ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCE SCHOOL OF MEDICINE

DEPARTMENT OF NEUROLOGY

ASSESSMENT OF KNOWLEDGE AND PRACTICES AND IMPACT OF INTERVENTION ABOUT EARLY DIAGNOSIS AND MANAGEMENT OF INCREASED INTRACRANIAL PRESSURE AMONG RESIDENTS AND NURSES WORKING AT TASH

BY

FIRAOLY WORKNEH (MD)

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RESEARCH THESIS:

ASSESSMENT OF KNOWLEDGE AND PRACTICE AND IMPACT OF INTERVENTION ABOUT
EARLY DIAGNOSIS AND MANAGEMENT OF INCREASED INTRACRANIAL PRESSURE AMONG RESIDENTS AND NURSES WORKING AT TASH

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INVESTIGATOR:

FIRAOLY WORKNEH (MD), RESIDENT IN CLINICAL NEUROLOGY

ADVISORS:

AMANUEL AMARE (MD)
INTERNIST, CONSULTANT NEUROLOGIST

SARAH WAHLSTER (MD)

CONSULTANT NEUROLOGIST, NEUROCRITICAL CARE SPECIALIST

MERON AWRARIS (MD)
CONSULTANT NEUROLOGIST

YOHANNES DEBEBE (MD).
CONSULTANT NEUROLOGIST

ADDIS ABABA UNIVERSITY,
ADDIS ABABA, ETHIOPIA
NOVEMBER, 2021

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ABSTRACT

BACKGROUND

Increased intracranial pressure is a commonly encountered and possibly fatal complication of neurologic, neurosurgical, and systemic diseases. Diagnosis is made based on clinical findings and neuroimaging and supplemented by invasive and noninvasive intracranial pressure monitoring methods. Depending on the underlying condition, management consists of medical and surgical treatments. Early diagnosis and prompt management is critical to diminish mortality and disability

OBJECTIVE

To assess knowledge and practices around early diagnosis and management of increased intracranial pressure among residents and nurses working at Tikur anbessa specialized hospital.

To assess the impact of training on increased intracranial pressure diagnosis and management among residents and nurses working at Tikur anbessa specialized hospital.

METHOD

We conducted a cross-sectional analysis of data collected from September 1, 2021, to October 31, 2021, from 183 residents working in neurology, internal medicine, emergency, and critical care medicine, neurosurgery department, and nurses from the emergency department, neurology ward, neurosurgical ward, and adult intensive care unit. They were required to fill out a self-administered questionnaire in English designed to assess sociodemographic characteristics, knowledge, and practice on diagnosis and management of increased intracranial pressure. After completion of the questionnaire, they were shown a video of 18 minutes that was prepared by the investigator on increased intracranial pressure diagnosis and management. Adequate time was given for the participants to see and analyze the intervention material. Then after participants were asked to do the same questions again. Data were entered into Statistical package for social sciences version 26 for analysis.

Categorical variables were summarized by frequency and percentages. Continuous variables were summarized by mean $\pm$ SD. Associations were done by one-way analysis of variants and paired-t-test.

RESULT

The total correct answer score of residents pretraining range from 55.75% - 90.4%. post training, the scores raised to 81.5% - 98.78% which was statically significant($p=<0.05$).

Post-intervention shows the level of knowledge risen in terms of the 20 questions out of 21.($p<0.05$). only 5 out of the 20 questions answered with 85%of the participating residents correctly. But the post-training result shows nineteen questions were answered with more than 85%.

For the nurses intervention has shown to increase the level of Knowledge score of 10 out of 12 questions and 7/10 of practice scores.

CONCLUSION

There is substantial knowledge and practice gap among the health care professionals and as the intervention resulted in significant increment of scores, continuous trainings and guidelines are important in advancing the level of understanding, practice and improving patient outcomes.

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ACRONYMS AND ABBREVIATIONS

AAU	Addis Ababa university
CDC	Center of disease control
CHS	College of health science
COVID 19	Corona virus disease 19
CMRO2	Cerebral metabolic rate of oxygen
CPP	Cerebral perfusion pressure
CSF	Cerebrospinal fluid
CT	Computerized tomography
DN	Department of Neurology
ED	Emergency department
EVD	External ventricular drainage
ICP	Intracranial pressure
ICU	Intensive care unit
JUMC	Jimma university medical college
JVP	Jugular venous pressure
MAP	Mean arterial pressure
MCA	Middle cerebral artery
MD	Medical doctor
MICU	Medical intensive care unit
MOH	Ministry of health
MRI	Magnetic resonance imaging
OPD	Outpatient department
PaCO2	partial pressure of carbon dioxide
PEEP	Positive end expiratory pressure
PI	Personal investigator
PII	Personal identity identifiers
QID	Four times per day
TASH	Tikur anbessa specialized hospital
RPC	Research and publication committee
SPSS	Statistical package for social sciences
TCD	Transcranial doppler ultrasound
TBI	Traumatic brain injury
USA	United States of America

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INTRODUCTION

BACKGROUND

The Monro - Kellie hypothesis delineates that the intracranial compartment has a fixed volume, which is determined by its constituents - blood, parenchyma, and cerebrospinal fluid (CSF) – in normal person 1400ml,150 ml, and 150ml in volume respectively. Any increment of one of the components is at the expense of the others. Of the three, CSF has the lowest pressure and is a primary buffer.(1,2,3)

During normal production of CSF, there is a slight increment in intracranial pressure (ICP) that is buffered by shifting CSF from the ventricular compartment to the subarachnoid space. In the case of poor brain compliance, a small intracranial volume change results a larger change in ICP.

Cerebral perfusion pressure (CPP) is a net pressure gradient that drives oxygen delivery to the cerebral tissue and is calculated as the difference between mean arterial pressure (MAP) and ICP. (1,4,5) The normal ICP is 5-15 mmHG and MAP is calculated as a sum of diastolic pressure added to one-third of a difference between systolic pressure and diastolic pressure. (5,6) In physiological state autoregulation through cerebral artery vasoconstriction and vasodilation keeps CPP in a range of 60 -100 mmHg that is only effective with a MAP of 50 - 150 mmHg.(1,4,5)

In conditions resulting in cerebral hypoperfusion, there is physiologic cerebral vasodilation. In case of poor intracranial compliance and elevated ICP, such response increases intracranial blood volume and further worsens ischemia via reduction of CPP. The degree of damage is dependent on the severity of increased ICP and rapidity and duration of response. (4)

The exact prevalence of increased ICP is not known but traumatic brain injury (TBI) is a leading cause of disability globally and although it's believed that the prevalence is underestimated because of the low rate of reporting, estimated mortality is 200 per 100,000 people per year. (7) According to the center for disease (CDC) report there were 61,000 TBI-related deaths in the USA in the year 2019. (8) estimate results from developing countries shown higher incidence rates. (7)

Invasive ICP monitoring methods include external ventricular device (EVD) that measure using a catheter or micro transducers like optic devices or pneumatic sensors. (5) According to 2007 guideline for severe trauma Indication for ICP monitoring includes TBI patients with GCS score of 3-8 post-resuscitation and presence of contusion, hematoma, herniation, swelling, or compressed basal cisterns on brain CT scan or TBI with normal CT scan and age>40, motor posturing or systolic blood pressure < 90mmHG. Despite there is a requirement of further studies, a trial has shown non-superiority of raised ICP management based on invasive ICP monitoring to serial CT scan imaging and clinical examination findings. (9)

Non-invasive ICP monitoring techniques include transcranial doppler ultrasound (TCD), optic nerve sheath diameter ultrasound (ONSD), and fundoscopy. (10) Studies have compared the sensitivity of ONSD of different cutoff diameters with CT scan and invasive ICP monitoring methods and shown higher sensitivity and specificity. (11,12). In a study of pediatric malaria patients in Malawi on the prevalence of increased ICP, 50% of them had cerebral edema detected by optic nerve sheath ultrasound. (13)

Increased ICP can be caused by neurologic, neurosurgical, and systemic diseases. The etiologies include intracranial mass lesions (e.g. various types of intracranial hemorrhage, tumors and infectious processes), hydrocephalus, and conditions resulting in cerebral edema (large ischemic strokes, severe TBI with diffuse axonal injury, hypoxic-ischemic encephalopathy, acute hepatic failure); and changes in venous pressure (e.g. cerebral venous thrombosis), or CSF production (e.g. choroid plexus tumor).

Clinical manifestations of elevated ICP include headaches that are typically positional and increase with coughing or straining, vomiting, and impairments in the level of consciousness; visual changes such as double vision, or blurred vision; photophobia, shallow breathing, bradycardia, respiratory depression, hypertension with widened pulse pressure, pupillary changes, cranial nerve deficits, and papilledema. (1)
The Cushing triad describes the constellation of bradycardia, hypertension, and irregular respiration and is a sign of impending brain herniation.

In many neurological conditions, the initial insult will cause primary damage to the neural tissue, and management is targeted towards minimizing secondary brain injury. (14)

Elevated ICP can cause further secondary damage to the brain parenchyma and vital structures, and in its most extreme form result in herniation of the brain, resulting in irreversible neurologic injury and death. (15)

STATEMENT OF PROBLEM

The outcome of patients with increased ICP is dependent on early diagnosis and prompt management. (16) Other than a setup that provides adequate service and access to the appropriate resources (e.g. prompt imaging and care), the knowledge and practice of health care professionals is an important factor that can affect the outcome of patients with raised ICP. Identifying knowledge gaps and deficiencies in the current practice is a critical step in improving the care of our patients.

Such studies are generally scarce globally, especially in developing countries. In 2017 one quasi-experimental study done in Egypt on nurses' knowledge and practice on increased ICP following craniotomy, a notable knowledge and practice gap was seen and improvement was recognized on post-education assessment. (17)

In 2019 a study done in South Africa, on professional nurses' knowledge and practice regarding TBI showed neurocritical nurses score highest regarding knowledge and variability of practices (18).

There has not been a proper, systematic assessment of knowledge and practice in Ethiopia, and this study will be an important first step in identifying deficiencies and assessing current processes, to develop constructive solutions and improve the health care service to our patients

SIGNIFICANCE OF STUDY

Studying knowledge and practice around diagnosis and management of increased intracranial pressure management among residents and nurses working in TASH will identify knowledge gaps and deficiencies in our current practices, to prevent devastating outcomes such as neurological disability and death.

We plan to disseminate the result to different stakeholders, including hospital staff, the scientific community, and policymakers in Ethiopia. This study could serve as a model in other developing countries.

Based on our results, we plan to develop targeted teaching initiatives to provide the hospital staff with better awareness and knowledge about the occurrence and impact of increased ICP in neurology and neurosurgical patients. Additionally, this will provide valuable input for the scientific community and highlight the need for further research based on the gaps that will be identified. Furthermore, this will be important for the hospital administration and ministry of health (MOH) for planning training programs and guideline preparation to improve the quality of care.

TASH is chosen for this study because it is the largest tertiary hospital with functional neurology and neurosurgical departments.

LITERATURE REVIEW

Clinical manifestations of raised ICP include positional headaches that increase with coughing or straining, vomiting, decrease in the level of consciousness. Visual changes respiratory depression, hypertension with widened pulse pressure, pupillary changes, cranial nerve VI palsy (1)

The presence of Pupillary dilation, decrease the level of consciousness and motor posturing have shown to be relevant in revealing for the presence of raised ICP and would warrant prompt imaging (21). Compression or absence of basal cisterns and sulci, midline shift more than 5 mm, a large volume of hematoma, and intraventricular hemorrhage are imaging findings of increased ICP. (19,20,21,22)

In patients with a decreased level of consciousness, the clinical exam can be severely limited, and in the appropriate clinical context, invasive and noninvasive ICP monitoring techniques can help guide the patients care (5) Studies have shown that invasive ICP monitoring and optimized treatment can result in improvement of outcome (23) however, a randomized controlled trial in Bolivia and Ecuador has shown similar outcomes when comparing a clinical algorithm and a monitoring-based approach. Non-invasive methods have the advantage of being cost-effective and more easily available in a resource-limited setting, and their sensitivity and role in various clinical conditions are being investigated (5)

Transcranial doppler ultrasound (TCD) measures blood flow and calculates a pulsatility index from systolic and diastolic flow variation. This index can help identify elevated ICP. TCD is

portable, non-invasive, cost-effective, but at higher ICP the result is inaccurate, and trained personnel is needed as there can be substantial inter-operator variation based on expertise and experience. (5,24,25)

Optic nerve sheath diameter ultrasound is another emerging, noninvasive technique. Diameter increment has shown to correlate with increased ICP and while the accuracy and sensitivity are still being investigated, this modality can be used as a screening method to determine the need for imaging in the appropriate clinical context. (5,11,26)

Fundoscopy is a noninvasive, bedside examination tool, but is dependent on operator skill, ability to dilate the patients' pupils to obtain good visualization. (5,27)

Another non-invasive technique is motion-sensitive MRI which measures blood and CSF flow during the cardiac cycle. Studies have shown variation in measurement with repetition but are helpful as a screening method to identify patients who need invasive monitoring. (28) However, in a patient with elevated ICP, prolonged flat positioning to obtain an MRI can be unsafe.

Brain CT scan findings that signify increment of intracranial pressure include obliteration or compression of basal cisterns that correlate with at least one episode of raised ICP on invasive ICP monitoring, however, open cisterns do not correspond with normal ICP. Other findings like midline shift of greater than 5 mm, hyperdense or mixed density lesion of greater than 25 cm^3 are also important. (29,30)

Invasive methods include external ventricular drainage (EVD) and intraparenchymal monitors. EVD is a catheter placed through a burr hole, into a lateral ventricle. In addition to monitoring, it allows for treatment of ICPs by drainage of CSF and intraventricular blood, and can also be a way of administration of medications intrathecally. Intraparenchymal monitors are easy to place and safe but unlike EVD, it does not allow drainage of CSF and are not as durable at times. There is no consensus on the efficacy of intraparenchymal monitoring vs EVD however, a study has shown worse outcomes of early EVD insertion as compared to intraparenchymal monitoring. (31) Potential risks associated with invasive ICP monitoring are infection and tract hemorrhage that may result in serious complications. (5, 32-34).

Micro transducer ICP monitoring device is also another invasive method that uses fiber optic devices or pneumatic sensors placed intraparenchymal, subdural, or epidural. The standard is intraparenchymal and subdural can be considered if there is no focal elevation of ICP. Epidural has inaccuracy. (35) This is due to the existence of pressure gradient across specific compartments in CNS that is exacerbated during pathologic conditions. (5,36)

Patients diagnosed with confirmed or suspected increased ICP and at risk for developing elevated IPC should be closely monitored and managed in an ICU. There are general and specific measures in management.

General measures are mainly on the prevention of aggravating factors. Venous return obstructions (e.g. head position, agitation), fever, respiratory problems (airway obstruction, hypercapnia, hypoxia), severe hypertension, hyponatremia, anemia, and seizures are factors that precipitate increment of ICP. (37)

Midline and 30^0 elevated head positioning are the first important measure to optimize cerebral venous outflow. (37) In doing so extreme rotation, flexion of the neck, and hip flexion should be avoided. Head positioning has been shown to improve the level of awareness and mean arterial pressures. (38,39) Head of bed elevation ≥45° may reduce cerebral perfusion, suggesting ICP-CPP balance appears optimized around 30-45°. (40,41)

Management of respiratory problems with Controlled ventilation to maintain a normal PaCO2 is crucial. During mechanical ventilation, PEEP may cause an increment in ICP by increasing cerebral venous pressure. However, For PEEP to increase cerebral venous pressure to levels that increase ICP, cerebral venous pressure must at least equal ICP. (37,42)
During suctioning, preoxygenation with 100 % O2 and limited suctioning to 15 seconds with 10 minutes intervals are important measures to avoid ICP spikes. Other respiratory cares include monitoring respiratory rate, oxygen saturation, and auscultation of lung every 8 hrs. (37,39)

Pain and agitation significantly increase ICP. Sedatives like propofol and benzodiazepine cause a coupled reduction in the cerebral metabolic rate of oxygen (CMRO2) and CBF. Therefore, lowering ICP by lowering cerebral metabolic demand, and can also reduce seizures. Managing pain decreases ICP elicited by the Valsalva maneuver. Neuromuscular blockage improves ICP and decreases cerebral metabolic rate of oxygen (CMRO2) by decreasing muscle activation (e.g., shivering), carbon dioxide (CO2) production, and improving ventilator synchrony. (1,37,43,44).

Fever increases metabolic rate and vasodilation that may increase CBF that resulting rise in ICP. fever should be controlled with antipyretics and cooling blankets. Infectious causes must also be addressed. (13,69) Severe anemia causes a marked increase in CBF that is required to maintain cerebral oxygen delivery. Commonly maintenance of hemoglobin concentration greater than or equal to 10 g/dL is practiced.
Seizures can increase cerebral metabolic rate and ICP, in severe TBI, prophylaxis antiepileptic drugs for 7 days is recommended.(37)

Bowel and bladder care, including, stool softeners, high fiber diet, and avoidance of Valsalva, as well as close blood pressure monitoring and management – avoiding extremes on either end to preserve cerebral perfusion, avoidance of electrolyte disturbance (especially sodium management), and optimization of fluid status assessment are another important measures. (37,39,45)

Specific management options include medical therapies like hyperosmolar therapy, hyperventilation, barbiturate coma, hypothermia, steroids. Surgical interventions include CSF drainage, decompressive craniectomy, and resection of the mass.

Hypocarbia, PaCO2<35mmHG, achieved by induced hyperventilation which causes alkalosis of CSF and decreases cerebral volume by causing vasoconstriction, is a temporizing measure. (46) and the effect in lowering ICP is short-lived. Given the risk of ischemia due to reduction of CPP, it is to be applied with caution and is not recommended to be used in the first 24 hours in TBI patients, and used with caution in pediatric patients. (41) Close monitoring of PC02 and avoidance of hypercarbia with ventilator changes are important components of ICP care in patients with elevated ICP.

Barbiturate coma is only considered for refractory intracranial hypertension because of the serious complications of high dosing and making neurologic examination difficult for days. Pentobarbital is the one that's commonly used. The mechanism is unclear but it likely reduces CBF and CMRO2. Hypotension, hypokalemia, and respiratory problems are commonly seen complications (37,47)

Induced hypothermia has shown to decrease cerebral metabolism and proportionally CBF and ICP but long-term improvement of neurological function has not been demonstrated and some evidence suggests that it may cause harm. (48,49)

Glucocorticoid use for cerebral edema is reported in brain tumors, as well as tuberculous and bacterial meningitis. However, steroids are not recommended and potentially harmful in cerebral edema associated with intracerebral hemorrhage, ischemic stroke, or traumatic brain injury (TBI) (50)

Hyperosmolar therapy, using mannitol or hypertonic saline is an effective treatment of elevated ICPs and standard treatment for elevated ICPs and works by inducing movement of fluid from the interstitial/intracellular space to the intravascular space, reducing edema and ICPs. The use of hyperosmolar therapy varies based on the indication.
Comparison of the two hyperosmolar treatments has shown variable outcomes. Recent guidelines suggest favoring hypertonic saline), but evidence remains limited with no clear outcome benefit for any particular agent. The choice is mainly guided by factors accounting for comorbidities (e.g., heart failure, renal failure), serum values (e.g., sodium concentration, osmolality), and clinical factors (e.g., hypovolemia, central venous access). (51-54)
Mannitol 20%, 0.5-2g/kg intravenous is given as at scheduled time or as per need. Continuous administration is not recommended as it can result in rebound cerebral edema by disruption of BBB. Mannitol has been shown to precipitate acute renal failure at higher serum levels, >350mOsm. (55). It is the preferred option for a patient who needs diuresis and can be given peripherally.

Hypertonic saline on the other hand can be administered in various concentrations (2%, 3%, 7.8% to 23.4%). The 3% is administered as a 250 ml bolus, while 23.4 % is given as a 30 ml bolus over 15 minutes. 23% NaCl should be administered via central access given concerns for a detrimental effect on small peripheral veins. Hypertonic saline is preferable in

hypotensive patients given the effect on volume status but can precipitate flash pulmonary edema in patients with heart failure. Continuous and faster administration will cause cerebral edema and hypotension respectively. (51,53)
When treating patients with hyperosmolar therapy, sodium levels, and serum osmolarity should be monitored closely.

Cerebrospinal fluid (CSF) drainage; External ventricular drain (EVD) placement is the main form of CSF diversion. EVDs measure ICP and can drain CSF based on treatment goals. They are most commonly used in hydrocephalus, intraventricular hemorrhage, and subarachnoid hemorrhage (SAH) to alleviate intracranial hypertension and help mitigate elevated ICPs in TBI patients. (5)

Surgical decompression is another treatment option after failure of maximal medical therapy, in particular for patients with structural mass lesions. Decompressive craniectomy decreases ICP by allowing brain herniation through the skull defect. Bifrontal craniectomy in refractory posttraumatic cerebral edema has been shown to decrease ICP and improve survival, but not necessarily functional outcome. (56) In malignant MCA infarction, decompressive craniectomy within 48 hrs. of onset also have shown decreasing mortality and decreasing the occurrence of severe disability in younger patients (age< 60), while there is a mortality benefit in older patients, such an invasive therapy needs to be carefully considered given the high disability of large strokes in elderly patients.(57-59) Overall, risks and benefits of emergent surgical interventions in patients with severe acute brain injury must be carefully weighed and discussed with families.

As delineated above, outcomes of a patient with increased ICP can be improved with timely, appropriate management, targeted at preventing secondary brain injury. (16). Knowledge of ICP management and accurate practices among healthcare providers are crucial factors in ensuring the delivery of appropriate care.

There is limited data regarding the effect of health care professionals' knowledge of ICP management in developing countries. (39)
Knowledge and practice assessments of healthcare professionals, especially nurses, towards increased ICP, have shown poor knowledge and practice and post-training assessments have resulted in substantial improvement of knowledge. (17,18,60)

Integrated simulation and problem-based learning programs on nursing students that assess the effect of team efficacy and learning attitude on nursing care with increased intracranial pressure patients have been shown to improve their metacognitive ability (36)

A study done in Jimma university medical college, Ethiopia among stroke patients showed increased ICP was a frequently encountered complication in 30.2% of patients, and that suboptimal management and lack of skilled personnel were contributing factors. (35)

OBJECTIVES

GENERAL OBJECTIVES

To assess knowledge and practices and impact of intervention around early diagnosis and management of increased ICP pre and post-training among residents and nurses working at TASH.

SPECIFIC OBJECTIVES

To assess knowledge on the diagnosis, monitoring, and management options of increased ICP among residents and nurses working in TASH.

To assess the practice regarding increased ICP detection, monitoring, and management options among residents and nurses working in TASH.

To assess knowledge and practice difference pre and post-training on the diagnosis, increased ICP detection, monitoring, and management options among residents and nurses working in TASH

METHODS AND MATERIALS

STUDY AREA

The study was conducted in TASH, which is a government-owned 1025-bed tertiary hospital in Addis Ababa, the capital and largest city of Ethiopia.

TASH provides health services for approximately 370,00 to 400,000 patients per year. In this institution, outpatient and inpatient neurology and neurosurgery services are delivered. The services are provided in the outpatient department, emergency department, medical intensive care unit, surgical intensive care units, and wards. The staff working there are specialists, residents, and nurses. As a whole, the adult emergency department provides services for 20,000 patients per year. (72)

STUDY PERIOD

The study was conducted from September 1, 2021, to October 31, 2021

STUDY DESIGN

It is a cross-sectional study that assesses knowledge and practices pre and post-training around early diagnosis and management of increased ICP among residents and nurses working at TASH

SOURCE POPULATION

All residents and nurses working in the intensive care unit, emergency department, and wards in TASH.

STUDY POPULATION

Sampled neurology, neurosurgery, internal medicine, emergency medicine residents, and nurses in the intensive care unit, emergency department, and wards in TASH.

INCLUSION CRITERIA

Consented neurology, neurosurgery, internal medicine, emergency medicine residents, and nurses working in adult surgical and medical intensive care unit, emergency department, and neurology and neurosurgical wards working from September 1, 2021, to October 31, 2021.

EXCLUSION CRITERIA

All neurology, neurosurgery, internal medicine, emergency medicine residents, and nurses working in Adult medical and surgical intensive care units, emergency department, and wards who are not assigned at TASH in the study period, who are on month off, or not willing to participate.

SAMPLE SIZE AND SAMPLE TECHNIQUES

The assumptions used to calculate the actual sample size are 95% level of confidence with 0.05 α value (which yields $Z\ \alpha/2 = 1.96$ on the standard normal distribution curve), 5% margin of error. With these assumptions using a single population proportion formula:

$$n = \frac{\left(Z\frac{\alpha}{2}\right)^2 p(1-p)}{d^2}$$

Where, n = is sample size

z = the value of the standard normal curve score corresponding to the given

Confidence interval = **1.96**

p = estimated prevalence when prevalence of knowledge and practice of management of increased ICP among residents and nurses is unknown = 0.5

d = the permissible margin of error (the required precision) = 5%

$n = \frac{(1.96^2)(0.50(1-0.50))}{0.05^2} = 384$

Since the population is less than 10,000 a correction formula will be used. Therefore, using the correction formula:

$n = {no}/{1 + \frac{no}{N}}$ Where n_o is the initial sample size and N is the total population

$$n = {384}/{1 + \frac{384}{residents\ and\ nurses\ of\ TASH}}$$

N = 384

n_o = 303

After adding 10% non-response rate

The sample size will be **186** residents and nurses working in ED, MICU, wards in TASH.

Stratified sampling formula

$$\frac{\text{Size of the entire sample} \times \text{layer size (number of people in the strata)}}{\text{Population size}}$$

Table 1Population size and stratified sample size among residents and nurses working in Tikur anbessa specialized hospital, Addis Ababa, Ethiopia, September 1, 2021, to October 31, 2021

No	Study population	Year of residency	Place of work	Total number	Sample size
1	Emergency medicine residents	I		19	186*19/303 =12
		II		12	186*12/303 = 7
		III		7	186*7/303 = 4
2	Internal medicine residents	I		40	186*40/303 =26
		II		32	186*32/303 =19
		III		33	186*33/303 =19
3	Neurology residents	II		12	186*12/303 =7
		III		7	186*7/303 =4
4	Neurosurgery residents	II		9	186*9/303 =6
		III		7	186*7/303 =4
		IV		9	186*9/303 =6
		V		16	186*16/303 =10
5	Nurses		Emergency department	40	186*40/303 =25
			Neurology ward	14	186*14/303 =9
			Neurosurgical ward	12	186*12/303=7
			Adult ICU	34	186*34/303 =21

STUDY VARIABLES

INDEPENDENT VARIABLES

Age, educational level, occupation, year of experience, current working unit

DEPENDENT VARIABLES

Knowledge and practice on increased ICP

OPERATIONAL DEFINITION

Increased ICP is a pathologic state common to a variety of serious systemic, neurologic and neurological conditions, all of which are characterized by the addition of volume to the intracranial vault

DATA COLLECTION

Residents were randomly selected from neurology, internal medicine, emergency, and critical care medicine, neurosurgery department, and nurses were selected from the emergency department, neurology ward, neurosurgical ward, and adult ICU by using the lottery method.

After informed consent, residents and nurses were required to fill out a self-administered questionnaire in English that was developed after a rigorous literature review and consultation and discussion with a neurocritical care specialist. It was designed to assess

sociodemographic characteristics, knowledge, and practice on early diagnosis and management of increased ICP among residents and nurses working in TASH.

A pilot study was done on 10 participants (5% of sample size). Following this, questions that were not answered by most participants were reformed, redundant questions were dropped. Those who participated in the pilot study were not included in the main study.

The questionnaire for the residents consists of a total of 41 questions categorized into two sections assessing knowledge and practice on early diagnosis and management of increased ICP.

The questionnaire for the nurses consists of a total of 22 questions categorized into two sections assessing knowledge and practice on early diagnosis and management of increased ICP.

After completion of the questionnaire, both residents and nurses were shown an 18-minute-long video on increased ICP diagnosis and management. The video was a slideshow with narration in English. It was prepared by PI in collaboration with a neurocritical care specialist. The PI showed the video to the residents in their working place by using a tablet and a trained nurse data collector showed the nurses in their working place by using a tablet.

DATA ANALYSIS

The data were checked manually and cleaned for completeness. It was entered manually into SPSS version 26. Continuous variables were summarized by mean SD. Categorical variables were summarized by frequency and percentages. Associations were done by paired t-test and one-way ANOVA. Associations were considered significant when P- value is < 0.05 at 95% confidence interval and power of 80%

ETHICAL ISSUES

Protocol approval was obtained before the beginning of data collection from the department research and publication committee, DRPC.

Personal identifier information (PII), were not included in the questionnaire. The information in the questionnaire was used solely for the intended purpose and the primary investigator put paper questionnaires in a locked cabinet and the SPSS data in a safe password-locked computer.

DISSEMINATION OF RESULTS

The result of the study will be disseminated to key stakeholders, including CHS, AAU, TASH, departments of neurology, department of internal medicine, department of emergency and critical care medicine, department of surgery neurosurgery unit, and appropriate institution of higher education. The result will further be disseminated to the wider scientific community through an abstract presentation at a conference and publication in a peer-reviewed scholarly journal.

RESULTS

SOCIO-DEMOGRAPHIC CHARACTERISTICS OF HEALTH PROFESSIONALS

Out of the expected 186 participants, 183 participated in the study with a response rate of 98.4%. Residents were 66.1% of participants and 33.9% were nurses.

The majority of respondents were males (63.4%) and among them 92(79.3%) were residents. The mean (SD) age of the residents was 29.1(±1.9) and nurses 31.2(±4.4). The mean year of experience for residents was 3.9 years (SD=1.6 years) and for nurses 6.47(SD=3.3). All study participants have managed increased ICP in the past but only 62% of the residents and 62.9% of nurses manage patients with EVD. (Table 2)

Table 2 Socio-demographic characteristics of the study sample, Tikur Anbessa specialized hospital, Addis Ababa, Ethiopia, September 1, 2021, to October 31, 2021

Variables	**Frequency(n=183)**	**Percentage**

Sex		Residents n=121	Nurses n=62	
	Male	92	24	63.4
	Female	29	38	36.6
Have you ever managed patients with increased ICP?				
	Yes	121	62	100
	No	0	0	0
Have you ever managed patients with EVD?				
	Yes	75	39	62.3
	No	46	23	37.7
Current working unit				
	Emergency ward	35	25	32.8
	Intensive care unit	28	21	26.7
	Neurology ward	38	9	25.7
	Neurosurgical ward	20	7	14.8
How many patients with increased ICP have you managed?				
	0	0	0	0
	<10	53	31	45.9
	11-50	50	17	36.6
	51-100	15	12	14.7
	>101	3	2	2.8
How many patients with an EVD have you directly managed?				
	0	46	23	37.7
	<10	48	16	34.9
	11-50	23	16	21.4
	51-100	4	4	4.4
	>101	0	3	1.6

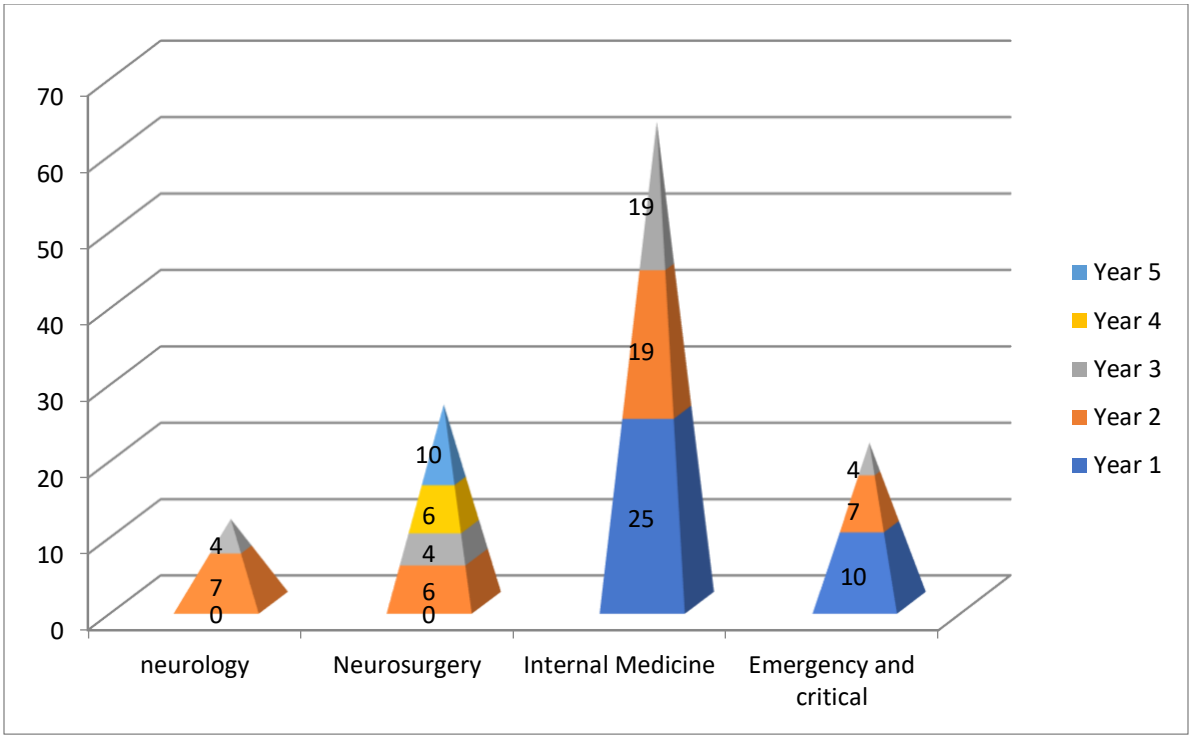


Figure 1: The educational level of participating residents, Tikur anbessa specialized hospital, Addis Ababa, Ethiopia, September 1, 2021, to October 31, 2021

Regarding educational level, out of 121 residents in the study, 31 were year 3 residents. Out of 62nurses, 52 had a degree and 10 had masters and above.

ASSESSMENT AND IMPACT OF INTERVENTION ON KNOWLEDGE AMONG RESIDENTS AND NURSES ON EARLY DIAGNOSIS AND MANAGEMENT OF INCREASED ICP (TABLE 2)

There were a total of 41 questions; 21 to assess knowledge and 20 to assess the practice of residents. The most answered one from the knowledge assessment questions was concerning vital signs that describe the Cushing triad (96.7%) followed by the question asked about not a symptom of increased ICP (92.6%). The least answered question was about conditions that typically do not cause increased ICP (10.7%) followed by an osmolar gap during mannitol treatment (22.3%). The maximum score was 20/21, and the minimum score was 6/21.

Post-intervention shows the level of knowledge risen in terms of the 20 questions out of 21 with a significant difference in their scores ($P < 0.05$ and CI -5.417 - -4.501) among the

residents. Knowledge about the concerning vital signs for the Cushing triad remains the same as in the pre-intervention phase.

There were 22 questions for the nurses; 12 to assess knowledge and 10 to assess practice. The first question in the knowledge section was about the essential components that affect ICP. Answers revealed 17/61 (27.8%) of the respondent nurses provided the correct answer; the same result (27.8%) was obtained regarding the physiologic range of cerebral perfusion pressure (CPP) and clinical sign which indicate increased ICP.

Only 13% of the nurses find the correct answer for the question stated "What condition does typically not cause increased ICP?" (The least answered). And the range of the score was nine (9) for the overall knowledge-based question among the nurses.

Knowledge of nurse staff was found to be increased for ten of the 12 questions. Answers to the remaining two questions which are concerned about an essential component of ICP and identification of affected cranial nerve show the same level of knowledge.

Table 3: Number of correct answers and Impact of the intervention on the knowledge of residents and nurses, Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia, September 1, 2021, to October 31, 2021

Questions	**CORRECT ANSWER**				P-test*	
	PRETRAINING		**POSTTRAINING**			
	Residents (**n=121**) Nº. %	Nurses (**n=62**) Nº. %	Residents (**n=121**) Nº. %	Nurses (**n=62**) Nº. %	Residents	Nurses
1. Which is not an essential component that can affect intracranial pressure (ICP)?	100, 82.6	17, 27.4	121,100	20, 32.3	0.00	0.41
2. What is the normal ICP range?	82, 67.8	34, 54.8	120, 99.2	51, 82.3	0.00	0.00
3. What is a physiologic range of cerebral perfusion pressure (CPP)?	58, 47.9	17, 27.4	120, 99.2	54, 87.1	0.00	0.00
4. What condition does typically not cause increased ICP?	13, 10.74	8, 12.9	110, 90.9	15, 24.2	0.00	0.03
5. What clinical sign is not an indicator of increased ICP?	104, 86	18, 29	121, 100	49, 79	0.00	0.00
6. Which is not a symptom of increased ICP?	112, 92.6	33, 53.2	120, 99.2	58, 93.5	0.04	0.00
7. On examining a patient with increase ICP, you find left pupil dilation, inability to move the eye upward, and eyelid ptosis, which cranial nerve compression does it signify?	102, 84.3	20, 32.3	120, 99.2	17, 27.4	0.00	0.47
8. Which patient's vital signs do you think are concerning for the Cushing triad?	117, 96.7	24, 38.7	121, 100	58, 93.5	0.45	0.00
9. Which is not a direct complication of increased ICP?	109, 90.1	25, 40.3	119, 98.3	57, 91.9	0.01	0.00
10. How do you calculate cerebral perfusion pressure (CPP)?	108, 89.3		119, 98.3		0.01	
11. Which is true about autoregulation?	99, 81.8		120, 99.2		0.00	
12. If a patient's BP is 120/70 and their ICP is 12, what is the MAP?	102, 84.3		118, 97.5		0.00	

13. For the patient in the above question, what is the cerebral perfusion pressure (CPP)?	100, 82.6		117, 96.7		0.00	
14. Which of the following is not a risk factor for increased ICP after TBI?	101, 83.5		119, 98.3		0.00	
15. Which is false about the osmolar gap during mannitol treatment?	27, 22.3		109, 90		0.00	
16. Hypercarbia (high PaCO2) causes vasodilation and decreases ICP.	76, 62.8	30, 48.4	117, 96.7	50, 80.6	0.00	0.00
17. PCO2< 28 mmHg can result in ischemic stroke due to vasoconstriction.	73, 60.3	16, 25.8	119, 98.3	23, 37.1	0.00	0.00
18. Placement of ICP monitoring is indicated in patients with traumatic brain injury with a GCS of $\leq$ 8 and abnormal brain CT scan findings.	92, 76	29, 30.6	120, 99.2	53, 85.5	0.00	0.00
19. Steroids are indicated in managing cerebral edema in a patient with hemorrhagic stroke.	108, 89.3		121, 100		0.00	
20. Hypoxic-ischemic brain injury can cause impaired intracranial compliance.	103, 85.1		120, 99.2		0.00	
21. Lumbar punctures can cause a rapid and sudden drop in ICP and leads to herniation.	106, 87.6		121, 100		0.00	

*P-value for paired samples t-test comparing pre-test and post-test scores.

ASSESSMENT AND IMPACT OF THE INTERVENTION ON PRACTICE AMONG RESIDENTS AND NURSES ON EARLY DIAGNOSIS AND MANAGEMENT OF INCREASED ICP (TABLE 3)

Based on the pretraining analysis, only 5 out of the 20 questions answered with 85%of the participating residents correctly. But the post-training result shows nineteen questions were answered with more than 85%. The paired t-test also prove that there is a significant difference between the pre and post-training result in all practical questions.

For the nurses, 7out of 10 questions show a statically significant difference between pre and post-training.

Table 4: Number of correct answers and Impact of the intervention on the practice of residents and nurses, Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia, September 1, 2021, to October 31, 2021

Questions	**CORRECT ANSWERS**				P-test*	
	PRETRAINING		**POSTTRAINING**			
	Residents **(n=121)** **Nº.** %	Nurses (**n=62**) Nº. %	Residents **(n=121)** **Nº.** %	Nurses (**n=62**) Nº. %	Residents	Nurses
1. The most appropriate disposition?	115, 95	49, 79	120, 99.2	13, 21	0.02	0.00
2. Categorizing traumatic brain injury (TBI)?	105, 86.8	28, 45.2	120, 99.2	52, 83.9	0.00	0.00
3. Activities a patient with concern for increased ICP should avoid?	112, 92.6	17, 27.4	119, 98.3	22, 35.5	0.00	0.19
4. The patient's arm is extended straight out and toes pointed down, how do you document this?	99, 81.8	20, 32.3	119, 98.3	19, 30.6	0.00	0.78
5. Position patients with increased ICP in bed should avoid?	64, 52.9	8, 12.9	118, 97.5	18, 29	0.00	0.00
6. A patient with elevated ICP is on mechanical ventilation and needs suctioning, how would you do it?	56, 46.3	18, 29	105, 86.8	47, 75.8	0.00	0.00
7. not recommended bowel and bladder care for a patient with increased ICP?	82, 67.8	17, 27.4	115, 95	46, 74.2	0.00	0.00
8. For patients with ICP monitoring. which finding during follow-up will concern you the most?	72, 59.5	20, 32.3	110, 90.9	29, 46.8	0.00	0.60
9. A patient with a brain Tumor + increased ICP. What is the right way of administering Mannitol?	116, 95.9	38, 61.3	121, 100	56, 90.3	0.02	0.00
10. how would you score the GCS?	86, 71.1	12, 19.4	111, 91.7	19, 30.6	0.00	0.34
11. A patient with increased ICP in the ICU, what is your PaCO2 target?	76, 62.8		117, 96.7		0.00	
12. Which management improve mortality and outcome in patient with large MCA territory infarction?	57, 47.1		99, 81.8		0.00	

13. ESRD patient on hemodialysis having sustained ICP and comatose, step in the management?	63, 52.1		109, 90		0.00	
14. In which ventricle do you aim to insert EVD?	79, 65.3		117, 96.7		0.00	
15. Benefit of EVD over the intraparenchymal monitor?	59, 48.8		108, 89.3		0.00	
16. hemorrhagic stroke with ventricular extension and increased ICP, what is the management option?	41, 33.9		115, 95		0.00	
17. Interpretation of the graph of a patient with brain contusion on an ICP monitor?	54, 44.6		117, 96.7		0.00	
18. interpretation of the two waveforms seen one after the other?	59, 48.8		117, 96.7		0.00	
19. GCS 12/15 with 40 ccs cerebellar hemorrhage with intraventricular extension, what is a treatment of choice?	72, 59.5		111, 91.7		0.00	
20. For which patient do you prioritize doing a brain CT scan?	102, 84.3		117, 96.7		0.00	

*P-value for paired samples t-test comparing pre-test and post-test scores.

COMPARATIVE STUDY TEST RESULTS

RESIDENTS

Pretraining, neurology residents had the highest mean score of knowledge 17.36 (82.7%), neurosurgery residents had 17.27(82.2%) and internal medicine residents had 15.79(75.2%). The lowest mean score was seen among emergency and critical care medicine residents 12.24(58.3%). Post-training, neurology residents scored 100%, neurosurgery scored 99.8%, internal medicine scored 98.8% and emergency and critical care residents scored 93.2%. (Figure 2)

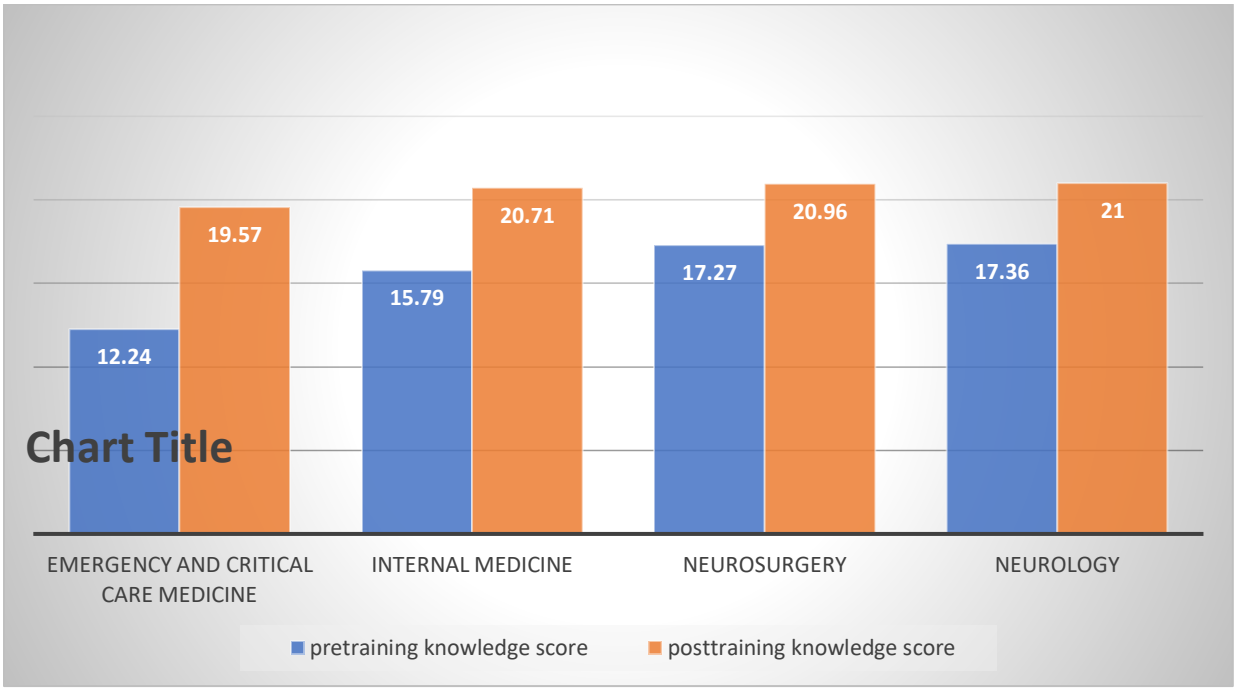


Figure 2:Mean knowledge score comparison of pre and post-training for resident's occupation, Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia, September 1, 2021, to October 31, 2021

Pretraining, the highest mean total score of practice was of neurosurgery residents 16.15 (80.8%), the lowest score was of emergency and critical care medicine residents 10.62 (53%). The intervention raised the score percentage by 34.3% for the lowest scoring residents from the pretraining score. (Figure 3)

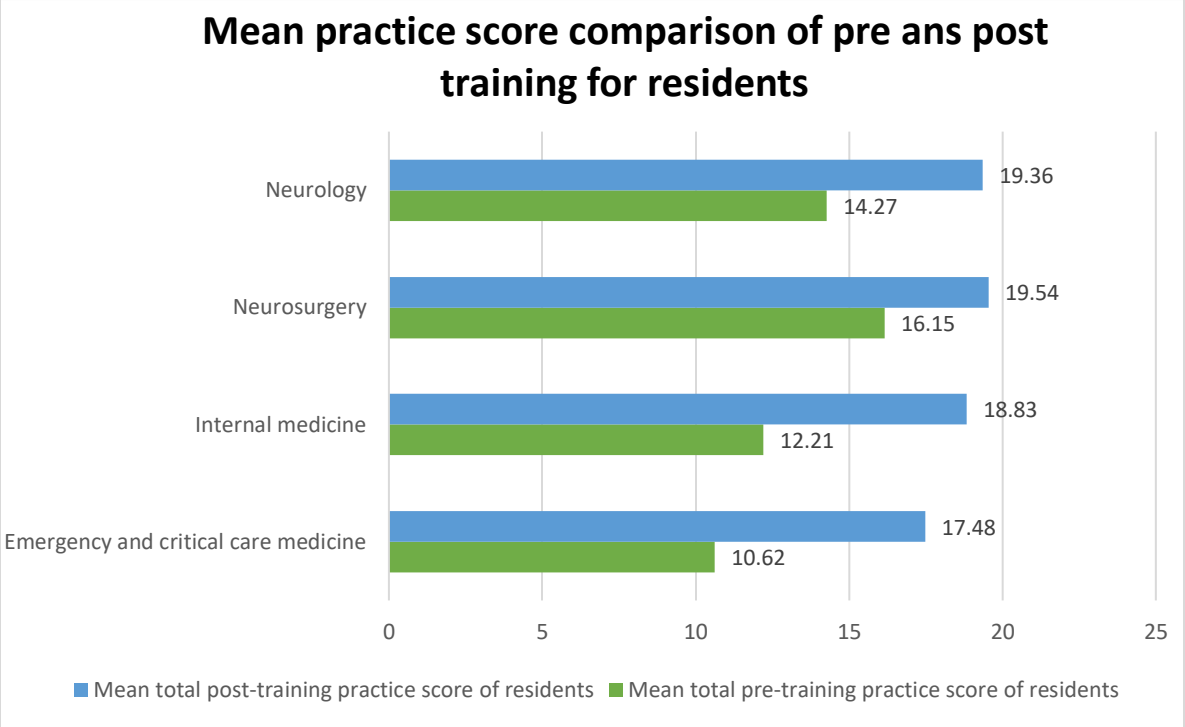


Figure 3: Mean practice score comparison of pre and post-training for resident's occupation, Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia, September 1, 2021, to October 31, 2021

According to the results of one way ANOVA, in terms of the pretest result, the mean difference between residents of different occupations and year of residency was statistically significant (e.g. neurology vs. internal medicine (3.63, P=0.00), first-year residents vs. all year residents) but for the year of experience there is no statically significant mean difference(P =0.78)

The knowledge and practice difference based on year of training showed the highest score of fourth-year neurosurgery residents. The statically significant mean difference seen comparing first-year residents to others.

Table 5: Mean difference of knowledge and practice between Resident education level, Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia, September 1, 2021, to October 31, 2021

Resident education level(I)	Resident education level(J)	Mean difference(I-J)	sig	95% Confidence Interval	
First-year	Second-year	-4.63	.00	-7.70	-1.57
	Third-year	-4.42	.00	-7.71	-1.14
	Fourth-year	-9.86	.00	-15.06	-4.68
	Fifth-year	-8.30	.00	-13.05	-3.55
Second-year	Fourth-year	-5.23	.04	-10.33	-0.14

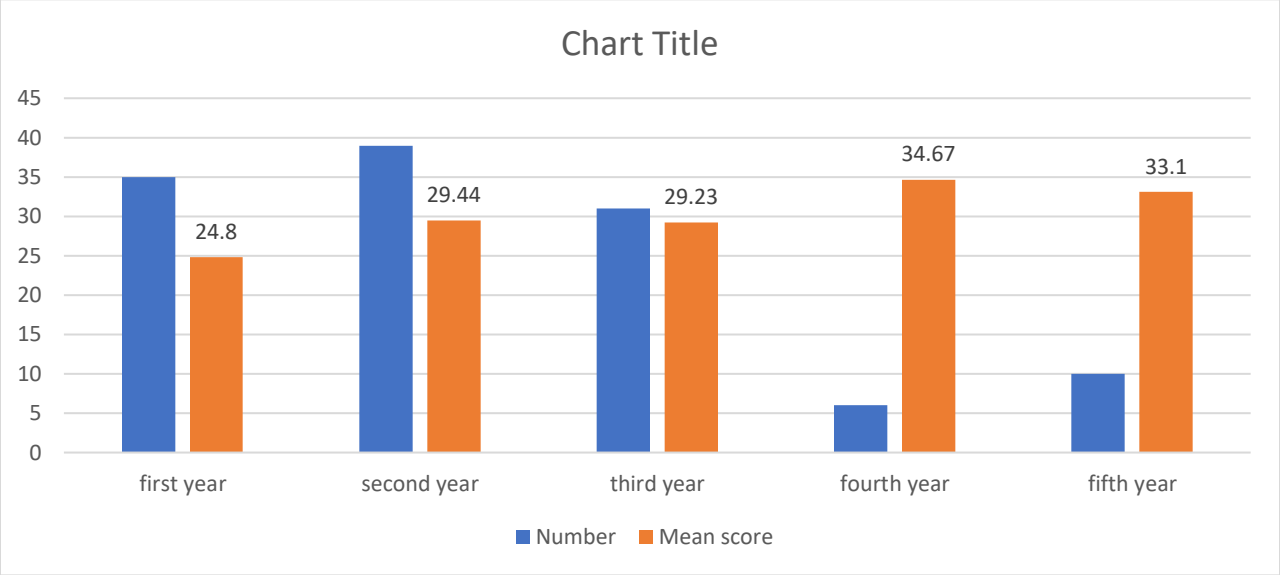


Figure 4:knowledge and practice pretraining mean score based on educational level Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia, September 1, 2021, to October 31, 2021

Nurses

Depending on their current working unit, there was no statistically significant difference pre and post-training of knowledge (P-value 0.75 and 0.07) and practice score (P=0.61and 0.31) respectively. Likewise, there was no statically significant difference in their educational level (p= 0.08) and year of experience (P=0.32).

DISCUSSION

To the best of the investigator's knowledge, this is the first study targeting knowledge and practice on increased ICP management among residents and nurses in the globe.

Increased ICP is feared and serious complications of neurologic, neurosurgical, and systemic diseases. Early diagnosis, continuous monitoring, and management are essential for better outcomes of patients.

In this study, the residents showed better understanding of basic physiology of increased ICP which could be taken as a ground for understanding possible problems. They also scored higher regarding the clinical features.
Before pursuing treatment, knowing the problem and the cause is crucial. To this end the residents scored low which could imply that they may not well implement disease specific management options.

During elevated ICP, lumbar puncture can cause a sudden and rapid drop in ICP and lead to brain herniation. Avoidance of this procedure in presumed cases is important and most of the residents were shown to know that in this study.

The intervention have shown to result significant improvement on the residents level of knowledge which could indicate due attention should be given for neurocritical care problems and the benefit practicing residents would get from continuous educational programs from the need for neurocritical care specific training programs.

Nurses are front liners on the care of critical patients, early detection of abnormalities and intervention, and also timely reporting to physicians is an important part of their job. This study identified low nurses' knowledge scores. The highest score was about the normal ICP range and only 54.8% of participants gave the correct answer. Post-intervention there was a significant rise in their score. As compared to a study done in Egypt, in this study the nurses scored low on basic science, clinical features, and complications, but the lowest score was on causes of increased ICP which was also seen on previous studies. (60)

Regarding practical points, most residents scored well on the principle of management nevertheless, there was a big gap coming to details of general management options like the proper way of positioning, suctioning procedures, and bowel and bladder care.. Concerning the specific treatment options where physicians are more expected to decide on they scored low and generally the lowest scores were seen concerning surgical options of management and monitoring parameters after EVD insertion but this can be reasonable since there is no well-established ICU and neurocritical care education and training with due attention in the setup. The intervention has shown to produce a significant change in their understanding of the principle of management in general and also in patient-specific scenarios which are expected to be faced in practice.

Previously it was seen that the nurses major way of education is clinical practices which may create significant gap between scientific advancement publications and their practice. (64) The nurses' understanding of management principles shows a substantial gap in almost all aspects which is also consistent with what is seen in previous studies. (60) Even if some results decrease post-intervention, for the most part, the intervention was successful and significantly improved scores.

CONCLUSION

The study showed that there is a knowledge and practice gap among health care professionals and after the intervention, a significant change was seen. This study could be a ground for further studies and a wake-up call for the departments and the hospital to prepare continuous refreshment training and guidelines.

RECOMMENDATION

As increased ICP is a life-threatening condition therefore it is essential to detect raised ICP early and institute proper management. To this end in the advancement of the care, it would be important for the professionals to work on themselves to bridge the knowledge gap, for the stakeholders to prepare training programs and nationwide applicable guidelines to upscale the care where the reflection will be seen through patients outcome.

More on, specialized nurses teaching programs on neurocritical care should be started.

LIMITATION

The limitations seen in this study were due to the current pandemic; COVID 19, participants could not be gathered at a time, and training could not be in person. This might help participants to concentrate more.

Follow-up assessment; at 3 and 6 months post-intervention, would have been a better opportunity to draw a conclusion about the long-term and sustainable impact the training had on the knowledge and practice of ICP diagnosis, monitoring, and management.

ANNEX 1

WORK PLAN

Table 6: Activities and timeline for the study on Assessment of Knowledge and practice about the management of increased intracranial pressure among residents, interns, and nurses working in TASH, Addis Ababa, Ethiopia, September 1, 2021, to October 31, 2021

No	Description	Responsible	July 2020	Aug-Sept 2020	Oct 2020	Jan – Aug 2021	Sep-Oct 2021	Nov 2021
1	Prepare proposal and submit to advisors	PI						
2	Proposal submission for defense	PI						
3	Proposal defense	PI						
4	Final submission	PI						
5	Data collection	PI						
6	Data analysis	PI						
7	Submission to advisors	PI						
8	Feedback from advisors	Advisors						
9	Final defense	PI						

BUDGET

Table 7: budget breakdown for the study on Assessment of Knowledge and practice towards management about increased intracranial pressure among residents, interns, and nurses working in TASH, Addis Ababa, Ethiopia, September 1, 2021, to October 31, 2021

Personnel costs					
Title	№	Qualification	Rate (Birr/day)	Total task duration	Total price (birr)
Data collector per diem	1	Nurse	100/day	61	6100
Data collector training per diem	1	Nurse	200/day	1	200
Supplies and materials					
Activity	unit	Quantity	Unit price(Birr)	Total price(Birr)	
Printing	Piece	110	2	220	
Photocopy	Piece	4092	2	8,184	
pen	Piece	100	10	1000	
Pencil	Piece	1	5	5	
Staples	Pack	10	50	500	
Stapler	Piece	1	100	100	
Clipboard	Piece	1	100	100	
Binding	Piece	20	50	1000	
Mobile card	Piece	20	100	2000	
Contingency (5%)			Any time during the research	655.45	
Total				20,064.45	

ANNEX 2

CONSENT FORM

Greeting Hello, how are you?

My name is ……. I am working in the research team of a graduate thesis of Addis Ababa university college of health sciences, department of neurology. I would like to interview you with a few questions about the early diagnosis and management of increased intracranial pressure. This study is aimed to assess knowledge and practice towards early diagnosis and management of increased intracranial pressure among residents and nurses working in TASH. This will be helpful_to improve provider education and outcomes. The study will provide information about the current knowledge and practice and results will be used to further develop training programs. I would like to take your time to respond to my questions and it will take approximately 60 minutes. I request you to answer as truthfully as possible. Your name will not be written anywhere in the form and all the information you give is confidential except for this study and it will never be disclosed to a third party. In addition, I would like to inform you that participating in this study has no short-term or long-term risk or benefit to you. I also would like to inform you that you have the full right to withdraw from the study or to stop the study at any time or skip any question that you do not want to answer. Your cooperation and willingness to participate in the study are very helpful in identifying knowledge gaps and building improved educational opportunities for our providers.

Do you agree to participate in this study? Yes …… No …….

Respondent agrees to participate go to the next part.

Respondent does not agree to be participant stop

Thank you in advance for your cooperation

Data collectors name…….sign:…….

If you have any questions or doubts, you can contact us at the address below.

Name of the principal investigator: Firaoly workneh

Mobile : +251913674150 Email: fraolyw@gmail.com

<u>የስምምነት ሰነድ</u>

ጤና ይስጥልኝ እንድምን አሉ?

እኔ ዶ/ር ፍራኦሊ ወርቅነህ በአዲስ አበባ ዩንቨርሲቲ የጤና ሳይንስ ኮሌጅ በነርቭ ህክምና ክፍል እጩ የድህረ ምረቃ ትምህርት ክፍል መመረቂያ ጥናት አዘጋጅ የቡድን አባል ነኝ፡፡

ስለ ጭንቅለት ውስጥ ግፊት መጨመር በሽታ ጥቂት ጥያቄዎችን እንዳቀርብ ፍቃድዎን እጠይቃለሁ፡፡

የዚህ ጥናት ዋና አላማው የጥቁር አንበሳ ሆስፒታል የሚገኙ የህክምና ተማሪዎች፣ የእጩ የድህረ ምረቃ የህክምና ተማሪዎች እና ነርሶች ስለ ጭንቅላት ውስጥ ግፊት የመጨመር በሽታ በግዜ መመርመር እና ማከም ላይ ያላቸውን ሞያዊ እውቀት ለማወቅ የሚረዳ ሲሆን አዎንታዊ ውጤት እንዲገኝ የሚያግዝ ጥናት ነው፡፡

ይህም ጥናት በአሁን ግዜ ስለበሽታው ያለውን ሞያዊ እውቀት እንዲሁም የአሰራር መንገድ መረጃ ለመስጠት የሚያግዝ ሲሆን ለወደፊትም እቅድ ለማውጣትና ስልጠና ለመስጠት ግብአት ይሆናል፡፡

ይህንን መጠይቅ ጊዜዎን ወስደው እንዲሞሉልኝ በትህትና እየጠየኩ ጥያቄዎቹን ለመመለስ በግምት ---------- ደቂቃ ሊወስድብዎ ይችላል፡፡

መጠይቁን በተቻልዎት መጠን በሀቅ ይሞሉልኝ ዘንድ በትህትና እጠይቃለሁ፡፡

ስምዎ በዚህ መጠይቅ ውስጥ የማይመዘገብ ሲሆን የሚሰጡኝ ሙሉ መረጃ ለዚህ ጥናት ብቻ የሚውል ሲሆን ለሌላ ሶስተኛ ወገን የማይተላለፍ እና ሚስጥራዊ ነው፡፡

በተጨማሪም በዚህ መጠይቅ ላይ ስለተሳተፉ በአጭር ጊዜም ይሁን በረጅም ጊዜ ሞያዊ ጥቅምም ይሁን ጉዳት አይደርስብዎትም፡፡

በመጨረሻም በዚህ መጠይቅ ለመሳተፍም ሆነ ለማቆም መብት ያልዎት መሆኑን እና መመለስ ለማይፈልጓቸው ጥያቄዎች ማለፍ(አለመሙላት) የሚችሉ መሆኑን ለማሳወቅ እወዳለሁ፡፡

ፍቃድዎ ሆኖ በዚህ ጥናት ለመሳተፍ መተባበርዎ በሽታውን ለማከም የሚታዮ ችግሮችን ነቅሶ ለማውጣት በጣም የሚረዳ ነው፡፡

ስለዚህ በዚህ ጥናት ለመሳተፍ ፍቃደኛ ነዎት?

አዎ ☐ አይ ☐

መልስ ሰጪ ለመሳተፍ ከተስማሙ ወደቀጣይ ይዘዋወሩ

መልስ ሰጪ ለመሳተፍ ካልተስማሙ ያቁሙ

ስለትብብርዎ በቅድሚያ አመሰግናለሁ

መረጃ ሰብሳቢ ስም ----------

ፊርማ ----------

ማንኛውም ጥያቄ ወይም ተጨማሪ መረጃ ካስፈለግዎት ከዚህ በታች ባለው አድራሻ ያግኙኝ

ዋና የጥናቱ ተመራማሪ…… ዶ/ር ፍራኦሊ ወርቅነህ

ስልክ…….. +251913674150 E-mail :-fraolyw@gmail.com

QUESTIONNAIRE

PART 1: Socio-demographic characteristics (circle your choice)

1. Age

   ……..

2. Sex
   a) Female
   b) Male

3. Occupation
   A. Resident
      a) Neurology
      b) Neurosurgery
      c) Internal medicine
      d) Emergency and critical care

   B. Nurse
      a. Emergency room
      b. Intensive care unit
      c. Neurology ward
      d. Neurosurgery ward

4. Educational level
   1. Resident
      a) First-year
      b) Second-year
      c) Third-year
      d) Fourth-year
      e) Fifth-year
   2. Nurse
      a) Diploma

b) Degree
c) Masters and above

5. Current working unit
    a. Emergency room
    b. Intensive care unit
    c. Neurology ward
    d. Neurosurgery ward
6. Years of experience (since graduation from medical/nursing school) …….. years

7. Have you managed patients with increased intracranial pressure(ICP)?
    a. Yes
    b. No

8. How many patients with increased ICP have you managed?
    a. 0
    b. <10
    c. 11-50
    d. 51-100
    e. >101
9. Have you managed patients with an extra ventricular drain (EVD)?
    a. Yes
    b. No
10. How many patients with an extra ventricular drain (EVD) have you directly managed?
    a. 0
    b. <10
    c. 11-50
    d. 51-100
    e. >101

PART 2: QUESTIONS ABOUT STUDY OBJECTIVES

A.KNOWLEDGE ON INCREASED ICP MANAGEMENT (FOR ALL PARTICIPANTS)

I- Please circle your choice

1. Which is not an essential component that can affect intracranial pressure (ICP)?
   a. Brain
   b. Periosteum of the skull
   c. Blood
   d. Cerebral spinal fluid
2. What is the normal ICP range?
   a. 5 – 15 mmHG
   b. 5 – 20 mmHG
   c. 10 – 25mmHG
   d. 10 – 40 mmHG
   e. 20 – 35 mmHG
3. What is a physiologic range of cerebral perfusion pressure(CPP)?
   a. 50 -150 mmHG
   b. 80 -110 mmHG
   c. 70 – 110 mmHG
   d. 60 – 100 mmHG
   e. 80 – 100 mmHG
4. What condition does typically not cause increased ICP?
   a. Stroke
   b. Trauma
   c. Acute Heart failure
   d. Diabetic ketoacidosis
   e. Hypoxic-ischemic state
   f. Liver failure
   g. Meningitis
5. What clinical sign is not an indicator of increased ICP?
   a. Anisocoria
   b. Posturing
   c. Bradycardia

d. Cheyne-stoke pattern

e. Gerstmann's syndrome

6. Which is not a symptom of increased ICP?
    a. Headache
    b. Nausea and vomiting
    c. Confusion
    d. Visual changes
    e. Neck pain
7. On examining a patient with increase ICP, you find left pupil dilation, inability to move the eye upward, and eyelid ptosis, which cranial nerve compression does it signify?
    a. IV
    b. III
    c. VI
    d. V
    e. II
8. Which patient's vital signs do you think are concerning for the Cushing triad?
    a. BP-150/112 , PR-110, RR- 8
    b. BP- 90/60, PR- 80, RR- 22
    c. BP- 200/100, PR- 50, RR- 8
    d. BP- 80/40, PR- 49, RR-12
    e. BP-100/60, PR- 135, RR- 27
9. Which is not a direct complication of increased ICP?
    a. Apnea
    b. Ischemic stroke
    c. Death
    d. Cardiac arrest
    e. Hypocalcemia
    f. Irregular breathing

II- Please answer each of the following questions with True, False, or I don't know (check √ on the chosen answer)

10. Hypercarbia(high PaCO2) causes vasodilation and decreases ICP.

☐ True ☐ **False** ☐ I don't know

11. PCO2< 28 mmHg can result in ischemic stroke due to vasoconstriction.

☐ **True** ☐ False ☐ I don't know

12. Placement of ICP monitoring is indicated in patients with traumatic brain injury with a GCS of ≤ 8 and abnormal brain CT scan findings.

☐ **True** ☐ False ☐ I don't know

B.KNOWLEDGE ON INCREASED ICP MANAGEMENT (FOR RESIDENTS ONLY)

I – Please circle your choice

13. How do you calculate the cerebral perfusion pressure(CPP)
    a. ICP – Jugular venous pressure(JVP)
    b. Mean arterial pressure(MAP) – ICP
    c. Systolic blood pressure(SBP)+ ICP
    d. SBP - JVP
    e. MAP – 1/3 diastolic blood pressure (DBP)
14. Which is true about autoregulation?
    a. It's effective if MAP is 70- 200 mmHg
    b. It ensures a steady blood flow to the brain even in severe brain injury
    c. It's a mechanism that maintains consistent CBF (cerebral blood flow) despite blood pressure fluctuations
    d. It's not affected by blood pressure
    e. Adjustment of the diameter of blood vessels is not indicated since its autoregulatory
15. If a patient's BP is 120/70 and their ICP is 12, what is the MAP?
    a. 110
    b. 86
    c. 50
    d. 190
    e. 96
16. For the patient in the above question, what is the CPP?
    a. 38

b. 84

c. 74

d. 98

e. 178

17. Which of the following is not a risk factor for increased ICP after TBI?

a. Advanced Age

b. The initial level of consciousness

c. Comorbidities including heart failure and hypertension

d. Seizure

e. Low WBC count

18. Which is false about the osmolar gap during mannitol treatment

a. Calculated as measured osmolality minus calculated osmolarity

b. Can predict specific mannitol serum concentration

c. The normal value indicates sufficient clearance of mannitol

d. Must be calculated for all patients who are on mannitol treatment

e. none

II - Please answer each of the following questions with True, False or I don't know(check √ on the chosen answer)

19. Steroids are indicated in managing cerebral edema in a patient with hemorrhagic stroke.

☐ True ☐ **False** ☐ I don't know

20. Hypoxic-ischemic brain injury can cause impaired intracranial compliance.

☐ **True** ☐ False ☐ I don't know

21. Lumbar punctures can cause a rapid and sudden drop in ICP and lead to herniation.

☐ **True** ☐ False ☐ I don't know

C- CASE-BASED QUESTIONS ON INCREASED ICP MANAGEMENT(FOR ALL PARTICIPANTS)

I – Please circle your choice

1. A 30 years old male patient is brought to ER after sustaining a road traffic accident, on examination, his BP - 160/100, PR- 120, Glasgow coma scale (GCS) is 10 and his pupils are unequal. The ER team is asking you to admit the patient. Which is the most appropriate disposition?
    a. Ward
    b. ICU
    c. Home
    d. The admission place doesn't matter
2. How would you categorize his traumatic brain injury (TBI)?
    a. Mild
    b. Moderate
    c. Severe
3. Which activities should a patient with concern for increased ICP avoid?
    a. Feeding
    a. Talking
    b. Keeping head of bed between 35-45 degree
    c. Valsalva maneuver
    d. Moving extremities
4. When examining a patient you notice the patient's arm is extended straight out and toes pointed down, how do you document this?
    a. Decorticate posture
    b. Decerebrate posture
    c. Flaccid
    d. Opisthotonos
    e. none
5. When positioning patients with increased ICP in bed, you should avoid……..
    a. Head elevation 30^{o} to 45^{o}
    b. Hip flexion
    c. Midline positioning of the head
    d. Use cervical collar
    e.

6. A patient with elevated ICP is on mechanical ventilation and needs suctioning, how would you do it?
    a. **Briefly hyperventilate with 100% O2 before suctioning**
    b. Suctioning should not last longer than 2 minutes
    c. Give a 15-second rest interval between each suctioning
    d. Frequent suctioning
7. From the listed options which are not recommended bowel and bladder care for a patient with increased ICP?
    a. Stool softener
    b. **Low fiber diet**
    c. Avoid Valsalva
    d. Gut stimulant
8. A 35-year-old male patient sustained a traumatic brain injury and an ICP monitor was placed. which finding during follow-up will concern you the most?
    a. CPP 86mmHG
    b. **PaCO2 55mmHG**
    c. ICP 17mmHG
    d. Pulse rate 89bpm
    e. None - all are normal
9. You are on duty in the medical ICU and there is a patient with a brain Tumor + increased ICP. Mannitol is prescribed but the route of administration is not mentioned. What is the right way of administration?
    a. Intrathecal
    b. **Intravenous**
    c. Intramuscular
    d. Oral
    e. rectal
10. You are assessing the GCS (Glasgow coma scale) of a 48 years old male patient with a subarachnoid hemorrhage, he opens his eyes when you call him, he moves to localize pain and uses inappropriate words, how would you score the GCS?
    a. 12
    b. **11**
    c. 10
    d. 13
    e. 15

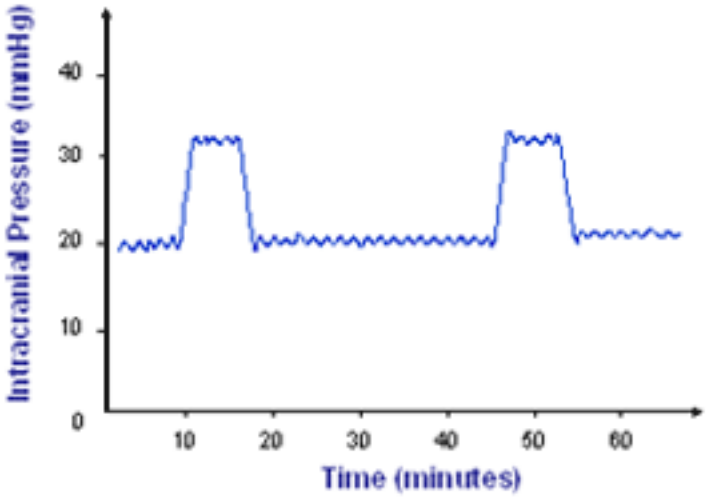
D. PRACTICE ON INCREASED ICP MANAGEMENT(FOR RESIDENTS ONLY)

I – Please circle your choice

11. You are managing a patient with increased ICP in the ICU, What is your PaCO2 target?
    a. 40 – 45 mmHG
    b. 20 – 25 mmHG
    c. 30 - 35 mmHG
    d. Less than 20 mmHG
12. You are managing a 38-year-old male with a large MCA territory infarction 24 hours ago who is complaining of headaches that exacerbate while he coughs and blurring of vision. Later he becomes drowsy and his BP= 110/70, his pupils are sluggish on the right and brisk on left, on investigation his creatinine has increased from 0.9 to 1.5 in a day. Which treatment has been shown to improve mortality and outcome in such patients?
    a. Resuscitation with isotonic saline and give mannitol
    b. Give Thiopental
    c. Hypertonic saline
    d. Decompressive surgery
13. A 75-year-old male patient with ESRD (End-stage renal disease) on hemodialysis is having sustained ICP spikes to the 30s after sustaining a severe hit to the head, leaving him comatose. What should be the next step in management?
    a. Hypothermia
    b. Mannitol
    c. Hypertonic saline
    d. Supportive care only
    e. Sedatives
14. During EVD insertion, in which ventricle do you aim to insert the catheter?
    a. Fourth ventricle
    b. Subarachnoid space
    c. Lateral ventricle
    d. Third ventricle
    e. Prepontine cistern

15. A 25-year-old female patient who suffered a bike accident is brought to the ER with a GCS of 4. The team decides to place an ICP monitor. Compared to an intraparenchymal monitor, an EVD is:
    a. Easier to place
    b. Does not require reversal agent in patients on anticoagulation or with liver disease
    c. Has less risk of infection and bleeding than an intraparenchymal device
    d. Can be used for the treatment of ICP spikes via CSF diversion
    e. Is less durable
16. A 56-year-old known diabetic and hypertensive male patient presents with a left-sided weakness for 2 days as well as altered mental status, headaches, and repeated vomiting, on examination he is tachycardic (PR=112) BP= 140/90, GCS of 13/15, motor weakness of power 3/5 on left upper and lower extremities, brain CT scan showing right basal ganglia 2cm*3cm hyperdense lesion with ventricular extension and enlargement of the temporal horn of lateral ventricle. His blood glucose is 300mg/dl

    What should be the next critical step in management?
    a. Start antihypertensive medication
    b. Start him on an insulin sliding scale
    c. Start him on mannitol
    d. Placement of EVD
    e. Do brain MRI
17. A 26-year-old female who sustained a road traffic accident is comatose and a brain CT scan shows contusions. An ICP monitor was inserted and this was shown for more than 16 minutes on the monitor screen (see figure below), what is depicted below?



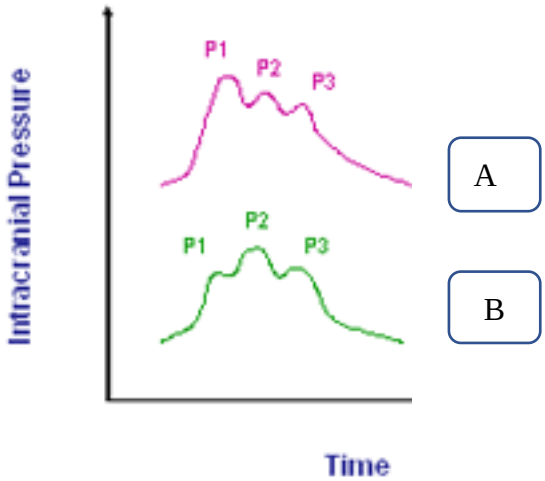
a. P1 waves showing buffering of ICP raise by displacement in a ventricular compartment

b. Lundberg A waves showing impending raised ICP

c. Lundberg B waves that require no treatment

d. Lundberg C waves that are physiologic

18. A patient has an ICP monitor in place. These are the two waveforms seen one after the other, How do you interpret seeing this?



a. P1 is increased on 'B' waveform indication closure of the aortic valve

b. P2 amplitude is increased on 'B' waveform showing decrement of brain compliance

c. P3 is the same on both waveforms showing arterial pressure transmission from choroid plexus
d. Lundberg C waves show an interaction between cardiac and respiratory cycles
e. The waveform B is a normal ICP tracing form

19. A 65-year-old male patient with a GCS of 12 was diagnosed with a 40 cc cerebellar hemorrhage with intraventricular extension. What is a treatment of choice?
    a. Hypertonic saline
    b. Mannitol
    c. Suboccipital Decompressive hemicraniectomy
    d. Hyperventilation
    e. Prone positioning
20. From the cases listed below, for which patient do you prioritize doing a brain CT scan?
    a. A 2-year-old conscious toddler who sustained fall down accident
    b. A 66-year-old SAH and irregular breathing, reporting double vision
    c. A 45-year-old cardioembolic stroke patient with tachycardia of 130.
    d. A 53-year-old end-stage CKD patient with behavioral changes
    e. A 16 years old boy involved in a car accident with GCS 15 and minor post-traumatic amnesia

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