# SLHD Guideline

## Newborn Care: Subgaleal haemorrhage and observation of the newborn following instrumental delivery

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<thead>
<tr>
<th>TRIM Document No.</th>
<th>SD22/20695 (POL/597)</th>
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<tbody>
<tr>
<td>Policy Reference No.</td>
<td>SLHD,GL2022_10</td>
</tr>
<tr>
<td>Related MOH Policy</td>
<td>N/A</td>
</tr>
<tr>
<td>Keywords</td>
<td>Newborn; subgaleal; haemorrhage; vacuum; assisted; birth; instrumental; delivery; observation; forceps</td>
</tr>
<tr>
<td>Applies to</td>
<td>All clinical staff providing neonatal care in SLHD</td>
</tr>
<tr>
<td>Clinical Streams</td>
<td>Women’s Health, Neonatology and Paediatrics</td>
</tr>
<tr>
<td>Tier 2 Sign-off</td>
<td>Clinical Director, Women’s Health, Neonatology and Paediatrics SLHD</td>
</tr>
<tr>
<td>Date approved by SLHD Policy Committee</td>
<td>10/03/2022</td>
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<tr>
<td>Status</td>
<td>Active</td>
</tr>
<tr>
<td>Review Date</td>
<td>09/03/2027</td>
</tr>
<tr>
<td>Risk Rating</td>
<td>H</td>
</tr>
<tr>
<td>Replaces</td>
<td>N/A</td>
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</table>

## Version History

| Current Version | V.1 – 10/03/2022 |
Newborn Care: Subgaleal haemorrhage and observation of the newborn following instrumental delivery

Contents
1. Introduction 3
2. The Aims / Expected Outcome of this Guideline 3
3. Risk Statement 3
4. Scope 3
5. Education and Training 3
6. Implementation 3
7. Key Performance Indicators and Service Measures 4
8. Guideline 4
   8.1 Background 4
   8.2 Aetiology and differential diagnoses 4
      8.2.1 Anatomy 4
      8.2.2 Chignon 4
      8.2.3 Cephalohaematoma 5
      8.2.4 Subgaleal haemorrhage 5
   8.3 Risk Factors 6
   8.4 Diagnosis 6
      8.4.1 Clinical examination 6
      8.4.2 Clinical signs 6
      8.4.3 Systemic signs 7
   8.5 Consequences / Prognosis 7
   8.6 Surveillance - Delivery Suite, Postnatal Ward, Special Care Nursery and Neonatal Intensive Care 8
      8.6.1 Delivery 8
      8.6.2 Vitamin K 8
      8.6.3 Neonatal Surveillance 8
      8.6.4 Clinical suspicion of subgaleal haemorrhage 8
   8.7 Suspected or confirmed Subgaleal Haemorrhage 10
      8.7.1 Initial observations and management 10
      8.7.2 Immediate investigations 10
      8.7.3 Ongoing monitoring 10
      8.7.4 Discharge criteria 11
   8.8 Management of Subgaleal Haemorrhage 11
      8.8.1 Principles of management 11
      8.8.2 Recognition of acute blood loss or hypovolaemia 11
      8.8.3 Volume replacement 12
      8.8.4 Massive transfusion protocol 12
      8.8.5 Coagulopathy correction 12
      8.8.6 Acidosis 13
      8.8.7 Other 13
9. Consultation 15
10. References 15
11. National Safety and Quality Standard/s, 2nd ed 16

Compliance with this Guideline is Recommended.
Newborn Care: Subgaleal haemorrhage and observation of the newborn following instrumental delivery

1. Introduction

Subgaleal haemorrhage in the newborn may occur following any mode of delivery, however, is most common following vacuum assisted delivery. It is an accumulation of blood within the subgaleal space, occurring following rupture of the emissary veins and without anatomical tamponade. The blood loss into the subgaleal space may be up to 80% of the newborns circulating blood volume, resulting in hypovolaemic shock, coagulopathy and considerable mortality.

Subgaleal haemorrhage may be difficult to diagnose, and requires repeated clinical assessment including clinical observations and inspection and palpation of the scalp. Subgaleal haemorrhage may accumulate rapidly, therefore, requires prompt recognition, assessment of volume status, re/cognition of coagulopathy, early aggressive resuscitation and management.

2. The Aims / Expected Outcome of this Guideline

- Outline observations and clinical examination required for a newborn following instrumental delivery.
- Early identification of newborns with subgaleal haemorrhage.
- Early, aggressive resuscitation and management of newborns with symptomatic subgaleal haemorrhage.

3. Risk Statement

SLHD Enterprise Risk Management System (ERMS) Risk #1: Unwarranted Deviation from standards of clinical care:

- Delayed recognition of subgaleal haemorrhage;
- Delayed early management of hypovolaemia; and,
- Coagulopathy in subgaleal haemorrhage can result in end organ damage secondary to hypoperfusion, and death.

4. Scope

SLHD medical, nursing and midwifery staff involved in the care of newborns.

5. Education and Training

Basic Life Support - Newborn: Module - This mandatory 40 minute eLearning module accessible via My Health Learning (MHL) targets maternity clinical staff and focusses on how to recognise and respond in a healthcare environment to a newborn requiring resuscitation.

6. Implementation

- Guideline to be published on the RPA Newborn Care inter/intranet and accessible to all staff.
- Distribution and notification of this guideline to clinical staff via departmental email, ward / unit meetings and availability on the SLHD Intranet.

Compliance with this Guideline is Recommended.
7. **Key Performance Indicators and Service Measures**

- Reviewed at quarterly Morbidity and Mortality meetings.
- Reviewed at Hospital Acquired Complication data review.
- BTF Standard Newborn Observation Chart (SNOC) - six monthly audit via Quality Audit Reporting System (QARS).

8. **Guideline**

8.1 **Background**

Subgaleal haemorrhage may occur following normal vaginal delivery and caesarean section, however, is most common following instrumental delivery. Chang et.al. (2) reported an incidence of 0.6/1000 of all deliveries, and 4.6/1000 of vacuum assisted births. Uchil and Arulkumaran (3) reported a similar incidence of 0.4/1000 in spontaneous deliveries and 5.9/1000 in vacuum assisted deliveries. In a prospective study by Boo et.al. (4), of 10,066 infants born over a 26 month period, 3.4% were born by vacuum extraction. The babies born by vacuum extraction were examined prospectively for subgaleal haemorrhage, and the incidence of subgaleal haemorrhage was determined to be 21%.

The rate of instrumental deliveries in NSW in 2019 remained steady at 11.6% of all births when compared to the preceding 6 years (5). 4.5% of these deliveries were forceps and 7.1% vacuum deliveries (5). At RPA Women and Babies, there has been an increasing trend in the proportion of vaginal births that are vacuum deliveries compared to preceding years. In 2018, 15% of all vaginal births were vacuum deliveries, with this percentage increasing to 17% in 2019. This has corresponded with an increase in the number of subgaleal haemorrhage diagnoses. The rate of vacuum delivery at Canterbury Hospital has remained steady between 13-15% over the past 4 years. The subgaleal haemorrhage numbers remain low.

8.2 **Aetiology and differential diagnoses**

8.2.1 **Anatomy**

The scalp consists of five layers – skin, dense connective tissue, galeal aponeurotica, loose connective tissue permitting movement of the galea and the periosteum encasing each cranial bone. The subgaleal space exists superior to the periosteum and inferior to the fibrous galea. It is not limited by the sutures, and extends across the entire cranial vault from the frontalis muscle, to the posterior nuchal lines and laterally to the temporalis muscle.

8.2.2 **Chignon**

The chignon or caput succedaneum is caused by a collection of interstitial fluid and small haemorrhages that occur under the scalp. It is most obvious after immediate removal of the vacuum cap, is firm in consistency and may cross suture lines. The chignon usually starts to resolve within an hour of birth, and should completely resolve within 18 hours (8, 9). There is no long term significance for the newborn.
8.2.3 Cephalohaematoma

Cephalohaematoma is a collection of serosanguineous fluid between the periosteum and skull bones. The reported incidence is between 1 and 25%, and there is a trend for cephalohaematomas to occur more commonly with vacuum compared to forceps deliveries. However, the clinical significance is minimal because the bleed is confined within the periosteum, limiting the amount of blood that can be lost. Cephalohaematomas do not cross suture lines. They usually resolve within several days.

8.2.4 Subgaleal haemorrhage

Subgaleal haemorrhage occurs when blood accumulates in the subgaleal space. It develops without anatomical tamponade and is secondary to rupture of the emissary veins providing drainage of the superficial scalp veins into the intradural venous sinuses. Subgaleal haemorrhages cross suture lines.

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Figure 1 Schematic representation of the five anatomic layers of the scalp and their relationship to various haemorrhages that may develop within these tissue planes (10) (Reproduced by permission of Oxford University Press on behalf of the Congress of Neurological Surgeons)

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| Table 1: Distinguishing features of different neonatal extracerebral fluid collections |
|---------------------------------|----------------------------------|---------------------------------|----------------------------------|
| Feature                        | Caput suceedaneum                | Cephalhaematoma                 | Subgaleal haemorrhage            |
| Location                       | At point of contact; can extend across sutures | Usually over parietal bones; does not cross sutures | Beneath epicranial aponeurosis; may extend to orbits, nape of neck |
| Characteristic findings        | Vaguely demarcated; pitting edema that shifts with gravity | Distinct margins; initially firm, more fluctuant after 48 h | Firm to fluctuant; ill-defined borders; may have crepitus or fluid waves |
| Timing                         | Maximal size and firmness at birth; resolves in 48–72 h | Increases after birth for 12–24 h; resolution over 2–3 wk | Progressive after birth; resolution over 2–3 wk |
| Volume of blood                | Minimal                          | Rarely severe                   | May be massive, especially if there is an associated coagulopathy |

Table 1: Distinguishing features of different neonatal extracerebral fluid collections (1) (Reproduced by permission of Canadian Medical Association Journal)
8.3 Risk Factors

In the prospective observational study by Boo et.al. (4), the following risk factors for development of subgaleal haemorrhage were identified:

- Maternal nulliparity (adjusted odds ratio 4.0, 95% confidence interval 1.6, 10)
- Failed vacuum extraction (adjusted odds ratio 16.4, 95% confidence interval 2.0, 135.6)
- Apgar score of less than 8 at 5 minutes (adjusted odds ratio 5.0, 95% confidence interval 1.7, 15.2)
- Marks of vacuum cup over sagittal suture (adjusted odds ratio 4.4, 95% confidence interval 1.9, 10.2)
- Marks of leading edge of vacuum cup at < 3cm away from anterior fontanelle (adjusted odds ratio 6.0, 95% confidence interval 1.7, 21.0)

Observational studies suggest additional risk factors including:

- Difficult vacuum extraction requiring multiple applications of the cup (11)
- Prolonged second stage (>120 minutes) (12)
- Difficult vacuum characterised by extraction over more than three contractions, 20 minutes extraction time or more than two cup detachments (9)
- Malposition of the foetal head (13)
- Forceps delivery, particularly high or mid cavity forceps delivery (13,14)
- Macrosomia (2,13)
- Prematurity (2,13)

8.4 Diagnosis

8.4.1 Clinical examination

- Subgaleal haemorrhage may be evident at birth or develop insidiously over 1 to 6 hours (13). Subgaleal haemorrhage is often recognised late because the blood loss moulds to the shape of the skull and scalp, making clinical recognition potentially difficult. Repeated examination is therefore required.

8.4.2 Clinical signs

The following clinical signs include:

- Generalised swelling (Figure 2) or boggy consistency of the scalp, especially at the vacuum cup site. The swelling is not contained by suture lines.
- Early signs may be subtle. It is the perception of free fluid between the scalp and the skull that is critical to the early diagnosis of subgaleal haemorrhage.
- The scalp may become fluctuant on palpation, often described as ‘fluidic’ or ‘like a leather pouch filled with fluid’. The swelling may be gravity dependent, ballotable or resemble pitting oedema.
- Irritability and pain on handling.
- Swollen eyelids.
- Inferiorly displaced ears (Figure 3).
- Increasing head circumference (late sign).
8.4.3 Systemic signs

Systemic signs are related to blood loss and may include:

- 5 minute Apgar score < 7 in the absence of asphyxia and following a difficult or failed instrumental delivery
- Tachycardia
- Tachypnoea
- Reduced activity
- Pallor
- Hypotension – mean blood pressure < 40 mmHg in a term infant
- Acidosis

8.5 Consequences / Prognosis

Recent studies report mortality of infants with subgaleal haemorrhage admitted to neonatal intensive care to be between 2.8% - 14% (2, 4, 11, 12).

Associated injuries include subdural and cerebral haemorrhages, skull fractures, cerebral oedema, scalp abrasions, lacerations and retinal haemorrhages. Encephalopathy has been described in up to 72% of infants admitted to neonatal intensive care for management of subgaleal haemorrhage (11). More recently, it is documented that 23% of newborns with subgaleal haemorrhage are encephalopathic, and this is predictive of a longer NICU stay, need for transfusion and death (15).
8.6 Surveillance - Delivery Suite, Postnatal Ward, Special Care Nursery and Neonatal Intensive Care

8.6.1 Delivery
All babies delivered by instrumental delivery will have a member of neonatal/paediatric medical staff in attendance at the delivery. The head should be examined immediately following delivery by neonatal/paediatric medical staff.

8.6.2 Vitamin K
All neonates delivered by instrumental delivery should have intramuscular vitamin K immediately following birth. If consent for intramuscular vitamin K is refused, parents should be counselled about the risks, including the risk of subgaleal haemorrhage, by a medical officer. The outcome of a medical review is documented in the electronic medical record.

8.6.3 Neonatal Surveillance
Hats and/or bonnets are not to be used in babies delivered by instrumental delivery.

The following surveillance guidelines are adapted from the Royal Australian and New Zealand College of Obstetricians and Gynaecologists recommendations (2009, reviewed in 2015) (9).

All babies delivered by instrumental delivery should have surveillance observations and examination at 1, 2, 3, 4, 6, 8 and 12 hours of age. In addition to baseline neonatal observations (activity, colour, heart rate, respiratory rate, oxygen saturation, temperature), examination of the head includes:

- Visual inspection of the scalp
- Palpate to assess for resolution of the chignon
- Palpate to note any ballotable mass or movement of fluid (gravity dependent) in scalp. Note the colour and head shape, including displacement of the ears or pitting oedema.
- Head circumference
- Document all observations in the electronic medical record.

Staff should be especially vigilant for the following babies:

- Those born following a failed vacuum extraction
- Total vacuum extraction time > 20 minutes and/or 3 pulls and/or > 2 cup detachments
- Placement of the vacuum cup over the sagittal suture, near the anterior fontanelle
- 5 min Apgar < 7

8.6.4 Clinical suspicion of subgaleal haemorrhage
Clinical suspicion of subgaleal haemorrhage may occur immediately following delivery or identified on routine postnatal ward surveillance.

- Clinical review to be called if a subgaelal haemorrhage is suspected, as per neonatal CERS policy.
- Following review by neonatal medical staff, babies with suspected or confirmed subgaleal haemorrhage are to be admitted to the special care nursery at Canterbury Hospital or neonatal intensive care at RPA for observation, immediate resuscitation (if required), and further investigation and management.
- Confirmation of diagnosis of subgaleal haemorrhage is to be made by the neonatal nurse practitioner, neonatal fellow, or neonatal or paediatric consultant.

**Instrumental delivery**
- Member of neonatal medical staff in attendance

**Vitamin K IM**
- No hats or bonnets

**Surveillance observations**
- at 1, 2, 3, 4, 6, 8 and 12 hours of age

**Clinical suspicion of subgaleal haemorrhage?**

**YES**
- Call clinical review (CERS policy)

**Admit to NICU/SCN for observation and management as per Subgaleal Haemorrhage flowchart**

**NO**
- Continue routine postnatal care

**Subgaleal haemorrhage surveillance observations**
- Heart rate, respiratory rate, oxygen saturation, temperature
  - Activity and colour
  - Head circumference
- Visual inspection and palpation of scalp for swelling, ballotable mass or presence of fluid crossing suture lines, evidence of ear displacement or pitting oedema
  - Document in eMR

*Figure 4 - Neonatal surveillance - Delivery suite, postnatal ward, special care nursery and neonatal intensive care*
8.7 **Suspected or confirmed Subgaleal Haemorrhage**

All babies with suspected or confirmed subgaleal haemorrhage are to be admitted to special care nursery at Canterbury Hospital or neonatal intensive care at RPA. The neonatal/paediatric fellow or the consultant on call should be informed of the admission.

8.7.1 **Initial observations and management**

- Nurse on open care system with servo control
- Continuous cardiorespiratory monitoring and preductal SpO2 monitoring
- Blood pressure, capillary refill and colour
- Measure head circumference
- Initiate strict fluid balance documentation
- Obtain and secure intravenous access. Insertion of an umbilical venous catheter should be considered in subgaleal haemorrhage with clinical evidence of hypovolaemia and/or poor perfusion
- Consider inserting an arterial line for monitoring of blood pressure if evidence of poor systemic perfusion

8.7.2 **Immediate investigations**

Blood to be collected on insertion of intravenous access:

- Blood gas for acid base status and lactate
- Full blood count including haematocrit
- Coagulation studies including prothrombin time, activated partial thromboplastin time and, if symptomatic, fibrinogen
- Neonatal blood group +/- cross match. Note – neonatal blood group/cross match is only valid at the site it is collected
- Blood glucose level
- Newborn Bloodspot Screening Test – if transfusion likely
- For babies born at Canterbury Hospital likely to require transfer to higher level care, collect maternal blood for blood group and cross match

Clinician performed ultrasound may assist in confirming the diagnosis and location of the haemorrhage.

8.7.3 **Ongoing monitoring**

- Continuously monitor heart rate, respiration including rate and effort, oxygen saturation and blood pressure if arterial monitoring available. Blood pressure to be performed 15-30 minutely in symptomatic subgaleal haemorrhage, or hourly if asymptomatic
- Hourly assessment of level of activity, capillary refill and peripheral perfusion
- Monitor urine output
- Inspect and palpate scalp swelling to assess for continuing blood loss, increasing size of ballotable mass, change in head shape, change in colour, swollen eyelids or displaced ears. Note that increasing head circumference is a late sign of significant blood loss. Clinical examination with serial estimation of blood loss into the subgaleal space prior to an observed increase in head circumference is required. Scalp examinations should occur hourly for the first 4 hours, then again at 6, 8 and 12 hours of life, or more frequently as clinically indicated

Compliance with this Guideline is Recommended.
• Repeat full blood count and coagulation studies 4 - 6 hours after initial assessment

### 8.7.4 Discharge criteria

Babies with suspected or confirmed subgaleal haemorrhage require monitoring in special care nursery at Canterbury Hospital or neonatal intensive care at RPA for a minimum of 6 hours.

Babies may be discharged to the postnatal ward for ongoing surveillance from 6 hours, if the following criteria are met at:

• Normal heart rate, respiratory rate, blood pressure, oxygen saturation and temperature
• No significant drop in haemoglobin or haematocrit on repeat full blood count at 4 - 6 hours after initial investigations
• No evidence of evolving coagulopathy on repeat coagulation studies and platelet count stable at 4 - 6 hours after initial investigations
• Blood sugar level is stable and baby has attempted feeding
• Subgaleal haemorrhage surveillance observations to continue and be completed at 8 and 12 hours on the postnatal ward

Confirmation of diagnosis of subgaleal haemorrhage is to be made by the neonatal nurse practitioner, neonatal fellow, or neonatal or paediatric consultant.

### 8.8 Management of Subgaleal Haemorrhage

Symptomatic subgaleal haemorrhage is a medical emergency. Early recognition with a low index of suspicion is essential to initiate timely and effective management.

#### 8.8.1 Principles of management

a. Implement neonatal advanced life support by first managing Airway and Breathing issues as required
b. Recognise circulatory issues and provide aggressive resuscitation to restore blood volume and provide circulatory support. Consider triggering the massive transfusion protocol
c. Correction of coagulopathy
d. Correction of acidosis

The study with the lowest reported mortality applied treatment triggers for transfusion at haemoglobin 140 g/L or coagulopathy correction at international normalised ratio 1.5 4.

These thresholds take into consideration the potential for ongoing bleeding. They should be taken into consideration, along with the clinical indicators.

#### 8.8.2 Recognition of acute blood loss or hypovolaemia

• Tachycardia (heart rate >160) or increasing trend in heart rate
• Pallor and/or poor peripheral perfusion with prolonged capillary refill (> 3 seconds)
• Low or falling blood pressure (mean blood pressure < 40 mmHg in a term baby)
• Reduced level of activity
• Presence of, or worsening metabolic acidosis
• Low or falling haemoglobin or haematocrit
• Clinician performed ultrasound is useful in assessment of volume status. Small systemic veins and low ventricular filling volumes can be indicators of hypovolaemia
8.8.3 **Volume replacement**

- For initial volume replacement, give 10-20 ml/kg 0.9% sodium chloride intravenously over 5 to 10 minutes, or faster if the baby is in extremis
- Obtain consent for blood products
- If shock is present, urgently request uncrossmatched Group O negative blood and Group AB fresh frozen plasma from the blood bank (see below for instructions). Group O negative blood and Group AB fresh frozen plasma should be given as soon as available, but start with 0.9% sodium chloride while waiting for blood products
- If time permits and/or initial resuscitation is underway, order fresh frozen plasma and cross matched red blood cells from the blood bank
- For ongoing volume replacement give fresh frozen plasma and then red cells as clinically indicated for volume replacement. Coagulopathy is common, therefore early use of fresh frozen plasma is important
- Ensure that all fluids are transfused via a fluid warmer

To order uncrossmatched Group O negative blood:

- Ring blood bank (#58033 at RPA, #70204 at Canterbury) and request ‘Paediatric Pack’ of uncrossmatched Group O negative blood.
- Send someone urgently to collect the blood from blood bank.

8.8.4 **Massive transfusion protocol**

The massive transfusion protocol should be triggered in the instance of:

- Transfusion of more than 50% total blood volume (40-45 ml/kg) in less than 4 hours
- Transfusion of more than 100% of total blood volume (85 ml/kg) in 24 hours
- Need to replace more than 10% of total blood volume per minute

Refer to **SLHD Blood Product Transfusion in the Newborn Guideline** for comprehensive guidance.

8.8.5 **Coagulopathy correction**

- Up to 81% of neonates with subgaleal haemorrhage may develop coagulopathy (4)
- If there has been a large subgaleal haemorrhage requiring transfusion of up to 40 ml/kg but there is no ongoing bleeding, then the baby should be investigated for transfusion associated coagulopathy and managed reactively
- If the subgaleal haemorrhage is progressive and blood transfusion of more than 40 ml/kg has occurred then coagulopathy should be assumed, and managed proactively. See SLHD Blood Product Transfusion in the Newborn guideline for further information
- If coagulation studies are abnormal, correct with 15 ml/kg fresh frozen plasma. Repeat coagulation studies after fresh frozen plasma administration to confirm correction
- If subgaleal haemorrhage is progressive, or the fibrinogen level < 1.5 g/l, then consider 5ml/kg cryoprecipitate. This can be repeated if necessary
- If thrombocytopenic, consider platelet transfusion. If subgaleal haemorrhage is progressive, maintain platelet count > 100 x 10^9/L
• Consider contacting haematology to discuss the role of recombinant activated factor VII. Case reports have reported successful control of haemorrhage with its use (12, 16, 17). Combined use with tranexamic acid has been reported (16).

8.8.6 Acidosis

• Acidosis will usually correct with appropriate volume replacement
• Persistence of a metabolic acidosis may be an indicator of persisting hypovolaemia

8.8.7 Other

• Inotropes and vasopressors may be required
• Consider escalation of therapy including intubation and ventilation in the instance of a rising lactate, developing or persisting acidaemia, hypotension, coagulopathy or anaemia (13)
• Monitor ionised calcium levels with serial blood gases and maintain levels >1.1mmol/L
• Monitor potassium levels as there is a risk of hyperkalaemia with transfusion
• Ensure that a core temperature is recorded regularly and maintained between 36.5-37 degrees Celsius. Coagulation factor activity reduces by 10% for every 1 degree Celsius drop in temperature (18)
• Consider pain management and provision of analgesia. Refer to SLHD Pain Management and Sedation in the Newborn guideline for guidance
• Jaundice occurs in approximately 60% of infants with a subgaleal haemorrhage (4). Once stabilised, babies should be monitored for jaundice.
Figure 5 - Subgaleal Haemorrhage Management

Suspected/Confirmed Subgaleal Haemorrhage
- Admit to NICU/SCN
- Inform fellow/consultant on call
- Ensure vitamin K given

SYMPTOMATIC
Evidence of shock, hypovolaemia or acute blood loss, poor perfusion, systemic signs or encephalopathy

Obtain peripheral venous access
- consider umbilical venous catheter +/- arterial access (UAC/peripheral arterial line)

Send blood - blood gas + lactate, FBC, coagulation studies, blood group/X match (URGENT), BSL
newborn bloodspot screening test (If transfusion likely)

Early resuscitation and recognition of coagulopathy
1. Manage Airway and Breathing issues as required
2. Volume replacement
   - Uncrossmatched O neg blood +/- fresh frozen plasma
   - 10-20 ml/kg 0.9% sodium chloride over 5-10 mins (while awaiting blood products)
   - Crossmatched blood +/- fresh frozen plasma
   - Consider Massive Transfusion Protocol
3. Correct coagulopathy
   - Fresh frozen plasma +/- cryoprecipitate
   - Correct platelets
4. Correct acidosis
   - Unrecognised ongoing blood loss/hypovolaemia

STABLE
No evidence of shock, hypovolaemia, poor perfusion or acute blood loss, systemic signs or encephalopathy. Observations within normal limits.

Insert peripheral intravenous cannula
Send blood - blood gas + lactate, FBC, coagulation studies, blood group, BSL

Observe in NICU/SCN (Canterbury). If develops evidence of shock, hypovolaemia or acute blood loss, poor perfusion, systemic signs or encephalopathy - manage as per SYMPTOMATIC flowchart.

Repeat FBC, coagulation studies in 4-6 hours.

Discharge to postnatal ward from 6 hours
- No significant drop in haemoglobin and coagulation studies remain normal
- Baby has attempted feeding and maintained BSL
- Observations remain stable
- Ongoing subgaleal haemorrhage surveillance observations to continue on postnatal ward. Postnatal ward JMO review within 12 hours
Consultant/fellow/nurse practitioner to examine to confirm diagnosis of subgaleal haemorrhage

OBSERVATIONS
Nurse on open care system with servo control
Continuous cardiorespiratory monitoring + preductal Sp02 monitoring
Blood pressure + capillary refill/colour
- hourly (stable), 15-30 minutely or continuous (symptomatic)
Measure head circumference + inspect and palpate head - 1,2,3,4,6,8,12 hours. More frequently if clinically indicated. Strict fluid balance

CANTERBURY
- Consider early escalation and discussion with NETS
- Collect maternal blood for blood group/X match prior to transfer
- Baby blood group/X match are only valid at the site they are collected.

Discuss with on call fellow/consultant (Canterbury to discuss with RPA)
- Drop in haemoglobin or platelets
- Deranged coagulation studies

Compliance with this Guideline is Recommended.
9. Consultation

Head of Department, Haematology RPA Hospital
Midwifery staff, RPA and Canterbury Hospitals
Neonatal and Paediatric Staff Specialists, RPA and Canterbury Hospitals
Senior Scientist, Blood Bank RPA Hospital
SLHD Maternity Policy Committee
SLHD Centre for Education and Workforce Development Policy Committee

10. References


11. **National Safety and Quality Standard/s, 2nd ed**

- Clinical Governance Standard
- Comprehensive Care Standard
- Blood Management Standard
- Recognising and Responding to Acute Deterioration Standard