DIAGNOSTIC UTILITY AND ACCURACY OF OPTIC NERVE SHEATH DIAMETER (ONSD) IN DETECTING RAISED INTRACRANIAL TENSION

A Dissertation submitted in partial fulfillment of

M.D (General Medicine) branch I Examination of the Tamil Nadu

Dr. M.G.R. UNIVERSITY, CHENNAI

to be held in 2016

DECLARATION BY THE CANDIDATE

This is to declare that dissertation entitled "DIAGNOSTIC UTILITY AND ACCURACY OF OPTIC NERVE SHEATH DIAMETER (ONSD) IN DETECTING RAISED INTRACRANIAL TENSION " is my original work towards partial fulfilment of M.D (General Medicine) Branch I Examination of the Tamil Nadu Dr. M. G. R. UNIVERSITY, CHENNAI to be held in 2016

Candidate

Dr. Allan John Samuel

Post graduate

Department of General Medicine

Christian Medical College

Vellore - 632004

CERTIFICATE

This is to certify that dissertation entitled "DIAGNOSTIC UTILITY AND ACCURACY OF OPTIC NERVE SHEATH DIAMETER (ONSD) IN DETECTING RAISED INTRACRANIAL TENSION", is the bonafide original work of Dr. Allan John Samuel, towards the M.D. Branch – I (General Medicine) Degree Examination of the Tamil Nadu Dr. M.G.R University, Chennai to be conducted in 2016

Guide

Dr. Anand Zachariah.

Professor and Head

Department of Medicine Unit – I

Christian Medical College

Vellore – 632004

Co guides:

Dr. Kishore Pichamuthu (Associate Professor - Critical care)

Dr. Anitha Jasper (Assistant Professor Radiology Dept)

Dr. Soumya S (Professor Medicine-3)

Dr. Samuel Hansdak (Professor Medicine-4)

Dr. Tarun K George (Assistant. Professor Medicine-2)

Dr. Manjeera Jagannati (Assistant. Professor Medicine-5)

CERTIFICATE

This is to certify that dissertation entitled "DIAGNOSTIC UTILITY AND ACCURACY OF OPTIC NERVE SHEATH DIAMETER (ONSD) IN DETECTING RAISED INTRACRANIAL TENSION", is the bonafide original work of Dr. Allan John Samuel, towards the M.D. Branch – I (General Medicine) Degree Examination of the Tamil Nadu Dr. M.G.R University, Chennai to be conducted in 2016

Head of Department

Dr. Anand Zachariah

Head of Department

Department of General Medicine and Medicine Unit- I

Christian Medical College

Vellore - 632004

IRB Approval Letter

OFFICE OF RESEARCH
INSTITUTIONAL REVIEW BOARD (IRB)
CHRISTIAN MEDICAL COLLEGE, VELLORE, INDIA.

Dr. B.J. Prashantham, M.A., M.A., Dr. Min (Clinical)
Director, Christian Counseling Center,
Chairperson, Ethics Committee.

Dr. Alfred Job Daniel, D Ortho, MS Ortho, DNB Ortho
Chairperson, Research Committee & Principal

Dr. Nihal Thomas,
MD., MNAMS., DNB (Endo), FRACP (Endo), FRCP (Edin), FRCP (Glasg)
Deputy Chairperson
Secretary, Ethics Committee, IRB
Additional Vice Principal (Research)

July 11, 2014

Dr. Allan John Samuel
PG Registrar
Department of Medicine
Christian Medical College
Vellore 632 004

Sub: **Fluid Research Grant Project:**
Optic nerve sheath diameter as a screening tool for assessing raised intracranial tension in patients presenting to Medicine department.
Dr. Allan John Samuel, PG Registrar, Medicine, Dr. Anand Zachariah, Dr. Kishore Pichamuthu, Dr. Anitha Jasper, Dr. Soumya S, Dr. Samuel Hansdak, Dr. Tarun K George, Medicine, CMC, Vellore.

Ref: IRB Min No. 8938 dated 07.07.2014

Dear Dr. Allan John Samuel,

The Institutional Review Board (Blue, Research and Ethics Committee) of the Christian Medical College, Vellore, reviewed and discussed your project titled "Optic nerve sheath diameter as a screening tool for assessing raised intracranial tension in patients presenting to Medicine department." on July 7th 2014. I am quoting below the minutes of the meeting.

The Committee raised the following queries:

a) The lumbar puncture and the CT/MRI may not be comparable, between the LP and the imaging, which of them is going to be the gold standard.
b) Please mention about the workshop that you plan to conduct prior to your study in the proposal.
c) The patient information sheet is inadequate.
d) There is a mix-up between the terms assent and consent.
e) Signatures of other people are present- are they going to be included in the publication plans?
f) The intra-arterial line may not give as accurate a measurement of ICP and the amount of CSF being taken off may be excessive.

Ethics Committee Blue, Office of Research, 1st Floor, Carman Block, Christian Medical College, Vellore, Tamil Nadu 632 002.
Tel : 0416 - 2284294, 2284202 Fax : 0416 - 2262788, 2284481 E-mail : research@cmcvellore.ac.in

Dr. B.J. Prashantham, M.A., M.A., Dr. Min (Clinical)
Director, Christian Counseling Center,
Chairperson, Ethics Committee.

Dr. Alfred Job Daniel, D Ortho, MS Ortho, DNB Ortho
Chairperson, Research Committee & Principal

Dr. Nihal Thomas,
MD., MNAMS., DNB (Endo), FRACP (Endo), FRCP (Edin), FRCP (Glasg)
Deputy Chairperson
Secretary, Ethics Committee, IRB
Additional Vice Principal (Research)

g) The consent form in English is absent, please include that.
h) Please provide the CVs of the co-investigators in the CV.
i) The Tamil informed consent form needs to be typed.
j) The parts in section 2 need to be put as not applicable.
k) You will need a separate Information sheet and consent form for the control subjects.

Dr. Allan John Samuel and Dr. Anand Zachariah were present during the presentation of the proposal and satisfactorily responded to the queries raised by the Members. After discussion, it was resolved to **ACCEPT the proposal AFTER receiving the suggested modifications and answers to the queries.**

Note:
1. Kindly **HIGHLIGHT** the modifications in the revised proposal.
2. Keep a **covering letter and point out the answer to the queries.**
3. Reply to the queries should be submitted within **3 months** duration from the time of the thesis/ protocol presentation, if not the thesis/protocol have to be resubmitted to the IRB.
4. The **checklist** has to be sent along with the responses.

Email the details to research@cmcvellore.ac.in and send a hard copy through internal dispatch to Dr. Nihal Thomas, Addl. Vice-Principal (Research), Principal's Office, CMC.

Yours sincerely,

Dr. Nihal Thomas
Secretary (Ethics Committee)
Institutional Review Board

DR. NIHAL THOMAS
MD.,MNAMS.,DNB(Endo),FRACP(Endo),FRCP(Edin),FRCP(Glasg)
SECRETARY - (ETHICS COMMITTEE)
Institutional Review Board,
Christian Medical College, Vellore - 632 002.

Cc: Dr. Anand Zachariah, Medicine. CMC, Vellore

IRB Min No: 8938 dated 07.07.2014

Ethics Committee Blue, Office of Research, 1st Floor, Carman Block, Christian Medical College, Vellore, Tamil Nadu 632 002.
Tel : 0416 - 2284294, 2284202 Fax : 0416 - 2262788, 2284481 E-mail : research@cmcvellore.ac.in

Anti-plagiarism Certificate

Turnitin Originality Report

DIAGNOSTIC UTILITY AND ACCURACY OF OPTIC NERVE SHEATH DIAMETER (ONSD) IN DETECTING RAISED INTRACRANIAL TENSION by 201311453.md
General Medicine, Dr Allan John Samuel

From TNMGRMU EXAMINATIONS (The Tamil Nadu Dr.M.G.R.Medical Uty 2014-15 Examinations)

- Processed on 27-Sep-2015 23:16 IST
- ID: 576120866
- Word Count: 14481

Similarity Index
8%
Similarity by Source

Internet Sources:
5%
Publications:
7%
Student Papers:
2%

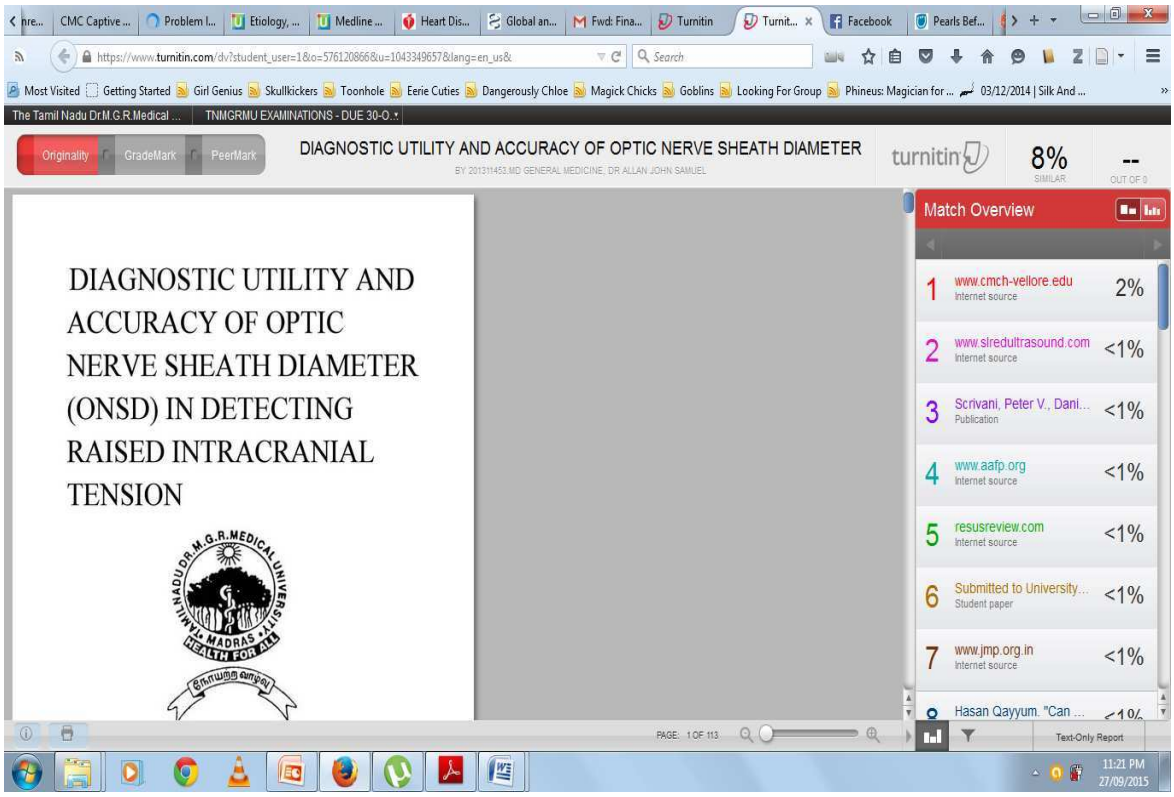


Table of Contents

Acknowledgements

Right at the outset, I want to thank my guide Dr. Anand Zachariah, with all my heart for meticulously and painstakingly guiding me through this entire process of completing my dissertation. I cannot thank him enough for all the patience and kindness with which he dealt with me and every single problem that I had during this course. I would also like to thank my co-investigator Dr.Kishore Pichamuthu for training me in doing USG guided ONSD measurement. Also I would like to thank my co-investigator Dr. Anitha Jasper, for reviewing all the neuroimages of the brain and assessing them for raised intracranial tension.

I am also grateful to the entire Department of Medicine, Department of Emergency Medicine, Department of Critical care for all the support I received in preparing this dissertation throughout my three years course in General Medicine. I would specially like to thank Dr. L. Jeyaseelan and Mr. Prakash Ramasami from the Department of Clinical Epidemiology, who helped me with the analysis of the data.

I would like to thank to all the hospital patients who agreed to be a part of this study. I am deeply thankful to God whose daily love and encouragement was inevitable in doing this thesis. I would also like to thank my wife Dr. Femi K Sam for all the encouragement and help.

1. Introduction

Patients presenting to the Emergency department with acute onset of altered sensorium is very common. The commonest etiologies are CNS infections and cerebrovascular accident. Central nervous system infections such as meningitis or meningoencephalitis are a very common disorder seen especially in the young adult. All patients with suspected CNS infections require cerebrospinal (CSF) analysis to be done for diagnosis as to the etiology of the disease and to decide on further treatment plan. But CSF analysis is contraindicated in patients with raised intracranial pressure since it can lead to the herniation of the brain and death. In patients with cerebrovascular accident intracranial pressure can be increased as part of the diffuse cerebral edema in case of ischemic strokes or because of the space occupying nature of hematoma in case of intracranial hemorrhage. Increase in intracranial pressure as part of the disease process or due to complications such as hydrocephalus will contribute towards clinical deterioration of the condition of the patient and may require treatment for the same in the form of anti edema measures or even surgical procedures. Hence the intracranial pressure plays a critical role in the management of these patients.

Traditionally the only methods to measure intracranial pressure were by intraventricular/ intraparenchymal catheters placed in the brain, or in case of patients with extra ventricular drainage procedures, from the drain. The third method which was being employed was by the placement of intrathecal needle usually at the lumbar spine level

and connecting it to a manometer or pressure transducer. The former two were considered as gold standard for measuring raised intracranial pressure while the third being considered as less reliable and predictive of the true intracranial pressures in many studies. But all these procedures are invasive with inherent procedure risks and risks of infection. The former two are done usually in patients with traumatic brain injury or post neurosurgery as it is unethical to undergo such invasive procedures in patients with central nervous system infection who are being evaluated in the current study.

Hence unsurprisingly non-invasive procedures to measure intracranial pressures have been of keen interest. One such recent test was the introduction of transcranial Doppler to assess intracranial pressure. But this has gone out of vogue in view of the high technical expertise needed and the poor reproducibility. Hence in current clinical practice commonly employed method to look for raised intracranial pressure is computerized tomography or magnetic resonance imaging of the brain. But they give only an impression whether the intracranial pressure is raised or not at the point in time when the test being done. And these tests are expensive, time consuming, not frequently available in remote locations and more importantly cannot be done at the point of care. This is important as many of these patients will be in the intensive care unit requiring close monitoring and care. Hence an easy, rapid, inexpensive bedside test to assess for raised intracranial pressure is a well felt need.

Measurement of optic nerve sheath diameter (ONSD) using ultrasonography is an inexpensive and rapid method to determine raised intracranial tension. But the efficacy of this test to detect raised intracranial pressure as compared to neuroimaging or direct measurement of CSF pressure in patients with altered sensorium in medical patients and in the Indian setting has not been established. Currently computerized tomography or magnetic resonance imaging is used in patients with suspected meningitis and altered sensorium before doing lumbar puncture to rule out raised intracranial pressure. However, this test is expensive, time consuming and not freely available, especially in rural locations. The availability of a cheap and easy to perform test will simplify the initial management of such patients. The study aims at measuring the optic nerve sheath diameter in patients presenting to Christian Medical College, Medicine department with altered sensorium and acute cerebrovascular accident and the correlation of the optic nerve sheath diameter with raised intracranial tension as confirmed using either direct measurement of Cerebrospinal fluid pressure during lumbar puncture or comparing with signs of raised pressure in computerized tomography or magnetic resonance imaging of the brain. At the end of the study we are trying to answer the following questions.

1. Can ONSD be used to diagnose raised intracranial pressure in patients with stroke and acute CNS infection?
2. Can ONSD be used to monitor clinical improvement in patients with stroke and CNS infection?

2. Aim of the study

The aim of the study is to establish the relationship between optic nerve sheath diameter (ONSD) and the intracranial pressure (ICP) in patients with suspected central nervous system infection and cerebrovascular accident.

3. Objectives of the study

1.To assess the diagnostic utility and accuracy of optic nerve sheath diameter (ONSD)in detecting raised intracranial tension as determined by CT/MRI imaging or CSF pressure during lumbar puncture in patients with central nervous system infection, acute cerebrovascular accident and acute onset altered sensorium.

2.To assess the temporal profile of ONSD in patients with acute CNS infection and cerebrovascular accident and to correlate with clinical improvement.

4. Literature review

Embryology of the optic nerve

The genesis of the optic nerve sheaths start towards the later part of the seventh week of gestation. Slender, long mesenchymal cells will envelop the optic nerve and will gradually transform into one well knitted layer. Towards the tenth week of life the pia mater is distinguishable. This is succeeded by the dura mater towards the fifth month of life and then the arachnoid mater by seventh month of life. The pia mater and the arachnoid layers originate from the neural crest cells.

The Optic nerve: It traces its origin from the optic stalk which is present in the embryo. This optic stalk appears in the embryo by the fourth week of gestation and then bridges the optic vesicle with the forebrain. Gradually this stalk elongates and becomes narrower. The cavity of the stalk is systematically taken over by the axons from the ganglion cells of the retina. These axons gradually take over completely the optic stalk lumen by the eighth week. The axons extend till the brain and a preliminary optic chiasm is created. The physiology behind the retinal ganglion cells migrating till the optic disc has still not been elucidated.

The axons belonging to the optic nerve is myelinated. This process initially starts in the central portion and then gradually progress in an outward manner till the lamina cribrosa. The myelin sheath originates from the oligodenedrocytes and it is completed following birth.

Optic nerve anatomy:

The optic nerve is a white matter tract and its length in humans is about 50 mm and about 3mm in width extending from the eye to the optic chiasm. Ontogenetically the optic nerve is a component of the CNS. It is divided into four parts. The optic nerve head or the intraocular portion is about 1 to 1.5 mm long. The second or the intraorbital part is about 30 to 40 mm in length and has a tortuous path which is in the shape of an S to allow for the movements of the eye. The third or the intracanalicular part is about 5 to 8 mm in length and is adherent to the canal. The fourth or the intracranial part is about 10 mm in length and leads up to the optic chiasm where it meets the opposite optic nerve.

Inside the cranium the optic nerve is sheathed only by the pia mater and inside the optic canal it is sheathed by the arachnoid mater also. Near the optic foramen the duramater from the cranium also comes and bisects into the outer layer which will fuse with the perioteum of the orbit. The inner layer will join the optic nerve. Hence inside the orbit and optic canal the optic nerve is encased by all the three layers. These 3 sheaths are the extensions of the meninges of the central nervous system. The outer layer of the sheath ie. the dura mater consists of thick and dense collagenous fibrillae. The thickness of the duramater ranges from 0.35 to 0.5mm. Anteriorly, along with the ciliary vessels and nerves, it splits and insert into the sclera and rectus muscle. Posteriorly it consists of 2 layers, the first merges with the periosteum of the canal. The second layer is fused with the optic nerve and the canal bony wall. After the cranial foramen, the dura is continuous

with the periosteum of the sphenoid bone. There is a potential space betwixt the duramater and arachnoid which is called the subdural space and the space betwixt the arachnoid and piamater known as subarachnoid space. These spaces maintain connection with the respective intracerbral spaces.

The second layer, the arachnoid mater is quite consists of elastic and collagenous fibers with blood vessels and Fibroblasts. The fibers form a mesh like trabecular pattern which are coated with meningothelia. The meningothelia can replicate and form onion shaped structures. These structures are called psammoma bodies and when calcified are known as corpora arenacea.

The final layer, the pia mater is adherent to the optic nerve and is made up of collagenous and elastic fibers. Pia mater is adherent to the optic nerve and it has fibers extending into the nerve to form septations. The pia mater fuses with the sclera and choroid layer in the anterior aspect. In the posterior aspect, the pia mater extends through the optic foramen and results in a fused single layer around the intracranial part of the optic nerve.

Between the dura and the arachnoid mater there is the subdural space. The subdural space has no connection with the intracranial subdural space and hence is not of clinical importance. But the subarachnoid space maintains its connection with the intracranial subarachnoid space namely the chiamal cistern. Hence it contains the cerebrospinal fluid which acts as a conduit for transmis

sion of intracranial pressure.

Meningitis

Global prevalence of meningitis

In a study done in USA, where over a 9 year period 3188 patients with meningitis were enrolled in th study. In this study the prevalence in adult age group ranged from 0.66 to 1.38 cases per 1,000,000 population. As expected, the incidence was much higher in neonate group. The statistics also have shown a persistent and significant fall in the incidence of meningitis since 1970. There has been a 55% fall in the incidence of bacterial meningitis since 1970(1). This decrease had been mainly in the pediatric age group due to the introduction of Hemophilus b vaccination. In the adults, the mortality rate was 16.4%, which increased progressively with age. (upto 22% in those aged above 65 years of age). Streptococcus pneumoniae was the most common pathogen isolated in the adults. Although thre had been significant decrease in the incidence of meningitis, the mortality rate had remained the same with little decrease over the years. (2)

In an observational study done among in Netherlands, 754 patients with community acquired meningitis was enrolled in the study based on data from Netherlands research laboratory for meningitis. The data showed that the symptoms of headache, nuchal rigidity and febrile episode were present in 87%, 83% and 77% respectively. The triad of symptoms was present in about 44%. Altered sensorium was present in only 69% only. Seizures occurred in about 5% of the patients.(3)

Asian prevalence of meningitis

In a retrospective done in a single centre in Thailand, 161 cases were identified over a 20 year period. In this study 59% was due to hospital acquired causes, and among the community acquired pneumonia, Streptococcus pneumoniae was the most common pathogen which was identified. The mortality rate was 15.5% (4)

Stroke

Global prevalence of stroke

In a meta analysis of 119 studies, the world wide incidence of strokes were looked at. The data from this study showed about 11569538 incidents of ischemic cerebrovascular accident occurs per year with about 2835419 people dying per year. Hemorrhagic cerebrovascular accident events numbered about 5234997 episodes with 3038763 deaths. In the low income nations there was also noted that there is 22% increase in hemorrhagic cerebrovascular accidents.(5) The infarcts caused about 68% of stroke while hemorrhage was responsible in 32% of patients.(5)

Optic nerve sheath diameter

Studies among healthy volunteers

A study was done in China among 519 healthy subjects to assess the normal variation in optic nerve sheath diameter. All the measured characteristics including optic nerve sheath diameter, optic nerve diameter and eyeball transverse diameter showed a non-normal distribution. There was no statistically significant difference between male and female and among the right and left eyes.(6)

A prospective observational study was done in Hong Kong among non- neurological patients and staff in the Emergency department of the hospital. 100 candidates were enrolled in the study and the mean optic nerve sheath diameter was 4.05mm. There was no statistical difference between gender, the side of the eye and among the staff and the patients. (7)

In another study done among 42 healthy individuals comparing routine transverse visual axis technique versus infraorbital approach. The study showed no statistically significant difference both the groups. (8) The average ONSD of the right eye was 4.73mm (0.73) and left eye was 4.48 mm (0.62)

In a prospective study done in Bangladesh to determine the normal values for the optic nerve diameter, 136 healthy volunteers were enrolled into the study. The average ONSD

value was calculated to be 4.41mm (4.24-4.83mm). The ONSD values were distributed in a bimodal pattern. The highest value was 4.75mm. (9).

In a study done among 400 healthy volunteers in Nigeria to look for the normal value of the optic nerve sheath diameter. The median value for the optic nerve sheath diameter ranged from 3.36to 5.1mm. There was no statistically significant difference between the genders or either of the eyes.(10)

Table 3: Measured mean optic nerve sheath diameter (ONSD) in each age group of the male and female participants

Age Groups (years)	Males			Females		
	Number	Right ONSD (mm)	Left ONSD (mm)	Number	Right ONSD (mm)	Left ONSD (mm)
15–24	52	4.18 (SD 0.47)	4.17 (SD 0.41)	100	4.18 (SD 0.51)	4.18 (SD 0.46)
25–34	36	4.18 (SD 0.75)	4.14 (SD 0.44)	23	4.18 (SD 0.54)	4.17 (SD 0.48)
35–44	35	4.17 (SD 0.35)	4.15 (SD 0.29)	28	4.15 (SD 0.19)	4.13 (SD 0.26)
45–54	28	4.19 (SD 0.55)	4.17 (SD 0.50)	19	4.17 (SD 0.19)	4.14 (SD 0.90)
55–64	20	4.19 (SD 0.74)	4.20 (SD 0.56)	17	4.19 (SD 0.41)	4.17 (SD 0.36)
65–74	20	4.17 (SD 0.3)	4.15 (SD 0.37)	14	4.19 (SD 0.34)	4.18 (SD 0.18)
> 75	1	4.18	4.22	7	4.18 (SD 0.2)	4.19 (SD 0.21)

ONSD variation with change in position.

A prospective case control study done among 10 normal volunteers, to look for variation in ONSD with position. In these patients ONSD was checked in the supine, Trendelenburg's and revere Trendelenburg's position, with a time gap of 1 minute between each of these positions. There were no statistically significant differences between any of the positions and the optic nerve sheath diameters. The mean the optic nerve sheath diameter in the right and left eye while the patient was lying supine was 4.6mm and 4.5 mm and while in Trendelenburg's position it was 4.4mm and 4.7mm while in reverse Trendelenburg's position it was 4.4mm and 4.8mm. (11)

ONSD and IC bleed

In a prospective study 35 patients with probable intracranial bleed secondary to trauma or aneurysmal rupture and probable raised intracranial pressure were enrolled. Among them 14 patients had features of raised intracranial pressure. The mean ONSD among these patients with raised intracranial pressure was 6.27mm (95% CI ¼ 5.6 to 6.89). and was 4.42mm (95% CI ¼ 4.15 to 4.72) in the normal intracranial pressure group. The sensitivity was 100% with a specificity of 95%. (12)

In another prospective study done in Netherland, 18 patients were enrolled in the study. Here the variability of ICP and ONSD with tracheal suctioning maneuvers was assessed. These maneuvers are known to cause transient rise in intracranial pressure. At the ONSD

cutoff of 5 mm the area under the curve was 0.99 with the sensitivity being 94% and the specificity being 98%.(13)

Fifteen patients were enrolled in the study of which 4 had trauma and 11 had spontaneous ICH. All the patients had invasive intracranial pressure monitoring. The relationship between optic nerve sheath diameter and ICP was plotted. For intracranial pressure of 20 or more the average optic nerve sheath diameter was found to be 5.4 ± 0.49 mm while for the controls with intracranial pressure of less than 20 cm of water the average optic nerve sheath diameter was 4.4 ± 0.49 mm. Using the intracranial pressure an ROC curve was plotted which showed the area under the curve to be 0.93 (95% CI = 0.84 to 0.99). The standard of 5mm showed a sensitivity of 88% and specificity of 93% (14)

In another study 12 patients with chronic subdural hemorrhage or hygroma were enrolled and the optic nerve sheath diameter was compared to subdural pressure. The mean optic nerve sheath diameter preoperatively was found to be 6.1mm ± 0.7. Post operatively the mean optic nerve sheath diameter decreased to 4.8mm ± 0.9 mm. (15)

In a case report optic nerve sheath diameter was compared with CT imaging features of raised intracranial tension in patients who had presented with hyperacute intracranial hemorrhage secondary to CVA. 4 patients were compared and a significant positive relation was detected between ONSD and the midline displacement of the ventricle. (16)

In another study done in Czech Republic where 31 patients with acute hemorrhagic cerebrovascular accident were compared with 15 ischemic cerebrovascular accidents and

16 normal subjects. The mean ONSD in the ICH subjects was 5.48mm while in the normal controls was 3.41mm and in ischemic stroke was 3.42mm. The sensitivity for the cutoff of 5mm to detect a hematoma more than 2.5cc volume was 70% and the specificity was 100%.(17)

One study was done in Turkey where 28 patients with raised intracranial tension (both trauma and non-trauma) on CT imaging were enrolled and their optic nerve sheath diameters were measured. The mean optic nerve diameter in the subjects with the raised ICT was 6.4mm and for those in the control group it was 4.6mm.(18)

CSF pressure and ONSD dynamic change

Another study was done in Germany among patients with presumptive diagnosis of CSF absorption disorders such as communicating hydrocephalus. They underwent intrathecal infusion of Ringer's solution through the intrathecal needles inserted in the lower lumbar region. The continuous CSF pressure was being monitored by another intrathecal needle connected to a pressure transducer. The results showed positive correlation between the increase in intrathecal pressure and the optic nerve sheath diameter. The maximum increase in the optic nerve sheath diameter correlated with the maximum intrathecal CSF pressure with an average increase of 1.8mm or 45% increase from the baseline optic nerve sheath diameter. The changes in ONSD closely mirrored that of CSF pressure. (19)

Change in ONSD with anti-edema therapy

A prospective observational study was done among patients with traumatic brain injury or subarachnoid hemorrhage. 13 patients were enrolled in the study and they had either EVD pressure monitoring or intraparenchymal pressure monitoring. All these 13 patients had elevated CSF pressure and had to be started on mannitol therapy as part of anti edema measure to reduce CSF pressure. There was significant correlation between the ICP and the ONSD before and after mannitol therapy and was associated with decrease in CSF pressure after the mannitol therapy(20)

ONSD in the pediatric age group

In the study 21 children in Malawi, Africa with suspected raised intracranial pressure, the common diagnosis being space occupying lesions, meningitis and coma were evaluated. 14 children had suspected raised intracranial pressure and 8 of them had CT imaging of the brain done. All 8 of these children had raised intracranial pressure with a mean ONSD of 5.4mm (4.3–6.2 mm). The remaining 7 had no features of raised intracranial pressure. Four children out of seven had imaging of the brain done and all of them were normal 2.5–4.1 mm. Their mean ONSD was 3.6mm (2.8–4.4 mm). Among the controls were 30

children with mean ONSD of 3.5mm (2.5–4.1 mm). For a ONSD cut-off of 4.2 mm the sensitivity was calculated to be 100% and the specificity was 86%.(21)

In a study done among 17 pediatric patients with raised intracranial tension post shunting of hydrocephalus to look for correlation between optic nerve sheath diameter and correlation with hydrocephalus, it was found that these patients had high ONSD values of 4.5 mm or more. These patients were designated as group 4. Group 1 had normal healthy volunteers. Group 2 had patient post shunting of hydrocephalus and was asymptomatic while group 3 had patients post shunting of hydrocephalus and was initially symptomatic for raised ICT but they became asymptomatic later and their symptoms were deemed not to be due to raised ICT. (22)

			ONSD		
Group	Number	Clinical features	Range	Mean	SD
1	102	Normal	2.1–4.3 mm	3.1 mm	0.36
2	6	Hydrocephalus, normotensive	2.1–3.6 mm	2.9 mm	0.5
3	5	Hydrocephalus, symptoms of suggestive of raised ICP, not requiring intervention	2.6–3.8 mm	3.1 mm	0.4
4	12	Hydrocephalus, symptoms suggestive of raised ICP, requiring intervention	4.5–7.0 mm	5.9 mm	0.6

ONSD in idiopathic intracranial hypertension

In a study done in Germany where 10 patients with idiopathic intracranial hypertension were enrolled and their ONSD were measured. The patients had mean optic nerve sheath diameter of 6.4 +/-0.6mm. After the lumbar puncture, they were noted to have decrease in the optic nerve sheath diameters in both the eyes. There was also no statistically significant difference between the ONSD and age, gender or BMI of the patients.(23)

Meta-analysis and systematic review

In a meta-analysis done of 6 studies which focused on ONSD and invasive intracranial pressure monitoring, it showed a sensitivity of 86.7% and a specificity of 79.4%. The problem of the study was that different studies had taken different cutoffs varying from 5 mm to 5.9mm. All the studies were done in traumatic brain injury patients or on patients with spontaneous ICH. (24)

Studies comparing the ultrasonographic measurement of the optic nerve sheath diameter (ONSD) with the measurement of intracranial pressure (ICP) or cerebrospinal fluid (CSF) pressure in neurocritically ill adults.

Author	*N*	Diagnosis	ONSD/ICP correlation coefficient	ONSD cut-off	Sensitivity (%)	Specificity (%)	ICP/CSF pressure measurement device
Geeraerts et al 2007[35]	31	TBI	0.68	5.9	87	94	IB
Geeraerts et al 2008[60]	37	TBI	0.71	5.86	95	79	IB
Harbison Kimberly et al 2008[61]	15	TBI ($n=4$) ICH	0.59	5	88	93	Ventriculostomy
Soldatos et al 2008[62]	50	TBI	0.68	5.7	74.1	100	IB/TCD
Moretti and Pizzi 2009[63]	53	ICH	0.69	5.2	94	76	Ventriculostomy ($n=32$) IB ($n=21$)
Moretti and Pizzi 2009[26]	63	ICH	0.7	5.2	93.1	73.9	Ventriculostomy ($n=39$) IB ($n=24$)

TBI, traumatic brain injury; ICH, intracranial hemorrhage; IB, intraparenchymal bolt; TCD, transcranial Doppler sonography.

Pooled performance estimates (with 95% confidence intervals) from the studies comparing ONSD with ICP where the true/false-positive/-negative results could be calculated.

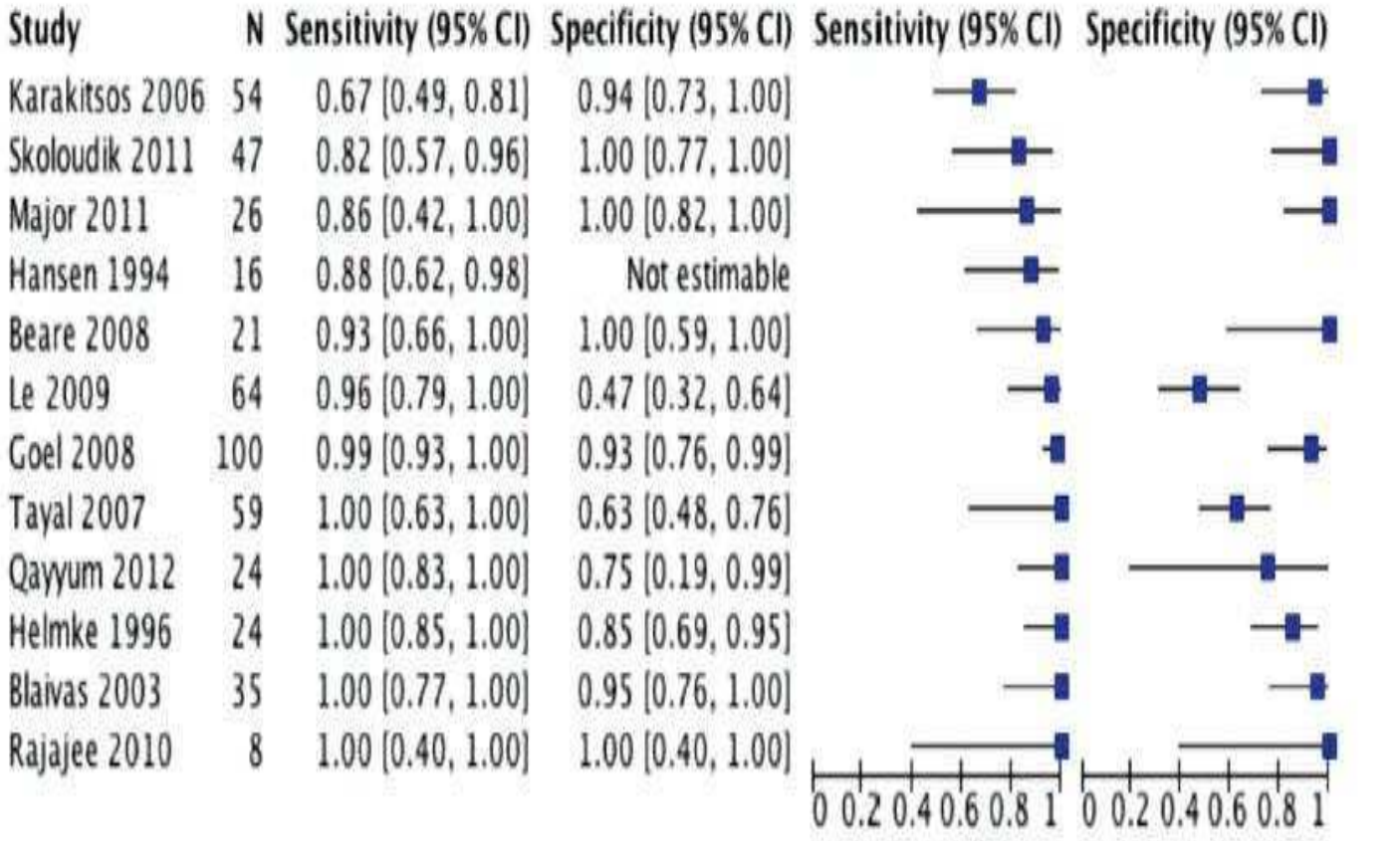
Sensitivity	86.71% (80.03–91.8%)
Specificity	79.74% (73.91–84.76%)
Positive likelihood ratio	4.28 (3.28–5.58)
Negative likelihood ratio	0.17 (0.11–0.25)
Positive predictive value	72.94% (65.6–79.46%)
Negative predictive value	90.5% (85.56–94.18%)
Diagnostic odds ratio	25.68 (14.405–45.751)

ONSD, optic nerve sheath diameter; ICP, intracranial pressure.

Meta-analysis was done to evaluate the efficiency of the optic nerve sheath diameter as measured by ultrasound with invasive intraventricular cerebrospinal fluid pressure monitoring. Out of the 699 articles evaluated, 6 were included in the meta-analysis. The pooled sensitivity of the ONSD was 90% and the specificity was 85%. There was no statistically significant heterogeneity in any of the data analyzed.(25)

In a meta-analysis, 12 studies which compared optic nerve sheath diameter with CT imaging was compared. The meta-analysis showed a sensitivity of 95.6% and specificity of 92.3% (26)

Figure 4. Forest plot of sensitivity and specificity of optic sonography for diagnosis of raised ICP compared to CT. Results for sensitivity show a degree of homogeneity with overlapping CIs. Specificity estimates between studies show marked variation, illustrated by nonoverlapping CIs.



Indian studies

In a study done in Mumbai where 100 traumatic brain injury patients were enrolled. 73 patients had CT features of raised ICT. The mean optic nerve sheath diameter in this group was 5.8 +/- 0.57mm. In the other group with no raised ICT, the mean ONSD was 3.5 +/-0.75mm.(27)

Table 1 Optic nerve ultrasonography (ONUS)[a] compared with cranial CT for evidence of signs of raised intracranial pressure

ONUS	CT positive	CT negative
Positive	72	2 (false-positive)
Negative	1 (false-negative)	25

[a] Sensitivity 98.6%, negative predictive value 97.3%, specificity 92.6%, positive predictive value 96.3%.

A prospective study was done in Hyderabad in patients admitted with altered sensorium and raised intracranial tension due to various medical causes. Among the 60 patients in Group B, 35 had features of raised intracranial tension on neuroimaging. Of these, 21 cases were diagnosed as having meningitis and 12 cases had stroke (both ischemic and hemorrhagic) and 2 had metabolic encephalopathy. This group had an average ONSD of

5.43+/- 0.53mm. The ROC curve was calculated and the area under the curve was 98.6% with sensitivity being 77.8% and specificity being 100%. Among the normal 25 patients, 2 were diagnosed as having meningitis and 18 cases had stroke (both ischemic and hemorrhagic) and 5 had metabolic encephalopathy. The Group A had 41 healthy controls (28)

ONSD (mm)	Group A	Group B	95% CI	F	P
Female	4.627±0.09	5.103±0.62	4.68-5.01	11.46	0.002
Male	4.8±0.10	5.081±0.58	4.87-5.11	4.82	0.003
Age years	27.44±3.31	56.15±18.86	40.47-48.52	92.805	<0.001
Total (101)	41	60			

CI: Confidence interval; ONSD: Optic nerve sheath diameter

Another study was done by the same author comparing Optic nerve sheath diameter with the MRI imaging enrolling 100 patients with diagnosis of meningoencephalitis. The mean Optic nerve sheath diameter for the women was 5.48mm +/- 0.43mm and among the males was 5.40 mm +/- 0.37mm. (29)

ONSD	USG (mm)	MRI (mm)	95% CI	t	P
Female (50)	5.48±0.43	5.68±0.44	0.825-0.993	−9.06	<0.001
Male (50)	5.40±0.37	5.56±0.38	0.959-0.99	−16.914	<0.001

ONSD: Optic nerve sheath diameter; USG: Ultrasonography; MRI: Magnetic resonance imaging; CI: Confidence interval

Study on ONSD and TB meningitis patients

In another study done among 25 patients with tuberculous meningitis and compared with controls. The patients with tuberculous meningitis had a mean ONSD of 5.81mm while in the control group mean ONSD was 4.37mm. There was no data available regarding the sensorium or clinical condition of patients or the confirmation of tuberculosis diagnosis. Also there was no data regarding intracranial pressure or the imaging features of raised intracranial pressure. (30)

ONSD and LP correlation

In a blinded cross-sectional study of patients with suspected raised intracranial tension, 279 patients were enrolled and their optic nerve sheath diameter and lumbar puncture pressure was measured. 101 subjects had elevated CSF opening pressure during lumbar puncture while 178 subjects had normal opening pressure. In patients with elevated CSF pressure the average ONSD was 4.58 +/- 0.46mm while that of the normal CSF pressure group was 3.55 +/- 0.38mm. Out of the 279 subjects, 18 had bacterial infection, 132 had viral infection, 1 had fungal infection, 3 had neurocysticercosis and 2 had neurosyphillis. The rest of the 123 subjects did not have any infectious etiology and were found to have CVA in 43 subjects, intracranial space occupying lesion in 17 subjects, hydrocephalus in 6 subjects and peripheral neuropathy in 21 subjects. A ROC curve was generated using the CSF pressure as the standard and it provided an area under the curve of 0.965. The sensitivity calculated was 95% with a specificity of 92% at a cutoff point of 4.1mm(31)

In a study done in USA where patients presenting to the emergency services and requiring lumbar puncture were enrolled and the correlation between CSF pressure and ONSD was analyzed. The indication for the lumbar puncture was mainly to rule out infection in 30 (58.8%) patients and to rule out subarachnoid hemorrhage in 11(21.6%). All the patients had non traumatic causes for the raised ICP. The sensitivity of the optic nerve sheath diameter cutoff of 5mm was found to be 75% with a specificity of 44% with an area under the curve of 0.69.Compared to the many other previous studies which had

showed good correlation between ONSD and ICP, this study was done exclusively in non trauma patients and it showed a poor specificity as compared to CSF pressure measured by lumbar puncture.(32)

Diagnostic accuracy of average ONSD predicting elevated ICP (based on manometry on LP)

ONSD average	Opening pressure ≥20 cm H_2O	Opening pressure <20 cm H_2O
≥5 mm (+)	18 (35.3%)	15 (29.4%)
<5 mm (−)	6 (11.8%)	12 (23.5%)
	Sensitivity = 0.75	Specificity = 0.44

In a study done among 98 Human immunodeficiency virus infected Ugandan patients with suspected cryptococcal meningitis. Four subjects were diagnosed as having tuberculous meningitis, 15 were found to have aseptic meningitis of unknown etiology and 79 were diagnosed as having cryptococcal meningitis. The median value of the optic nerve sheath diameter was 5.5mm (both pre lumbar puncture and post lumbar puncture). Region under the curve was calculated and at a cutoff of 5mm the sensitivity was 85%

and the specificity was 59% for detecting a CSF opening pressure greater than 20cm of CSF (25).

ONSD and cutoff values- study from Tamil Nadu

In a study done in Vellore, 60 patients admitted to Intensive care unit underwent ONSD measurement. 14(23%) patients had features of raised intracranial pressure. The measurements were taken 3mm behind the papilla and also 3mm behind the globe to look for their agreement with raised ICT. All values correlated with raised ICT, though there was variation in the cutoff values. (33)

	3mm behind papilla - within anatomic dura	3mm behind papilla - within echogenic fat	3mm behind globe - within anatomic dura	3mm behind globe - within echogenic fat
Cutoff	5.4 mm	6.05 mm	5.2 mm	5.95 mm

5. Methodology

Study setting

The study was conducted in Christian Medical College, Vellore (CMC). It a tertiary care level hospital situated in Vellore, Tamil Nadu.

Study design

This was a prospective observational study. The primary investigator was unaware of the CSF pressure or the brain neuroimaging findings at the time of the measurement of the optic nerve sheath diameter. The radiologist and the doctor performing the lumbar puncture were also unaware of the optic nerve sheath diameter values.

Study period

The patients were recruited from July 2014 –August 2014

Selection of patients

Method of recruitment:

All adult medical patients admitted to ward or ICU with (1) altered sensorium, (2) clinical picture suggestive of acute CNS infection or (3) stroke without history of trauma and with no past history of any raised intracranial tension will be included in the study after informed consent.

Inclusion criteria:

1. Patients who are clinically suspected to have CNS infection and who have had or are being planned for lumbar puncture with or without brain imaging (CT scan or MRI).
2. Patients who present with clinical picture of acute cerebrovasular accident who had brain imaging (CT brain or MRI) within last 24 hours or who are planned for CT/MRI brain in the next 24 hours
3. Patients who present with other causes of altered sensorium with GCS of 13/15 or below and who have had or are being planned for lumbar puncture or brain imaging (CT scan or MRI).

Exclusion criteria:

1. Consent not being given
2. Patients with history of chronic raised intracranial tension.
3. Patients with traumatic brain injury.
4. Pregnant women and children less than 15 years of age will not be included in the study.

Pilot study

Preliminary work done by the primary investigator includes chart review of Inpatients in Medicine-department from January 1st 2013 to May 31st 2013. 529 charts were reviewed and it showed 50 patients who had met the inclusion criteria. Of these raised ICT was present in 8 out of the 50 patients.

The break-up for the 8 patients with raised ICT was:-

TB with hydrocephalus = 6/50

CVA = 1/50

Toxoplasmosis = 1/50

These data were useful in planning the study and calculating the sample size.

Also as part of preliminary study, the primary investigator had done ONSD measurement of patients admitted in ICU, for a variety of diagnosis. 10 patients were evaluated and the results were cross checked by ICU consultant who is a trained sinologist. These showed no significant variation in the ONSD values and following which the study was undertaken by the primary investigator.

Initial evaluation and triage of patients

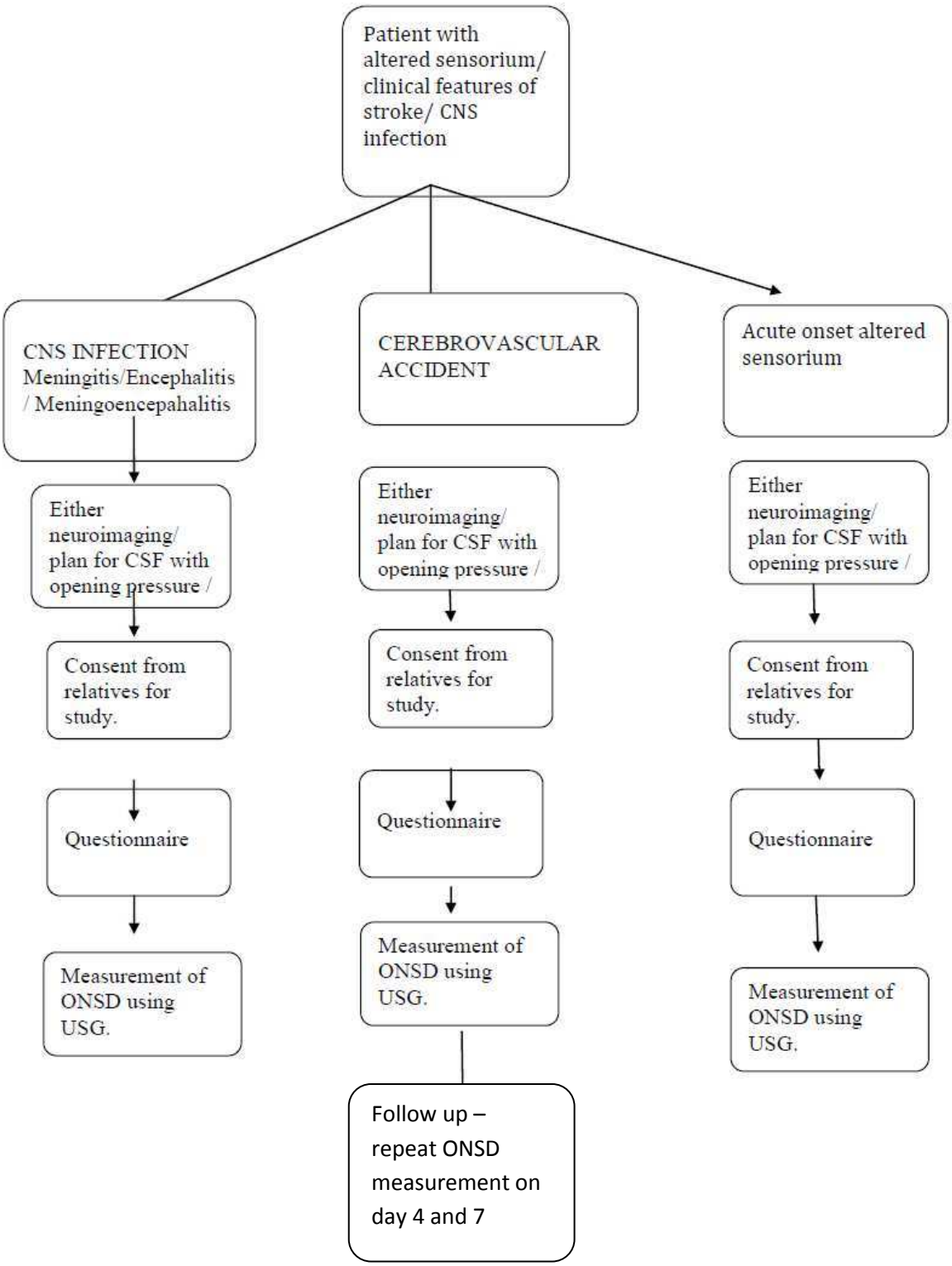
At presentation based on clinical diagnosis of meningoencephalitis or cerebrovascular accident the patients were triaged into either the cerebrovascular accident or the meningitis/ encephalitis arm. The patients with suspected meningoencephalitis were seen by the primary investigator before the lumbar puncture. After obtaining the informed consent, the patient history was taken and clinical examination was done. Following which the ultrasound examination of both the eyes using Sonosite M turbo high frequency linear probe (6-13MHz) was done in the supine position and the optic nerve sheath diameter were noted. Based on the treating team's decision patient will then undergo imaging of the brain including Computed tomography (CT) or Magnetic resonance imaging (MRI).Lumbar puncture was then done if no contraindications such as raised intracranial pressure (decided on the basis of papilloedema and/or brain imaging) or bleeding diathesis was present. During lumbar puncture, the cerebrospinal fluid pressure was measured using intra arterial extension line and the cerebrospinal fluid column length in cm was noted. The patients following this were admitted in the ward and then followed up with repeat ultrasound imaging on day 4 and day 7 along with clinical examination to look for improvement in clinical condition including GCS score and sensorium.

Patients with clinical diagnosis of cerebrovascular accident were admitted in the ward and underwent brain imaging including Computed tomography (CT) or Magnetic resonance imaging (MRI) as decided by the treating team of physicians. They were seen in the ward by the primary investigator and then after obtaining the informed consent, the patient history was taken and clinical examination was done. Following which the ultrasound examination of both the eyes using Sonosite M Turbo high frequency linear probe (6-13MHz) was done and the optic nerve sheath diameters of both the eyes were noted. They were followed up with repeat ultrasound imaging on day 4 and day 7 and clinical examination to look for improvement in clinical condition including GCS score, sensorium and neurological deficits. Since lumbar puncture was not clinically indicated in these patients, cerebrospinal fluid pressure was not measured. If any repeat brain imaging was done as decided by the treating team, these were also reviewed for the purposes of the study.

The brain imaging were analysed by a trained Radiologist who was unaware of the clinical details of the patient. The computed tomography images were evaluated for features of raised intracranial pressure such as sulcal and gyral effacement, dilated ventricles, periventricular CSF seepage and brain stem herniation. In MR images of the brain, additional features such as tortuosity of the optic nerve as it traverses through the orbital canal, and flattening of the posterior scleral wall were also noted. The Radiologist also will examine the images for features of ischemic or hemorrhagic cerebrovascular accident and meningitis/ encephalitis.

Controls

Normal individuals with no neurological illness or features of raised intracranial pressure were enrolled as controls. These were patients admitted in the hospital ward for other conditions. Since they did not have any suspected neurological condition they did not undergo lumbar puncture or brain imaging. There will be 1 normal control for every patient.



Flowchart of patient recruitment

Measurement of optic nerve sheath diameter.

This was done by the primary investigator using Sonosite Mturbo high frequency linear probe (6-13MHz) after having been trained by ICU Consultant who is trained Sonologist. Initially the primary investigator was trained by the ICU consultant, and afterwards all the images were saved and reviewed by co- investigator to reduce the chance of error in measuring values. The measurement was done using the high frequency linear probe (6-13MHz) Hz frequency probe. The measurement was done in supine position with the patient directing his gaze anteriorly. Copious amount of ultrasound gel was applied to the probe and the probe was applied horizontally over the closed eyelid as shown in figure `1. The optic nerve and its sheath layers were visualized at a point 3 mm from the papilla as this was the place of maximum distension in case of raised intracranial tension. Using the integrated caliper a point 3 mm perpendicular from the papilla was identified. The horizontal diameter was measured at this point from the inner surface of dura to dura. The values for both the eyes were recorded and the image with the measured valued was saved, for later review. All saved images were reviewed by the trained ICU sonologist and measurements were counterchecked. In case of any discrepancy, the measurement of the trained sonologist will be taken as the ONSD measurement.

When an Ultrasound image of the eye is obtained, the predominant structure is the eye globe. The globe is an anechoic structure which has an anterior and posterior chamber. The division of the chambers is by the lens which appears as 2 hyperechoic lines due to the reflection of the sound waves from the anterior and posterior surfaces of the lens.

Behind the globe the optic nerve can be seen as a hypoechoic strip with bilateral perioptic hyperechoic periorbital fat on either side of the nerve. Ideally, with the correct imaging condition, the nerve fibers which is hypoechoic will be seen distinct from the anechogenic subarachnoid space(34)

The volume of the perioptic CSF space is 0.1 - 0.2 mm3. Studies using gelatin infusion in the CSF space has shown proportionately larger increase in diameter of the retrobulbar segment than the posterior part of the nerve, even though anatomically the anterior diameter of the optic nerve is smaller compared to the posterior part. This has been attributed to the asymmetrical arachnoid trabecula distribution;(35) the reduced number of the arachnoid trabeculae in the anterior part of the optic nerve and the nature of the optic nature such that it is thinnest at the retrobulbar segment. (36)

Figure 2 shows a normal ONSD measurement of one of the study patients. It showed an ONSD of 0.41 mm which was consistent with normal ONSD. Figure 3 shows an elevated ONSD of 0.59 mm.

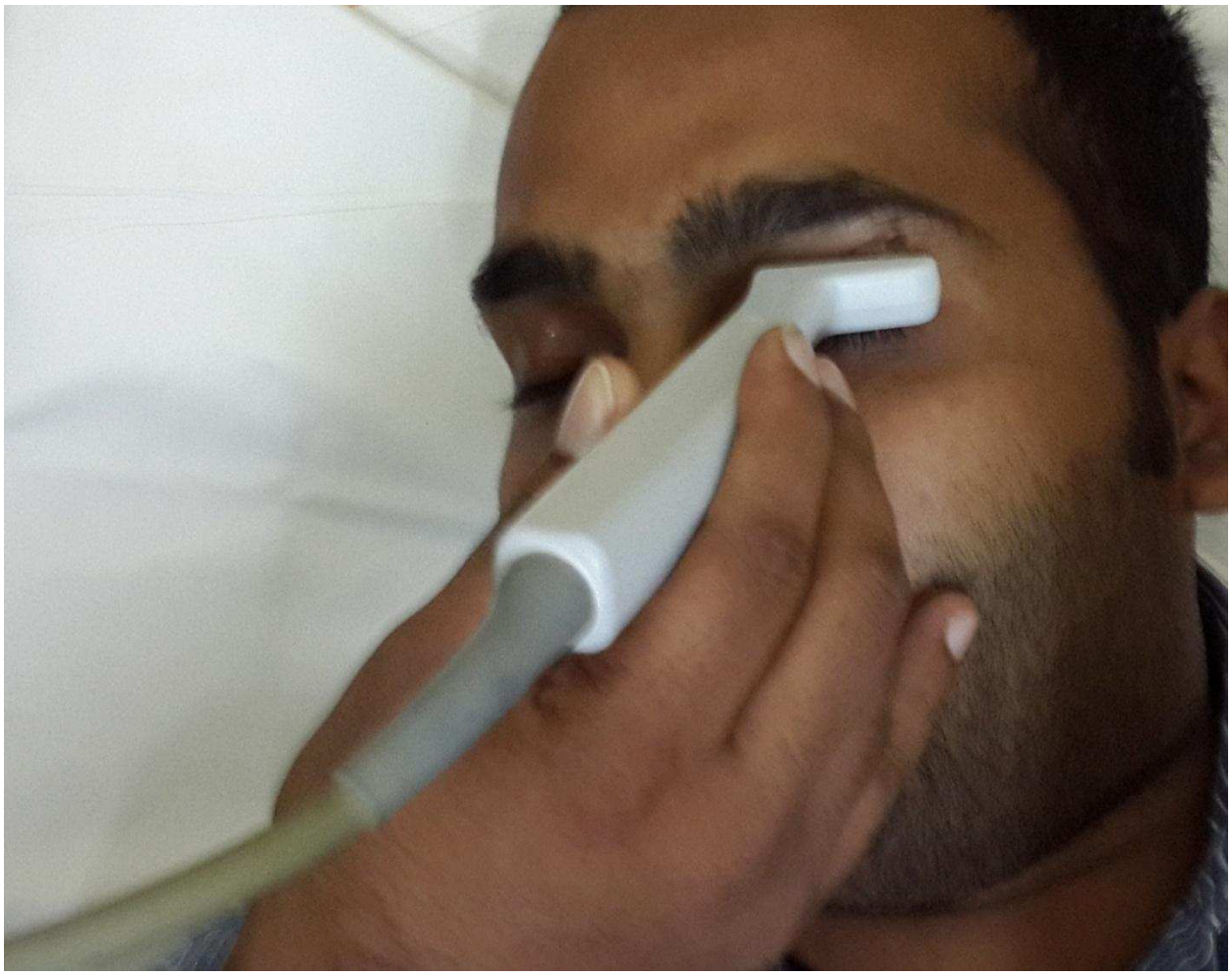
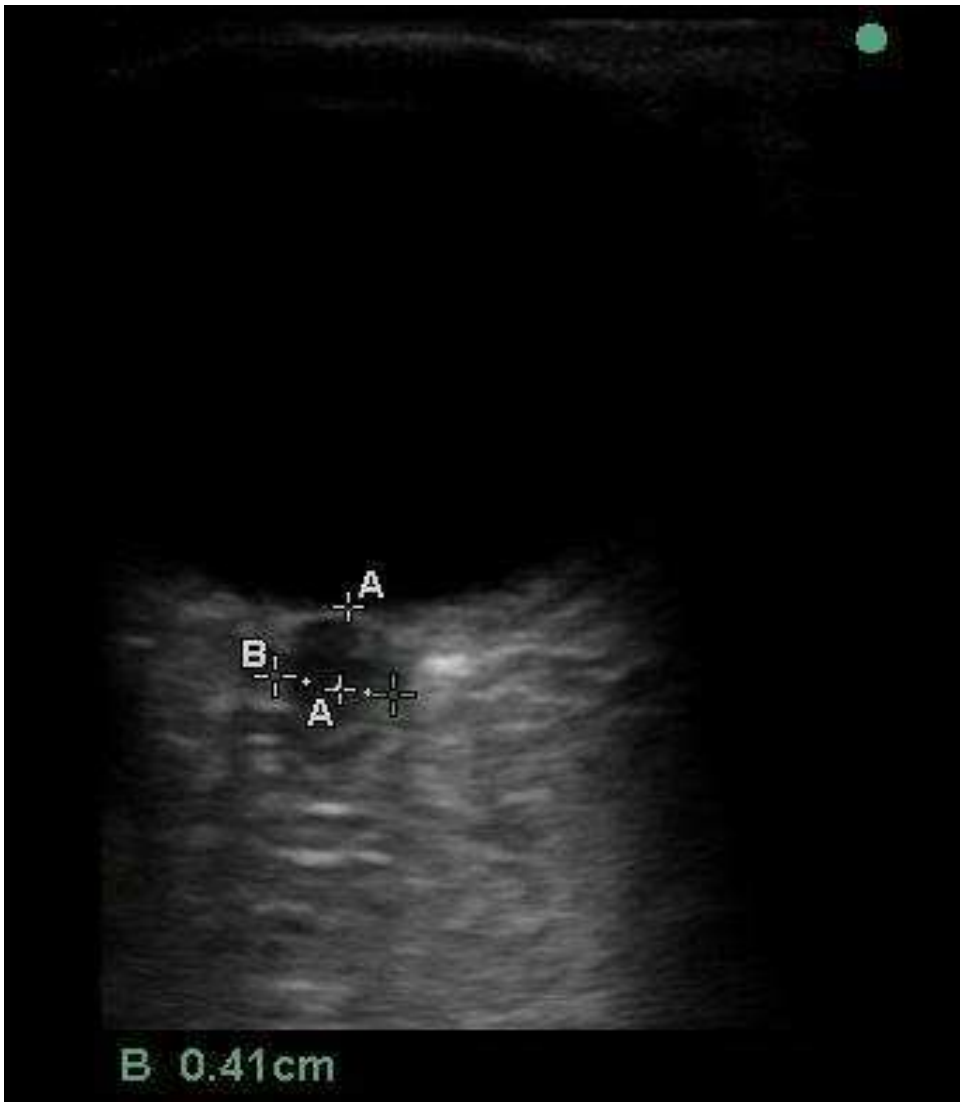
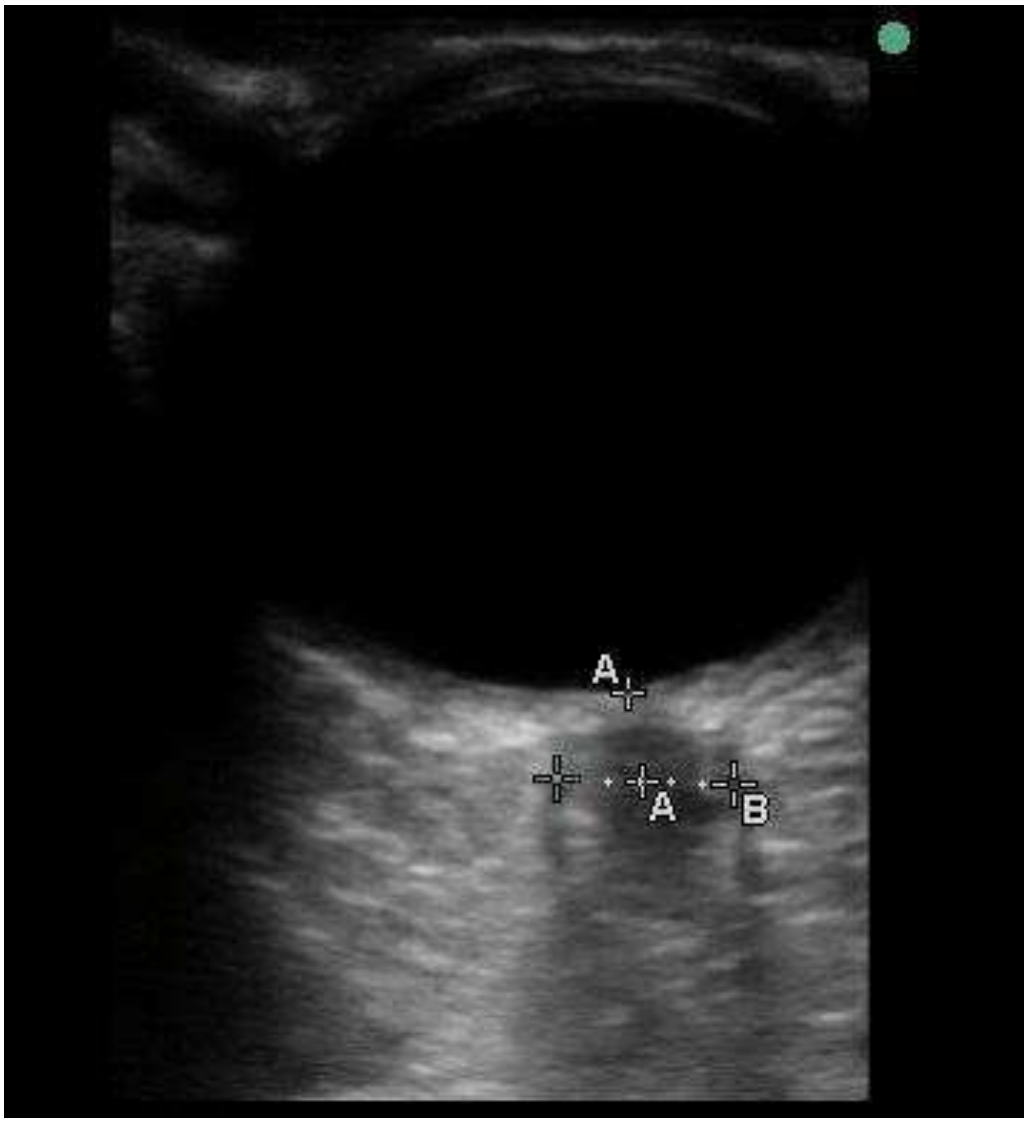


Figure 1: Measurement of Optic Nerve Sheath Diameter using ultrasound



In Figure 2 the ONSD was 0.41 mm which was suggestive of normal.



In Figure 3 Line B represent a diameter of 0.59mm which is suggestive of raised ICT

Measurement of CSF opening pressure:-

The CSF measurement was done independently by the treating team doctors. The CSF pressure was measured during lumbar puncture in cm of CSF by measuring the column of the CSF. In order to minimize variations in the value, a uniform approach was done during lumbar puncture. During lumbar puncture, the CSF column will be measured. The lumbar puncture was done with the patient in the lateral decubitus position with the legs and neck flexed onto the chest. A 20 gauge Yale spinal needle was used for the intrathecal puncture and once the subarachnoid space is entered, the patient was asked to straighten the legs. The cerebrospinal fluid pressure was measured using an arterial pressure monitoring line (Vygon) which was connected to the lumbar puncture needle and the level to which the CSF rises was noted and marked and measured in centimeters. The meniscus may fluctuate between 2 and 5 mm with the patient's pulse and between 4 and 10 mm with respirations. The patient was advised not to strain, because straining can increase the opening pressure, and cautioned not to hyperventilate, as hyperventilating will lower the opening pressure. This was taken as the CSF pressure. This was done by an independent observer who was part of the treating team of physicians and who was unaware of the optic nerve sheath diameter. The cutoff for elevated CSF pressure was taken as 250 mm of CSF

Correlation with CT/MRI imaging of the brain

For the patients who underwent CT/MRI imaging of the brain, the images were reviewed by an experienced Radiologist co-investigator independent of clinical data based on the below criteria to look for signs of raised intracranial tension.

The criteria for diagnosis of raised ICT on CT imaging

(a) Midline shift

(b) Evidence of transtentorial herniation,

(c) Effacement of sulci .

(d) Dilation of basal cisterns

(e) Cerebral oedema

The criteria for diagnosis of raised ICT on MR brain imaging

(a) Tortuosity of the optic nerve.

(b) Flattening of the posterior pole of the optic nerve

(c) Increased CSF perioptic hyperintensity or halo

(d) Evidence of uncal or transtentorial herniation,

(e) Crowding at the foramen magnum

CT features for ischemic stroke

- ✓ Hypoattenuation involving one-third or more of the middle cerebral artery (MCA) territory
- ✓ Obscuration of the lentiform nucleus
- ✓ Cortical sulcal effacement
- ✓ Focal parenchymal hypoattenuation
- ✓ Loss of the insular ribbon or obscuration of the Sylvian fissure
- ✓ Hyperattenuation of large vessel (eg, "hyperdense MCA sign")
- ✓ Loss of gray-white matter differentiation in the basal ganglia

- Ischemic Cortical stroke: Patients with stroke with imaging evidence of cortical infarction
- Ischaemic Sub-cortical stroke: Patients with stroke with imaging evidence of infarction of internal capsule/basal ganglia
- Ischaemic brain stem stroke: Patients with clinical evidence of a brain stem stroke syndrome with or without imaging evidence
- Hemorrhagic stroke CT imaging shows hyperacute blood as hyperdense. Over weeks, the blood will become isodense and may have a ring enhancement appearance. Chronically, the blood is hypodense.

Diagnostic criteria for raised intracranial pressure

- >250 mm of CSF pressure, or
- Imaging evidence of raised intracranial pressure as described.

Sample size calculation

The analysis was divided into the following subgroups:

1. Patients with stroke.
2. Patients with acute CNS infection.
3. Normal controls

Sample Size Calculation:

Single Proportion - Absolute Precision			
Expected Proportion Sensitivity or Specificity of increased Intracranial Pressure	0.9	0.9	0.9
Precision (%)	5	7.5	10
Desired confidence level (1- alpha) %	95	95	95
Required sample size	138	61	35

Based on the data of:

- Kimberly et al (2008): Sensitivity (88%) and Specificity (93%) for trauma patients, and
- Rajajee et al (2011): Sensitivity (98%) and Specificity (91%) of stroke patients,

it was assumed that the sensitivity and specificity each would be around 90% .

In order to estimate this with the precision of 10%, with 95% CI, we need to study minimum 35 patients with increased pressure and 35 with normal pressure.

We anticipated that nearly all patients with meningitis will have raised ICP based on CSF pressure monitoring or imaging features. Of the patients who present with cerebrovascular accident, 30% were estimated to have intracerebral haemorrhage and 20% were estimated to have cortical ischemic strokes, all of whom might have evidence of raised ICP on imaging.

Therefore, we decided to recruit 35 cases of CNS infection and stroke each. To obtain 1:5 controls we had to reruit 15 cases of encephalopathy and 15 normal controls .

Statistical Methods:

Data was entered in Microscoft Excel software. Data was cleaned using frequency distribution, Box-Cox plots and Histograms. Though the literature has suggested various cut off values, we found out the best cut off value using ROC curve with high sensitivity and reasonable specificity. The Diagnostics test statistics such as Sensitivity, Specificity, Predictive values and Likelihood ratio statistics with 95% CI was calculated (both frequentist and Bayesian methods will be used). The Spearman rank correlation was also calculated to study the strength of correlation. The predictive values will also be presented for various levels of pre test probabilities such as 5%, 10% and 15% etc.

Demographic variables are presented with frequency and percentages for categorical variables and with mean and SD for continuous variables. Accuracy of ONSD with the CT or MRI brain imaging and CSF pressure were assessed by plotting ROC curve and the clinically meaningful cut-off values for ONSD was computed after checking for its sensitivity and specificity and were presented with 95% confidence interval. Chi-square test was used to assess the association of disease conditions in intracranial tension. Symptoms and signs of intracranial tension were assessed using chi-square test. p-value of <0.05 is considered to be statistical significant.

The diagnostic test statistics was performed separately in patients with stroke and CNS infection. Statistical correlation of temporal profile of ONSD (day 0, 4 and 7 days) to clinical improvement (sensorium, headache and vomiting) was performed in patients with stroke and CNS infection to assess the utility for clinical follow up of patients.

Inclusion of patients

Out of 110132 patients admitted in the year 2014-2015 at Christian Medical College, 7976 patients were admitted under Medicine Department. Of these, 32 patients with cerebrovascular accident and 31 patients with suspected meningitis/ meningoencephalitis were enrolled in the study. 59 subjects with no neurological disorder but had been admitted in the wards for various other reasons were enrolled as the control subjects in the study. They were seen by the primary investigator and after obtaining the informed consent, was enrolled as participants in the study. The inclusion into the meningoencephalitis or the cerebrovascular accident arm was done based on the initial clinical diagnosis made at the first evaluation of the patients.

Case definitions:

Pyogenic meningitis:- patient presenting with acute onset of fever, with signs and symptoms of meningeal irritation, with or without altered sensorium, with CSF showing neutrophilic pleocytosis with elevated protein and decreased glucose with or without culture being positive

Tuberculous Meningitis:- patient presenting with sub acute history of fever with signs of meningeal irritation, with or without altered sensorium, with CSF showing

lymphocytic pleocytosis with elevated protein and normal or decreased glucose with or without culture being positive

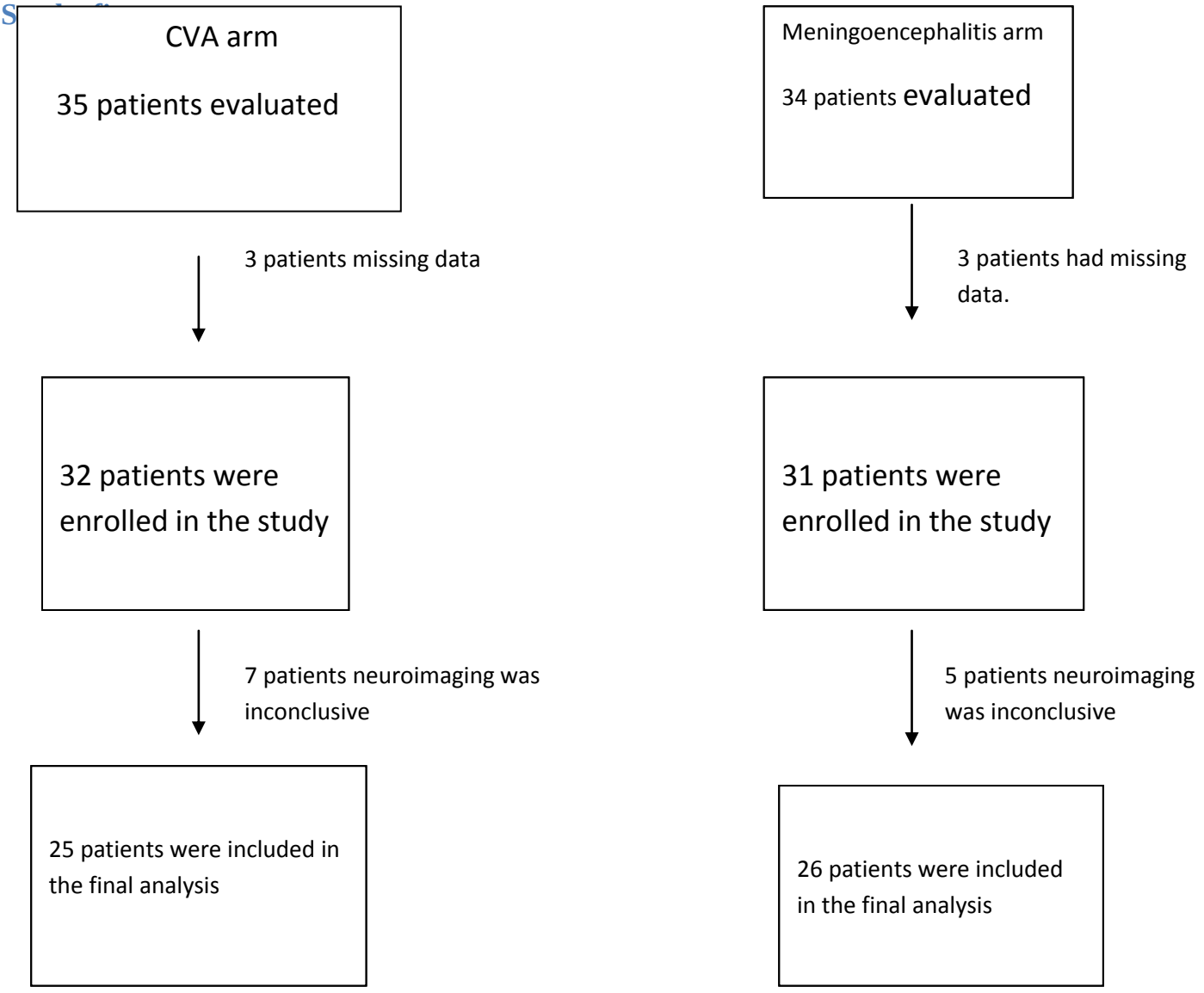
Viral meningitis:- patient presenting with acute history of fever with signs of meningeal irritation, with or without altered sensorium, with or without seizures with CSF showing lymphocytic pleocytosis with normal protein and normal glucose with culture being negative, with or without viral polymerase chain reaction being positive

Acute encephalitis:- patient presenting with acute history of fever with signs of meningeal irritation, with altered sensorium, with CSF showing normal counts with normal protein and normal glucose with culture being negative

Stroke: Patients presenting with sudden onset focal neurological deficits, including hemiplegia, hemiparesis, aphasia or cranial nerve involvement with imaging features diagnostic of thromboembolic or ischemic stroke.

The first measurement of the optic nerve sheath diameter was done within 24 hours of admission to the ward. A total of 23 patients had the day 4 optic nerve sheath diameters also checked. Out of these, 10 patients had meningoencephalitis while the rest 13 had

cerebrovascular accidents. In these patients brain imaging and cerebrospinal fluid analysis (if done) where followed up along with the opening pressure during the lumbar puncture. These patients were also followed upto the time of discharge to ascertain the final diagnosis and information on the treatment received.



Baseline characteristics

Age distribution

Out of the 63 patients who were enrolled in the study, 32 patients had cerebrovascular accident. They were subdivided into embolic, hemorrhagic or thrombotic based on the etiology of the stroke (Table 1) . The mean age in the cerebrovascular group was 59 years. And on subgroup analysis the mean age of thrombotic cerebrovascular accident group was 59.6 years while the mean age for embolic cerebrovascular accident group was 55.25 years. The mean age for hemorrhagic cerebrovascular accident group was 59.3 years.

Among the 31 patients in the meningoencephalitis group, the mean age was 38.6 years. Sub group analysis showed the mean age of the patients with aseptic meningitis was 46.4 years, while in the bacterial meningitis group was 41.14 years and in the group of patients with tuberculous meningitis was 34.1 years. There was only 1 patient with encephalitis and his age was 64 years. The detailed characteristics is given in Table 1

The mean age of the control group was 44 .8 years.

Table 1:- showing average age in years in different subgroups and the number of patients in each of the subgroups.

Group	Number of cases (n)	Patient age in years
Thrombotic CVA	18	59.6
Embolic CVA	4	55.25
Hemorrhagic CVA	10	59.3
Aseptic meningitis	5	46.4
Bacterial meningitis	7	41.14
Tuberculous meningitis	18	34.1
Encephalitis	1	64

Gender distribution

Among the patients with meningitis 21 patients were male and 9 were female among the meningoencephalitis. There was one male patient with encephalitis. The details are given in Figure 4.

Among the patients with cerebrovascular accident, 17 patients (53%) were male and 15 (47%) were female. The details are given in Figure 5.

Figure: 4 GENDER DISTRIBUTION AMONG PATIENTS WITH MENINGITIS

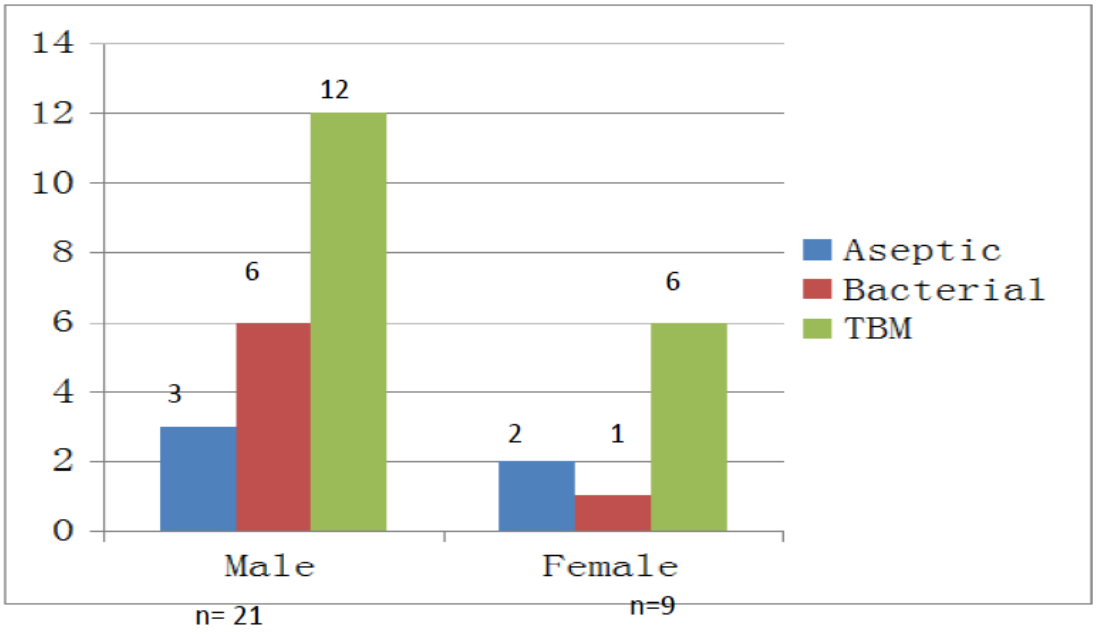
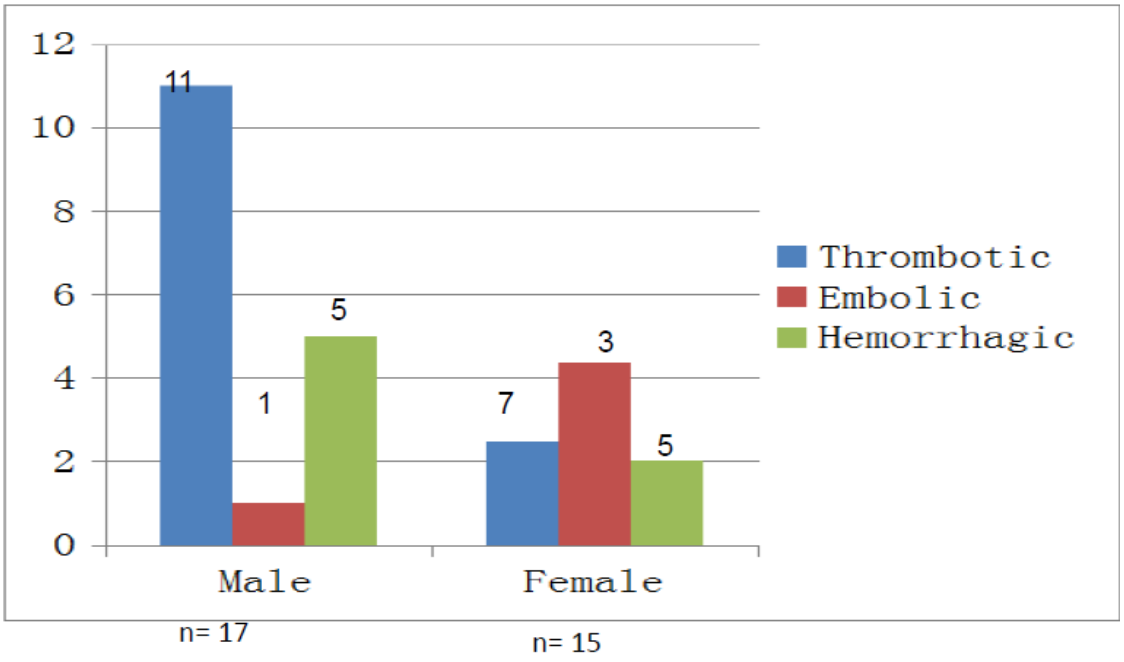


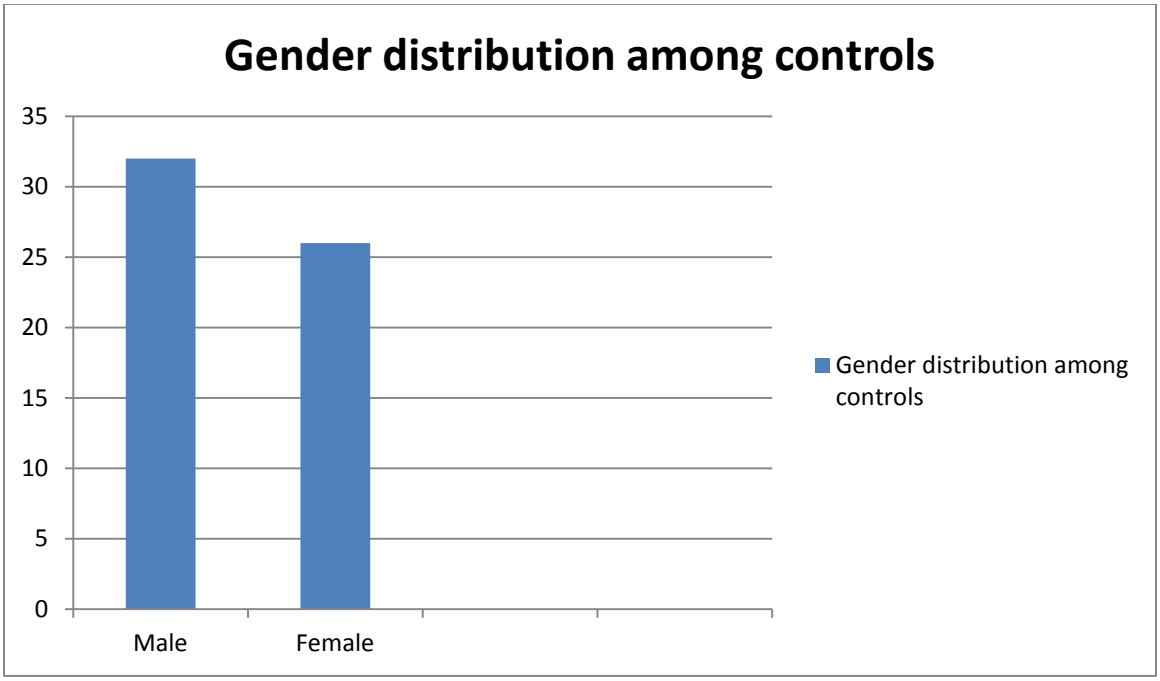
Figure:5 GENDER DISTRIBUTION AMONG PATIENTS WITH CEREBROVASCULAR ACCIDENT



GENDER DISTRIBUTION AMONG CONTROLS

Among the controls there were 32 (55.2%) males and 26 (44.8%) females. This has been shown in Figure 6.

Figure: 6 GENDER DISTRIBUTION AMONG CONTROLS



Admission characteristics and treatment outcome

Among the 31 patients with meningoencephalitis, the clinical symptom profile of the meningitis patients at admission was recorded. Special attention was paid to symptoms and signs which correlates with raised intracranial tension. Table 2 shows the symptom profile of these patients at admission. The majority of the patients had tuberculous

meningitis (18 out of 31). The frequency of headache was higher in TB meningitis (83%) compared to the acute meningitis (20%) and bacterial meningitis (43.8%). Altered sensorium was common in patients with acute meningitis like bacterial (85.7%), aseptic (100%) and encephalitis, while it was present only in 50% of patients with tuberculous meningitis. This may be due to the rapidity of the process in acute CNS infection leading to increase in intra-cranial pressure. Similarly the frequency of seizures were higher in acute meningitis (bacterial meningitis 14.2% and aseptic meningitis 20%) compared to TBM (11.1%). Papilloedema was more prevalent in tuberculous meningitis (44.4%) compared to bacterial meningitis (14.2%) and aseptic meningitis (0%) which could be due to the fact that papilloedema takes time to develop and may not have been present in the patients with acute meningitis. Anisocoria was present only two cases, one each in bacterial meningitis and TBM.

Among the 31 patients with meningoencephalitis where follow up data regarding treatment outcome were available, 21 patients were alive and well at the time of discharge, there were 5 deaths and 4 were discharged against medical advice. Three of the deaths were in patients with tuberculous meningitis and one each in aseptic meningitis and bacterial meningitis. This is shown in Figure 7.

In the Cerebrovascular group, among the 32 patients, 23 patients were alive and well at the time of discharge and there were 4 deaths and five patients were discharged against medical advice. There was one death each in the thrombotic and embolic strokes and two

in haemorrhagic stroke. Four patients who got discharged against medical advice were in the thrombotic stroke group. The details are shown in Figure 8.

Table 2. Incidence of symptoms against the type of meningitis

Type of meningitis (n)	Headache	Vomiting	Seizure	Altered sensorium	Papilloedema	Anisochoria
Bact. Meningitis (7)	3 (42.8%)	3 (42.8%)	2 (28.5%)	6 (85.7%)	1 (14.2%)	1(14.2%)
TBM (18)	15 (83.3%)	11(61.1%)	2 (11.1%)	9 (50%)	4 (44.4%)	1 (5.5%)
Aseptic meningitis (5)	1 (20%)	2 (40%)	1 (20%)	5 (100%)	0	0
Encephalitis (1)	0	0	1 (100%)	1 (100%)	0	0
Total	19/31	16/31	6/31	21/31	5/31	2/31

Figure 7. Discharge characteristics among meningitis patients

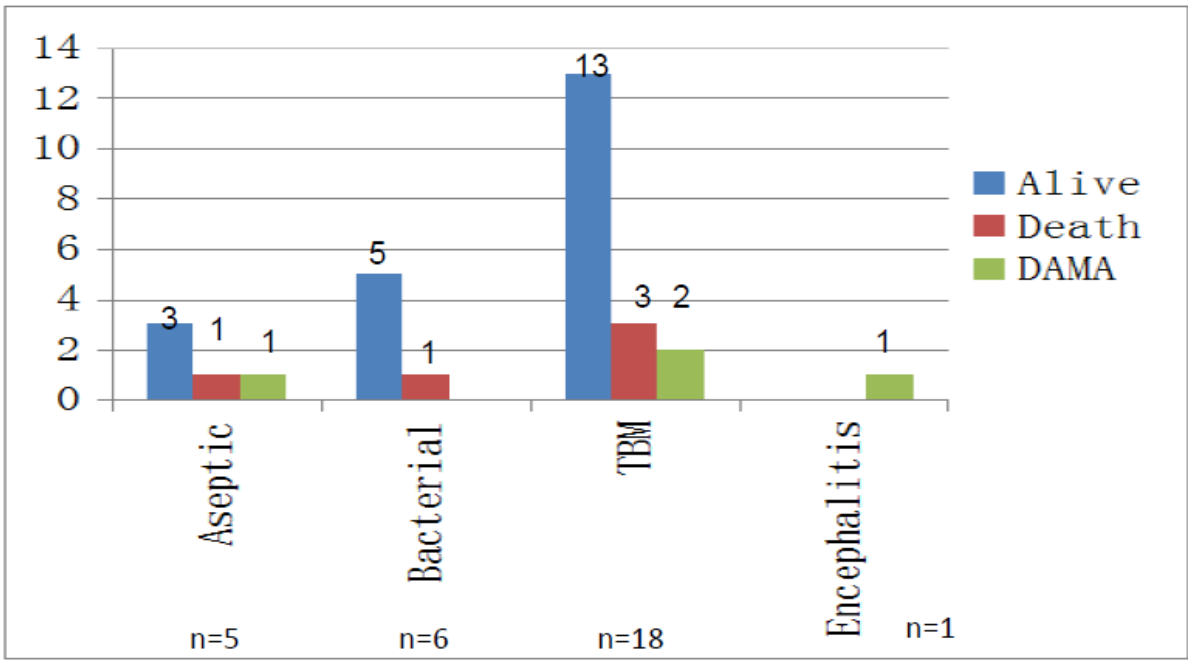
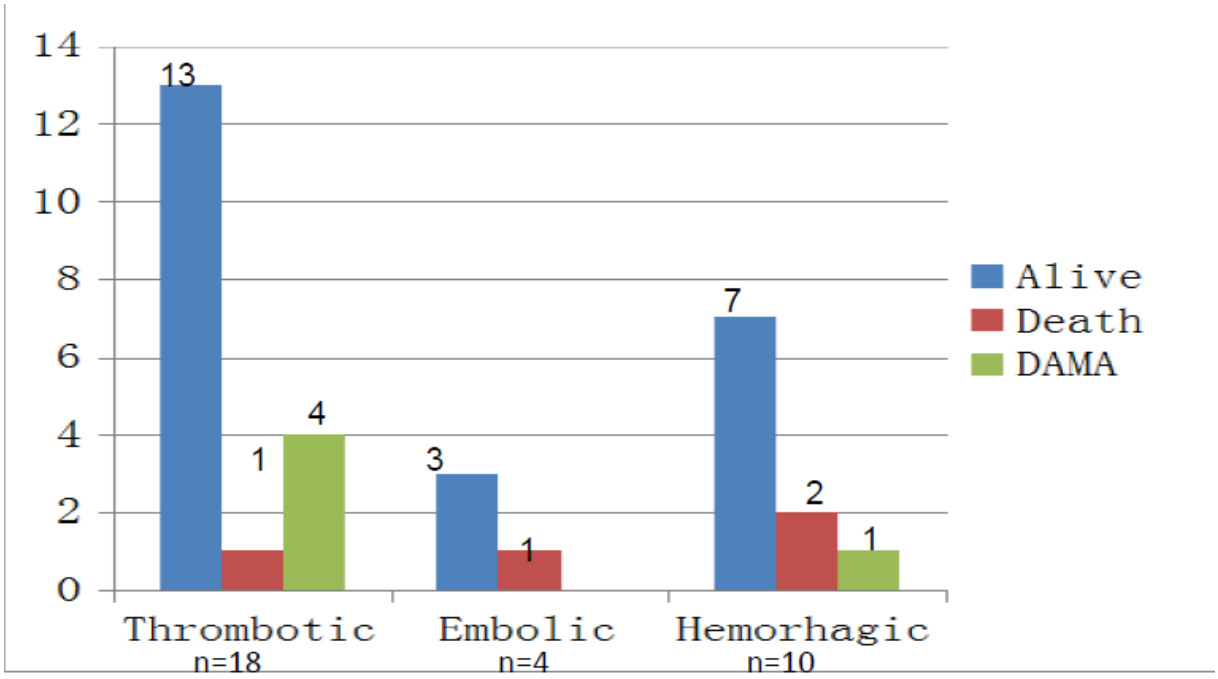


Figure 8. DISCHARGE STATISTICS AMONG PATIENTS WITH CEREBROVASCULAR ACCIDENT



Baseline ONSD values

The baseline ONSD values were noted for the different subtypes of meningitis (Table 3). It showed the higher mean ONSD in patients with tuberculous meningitis of 0,53 mm which is indicative of the increased prevalence of raised ICT in this subgroup. The mean ONSD in aseptic meningitis was 0.494 mm and in bacterial meningitis was 0.501 was higher than the mean among controls (0.45). The values are shown in Table 3.

Similarly the mean ONSD was calculated for the CVA subtypes and the hemorrhagic CVA had the highest value with mean of 0.54, since hemorrhage is most commonly associated with raised ICT (Table 4). The mean ONSD for thrombotic stroke was 0.49 and embolic stroke was 0.48 was higher than the normal control value.. The values are given in Table 4.

The mean ONSD for the 58 controls was 0.45 with a SD of 0.05.

Table.3 Baseline ONSD values for types of meningitis

	Mean ONSD(mm)	SD
Aseptic meningitis (n=5)	0.494mm	0.07
Bacterial meningitis (n=7)	0.501	0.068
Tuberculous meningitis (n=18)	0.53	0.062
Encephalitis (n=1)	0.41	-
All meningitis (n=31)	0.51	0.67

Table.4 Baseline ONSD values for types of CVA

	Mean ONSD(mm)	SD
Thrombotic CVA (n=18)	0.49	0.05
Embolic CVA (n=4)	0.48	0.05
Hemorrhagic CVA (n=10)	0.54	0.076
All CVA (n=32)	0.50	0.66

In table 5 the proportion of raised ONSD by the different subtypes of meningitis was plotted using the cutoff value for elevated ONSD of > 0.54 mm. The rate of raised intracranial pressure as assessed by ONSD was 55.5% in TBM compared to 40% in aseptic meningitis and 28.6% in bacterial meningitis.

Table.5 Proportion of raised ONSD by meningitis subtypes

(N=31)	**Elevated ONSD (> 0.54mm)**
Aseptic Meningitis (n=5)	2 (40%)
Bact. Meningitis (n=7))	2 (28.6%)
TBM (n=18)	10 (55.5%)
Encephalitis (n=1)	0

Table 6 shows the prevalence of elevated ONSD as seen in each of the stroke subtypes. Though thrombotic CVA was by far the commonest, the raised ONSD was more prevalent in hemorrhagic CVA

Table 6 Incidence of raised ONSD by CVA subtypes

N=25	**Elevated ONSD (> 0.54mm) (%)**
Thrombotic CVA (n=14)	4 (28.57%)
Embolic CVA (n=3)	1 (33.3%)
Hemorrhagic CVA (n=8)	6 (75%)

Evaluation of ONSD as a diagnostic tool

For this study we have taken the cutoff of 0.54mm or more as increased ONSD value, consistent with raised intracranial tension. CSF pressure of 25cm of CSF or more was taken as raised intracranial tension. The table 7 shows the comparison of ONSD with imaging features of raised ICT, either CT or MRI in both patients with stroke and meningitis.

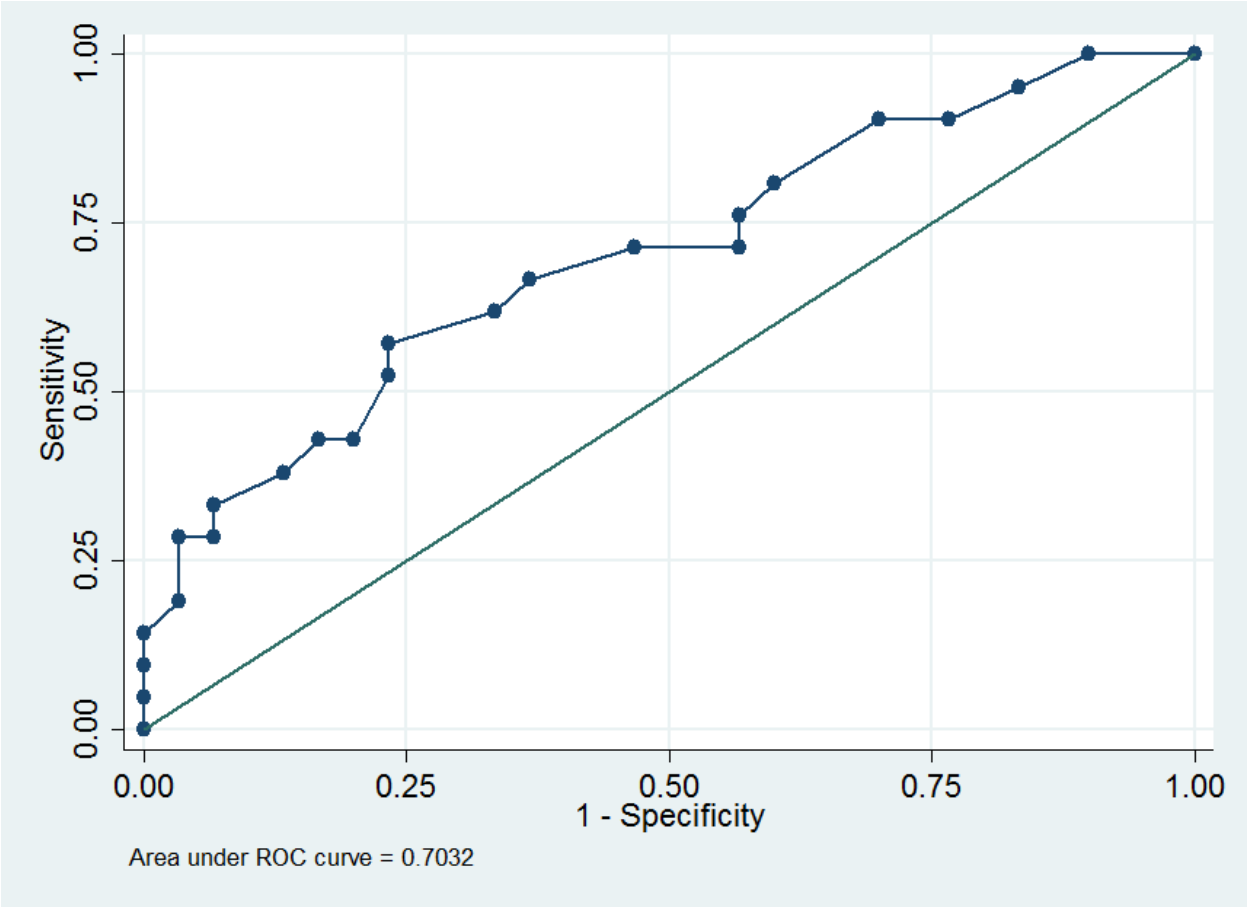
Table.7 ONSD compared with imaging features of raised ICT (N=51)			
	Imaging features of raised Intracranial tension	**Imaging features of Normal Intracranial tension**	Total
Raised ONSD (more than 0.54mm)	11 (61.11)	7 (38.89)	18
Normal ONSD (less than 0.54mm)	10 (30.3%)	23 (69.7%)	33
Total	21	30	51

At the cutoff value of 0.54mm we had obtained 52.38% sensitivity and 76.67% specificity with positive likelihood ratio of 2.24 and negative likelihood ratio of 0.62.The positive predictive value was 61.1% (95% CI 35.7-82.7) and the negative predictive value was 51.3% (95% CI 51.3-84.4)

ROC curve comparing ONSD with imaging. The values of optic nerve sheath diameter and imaging features of raised intracranial tension were put in a 2x2 table. Accuracy of ONSD with the CT or MRI brain imaging and CSF pressure were assessed by plotting ROC curve and the clinically meaningful cut-off values for ONSD was computed after checking for its sensitivity and specificity and were presented with 95% confidence

interval. The ROC curve had an area of 0.70 which showed reasonable association between ONSD and raised ICT based on imaging. The ROC curve is shown in Figure 9.

Figure.9 ROC curve of ONSD vs raised ICT by CT/MRI imaging of the brain



The detailed report showing the sensitivity, specificity, positive and negative likelihood ratio of each of the ONSD cutoff values were calculated. These values were plotted on the ROC curve and show the same significance as explained in Table 4. The detailed report is shown in Table 8.

Table.8 Detailed report of sensitivity and specificity

Cutoff	Sensitivity	Specificity	Correctly Classified	LR+	LR-
(>= .41)	100.00%	0.00%	41.18%	1.0000	
(>= .43)	100.00%	10.00%	47.06%	1.1111	0.0000
(>= .44)	95.24%	16.67%	49.02%	1.1429	0.2857
(>= .45)	90.48%	23.33%	50.98%	1.1801	0.4082
(>= .46)	90.48%	30.00%	54.90%	1.2925	0.3175
(>= .47)	80.95%	40.00%	56.86%	1.3492	0.4762
(>= .48)	76.19%	43.33%	56.86%	1.3445	0.5495
(>= .49)	71.43%	43.33%	54.90%	1.2605	0.6593
(>= .5)	71.43%	53.33%	60.78%	1.5306	0.5357
(>= .51)	66.67%	63.33%	64.71%	1.8182	0.5263
(>= .52)	61.90%	66.67%	64.71%	1.8571	0.5714
(>= .53)	57.14%	76.67%	68.63%	2.4490	0.5590
(>= .54)	52.38%	76.67%	66.67%	2.2449	0.6211
(>= .55)	42.86%	80.00%	64.71%	2.1429	0.7143
(>= .56)	42.86%	83.33%	66.67%	2.5714	0.6857
(>= .57)	38.10%	86.67%	66.67%	2.8571	0.7143
(>= .58)	33.33%	93.33%	68.63%	5.0000	0.7143

(>= .59)	28.57%	93.33%	66.67%	4.2857	0.7653
(>= .6)	28.57%	96.67%	68.63%	8.5714	0.7389
(>= .61)	19.05%	96.67%	64.71%	5.7143	0.8374
(>= .62)	14.29%	100.00%	64.71%		0.8571
(>= .66)	9.52%	100.00%	62.75%		0.9048
(>= .7)	4.76%	100.00%	60.78%		0.9524
(> .7)	0.00%	100.00%	58.82%		1.0000

Interpretation of ROC curve

The ROC curve can be interpreted as follows:

From 0.7-0.62:- these values of ONSD had a likelihood ratio of infinity and hence they can be used to rule in raised intracranial tension. Ie. the intracranial tension will be raised in 100% of the cases.

From 0.61-0.58:- likelihood ratio ranged from 4 to 8

From 0.43-0.39:- these values of ONSD had a likelihood ratio of zero and hence they can be used to rule out raised intracranial tension. ie. the intracranial tension will be normal in 100% of the cases.

This is illustrated in Table 9.

At the ONSD cutoff value of less than 0 .43, the sensitivity was 100.00% and specificity 10.00%.

At an ONSD cutoff value of more than 0.54mm we had obtained 52.38% sensitivity and 76.67% specificity. At cutoff value of > 0.58, the sensitivity was 33.33% and specificity 93.33%.

Diagnostic utility of ONSD based on ROC curve

Table.9 Diagnostic utility of ONSD

ONSD	Number of cases (%)	Positive Likelihood ratio	Interpretation
0.39-0.43	6 (11.7%)	0	Raised ICT can be ruled out
0.44-0.57	36 (70%)	1.1-2.86	Intermediate likelihood Raised ICT cannot be ruled out
0.58-0.61	6 (11.7%)	4-8	Moderate likelihood of raised ICT
0.7-0.62	3 (5%)	Infinity	All patients will have raised ICT

In this study, in 15 cases (28.4%) ONSD could provide conclusive information to rule in (16.7%) or rule out raised intracranial pressure (11.7%). In 36 cases (71.6%) of patients with ONSD values of 0.44-0.57 ONSD could not produce conclusive information of the status of the intracranial pressure.

Subgroup analysis

ONSD with CSF pressure in meningitis patients

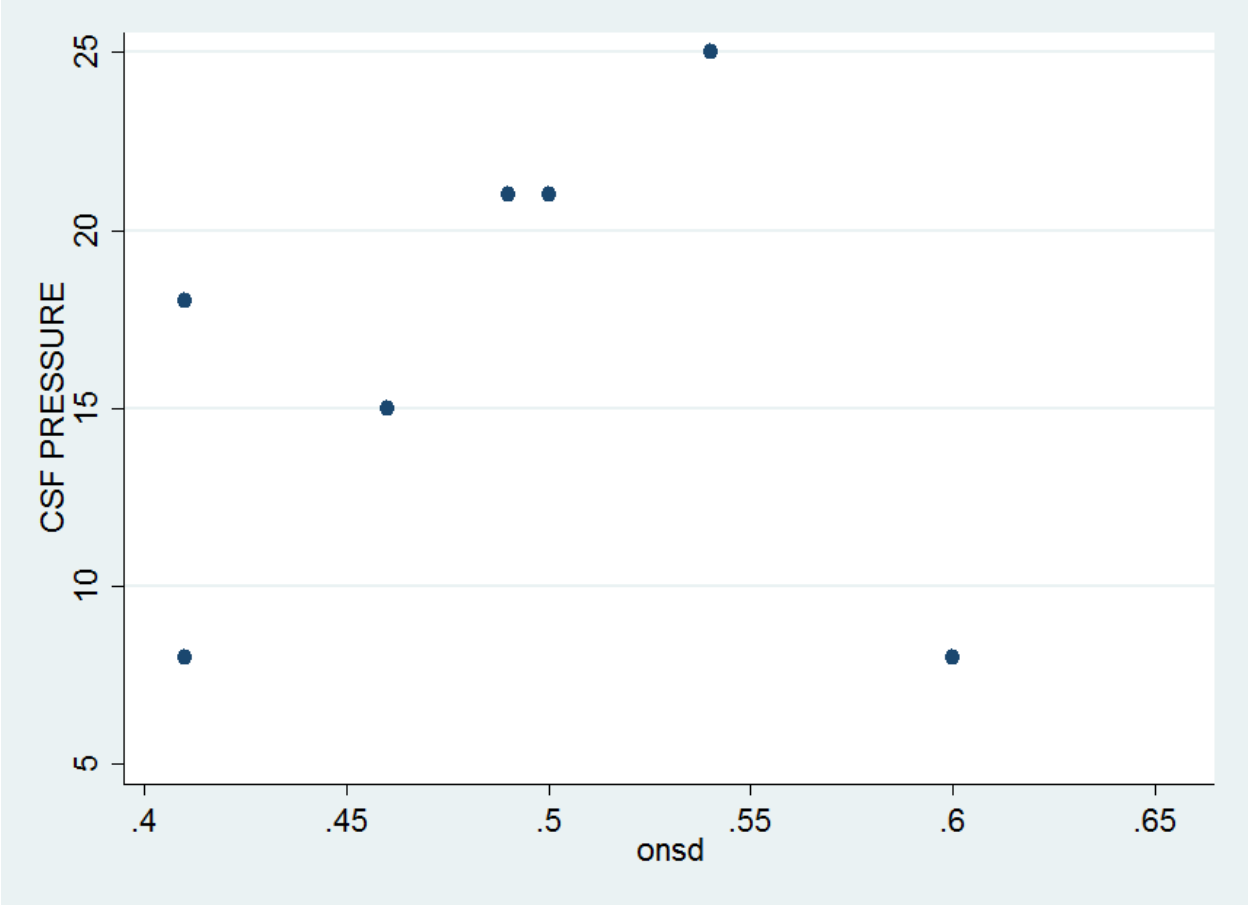
In Table 10 the ONSD values were plotted against the day 0 CSF pressure. This data was available only for 7 meningitis patients. There was only 1 patient with raised ICT which was picked by the ONSD also. But there was 1 false positive among the ONSD patient who had normal ICT by CSF pressure. The sensitivity and specificity of ONSD and CSF pressure was 100% and 83% respectively. The positive predictive value was 50% (95% CI- 1.3-98.7) and negative predictive value was 100 (95% CI 15.7-84.3)

Table.10 ONSD plotted against CSF pressure

N=7	Raised CSF pressure (>250 mm)	Normal CSF pressure (<250 mm)	Total
Raised ONSD (> 0.54mm)	1 (100%)	1 (16.67%)	2(28.57%)
Normal ONSD (<0.54mm)	0	5 (83.3%)	5 (71.43%)
Total	1	6	7 (100%)

The CSF pressure values for the 7 patients with meningitis were plotted as a scatter plot to show the distribution of CSF pressure values. This is shown in Figure 9. There were only 7 cases with one patient with elevated CSF pressure who had an elevated ONSD. Of the other 6 with normal CSF pressure 5 had a normal ONSD and one an elevated ONSD.

Figure.9 SCATTER PLOT SHOWING CSF PRESSURE AND ONSD



ONSD with imaging in meningitis patients

The ONSD data was plotted against imaging features to look for association between ONSD and imaging among patients with meningitis. The subgroup analysis of ONSD with imaging in meningitis patients showed good sensitivity and specificity. It showed a sensitivity of 70% and specificity of 81.2% at the ONSD cutoff of 5.4mm. The positive predictive value was 70 % (95% CI- 34.8-93.3) and negative predictive value was 81.3% (95% CI 54.4-96). These values are shown in Table 11.

Table.11 ONSD against CT/MR imaging in meningitis patients

N=26	Raised ICT in imaging	Normal Imaging	Total
Raised ONSD	7 (70%)	3 (18.71%)	10 (38.46%)
Normal ONSD	3 (30%)	13 (81.25%)	16 (61.54%)
Total	10	16	26 (100%)

ONSD with imaging in cerebrovascular accident

The ONSD data was plotted against imaging features to look for association between ONSD and imaging among patients with cerebrovascular accident. The subgroup analysis of ONSD with imaging in stroke patients showed poor sensitivity. It showed a sensitivity

of 36.4% and specificity of 71.4% at the ONSD cutoff of 5.4mm. The positive predictive value was 50 % (95% CI- 15.7-84.3) and negative predictive value was 58 (95% CI 32.9-81.6). These values are shown in Table 12.

Table.12 ONSD against imaging in patients with CVA

N=25	Raised ICT in imaging	Normal Imaging	Total
Raised ONSD	4 (36.36%)	4 (28.57%)	8 (32%)
Normal ONSD	7 (63.64%)	10 (71.43%)	17 (68%)
Total	11	14	25 (100%)

The summary of findings including the sensitivity, specificity, positive and negative predictive of ONSD with imaging and CSF pressure overall and in meningitis and stroke is given in Table 13.

Table.13 Comparison of diagnostic parameters of ONSD

	ONSD vs imaging All patients	ONSD vs imaging Meningitis	ONSD vs imaging stroke patients	ONSD vs CSF pressure Meningitis
Sensitivity	52.38%	70%	36.4%	100%
Specificity	76.67%	81.2%	71.4%	83%
Positive predictive value	51.3% (95% CI 51.3-84.4)	70 % (95% CI- 34.8-93.3)	50 % (95% CI- 15.7-84.3)	50% (95% CI- 1.3-98.7)
Negative predictive value	61.1% (95% CI 35.7-82.7)	81.3% (95% CI 54.4-96)	(95% CI 32.9-81.6)	100 (95% CI 15.7-84.3)

The results show that ONSD has a better sensitivity and specificity in patients with meningitis than in stroke. The sensitivity and specificity for ONSD are better in comparisons with CSF pressure compared to imaging. However the number of patients in whom CSF pressure was obtained was small and therefore the confidence intervals are wide.

Symptoms correlation with different modalities and raised ICT

A correlation was made between symptoms and signs and raised ICT by different diagnostic tests (Imaging, CSF pressure and ONSD). The number of patients with raised ICT out of the total number of patients as detected by the 3 different modalities of measuring ICT was examined to see how well symptoms and signs of raised ICT correlate with lab tests. This data is shown in Table 14. N shows the total number of patients with raised ICT as detected by the respective tests.

The proportion of patients with various symptoms and signs with raised ICT was as follows: headache 55.5%-100%; vomiting 52.3%-61.1%, seizure 14.2%-100%, altered sensorium 31.8%-100%, anisocoria 9%-66.7% and papilloedema 19.4-66.7%. Individual symptoms have a moderate sensitivity in diagnosing raised ICT.

Table.14 Symptoms of raised ICT against raised ICT by three different modalities of checking raised ICT

Table.14 Symptoms of raised ICT against raised ICT by three different modalities of checking raised ICT

Symptoms (n=51)	**Elevated ONSD (>0.54 mm)(N=18)**	**CSF pressure (>250 mm) (N=1)**	**Neuroimaging (N=21)**
Headache	10 (55.5%)	1 (100%)	12 (57.1%)
Vomiting	11 (61.1%)	0	11 (52.3%)
Seizure	5 (27.7%)	1 (100%)	3 (14.2%)
Altered sensorium	11 (61.1%)	1 (100%)	8 (38.1%)
Anisochoria	2 (66.67%)	0	2 (9%)
Papilloedema	4 (66.67%)	0	4 (19.04%)

Raised ONSD among different types of meningitis

Table 15 shows the number of patients with raised ICT and their diagnosis. Ie. the types of meningitis. As shown in the table 10, the predominant numbers of patients had tuberculosis and 50% of these patients had raised ICT. The other subtypes were less in number and had much less incidence of raised ICT. So clinically patients who had tuberculosis are more likely to have raised ICT.

Table.15 Distribution of raised ICT among the different subtypes of meningitis

(N=26)	**Elevated ONSD (> 0.54mm)**	**Elevated CSF pressure (>250 mm)**	**Neuroimaging features of raised ICT**
Aseptic Meningitis (n=4)	1	0	0
Bact. Meningitis (n=6))	2	0	1
TBM (n=15)	9	1	9
Encephalitis (n=1)	0	0	0

Role of ONSD in follow up

Temporal profile of symptoms (Table 16)

Day 4 value was available for 12 patients. Their symptom profile on Day 4 is shown in Table 14. 44.4% of patients with headache on day 4 had raised ICT by ONSD, 50% with vomiting and 75% with altered sensorium. All the patients who had seizure and papilloedema on day 4 had raised ICT by ONSD. The results show the moderate correlation of symptoms and signs to raised ICT particularly with altered sensorium and papilloedema.

Table.16 Symptom profile and ICT on Day 4

(n=12)	**Headache**	**Vomiting**	**Seizure**	**Altered sensorium**	**Papilloedema**	**Anisochoria**
Raised ONSD	4	3	1	4	2	0
Normal ONSD	5	3	0	3	0	0
% of symptoms having raised ICT	44.4%	50%	1/1	75%	2/2	-
Total	9/12	6/12	1/12	7/12	2/12	0/12

In the study group there was one patient who had normal ONSD at admission but developed increased ONSD on day 4. This patient had normal ONSD at admission and she was admitted with suspected otomastoiditis and cerebellitis but during the course developed worsening of sensorium and intracerebral abscess and was shifted to ICU. Neurosurgery opinion was taken and was managed conservatively with antibiotics and was discharged in a stable condition. The ONSD findings correlated with the clinical worsening.

There were 6 patients who had increased ONSD on day 1 and 4. In this group there was one patient who had subsequently developed papilloedema due to persistent high ICT by day 4. There were 5 patients who had elevated ONSD on day 1 who had normal ONSD on day 4. None of these patients developed signs of raised ICT on followup in the form of anisocoria and papilloedema. The ONSD values appear to be sensitive than any specific symptom or sign. These results show the feasibility and possible utility of ONSD in follow up monitoring of ICT in patients with meningitis and stroke.

Discussion

A prospective observational study was done to study the diagnostic utility of measuring optic nerve sheath diameter using ultrasound to assess raised intracranial tension in patients with meningoencephalitis and cerebrovascular accident.

The evaluation of optic nerve sheath diameter using ultrasound is a relatively rapid, painless and non-invasive procedure. The skill for the same can be acquired rapidly and is easily mastered by a general physician. The ONSD can be measured using any high frequency probe, though in this study we had employed linear probe.

Diagnostic value of ONSD for raised ICT

The overall sensitivity of 52.38% and 76.67% specificity of ONSD when compared to neuroimaging ; the area under the curve was 0.70 which showed a reasonable association between ONSD and neuroimaging.

In sub group analysis, the ONSD value in meningitis was found to have better correlation with sensitivity of 70% and specificity of 81.2%. The reason postulated for the poor correlation in stroke patients could be due to the ambiguous imaging features of raised ICT in patients with cerebrovascular accident. Since there was no clinical indication for lumbar puncture in these patients, none of them had their CSF pressures checked.

The reasons for poor correlation of ONSD in stroke patients could be:

(1) Poor sensitivity of diagnosing raised ICT based on imaging in stroke (37–39)

(2) Many patients had localized edema on imaging and the correlation of this finding to raised ICT is not known

Since stroke is an evolving neurological event in which ICT can rapidly increase, the time interval between imaging and ONSD could also result in discrepancy between imaging and ONSD measurements. The ONSD values correlated well with CSF pressure with 100% sensitivity and 83% specificity. But the number of patients who had CSF pressures checked was only 7 and hence the significance of the result is not certain. Many studies which had been done had showed good correlation of ONSD with CSF pressure which was also supported in the current study.

Use of ONSD in management of suspected meningitis in emergency department

Based on the analysis of the ROC curve (Figure 8 and Table 8) we suggest the following inference, which is given in table 17

Table.17 ONSD values and management recommendation

ONSD	Positive Likelihood ratio	Interpretation	Management recommendation
0.39-0.43	0	Raised ICT can be ruled out	No imaging is required before lumbar puncture
0.44-0.57	1.1-2.86	Raised ICT cannot be ruled out	If patient is having altered sensorium, papilloedema or focal neurological signs then imaging is required before LP
0.58-0.61	4-8	Moderate likelihood of raised ICT	Imaging is required, start anti-edema measures immediately
0.7-0.62	Infinity	All patients will have raised ICT	Imaging is required, start anti-edema measures immediately

The utility of ONSD is maximum in an Emergency department setting where a patient with suspected raised meningoencephalitis is being evaluated. If the patient is in altered sensorium, and the treating physician is unsure of the intracranial pressure , then lumbar puncture will have to wait till imaging studies are performed. In this situation ONSD

measurement can help to rule in or rule out raised ICT. If the value falls below 0.43mm, then these patients are 100% likely to have normal intracranial tension and CSF analysis can be safely performed.

If on the other hand, the value of ONSD is more than >0.58 then there is 100% chance that the intracranial tension is raised and hence lumbar puncture should be withheld till imaging of the brain has been done and anti-edema measures should be initiated. If the value is between 0.44 and 0.57, the need for imaging should be guided by clinical considerations. If there is altered sensorium or papilloedema or focal neurological signs then imaging should be performed before lumbar puncture. However if these are not there, then lumbar puncture is probably safely done without imaging. Because of this and the limited number of patients enrolled in the study, a single significant cut-off point could not be calculated.

However in our study only 30% of patients had ONSD values that were conclusive in ruling in or ruling out raised ICT. In 70% of patients the ONSD values are intermediate (0.44-0.57) and clinical considerations have to guide decisions on the need for neuroimaging before lumbar puncture.

Correlation of clinical symptoms and signs in diagnosing raised ICT

The results also show that there is moderate correlation between symptoms of headache, vomiting and raised ICT and better correlation with altered sensorium and papilloedema against the multiple diagnostic modalities for raised ICT (imaging, CSF pressure and ONSD). The results emphasize the importance of paying attention to clinical symptoms and signs as clinical clues for raised ICT.

Use of ONSD for following monitoring of patients with stroke and meningitis

The study showed that ONSD is feasible at the bedside and can be used for follow up monitoring. ONSD values can identify patients where ICT increases, remains high and falls on treatment and these trends correlate with the clinical course of patients.

Conclusion

The study shows that ONSD measured using ultrasound is a rapid and convenient bedside test for assessing for raised intracranial tension in patients with meningitis. It can be used as a useful adjunct to the clinical examination in suspected meningitis to measure ICT. A normal ONSD conclusively rules out raised ICT. An elevated value confirms the presence of raised ICT and can be used to initiate treatment for raised ICT. In both these situations it is useful in decision making on the need for imaging in meningitis and initiating anti-edema measures. However at intermediate ONSD value the need for imaging has to be decided based on clinical considerations. ONSD can also have a role as a convenient bedside test in follow up monitoring of ICT in patients with meningitis. ONSD measurement may not be as useful in assessing raised ICT in patients with cerebrovascular accident.

Recommendations

1. ONSD can be used as a diagnostic tool in the initial evaluation of suspected meningitis in casualty.

2. Diagnosis and management decisions can be made based on the following range of ONSD values:

   a. For the ONSD values from 0.7-0.58:- Patients will require immediate anti edema measures and neuroimaging.

   b. For the ONSD values from 0.43-0.39:- The doctor can proceed with lumbar puncture and there is no need for urgent neuroimaging.

   c. For the ONSD values from 0.43 – 0.58:- The need for imaging to be decided based on clinical evaluation. If patient is having altered sensorium, papilloedema or focal neurological signs then imaging is required before LP

3. ONSD can be used for follow up monitoring of ICT in patients with meningitis.

4. Further study is required to:

   a. Evaluate the utility of the above algorithm in meningitis and the use of ONSD
   b. Use of ONSD for follow up monitoring and to assess efficacy of anti-edema treatment.
   c. To evaluate how many imaging studies can be avoided based on a low ONSD and thereafter evaluate cost-effectiveness.

Limitation

1. The lack of gold standard test- invasive continuous ICP monitoring was unavailable.
2. Needs larger sample size to better study the association between ONSD and raised ICT among patients with meningitis.
3. The poor sensitivity of CT imaging to pick up raised ICT especially in patients with CVA.
4. CSF pressure (intrathecal pressure) was available only for meningitis patients.
5. The CSF pressure was measured by different observers- hence inter observer variability could be present.

6. Bibliography

1. Schuchat A, Robinson K, Wenger JD, Harrison LH, Farley M, Reingold AL, et al. Bacterial meningitis in the United States in 1995. Active Surveillance Team. N Engl J Med. 1997 Oct 2;337(14):970–6.

2. Thigpen MC, Whitney CG, Messonnier NE, Zell ER, Lynfield R, Hadler JL, et al. Bacterial meningitis in the United States, 1998-2007. N Engl J Med. 2011 May 26;364(21):2016–25.

3. van de Beek D, de Gans J, Spanjaard L, Weisfelt M, Reitsma JB, Vermeulen M. Clinical features and prognostic factors in adults with bacterial meningitis. N Engl J Med. 2004 Oct 28;351(18):1849–59.

4. Khwannimit B, Chayakul P, Geater A. Acute bacterial meningitis in adults: a 20 year review. Southeast Asian J Trop Med Public Health. 2004 Dec;35(4):886–92.

5. Krishnamurthi RV, Feigin VL, Forouzanfar MH, Mensah GA, Connor M, Bennett DA, et al. Global and regional burden of first-ever ischaemic and haemorrhagic stroke during 1990–2010: findings from the Global Burden of Disease Study 2010. Lancet Glob Health. 2013 Nov;1(5):e259–81.

6. Chen H, Ding G-S, Zhao Y-C, Yu R-G, Zhou J-X. Ultrasound measurement of optic nerve diameter and optic nerve sheath diameter in healthy Chinese adults. BMC Neurol. 2015;15:106.

7. Transorbital sonographic evaluation of optic nerve sheath diameter in normal Hong Kong Chinese adults - ResearchGate [Internet]. [cited 2015 Sep 10]. Available from: http://www.researchgate.net/publication/266582123_Transorbital_sonographic_evaluation_of_optic_nerve_sheath_diameter_in_normal_Hong_Kong_Chinese_adults

8. Amini R, Stolz LA, Patanwala AE, Adhikari S. Coronal Axis Measurement of the Optic Nerve Sheath Diameter Using a Linear Transducer. J Ultrasound Med Off J Am Inst Ultrasound Med. 2015 Sep;34(9):1607–12.

9. Maude RR, Hossain MA, Hassan MU, Osbourne S, Sayeed KLA, Karim MR, et al. Transorbital sonographic evaluation of normal optic nerve sheath diameter in healthy volunteers in Bangladesh. PloS One. 2013;8(12):e81013.

10. Anas I. Transorbital sonographic measurement of normal optic sheath nerve diameter in nigerian adult population. Malays J Med Sci MJMS. 2014 Oct;21(5):24–9.

11. Romagnuolo L, Tayal V, Tomaszewski C, Saunders T, Norton HJ. Optic nerve sheath diameter does not change with patient position. Am J Emerg Med. 2005 Sep;23(5):686–8.

12. Blaivas M, Theodoro D, Sierzenski PR. Elevated intracranial pressure detected by bedside emergency ultrasonography of the optic nerve sheath. Acad Emerg Med Off J Soc Acad Emerg Med. 2003 Apr;10(4):376–81.

13. Maissan IM, Dirven PJAC, Haitsma IK, Hoeks SE, Gommers D, Stolker RJ. Ultrasonographic measured optic nerve sheath diameter as an accurate and quick monitor for changes in intracranial pressure. J Neurosurg. 2015 Sep;123(3):743–7.

14. Kimberly HH, Shah S, Marill K, Noble V. Correlation of optic nerve sheath diameter with direct measurement of intracranial pressure. Acad Emerg Med Off J Soc Acad Emerg Med. 2008 Feb;15(2):201–4.

15. Watanabe A, Kinouchi H, Horikoshi T, Uchida M, Ishigame K. Effect of intracranial pressure on the diameter of the optic nerve sheath. J Neurosurg. 2008 Aug;109(2):255–8.

16. Lochner P, Mader C, Nardone R, Tezzon F, Zedde ML, Malferrari G, et al. Sonography of the optic nerve sheath beyond the hyperacute stage of intracerebral hemorrhage. J Ultrasound. 2014 Sep;17(3):225–8.

17. Skoloudík D, Herzig R, Fadrná T, Bar M, Hradílek P, Roubec M, et al. Distal enlargement of the optic nerve sheath in the hyperacute stage of intracerebral haemorrhage. Br J Ophthalmol. 2011 Feb;95(2):217–21.

18. Girisgin AS, Kalkan E, Kocak S, Cander B, Gul M, Semiz M. The role of optic nerve ultrasonography in the diagnosis of elevated intracranial pressure. Emerg Med J EMJ. 2007 Apr;24(4):251–4.

19. Hansen H-C, Helmke K. Validation of the optic nerve sheath response to changing cerebrospinal fluid pressure: ultrasound findings during intrathecal infusion tests. J Neurosurg. 1997 Jul 1;87(1):34–40.

20. Launey Y, Nesseler N, Le Maguet P, Yannick M, Philippe S. Effect of osmotherapy on optic nerve sheath diameter in patients with increased intracranial pressure. J Neurotrauma. 2013 Dec 28;

21. Beare NAV, Kampondeni S, Glover SJ, Molyneux E, Taylor TE, Harding SP, et al. Detection of raised intracranial pressure by ultrasound measurement of optic nerve sheath diameter in African children. Trop Med Int Health TM IH. 2008 Nov;13(11):1400–4.

22. Newman WD, Hollman AS, Dutton GN, Carachi R. Measurement of optic nerve sheath diameter by ultrasound: a means of detecting acute raised intracranial pressure in hydrocephalus. Br J Ophthalmol. 2002 Oct;86(10):1109–13.

23. Bäuerle J, Schuchardt F, Schroeder L, Egger K, Weigel M, Harloff A. Reproducibility and accuracy of optic nerve sheath diameter assessment using ultrasound compared to magnetic resonance imaging. BMC Neurol. 2013;13:187.

24. Moretti R, Pizzi B. Ultrasonography of the optic nerve in neurocritically ill patients: Ultrasonography of the optic nerve. Acta Anaesthesiol Scand. 2011 Jul;55(6):644–52.

25. Dubourg J, Javouhey E, Geeraerts T, Messerer M, Kassai B. Ultrasonography of optic nerve sheath diameter for detection of raised intracranial pressure: a systematic review and meta-analysis. Intensive Care Med. 2011 Apr 20;37(7):1059–68.

26. Ohle R, McIsaac SM, Woo MY, Perry JJ. Sonography of the Optic Nerve Sheath Diameter for Detection of Raised Intracranial Pressure Compared to Computed Tomography: A Systematic Review and Meta-analysis. J Ultrasound Med Off J Am Inst Ultrasound Med. 2015 Jul;34(7):1285–94.

27. Goel RS, Goyal NK, Dharap SB, Kumar M, Gore MA. Utility of optic nerve ultrasonography in head injury. Injury. 2008 May;39(5):519–24.

28. Shirodkar CG, Rao SM, Mutkule DP, Harde YR, Venkategowda PM, Mahesh MU. Optic nerve sheath diameter as a marker for evaluation and prognostication of intracranial pressure in Indian patients: An observational study. Indian J Crit Care Med Peer-Rev Off Publ Indian Soc Crit Care Med. 2014 Nov;18(11):728–34.

29. Shirodkar CG, Munta K, Rao SM, Mahesh MU. Correlation of measurement of optic nerve sheath diameter using ultrasound with magnetic resonance imaging. Indian J Crit Care Med Peer-Rev Off Publ Indian Soc Crit Care Med. 2015 Aug;19(8):466–70.

30. Sangani SV, Parikh S. Can sonographic measurement of optic nerve sheath diameter be used to detect raised intracranial pressure in patients with tuberculous meningitis? A prospective observational study. Indian J Radiol Imaging. 2015 Jun;25(2):173–6.

31. Wang L, Feng L, Yao Y, Wang Y, Chen Y, Feng J, et al. Optimal optic nerve sheath diameter threshold for the identification of elevated opening pressure on lumbar puncture in a Chinese population. PloS One. 2015;10(2):e0117939.

32. Caffery TS, Perret JN, Musso MW, Jones GN. Optic nerve sheath diameter and lumbar puncture opening pressure in nontrauma patients suspected of elevated intracranial pressure. Am J Emerg Med. 2014 Dec;32(12):1513–5.

33. K.K. Pichamuthu, J.V. Peter. IMPACT OF VARIATIONS IN THE MEASUREMENT OF OPTIC NERVE SHEATH DIAMETER ON THE DIAGNOSIS OF RAISED INTRACRANIAL PRESSURE - AN APPRAISAL OF QUANTITATIVE AND QUALITATIVE METHODS. In [cited 2015 Sep 7]. Available from: http://poster-consultation.esicm.org/ModuleConsultationPoster/posterDetail.aspx?intIdPoster=1859

34. Noble VE., Sutingo AN, eds. Manual of emergency and critical care ultrasound. New York: Cambridge University Press, 2007:175–81.

35. Liu D, Kahn M. Measurement and relationship of subarachnoid pressure of the optic nerve to intracranial pressures in fresh cadavers. Am J Ophthalmol. 1993 Nov 15;116(5):548–56.

36. Hayreh SS. PATHOGENESIS OF OEDEMA OF THE OPTIC DISC (PAPILLOEDEMA)*. Br J Ophthalmol. 1964 Oct;48(10):522–43.

37. Schwab S, Aschoff A, Spranger M, Albert F, Hacke W. The value of intracranial pressure monitoring in acute hemispheric stroke. Neurology. 1996 Aug;47(2):393–8.

38. Winkler F, Kastenbauer S, Yousry TA, Maerz U, Pfister H-W. Discrepancies between brain CT imaging and severely raised intracranial pressure proven by ventriculostomy in adults with pneumococcal meningitis. J Neurol. 2002 Sep;249(9):1292–7.

39. Hara M, Kadowaki C, Shiogai T, Takeuchi K. Correlation between intracranial pressure (ICP) and changes in CT images of cerebral hemorrhage. Neurol Res. 1998 Apr;20(3):225–30.

7. Appendices

Patient information sheet.

Study Title: Optic nerve sheath diameter as a screening tool for assessing raised intracranial tension in patients presenting to Medicine department

This study aims at developing a cheap and simple test to detect increased pressure in the brain in patients with stroke and meningitis or "brain fever" and unconsciousness of other causes. The test uses ultrasound (a simple radiological test) to look for swelling in the nerve supplying the eye to see if there is increased pressure.

We would like to include your relative because he or she has one of the above conditions. In this study we will perform an ultrasound on the eye on the first day, 4^{th} day and 7^{th} day. Inclusion into this study involves signing a consent form and an Ultrasound scan (it uses sound waves) over the closed eyelid to look for the thickness of the optic nerve (nerve supplying the eye). It's a painless, fast procedure and do not cause any threat to health. We will be documenting clinical information related to your relative's clinical condition and treatment. The data from the measurement may be useful for guiding treatment of the patient.

The patient will receive all standard treatment for his or her condition. The results of the blood test will be kept confidential. Participating in this study is purely

voluntary and at no cost to you/your relative and you can decide to withdraw from the study at any time. Withdrawal will not have any consequences to the treatment that you are receiving in the hospital.

At any point if you have any doubts my contact number is available below and please feel free to contact me at any time.

Consent form

Format for Informed Consent Form for Subjects

Informed Consent form to participate in a research study

Study Title: Optic nerve sheath diameter as a screening tool for assessing raised intracranial tension in patients presenting to Medicine department

Study Number: _____

Subject's Initials: _____ Subject's Name: _____

Date of Birth / Age: _____

(Subject)

(i) I confirm that I have read and understood the information sheet dated _____ for the above study and have had the opportunity to ask questions.

(ii) I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.

(iii) I understand that the Sponsor of the clinical trial, others working on the Sponsor's behalf, the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published.

(iv) I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s).

(v) I agree to take part in the above study.

(vi) I am aware of the Audio-visual recording of the Informed Consent.

Signature (or Thumb impression) of the Subject/Legally Acceptable

Date: _____/_____/_____

Signatory's Name: _____ Signature:

CLINICAL QUESTIONNAIRE FOR ONSD STUDY

Serial No

Date:-

Name:-

Age:-

Hospital Number

Gender: M/F

Address:-

History:-

Fever	Altered sensorium	Headache	Vomiting	Seizures	Loss of consciousness	Focal neurological deficit
Duration	Duration	Duration	Projectile vomiting	Focal / generalised/secondary generalisation	Duration	Sudden onset

Rigors		Site		Previous seizure		Hemiplegia/ hemiparesis
				No of episodes		Cranial nerves

Past history:-

Trauma	Diabetes mellitus			
Chronic raised ICT	Previous TIA			
History of TB	Other immunocompromised state			
HIV infection	History of CAD/ ACS			
Hypertension				

Day 0 Day 4

Day 7

Examination

a) GCS score
b) Pulse rate
c) Blood pressure
d) Respiratory rate
e) Neck stiffness

Day 0 Day 4

Day 7

f) Anisochoria of pupils
g) Light reaction of pupils
h) Papilloedema
i) Affected cranial nerves:-
j) Motor system:-

Bulk

Tone

Power

k) Cerebellar signs
l) Plantar reflex

Investigation:-

CT Brain- 1st scan 2nd scan 3rd scan

a) date of scan
b) Signs of raised ICT
c) Features of CVA

MRI Brain-

a) date of scan
b) Signs of raised ICT
c) Features of CVA

Lumbar puncture:-

CSF pressure-

CSF counts

CSF protein

CSF culture

	Day 0	Day 4	Day 7
ONSD-			
Final Diagnosis			

Data sheet

Serial no	Meningitis-	Meningitis	Stroke Thrombotic (Discharge: Alive 1 D DATE		NAME	Hosp No.	AGE
1	2	4	2 28.11.2014		Noorisha	939748D	54
2	2	5	2 25.11.2014		Deivanlammal	931527F	80
4	2	4	1 24.03.2015		Vasantha kumari	511148A	44
5	2	5	1 26.03.2015		Sunthari	949040F	67
6	2	5	3 13.03.2015		Manimegalai	948584F	63
7	2	2	1 11.03.2015		Mani	948366F	66
8	2	2	3 08.12.2014		Lakshmi	275701F	72
9	2	4	1 26.03.2015		Kanthammal	935140C	63
10	2	1	2 26.03.2015		Arumugam	453713F	90
11	2	5	2 05.12.20114		Vinod Kumar	932278F	33
12	2	6	1 11.03.2015		Shekira Begum	714808F	46
13	2	2	3 03.12.2014		Anusiya	932168F	70
14	1	1	1 06.12.2014		Kangayan	932354F	36
15	2	6	1 28.11.2014		Kottamveera Reddy	931835F	50
16	1	1	2 13.12.2014		Amsaveni	936188F	60
17	2	6	1 19.03.2015		Puniyakotti	406174F	51
19	1	3	1 14.05.2015		Muthulakshmi	955461F	29
20	2	2	1 13.05.2015		Santhanam	955346F	65
21	1	1	3 14.07.2015		Andiappan	965754F	70
22	1	3	1 24.04.2015		Syari	289741F	27
23	1	2	1 17.03.2015		Ramesh	955754F	51
24	2	5	1 18.05.2015		Meharun Nisa	887143d	58
25	1	3	2 14.05.2015		Chandrakanta Roy	955484F	37
26	1	3	1 13.05.2015		Hemanth Kumar	955425F	21
27	3		1 13.05.2015		Logendran	955315F	31
28	1	2	1 13.05.2015		Girija	955315F	46
29	1	3	2 01.05.2015		Sudha	954134F	42
30	1	1	1 25.06.2015		Malarkodi	963100F	52
31	1	3	1 18.04.2015		Pandu	952333F	53
32	1	3	3 28.07.2015		Sanjay	273151G	24
33	1	3	1 19.05.2015		Ramesh Babu	064588G	25
34	1	1	1 18.05.2015		Deena Daniel	955826F	14
35	1	3	2 26.05.2015		Karunanidhi	958522F	39
36	1	2	1 29.05.2015		Vishwan	958834F	27
37	1	3	1 30.05.2015		Devraj Naik	958865F	17
38	1	3	1 01.06.015		Baby	959047F	21
39	1	3	1 02.06.2015		Malathi	959088F	35
40	1	3	1 09.06.2015		Shankar	242855g	45
41	1	5	3 21.06.2015		Subbaiah	961784F	64
42	1	3	1 17.06.2015		Veerareddy	961437F	68
43	1	2	1 21.06.2015		Babu	961809F	52
44	1	3	3 18.60.2015		Murali	961545F	32
45	1	2	1 19.05.2015		Bhaskar	958715F	35
46	1	3	1 20.05.2015		Amarnath Reddy	958005F	35
47	2	6	1 13.05.2015		Rathnegandhi	955411F	66
48	2	3	1 22.06.2015		Subramani	961849F	52
49	2	6	1 27.07.2015		Parthiban	753970F	50
50	2	5	1 14.07.2015		Kannan	965863F	42
51	2	6	1 01.05.2015		Gopal	387633D	64

	52	2		5	1 01.05.2015	Jamuna	952879F		55
	53	2		5	1 28.04.2015	Nagarajan	954262F		62
erial no	Meningitis-1/ CVA-2 Meningitis Viral:1; f Stroke Thrombotic (Discharge: Alive 1 D DATE					NAME	Hosp No.	AGE	
	54	2		2	1 27.04.2015	Suri	954215F		45
	55	2		5	1 25.11.2014	Sunderashan	5407188		79
	56	2		5	1 26.11.2014	Chokalingam	931749F		54
	57	2		6	1 11.12.2014	Lakshmidevi	932952F		58
	59	2		4	1 02.06.2015	Sarathy	001379C		60
	60	2		2	1 02.06.2015	Karpakam	958828F		62
	61	1	3		1 01.08.2015	Nediya	959055F		19
	62	2		2	3 19.05.2015	Basheer	408098D		67
	63	2		6	3 22.06.2015	Velu	961739F		35
	64	3			1 18.06.2015	Satish	961963F		25
	65	3			3 25.11.2014	Murali	920763F		54
	66	3			1 09.06.2015	Dharmodhara Naidu	959741F		67
	67	3			1 01.06.2015	Subbamma	959010F		73
	68	3			1 17.06.2015	Natesan	961447F		65
	69	3			3 27.05.2015	Kamal	955020F		74
	70	3			1 02.06.2015	Vijayakumar	959105F		36
	71	3			1 10.07.2015	Bedakotla venkata	965506F		34
	72	3			1 22.06.2015	Sakunthala	961835F		69
	75	3			1 15.08.2015	IdahAli	287009G		54
	76	3			1 15.08.2015	Prabhu	968676F		30
	77	3			2 15.08.2015	Palaniswamy	389251F		44
	78	3			1 15.08.2015	Sevariappa	968870F		59
	79	3			1 15.08.2015	Ponnuswamy	575780D		76
	80	3			1 15.08.2015	Suresh	968376F		23
	81	3			1 15.08.2015	Kanakamma	970242F		50
	82	3			1 15.08.2015	Kamakalata	288365G		34
	83	3			1 15.08.2015	Putul Kumari	287815G		17
	84	3			1 15.08.2015	Reeta Devi	970274F		48
	85	3			1 15.08.2015	Suseelaa	970617F		50
	86	2		2	1 13.08.2015	Palani	280689G		65
	87	1	3		1 13.08.2015	Ramesh	970393F		45
	88	3			1 28.07.2015	Dakshinamoorthy	968046F		62
	89	3			1 13.08.2015	Jagenathan	965107F		55
	90	3			1 13.08.2015	Ajithesh	968975F		16
	91	3			1 13.08.2015	Sheo Bachan	1009610		58
	92	3			1 13.08.2015	Majunisa	968806F		70
erial no	Meningitis-1/ CVA-2 Meningitis Viral:1; f Stroke Thrombotic (Discharge: Alive 1 D DATE					NAME	Hosp No.	AGE	
	93	3			1 13.08.2015	Pushpavathi	967946F		75
	94	3			1 13.08.2015	Shabana Banu	276472G		37
	95	3			1 13.08.2015	Krishnan	970572F		28
	96	3			1 13.08.2015	Subramaniam	970910F		17
	97	3			1 13.08.2015	Kasi	218448F		56
	98	3			1 13.08.2015	Pocker Haji	284718G		60
	99	3			1 13.08.2015	Parasuraman	970428F		72
	101	3			1 19.08.2015	Janaki	970839F		64
	102	3			3 19.08.2015	Pavithra	968330F		18
	103	3			1 19.08.2015	Halima	956665F		28

104	3	1	19.08.2015	Priyanga	970450F	19
105	3	1	19.08.2015	Jayanthi	169942G	40
106	3	1	19.08.2015	Kumar	868829d	40
107	3	3	19.08.2015	Mohan	970746F	47
108	3	1	19.08.2015	Masum Mondal	279728G	27
109	3	1	19.08.2015	Tarun	970820F	34
110	3	3	19.08.2015	Niranjini Devi	968980F	32
111	3	1	19.08.2015	Tarup Mondal	285745G	42
112	3	1	19.08.2015	Vilson	727482D	33
113	3	1	19.08.2015	Sundaraj	898809F	55
114	3	1	19.08.2015	Balaji	675645F	49
115	3	1	19.08.2015	Anusur Rahman	968228F	52
116	3	1	19.08.2015	Perumal	970017F	40
117	3	1	19.08.2015	Abdul Salam	968222F	69
118	3	1	28.07.2015	Ajay	9998800F	17
119	3	1	24.08.2015	kasamma	973248F	55
120	3	1	24.08.205	Shahida Akther	297837g	29
121	3	1	24.08.2015	Jaya Roy kungar	288367g	28
122	3	1	24.08.2015	Padma	948615F	52
123	3	1	24.08.2015	Komalavalli	277716G	32
124	3	1	24.08.205	Malarkodi	081589g	51
125	3	1	24.08.205	Devayani Patra	522561d	29
100	1 partially treated		13.08.2015	Subam Das	281983G	22
73	1	2	15.08.2015	Nagaraj	209096G	55

SEX M-1, F-2	DAY-0 ONSD RIGHT	ONSD LEFT DAY-0	DAY-4 ONSD RIGHT	ONSD LEFT DAY-4	
	2	0.45	0.5	9999	9999
	2	0.51	0.57	0.53	0.54
	2	0.55	0.51	0.5	0.59
	2	0.5	0.48	0.38	0.39
	2	0.47	0.51	9999	9999
	1	0.45	0.45	9999	9999
	2	0.49	0.56	0.44	0.43
	2	0.43	0.4	0.43	0.41
	1	0.57	0.45	0.5	0.45
	1	0.7	0.67	0.51	0.45
	2	0.44	0.43	9999	999
	2	0.52	0.51	999	999
	1	0.6	0.6	999	999
	1	0.57	0.58	9999	999
	2	0.41	0.4	999	999
	1	0.45	0.51	999	999
	2	0.6	0.6	0.51	0.57
	2	0.42	0.43	999	999
	1	0.52	0.52	999	9999
	2	0.66	0.66	999	9999
	1	0.46	0.48	9999	9999
	2	0.46	0.43	0.49	0.47
	1	0.48	0.49	9999	9999
	1	0.54	0.54	0.6	0.6
	1	0.49	0.45	999	9999
	2	0.52	0.49	0.57	0.57
	2	0.46	0.41	9999	9999
	2	0.44	0.45	999	9999
	1	0.51	0.53	9999	999
	1	0.56	0.55	999	9999
	1	0.46	0.49	0.52	0.49
	1	0.49	0.47	0.49	0.48
	1	0.49	0.54	0.59	0.61
	1	0.61	0.53	999	9999
	1	0.46	0.46	9999	9999
	2	0.53	0.59	9999	9999
	2	0.46	0.5	99999	9999
	1	0.54	0.52	999	9999
	1	0.37	0.41	9999	9999
	1	0.61	0.54	0.49	0.44
	1	0.49	0.52	0.43	0.41
	1	0.44	0.46	0.46	0.52
	1	0.54	0.54	0.59	0.61
	1	0.5	0.46	999	999
	2	0.48	0.44	0.45	0.45
	1	0.43	0.41	9999	9999
	1	0.47	0.5	9999	9999
	1	0.46	0.43	9999	9999
	1	0.49	0.43	9999	9999

	2	0.37	0.48	9999	9999
	1	0.57	0.45	0.51	0.51
SEX M-1, F-2	DAY-0 ONSD RIGHT	ONSD LEFT DAY-0	DAY-4 ONSD RIGHT	ONSD LEFT DAY-4	
	1	0.4	0.41	9999	9999
	1	0.6	9999	9999	9999
	1	0.6	0.6	9999	9999
	2	0.49	0.56	9999	9999
	1	0.44	0.44	9999	9999
	2	0.47	0.46	9999	9999
	2	0.57	0.62	9999	9999
	1	0.47	0.46	9999	9999
	1	0.45	0.38	9999	9999
	1	0.45	0.53	0.38	0.41
	1	0.5	0.48	9999	9999
	1	0.52	0.51	9999	9999
	2	0.59	0.58	9999	9999
	1	0.46	0.41	0.48	0.49
	2	0.48	0.41	9999	9999
	1	0.71	0.65	9999	9999
	2	0.34	0.29	9999	9999
	2	0.53	0.56	9999	9999
	1	0.41	0.41	9999	9999
	1	0.44	0.45	9999	9999
	1	0.37	0.39	9999	9999
	1	0.52	0.54	9999	9999
	1	0.42	0.38	9999	9999
	1	0.4	0.41	9999	9999
	2	0.43	0.34	9999	9999
	2	0.43	0.4	9999	9999
	2	0.44	0.44	9999	9999
	2	0.49	0.49	9999	9999
	2	0.43	0.42	9999	9999
	1	0.44	9999	9999	9999
	1	0.44	0.46	9999	9999
	1	0.5	0.45	9999	9999
	1	0.4	0.34	9999	9999
	1	0.43	0.41	9999	9999
	1	0.46	0.46	9999	9999
	2	0.38	0.39	9999	9999
SEX M-1, F-2	DAY-0 ONSD RIGHT	ONSD LEFT DAY-0	DAY-4 ONSD RIGHT	ONSD LEFT DAY-4	
	2	0.43	0.42	9999	9999
	2	0.38	0.43	9999	9999
	2	0.47	0.42	9999	9999
	1	0.46	0.4	9999	9999
	1	0.46	0.45	9999	9999
	1	0.43	0.44	9999	9999
	1	0.43	0.4	9999	9999
	2	0.43	9999	9999	9999
	2	0.44	0.41	9999	9999
	2	0.4	0.35	9999	9999

2	0.4	0.42	9999	9999
2	0.4	0.41	9999	9999
1	0.41	0.44	9999	9999
1	0.37	0.41	9999	9999
1	0.4	0.38	9999	9999
1	0.5	0.49	9999	9999
2	0.46	0.44	9999	9999
1	0.41	0.4	9999	9999
1	0.39	0.4	9999	9999
1	0.38	0.42	9999	9999
1	0.41	0.42	9999	9999
1	0.49	0.49	9999	9999
1	0.46	0.38	9999	9999
1	9999	0.35	9999	9999
1	0.42	0.45	999	999
2	0.44	0.34	9999	99999
2	0.46	0.44	9999	9999
2	0.44	0.42	9999	9999
2	0.4	0.34	999	999
2	0.41	0.38	9999	99999
2	0.45	0.4	999	999
2	0.42	0.44	9999	99999
1	9999	0.43	9999	9999
1	0.4	0.41	9999	9999

DAY-7 ONSD RIGHT	ONSD LEFT DAY-7	DIAGNOSIS	FEVER 1- yes 2-no	FEVER DURATION	ALTERED_SENSORIUM	DURATION OF ALT S	HEADACHE
9999	9999	RHD: MS; AR; AF; C	2	0	2	0	2
9999	999	Lt thalamic BLEED V	2	0	2	0	2
9999	9999	RT MCA cardioembo	2	0	2	0	2
99999	9999	Rt thalamic bleed	2	0	2	0	1
9999	9999	ICH; CVA	2	0	2	0	1
9999	9999	CVA; Rt hemiplegia;	2	0	2	0	2
9999	9999	CVA	2	0	2	0	2
999	999	Rt MCA Territory inf	2	0	2	0	2
999	999	Rt. parietal infarct; I	1	5	2	0	2
999	999	ICH; Aspiration pne	2	0	2	0	2
999	999	cva; rt mca infarct; l	2	0	2	0	1
999	999	NSTEMI; CVA; DM; I	2	0	2	0	2
999	999	Aseptic Meningitis ;	1	7	1	1	2
0.45	0.48	AF; Rt intracerebra	1	14	1	7	2
999	999	Aseptic meningitis	1	10	1	1	2
9999	999	Rt MCA infarct; Lt fa	2	0	2	0	2
9999	9999	TBM GR II; Hydroce	1	30	1	15	1
999	999	CVA; Lt hemiparesis	2	0	2	0	2
9999	999	Aseptic meningitis;	1	7	1	3	2
999	9999	TBM GR II; SIADH	1	7	2	0	1
9999	9999	Acute pyogenic me	1	4	1	1	2
999	999	CVA Lt MCA territor	2	0	2	0	1
9999	9999	Disseminated TB- al	1	120	2	0	2
999	9999	Hydrocephalus with	1	10	2	0	1
999	999	Retarded catatonia	2	0	1	14	1
999	9999	Rt ear otomastoidit	1	2	1	1	1
9999	9999	TBM, Rt hemiplegia	2	0	2	0	2
99999	999	Aseptic Meningitis;	1	1	1	1	2
9999	9999	Disseminated TB- M	2	0	1	3	1
9999	9999	Chronic meningoen	1	545	2	0	1
9999	999	HIV Stage IV; MDR T	1	7	2	0	1
9999	9999	?HSV viral encephal	1	3	1	1	1
9999	9999	TBM, Septicemia, A	1	3	1	4	1
9999	9999	Acute bacterial me	1	2	1	0.1	1
9999	9999	Probable TBM, MRC	1	10	1	4	1
9999	9999	TBM with arachanoi	1	3	1	1	2
9999	9999	TBM with arachanoi	1	14	1	7	1
9999	9999	TBM; Hypokalemia	1	15	1	1	1
9999	999	Meningoenchephal	1	4	1	3	2
9999	9999	TBM; MRC Grade 2;	1	30	1	4	1
9999	9999	aCUTE BACTERIAL M	1	5	1	1	1
9999	999	Probable TBM, MRC	1	14	2	0	1
999	9999	Meningoenchephal	1	2	1	1	2
999	999	HIV Stage IV; TB m	2	0	2	0	1
0.5	0.52	Acute Left MCA anc	2	0	2	0	2
9999	9999	Acute CVA; HTN; DI	2	0	2	0	2
9999	9999	CVA Lt MCA territor	2	0	1	1	2
9999	9999	CVA; Rt capsulogan	2	0	2	0	2
9999	9999	CVA bilateral occipi	2	0	2	0	1

	9999	9999	CVA Lt Parietal hrrh	2	0	2	0	2
	9999	9999	CVA Rt MCA bleed;	2	0	2	0	2
DAY-7 ONSD RIGHT	ONSD LEFT DAY-7		DIAGNOSIS	FEVER 1-yes 2-no	FEVER DURATION(I	ALTERED_SENSORIUM	DURATION OF ALTE	HEADACHE
	9999	9999	Right CVA; hyperho	2	0	2	0	2
	9999	9999	Left parietotempori	2	0	2	0	2
	9999	9999	CVA; Lt Capsulopart	2	0	2	0	2
	9999	9999	CVA; Lt MCA; AF; DI	2	0	2	0	2
	9999	9999	Lt hemiplegia with I	2	0	2	0	2
	9999	9999	Rt hemiplegia with I	2	0	2	0	2
	9999	9999	Disseminated TB wi	1	7	1	1	1
	9999	9999	left subcortical infar	2	0	1	2	2
	9999	9999	Young stroke with L	2	0	2	0	2
	999	9999	ALCOHOL WITHDRA	1	3	2	0	1
	9999	9999	Severe CAD; BA; OL	1	3	1	2	2
	9999	9999	Inf; rt focal seizure	1	8	1	1	1
	9999	9999	scar epilepsy; old CI	2	0	2	0	2
	9999	999	ALCOHOL WITHDRA	1	2	2	0	2
	9999	9999	MODS; heat related	1	1	1	2	2
	9999	9999	ckd stage 5; malignu	2	0	2	0	1
	9999	9999	hiv	1	15	2	0	1
	9999	9999	metabolic encephal	1	3	1	1	2
	9999	9999	carcinoma lung ; bra	2	0	2	0	2
	9999	9999	myxedema coma	1	5	2	0	1
	9999	9999	Septic shock; severe	1	20	2	0	2
	9999	9999	CAP; IE; ARM; MR; (	2	0	2	0	2
	9999	9999	LRTI; DM; SEPTIC SI	2	0	2	0	2
	9999	9999	DKA; newly diagnos	2	0	1	0.8	2
	9999	9999	Severe iron deficien	2	0	2	0	2
	9999	9999		2	0	2	0	2
	9999	9999	SLE; APLM	2	0	2	0	2
	9999	9999	AGE; PUO; IDA	1	2	2	0	1
	9999	9999	AGE; resolved; DM;	1	3	2	0	2
	9999	9999	Lt MCA territory infa	2	0	2	0	2
	9999	9999	hiv; pulm tb; TBrm	1	10	2	0	1
	9999	9999	Probable HONC; DN	1	14	1	1	2
	9999	9999	hypereosinophilic sy	2	0	2	0	2
	9999	9999	Acute viral illness; H	1	8	2	0	2
	9999	9999	MYELOMA; dM	2	0	2	0	2
	9999	9999	metastatic SCC lung	2	0	2	0	2
DAY-7 ONSD RIGHT	ONSD LEFT DAY-7		DIAGNOSIS	FEVER 1-yes 2-no	FEVER DURATION(I	ALTERED_SENSORIUM	DURATION OF ALTE	HEADACHE
	9999	9999	ischemic cardiomyo	2	0	2	0	2
	9999	9999	Lt sided massive pla	1	4	2	0	2
	9999	9999	non hemolytic Im di	1	14	2	0	2
	9999	9999	Pulmonary TB - Cat	1	7	2	0	2
	9999	9999	Multiple MRSA epid	2	0	2	0	2
	9999	9999	Subacute ataxic syn	2	0	2	0	2
	9999	9999	Multiple myeloma;	1	20	2	0	2
	9999	9999		2	0	2	0	2
	9999	9999	VAP; pericardiopleu	2	0	2	0	2
	9999	9999	SLE; myocarditis; lu	1	30	2	0	2

9999	9999	OP; Methyl parathi	2	0	2	0	2
9999	9999	snake bite envenon	2	0	2	0	2
9999	9999	IDDM: DKA; nephro	2	0	2	0	2
9999	9999	Diseminated adeno	1	4	2	0	2
9999	9999	Severe Ar; IE	1	180	2	0	2
9999	9999		2	0	2	0	2
9999	9999	Probable adenocarc	2	0	2	0	2
9999	9999	Metstatic adenoca	1	120	2	0	2
9999	9999	DM: DKA	2	0	2	0	2
9999	9999	Recurrent pyelonep	1	1	2	0	2
9999	9999	CLD; Bleeding PR ur	1	7	2	0	2
9999	9999	Anaemia under eva	2	0	2	0	2
9999	9999	Snake envenomatio	2	0	2	0	2
9999	9999	UROSEPSIS; AKI ON	1	10	2	0	2
999	9999	NEUROCYSTICERCO	1	30	2	0	1
999	9999	AFI with thrombocy	1	7	2	0	2
9999	9999	polyarthritis under i	1	90	2	0	2
9999	9999	SLE	1	90	2	0	2
999	9999		2	0	2	0	2
999	9999	Sepsis	1	20	2	0	2
999	9999	IHD ?NSTEMI	1	2	2	0	2
999	9999	RHD; MS; post BMV	2	0	2	0	2
9999	9999	Partially treated pyr	1	27	2	0	2
9999	9999	partially treated bac	1	1	1	3	2

DURATION OF HEAI	VOMITING	PROJECTILE	VOMITII	SEIZURE	TYPE OF SEIZURE	NO. OF EPISODES	PREVIOUS SEIZURE 1-yes; 2-no	LOSS OF CONSCIOU	DURATION OF LOC
0	2	2	2	3	0	2	2	0	
0	1	2	2	3	0	2	1	1	
0	2	2	2	3	0	2	2	0	
1	1	2	2	3	0	2	2	0	
1	2	2	2	3	0	2	1	1	
0	2	2	2	3	0	2	2	0	
0	2	2	1	2	5	2	1	2	
0	2	2	2	3	0	2	2	0	
0	1	2	2	3	0	2	1	1	
0	1	2	2	3	0	2	2	0	
1	1	2	2	3	0	2	1	0	
0	1	2	2	3	0	2	2	0	
0	1	2	1	2	1	2	1	1	
0	2	2	2	3	0	2	2	0	
0	0	2	2	3	0	2	2	0	
0	1	2	2	3	0	2	2	0	
30	1	2	2	3	0	2	2	0	
0	2	2	2	3	0	2	2	0	
0	2	2	2	3	0	2	2	0	
7	1	1	2	3	0	2	2	0	
0	2	2	1	2	40	2	2	0	
1	2	2	2	3	0	2	2	0	
0	1	2	2	3	0	2	2	0	
10	1	1	2	3	0	2	2	0	
14	2	2	2	3	0	2	2	0	
2	1	2	2	3	0	2	2	0	
0	2	2	2	3	0	2	2	0	
0	1	2	2	3	0	2	2	0	
7	1	1	1	1	7	2	2	2	
545	1	2	2	3	0	2	1	120	
7	1	2	2	3	0	2	2	0	
1	2	2	2	3	0	2	2	0	
30	2	2	2	3	0	2	2	0	
2	1	1	2	3	0	2	2	0	
10	1	2	2	3	0	2	2	0	
0	2	2	2	3	0	2	2	0	
14	1	1	2	3	0	2	2	0	
30	2	2	2	3	0	2	2	0	
0	2	2	1	2	1	2	2	0	
30	2	2	2	3	0	2	2	0	
3	1	2	2	3	0	2	2	0	
14	1	2	2	3	0	2	2	0	
0	2	2	1	1	1	2	2	0	
120	2	2	2	3	0	2	2	0	
0	2	2	1	1	1	2	2	0	
0	1	2	2	3	0	2	2	0	
0	2	2	1	2	1	2	2	0	
0	2	2	2	3	0	2	2	0	
20	1	2	2	3	0	2	2	0	

0	2	2	2	3	0	2	2	0
0	2	2	2	3	0	2	2	0
DURATION OF HEAI VOMITING		PROJECTILEVOMITI SEIZURE		TYPE OF SEIZURE ge	NO. OF EPISODES	PREVIOUS SEIZURE 1-yrs; 2-no	LOSS OF CONSCIOU	DURATION OF LOC I
0	2	2	2	3	0	2	2	0
0	2	2	2	3	0	2	2	1
0	2	2	2	3	0	2	2	0
0	2	2	2	3	0	2	2	0
0	2	2	2	3	0	2	2	0
0	2	2	2	3	0	2	2	0
7	1	1	1	1	2	2	2	0
0	2	2	1	2	9999	2	2	0
0	2	2	2	3	0	2	2	0
2	2	2	1	1	2	0	2	0
0	2	2	2	3	0	0	2	0
8	2	2	1	2	1	0	2	0
0	2	2	1	2	2	0	2	0
0	2	2	1	1	7	1	2	0
0	2	2	2	3	0	0	2	0
2	1	2	2	3	0	0	2	0
20	1	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
5	2	2	2	3	0	0	2	0
0	1	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
30	1	2	2	3	0	0	2	0
0	1	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
10	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	1	2	2	3	0	0	2	0
0	1	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
DURATION OF HEAI VOMITING		PROJECTILEVOMITI SEIZURE		TYPE OF SEIZURE ge	NO. OF EPISODES	PREVIOUS SEIZURE 1-yrs; 2-no	LOSS OF CONSCIOU	DURATION OF LOC I
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	1	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	1	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0

0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	1	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	1	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	1	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
30	1	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	0	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0
0	2	2	2	3	0	0	2	0

FOCAL DEFICIT	ONSET	HEMIPLEGIA	yes-1	SIDE OF HEMIPLEGI	CRANIAL NERVE	TRAUMA	CHRONIC	RAISED IC	TB HISTORY	HIV	HYPERTENSION
	1	1	2	3	1	2	2	2	2	2	
	1	1	1	1	1	2	2	2	2	1	
	1	1	1	2	3	2	2	2	2	2	
	1	1	1	2	3	2	2	2	2	2	
	1	1	1	2	3	2	2	2	2	1	
	1	1	1	1	3	2	2	2	2	1	
	1	1	1	2	3	2	2	2	2	1	
	1	1	0	3	2	2	2	2	2	1	
	1	1	1	2	3	2	2	1	2	2	
	1	1	1	1	3	2	2	2	2	1	
	1	1	1	2	3	2	2	2	2	1	
	1	1	1	2	3	2	2	2	2	1	
	2	3	2	3	3	1	2	2	2	1	
	2	3	2	3	3	2	2	2	2	2	
	2	3	2	3	3	2	2	2	2	2	
	1	1	1	2	2	2	2	2	2	2	
	2	3	2	3	3	2	2	2	2	2	
	1	1	1	2	2	2	2	2	2	1	
	2	3	2	3	3	2	2	2	2	1	
	2	3	2	3	3	2	2	2	2	2	
	1	3	2	2	3	2	2	2	2	2	
	1	1	2	1	1	2	2	2	2	1	
	2	3	2	3	3	2	2	2	1	2	
	2	3	2	3	3	2	2	2	2	2	
	2	3	2	3	3	2	2	2	2	2	
	2	3	2	3	3	2	2	2	2	2	
	1	1	1	1	3	2	2	2	2	2	
	2	3	2	3	3	2	2	2	2	2	
	2	3	2	3	3	2	2	1	2	2	
	1	2	1	2	4	2	2	2	2	2	
	2	3	2	3	3	2	2	1	1	2	
	2	3	9999	3	3	2	2	2	2	2	
	2	3	2	3	3	2	2	2	1	2	
	2	3	2	3	3	1	2	2	2	2	
	2	3	2	3	3	2	2	2	2	2	
	1	1	2	3	3	2	2	2	2	2	
	1	1	2	3	4	2	2	2	2	2	
	2	3	2	3	3	2	2	2	2	2	
	2	3	2	3	3	2	2	2	2	2	
	2	3	2	3	3	2	2	2	2	1	
	2	3	2	3	3	2	2	2	2	2	
	2	3	2	3	3	2	2	2	2	2	
	2	3	2	3	3	2	2	2	2	2	
	2	3	2	3	3	2	2	2	1	2	
	1	1	1	1	1	2	2	2	2	2	
	1	1	1	1	1	2	2	2	2	1	
	1	1	1	2	3	2	2	2	2	1	
	1	1	1	2	3	2	2	1	2	1	
	2	3	2	3	3	2	2	2	2	1	

1	1	1	1	1	2	2	2	2	2
1	1	1	2	2	2	2	2	2	2
FOCAL DEFICIT Yes	ONSET sudden -1 gr	HEMIPLEGIA yes-1	SIDE OF HEMIPLEGI	CRANIAL NERVE rigl	TRAUMA	CHRONIC RAISED IC	TB HISTORY	HIV	HYPERTENSION
1	1	1	1	1	2	2	2	2	2
1	1	1	1	3	2	2	2	2	1
1	1	1	1	1	2	2	2	2	1
1	1	1	1	3	2	2	2	2	1
1	1	1	2	2	2	2	2	2	2
1	1	1	1	1	2	2	2	2	1
2	3	2	3	3	2	2	2	2	2
1	1	1	1	3	2	2	2	2	2
1	1	1	1	1	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	1	2	2	2	2
2	3	2	3	3	2	2	2	2	2
1	1	1	3	3	2	2	2	2	1
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	1
2	3	2	3	3	2	2	2	1	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
1	1	1	2	2	2	2	2	2	1
2	3	2	3	3	2	2	2	1	2
2	3	2	3	3	2	2	2	2	1
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	1
2	3	2	3	3	2	2	2	2	2
FOCAL DEFICIT Yes	ONSET sudden -1 gr	HEMIPLEGIA yes-1	SIDE OF HEMIPLEGI	CRANIAL NERVE rigl	TRAUMA	CHRONIC RAISED IC	TB HISTORY	HIV	HYPERTENSION
2	3	2	3	3	2	2	2	2	1
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	2	2	2	2	2	2
1	2	2	3	3	2	2	1	2	2
1	2	2	3	3	2	2	2	2	1
2	3	2	3	3	2	2	2	2	1
2	3	2	3	3	2	2	2	2	1
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2

2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	1
2	3	2	3	3	2	2	2	2	1
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	1	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	1
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	1	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	1
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2
2	3	2	3	3	2	2	2	2	2

DIABETES	PREVIOUS_TIA	IMMUNOCOMPROI	CAD	GCS DAY-0	PULSE DAY-0	Systolic BP day 0	Diastolic BP DAY-0	RR DAY-0	NECK STIFFNESS DA
2	2	2	2	14	102	140	90	22	2
1	2	2	2	4	100	120	60	24	2
2	2	2	2	15	90	110	80	18	2
2	2	2	2	15	72	150	90	24	2
1	2	2	2	7	90	200	100	28	2
2	2	2	2	14	100	150	80	24	2
1	2	2	2	7	80	120	70	18	2
1	2	2	2	15	88	120	70	16	2
2	1	2	2	6	100	220	110	32	2
2	2	2	2	6	92	170	100	18	2
2	2	2	2	15	90	170	100	26	2
1	2	2	2	7	90	120	80	26	2
1	2	2	2	12	100	90	60	28	2
2	2	2	2	15	110	160	90	999	2
2	2	2	2	10	106	100	60	27	1
1	2	2	2	15	92	140	100	20	2
2	2	2	2	14	94	110	70	28	1
1	2	2	2	15	64	120	88	22	2
1	2	2	2	10	70	140	70	24	1
2	2	2	2	15	79	100	70	32	1
2	2	2	2	9	92	110	72	24	1
2	1	2	2	9	100	150	100	18	2
2	2	2	2	13	102	124	80	26	1
2	2	2	2	15	72	100	70	20	1
2	2	2	2	13	92	116	86	24	2
2	2	2	2	12	116	110	70	30	1
2	2	2	2	15	92	130	90	22	1
2	2	2	2	15	100	140	80	24	1
2	2	2	2	6	126	160	100	32	1
2	2	2	2	15	100	110	70	16	1
2	2	2	2	15	106	100	70	32	1
2	2	2	2	10	122	100	60	46	2
2	2	2	2	9	104	110	80	34	1
2	2	2	2	8	94	110	80	31	1
2	2	2	2	14	68	100	60	20	1
2	2	2	2	14	110	120	88	18	1
2	2	2	2	14	112	130	90	36	1
2	2	2	2	14	108	110	86	16	1
2	2	2	2	9	102	160	80	32	1
2	2	2	2	14	110	200	100	30	1
2	2	2	2	13	80	100	60	28	1
2	2	2	2	15	92	130	88	18	1
1	2	2	2	8	126	90	50	40	1
2	2	2	2	15	90	150	90	18	1
1	2	2	1	10	68	110	78	20	2
1	2	2	2	14	78	116	86	19	1
1	1	2	2	8	106	160	90	20	2
2	2	2	2	14	90	200	110	14	2
1	2	2	2	15	114	100	86	28	2

	2	2	2	2	11	76	200	110	20	1
	2	2	2	2	15	72	130	80	16	2
DIABETES	PREVIOUS_TIA	IMMUNOCOMPROI	CORONARY ARTERY	GCS DAY-0	PULSE DAY-0	Systolic BP day 0	Diastolic BP DAY-0	RESPIRATORY RATE	NECK STIFFNESS DA	
	1	2	2	2	1	114	146	90	36	2
	1	2	2	1	7	68	100	60	20	2
	2	2	2	2	10	70	150	100	20	2
	1	2	2	2	11	150	140	80	24	2
	2	2	2	2	14	120	110	80	20	2
	1	1	2	2	10	106	150	90	24	2
	2	2	2	2	10	92	100	80	26	1
	1	2	2	1	9	84	140	100	18	2
	2	2	2	2	10	112	130	90	20	2
	2	2	2	2	12	124	100	82	26	2
	1	1	1	2	8	121	100	80	30	2
	2	2	2	2	9	78	134	80	34	2
	1	1	2	2	10	78	154	100	16	2
	2	2	2	2	10	100	130	80	16	2
	2	2	2	2	8	120	98	56	26	1
	2	2	2	2	15	84	170	130	90	2
	2	2	2	2	15	106	100	86	18	2
	1	2	2	2	9	110	90	60	28	2
	2	2	2	2	15	72	110	80	24	2
	2	2	2	2	15	45	120	80	20	2
	2	2	1	2	15	99	156	70	30	2
	2	2	2	2	15	100	110	86	32	2
	1	2	2	2	15	102	110	70	24	2
	2	2	2	2	7	120	70	50	30	2
	2	2	2	2	15	94	100	60	18	2
	2	2	2	2	15	100	100	70	24	2
	2	2	2	2	15	90	100	70	20	2
	2	2	2	2	15	110	90	70	74	2
	1	2	2	2	15	110	100	70	118	2
	1	1	2	2	15	88	110	90	20	2
	2	2	2	2	15	92	100	60	18	1
	1	2	2	2	14	96	160	100	18	2
	1	2	2	2	15	92	100	80	20	2
	2	2	2	2	15	86	100	60	20	2
	1	2	2	1	15	88	150	90	20	2
	2	2	2	2	15	80	130	90	12	2
DIABETES	PREVIOUS_TIA	IMMUNOCOMPROI	CORONARY ARTERY	GCS DAY-0	PULSE DAY-0	Systolic BP day 0	Diastolic BP DAY-0	RESPIRATORY RATE	NECK STIFFNESS DA	
	2	2	2	2	15	110	160	100	36	2
	2	2	2	2	15	96	110	70	18	2
	2	2	2	2	15	88	100	80	18	2
	2	2	2	2	15	100	100	60	26	2
	2	2	2	2	15	100	130	90	18	2
	2	2	2	2	15	54	132	86	20	2
	1	2	2	2	15	100	130	80	28	2
	2	2	2	2	15	88	110	70	24	2
	2	2	2	2	15	86	110	80	28	2
	2	2	2	2	15	110	110	70	18	2

2	2	2	2	15	120	120	88	24	2
2	2	2	2	15	100	140	90	22	2
1	2	2	2	15	92	120	80	14	2
2	2	2	2	15	96	100	70	16	2
2	2	2	2	15	110	100	70	23	2
2	2	2	2	15	110	110	70	14	2
2	2	2	2	15	100	100	60	24	2
2	2	2	2	15	88	130	90	12	2
2	2	2	2	15	72	100	60	26	2
1	2	2	2	15	88	130	90	12	2
2	2	2	2	15	110	100	88	26	2
2	2	2	2	15	98	110	70	24	2
2	2	2	2	14	110	80	60	24	2
1	2	2	1	15	110	90	70	26	2
2	2	2	2	15	72	110	70	24	2
2	2	2	2	15	15	102	100	70	2
2	2	2	2	15	98	100	70	16	2
2	2	2	2	15	82	110	70	20	2
1	2	2	2	15	102	130	90	24	2
2	2	2	2	15	106	150	80	16	2
2	2	2	2	15	102	120	80	20	2
2	2	2	2	15	88	110	70	24	2
2	2	2	2	15	96	120	80	16	2
2	2	2	2	9	100	110	70	30	2

ANISOCHORIA DAY- Rt PUP RN DAY-0	Lt PUP RN DAY-0	PAPILLOEDEMA DAYCRANIAL NERVES Di BULK DAY-0 normal TONE DAY-0					POWER DAY-0 R UL POWER DAY-0 R UL POWER DAY-0 R LL		
2	1	1	2	1	1	1	4	4	4
1	1	1	2	1	1	1	3	5	3
2	1	1	2	2	1	2	5	0	5
2	1	1	2	2	1	1	5	0	5
2	1	1	2	2	1	2	0	3	0
2	1	1	2	1	1	3	4	5	4
2	1	1	2	3	1	2	3	0	3
2	1	1	2	2	1	1	5	5	5
2	1	1	2	3	1	1	3	0	3
2	1	1	2	3	1	1	0	3	0
2	1	1	2	2	1	1	4	0	4
2	1	1	2	3	1	1	3	0	3
2	1	1	2	3	1	1	4	4	4
2	1	1	2	2	1	2	5	1	5
2	1	1	2	2	1	1	5	5	5
2	1	1	2	2	1	2	5	3	5
2	1	1	2	3	1	2	3	3	3
2	1	1	2	2	1	1	5	4	5
2	1	9999	2	3	1	1	4	4	4
2	1	1	2	3	1	1	5	5	5
1	2	1	2	3	1	1	5	3	5
2	1	1	2	1	1	3	1	5	1
2	1	1	2	3	2	2	4	4	4
2	1	1	1	3	1	1	5	5	5
2	1	1	2	3	1	3	4	4	4
2	1	1	1	3	1	1	4	4	4
2	1	1	2	3	1	2	0	5	0
2	1	1	2	3	1	1	5	5	5
2	2	2	2	3	1	3	3	3	3
1	1	3	1	4	1	1	5	4	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	2	2	5	2
2	1	1	2	3	1	1	4	4	4
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	0
2	1	1	1	4	1	2	5	1	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	4	4	4
2	1	1	2	2	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	3	1	3	1
2	1	1	2	1	1	2	3	5	3
2	1	1	2	2	1	3	4	1	4
2	1	1	2	2	1	2	5	4	5
2	1	1	2	2	1	1	5	5	5

2	1	1	2	1	1	2	0	5	0
2	1	1	2	2	1	2	5	0	5

ANISOCHORIA DAY-	Rt PUPILLARY REAC	Lt PUPILLARY REAC	PAPILLOEDEMA DAY	CRANIAL NERVES D	BULK DAY-0 normal	TONE DAY-0 normal	POWER DAY-0 rt UL	POWER DAY-0 lt UL	POWER DAY-0 rt LL
2	1	1	2	1	1	3	3	5	3
2	1	1	2	3	1	2	1	3	1
2	1	1	2	1	1	1	4	5	4
2	1	1	2	3	1	2	1	5	1
2	1	1	2	2	1	2	5	3	5
2	1	1	2	1	1	2	1	5	1
2	1	1	1	3	1	1	5	5	5
2	1	1	2	3	1	3	2	5	2
2	1	1	2	1	1	2	0	5	0
2	1	1	2	3	1	1	4	4	4
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	4	5	4
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	4	4	4
2	1	1	1	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	4	4	4
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	4	4	4
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	2	1	2	5	4	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5

ANISOCHORIA DAY-	Rt PUPILLARY REAC	Lt PUPILLARY REAC	PAPILLOEDEMA DAY	CRANIAL NERVES D	BULK DAY-0 normal	TONE DAY-0 normal	POWER DAY-0 rt UL	POWER DAY-0 lt UL	POWER DAY-0 rt LL
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	2	5	5	0
2	1	1	2	3	1	3	5	5	2
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5

2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	5	5	5
2	1	1	2	3	1	1	4	4	4

POWER DAY-0 LE LL	CEREBELLAR SIGNS	PLANTAR REFLEX DA	GCS DAY-4	PULSE DAY-4	BLOOD PRESSURE S	BLOOD PRESSURE D	RESPIRATORY RATE	NECK STIFFNESS DA	ANISOCHORIA DAY-
4	2	1	15	90	110	70	18	2	2
5	2	2	6	90	110	60	28	2	1
0	2	2	15	92	120	86	22	2	2
0	2	2	15	96	156	100	16	2	2
3	2	2	999	9999	999	999	9999	9999	9999
5	2	2	9999	9999	999	9999	9999	9999	9999
0	2	2	9	88	160	90	22	2	2
5	2	2	15	96	130	70	20	2	2
0	2	2	8	110	190	110	36	2	2
3	2	2	6	88	160	90	20	2	2
0	2	2	999	999	999	999	999	999	999
0	2	2	999	999	9999	999	999	999	999
4	2	1	999	999	9999	999	999	999	999
1	2	2	15	100	140	90	98	2	2
5	2	1	999	9999	999	999	9999	9999	9999
5	2	2	999	9999	999	999	9999	9999	9999
3	2	1	14	94	100	80	20	1	2
4	2	2	9999	9999	9999	999	9999	9999	9999
4	2	2	9999	9999	9999	999	9999	9999	9999
5	2	1	9999	9999	9999	999	9999	9999	9999
3	2	1	9999	9999	9999	999	9999	9999	9999
5	2	2	9999	9999	9999	999	9999	9999	9999
4	2	1	9999	9999	9999	999	9999	9999	9999
5	2	1	15	72	100	70	20	1	2
4	2	1	9999	9999	99999	999	9999	9999	9999
4	2	1	9999	9999	9999	999	9999	9999	9999
5	2	2	9999	9999	9999	999	9999	9999	9999
5	2	1	9999	9999	9999	999	9999	9999	9999
3	2	1	9999	9999	9999	999	9999	9999	9999
4	2	2	9999	9999	9999	999	9999	9999	9999
5	2	1	9999	9999	9999	999	9999	9999	9999
5	2	1	9999	9999	9999	999	9999	9999	9999
5	2	2	10	100	120	86	34	1	2
4	2	2	9999	9999	9999	999	9999	9999	9999
5	2	1	9999	9999	9999	999	9999	9999	9999
0	2	1	9999	9999	9999	999	9999	9999	9999
2	2	1	9999	9999	9999	999	9999	9999	9999
5	2	1	9999	9999	9999	999	9999	9999	9999
5	2	1	9999	9999	9999	999	9999	9999	9999
4	2	2	14	110	200	100	30	1	2
5	2	1	15	80	100	60	28	1	2
5	2	1	15	92	130	86	18	1	2
5	2	1	10	126	90	50	40	1	2
5	2	1	9999	9999	9999	9999	999	9999	9999
3	2	2	10	72	110	78	20	2	2
5	2	2	9999	9999	9999	9999	999	9999	9999
1	2	2	9999	9999	9999	9999	999	9999	9999
4	2	2	9999	9999	9999	9999	999	9999	9999
5	2	2	9999	9999	9999	9999	999	9999	9999

5	2	2	9999	9999	9999	9999	999	9999	9999
0	2	1	15	82	110	70	20	2	2

OWER DAY-0 LE LL CEREBELLAR SIGNS	PLANTAR REFLEX DA	GCS DAY-4	PULSE DAY-4	BLOOD PRESSURE S	BLOOD PRESSURE D	RESPIRATORY RATE	NECK STIFFNESS DA	ANISOCHORIA DAY-	
5	2	2	9999	9999	9999	9999	999	9999	9999
3	2	2	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	2	9999	9999	9999	9999	999	9999	9999
3	2	2	9999	9999	9999	9999	999	9999	9999
5	2	2	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	2	9999	9999	9999	9999	999	9999	9999
4	2	1	15	100	110	70	20	2	2
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
4	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
4	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
4	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
4	2	2	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999

OWER DAY-0 LE LL CEREBELLAR SIGNS	PLANTAR REFLEX DA	GCS DAY-4	PULSE DAY-4	BLOOD PRESSURE S	BLOOD PRESSURE D	RESPIRATORY RATE	NECK STIFFNESS DA	ANISOCHORIA DAY-	
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
0	2	1	9999	9999	9999	9999	999	9999	9999
2	2	2	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999

5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
5	2	1	9999	9999	9999	9999	999	9999	9999
4	2	1	9999	9999	9999	9999	999	9999	9999

PUPILLARY REATIOI	PAPILLOEDEMA DA!	CRANIAL NERVES D.	BULK DAY-4	TONE DAY-4	POWER RT UL	POWER LT UL	POWER RT LL	POWER DAY-4 LT LL	CEREBELLAR SIGNS
1	2	1	1	1	4	5	4	5	2
1	2	1	1	1	3	5	3	5	2
1	2	3	1	2	5	0	5	0	2
1	2	3	1	3	5	3	5	3	2
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
1	2	3	1	2	3	0	3	0	2
1	2	2	1	1	5	5	5	5	2
1	2	3	1	1	3	0	3	0	2
1	2	3	1	1	0	4	0	4	2
999	999	9999	999	999	9999	9999	9999	999	999
9999	999	9999	9999	999	9999	9999	9999	999	999
9999	999	9999	9999	999	9999	9999	9999	999	999
1	2	2	1	2	9999	9999	9999	1	2
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
1	1	3	1	1	4	4	4	4	2
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
1	1	1	3	1	1	5	5	5	5
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
1	2	3	1	2	2	5	2	5	2
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
1	2	3	1	1	4	4	4	4	2
1	2	2	1	1	5	5	5	5	2
1	2	3	1	1	5	5	5	5	2
1	2	3	1	1	5	5	5	5	2
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
1	2	3	1	3	1	3	1	3	2
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999

9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
1	2	2	1	2	5	1	5	1	2
ARY REATIOI	PAPILLOEDEMA DA'	CRANIAL NERVES D	BULK DAY-4	TONE DAY-4	POWER RT UL	POWER LT UL	POWER RT LL	POWER DAY-4 LT LL	CEREBELLAR SIGNS
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
1	2	3	1	1	5	5	5	5	2
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
ARY REATIOI	PAPILLOEDEMA DA'	CRANIAL NERVES D	BULK DAY-4	TONE DAY-4	POWER RT UL	POWER LT UL	POWER RT LL	POWER DAY-4 LT LL	CEREBELLAR SIGNS
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999

9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	9999	9999	9999	9999	9999	9999

PLANTAR REFLEX D	CT DATE	CT RAISED ICT yes:1	CT FEATURE OF CVA	MRI DATE	MRI RAISED ICT	MRI FEATURE OF CV	CSF PRESSURE	CSF COUNT	CSF NEUTROPHIL
1	27.11.2014	1	cerebral edema; sul	9999	9999	9999	9999	9999	99999
2	23.11.2014	1	left thalamic bleed;	9999	9999	9999	999	999	99999
2	25.03.2015	2	right mca infarct	9999	9999	9999	9999	9999	99999
2	25.03.2015	2	right thalamic hema	99999	99999	99999	99999	9999	99999
9999	13.03.2015	1	diffuse edema; intra	9999	9999	9999	9999	9999	99999
9999	10.03.2015	2	right caudate and putamen infarct		9999	9999	9999	9999	99999
2	07.12.2014	2	symmetrical b/l peri	9999	9999	9999	9999	9999	99999
2	25.03.2015	3	rt mca infarct; locali	999	999	999	99999	99	99999
2	26.03.2015	2	right parieto occipit	999	999	999	999	999	99999
2	05.12.2014	1	left capsuloganglion	999	999	999	999	999	99999
999	10.03.2015	1	ill defined hyperden	999	999	999	99	999	99999
999	03.12.2014	2	rt frontoparietal	999	999	999	999	999	99999
999	07.12.2014	3	diffuse sulci effacen	999	999	999	8	40	17
2	27.11.2014	1	diffuse edema; corti	999	999	999	999	9999	99999
9999	13.12.2014	2	Normal	999	999	999	999	12	2
9999	18.03.2015	2	Right ICA territory o	9999	9999	999	999	9999	99999
1	14.05.2015	1	Diffuse cerebral ede	9999	999	9999	9999	9999	9999
9999	12.05.2015	2	Rt frontal and perie	15.05.15	2	Rt MCA territory inf	9999	9999	99999
9999	13.07.2015	2	age related atrophy	999	999	999	999	12	11
9999	23.04.2015	1	nodular leptomenin	28.04.2015	1	Tortous posterior pc	999	70	60
9999	17.05.2015	3	Mild edema, diffuse	999	999	999	999	160	94
9999	17.05.2015	1	left capsuloganglion	999	999	999	999	999	99999
9999	14.05.2015	2	Normal	17.05.2015	2	normal	9999	4	0
2	14.05.2015	1	Dilated ventricles; H	15.05.2015	1	Diffuse edema; Opti	999	999	9999
9999	12.05.2015	2	mild sulcal effacemi	9999	9999	9999	999	2	3
9999	12.05.2015	1	Diffuse cerebral ede	14.05.2015	1	Rt otomastoidits; d	9999	1600	90
9999	999	9999	9999	02.05.2015	1	tortous optic nerve;	9999	10	3
9999	25.06.2015	2	Normal	9999	99999	9999	9999	80	12
9999	16.04.2015	1	Diffuse cerebral ede	999	9999	999	999	999	9999
9999	26.07.2015	1	optic nerve tortous;	999	9999	9999	999	999	9999
9999	18.03.2015	3	Leptomeningeal enl	24.03.2015	3	Leptomeningeal enl	21	70	30
9999	18.08.2014	2	prominent ventricle	20.04.2015	2	prominent ventricle	999	15	1
2	26.05.2015	1	Diffuse cerebral ede		999	9999	9999	25	280	3
9999	29.05.2015	2	Frontalbone fractur	06.06.2015	2	EPTOMENINGEAL E	9999	920	92
9999	04.06.2015	2	Normal	04.06.2015	2	Mild leptomeninges	9999	35	6
9999	01.06.2015	2	Normal	01.06.2015	2	Minimal tentorial er	999	450	5
9999	01.06.2015	3	Low lying tonsil; Flat	02.06.2015	3	Pachymeningeal inf	999	280	65
9999	09.06.2015	2	Normal		999	999	9999	999	470	97
9999	21.06.2015	2	Normal		999	9999	99999	18	24	77
2	17.06.2015	1	Poor quality of imag		999	9999	999	999	430	12
1	21.06.2015	2	Normal		9999	9999	9999	999	360	52
1	23.06.2015	2	Normal		999	999	999	999	150	28
1	28.05.2015	3	Peri optic CSF halo		999	999	999	999	65	4
9999	20.05.2015	2	Normal		999	9999	999	21	15	8
2	13.05.2015	3	Multi infarct; localis		9999	9999	9999	9999	9999	9999
9999	9999	9999	9999	22.06.2015	1	Chronic infarct; Acu	9999	9999	9999
9999	27.07.2015	2	right mca infarct		999	9999	9999	9999	9999	9999
9999	14.07.2015	3	Localised edema/bl		999	9999	9999	9999	9999	9999
9999	30.04.2015	2	Bilateral occipital lol		999	9999	9999	9999	9999	9999

9999	29.04.2015	1	Left>Right parench	999	9999	9999	9999	9999	9999
1	27.04.2015	2	Focal bleed rt basal	999	999	9999	9999	9999	9999
PLANTAR REFLEX D(	CT DATE	CT RAISED ICT yes:1	CT FEATURE OF CVA	MRI DATE	MRI RAISED ICT	MRI FEATURE OF CV	CSF PRESSURE	Total CSF COUNT	CSF NEUTROPHIL
9999	27.04.2015	3	left thalamic infarct;	999	9999	9999	9999	9999	9999
9999	24.11.2014	1	Left parietotempora	999	9999	9999	9999	9999	9999
9999	9999	9999	999	26.11.2015	3	left capsuloganglion	9999	9999	9999
9999	10.12.2014	3	large lt mca infarct	999	999	999	9999	9999	9999
9999	9999	9999	9999	02.06.2015	2	Rt MCA territory inf	9999	9999	9999
9999	02.06.2015	2	Lt MCA infarct	999	999	9999	9999	9999	9999
9999	999	9999	9999	01.06.2015	1	Multiple tuberculon	9999	130	4
9999	20.05.2015	1	NPH	22.05.2015	1	NPH	8	4	0
9999	21.06.2015	3	Lt MCA infarct	21.06.2015	3	Lt MCA infarct; Lt IC	999	9999	9999
1	17.06.2015	2	Normal	20.06.2015	2	normal	3	40	0
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	09.06.2015	2	Normal	999	999	9999	999	5	4
9999	01.06.2015	1	9999	999	999	9999	28	6	1
9999	17.06.2015	3	PROMINENT VENTR	999	999	9999	999	3	0
9999	27.05.2015	2	SDH	999	999	9999	999	999	9999
9999	2.06.2015	1	Effaced sulci;	999	999	9999	999	999	9999
9999	10.07.2015	2	Normal	999	999	9999	999	3	2
9999	22.06.2015	2	Calcified old granulo	999	999	9999	999	1	0
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	14.08.2015	2	Normal	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	12.08.2015	2	Normal	999	999	9999	999	3	0
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	13.08.2015	2	Chronic rt thalamic,	999	999	9999	999	999	9999
9999	13.08.2015	2	Normal	999	9999	999	15	100	1
9999	28.07.2015	2	Suboptimal study	999	999	9999	999	2	0
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
PLANTAR REFLEX D(	CT DATE	CT RAISED ICT yes:1	CT FEATURE OF CVA	MRI DATE	MRI RAISED ICT	MRI FEATURE OF CV	CSF PRESSURE	Total CSF COUNT	CSF NEUTROPHIL
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	15.08.2015	2	In favor of PSP	999	2	0
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999

9999	9999	9999	9999 18.08.2015		2 normal		999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	60	3
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999	9999	9999	9999	999	999	9999	999	999	9999
9999 02.08.2015		2 Normal		999	999	9999	999	8	0
9999 15.08.2015		2 FEATURES OF CHRO		999	999	9999	8	8	98

CSF LYMPHOCYTE	CSF RBC	CSF PROTEIN	CSF glucose	CSF MGIT not done	CSF Fungal	CSF Multiplex	CSF Xpert	CSF Bacterial	
	99999	9999	9999	9999	9999	9999	99999	9999	9999
	99999	9999	9999	9999	9999	9999	99999	9999	99
	99999	9999	9999	9999	9999	9999	99999	9999	99999
	99999	9999	9999	9999	9999	9999	99999	9999	99999
	99999	9999	9999	9999	9999	9999	99999	9999	9999
	99999	9999	9999	9999	9999	9999	99999	9999	9999
	99999	9999	9999	9999	9999	9999	99999	9999	9999
	99999	9999	9999	9999	9999	9999	99999	9999	999
	99999	9999	9999	9999	9999	9999	99999	9999	999
	99999	9999	9999	9999	9999	9999	99999	9999	9999
	99999	9999	9999	9999	9999	9999	99999	9999	999
	99999	9999	9999	9999	9999	9999	99999	9999	999
	77	4	70.8	127	3	3	3	3	2
	99999	9999	9999	9999	9999	9999	99999	9999	999
	97	2	26.8	71	2	3	3	3	2
	99999	9999	9999	9999	9999	9999	99999	9999	999
	999	999	999	999	9999	999	99999	9999	9999
	99999	9999	9999	9999	9999	9999	99999	9999	99999
	85	35	65.4	45	3	3	2	2	2
	32	10	231.5	39	1	3	3	2	2
	6	25000	150.6	95	2	3	2	3	2
	99999	9999	9999	9999	3	3	3	3	3
	4	640	54.4	63	2	2	3	2	2
	9999	999	9999	9999	999	999	999	999	999
	2	960	26.7	58	2	2	999	2	No growth
	10	960	191	54	2	2	2	3	2
	90	35	98.9	46	2	2	3	2	2
	88	30	117.9	83	3	3	2	3	2
	9999	9999	999	9999	999	9999	9999	9999	9999
	9999		999	99999	999	999	999	999	999
	65	120	168.4	33	1	2	3	2	1
	9	20	39.8	590	3	3	2	3	2
	95	750	74.2	34	1	2	3	3	2
	8	210	544.2	5	3	3	3	3	2
	87	920	43.4	66	2	2	3	2	2
	7	40	4300	13	2	2	3	2	2
	35	350	124.3	7	1	3	3	1	2
	1	30	89	15	2	2	3	2	2
	23	480	94.3	154	3	3	2	2	2
	88	40	97.6	23	2	3	3	3	2
	68	20	114.5	66	3	3	2	2	2
	70	330	196.7	59	2	3	3	3	2
	90	120	97.9	185	3	3	2	3	1
	40	28	77.2	87	2	2	3	2	3
	9999	9999	9999	9999	999	9999	9999	9999	9999
	9999	9999	9999	9999	999	999	999	999	999
	9999	9999	9999	9999	999	9999	9999	9999	9999
	9999	9999	9999	9999	999	999	999	999	999
	9999	9999	9999	9999	999	9999	9999	9999	9999

9999	9999	9999	9999	999	999	999	999	9999
9999	9999	9999	9999	999	9999	9999	9999	9999
CSF LYMPHOCYTE	CSF RBC	CSF PROTEIN	CSF glucose	CSF MGIT/LJ POSITI	CSF Fungal POSITIVI	CSF Multiplex POSI	CSF Xpert POSITIVE:	CSF Bacterial POSITI
9999	9999	9999	9999	999	9999	9999	9999	9999
9999	9999	9999	9999	999	999	999	999	9999
9999	9999	9999	9999	999	9999	9999	9999	9999
9999	9999	9999	9999	999	999	999	999	9999
9999	9999	9999	9999	999	999	999	999	9999
9999	9999	9999	9999	999	9999	9999	9999	9999
96	20	95.7	30	2	2	3	2	2
4	3	56.4	122	2	3	2	2	2
9999	9999	9999	999	999	9999	9999	9999	9999
89	16000	252.3	83	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
17	30	41	63	2	2	2	9999	2
9	23	38.8	129	999	9999	999	9999	2
7	50	40.1	10.8	999	9999	2	9999	2
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
8	40	31.9	69	2	2	999	9999	2
1	2	33.3	179	999	9999	999	9999	2
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
3	1	35.8	61	999	9999	999	9999	2
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
99	2	341.1	39	9999	2	2	2	2
2	2	55.2	195	999	9999	999	9999	2
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
CSF LYMPHOCYTE	CSF RBC	CSF PROTEIN	CSF glucose	CSF MGIT/LJ POSITI	CSF Fungal POSITIVI	CSF Multiplex POSI	CSF Xpert POSITIVE:	CSF Bacterial POSITI
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
2	20	59.6	62	9999	999	9999	99	2
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999

999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
93	1800	28.5	61	999	9999	999	2	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
999	999	9999	999	999	9999	999	9999	9999
98	90	41.5	63	999	9999	999	9999	9999
2	4800	204	135	2	2	999	9999	2