts, Executive Nurse Director*
Author(s)	*Sarah James, Consultant Midwife*

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Summary of reviews/amendments

Version Number	Date of Review Approved	Date Published	Summary of Amendments
1	29/10/23	25/1/24	New Document – to replace GAIN guidance

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' The words woman and women have been used throughout this document as this is the way that the majority of those who are pregnant and having a baby will identify. For the purpose of this document, this term includes girls. It also includes people whose gender identity does not correspond with their birth sex or who may have a non-binary identity'.

1. Introduction

GAIN guidance for the management of hyponatraemia in adults is available[1], but labouringwomen are an at risk group for which no specific guidance currently exists.

Cases of peripartum dilutional hyponatraemia often referred to as water intoxication, have occurred in Northern Ireland and across the world affecting mothers and their babies[2-18].

GAIN funding was obtained and a multidisciplinary group established to explore the issue and produce guidance. This document summarises current evidence and offers a consensus view on the detection, prevention and management of dilutional hyponatraemiain labouring women over the age of 16.

Where a parturient is below 16 years of age a paediatric fluid balance chart should be used and consideration given to discussing intravenous fluid prescribing with a paediatrician.

2. Background

Many conditions and situations can lead to hyponatraemia but the focus of this guideline is on peripartum dilutional hyponatraemia which is hypotonic hyponatraemia. This occurs when a woman takes on more fluid of low sodium content than she can excrete leading to dilution of the blood and a fall in sodium concentration. An acute fall in the sodium level can result in cerebral oedema and life threatening symptoms. Maternal hyponatraemiaalso has serious implications for the fetus. Water freely diffuses across the placenta causing fetal blood sodium concentration and osmolality to reflect that of the mother. Therefore maternal hyponatraemia can lead to neonatal hyponatraemia[19–22].

Women in labour are at greater risk of developing hyponatraemia than non-pregnant women because of a lower baseline plasma sodium[23-27], an impaired ability to excrete water in the third trimester[28,29] and exposure to the anti-diuretic effect of oxytocin[30]. These issues are explored later in the guidance (Fluid and Electrolyte Balance in Pregnancy page9).

Early reported cases were associated with the administration of large volumes of hypotonic intravenous fluids, most commonly 5% dextrose, as the carrier solution for oxytocin[3,4,5]. This led to the use of more concentrated oxytocin infusions with sodium containing solutions as the diluent. Despite this, cases of dilutional hyponatraemia persist. Since 2002 there have been fifteen reported cases amongst labouring women[2,6-16,18] and eleven cases of serious adverse neonatal events, including seizures and apnoeas, all attributed to dilutional hyponatraemia[8,12,13-16,18,31]. Worryingly, the majority of the mothersof these neonates appear to have been asymptomatic or shown only mild non-specific symptoms despite having severe hyponatraemia [8,12,13,16,31]. An observational study ofSwedish women in labour found an 8% incidence of hyponatraemia at delivery. All of the women were asymptomatic. Relying on symptoms alone to identify cases of peripartum hyponatraemia will likely underestimate the incidence as the majority will have no symptoms or the symptoms will be so subtle as to go unrecognised.

Labour per se does not cause hyponatraemia[27] but it does predispose to its occurrence. Women in late pregnancy are less able to excrete excess free water. This is compounded in labour by raised levels of antidiuretic hormone and the additional antidiuretic effect of oxytocin. This causes labouring women to retain water, so that if excess fluid is administered or consumed hyponatraemia is more likely to occur.

An additional important peripartum risk factor is the total volume of fluid intake during labour, both intravenous and oral. This has the potential to affect both low and high risk parturients. As the volume of fluids received during labour increases, the risk of maternal hyponatraemia becomes greater. Women receiving less than 1 litre of fluid in labour were less likely to develop hyponatraemia compared to those who received more than 2.5 litres (1% vs 26%)[27]. The association between hyponatraemia and the use of large volumes of hypotonic intravenous fluids and oxytocin

for induction and augmentation of labour has long been recognised[3,4,5,28]. However, in recent cases hyponatraemia occurred as a result of excessive oral fluid intake in a setting where little or no oxytocin or intravenous fluids had been given[8-11,13, 14,16,18]. A repetitive theme in these cases is the absence of accurate fluid balance monitoring and recording.

In recent years there has been relaxation of fasting guidance for women in labour. Concerns regarding eating during labour relate to the risk of aspiration associated with general anaesthesia in the event of emergency. Modern practice has made this a rare event and a Cochrane review found no evidence to support restricting oral intake in women at low risk of requiring anaesthesia[32]. This coincides with the common antenatal advice for pregnant women to drink frequently in labour to prevent dehydration.

In summary the problem of peripartum dilutional hyponatraemia has the potential to cause severe harm to labouring women and their babies and it is likely that it is under recognised. Physiological factors predispose pregnant women to hyponatraemia, especially where additional risk factors such as excessive oral intake, intravenous fluids and exogenous oxytocin are present. The purpose of this guideline is to reduce the risk of hyponatraemia through the expedients of:

- Increased awareness
- Accurate fluid balance monitoring
- Earlier detection

3. Fluid and Electrolyte Balance in Pregnancy

Blood sodium concentration and osmolality are lower in pregnancy with 130 - 140 $mmolL^{-1}$ being considered the normal range[19,23,25-27] compared to 135 – 145 $mmolL^{-1}$ in non- pregnant adults[1]. In this guideline hyponatraemia in pregnancy is defined as a blood sodium concentration below 130 $mmolL^{-1}$.

3.1 Lower baseline plasma sodium

Physiological changes affecting fluid and electrolyte balance occur as early as six weeks of amenorrhoea. Renal blood flow increases and there is expansion of the plasma volume and retention of sodium. Normal pregnancy is thus a state of positive sodium and water balance: by term women will have accumulated an additional 7-10 litres of total body water[34]. As the volume regulatory mechanisms underlying this are complex and involve adaptations in the renin angiotensin aldosterone system and resetting of the osmotic threshold for antidiuretic hormone (ADH) release[28].

The body tightly regulates the osmolarity of blood maintaining it around 285 $mOsmokg^{-1}$ innon-pregnant adults. With dehydration osmolarity increases, that is blood becomes more concentrated, and the body responds by increasing the secretion of ADH from the posterior pituitary gland. ADH binds to receptors in the kidneys causing water to be reabsorbed leading to a fall in blood osmolarity as volume is restored. In response to excessive intake of water the osmolarity will fall and the secretion of ADH will be reduced resulting in less water being reabsorbed by the kidneys and a greater volume being excreted in the urine with subsequent rise in the blood osmolarity. In pregnancy blood osmolarity is lower at around 280 $mOsmokg^{-1}$ and the physiological mechanisms working to maintain this include lower thirst and ADH secretion thresholds[35,36].

3.2 Antidiuretic effect of oxytocin

Oxytocin is the hormone responsible for uterine contractions. Secreted from the posterior pituitary gland it has a structure similar to ADH giving it an antidiuretic action at high concentrations. In labour higher quantities of endogenous oxytocin are present and synthetic oxytocin is commonly administered intravenously to induce or augment labour. Oxytocin can contribute to dilutional hyponatraemia when large volumes of sodium free fluids are consumed or given intravenously simultaneously[30]. This is compounded in late pregnancy by a reduced ability to excrete excess water.

3.3 Impaired ability to excrete water in the third trimester

During the first and second trimesters women are able to excrete excess fluid in the urine as effectively as non-pregnant adults. In the third trimester this ability to excrete excess water is reduced, predisposing to fluid retention[28,29].

4. Signs and Symptoms of Hyponatraemia

For detailed guidance on recognition of hyponatraemia refer to the 2010 GAIN guideline Hyponatraemia in Adults[1].

Signs and symptoms of hyponatraemia are primarily related to dysfunction of the central nervous system. Cerebral oedema may develop and early manifestations of hyponatraemia include:

- Anorexia
- Nausea
- Lethargy
- Apathy
- Headache

Early symptoms are non-specific and may be attributed to pregnancy, labour and common conditions such as pre-eclampsia.

More advanced signs and symptoms include:

- Disorientation
- Agitation
- Seizures
- Depressed reflexes
- Focal neurological deficits
- Cheyne-Stokes respiration
- Coma

Symptoms correlate with the severity of hyponatraemia and the speed of change in sodium concentration. Rapid changes can cause fluid shifts between extracellular and intracellular compartments with no opportunity for physiological compensation leading toacute symptoms

5. Prevention and Diagnosis of Hyponatraemia in Labour

Maternal dilutional hyponatraemia during labour can be prevented by keeping a neutral fluid balance and can be recognised by fluid balance monitoring and clear documentation with blood sodium testing when necessary.

Healthy women in labour who are in a neutral fluid balance are at low risk of developing hyponatraemia. As fluid intake in labour increases so too does the risk of hyponatraemia[27]. Women who have a fluid intake of up to 1 litre in labour will have a 1% incidence of hyponatraemia at delivery, between 1 to 2.5 litres intake increases this to 5% and above
2.5 litres 26% will be hyponatraemic[27].

In cases of hyponatraemia a thorough review of the clinical history, medications, fluid inputand output is necessary to establish the cause. Alternative causes of hyponatraemia should always be considered, particularly in severe hyponatraemia, where concurrent illness exists or symptoms and laboratory results pre-date labour. Blood osmolality, urine sodium and urine osmolality tests are useful in determining the cause of hyponatraemia.

Detailed information on diagnosis and management of hyponatraemia is available in the 2010 GAIN guideline Hyponatraemia in Adults[1], reference sheet included in Appendix 2.

6. Guidance on peripartum fluid balance and sodium monitoring

a) Guidance for the care of women <u>on</u> the Wales Labour & BirthCare Pathway (suitable for midwifery led care)

1. The importance of accurate fluid balance monitoring during labour should beexplained to all women.
2. Once in established labour, fluid balance observations should be commenced and recorded in the comments section of the partogram
3. Women should have oral intake recorded at least four hourly.
4. Women should be encouraged to void 2-4 hourly and should have urine output measured and recorded.
5. Women should have other fluid losses measured and recorded e.g. vomit.
6. A four hourly cumulative fluid balance should be recorded on the fluid balance chart
7. Before transfer to another clinical area a cumulative fluid balance total should be recorded.
8. If a woman has greater than 1500 mls positive on her fluid balance, a blood sodiumshould be checked. If the result is within normal limits (equal to or greater than 130 $mmolL^{-1}$) the woman may stay under midwifery led care, a regional fluid balancechart should be commenced and the Peripartum Sodium Monitoring Pathway should be followed.
9. If the sodium level is less than 130 $mmolL^{-1}$ or if sodium testing is not readily available, the on call obstetric registrar should be contacted and clinical judgementused, particularly with regard to parity and progress in labour to decide whether transfer to labour ward is required.

b) Guidance for the care of women <u>not on</u> the Wales Labour &Birth Care Pathway (requiring consultant led care)

1. The importance of accurate fluid balance monitoring during labour should beexplained to all women.
2. All fluid balance observations should be recorded on the regional fluid balancechart.
3. Women should have oral intake documented at least four hourly.
4. Women should have intravenous (IV) fluid intake documented hourly.

5. IV fluids must have a prescribed reason documented on the fluid balance chart.
6. IV fluids must be prescribed in millilitres (ml) per hour.
7. IV fluids must be administered via volumetric pumps (in exceptional circumstancessuch as fluid resuscitation during haemorrhage this can be waived).
8. IV fluids are not routinely required with epidural analgesia.
9. IV fluids should not routinely be prescribed for the treatment of ketosis in non-diabetic women.
10. Women should be encouraged to void 2-4 hourly and to have urine output volume measured and recorded.
11. Women should have other fluid losses measured and recorded e.g. vomit.
12. Women require sodium monitoring (Peripartum Sodium Monitoring Pathway, page16) if they are:
    a. On an oxytocin infusion (includes induction and augmentation of labour, treatment of postpartum haemorrhage)
    b. In labour and require IV insulin and dextrose.
    c. Noted to have a blood sodium below 130 $mmolL^{-1}$ for any reason.
    d. Greater than 1500 mls positive on their fluid balance.

7. Sodium Monitoring

7.1Peripartum

When an oxytocin infusion is commenced a blood sodium level should be checked using point of care testing (POCT) where available. It is not necessary to await the result prior to starting the infusion.

Where an oxytocin infusion is commenced as prophylaxis against uterine atony in the setting of elective Caesarean section sodium monitoring is not routinely required.

It is essential that blood samples are not taken from a limb attached to an intravenous infusion as this may lead to inaccurate results.

Results should be referenced against the Peripartum Sodium Monitoring Pathway to guidefrequency of repeat testing and further management (page 16).

All women requiring intravenous insulin and dextrose infusions during labour should havea blood sodium level checked at least four hourly.

Where blood sodium is equal to or greater than 130 $mmolL^{-1}$ further testing is necessary 8 hourly unless either of the following occurs:
the change in sodium concentration has been greater than 1 $mmolL^{-1}$ per hour (eg. 10$mmolL^{-1}$ over 8 hours), this rapid fall in sodium increases the risk of developing symptoms and so 4 hourly testing is necessary.
a positive fluid balance of more than 1500 mls is achieved: this necessitates an immediate repeat sodium check.
The paediatric team should be made aware of babies born to hyponatraemic mothers.

In cases where the maternal sodium is below 125 $mmolL^{-1}$ oxytocin should be stopped while senior clinical advice is sought. The decision regarding further oxytocin administration should be made following assessment of the woman's clinical condition andcircumstances after discussion with a consultant obstetrician.

Following delivery if a woman remains on an oxytocin infusion, for example as treatmentfor postpartum haemorrhage, she should remain on the Peripartum Sodium Monitoring Pathway.

7.2 Postpartum

Once a woman has a blood sodium level equal to or greater than 130 $mmolL^{-1}$ no further sodium checks are necessary unless clinically indicated.

If a woman has a sodium level below 130 $mmolL^{-1}$ she should be reviewed by the obstetric team and consideration given to alternative causes, the patient's clinical condition and the severity of the hyponatraemia, and a decision made as to whether she is suitable for discharge.

8. Management of Symptomatic Hyponatraemia

For more detailed guidance on the investigation, diagnosis and treatment of hyponatraemia refer to the 2010 GAIN guideline Hyponatraemia in Adults[1], reference sheet included in Appendix 2.

In server cases POCT blood gases are available for sodium levels.

In a patient with <u>significant clinical symptoms</u> believed to be due to hyponatraemia (for instance, seizures or loss of consciousness), 100 mls of 3% saline should be given immediately as an IV bolus over 30 minutes and hourly thereafter in these severe cases. Consider co-administration of 20 mg IV furosemide if there is any evidence of fluid overload. This will raise serum sodium by approximately -1-4 $mmolL^{-1}$ and will reduce cerebral oedema. The assistance of an experienced clinician should be sought to guide further treatment. Senior members of obstetric and anaesthetic teams should be involved and enhanced maternity care provided either on the delivery suite or in a critical care environment for ongoing management.

Following administration of hypertonic saline it is necessary to monitor sodium levels hourly. Rapid increases in blood sodium concentration can cause serious harm including central pontine myelinolysis. Therefore, the level should rise by no more than 12 $mmolL^{-1}$ in a 24 hour period.

An arterial line is likely to be required.

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