How do I do it:
Insertion of VP shunt in neonates

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Introduction

- VP shunting is usually the treatment of choice for hydrocephalus in neonates
- Shunt failure ranges from 25-40% at one year follow-up
- Shunt survival decreases progressively and may be as low as 20% ten years after implantation
- Shunt failure is a permanent risk for hydrocephalic patients
- Expressive rates of shunt complications are related to improper surgical technique
Introduction

- Infection remains the most significant complication of VP shunts
- Shunt infection has a great potential for mortality and morbidity
- Neonates have a higher risk of shunt infection
- Shunt infection is usually due to inoculation of microorganisms during surgery
- Several protocols have been introduced to reduce infection rates
- All of them emphasize the need for a thorough surgical technique
Preoperative assessment

Skin inspection

• Previous scars
• Tracheostomy
• Gastrostomy
• Defects of the abdominal wall
• Sores
• Bruises
• Cutaneous / subcutaneous infection
Preoperative assessment

Medical conditions

• Etiology
• Prematurity
• Infections
Preoperative preparation

Hair and body preparation

• Body wash and shampoo (Chlorhexidine 12h and 1h before surgery)
• No shaving
• Scrub the skin for 5 minutes just before start operating

Antibiotic prophylaxis

• Intravenously at anesthetic induction
Shunt selection

No significant differences between shunts
No significant differences in shunt survival

So:

- Selecting shunts remains an individual choice

But:

- Consider the variations between patients
Shunt selection

Variations such as:

- Prematurity
- Skin thickness
- Size of ventricles
- Etiology of hydrocephalus

Relates to:

- Profile of the hardware
- Pressure / resistance
- Flow-regulating valves
- Programmable valves
- Anti-siphon devices (ASD)

...etc
Hardware in neonates

My preference for neonates (at term) and infants:

- Low profile shunt
- Differential pressure shunt as initial option
- Medium pressure valve
- Open-ended distal tubing
- Reservoir
- Impregnated catheters in high-risk patients
Surgery: Operating theater  (After Choux et al, 1992)

Schedule / timing:

- Shunts first, whenever possible
- Neonates and infants first
- No more than four shunts / day

Staff:

- Restrict personal to a minimum
- No scrub nurse
- Prevent entry and exit of people in the OR
Surgery: Operating theater

- Change gloves before manipulating the hardware
- Instruments used to manipulate skin and to handle shunt hardware should be kept in separate tables
Surgery: positioning

- Supine with the head turned to the opposite side (occipital burr hole)
- Brow-up (frontal burr-hole)
- Neck extended
- Keep a single plane between the skull, cervical and abdominal region
Surgery: positioning

Cranial entry

• Occipital entry is preferred
• Frontal entry is better for smaller ventricles
• No differences regarding function, seizures or infections

http://www.hermesprado.com
Advantages and disadvantages of cranial entries:

- Occipital entry (OE) allows to enter the lateral ventricle along its major axis
- OE usually does not require intervenient incisions
- Frontal entry (FE) is better in the case of smaller ventricles
- FE often requires an intermediate incision
- FE is a short way to reach the ventricles and do not traverse eloquent areas
Surgery: preparation

- Hair and skin prepared with chlorhexidine solution
- Always mark incisions before draping
- Sterile disposable adhesive drapes with minimal exposition of the skin
Scalp incision and burr hole positioning

- Semilunar incision usually on the right side ("virgin" patients)
- Avoid coagulating the skin
- Create a subcutaneous pocket to house the reservoir
- Occipital: 2-3 cm from midline, 3-4 cm above the inion
- Frontal: 2-3 cm from midline just in front of the coronal suture or at the fontanel angle (neonates)
- Dandy-Walker: Position burr hole according preoperative imaging
Creating a burr hole

- Use a twist drill or a even an 15 scalpel blade
- Dural opening large enough to allow entry of the ventricular catheter
- Do not place the burr hole underneath the incision line
Handling the hardware

• Select the shunt prior surgery
• Be sure the valve profile is adequate
• Open the pack at the last moment
• Do not test the valve
• Do not touch the valve components (Faillace WJ, 1995)
• Protect forceps with small pieces of tubing
Ventricular catheter placement

**Landmarks for occipital entry**
- Ipsilateral mediopupillary line parallel to the sagittal suture

**Landmarks for frontal entry**
- Inner canthus of the ipsilateral eye
- Opposite tragus
Ventricular catheter placement

- Place the tip of the catheter in the frontal horn, in front of the choroid plexus
- Alternatively: Place the tip of the catheter in the most dilated part of the lateral ventricle
- Allow CSF to flow before connecting the valve
- Collect CSF for examination
Ventricular catheter placement

- Length of ventricular catheter varies according individual data
- US, Endoscopy, NNav may be used if available and/or required
- Do not place the valve underneath the incision line
- Fix the ventricular catheter to the periosteum of the skull
Abdominal incision

- Minilaparotomy: paraumbilical incision
- Alternatively: midline incision, umbilical incision
- Catheter insertion under direct vision
- Alternatively: Peritoneal trocar, video-laparoscopy
- Caution: Assure bladder is empty if a trocar is considered
Tunneling

- From abdominal to cranial
- Alternatively: from cranial to abdominal
Connecting the shunt components

- Tie tightly the shunt components
- Be sure there the suture does not constrict the lumen of the tubing
Testing the shunt

- Allow CSF to flow from the distal end for some time
- Lower the distal end to increase flow
- Alternatively: Aspirate CSF / pump the reservoir (except if ASD)
- Be sure the shunt is working properly before insertion in the peritoneal cavity.
Closure

Closing the scalp:
• Two layers closure whenever possible
• Avoid pressure over the wound

Abdomen:
• Peritoneum: Purse-string suture
• Alternatively: No suture at all
• Wound closed in separate layers with absorbable sutures
• Skin closure with nylon sutures
Postoperative care

- Avoid pressure over the valve
- Flat bed for 24-48h
- Antibiotics for 24 h
- Dressings changes: every 24h until discharge (mean 2 days)
- Shampoos 24 and 48h after surgery
- Discharge: 48h after surgery
- Sutures removal: 10 days after surgery
- Follow-up consultations: 30, 90, 180 days after surgery
Thank you!