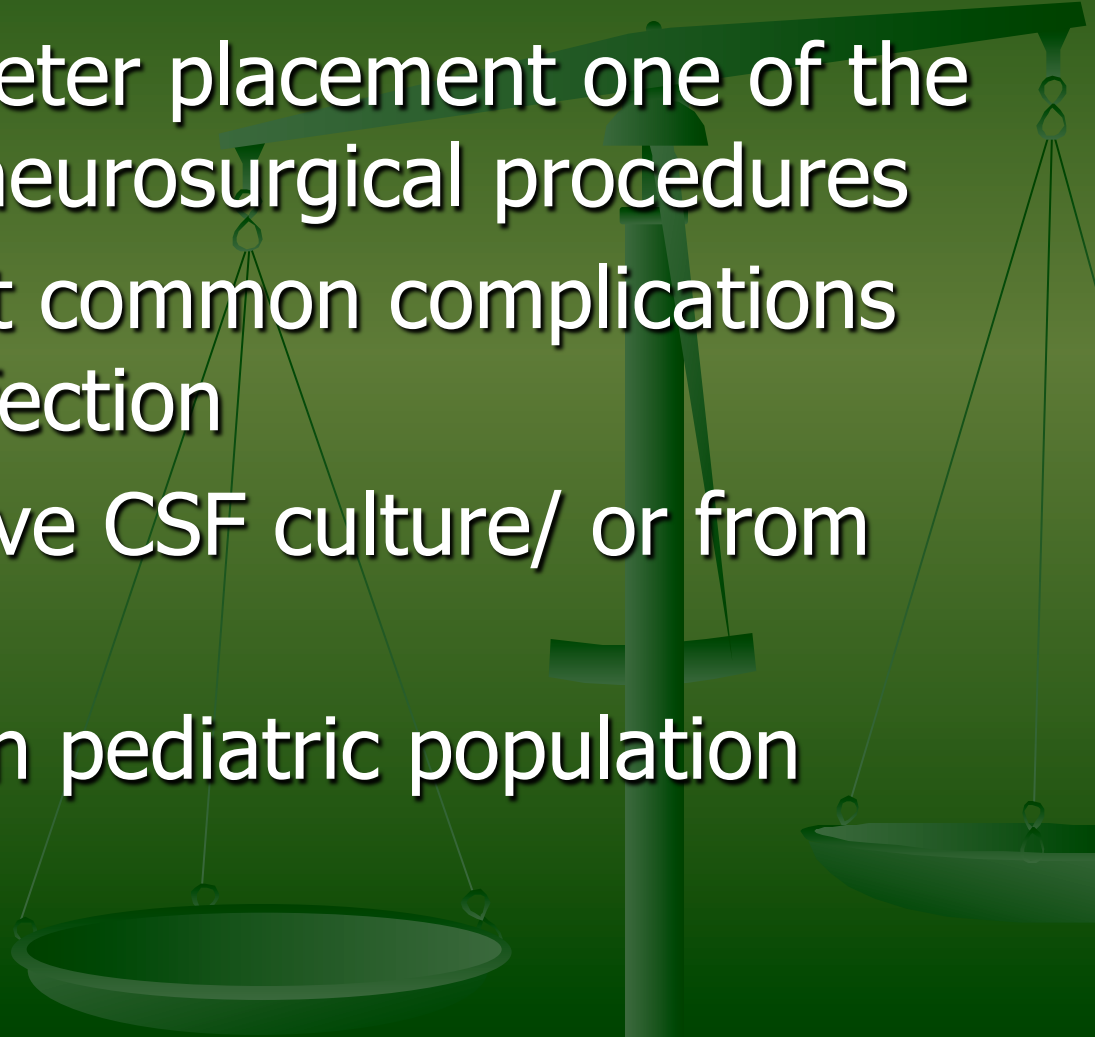


SHUNT INFECTION



Introduction

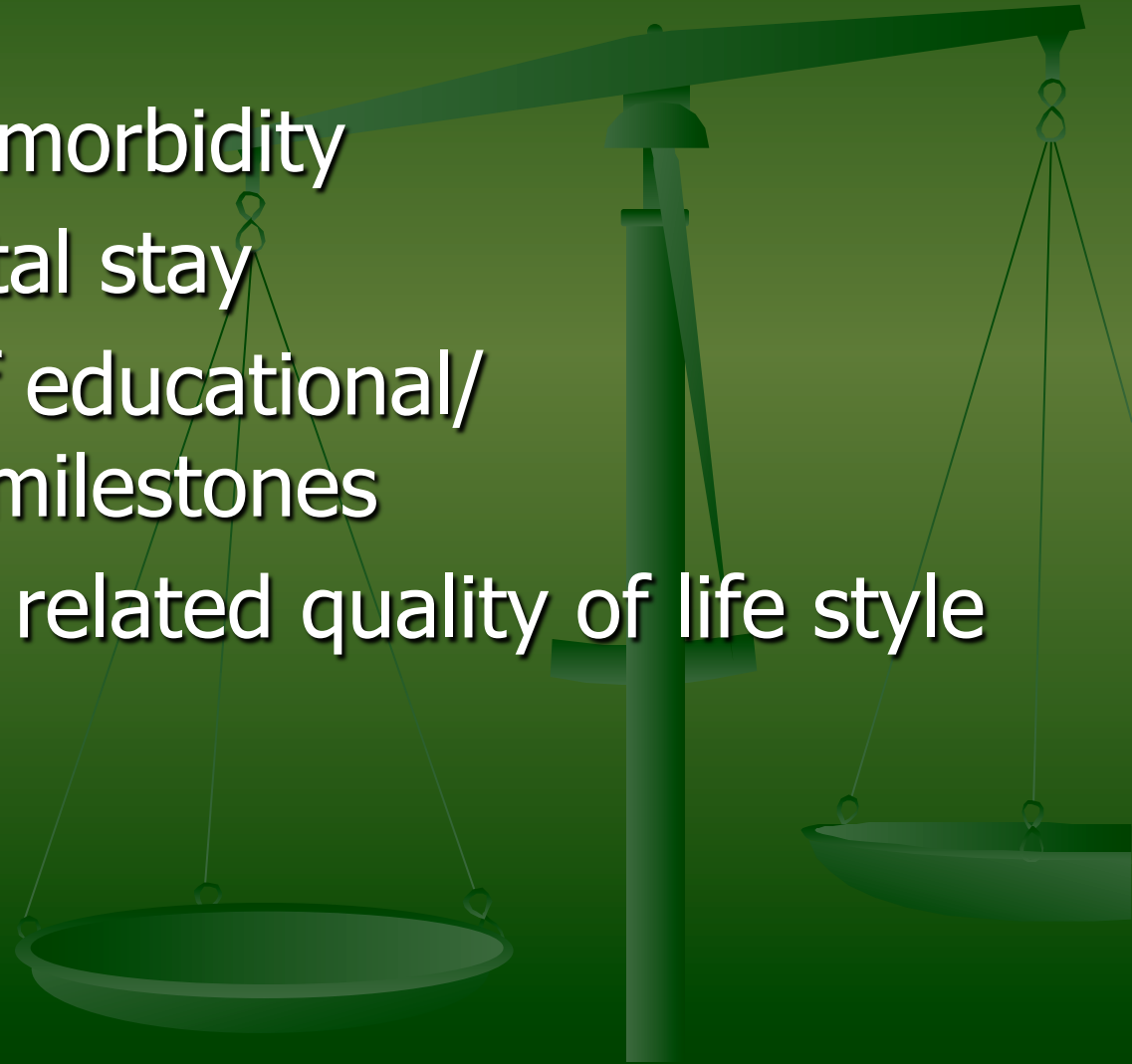
- Ventricular catheter placement one of the most common neurosurgical procedures
 - One of the most common complications associated is infection
 - Infection: positive CSF culture/ or from shunt hardware
 - More common in pediatric population
- 

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-> 0.25×10^9 with leucocytosis
 - CSF lactate conc. >0.35 mmol/l
 - CSF glucose/serum glucose <0.4
 - CSF glucose value <2.5 mmol

Implications

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



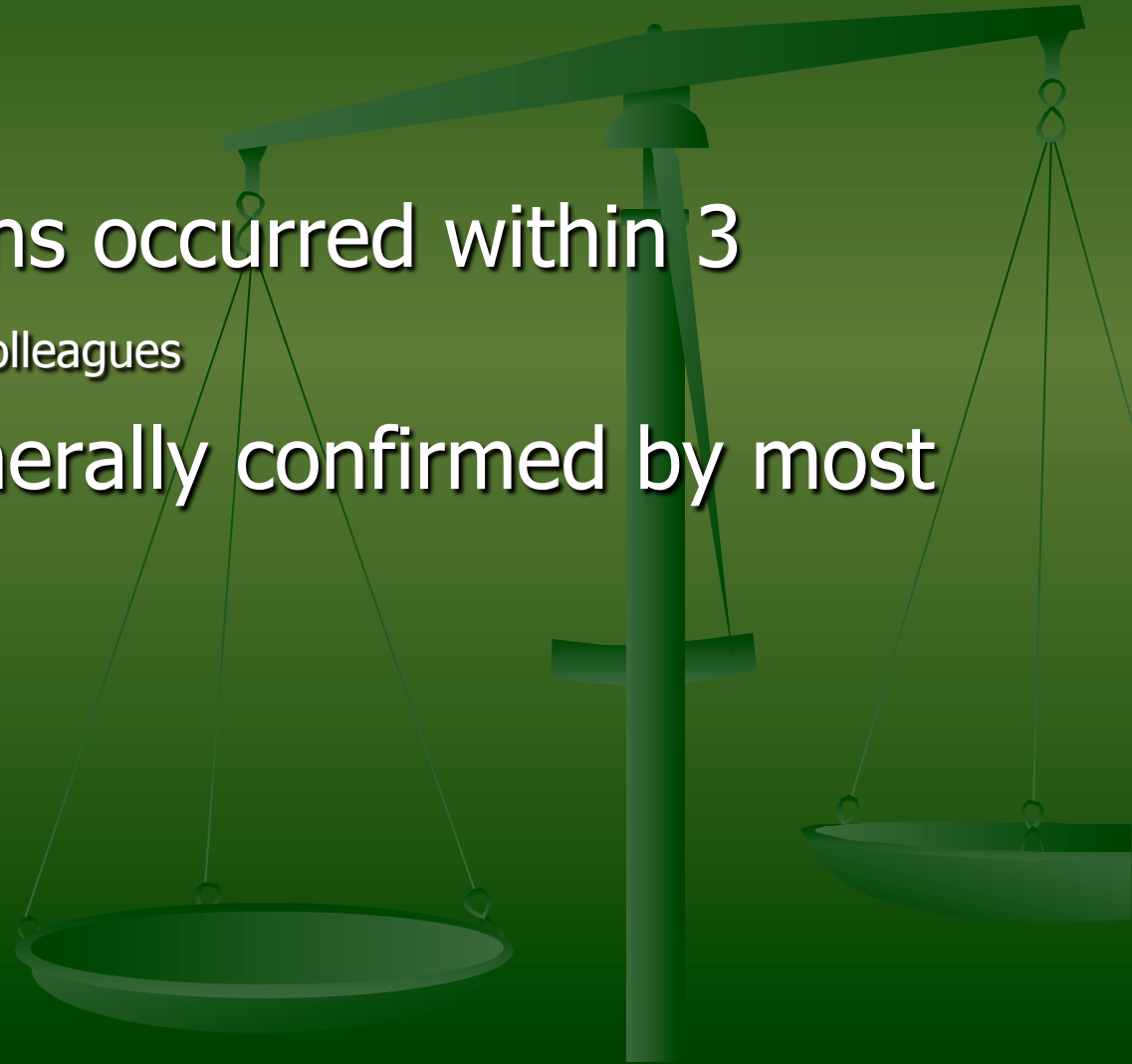
Infection Rate



- 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 etal.,

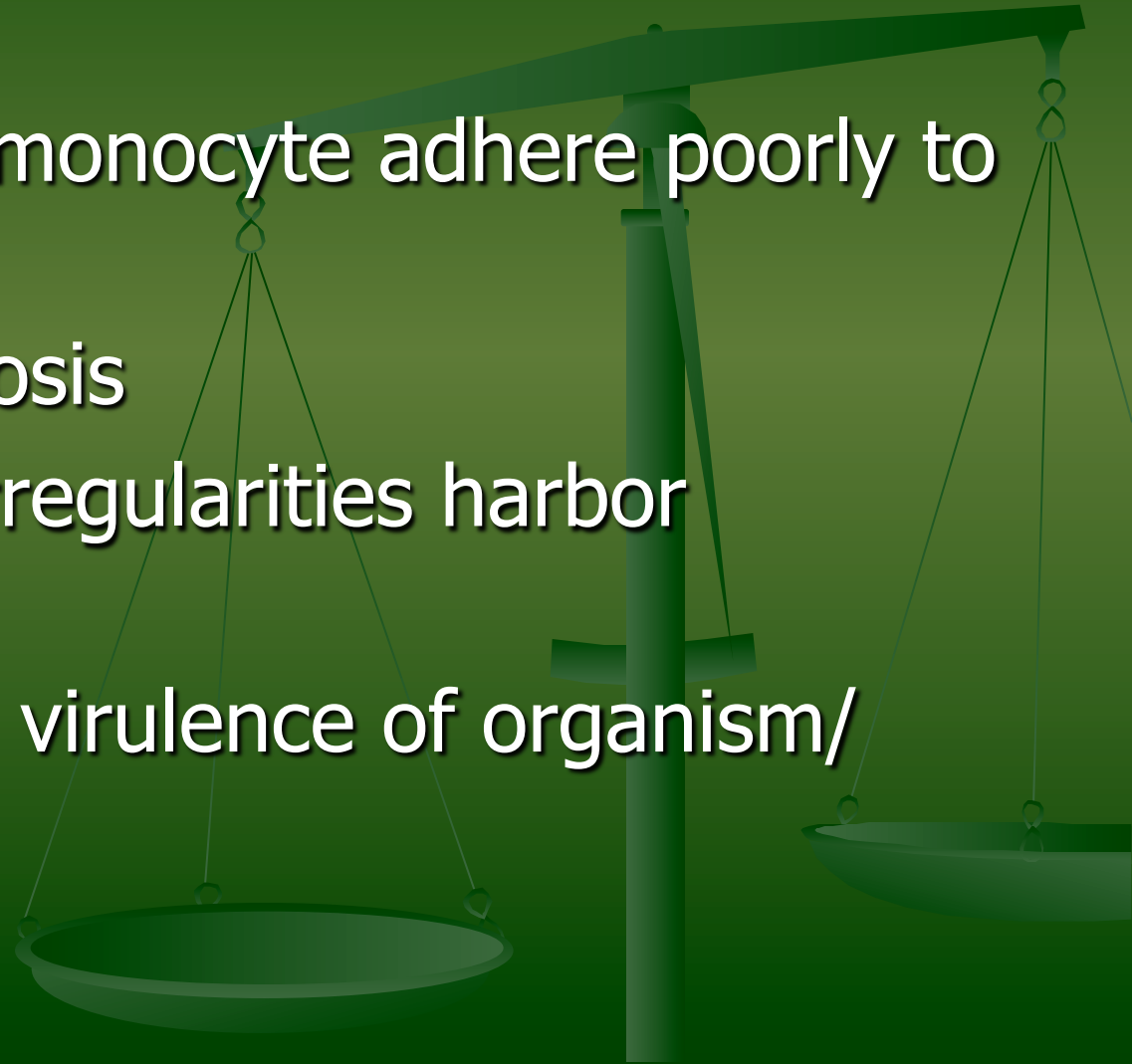
Route of infection

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



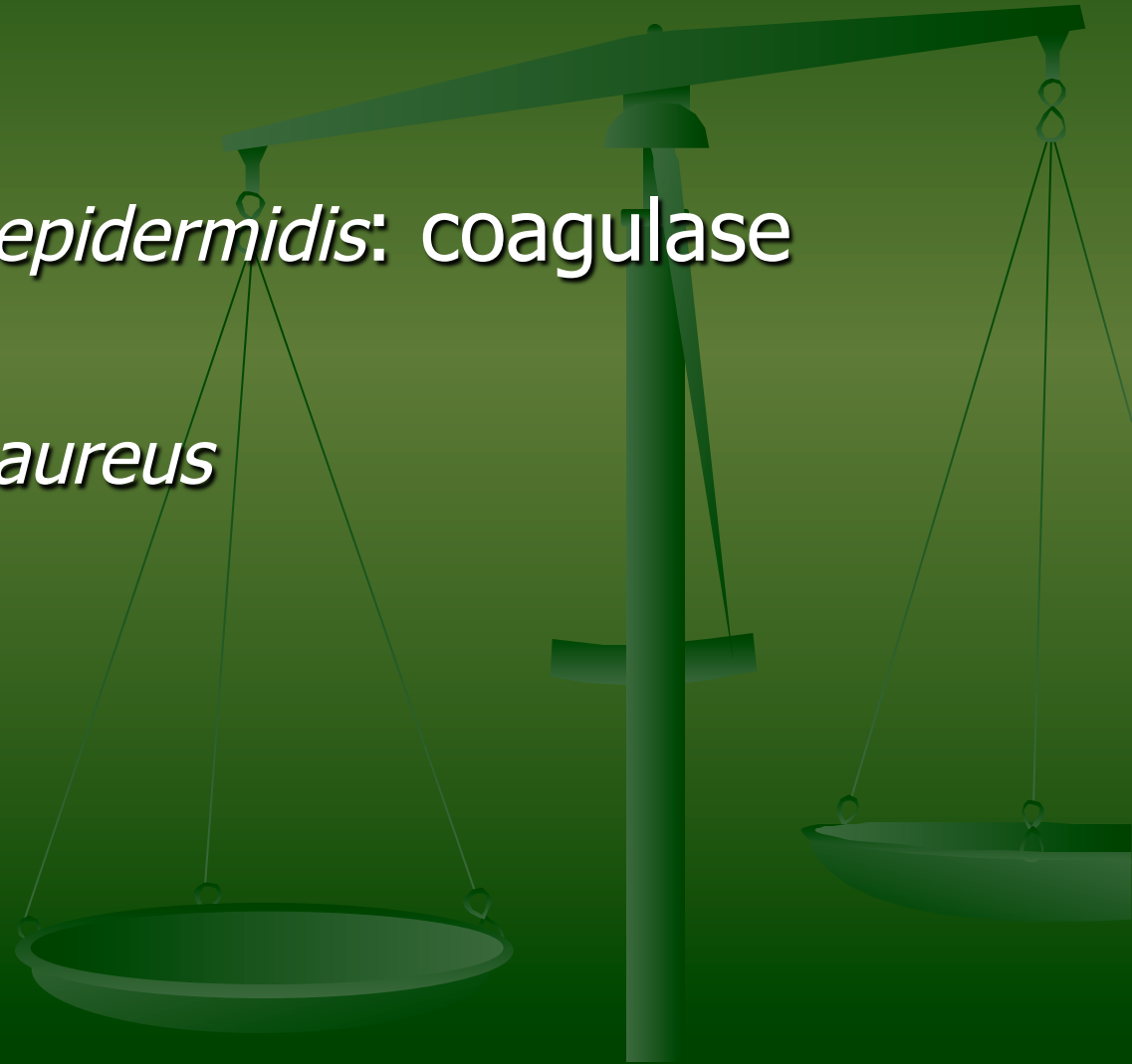
Pathogenesis

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

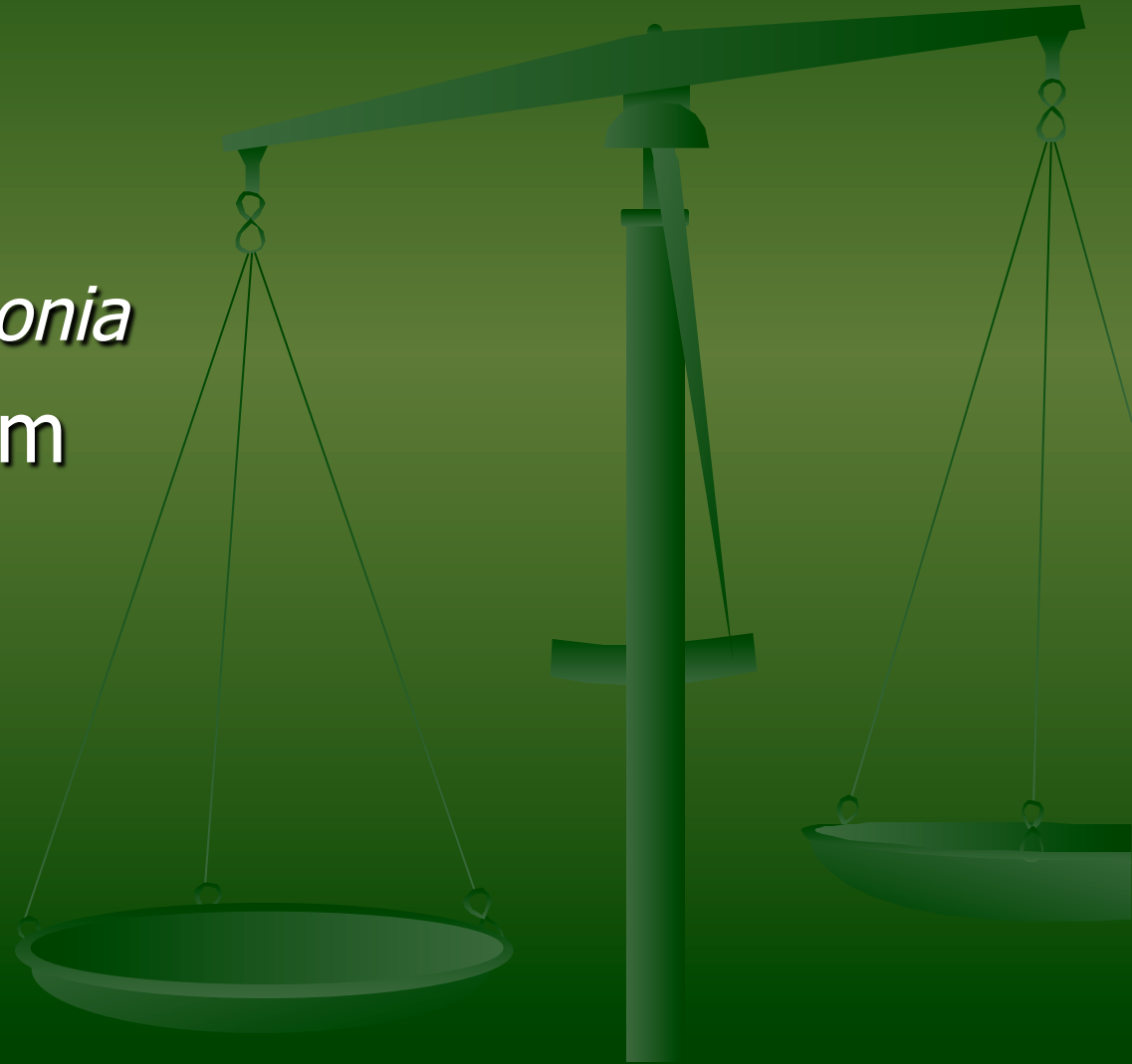


Organisms

- Early/ late
- *Staphylococcus epidermidis*: coagulase negative
- *Staphylococcus aureus*
- *Escherichia coli*

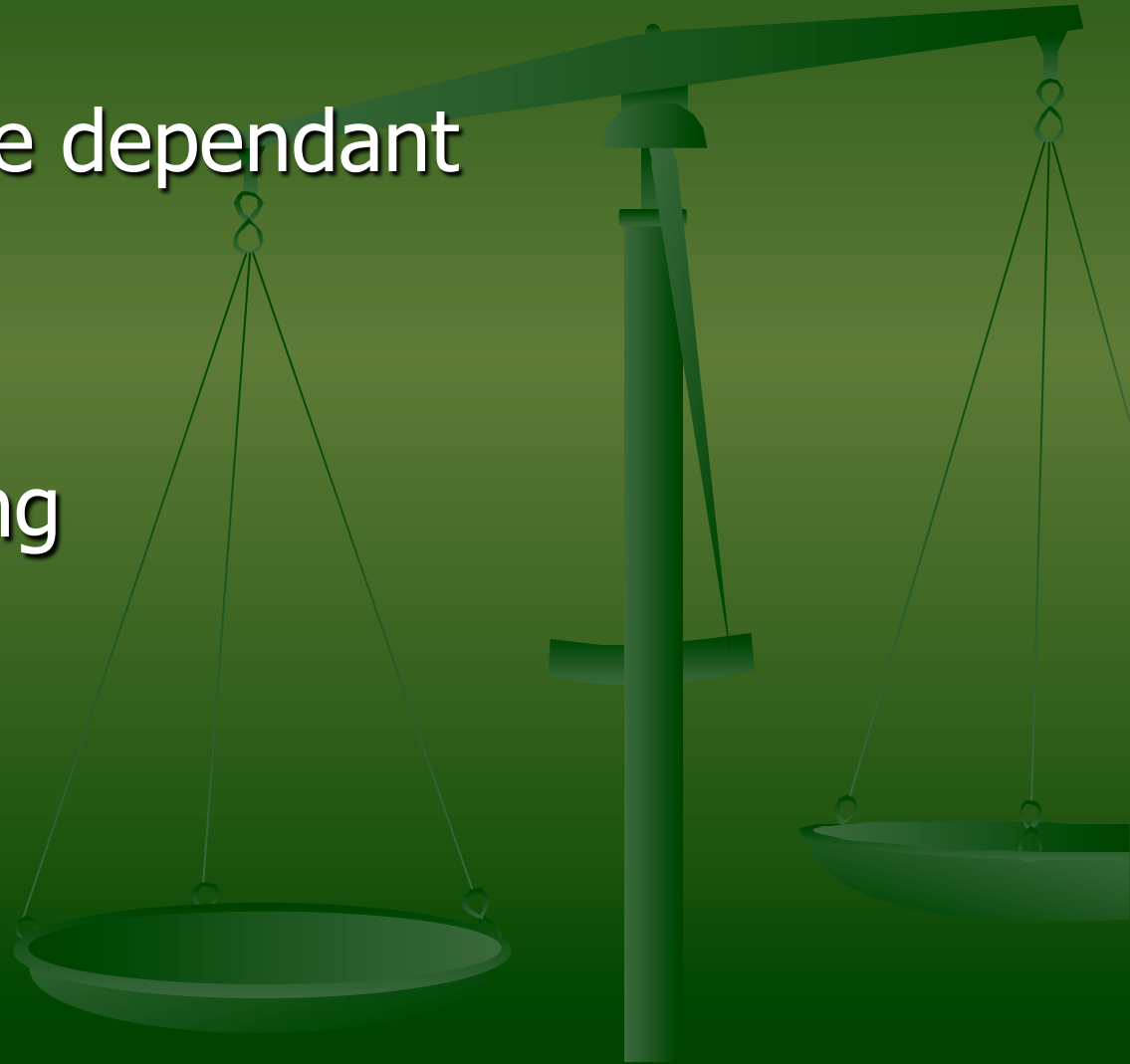


- *Proteus mirabilis*
- *Klebsiella pneumonia*
- *Propionibacterium*
- Fungal



Presentation

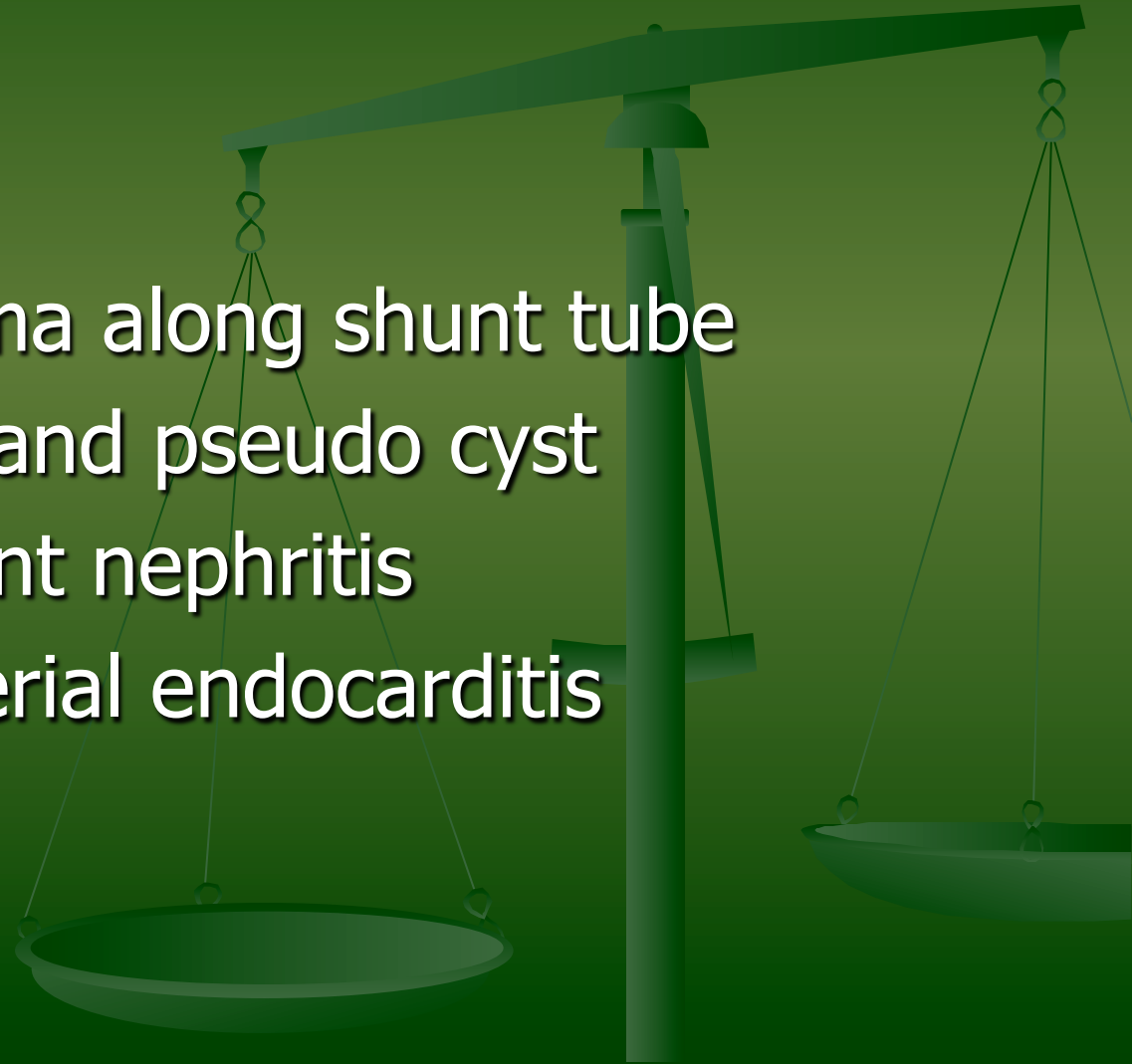
- Variable and age dependant
- Headache
- Lethargy
- Nausea/ vomiting
- Irritability
- Apnea



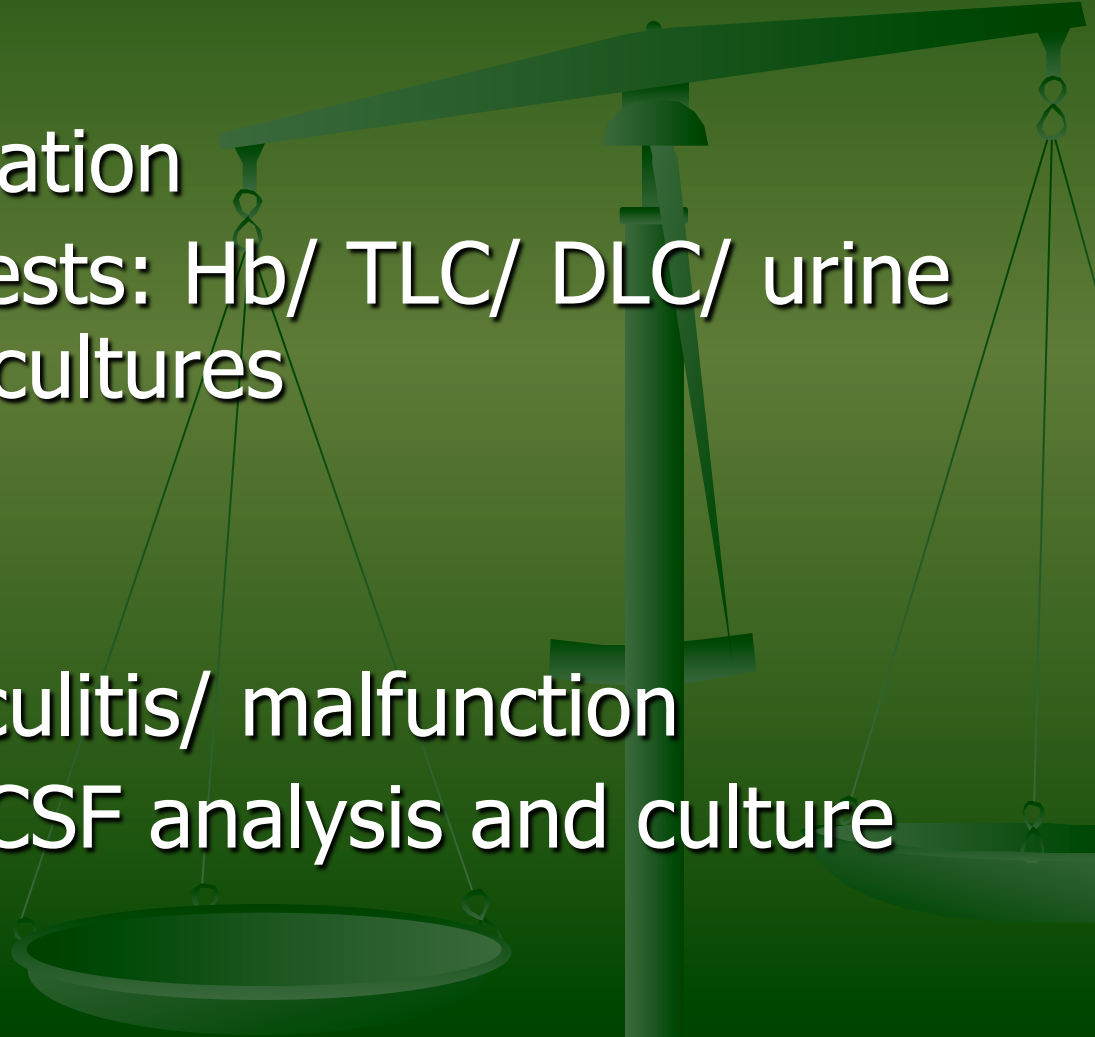
- Bradycardia
- Fever
- Gait disturbances
- Seizures
- Visual disturbances
- Gaze palsy



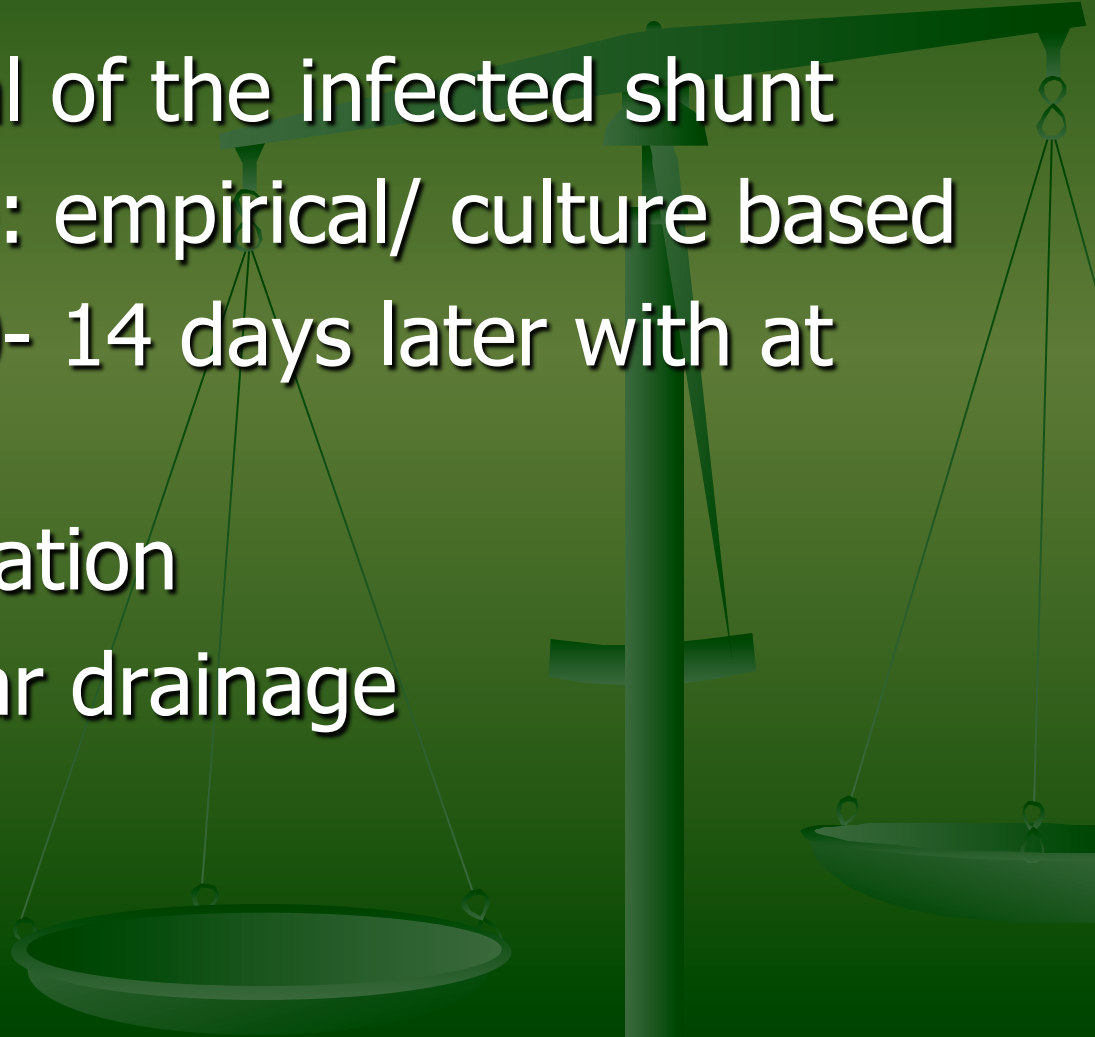
- Papilloedema
- Abdominal pain
- Erythema/ edema along shunt tube
- Fluid collection and pseudo cyst
- Features of shunt nephritis
- Sub acute bacterial endocarditis

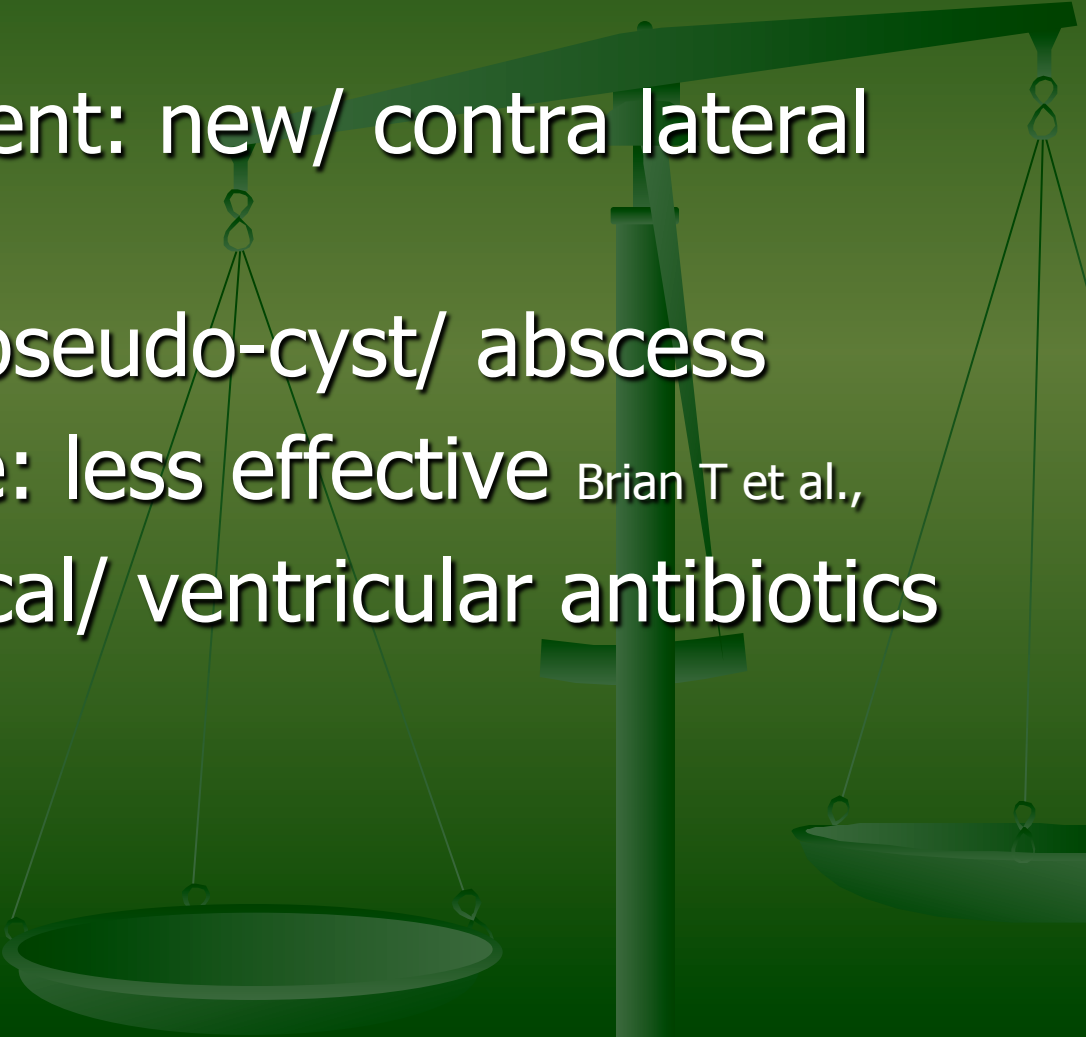


Evaluation and Diagnosis

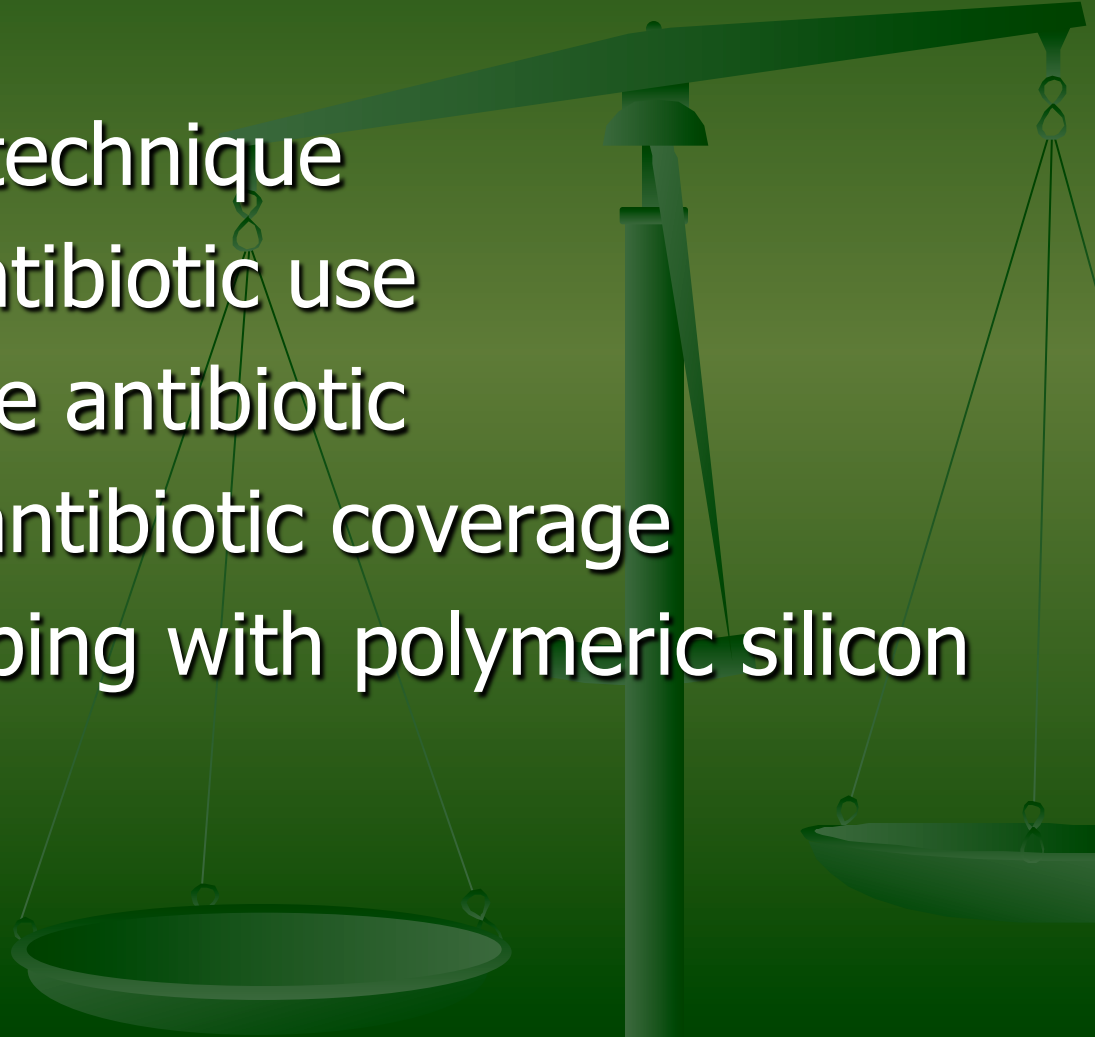
- Detailed history
 - Physical examination
 - Routine blood tests: Hb/ TLC/ DLC/ urine analysis/ blood cultures
 - X-Ray
 - USG
 - CT scan: ventriculitis/ malfunction
 - Shunt tap with CSF analysis and culture
- 

Treatment

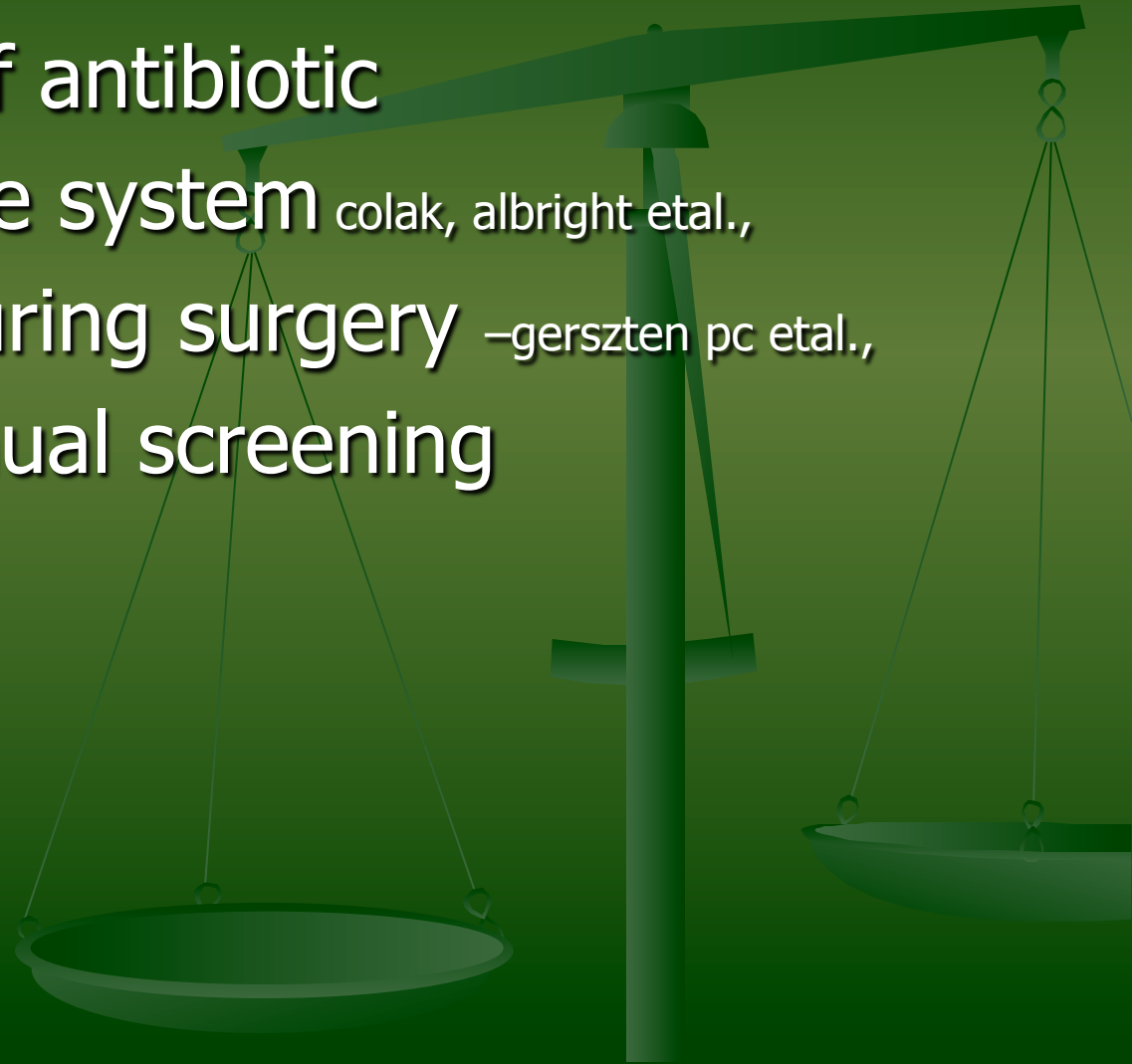
- Surgical removal of the infected shunt
 - Antibiotic usage: empirical/ culture based
 - Re-insertion: 10- 14 days later with at least 48 hours
 - Shunt exteriorization
 - Repeated lumbar drainage
- 

- 
- 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

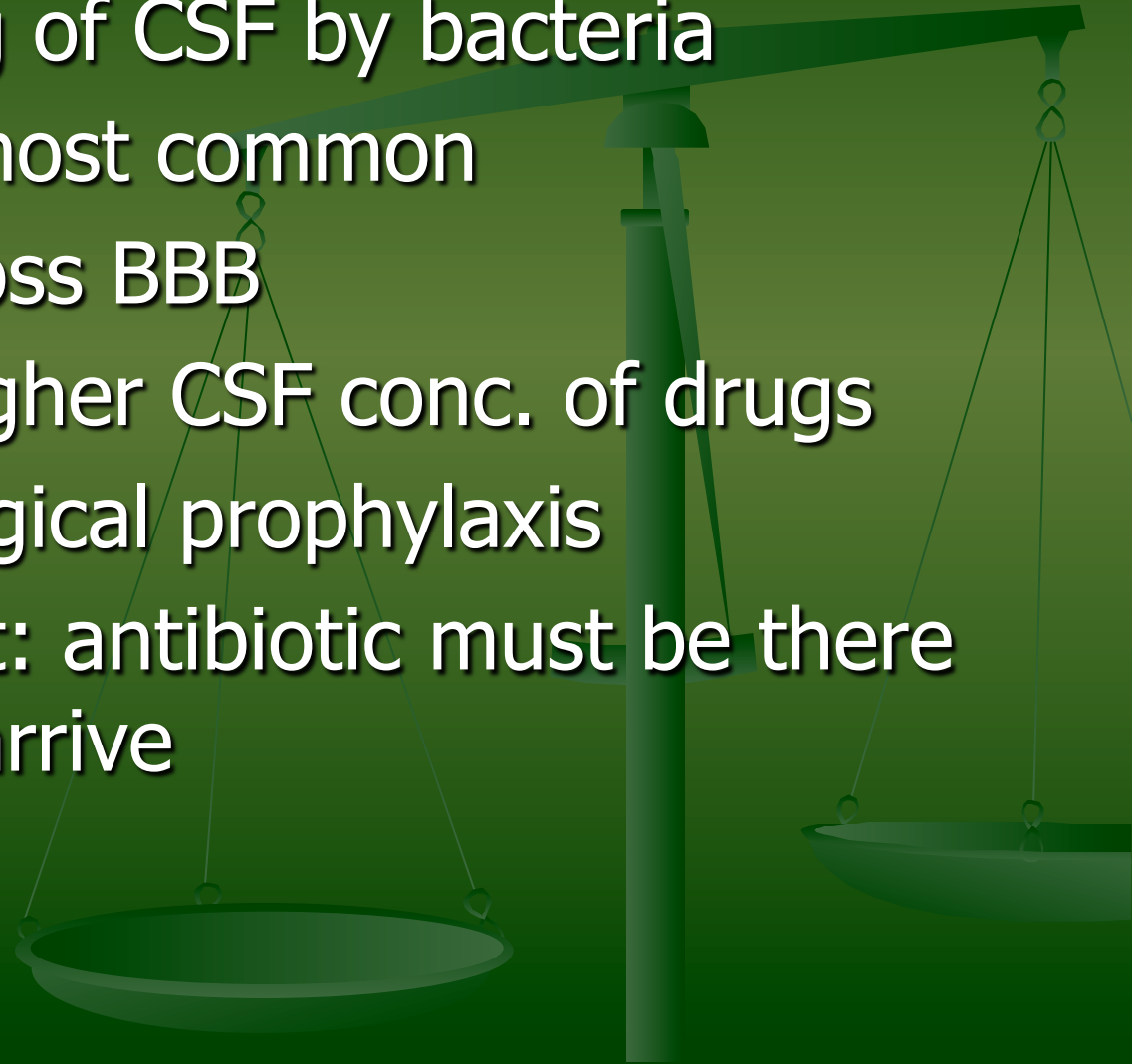
- Sterile surgical technique
 - Perioperative antibiotic use
 - Role of first dose antibiotic
 - Post operative antibiotic coverage
 - Use of shunt tubing with polymeric silicon
- 

- Impregnation of antibiotic
- Use of one piece system colak, albright etal.,
- Hypothermia during surgery -gerszten pc etal.,
- Annual or biannual screening



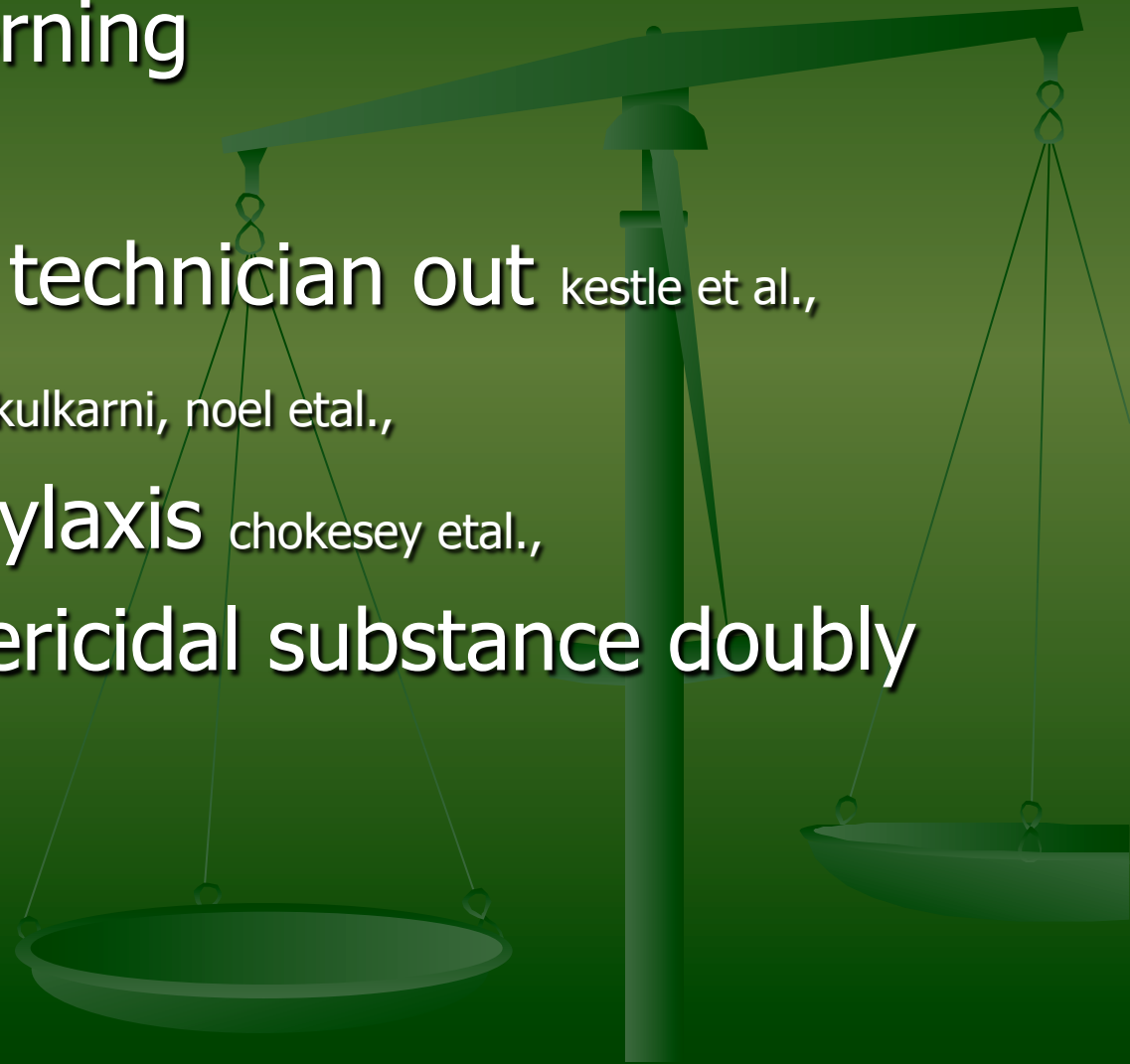
Pharmacology of IVT drugs

- 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

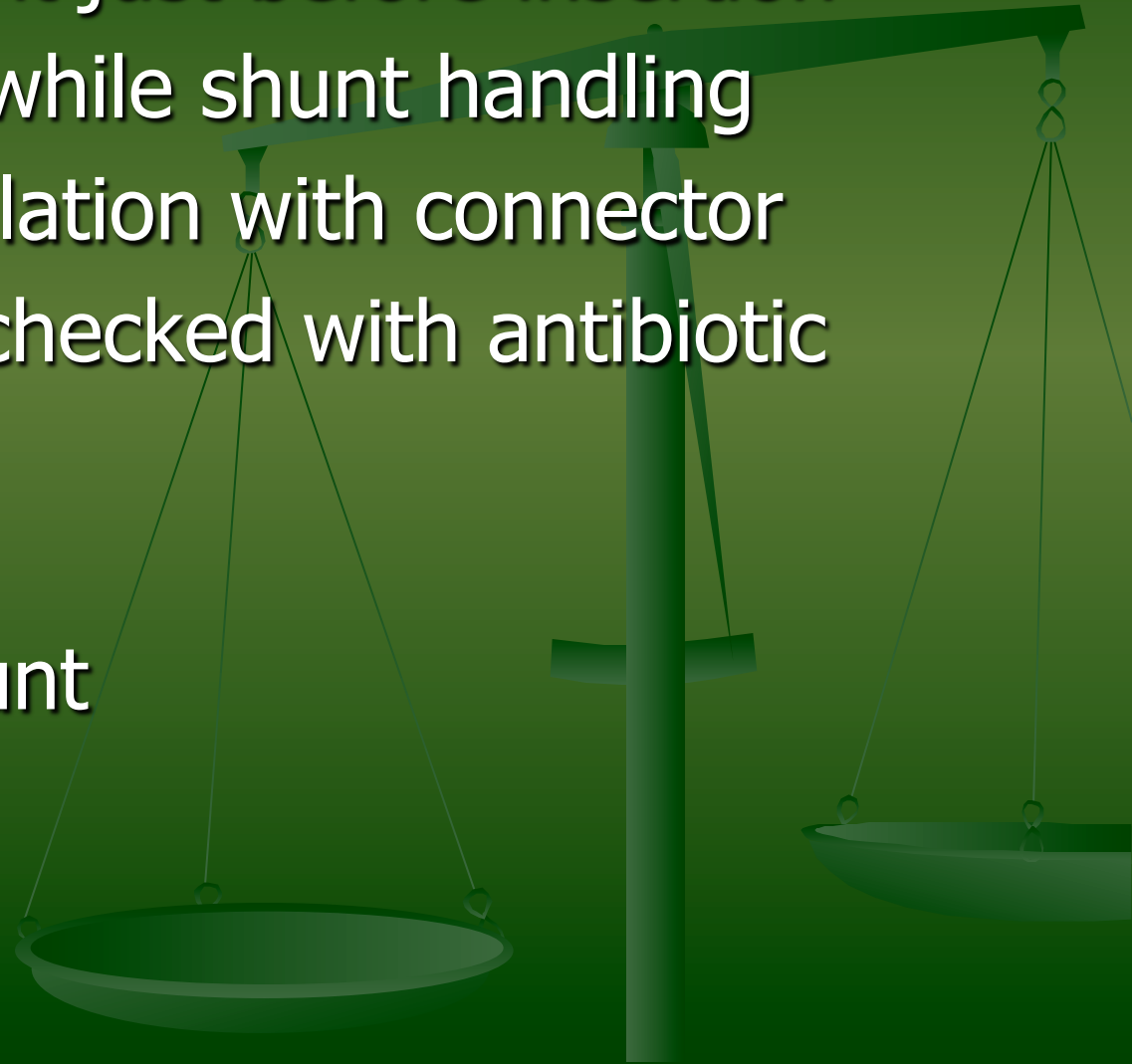


Surgical technique- Do's

- First case in morning
- Minimal staff
- Send scrubbing technician out kestle et al.,
- Double gloving kulkarni, noel etal.,
- Antibiotic prophylaxis chokesey etal.,
- Pouring of bactericidal substance doubly
- Skin draping

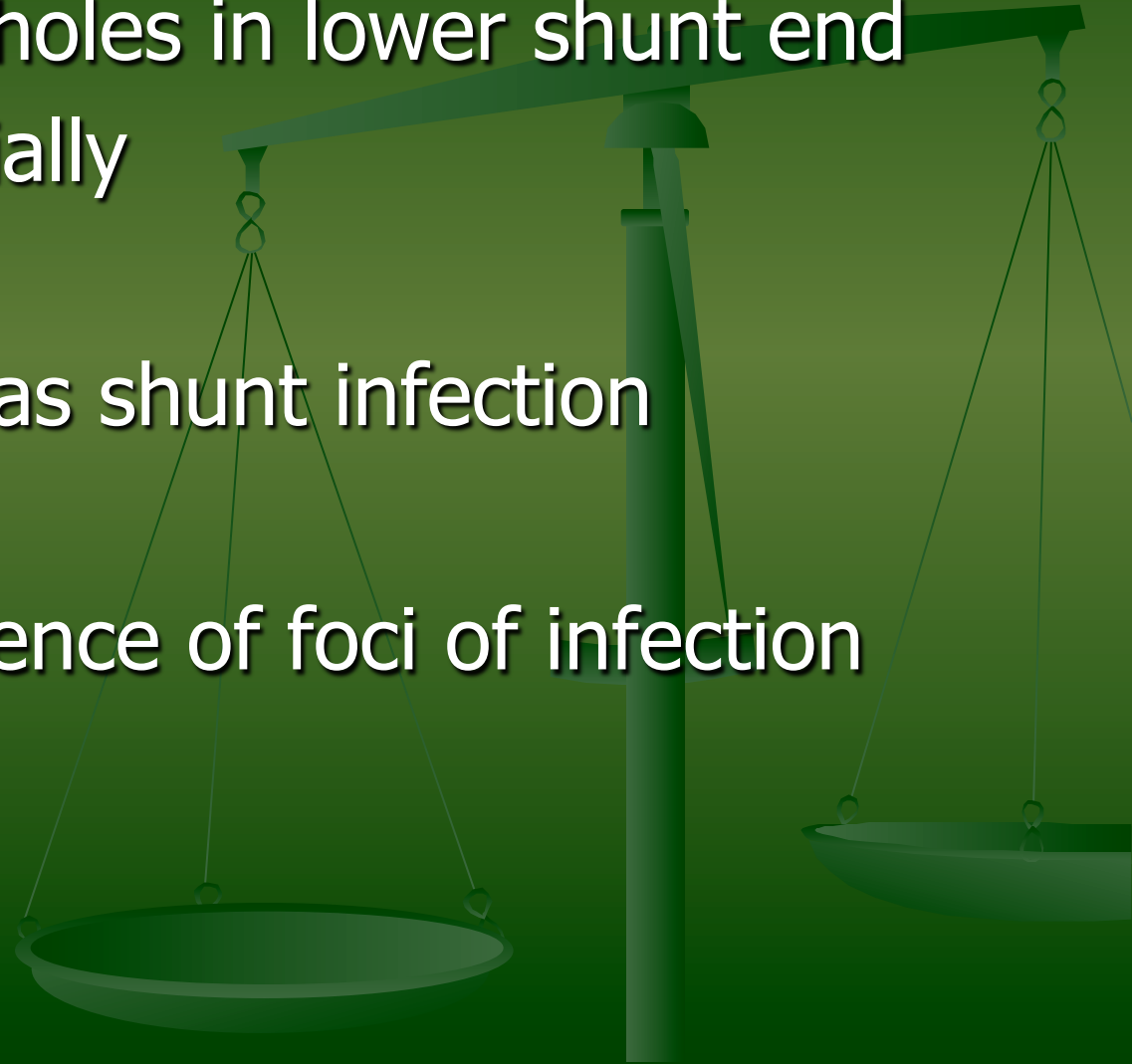


- Opening of shunt just before insertion
- Change gloves while shunt handling
- Minimal manipulation with connector
- Shunt patency checked with antibiotic saline
- Usage of AIS
- Single piece shunt



Surgical technique- Dont' 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

