



Magnitude and Pattern of Germinal Matrix Hemorrhage in newborns born below 32 weeks of gestational age at Saint Paul's Hospital Millennium Medical College, Addis Ababa, 2018

A THESIS RESEARCH TO BE SUBMITTED TO THE DEPARTMENT OF RADIOLOGY, SAINT PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE FOR THE PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE CERTIFICATE OF SPECIALITY IN RADIOLOGY

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**Magnitude and Pattern of Germinal Matrix Hemorrhage in newborns
born below 32 weeks of gestational age at Saint Paul's Hospital
Millennium Medical College, Addis Ababa, 2018**

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Abstract

Background: Intraventricular / Germinal matrix hemorrhage (IVH/GMH) remains a significant cause of morbidity and mortality in infants who are born prematurely. Sequelae of GM/IVH include short and long term complications that results in life-long neurologic deficits, most importantly cerebral palsy, developmental delay and seizures. GM/IVH is diagnosed primarily through the use of brain imaging studies, specifically cranial ultrasonography. Because GM/IVH can occur without clinical signs, screening and serial examinations are necessary for the diagnosis.

Objective: To determine magnitude, pattern and predictors of intraventricular hemorrhage in newborns born below 32 weeks of gestational age and admitted at Saint Paul's Hospital Millennium Medical College (SPHMMC) neonatal intensive care unit (NICU).

Methods: A prospective cross-sectional hospital based study was conducted where 97 preterm neonates meeting the study's inclusion criteria had cranial ultrasound done after the first 48 hours of age. Data on the risk factors was obtained from the neonatal referral form, maternal records and direct interview with the neonate's mother

Result: In this study, of the total 97 neonates, 63 neonates (64.9%) had normal brain sonography, while 34 neonates (35.1%) had IVH/GMH. Grade 1 IVH was the most common(47.1%) followed by grade 2 IVH at 29.4%. This made mild IVH (grade 1 and grade 2) 76.5% of the total IVH cases detected. Grade 3 IVH was the third common at 20.6% and grade 4 IVH was the least making 2.9%.

There was significant reduction in magnitude of IVH in those neonates whose mothers were given antenatal steroid ($p=0.003$, $RR=0.45$, $95\%CI$ 0.26-0.76).

Conclusion and Recommendation: The magnitude of IVH in very preterm/VLBW neonates is high, therefore all very preterm/VLBW neonates should be serially scanned. Antenatal steroid administration significantly decreases magnitude of IVH. Hence, antenatal steroid should be administered to pregnant women at risk for preterm delivery.

Keywords:

Transfontanelle ultrasound, Intraventricular hemorrhage, Preterm neonate.

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ACRONYMS

AGA=Appropriate for Gestational Age

CUS/TUS=Cranial/transfontanelle ultrasound

CT= Computed Tomography

CP=Cerebral Palsy

EGA=Estimated Gestational Age

ELBW =Extremely Low Birth Weight

GM/IVH=Germinal matrix/Intraventricular Hemorrhage

ICH= Intracranial Hemorrhage

IPH=Intraparenchymal Hemorrhage

LBW=Low Birth Weight

MRI= Magnetic Resonance Imaging

NICU=Neonatal intensive care unit

PVL=Periventricular Leukomalacia

SEH=Subependymal Hemorrhage

SGA=Small for Gestational Age

SPHMMC=Saint Paul's Hospital Millennium Medical College

TASH= Tikur Anbessa Specialized Hospital

VLBW =Very Low Birth Weight

Introduction

1.1 Background :

Germinal matrix/ Intraventricular hemorrhage is defined as bleeding in the capillary network of the germinal matrix of the developing brain. It is the most frequently encountered major neurological complication in preterm infants born at ≤ 32 weeks gestation or ≤ 1500 g, a group for whom survival have markedly improved in the past several years. Although the incidence has declined since the 1980s, IVH still remains a significant problem with grave neurodevelopmental consequences that may manifest late in childhood such as cerebral palsy, cognitive/intellectual impairment and epilepsy. Knowledge of the incidence, associated risk factors and pattern of intracranial hemorrhage (ICH) is essential in determining the etiology of the hemorrhage in the preterm infant, since the key to preventing neurologic damages in newborns is to define preventable causes and to treat the complications of hemorrhage. Neonatal neuroradiological studies, particularly brain ultrasonography plays a central role in the addressing this issue. Recent advances and widespread use of cranial ultrasonography since the early 1980s has significantly contributed to gradual decrease in incidence of IVH and has helped with the identification of risk factors. With ultrasound, hemorrhage can be diagnosed in the neonatal ICU inexpensively by the bedside without any significant risk factor such as radiation exposure. Routine cranial ultrasound screening should be performed on all premature infants less than 30 weeks' gestation or less than 1500 g and a later second scan at 4 weeks of postnatal age [1,2,14,15].

1.2 Statement of the problem

The health of newborn plays a vital role to achieve sustainable development goals. Globally, the mortality rate of newborns is increasing accounting for 40% in 1990 to 45% under five child mortality in 2015 [29]. Prematurity is the leading cause of death for under five children accounting for 18% under five child mortality [30]. Complications from preterm births are the leading direct cause of neonatal deaths accounting for 35% of all newborn deaths and a contributing factor for an additional 40% to 60% of neonatal deaths. Preterm infants have a high risk of birth complications, including infectious diseases, respiratory insufficiency, intraventricular hemorrhage, neurosensory deficits and other organ system complications [31]. In

Ethiopia, out of the 91,700 neonatal deaths in 2010, 32,700 (or a little more than one-third) were deaths from complications of preterm birth [27].

GM/IVH remains a significant cause of both morbidity and mortality in prematurely born infants. Sequelae of GM/IVH include short and long term complications resulting in life-long neuro-developmental handicap, most importantly cerebral palsy, developmental delay, and seizures. Studies in developed countries demonstrated that severe IVH is the most important predictor of development of cerebral palsy and other neurodevelopmental abnormalities in very low birth weight (VLBW) infants [5,23].

Sadly, in most developing nations where neonatal mortality is high and social supports for individuals with cerebral palsy and neurodevelopmental disabilities are poor; the exact contribution of IVH to the morbidities and mortalities involving VLBW infants, its possible risk factors and long-term outcome among these babies have not been well studied.

In Ethiopia, there are limited studies done assessing the magnitude and associated risk factors of intraventricular hemorrhage (IVH) in preterm infants. In one Ethiopian study, IVH was seen in 32% of preterm infants on autopsy examination [27]

The main aim of this study is to determine the magnitude, pattern and associated risk factors of IVH in preterm infants with birth weight of <1500 gm and/or gestational age of <32 weeks.

1.3 Significance of the Study

In Ethiopia, only one study was found that assessed the occurrence of intraventricular hemorrhage in preterm newborns. Conducting study on the magnitude, pattern and associated risk factors of intraventricular hemorrhage in preterm infants will add to our understanding of possible cause and the impact of its burden in our country. It may also help policy makers and stake holders to formulate strategies that aim at the prevention, early detection and management of prematurity related neonatal morbidities and mortalities. In addition, this has potential to further the cause to improve the care of these premature neonates by providing the appropriate platform for counseling of the parent/caregiver about prognosis and the need for early intervention.

2 Literature review

Germinal matrix hemorrhage is bleeding in the germinal matrix (which is defined as is a fine network of blood vessels and primitive neural tissue that lines the ventricular system in the subependymal layer during fetal life) below the subependymal layer and may be contained by the ependyma (GMH) or may rupture into the ventricular system (IVH) or less often into the adjacent parenchyma. GMH is a common event occurring primarily in premature infants less than 32 weeks' gestational age. The germinal matrix is rarely a site of hemorrhage after 32 weeks' gestation because it has almost disappeared. [1,2]

Although the incidence once was as high as 55%, most nurseries have experienced a significant drop in GMH due to advances in neonatal care. Recent reports of GMH and intraventricular hemorrhage now range from 10% to 25% in very-low-birth weight infants (≤ 1000 g) in most neonatal intensive care units mainly attributed to greater use of antenatal steroid prophylaxis [7, 23].

Multiple factors have been studied as causes for GMH. Although no single cause has been identified, common associations include prematurity with complications such as hypoxia, hypertension, hypercapnia, hypernatremia, rapid volume increase, and pneumothorax. Infants at greatest risk are those at gestational ages of less than 30 weeks, with birth weight less than 1500 g, or both full term infants rarely experience this type of hemorrhage. [1]

Germinal matrix is highly susceptible to pressure and metabolic changes, which can lead to rupture of the vessels. This periventricular region is selectively vulnerable to hemorrhage in premature infants predominantly in the first 48 h of life. IVH characteristically initiates in the periventricular germinal matrix. When the hemorrhage in the germinal matrix is substantial, the ependyma breaks, and the cerebral ventricle fills up with blood. Thus, IVH is typically a progression of germinal matrix hemorrhage [2].

Pathogenesis of IVH is multifactorial and is primarily ascribed to inherent fragility of the germinal matrix vasculature, disturbance in the cerebral blood flow and platelet and coagulation disorders [2].

The classification of GMH most widely used was proposed by Burstein et al [2,4]. Subependymal hemorrhage (Grade I hemorrhage) is germinal matrix hemorrhage contained by ependyma, often presenting as focal area of hemorrhage in the caudo-thalamic groove. Grade I hemorrhage may completely resolve, occasionally form subependymal cyst or may progress by

rupturing into the ventricles. The most common form of extension is directly into the ventricular system, occurring in about 80% of subependymal hemorrhages. With a grade I hemorrhage that does not extend into the ventricular system, the ventricles usually retain a normal size [7,1]. Intraventricular hemorrhage (Grade II hemorrhage) occurs when SEH bursts into the lateral ventricle, and it presents as hyperechoic clot that fills a portion of the ventricular system or all of a ventricle when the clot forms a cast of the ventricle. As the clot matures, it becomes echolucent centrally and better defined. Low-level echoes from debris floating in a ventricle may occur in IVH as the clot breaks apart. Use of the posterior fontanelle or axial views will increase the detection of IVH in normal-sized ventricles, because at times there are only small clots or CSF-blood fluid levels in the occipital horn.[1,17] Grade II hemorrhages may evolve to grade III lesions either by further hemorrhage distending the ventricular system or with the development of ventriculomegaly. A small amount of intraventricular hemorrhage without progression may cause focal or mildly diffuse, but rarely moderate, ventricular enlargement. However, with such non-progressive grade II hemorrhage, the ventricular system will generally evolve to a normal or mildly dilated status [7, 17]. Blood in the 3rd or 4th ventricle may be missed and is much more clearly diagnosed on posterior fossa ultrasound with mastoid views. If the blood extends into the cisterna magna, there is an increased risk for post hemorrhagic hydrocephalus. Cisterna magna clot is a better predictor of post hemorrhagic hydrocephalus than initial hydrocephalus. Early-onset IVH, in the first 6 hours of life, is uncommon and has been associated with a higher risk for both cognitive and motor impairment, including cerebral palsy [1,7]

Intraventricular hemorrhage with hydrocephalus (Grade III hemorrhage); IVH causes hydrocephalus, resulting in better definition of the clot and then the choroid plexus. Echogenic clot may be adherent to ventricular walls or may become dependent within the ventricle. Posterior fontanelle images may show IVH in the occipital horn in subtler cases. As with SEH, in time the echogenic clot will become more echolucent centrally and may eventually resolve. A chemical ventriculitis as a response to blood in the CSF typically causes thickening and increased echogenicity of the subependymal lining of the ventricle [1,17]. While the initial ventriculomegaly present with a grade III hemorrhage is generally from distension by hemorrhage, in short course, obstructive changes will lead to increased CSF volume within the ventricles. Post hemorrhagic hydrocephalus may require shunting if it is progressive. Typically, the most severe degree of hydrocephalus occurs after several weeks. As the blood clears from the

ventricles, particularly with a block at the aqueduct, the ventricular size may return to normal [1, 7]. In one series, post hemorrhagic ventricular dilation required surgical treatment with a ventriculoperitoneal reservoir or shunt in only 34% of very low birth weight (VLBW) infants with hydrocephalus [8].

Intraparenchymal hemorrhage (Grade IV), is IVH that extends into the brain parenchyma. Frontal and parietal lobe distribution is the most common site. Studies suggest that IPH is caused by hemorrhagic venous infarction, believed to be secondary to large SEH compressing subependymal veins [9, 10, 14]. Infants with parenchymal hemorrhage associated with GMH typically develop hemiparesis. Acutely, IPH appears as an echogenic homogeneous mass extending into the brain parenchyma. As the clot retracts, the edges form an echogenic rim around the center, which becomes sonolucent. The clot may move to a dependent position, and by 2 to 3 months after the injury, an area of porencephaly (if there is communication with the ventricle) or encephalomalacia develops [1,7,17]. Unusual types and sites of IPH, acute cystic changes, midline shift, and downward extension of hemorrhage into the thalamus may result from hemorrhage into PVL, secondary to infarction or thromboembolism, from a bleeding diathesis (e.g., vitamin K deficiency), hemophilia, alloimmune thrombocytopenia or Rh immune incompatibility and hypernatremia [11,12].

Potential pitfalls exist in the differentiation of a grade I from a focal grade II hemorrhage adjacent to the caudate nucleus, and in the identification of a small amount of intraventricular blood. However, follow-up examinations to evaluate for progressive hemorrhage or developing ventriculomegaly are indicated in both cases and should differentiate between the grade of hemorrhage on the basis of ventricular changes [7, 13]

Based on study done by Rumak et al, incidence of subependymal hemorrhage alone (Grade I) was reported to be 32%, 64% of patients had subependymal hemorrhage and intraventricular hemorrhage (Grade II-III) and 18% had Intraparenchymal hemorrhage. 36% of patients who had ICH developed hydrocephalus [15].

Knowledge of the timing and course of neonatal intracranial hemorrhage is essential in determining the etiology of hemorrhage, since the key to preventing neurologic damage in newborns is to define preventable causes and treat the complication of hemorrhage. Most hemorrhage (90%) occurs in the first 7 days of life, but only one third of these occur in the first 24 hours [1]. Study conducted by Rumak et al demonstrated that the initial hemorrhage occurred

in the first three days of life, with 36% occurring on day one, 32% on day two and 18% on day three. Most of the major hemorrhages (Grade III and IV) occurred on day one although ventricular enlargement occurred at a variable time after the initial insult. By sixth day, 91% of all intracranial hemorrhage has occurred [15].

Higher-grade hemorrhages are important to identify since these infants are at risk for developing hydrocephalus and neurodevelopmental delay compared with age and weight matched premature infants. The majority of the higher-grade (III–IV) hemorrhages occur in premature infants born at ≤ 26 weeks gestation. In contrast, studies have shown that premature infants with uncomplicated grade I or II intraventricular hemorrhage have similar outcomes to premature infants without IVH [16].

Sonography is the most effective method for detecting this hemorrhage in the newborn period and for follow-up in the subsequent weeks. US has been proven to be as accurate as CT in the diagnosis of ICH, particularly when ICH occurs in the typical subependymal and intraventricular regions [1, 15]. However controversy exists concerning the sensitivity and interobserver agreement of the various neonatal neuroimaging modalities, namely MR imaging, CT and cranial ultrasonography, in diagnosing GM/IVH in premature newborns. In a study conducted on 76 neonates with an estimated average gestation age of 35 wks who underwent US within 72hrs of CT or MR examinations, Blankenberg et al compared the efficacy of US relative to CT and MRI for the diagnosis of ischemia and hemorrhages and found that in 39% of neonates CT and MRI provided better confidence than US for the diagnosis of neonatal hemorrhage or ischemia and significantly better interobserver agreement with CT than with US for the detection of GM/IVH and cortical ischemia [18]. However, their study was small and there was no adequate representation of preterm infants in their study. Recent studies suggest that cranial US examination provides a relatively sensitive and highly specific means of detecting IVH and should be employed in screening preterm neonates for IVH and the interobserver agreement of CT is higher than US for the detection of IVH, and can detect extra-axial hemorrhages which are likely to be missed on US [19]. MRI is more helpful for better understanding of more subtle disabilities, importantly Cerebral palsy [20].

Chess et al conducted case-control study to develop a screening protocol using head ultrasound to detect high-grade intraventricular hemorrhage (IVH) in VLBW infants with greater specificity than current practice. He concluded that by using the new screening criteria for obtaining US

scans to screen for high-grade IVH, a large number of US scans showing normal anatomy or low-grade IVH were eliminated resulting in significant cost savings [16]. In contrast, Paul et al performed a case control investigation of two cohorts of VLBW infants and their data demonstrated that selective cranial sonography based on clinical risk factors would miss substantial number of cases of IVH in VLBW infants. On the bases of this investigation it is recommended that all VLBW infants receive a minimum of one cranial sonogram to rule out IVH and one follow up sonogram to diagnose cystic periventricular leukomalacia (PVL). Although more selective screening would eliminate a large number of sonograms, the sacrifice would be the failure to diagnose a substantial number of infants with brain injury [21].

The optimal cost-effective timing to screen premature infants is at 1 to 2 weeks of age, to identify patients with significant hemorrhage as well as those developing hydrocephalus. Small subependymal hemorrhages (grade I) might be missed when screening late if they resolve quickly, but these have not proven clinically important. A late screen for periventricular leukomalacia (PVL) should performed at 1 month to search for the cystic changes of PVL, because the clinical course or first brain ultrasound will not predict the later development of hydrocephalus or PVL. These predictors of the most severe neurologic outcome (PVL and ventricular enlargement) may be missed if the late screen is not done. An examination should be performed earlier if required by the patient's condition [15, 22, 1]

Limited numbers of studies were conducted in regional and local levels to assess the magnitude and prevalence of ICH. A study done in South Africa reported a prevalence of IVH to be 53% in VLBW neonates [24]. A study done in Lusaka, Zambia, showed the prevalence of IVH in preterm infants with birth weight 1,500 g and less was 34.2%. According to this study, subependymal hemorrhage (Grade I) was the most frequent (54.9%) followed by severe IVH (grade III and IV) at 27.5%. The case fatality rate was 85.7% for those with grade IV hemorrhage in the first three days of life. Grade II was the least prevalent at 17.7%. Risk factors significantly associated with IVH were birth weight and gestational age [25]. One can argue these two African studies are limited in a way that they failed to show the association between IVH and risk factors other than birth weight and gestational age.

In another study done in Nigeria, serial transfontanelle sonography (TUS) was performed on 300 preterm neonates admitted into a tertiary hospital in Lagos, where sonographic findings, relevant antenatal, perinatal, and postnatal history were obtained, with relevant tests of statistical

significance. In this study, 95 neonates (31.7%) had IVH, where 90.5% of hemorrhages occurred in the first week of life[28]. Incidence of IVH was higher in babies born at gestational age less than 32 weeks (41.8%) and birth weight less than 1,500 g (40.3%). This prospective, cross-sectional study demonstrated no statistical correlation between grades of IVH and the degree of prematurity [26].

In a study conducted at Tikur Anbessa Hospital, Addis Ababa, Ethiopia, all preterm babies admitted to the neonatal ICU from November 2000 to November 2001 were followed until discharge or death. There were 298 babies with birth weight of less than 2000 gm and gestational age of less than 36 weeks. 56 babies died (28%) and consent was obtained to perform autopsy examination on all of them. The mean gestational age was 31 weeks (with range of 26-35 weeks) and the mean birth weight was 1377 g (with range of 780-1900 g). Intra ventricular Hemorrhage (IVH) was seen in 18 preterm infants on autopsy examination (32%). 16 out of 18 of babies who had IVH (88.8%) were less than 1500 grams. All babies with IVH were in respiratory distress and required resuscitation. Recommendations were made to improve delivery services and neonatal intensive care unit services to reduce incidence of IVH in preterm babies [18]. The findings in this study were reported based on autopsy examination [27]. Although cranial sonography is the imaging modality of choice for early detection and subsequent follow-up of IVH in the newborn period, to date, there are no known reported studies on the prevalence and pattern of IVH in Ethiopia based on head ultrasound studies.

Complications of subependymal GM/IVH are intraventricular obstructive hydrocephalus and extraventricular obstructive hydrocephalus. Complications of intraparenchymal hemorrhage are permanent areas of damaged brain that can become necrotic, leading to porencephalic cysts [1]. Multiple studies have found strong association between severe CUS findings and adverse neurodevelopmental outcome such as CP, seizure and cognitive impairment. Long-term follow-up of the National Brain Hemorrhage Study (NBHS) cohort showed that parenchymal lesions or ventricular enlargement (PL/VE) on neonatal CUS were significantly associated with disabling cerebral palsy (CP) at 2 years and with poor motor abilities at 6 and 9 years. Severe cognitive impairment also was related to PL/VE [28]. Screening for the onset of hemorrhage and following the patient for complications may prevent late diagnosis of severe complications, thus decrease potential brain damage and ensuing neuro-developmental impairment.

3 OBJECTIVES

3.1 General objective

To determine magnitude and pattern and predictors of Intraventricular Hemorrhage in preterm infants admitted to NICU of SPHMMC.

3.2 Specific objectives

- To determine magnitude and pattern of IVH
- To identify associated factors of IVH

4 Methods and Materials

4.1 Study area and study period

The study was conducted at NICU of SPHMMC in Addis Ababa, Ethiopia. St. Paul's Hospital was built in 1961 by Emperor Haile Selassie in collaboration with the German Evangelical Church, as a source of medical care for underserved populations. It's the second largest hospital in the country with a catchment population of more than 5 million. Currently it has 392 beds, with an annual average of 200,000 patients. Approximately 75% of the patients receive medical services free of charge. It is under supervision of Federal Ministry of Health. It is capable of giving services for 24 hrs of a day. The annual number of deliveries is 10,150 in St Paul's Hospital Millennium Medical College. Almost all high risk neonates and all preterm neonates are admitted to NICU and evaluated by the NICU team. The NICU has resuscitation corner, incubators, radiant warmer, phototherapy unit, and exchange transfusion equipment. The unit lacks facilities for blood gas analysis and parenteral nutrition. The selection of the hospital is purposive for the reason that it has better organized manpower, services for neonates, client flow, and being part of the SIP Project with comparable follow up and treatment guideline for preterm neonates.

Study was conducted from February, 01, 2019 to July /31/2019

4.2 Study Design

Hospital based cross-sectional study with internal comparison will be used to determine magnitude, pattern and predictors associated with Intraventricular Hemorrhage.

4.3 Study Population

All neonates with estimated gestational age (EGA) less than or equal to 32 weeks and/or birth weight 1500 g and below admitted to SPHMMC's NICU (delivered at St. Paul hospital or catchment facilities) and who have transfontanelle ultrasound.

4.4 Eligibility criteria

4.4.1 Inclusion Criteria

- All neonates with gestational age of 32 weeks or less.
- All neonates with birth weight of 1500 g or less.

4.4.2 Exclusion Criteria

All neonates with gestational age greater than 32 weeks

4.5 Sample Size Determination

As it was a time limited prospective study, all available cases during the study period who met the inclusion criteria were included in the study due to limited number of cases. Accordingly, **97** neonates were recruited for the study.

Sample selection was done using purposive sampling techniques.

4.6 Data Collection tools and technique

Cranial sonography was performed for 97 preterm neonates after the first 48 hours age by a senior radiology resident using multifrequency, 5-7.5 MHz, transducer to obtain standard images in sagittal and coronal planes through the anterior fontanelle. Posterior sagittal and coronal views were obtained via the posterior fontanelle, whenever required. Specific questions were addressed using the American College of Radiology (ACR) Practice Guideline for the Performance of Neurosonography in Neonates and Infants. Templates were used for reports using standard protocols to ensure what needs to be covered will not be forgotten. The Sonographic findings in each neonate were documented by the principal investigator using a proforma and in their respective case notes. The age at which IVH was diagnosed was recorded and maximum grade of haemorrhage also determined using the Papille Grading system[35] as outlined in [table 1](#).

Data was collected from the medical records and by interviewing the mothers. The data collectors were trained residents who are working in the study area. They collect the data using semi structured and pre-tested questionnaire. Most of the items were adapted from existing literatures. Questionnaire was used to collect data after being pre-tested before the study period. Modification of the questioner was done based on the pre-test and the pre-test questionnaires will not be included in the study. The questionnaire has 3 parts including socio-demographic factors of the mother, reproductive history, and perinatal events and birth outcome. The wording and sequence of questions were designed in such a way that the logical flow of ideas is from general to specific. The principal investigators supervise the data collectors.

Table 1 Papille Grading System of IVH

Grade	Radiological appearance - Site of haemorrhage
1	Subependymal region and/or germinal matrix (less than 10% ventricular extension)
2	Subependymal haemorrhage with extension into the lateral ventricles filling without or with mild ventricular enlargement (10 - 50% ventricular filling)
3	Subependymal haemorrhage with extension into the lateral ventricles with significant ventricular enlargement (more than 50% ventricular filling)
4	Intraparenchymal haemorrhage

4.7 Study Variables

4.7.1 Dependent variable

Intraventricular Hemorrhage in preterm newborns

Type (Pattern) of Intraventricular Hemorrhage in preterm newborns

4.7.2 Independent variables

Maternal age

Maternal parity

Maternal marital status

Maternal educational status

Maternal weight

Neonatal weight

Neonatal gestational age

Fetal presentation

Duration of labor

Duration of rupture of membrane

Mode of delivery

Neonatal resuscitation

4.8 Data processing & analysis

After data collection, each questionnaire was checked for completeness based on the code given during data collection. Data was entered in to SPSS version 20. Coding of individual questionnaires was checked before data entry in to the software. Further, data cleaning was performed to check for outliers, missed values and any inconsistencies before the data was analyzed using the software. Descriptive statistics like frequency tables, graphs and descriptive

summaries were used to describe the dependent and independent variables. Bi-variate and multivariate logistic regression was done to see the association between dependent and independent variables. A confidence limit of 95% and p- value less than 0.05 was used as cut of point to see presence of statistical significance. To control the effect of confounding variables stepwise multiple logistic regression analysis was done and adjusted odds ratios (AORs) were used to explore the real association. Chi-square and Fisher exact test was also used for categorical variables.

4.9 Data Quality Assurance

Data was collected by using a pre-tested questionnaire in the NICU unit. It was adopted from different studies. The data collectors were trained on the structured questionnaire until they became well conversant with the instrument. Every day, all of the collected data were reviewed and checked for completeness and relevance by the principal investigator and continuous supervision was arranged to control the data collection procedure and all the data from NICU were checked for completeness, clarity and consistency by the principal investigator during the data collection days. Data was intensively cleaned before any analysis.

4.10 Result Dissemination Plan

Data will be analyzed and important conclusions and recommendations will be generated. The results of the research will be presented to department of Radiology and Pediatrics and child health. Findings will also be presented on different conferences and professional society meetings. The findings will also be published in a relevant scientific journal and disseminated online. The data will also be used as a base line for future studies and interventions.

4.11 Ethical Considerations

During the data collection the aim of the study was explained to all the study participants and informed written consent will be obtained. Participants were given adequate time to go through the consent form if they are literate. When they are not literate data collectors read the forms for them. Participants were informed that they will be free to withdraw at any time without giving reasons. A decision not to participate was respected and the participants were assured that non-participation would not affect the health care their babies receive in anyway.

4.12 Operational Definitions

Preterm birth: Neonate born at gestational age of less than 37 weeks.

AGA: Birth weight for gestational age between 10-90%

SGA: Birth weight for gestational age < 10%

LGA: Birth weight for gestational age > 90%

Term birth: >37 completed weeks

Low birth weight: birth weight between 1500grams and less than 2500gm

Very low birth weight: Birth weight between 1000grams and less than 1500grams

Extremely low birth weight: Birth weight less than 1000grams

Intracranial hemorrhage: pathological accumulation of blood in the cranial vault.

Intraventricular hemorrhage: bleeding in the developing region of the brain which regresses by term.

5 RESULTS

5.1 Sociodemographic characteristics of mothers and neonates

The study included 97 preterm neonates of which 45(46.4%) were males and 52(53.6%) were females (1:1.2 ratio). The mean maternal age was 25.62($\pm$ 4.0) years ranging from 18 to 36 years. Sixty-two mothers (63.9%) were given antenatal steroid(dexamethasone). Seventy-eight neonates (80.4%) were born at SPHMMC while 19 neonates (19.6%) were out born.

The mean postnatal age at screening was 7.0($\pm$ 3.5) days ranging from 2 to 14 days. The gestational age at birth ranged between 26 and 35 completed weeks. The mean birth weight was 1291grams which ranged between 780 and 1700grams. (see [table 2](#))

Table 2 Perinatal variables of neonates attending St Paul Hospital Millennium medical college Feb 2019 Addis Ababa, Ethiopia.

Characteristics	Minimum	Maximum	Mean	Std. Deviation
Gestational age(weeks)	26	35	31.05	1.917
Birth weight(grams)	780	1700	1291.34	211.313
Screening age(days)	2	14	7.04	3.509

Seventy-four (76.3%) of the recruited preterm neonates were delivered at gestational age of less or equal to 32weeks and 23(23.7%) of them were born at GA>32 weeks. Eighty-one (83.5%) of these neonates had birth weight less than or equal to 1500grams while the birth weights of 16(16.5%) neonates were >1500grams. Seventy-three (75.3%) of the neonates were appropriate for gestational age and 24(24.7%) of the neonates were small for gestational age. (See [table 3](#))

5.2 Magnitude and severity of Intraventricular Haemorrhage

The overall incidence of IVH in this study was 35.1%(34 neonates) and of the 45 male neonates recruited 19(42.2%) had IVH while of the 52 females 15(28.8%) had IVH. However, there was no statistically significant difference($p=0.169$) in the proportion of males to females with IVH when the Chi square test was used.

Table 3: Sociodemographic characteristics of newborns (N=97) attending St Paul Hospital Millennium medical college Feb 2019 Addis Ababa, Ethiopia.

Characteristics		Frequency	Percent (%)
Sex	Male	45	46.4
	Female	52	53.6
Gestational age(weeks)	<28weeks	3	3.1
	28-32 weeks	71	73.2
	>32 weeks	23	23.7
Birth weight	<1000grams	11	11.3
	1000-1500grams	70	72.3
	>1500grams	16	16.5
Birth weight for gestational age	AGA	73	75.3
	SGA	24	24.7
Newborn resuscitation	Yes	16	16.5
	No	81	83.5
Mode of delivery	SVD	51	52.6
	C/S	46	47.4
Antenatal steroid	Given	62	63.9
	Not given	35	36.1
Place of delivery	SPHMMC	78	80.4
	Out born	19	19.6

The incidence of IVH among preterm neonates delivered at GA less or equal to 32weeks was 39.2% and in those neonates who were born at GA>32weeks was 21.7%. (**Table 4**)

The incidence in those with birth weights less than or equal to 1500 grams was 34.6% and for those with birth weight of >1500grams was 37.5 %.(**Table 5**)

Table 4 Frequency of IVH per group of gestational age attending St Paul Hospital Millennium medical college Feb 2019 Addis Ababa, Ethiopia.

Gestational age(weeks)		transfontanel US		Total
		Normal	IVH	
	≤32	45	29	74
	>32	18	5	23
Total		63	34	97

Among the 34 neonates who had IVH, 29(85.3%), and 28(82.4%) of them were delivered at or below 32 weeks of GA, and had birth weight of 1500grams or less respectively.

Table 5 Frequency of IVH per group of birth weight attending St Paul Hospital Millennium medical college Feb 2019 Addis Ababa, Ethiopia.

Birth weight(grams)		transfontanel US		Total
		Normal	IVH	
	≤1500	53	28	81
	>1500	10	6	16
Total		63	34	97

. Grade 1 IVH was the most common(47.1%) followed by grade 2 IVH at 29.4%. This made mild IVH (grade 1 and grade 2) 76.5% of the total IVH cases detected. Grade 3 IVH was the

third common at 20.6% and grade 4 IVH was the least making 2.9%. Among patients who had grades 1,2 and 3 IVH ,81.3%, 90% and 100% of them occurred at GA of 32weeks or below respectively. There was only one neonate with grade 4 IVH and the GA was >32weeks. Similarly, those neonates with birth weights of 1500grams or below and who had grades 1,2,3 and 4 IVH were 75%,90%,85.7% and 100% respectively. (Table 6)

Table 6 Grades of IVH per groups of GA and birth weight attending St Paul Hospital Millennium medical college Feb 2019 Addis Ababa, Ethiopia.

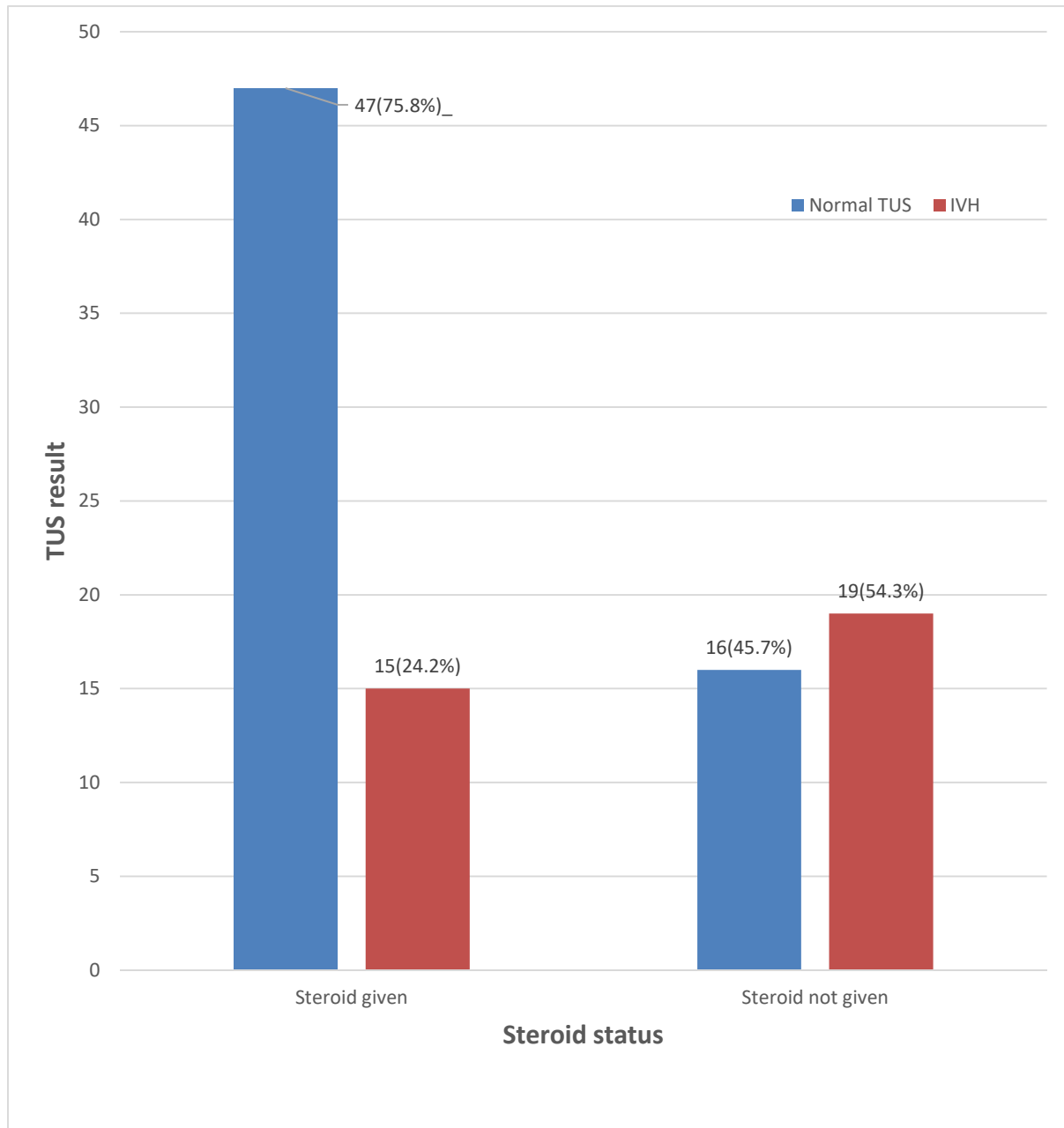
Variables		IVHGrade IVH grade			
		grade 1	grade 2	grade 3	grade 4
GA(weeks)	≤32	13	9	7	0
	>32	3	1	0	1
Birth weight(grams)					
		12	9	6	1
		4	1	1	0
<1500					
>1500					

Chi square and Fisher's Exact Tests were used to test for any significant associations between the dependent variable (magnitude of IVH) and independent variables. However, there were not significant associations between magnitude of IVH and gestational age($p=0.202$), sex($p=0.169$), birth weight($p=0.086$) and mode of delivery($p=0.079$). Among the inborn neonates 30.8% of them had IVH while 52.6% of the out born neonates had IVH, but this difference was not statistically significant($p=0.073$).

The percentage of IVH in those neonates whose mothers were given antenatal steroid was 24.2% while 54.3% of neonates whose mothers were not given steroid had IVH. This was statistically

significant reduction in the magnitude of IVH ($RR=0.45, 95\%CI\ 0.26-0.76$) among the neonates whose mothers were given antenatal steroid. (Figure 1)

Figure 1: Relationship between antenatal steroid administration and magnitude of IVH attending St Paul Hospital Millennium medical college Feb 2019 Addis Ababa, Ethiopia.



6. DISCUSSION

The main aim of this study was to determine the magnitude and severity of IVH in VLBW and/or very preterm neonates admitted to the NICU of SPHMMC from February,2019 to July,2019.

In developed countries, IVH has current incidence of about 30% in VLBW infants. These rates are expected to fall with continued obstetrics and neonatal care such as administration of antenatal corticosteroid and post-natal surfactant [10]. The few studies from developing countries have reported figures ranging from 50% in South Africa and Hong Kong to almost 100% in Malaysia [31]. The data from developing countries are difficult to compare with one another or with data from developed countries because of the differences in neonatal practices as a result of the prudent utilization of limited resources.

In our study, the magnitude of IVH (35.1%) is comparable to most studies in developing countries but higher than developed countries. The study found result that is slightly higher than what was found in Zambia (34.2%) but lower than those found in Nigeria (41.8%) and Iran (64.4%) [7,28,31,32]. In resource-limited settings, one may propose that non-availability of means to investigate for appropriate risk factors and intervene appropriately or adopt measures proved to be effective in other settings, may be the reason the rates of severe IVH have remained unchanged[7]. This may also be true for SPHMMC where this study was conducted.

In Ethiopia, there are limited studies done assessing the magnitude and associated risk factors of intraventricular hemorrhage in preterm infants. Based on our search, only one published study was found assessing the occurrence of intraventricular hemorrhage in preterm newborns on autopsy examination at Tikur Anbessa Specialized Hospital [18]. According to this study, IVH occurred on 36.4% of cases in preterm infants with birth weight of <1500 gm and gestational age of <32 weeks which is slightly higher than the result found in our study.

The study also revealed that the severity (grade 1 to 4) of IVH to be 47.1%,29.4%,20.6% and 2.9% respectively. Accordingly, the most frequent grade of IVH observed in this study is grade I, making 47.1% of the 34 IVH cases, and the site of haemorrhage being subependymal germinal matrix overlying the caudothalamic groove. The pattern of grades of IVH in this study is the same as those in previous studies [28].

Papile et al from their study concluded that IVH in preterm neonates classically emanates from small vessels, principally capillaries in the subependymal germinal matrix, which is a richly vascular structure and is more pronounced in the 24 -32 weeks old fetus[30].

In our study, although 85.3% and 82.4% of IVH occurred in very preterm (32weeks or less) and VLBW babies respectively, the statistical association is not significant. The magnitude of IVH was also much higher in out born neonates (52.6%) than those who were born at SPHMMC (30.8%) which could be explained with the presence of multiple risk factors such as lack of antenatal corticosteroid administration, respiratory distress, hypothermia and hypovolemia during transportation. Almost all mothers of the out born neonates did not receive antenatal corticosteroid(dexamethasone). It is known that administration of antenatal corticosteroid for mothers at risk of preterm labor and delivery has proven benefit in decreasing the risk of IVH [10]. The effect of antenatal corticosteroid administration in decreasing the magnitude of IVH was also statistically significant in our study (RR=0.45,95%CI 0.26-0.76).

In this study, the median age of screening TUS was about 7 days but it does not reflect the exact time of IVH evolution because serial screening starting from birth and follow up TUS was not done.

Multivariate logistic regression analysis to test for the associated risk factors of IVH was not done in this study due to the limited cross sectional study nature which resulted in small sample size.

STRENGTH AND LIMITATIONS OF THE STUDY

Strengths of the study

- All the data were prospectively collected by the principal investigators and trained residents who were capable of identifying all the necessary information.
- The result can serve as a baseline data for further longitudinal studies.

Limitations

- As it was point prevalence cross sectional study, patients who had IVH were not followed for their outcomes.
- Time of evolution of IVH was not followed by serial TUS scanning starting from birth.

- It was also difficult to identify some of the findings using the bedside ultrasound. We were forced to transport some of the neonates down to the radiology department for a better machine.
- This study was not able to examine the association between intraventricular hemorrhage and its various risk factors due to small sample size.

7. CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

In our study we found intraventricular hemorrhage with magnitude of 35.1% which is higher than that in developed countries. Grade 1 IVH was the most common at 47.1%. We also identified that administration of antenatal corticosteroid significantly decreased the magnitude of intraventricular hemorrhage. However, further longitudinal study with adequate sample size is required to determine magnitude, severity and risk factors of IVH.

7.2. Recommendations

1. The magnitude of IVH in very preterm and/or VLBW neonates is high. Therefore, all very preterm/VLBW neonates should be serially scanned.
2. Antenatal steroid administration significantly decreases magnitude of IVH. Hence, antenatal steroid should be administered to pregnant women at risk for preterm delivery.
3. More longitudinal research is needed to determine factors associated with IVH in preterm babies and their outcomes.

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List of annex

. No.	Parameters	Coding categories	Code
1.	Parity	Primi-para	1
		Multipara	2
2.	Maternal weight	Pre-pregnancy	
		Gain during pregnancy	
3.	ANC follow up	Yes	1
		No	2
4.	If the mother has ANC follow up specify the no of Visits		
5	Onset of labor	Spontaneous	1
		Induced	2
		Elective C/S (without onset of labor)	3
6.	If the answer for the above question is C/S specify the indication		
7.	Fetal presentation	Face	1
		Breech	2
		Vertex	3
		Others (specify)	4
8.	Duration of labor (in hrs)		
9.	Duration of rupture of membrane hrs	<18hrs	1
		≥18hrs	2
10	Mode of delivery	SVD	1
		Forceps assisted	2
		Vacuum assisted	3
		Assisted breech	4
		C/S	5
11	Antenatal steroid	Given	1
		Not given	2
12	Place of delivery	SPHMMC	1
		Other facility	2
		Home	3
13.	Maternal/obstetric complications	None	1
		Chorioamnionitis/infection	2
		Hemorrhage/bleeding disorder	3
		Fetal distress	4
		Cord accident	5

Annex 1.1: English questionnaire

Code: _____

Date: _____

Part I: Socio-demographic characteristics of the mother

S. No.	Parameters	Coding categories	Code
1	Age in years		
2.	Card No.		
3.	Address		
4.	Religion	Orthodox	1
		Muslim	2
		Catholic	3
		Protestant	4
		Other (specify)	
5.	Marital status	Married	1
		Divorced	2
		Widowed	3
		Others	
6.	Educational level	Illiterate	1
		Primary education	2
		Can read and write	3
		Secondary education	4
		Tertiary and above	5
7.	Current occupation	Unemployed	1
		Daily laborer	2
		Government employee	3
		Private employee	4
		House wife	5

Part II: Reproductive and Obstetric History

Part III. Neonatal Out Come

S. No.	Parameters	Coding categories	Code
1.	Sex	Male	1
		Female	2

	Birth weight	Macrosomia (>4kg)	1
		NBW(2500gm-4000gm)	2
		LBW(1500-2499gm)	3
		VLBW(1000-1499gm)	4
		ELBW<1000gm	5
2.	Gestational age	Term(37-42wks)	1
		32 to 36wks&6days	2
		28-32weeks	3
		<28weeks	4
	APGAR score	1 st min	
		5 th min	
3.	Newborn resuscitated	Yes	1
		No	2
4.	Vitamin K Given	Yes	1
		No	2
5	Admission diagnosis/complication	Asphyxia	1
		Sepsis/infection	2
		RDS/HMD	3
		Hypovolemic shock	4
		Coagulation/bleeding abnormalities	5
		Other	6
6	Transfontanelle ultrasound(TUS) result	Normal	1
		Abnormal	2
7	If TUS was done and IVH was found,what is the grade?	Grade I	1
		Grade II	2
		Grade III	3
		Grade IV	4

Annex 1.1: Amharic questionnaire (የአማርኛ ቃለ መጠይቅ)

: _____

: _____

I:

S. No.	Parameters	Coding categories	Code
1	እድሜ (በዓመት)		
2.	የህክምና ካርድ ቁጥር		
3.	አድራሻ		
4.	ሐይማኖት	ኦርቶዶክስ	1
		ሙስሊም	2
		ካቶሊክ	3
		ፕሮቴስታንት	4
		ሌላ(ግለጽ)	
5.	የትዳር ሁኔታ	ያገባች	1
		የተፋታች	2
		ባል በሞት የተለያት	3
		ሌላ(ግለጽ)	
6.	የትምህት ደረጃ	ፊደል ያልቆጠረች	1
		የመጀመሪያ ደረጃ	2
		መጻፍ እና ማንበብ	3
		ሁለተኛ ደረጃ ት/ት የተማረች	4
		ኮሌጅ እና ከዛ በላይ	5
7.	የስራ ሁኔታ	ስራ የሌላት	1
		የቀን ሰራተኛ	2
		የመንግስት ተቀጣሪ	3
		የግል ስራ	4
		የቤት እመቤት	5

S. No.	Parameters	Coding categories	Code
1.	Parity (□□□□ □□□ □□)	Primi-para/□□□□□□ □□	1
		Multipara /□□□□□ □□□ □□□	2
2.	የእናት ክብደት መጠን	ከ እርግዝና በፊት	
		በ እርግዝና ወቅት የጨመረችው	
3.	የእርግዝና ክትትል	አላት	1

□□□ ለ: □□□ □□□□□ □□□ □□□

		የላትም	2
4.	የ ላይኛው ጥያቄ መልስ አዎ ከሆነ ስንት ጊዜ ለእርግዝና ክትትል የጤና ተቋም ጎበኝቶ: በቁጥር ይገለጽ		
5	ምጥ እዴት ጀመራት	በራሱ ሰአት	1
		በምጥ ማምጫ መድሃኒት	2
		ምጥ ሳይጀምር በአጥፊነት	3
6.	የ ላይኛው ጥያቄ መልስ በአጥፊነት ከሆነ ምክንያቱን ግለጽ		
7.	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ /Face	1
		☐ ☐ ☐ /Breech	2
		☐ ☐ ☐ ☐ ☐ /Vertex	3
		☐ ☐ (☐ ☐ ☐)	4
8.	ምጥ የቆየበት ሰአት		
9.	የእንሽርት ውሀው ፈስሶ ልጅ ከመወለዱ በፊት ለስንት ሰአት ቆየ	☐ 18 ☐ ☐ ☐ ☐ ☐ ☐ ☐	1
		18 ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	2
10	Mode of delivery	☐ ☐ ☐ ☐ ☐ ☐ /(☐ ☐ ☐ ☐ ☐ ☐)	1
	(☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ /(☐ ☐ ☐ ☐)	Forceps / ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	2
		Vacuum / ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	3
		☐ ☐ ☐ ☐ ☐ ☐	4
		ሌላ(ግለጽ)	5

ANNEX 2

Consent form

Parent's/ Care giver's information document

Dear participants!

My name is -----, I am currently a member of data collectors for a research which is conducted by Drs. Namrud Shiferaw and Kindu Agmas, (3rd year radiology and pediatrics residents respectively), on the study intended to assess the "**Magnitude of intraventricular hemorrhage in newborns born below 32 weeks of gestational age at Saint Paul's Hospital Millennium Medical College**" which is expected to forward recommendations to improve the care we provide. You are invited to participate on this project. If you are willing to participate on this project, you need to understand and sign the agreement form. You do not need to write your name on the form, and the results obtained will be kept confidential by using coding system.

Procedure:

We invite you to participate in this project. If you are willing to participate in this project, you need to understand and sign the agreement form. You do not need to write your name on the form and all your responses and the results obtained will be kept confidentially by using coding system whereby no one will have access to your response.

Risk/Discomfort:

By participating in this research project, you may feel that it has some discomfort especially on wasting time about 20 minutes. We hope you will participate in the study for the sake of the benefit of the research result. There is no risk in participating in this research project.

Benefits:

If you participate in this research project, there may not be direct benefit to you but your participation is likely to help us to meet the research objective.

Incentives:

You will not be provided any incentives or payment to take part in this project.

Confidentiality and privacy

The information collected from this research project will be kept confidential. Information will be stored in a file, without your or the neonate's name, only code number is used. It will not be revealed to anyone except the principal investigator and it will be kept locked with key.

Right to refuse or withdraw:

You have full right to refuse from participating in this research. Refusal to participate will not affect the quality of care the neonate will receive. You have also full right to withdraw from this study at any time you wish without losing any of your right.

Person to contact:

This research project was reviewed and approved by the IRB saint Paul's hospital millennium medical college. If you have any question you can contact the investigator

Contact address of principal investigator: -

Dr. Namrud Shiferaw

Tell: 0912052636

Email: namrudy@gmail.com

Informed consent: I hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating voluntarily in the research project. I understand that I am at autonomy to withdraw from the project at any time.

Signature of participants_____ date _____

Name and signature of data collector_____ date _____

የስምምነት መግለጫ

የወላጅ/የአስታማሚ መረጃ ሰነድ

ውድ ተሳታፊዎች

_____ እባላለሁ። የ3ኛ አመት □□□□ □□□□ ሐኪም □ሆነው ዶ/ር □□□□ □□□□ □□ የህፃናት ህክምና ተማሪ ሐኪም □ሆነው ዶ/ር ክንዱ አግማስ ለሚያካሂደው ጥናት መረጃ ከሚሰበሰቡት ሰዎች ውስጥ ነኝ። ጥናቱ በቅ/ጳ/ሆ/ሚ/ሜ/ኮ/ያለጊዚያቸው በሚወለዱ ጨቅላ ህጻናት ላይ የሚከሰተውን የጭንቅላት ውስጥ ደም ፍሰት የስርጭት መጠን ለማጥናት ያተኮረ ነው። እርስዎም የህክምና አገልግሎትን ለማሻሻል እንደሚያግዝ በታመነበት በዚህ ጥናት እንዲሳተፉ ተጋብዘዋል። በዚህ ጥናት ለመሳተፍ ፈቃደኛ ከሆኑ ይህንን የስምምነት ቅጽ ተረድተውና ተስማምተው ይፈርማሉ። በቅጹ ላይ ስምዎን እንዲፅፉ አይጠበቅም። የጥናቱ ውጤትም የመለያ ኮድ ተሰጥቶት በሚስጥር የሚያዝ ይሆናል።

የጥናቱ ጉዳት አልባነት

የዚህ ጥናት አላማ የጭንቅላት አልትራሳውንድ በመስራት የሚከናወን ስለሆነ እርስዎ በዚህ ጥናት ለመሳተፍ በመስማማትዎ በጨቅላ ህጻኑ ላይ የሚፈጠር ተጨማሪ ህመምም ሆነ አላስፈላጊ የህክምና ሂደት አይኖርም።

ጠቀሜታ

እርስዎ በዚህ ጥናት በመሳተፍዎ የሚያገኙት ቀጥተኛ ጥቅም ባይኖርም ተሳትፎዎ የጥናቱን አላማ ለማሳካት ይረዳል።

ማበረታቻ

በዚህ ጥናት መሳተፍ ማበረታቻ ወይም ክፍያ አያስገኝም።

የመረጃው ግላዊነት

በዚህ ጥናት የሚሰበሰበው መረጃ የእርስዎ ወይም የህፃኑ ስም ያልተጠቀሰበት መለያ ኮድ ተሰጥቶት ተጠብቆ የሚቀመጥ ሲሆን ከአጥኚው በስተቀር ለሦስተኛ ወገን ይፋ አይደረግም።

በጥናቱ ያለመሳተፍ መብት

እርስዎ በዚህ ጥናት ያለመሳተፍ መብት መብት ያለዎት ሲሆን ያለመሳተፍዎ ለህፃኑ በሚሰጠው ህክምና ላይ የሚያሳድረው ተፅዕኖ አይኖርም።

ጥያቄ የሚቀርብለት አካል

ይህ ጥናት በሚመለከተው የሆስፒታሉ አካል እውቅና ያገኘ ሲሆን ለሚኖርዎት ማንኛውም ጥያቄ ከዚህ በታች በተገለፀው አድራሻ አጥኚውን ማግኘት ይቻላል።

የአጥኚው አድራሻ

ዶ/ር □□□□ □□□□

ስልክ ቁ. 0912052636

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ፈቃደኝነት

የዚህን ሰነድ ይዘት፣ የጥናቱን ሁኔታና በጥናቱ ያለመሳተፍ መብት ያለኝ መሆኑን ተረድቼ በጥናቱ ለመሳተፍ መስማማቴን አረጋግጣለሁ።

የተሳታፊ ፊርማ _____ ቀን _____

የመረጃ ሰብሳቢ ስምና ፊርማ _____ ቀን _____

REASERCH APPROVAL

This research by ----- (principal investigator) is accepted in its presented form by examiners in satisfying research requirement for the Specialty certificate in radiology.

EXAMINERS

FULL NAME	RANK	SIGNATURE	DATE
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1. _____	_____	_____	_____
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2. _____	_____	_____	_____
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