1.0 Introduction

Patients with hydrocephalus requiring cerebrospinal fluid diversion via a shunt were identified as a population that Neurosurgery cared for that required streamlining of care due to high volumes and complications such as infection which were relatively high compared to other procedures. This clinical practice guideline has been updated to reflect emerging changes in evidence (initial document developed 1997/98).

Target Population

- Inclusion: (May include cysto-peritoneal shunting and subdural peritoneal shunts)
- Infant/child with hydrocephalus requiring 1st shunt intervention.
- Child with existing shunt for hydrocephalus management.
- Newborn to 18 years of age with signs/symptoms of shunt malfunction (i.e. nausea/vomiting, headache, lethargy, irritability &/or altered level of consciousness (LOC))

Target Users

- All health care providers who may encounter a patient with a shunt or requiring a shunt.

2.0 Definitions

- **Shunt**: Referring only to a ventricular-peritoneal shunt
- **Shunt Revision**: Surgical replacement or change to an existing shunt

3.0 Clinical Practice Recommendations

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<table>
<thead>
<tr>
<th>PRE-ADMISSION</th>
<th>ADMISSION/PRE-OP</th>
<th>INTRA-OPERATIVE</th>
<th>POST-OP</th>
<th>DISCHARGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>History &amp; physical assessment (including fontanelle assessment and head circumference if less than 10 months)</td>
<td>Neurological Vital Signs Q 1-4h</td>
<td>See Short Infusion Protocol Checklist to be completed in OR (sitting room staff only)</td>
<td>Neurological Vital Signs Q 2-4h</td>
<td>Vital signs and Neurological Vital Signs per discharge</td>
</tr>
<tr>
<td>CT scan or MRI (new diagnosis should have a full MRI, otherwise could just do FAST MRI to assess ventricular area) or Head US (if infant and clinically appropriate)</td>
<td>Shunt series if CT/MRI or US is equivocal, abnormal or shunt components are out of place (could be targeted/biopsy shunt series looking at specific area if recent revision)</td>
<td>Orbit/Oral</td>
<td>Blood glucose Q 12h</td>
<td>Head circumference recorded</td>
</tr>
<tr>
<td>Ventriculostomy isb (new diagnosis should have a full MRI, otherwise could just do FAST MRI to assess ventricular area) or Head US (if infant and clinically appropriate)</td>
<td>Abdominal ultrasound (recent shunt insertion, abdominal examination)</td>
<td>Restricted</td>
<td>Blood glucose Q 12h</td>
<td>Signs and symptoms of increased ICP</td>
</tr>
<tr>
<td>Pregnancy screening as per policy: [Insert Policy]</td>
<td>Pregnancy screening</td>
<td>Blood glucose Q 12h</td>
<td></td>
<td>Child and family verbalise pain &amp; nausea well controlled prior to discharge</td>
</tr>
<tr>
<td>Routine labs including CBC, Electrolytes, PT/INR and Type/Sens</td>
<td>Routine labs including CBC, Electrolytes, PT/INR and Type/Sens</td>
<td>Blood glucose Q 12h</td>
<td></td>
<td>Insulin is assessed</td>
</tr>
<tr>
<td>If suspected septic medical team to consider initiating the septic protocol</td>
<td>If suspected septic medical team to consider initiating the septic protocol</td>
<td>Blood glucose Q 12h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short shunt insertion is usually considered in patients who have had a shunt surgery within the past 8 months</td>
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<td>Blood glucose Q 12h</td>
<td></td>
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<tr>
<td>No return to theatre for the same patient within the same admission</td>
<td>No return to theatre for the same patient within the same admission</td>
<td>Blood glucose Q 12h</td>
<td></td>
<td></td>
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<tr>
<td>Cell necroscopy immediately if the symptoms are marked or rapidly progressive</td>
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<td>Blood glucose Q 12h</td>
<td></td>
<td></td>
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<tr>
<td>Pre-op facility as per policy pre-op bathing policy</td>
<td>Pre-op facility as per policy pre-op bathing policy</td>
<td>Blood glucose Q 12h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prescribe pre-operative and postoperative medications</td>
<td>Prescribe pre-operative and postoperative medications</td>
<td>Blood glucose Q 12h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assess family understanding of plan of care</td>
<td>Assess family understanding of plan of care</td>
<td>Blood glucose Q 12h</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Consults

- Neurosurgeon mandatory on team
- Radiologist mandatory on team
- Physical therapist mandatory on team
- Social worker & child life mandatory on team
- Nutrition mandatory on team

Ventricular Peritoneal Shunt Insertion or Revision
### Ventricular Peritoneal Shunt Insertion or Revision

<table>
<thead>
<tr>
<th>Activity</th>
<th>Activity As Tolerated</th>
<th>Nutrition &amp; Diet</th>
<th>Activity As Tolerated</th>
<th>Activity As Tolerated</th>
<th>Nutrition &amp; Diet</th>
<th>Activity As Tolerated</th>
<th>Activity As Tolerated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete falls assessment, document in care plan and on patient record Falls and CSE policy.</td>
<td>Activity As Tolerated</td>
<td>PPO or DNT As Tolerated</td>
<td>Activity As Tolerated</td>
<td>PPO or DNT As Tolerated</td>
<td>Activity As Tolerated</td>
<td>PPO or DNT As Tolerated</td>
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</tbody>
</table>

**Pain Management**

- Age appropriate pain assessment using pain assessment tool.
- Inhibit Sedation/Analgesia bundle.
- Train assessment tools (please select appropriate):
  - PROMP
  - FLACC
  - Wong
  - Numeric
  - Faces
  - NCCPC-P
  - NCCPC-P/V

**Routine Management**

- Activity As Tolerated
- Nutritional & Diet
- Diet As Tolerated
- Activity As Tolerated

**Dressing & Wound Care**

- Neururinary Foley in situ; keep type of closure intact.
- Incision to remain covered for 24-48 hours post-op.
- Notify MD if dressing wet or oozing from incision noted.
- Change sterile cloth daily and per.

**Fixed Management**

- Discontinue IV when antibiotics completed.
- Instruct fluid and no further investigations pending (CT, MRI).

**Information for quick reference**

- Neurosurgeon to attend if further intervention needed.

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## Pre-operative teaching:
- NPO instructions
- OR time
- IV insertion if applicable
- Pre-op bath
- Transport to OR
- Answer questions or offer resource for short related questions
- Recovery room
- Post-op medications/Pain management
- Assess child & family’s understanding
- Child/parent verbalizes awareness/understanding of plan of care

## Post-operative teaching:
- Want to remain flat for 48 hours
- Pain management
- FSA site notified if any leakage noticed/inferior vena cava
- Expected bruising
- Briefly explain care if family
- Signs and symptoms of increased ICP
- Review/Provide short neuro/nursing
- Abdominal pain:
  - Medical:
    - Pain
  - Pediatric:
    - Fever
  - Other:
    - Bradycardia
    - Hypotension
    - Leukocytosis
- If child has a programmable valve: MOPP to document setting and ensure family is aware of programmable valve, current setting and MOPP restrictions/FV to remain flat

## Discharge medication reconciliation:
- Medication reconciliation completed: medication reconciliation policy
- Anxiety: ordered
  - Amitriptyline
  - Morphine
- Antibiotics: neomycin 50 mg/kg IV (max 2g) given 1 dose 6 hrs post intra-operative
- Antacids: 
  - Undesirable or diarrhea

## Review with family wound care
- Review/Provide short neuro/nursing/Abdominal pain

## Review/Provide discharge:
- Medical records: phone number, contact person
- Follow-up appointment: imaging/follow-up
- Child and family’s awareness/understanding of plan of care post-discharge
4.0 Guideline Group and Reviewers

Guideline Group Membership:
1. Patricia Rowe, RN (EC), MN, NP Paeds Nurse Practitioner Neurosurgery
2. Maria Lamberti-Pascuili, RN, Neurosurgery Research Nurse
3. Sara Breitbart, RN, (EC), MN, NP Paeds Nurse Practitioner Neurosurgery
4. Dr. Abhaya Kulkarni: Staff Neurosurgeon
5. Dr. D.D. Cochrane: Staff Neurosurgeon

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4. Dr. Michael Taylor: Staff Neurosurgeon
5. Arbelle Manicat-Emo, RN (EC), MN, NP Paeds Nurse Practitioner Neurosurgery
6. Herta Yu, RN (EC), MN, NP Paeds Nurse Practitioner Neurosurgery
7. Dr. Dennis Scolnik Staff Physician, Emergency
8. Dr. Jamie Hutchison Staff Physician, CCU
9. Sabrina Boodhan, Pharmacist

External Reviewers:
1. Dr. Jan Riva-Cambrin MD FRCS: Assistant Professor of Neurosurgery, University of Utah
2. Dr. Mandep Tamber MD, PhD, FRCS: Assistant Professor, Pediatric Neurosurgery University of Pittsburgh School of Medicine Children’s Hospital of Pittsburgh

5.0 References


Attachments:

- Shunt protocol.pdf
- ventricular shunt_CPG_September 2021.pdf