SHUNT INFECTION
Introduction

- Ventricular catheter placement one of the most common neurosurgical procedures
- One of the most common complications associated is infection
- Infection: positive CSF culture/ or from shunt hardware
- More common in pediatric population
CRITERIA – Brown and Durand et al.,

- Positive CSF/shunt tip culture in patient with clinical presentation of ABM/shunt malfunction
- At least 1 parameter of CSF inflammation
  - TLC -> 0.25x10^9 with leucocytosis
  - CSF lactate conc. > 0.35mmol/l
  - CSF glucose/serum glucose < 0.4
  - CSF glucose value < 2.5mmol
Implications

- High mortality/ morbidity
- Extended hospital stay
- Loss or delay of educational/ developmental milestones
- Reduced health related quality of life style
- Large cost
Infection Rate

- Varied rate at different centers
- Walter et al., 18%/ patient: 20 year study
- 5% / surgical procedure
- Ammirati et al., 22%/ patient and 6%/ procedure
- Borgberj et al., 7.4%
- ISPN multi centric study: 6.5%
Time to Infection

- 92% of infections occurred within 3 months - Casey and colleagues
- This finding generally confirmed by most
Risk factors

- Age: <6 months-19% versus 7% in older population – Casey and colleagues
- Time period
- Educational level/ surgical skill of surgeons
- Length and time of surgery
- Use of antibiotic before and after surgery
- Method for placement of distal catheter
- Type of shunt
- Reason for shunt
- Shunt revision
- Concurrent infection
- Presence of spinal dysraphism- Daniel M Scuba et al.,
Route of infection

- Blood stream
- Shunt tubing
- Contamination with epidermal commensals during surgery
Pathogenesis

- Risk factors
- Neutrophil and monocyte adhere poorly to shunt system
- Weak phagocytosis
- Shunt surface irregularities harbor organism
- Inoculums size/ virulence of organism/ host defense
Organisms

- Early/ late
- Staphylococcus *epidermidis*: coagulase negative
- Staphylococcus *aureus*
- Escherichia *coli*
- Proteus *mirabilis*
- Klebsiella *pneumoniae*
- Propionibacterium
- Fungal
Presentation

- Variable and age dependant
- Headache
- Lethargy
- Nausea/ vomiting
- Irritability
- Apnea
- Bradycardia
- Fever
- Gait disturbances
- Seizures
- Visual disturbances
- Gaze palsy
- Papilloedema
- Abdominal pain
- Erythema/edema along shunt tube
- Fluid collection and pseudo cyst
- Features of shunt nephritis
- Sub acute bacterial endocarditis
Evaluation and Diagnosis

- Detailed history
- Physical examination
- Routine blood tests: Hb/ TLC/ DLC/ urine analysis/ blood cultures
- X-Ray
- USG
- CT scan: ventriculitis/ malfunction
- Shunt tap with CSF analysis and culture
Treatment

- Surgical removal of the infected shunt
- Antibiotic usage: empirical/ culture based
- Re-insertion: 10-14 days later with at least 48 hours
- Shunt exteriorization
- Repeated lumbar drainage
- Shunt replacement: new/ contra lateral site
- Procedures for pseudo-cyst/ abscess
- Antibiotics alone: less effective Brian T et al.,
- Role of intrathecal/ ventricular antibiotics Brian et al.,
Prevention

- Sterile surgical technique
- Perioperative antibiotic use
- Role of first dose antibiotic
- Post operative antibiotic coverage
- Use of shunt tubing with polymeric silicon
- Impregnation of antibiotic
- Use of one piece system \textit{colak, albright etal.}
- Hypothermia during surgery \textit{gerszten pc etal.}
- Annual or biannual screening
Pharmacology of IVT drugs

- Prevent seeding of CSF by bacteria
- Staph species most common
- Drugs don’t cross BBB
- IVT provides higher CSF conc. of drugs
- Thus better surgical prophylaxis
- Current concept: antibiotic must be there when bacteria arrive
Surgical technique- Do’s

- First case in morning
- Minimal staff
- Send scrubbing technician out (Kestle et al.,)
- Double gloving (Kulkarni, Noel et al.,)
- Antibiotic prophylaxis (Chokesey et al.,)
- Pouring of bactericidal substance doubly
- Skin draping
- Opening of shunt just before insertion
- Change gloves while shunt handling
- Minimal manipulation with connector
- Shunt patency checked with antibiotic saline
- Usage of AIS
- Single piece shunt
Surgical technique - Don’t’s

- Cut/ slit/ make holes in lower shunt end
- Tunnel superficially
- Handle skin
- Stitch infection as shunt infection
- H2 blockers
- Perform in presence of foci of infection
Thank you