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
### Ventricular Peritoneal Shunt Insertion or Revision

#### Pre-admission

- **History & physical assessment (including neurologic assessment and head circumference if less than 10 months)**
- **CT scan or MRI (neurodiagnostic studies should be a 3 T MRI, otherwise could be a 1.5 T MRI for a faster MRI and less claustrophobia, if an infant and craniotomy appropriate)**
- **Shunt series if CT/MRI if not visualized, abnormal or shunt components out of place**
- **Should be targeted in the series looking at specific area if recent revision**
- **Abdominal ultrasound (recent shunt insertion, abdominal examination)**
- **Pregnancy screening as per policy: **
  - Pregnancy Panel
  - Routine lab including CBC, Erythrocytes, PT/INR and Thrombometry
- **If suspected sepsis medical team to consider initiating the sepsis protocol**
- **Shunt infection should be considered in patients who have had a shunt surgery within the past 6 months**
- **If suspected infection medical team to consider the sepsis protocol**
- **Call neurosurgery immediately if the symptoms are marked or rapidly progressive**
- **Pre-op nothing by mouth per operating room policy**
- **Pre-operative counseling and hospitalization**
- **Assess family understanding of plan of care**

#### Consults

- **Neurosurgery consult: if indicated**
- **Neurointervention to complete pre-operative orders in electronic system**
- **IV therapy for hydration and/or antibiotics if indicated**
- **Neurosurgeon to obtain consent from parent/patient/child**
- **Consults as appropriate for example Endoscopy, Hematology, General Pediatrics, General Surgery**
- **Social Work, Child Life consult as indicated**

#### Admissions/Pre-Op

- **Neurological Vital Signs Q1-4h. Assess if patient requires close neurologic observation and notify if indicated**
- **IF > 10 months of age, check and record fontanelle Q3.5-4h and head circumference daily**
- **Monitor for signs & symptoms of increased ICP**
- **Neurosurgeon to review brookman results (consult as appropriate to serological testing if any abnormalities)**
- **Pre-op nothing by mouth per operating room policy**
- **Pre-op nothing by mouth per operating room policy**

#### Intraperative

- **See Shunt Insertion Protocol Checklist to be completed in OR (swinging room staff only)**
- **OR IntraCranial pressure line**
- **Limited by signs on chart**
- **Number of people in the OR: ensuring no limited**
- **Monitor position of the head to ensured closer to head than head**
- **Call Alzet® 30 mg/kg IV (max 30g)**
  - One pre-op dosage
  - One pre-op dose at 8h after initial to be performed with post-op orders
- **Use clipped as needed, not shown**
- **Cannula and samples required for each participant**
- **Dacryocystitis requiring for each participant**
- **Skin preparation**
  - Remove hair, delphi, & adhesive material
- **Clamps applied in surgical field & not washed off**
  - Isobutyl™ over surgical field
  - Encourage Alzet® was administered
- **Shunt implanted or removed as per usual practice**
- **Bacterial impregnated sutures or if Etrad® not available**
- **Regular wound catheter with Antibiotic injection – Intrathecal**
  - Vancomycin (15mg in 1ml of normal saline)
  - Gentamicin (8mg in 2ml of normal saline)
- **Skin closure as per standard practice**
- **Neurosurgeon to document in electronic patient chart nature of surgery, type of shunt device (including wiring of valve system, wiring of programmable device if used). Any complications and surgical incision closure**
- **Consulted cranial nerves to also be operated by neurosurgeon including: nature of surgery, type of shunt device (including wiring of valve system, wiring of programmable device if used), any complications and surgical incision closure**
- **Neurosurgeon to notify unit if patient needs any heightened monitoring post-op dressing applied to all wounds. Leave in place overnight**
- **Dressing applied to all wounds. Leave in place overnight**

#### Post-op

- **Neurological Vital Signs Q2.5-4h**
- **Vital Signs Q3.5-4h**
- **9-10 months of age check and record fontanelle Q3.5-4h and head circumference daily**
- **Monitor for signs & symptoms of**
  - **Increased ICP**
  - **Sedation**

#### Imaging

- **CT scan: Fast MRI or head cta-scan depending on child's age**
- **Baseline post-op imaging is not required – will only be ordered when specifically indicated**

#### Discharge

- **Vital signs and Neurological Vital Signs per discharge**
- **Head circumference recorded**
- **Signs and symptoms of increased ICP**
- **Child and family verbalization pain & nausea well controlled prior to discharge**
- **Ensure patient has had a bowel movement**
- **Indomethacin is assessed**

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### Activity
- Activity As Tolerated

### Nutrition & Diet
- NPO or Diet As Tolerated (Anesthesia NPO guidelines)

### Activity
- Complete falls assessment; document in care plan and in patient record (falls and CSCI section)
- Activity As Tolerated

### Nutrition & Diet
- NPO or Diet As Tolerated (Anesthesia NPO guidelines)

### Activity
- Elevate head of bed as per medical orders
- Activity as tolerated or bedrest
- Encourage deep breathing and coughing exercises.

### Nutrition & Diet
- Diet As Tolerated
- Patient to be eating moderate amounts with no nausea and maintaining hydration prior to discharge

### Dressing & Wound Care
- Neurorsurgery to note in chart type of closure (staples/tissue glue)
- Incision to remain squared for 24-48 hours post-op
- Notify MD if dressing well or oozing from incision noted
- Change pillow case daily and pins

### Fixed Management
- Discontinue IV when antibiotics completed, tolerating full fluids and no nausea and no further investigations pending (CT, MRI)

### Activity
- Activity As Tolerated

### Nutrition & Diet
- Diet As Tolerated
- Patient to be eating moderate amounts with no nausea and maintaining hydration prior to discharge

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### Fixed Management
- Discontinue IV when antibiotics completed, tolerating full fluids and no nausea and no further investigations pending (CT, MRI)

### Activity
- Age appropriate pain assessment using pain assessment tool
- Initiate GPC/PCA bundle
- Pain assessment tools (please select appropriate)
  - PIPP
  - FLACC
  - Wong
  - Numeric
  - Faces
  - NCCPC-R
  - NCCPC-PV

### Activity
- Age appropriate pain assessment as per previous selection pain assessment tool

### Activity
- Continue pain management, pain assessment tools
- Parent observation
- Age appropriate pain assessment as per previous selection pain assessment tool
<table>
<thead>
<tr>
<th>Pre-operative teaching:</th>
<th>Post-operative teaching:</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPO instructions</td>
<td>Wash to remain dry for 48 hours</td>
</tr>
<tr>
<td>Clear fluids</td>
<td>Pain management</td>
</tr>
<tr>
<td>IV insertion if applicable</td>
<td>Anxieties in family</td>
</tr>
<tr>
<td>Pre-op bath</td>
<td>· Sites and concerns of increased ICP</td>
</tr>
<tr>
<td>Transport to OR</td>
<td>· Review with family wound care</td>
</tr>
<tr>
<td>Answer questions or offer resource for short related questions</td>
<td>· Review with patient and family for care plan post-discharge</td>
</tr>
<tr>
<td>Recovery room</td>
<td>If child has a programmable valve: MOCR to document setting and ensure family are aware of programmable valve, current setting and MOCR to reinforce learning. Provide family with a Patient Data Card</td>
</tr>
<tr>
<td>Post-op medications</td>
<td></td>
</tr>
<tr>
<td>Pain management</td>
<td></td>
</tr>
<tr>
<td>Anxiety in family</td>
<td></td>
</tr>
</tbody>
</table>

**PREPARATION**

- Review child & family’s knowledge base
- Provide hydrocephalus patient education
- Provide shunt revision Patient Education
- Orientation to Ward and Routines (both family and child)
- Discharge Preparation

**PROCEDURE**

- Stock medication reconciliation. Ensure to evaluate if child is on any anticoagulant or other medications that may affect coagulation or platelet function.
- Antibiotics ordered.
- Morphine or Ketamine
- Antibiotics to be given in OR Room - See Intraoperative plan.

**ANESTHESIA**

- See Anesthesia Guidelines
- Adjuvant drugs based on pain assessment
- Morphine or Ketamine
- Antibiotics to be given in OR Room - See Intraoperative plan

**POSTOPERATIVE**

- Medication reconciliation completed: review and reassess.
- Adjuvant drugs based on pain assessment.
- Morphine
- Antibiotics
- MSOC 50 mg IV (max 25) given 1x before the post intraoperative phase
- Anti-emetics
- Undertreatment or overdose?

**DISCHARGE**

- Review with family wound care
- Review/Provide short shunt revision patient education
- Review with patient and family for care plan post-discharge
- If child has a programmable valve: MOCR to document setting and ensure family are aware of programmable valve, current setting and MOCR to reinforce learning. Provide family with a Patient Data Card.
4.0 Guideline Group and Reviewers

Guideline Group Membership:
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5.0 References


Attachments:

Shunt protocol.pdf
ventricular shunt_CPG_September 2021.pdf