CHILDREN AND LUMBAR PUNCURES

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Conflict of interest statement

- No conflict of interest to declare

Reason for LP

- Fever
- Fever with GI symptoms
- ALTE/gasping/apnea
- Rule out congenital syphilis
- Rule out Seizures
- Respiratory symptoms
- Poor feeding
- Cerebral Malaria

Cerebrospinal fluid results

- 3 cases cerebrospinal fluid culture were positive
- Direct Antigen Test (latex test) for 21 patients ordered which were negative
- Lumbar puncture for 15 cases attempted limited CSF
- 10 cases bloody ,which 7case> 10.000 RBC and 2cases >500 RBC
- 13 cases Lumbar puncture were completely successful
- 2 cases was dry tap

Data from Stanfield Ward Qtr 1 2022

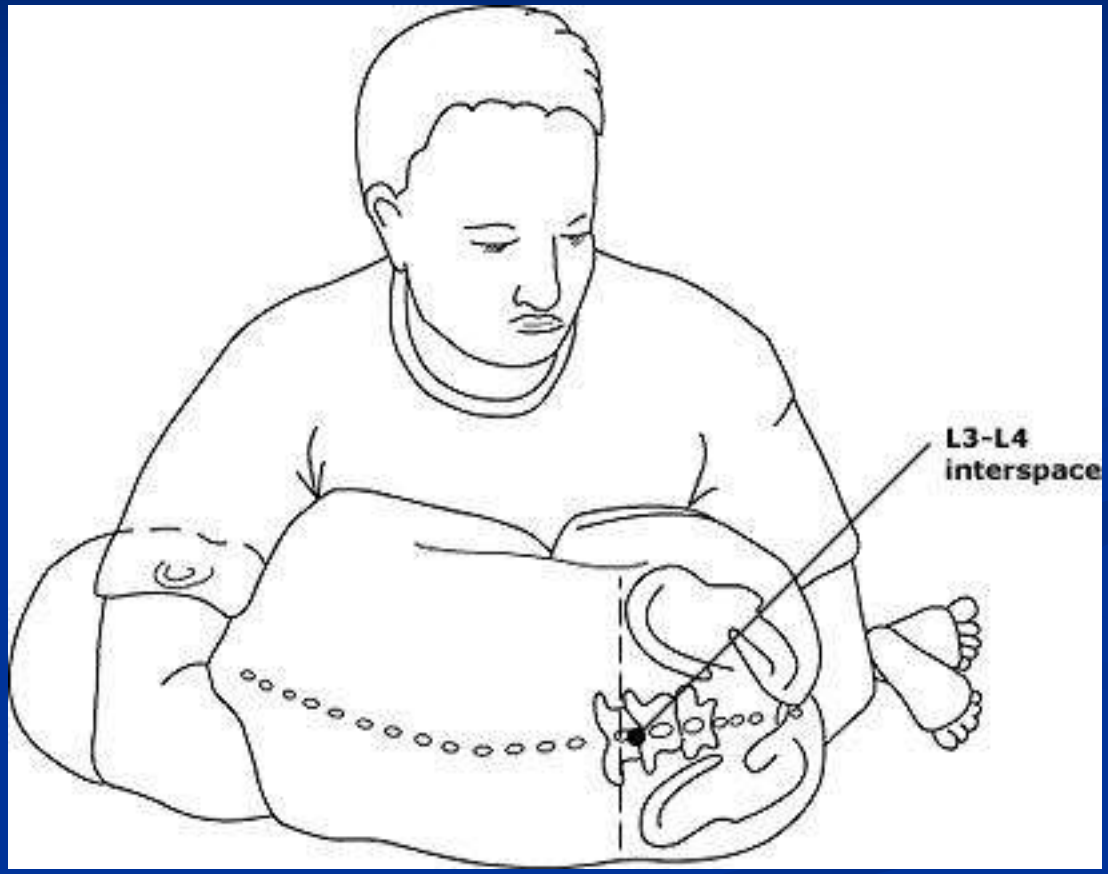
Basics in Lumbar Puncture

- Position
- Prep/drape
- Infiltrative anesthetics or topical anesthetics
- Technique

Lateral recumbent

- The lateral recumbent position is used most frequently. The child is positioned near the edge of the examining table. The child should have the neck flexed and knees drawn upward by the assistant
- The assistant places one arm around the posterior aspect of the child's neck and the other arm under the child's knees
- The child's hips and shoulders should be kept perpendicular to the examining table in order to maintain spinal alignment without rotation.

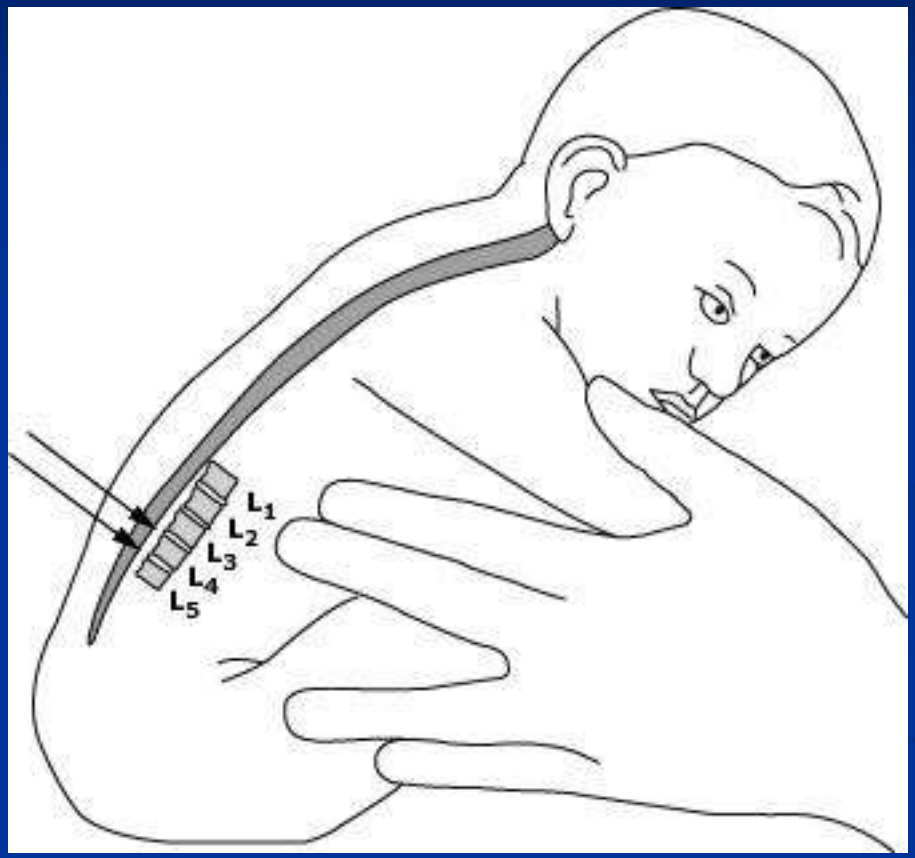
Lateral recumbent position



Sitting position

- The sitting position may be preferred in children who have the potential for developing respiratory compromise because of hyper flexion of the neck in the lateral recumbent position
- In addition, this position may improve flow of CSF in very small infants (less than two weeks of age).
- The assistant grasps one of the infant's arms and one of the legs in each hand while supporting the head to prevent excessive flexion at the neck.

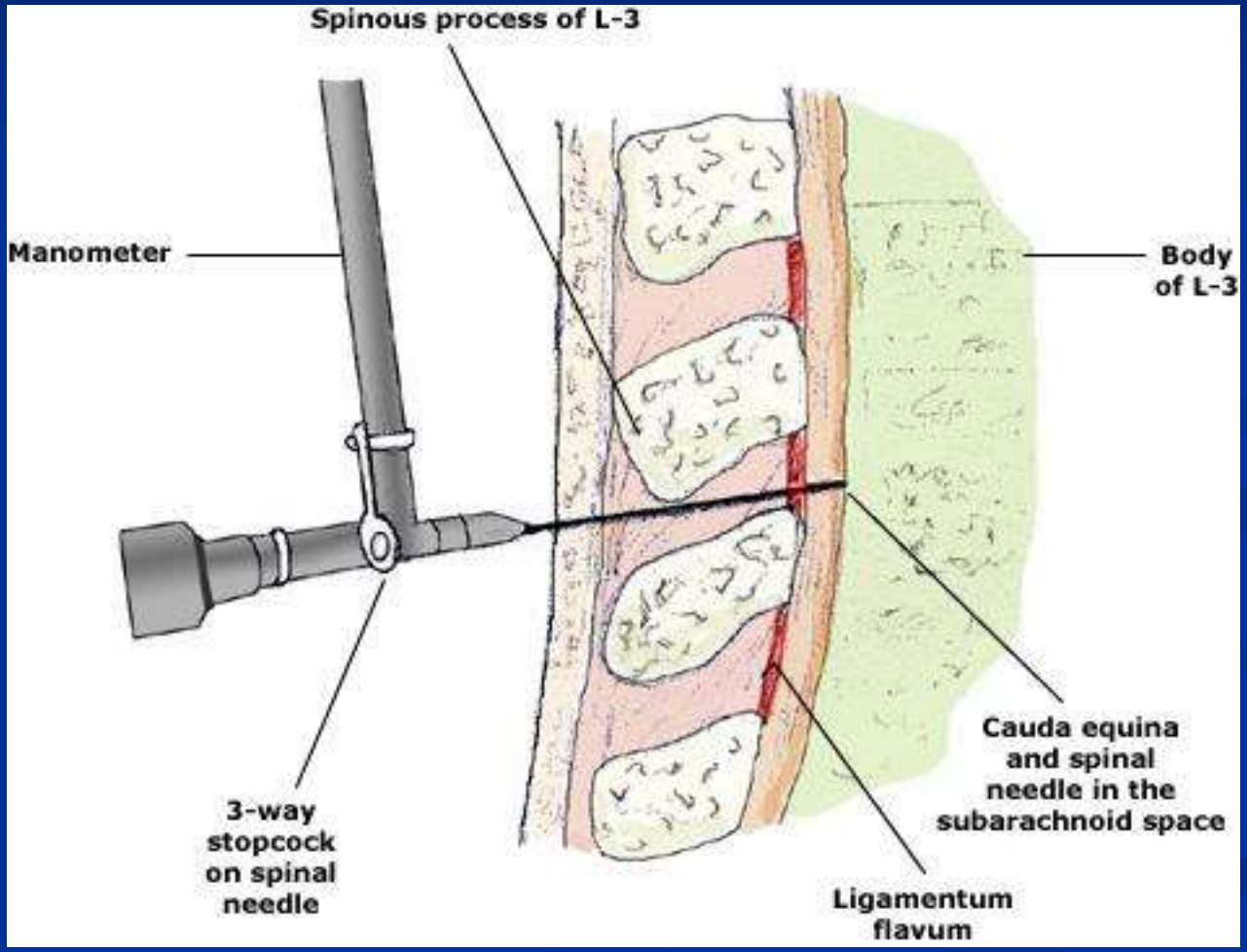
Sitting position



Use of manometer

- Opening pressure measurement may be deferred in a struggling or uncooperative patient, or if the LP is performed with the patient in the sitting position, because the measurement may be unreliable
- Normal opening pressures range from 50 to 200 mm H2O in a relaxed patient in the lateral recumbent position with the neck and legs extended. The range can increase to 100 to 280 mm H2O in patients in the lateral recumbent position with the neck and legs flexed

Manometry


Spinous process of L-3
Manometer
Body of L-3
Cauda equina and spinal needle in the subarachnoid space
3-way stopcock on spinal needle
Ligamentum flavum

Fluid collection

- The CSF should be collected in three to four sterile tubes. Approx.1 mL
- The first tube should be sent for Gram stain and bacterial culture and antigen detection, the second for CSF glucose and protein, and the third for CSF cell count and differential
- Additional tubes may be saved for future studies or used for viral culture, fungal culture, cell pathology, or special chemistries
- If subarachnoid hemorrhage (SAH) is suspected, four tubes should be collected

Rapid Diagnostic Test

- Antigen detection by latex particle agglutination was once a routine part of bacterial meningitis
- This test can be still useful because Gram stained smear or culture may be negative in pretreated patients
- This test has high sensitivity but has low specificity

CT should be performed before LP

- Altered mental status
- Focal neurological signs
- Papilledema
- Seizure
- Risk for brain abscess (immunocompromise or congenital heart disease with a right-to-left shunt)

Specific contraindications

- Increased intracranial pressure (ICP)
- Bleeding diathesis — Evidence regarding the safety of performing LP in patients with thrombocytopenia or coagulation factor deficiency is limited, Nevertheless, because of the risk of subdural or epidural hematoma formation, it generally is not advised performing LP in patients with coagulation defects who are actively bleeding, have severe thrombocytopenia (eg, platelet counts <50,000/microL), or an INR >1.4
- Cardiopulmonary instability
- Soft tissue infection at the puncture site

What if!

- Patients with spinal abnormalities (such as spina bifida or severe scoliosis) should be identified. An alternative approach for obtaining CSF (such as performing the procedure under fluoroscopy) may be required for such patients
- In Poor flow , Pulling the needle back to the subcutaneous tissue and redirecting
- Removing the spinal needle and attempting the procedure at a different site; a new needle should be used for each additional attempt, if the needle has been removed completely

Bloody puncture

- A traumatic puncture occurs when the spinal needle strikes the venous plexus that encircles the spinal cord
- The CSF typically clears as it is collected if the spinal needle is in the subarachnoid space
- The spinal needle should be removed if the bloody fluid clots in the hub or does not clear
- Predicted CSF WBC count/microL = CSF RBC count x peripheral blood WBC count /peripheral blood RBC count

Bloody puncture Cont,

- The presence of CSF bleeding results in approximately 1 mg of protein/dL per 1000 RBCs/microL
- The CSF-to-serum glucose ratio is approximately 0.6 in normal individuals;
- In traumatized one ,glucose falsely going up

Characteristics of CSF

- Successful lumbar puncture estimated

Neonate

- WBC 6(3-10),
- RBC1(0-3),
- Protein 144(54-234),
- Glucose44(38-56),

Infant

- WBC8(5-12)
- RBC 0,
- Protein94(68-121),
- Glucose48(42-55)

SURE + DP sub study

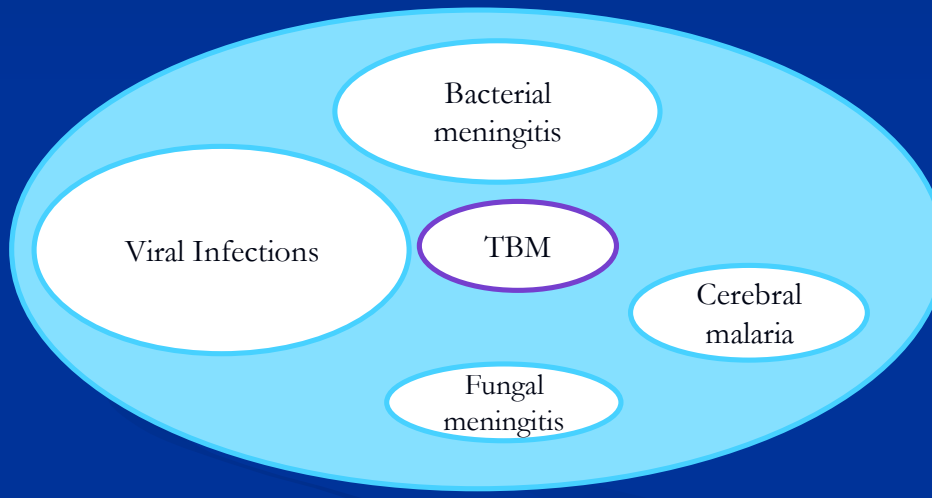
Improving Diagnosis and Prognosis for paediatric tuberculous meningitis through the SURE treatment trial

INTRODUCTION

- Under report and under diagnose of meningitis (LMIC)

- Delayed Initiation of treatment in tuberculous meningitis (TBM) leads to higher mortality and sequela

- No available test to rule out tuberculosis
  - Sensitivity and specificity of **Xpert MTB/RIF TBM** in children (54.1% and 93.8%) vs adults (71.1% and 98%)



WHO. High-priority target product profiles for new tuberculosis diagnostics. 2014
Kay, A. *Cochrane Database Syst. Rev.* (2020)

SURE+DP RESEARCH QUESTIONS

1. What is the diagnostic performance of novel biomarkers to distinguish between tuberculous meningitis and non-TB central nervous system infections in children and young people (CYP)?

2. What is the performance of prognosis biomarkers to predict clinical outcomes and treatment response in CYP with TBM randomised in the SURE treatment trial?

Sample collection and handling plan

- Non-TBM controls will be asked for serum, whole blood, urine and CSF only at baseline.

- TBM cases enrolled in both SURE and SURE+DP will be asked for store following samples:
  - 2.5 ml of whole blood into RNA PAXgene tube ---------- Baseline, 2 and 8 weeks
  - 1-1.5 ml of serum ---------- Baseline, 2 and 8 weeks
  - 2 mL of urine (clean catch or catheter sample) ---------- Baseline
  - CSF surplus after ensure sufficient volume for diagnostic tests --- Baseline and if a repeat LP is clinically indicated

SURE+DP follow-up

- TBM cases recruited to the SURE treatment trial will be evaluated daily during hospitalisation and outpatient follow up until week 72, following SURE treatment trial time points.

- Non-TBM control will a four-week follow up visit to review the final diagnosis, confirm that the participant is alive and was not diagnosed with TBM after discharge.

METHODOLOGY
EXPERIMENTAL WORK

- RNA SEQUENCING: identify new biomarkers
- RT PCR: validation of three gene TB signature in collaboration with Professor Levin M. (Imperial College London)
- CSF AND SERUM METABOLOMICS: identify prognosis biomarkers
- LAM DETECTION (FujiLAM)
- ESTABLISHING ALTERNATIVE DIAGNOSIS IN NON-TBM CONTROLS: multipathogen panels (Professor Jarvis at LSHTM)

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