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1 Introduction

This document is a supplement to the Queensland Maternity and Neonatal Clinical Guideline *Newborn hypoglycaemia*. It provides supplementary information regarding guideline development, makes summary recommendations, suggests measures to assist implementation and quality activities and summarises changes (if any) to the guideline since original publication. Refer to the guideline for abbreviations, acronyms, flow charts and acknowledgements.

1.1 Funding

The development of this guideline was funded by Health Systems Innovation Branch, Queensland Health. Working party members participated on a voluntary basis.

1.2 Conflict of interest

Declarations of Conflict of Interest were sought from working party members as per the Queensland Maternity and Neonatal Clinical Guidelines Program’s *Conflict of Interest* statement. No conflict of interest was identified.

1.3 Guideline review

The Maternity and Neonatal Clinical Guidelines are reviewed every 5 years or earlier if significant new evidence emerges. Table 1 provides a summary of changes made to the guidelines since original publication.

Table 1. Summary of change

<table>
<thead>
<tr>
<th>Publication date</th>
<th>Identifier</th>
<th>Summary of major change</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 2010</td>
<td>NN1002.8-V1-R12</td>
<td>• First publication</td>
</tr>
<tr>
<td>August 2011</td>
<td>MN10.8-V2-R12</td>
<td>• New website. Name and format updates</td>
</tr>
<tr>
<td>July 2012</td>
<td>MN10.8-V3-R12</td>
<td>• Hydrochlorothiazide dosage corrected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Reference to Neofax added</td>
</tr>
<tr>
<td>August 2013</td>
<td>MN13.8-V4-R18</td>
<td>• First review key amendments:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Name of guideline changed from <em>Neonatal hypoglycaemia and blood glucose monitoring</em> to <em>Newborn hypoglycaemia</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• BGL monitoring recommendations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Definition of severe hypoglycaemia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Addition of flow charts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Supplement published</td>
</tr>
<tr>
<td>June 2015</td>
<td>MN13.8-V5-R18</td>
<td>• Amendment: indications for the option of using Glucose Gel 40% included</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Author changed to Queensland Clinical Guidelines</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Front cover updated</td>
</tr>
</tbody>
</table>

2 Methodology

The Queensland Maternity and Neonatal Clinical Guideline Program (the Program) follows a rigorous process of guideline development. This process was endorsed by the Queensland Health Patient Safety and Quality Executive Committee in December 2009. The guidelines are best described as “evidence informed consensus guidelines” and draw from the evidence, existing national and international guidelines and the expert opinion of the working party.

2.1 Topic identification

The topic was identified as a priority by the Statewide Maternity and Neonatal Clinical Network at a forum in 2009.
2.2 Scope
The scope of the guideline was determined using the PICO Framework (Population, Intervention, Comparison, and Outcome) as outlined in Table 2.

Table 2. PICO Framework

<table>
<thead>
<tr>
<th>PICO</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>• Newborns at risk for hypoglycaemia</td>
</tr>
<tr>
<td>Intervention</td>
<td>• Management of newborns at risk of or with hypoglycaemia</td>
</tr>
<tr>
<td>Comparison</td>
<td>N/A</td>
</tr>
<tr>
<td>Outcome</td>
<td>• Appropriate screening and management of hypoglycaemia in newborns</td>
</tr>
<tr>
<td></td>
<td>• Decreased long-term neurological sequelae of unrecognised, prolonged hypoglycaemia</td>
</tr>
<tr>
<td></td>
<td>• Shorter hospital length of stay associated with earlier recognition and subsequent measurement</td>
</tr>
</tbody>
</table>

2.3 Clinical questions
The following clinical questions were generated to inform the guideline scope and purpose:
- What is the preferred management of babies at risk of hypoglycaemia?
- What is the preferred management for babies with severe, persistent or recurrent hypoglycaemia?
- What ongoing care is preferred?

2.4 Exclusions
The following exclusions were identified in the guideline scope:
- Associated co-morbidities

2.5 Search strategy
A search of the literature was conducted during 2009 and then refreshed in 2012/13 using multiple techniques including search and review of:
- Known guideline sites (e.g. Royal Australian and New Zealand College of Obstetricians and Gynaecologists, National Guideline Clearing House, Royal College of Obstetrician and Gynaecologists, Society of Obstetricians and Gynaecologists of Canada, American Academy of Pediatrics)
- Synthesised evidence (e.g. UpToDate, Cochrane reviews)
- Summaries of relevant literature (e.g. identified using CINahl, PubMed)
- Individual case reports, studies and trials identified in the literature
- Relevant reference lists
2.6 Consultation
Major consultative and development processes occurred between November 2012 and June 2013. These are outlined in Table 3.

Table 3. Major guideline review and development processes

<table>
<thead>
<tr>
<th>Process</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical lead</td>
<td>• The nominated co-clinical leads were approved by the Program Steering Committee</td>
</tr>
<tr>
<td>Consumer participation</td>
<td>• Consumer participation was invited from a range of consumer focused organisations who had previously accepted an invitation for on-going involvement with the Program</td>
</tr>
</tbody>
</table>
| Working party            | • An EOI for working party membership was distributed via email to Queensland clinicians and stakeholders (~1500) in February 2013  
• The working party was recruited from responses received  
• Working party members who participated in the working party consultation processes are acknowledged in the guideline  
• Targeted working party membership was sought in April 2013  
• Working party consultation occurred in a virtual group via email |
| Statewide consultation   | • Consultation was invited from Queensland clinicians and stakeholders (~1500) during April 2013  
• Feedback was received primarily via email  
• All feedback was compiled and provided to the co-clinical leads and working party members for review and comment |

2.7 Endorsement
The guideline was endorsed by:
• The Program Steering Committee in June 2013  
• Statewide Maternity and Neonatal Clinical Network [Queensland] in July 2013

2.8 Publication
The guideline and guideline supplement were published on the Program website in August 2013
The guideline can be cited as:

The guideline supplement can be cited as:
3 Levels of evidence

The levels of evidence and grades of recommendations identified in the NHMRC [National Health and Medical Research Council] additional levels of evidence and grades for recommendations for developers of guidelines (2009) were used to inform the summary recommendations. Levels of evidence are outlined in Table 4. Summary recommendations are outlined in Table 5.

Note that the ‘consensus’ definition in Table 4 is different from that proposed by the NHMRC and instead relates to other forms of evidence and/or the clinical expertise of the guideline’s clinical leads and working party.

Table 4. NHMRC levels of evidence and grades of recommendation

<table>
<thead>
<tr>
<th>Level of evidence</th>
<th>Grades of recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>A systematic review of level II studies</td>
</tr>
<tr>
<td>II</td>
<td>A randomised controlled trial</td>
</tr>
<tr>
<td>III-1</td>
<td>A pseudo randomised controlled trial (i.e. alternate allocation or some other method)</td>
</tr>
<tr>
<td>III-2</td>
<td>A comparative study with concurrent controls: • Non-randomised experimental trial* • Cohort study • Case-control study • Interrupted time series with a control group</td>
</tr>
<tr>
<td>III-3</td>
<td>A comparative study without concurrent controls: • Historical control study • Two or more single arm study** • Interrupted time series without a parallel control group</td>
</tr>
<tr>
<td>IV</td>
<td>Case series with either post-test or pre-test/post-test outcomes</td>
</tr>
<tr>
<td>Consensus</td>
<td>Best practice informed by other forms of evidence and/or the clinical expertise of the guideline working party</td>
</tr>
</tbody>
</table>

¹ This also includes controlled before-and-after (pre-test/post-test) studies, as well as adjusted indirect comparisons (ie. utilise A vs B and B vs C, to determine A vs C with statistical adjustment for B).

² Comparing single arm studies ie. case series from two studies. This would also include unadjusted indirect comparisons (ie. utilise A vs B and B vs C, to determine A vs C but where there is no statistical adjustment for B).
### 3.1 Summary recommendations

Table 5. Summary recommendations

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Levels of evidence</th>
<th>Grading of recommendation</th>
</tr>
</thead>
</table>
| 1. Identify babies at risk of developing hypoglycaemia particularly:  
* Preterm (less than 37 weeks)  
* Small for gestational age (less than 10\textsuperscript{th} percentile)  
* Low birth weight (less than 2500 grams)  
* Infant of a diabetic mother  
* Large for gestational age (LGA, greater than the 90\textsuperscript{th} percentile). | III; IV\textsuperscript{1} | C\textsuperscript{1}  
LGA babies: D\textsuperscript{1} |
| 2. Routine BGL screening does not need to occur in asymptomatic, appropriately grown term babies who do not have risk factors.\textsuperscript{2,3} | Consensus | D |
| 3. Asymptomatic hypoglycaemic babies do not require routine admission to the neonatal unit if their BGL can be effectively managed with feeding. | Consensus | D |
| 4. For babies at risk for newborn hypoglycaemia, initiate early feeds within 30-60 minutes of birth and continue oral feeding at least every 3 hours (or more frequently in response to feeding cues).\textsuperscript{3} | III, IV | B |
| 5. Hypoglycaemia is diagnosed at a BGL less than 2.6 mmol/L.\textsuperscript{3} | III | C |
| 6. BGL monitoring should occur:  
* Whichever is sooner:  
  o Prior to the second feed or within 3 hours of birth if the baby has fed effectively  
  o At 2 hours of age if the baby has not fed effectively  
  o Every 4-6 hours pre-feeds until monitoring ceases  
* If feeding is unsuccessful, recheck BGL. | III; Consensus | C |
| 7. If any baby is unwell, has abnormal clinical signs or develops clinical signs of hypoglycaemia, a medical review is required, check BGL immediately and repeat 4-6 hours or as indicated. | III Consensus | C |
| 8. For asymptomatic newborns ‘at risk’ the BGL should be maintained at or above 2.6 mmol/L.\textsuperscript{3} | III | C |
| 9. For well and asymptomatic infants with blood glucose levels of 1.5-2.5 mmol/L, feed immediately and recheck BGL levels in 30-60 minutes. | Consensus | D |
| 10. Confirm any glucometer BGL less than 2.0 mmol/L by blood gas machine or laboratory analysis  
* Initiate appropriate treatment once the confirmation sample has been collected. That is, do no wait for the results nor delay appropriate treatment.\textsuperscript{4} | III Consensus | C  
D |
<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Levels of evidence</th>
<th>Grading of recommendation</th>
</tr>
</thead>
</table>
| 11. For babies with no known underlying cause for hypoglycaemia, cease monitoring if for 24 hours the:  
• BGL has been greater than or equal to 2.6 mmol/L, and  
• The baby is feeding effectively, and  
• The baby is well and has not required IV therapy. | Consensus | D |
| 12. If blood glucose levels remain lower than 2.0 mmol/L despite oral feeds, the baby should have a paediatric/medical review with a view to further investigation and appropriate management:  
• IV therapy is indicated. | Consensus | C |
| 13. Any baby who is unwell, symptomatic or who has signs that cannot be readily explained should have:
• Their BGL checked  
• Immediate treatment  
• Concurrent investigation and management of the underlying cause. | III Consensus | C D |
| 14. Treat symptomatic, hypoglycaemic babies (and asymptomatic infants who have failed to respond to enteral supplementation) with intravenous (IV) Glucose solution. | III-2 | C |
| 15. Never give an IV bolus of Glucose without also increasing the background rate or concentration of the IV Glucose infusion. | Consensus | D |

### Parents and carers

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Levels of evidence</th>
<th>Grading of recommendation</th>
</tr>
</thead>
</table>
| 16. Provide parents and carers with opportunities for informed discussion. Ensure documented verbal and written information is provided on:  
• Definition  
• Preventative care  
• Symptoms  
• Tests  
  o Babies at risk of hypoglycaemia will require close monitoring  
• Treatment. | Consensus | D |
4 Implementation

This guideline is applicable to all Queensland public and private maternity facilities. It can be downloaded in Portable Document Format (PDF) from www.health.qld.gov.au/qcg

4.1 Guideline resources

The following guideline components are provided on the website as separate resources:

- Flowchart: Newborn hypoglycaemia: prevention and detection
- Flowchart: Newborn hypoglycaemia: management
- Education resource [PowerPoint]: Newborn hypoglycaemia
- Knowledge assessment: Newborn hypoglycaemia

4.2 Suggested resources

During the development process stakeholders identified additional resources with potential to complement and enhance guideline implementation and application. The following resources have not been sourced or developed by the Program but are suggested as complimentary to the guideline:

- Parent information (e.g. Queensland Centre for Mothers and Babies, Medline plus)
- Local development/application of case review procedure

4.3 Implementation measures

Suggested activities to assist implementation of the guideline are outlined below.

4.3.1 Program measures

- Notify Chief Executive Officer and relevant stakeholders
- Monitor emerging new evidence to ensure guideline reflects contemporaneous practice
- Capture user feedback
- Record and manage change requests
- Review guideline in 2018

4.3.2 Hospital and Health Service measures

- Table the guideline at the local Patient Safety and Quality Committee meeting
- Replace all other guidelines on this topic with the current version of this guideline
- Promote the introduction of the guideline to relevant health care professionals (e.g. at staff forums, clinical handovers, incorporate into orientation packages)
- Provide education and training to staff relevant to service capabilities
- Develop or access suggested resources as identified in Section 4.2 of this guideline
- Consider evaluation as outlined at Section 4.4

4.4 Clinical quality measures

Implementation of this guideline assists compliance with the Australian Commission on Safety and Quality in Health Care (ACSQHC) National Safety and Quality Health Service (NSQHS) Standards.5

Auditing the guideline recommendations and content may assist with identifying quality of care issues, specifically in relation to specific NSQHS and EQuIP quality measures [refer to Table 7] which are designated in the accreditation review program of The Australian Council on Healthcare Standards (ACHS) NSQHS Standards Program.6
Table 7. ACSQHC NSQHS Standards and ACHS EQuIP quality measures

<table>
<thead>
<tr>
<th>NSQHS Standard</th>
<th>Newborn hypoglycaemia guideline Summary recommendation number</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Governance for safety and quality in health service organisations</td>
<td>[refer to Table 5 &amp; Table 6]</td>
<td>1-16</td>
</tr>
<tr>
<td>1.2 Care provided by the clinical workforce is guided by current best practice.</td>
<td></td>
<td>1-16</td>
</tr>
<tr>
<td>1.5 Patient [/parent] rights are respected and their engagement in their [baby’s] care is supported.</td>
<td></td>
<td>2, 3, 16</td>
</tr>
<tr>
<td>9. Recognising and responding to clinical deterioration in acute health care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.2 Patients whose condition is deteriorating are recognised and appropriate action is taken to escalate care.</td>
<td></td>
<td>5, 12</td>
</tr>
<tr>
<td>9.3 Appropriate and timely care is provided to patients whose condition is deteriorating.</td>
<td></td>
<td>9, 10, 13, 14, 15</td>
</tr>
<tr>
<td>9.4 Patients, families and carers are informed of recognition and response systems and can contribute to the processes of escalating care.</td>
<td></td>
<td>16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EQuIP Content</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. Service delivery</td>
<td>Auditing care and implementation of the guideline assists with meeting this criterion.</td>
</tr>
<tr>
<td>11.4 Health care and services are evaluated to ensure that they are appropriate and effective.</td>
<td></td>
</tr>
<tr>
<td>12. Provision of care</td>
<td></td>
</tr>
<tr>
<td>12.1 Assessment and care planning ensure that current and ongoing needs of the consumer / patient are identified.</td>
<td>Implementation of the guideline assists with meeting this criterion</td>
</tr>
<tr>
<td>12.3 Systems for ongoing care and discharge / transfer are coordinated and effective and meet the needs of the consumer / patient</td>
<td>16</td>
</tr>
</tbody>
</table>

5 Areas for further research
A research question arising out of review of this guideline includes:
- When confounding factors are controlled, does in-utero exposure to Selective Serotonin Reuptake inhibitors impact adversely on neonatal risk for hypoglycaemia?
References


