An-Najat : Jurnal Ilmu Farmasi dan Kesehatan
Vol.1, No.4 November 2023
e-ISSN: 2987-4793; p-ISSN: 2987-2987, Hal 29-39
DOI: https://doi.org/10.59841/an-najat.v1i4

Vaginal Delivery Management of Hydrocephalic Fetuses in Wonosari Hospital : Case Report

Adzka Fahma Rodliya
Universitas Gadjah Mada

Resa Paksi Mandariska
Universitas Gadjah Mada
Alamat: Bulaksumur, Caturtunggal, Kec. Depok, Kabupaten Sleman, Daerah Istimewa Yogyakarta
Korespondensi penulis: adzkafahmarodliya@gmail.com

Abstract. *Fetal hydrocephalus is a congenital abnormality, which means the fetus is born with it, but babies and children can also experience it. Hydrocephalus pregnancy can trigger premature labor and can cause fetal distress. A 30 year old mother, G3P2A0, gestation age 34 weeks 4 days, was referred to Wonosari Hospital with diagnosis of Partus Prematurus Iminens (PPI), fetal hydrocephalus, and fetal distress. Based on the history of pregnancy examination at 24 weeks, the Biparietal Diameter (BPD) size of the fetal head was larger than the normal size, (5.94 cm), the fetus indicated ventriculomegaly, and on the third trimester ultrasound examination (32 weeks) the Biparietal Diameter (BPD) size is 9.49 cm so that the fetus is indicated for congenital hydrocephalus. The baby was born spontaneously, male, birth weight 2000 grams, body length 38 cm, head circumference 34 cm, chest circumference 24 cm, upper arm circumference 10 cm, born without crying, negative muscle tone, pale bluish skin color. From the results of this examination, it was confirmed that he was suffering from congenital hydrocephalus based on the physical appearance of the head, which was larger than the normal head size of premature babies in general, and dead..*

Keywords: *Congenital abnormality,hydrocephalus, premature.*

Abstrak. Hidrosefalus janin merupakan kelainan bawaan yang berarti janin dilahirkan dengan penyakit tersebut, namun bayi dan anak juga bisa mengalaminya. Kehamilan hidrosefalus dapat memicu persalinan prematur dan dapat menyebabkan gawat janin. Seorang ibu berusia 30 tahun, G3P2A0, usia kehamilan 34 minggu 4 hari, dirujuk ke RSUD Wonosari dengan diagnosis Partus Prematurus Iminens (PPI), hidrosefalus janin, dan gawat janin. Berdasarkan riwayat pemeriksaan kehamilan minggu ke 24, ukuran Diameter Biparietal (BPD) kepala janin lebih besar dari ukuran normal, (5,94 cm), janin terindikasi ventrikulomegali, dan pada pemeriksaan USG trimester III (32 minggu) ukuran Diameter Biparietal (BPD) 9,49 cm sehingga janin terindikasi menderita hidrosefalus kongenital. Bayi lahir spontan, berjenis kelamin laki-laki, berat lahir 2000 gram, panjang badan 38 cm, lingkar kepala 34 cm, lingkar dada 24 cm, lingkar lengan atas 10 cm, lahir tanpa menangis, tonus otot negatif, warna kulit pucat kebiruan. Dari hasil pemeriksaan tersebut dipastikan menderita hidrosefalus kongenital berdasarkan penampakan fisik kepala yang lebih besar dari ukuran kepala normal bayi prematur pada umumnya, dan meninggal.

Kata Kunci : Kelainan kongenital, hidrosefalus, prematur .

INTRODUCTION

Hydrocephalus sufferers have Cerebrospinal Fluid (CSF) abnormalities in the ventricles or subarachnoid. Normally the fluid should flow through the ventricles and out of the cisterns (small reservoirs) located at the base of the brain. This fluid functions to distribute food and remove metabolic waste products from the brain through the blood vessels. Apart from these problems, this disease is also caused by excessive production of CSf due to abnormalities in the womb or what are usually called congenital abnormalities. This causes increased intracranial pressure in the skull and causes the head to enlarge, the sutures to stretch, the bones

Received: 20 Juli 20023, Revised: 31 Agustus 2023, Accepted: 30 September 2023
Adzka Fahma Rodliya, adzkafahmarodliya@gmail.com

of the head to become thin, brain tissue to be compressed and mental defects, in severe cases it can cause death (Alluhaybi, Altuhaini, and Ahmad 2022).

The incidence of congenital hydrocephalus ranges from 0.3 to 1 per 1000 births in the world (Van Landingham et al., 2009). There are several factors that influence the occurrence of congenital hydrocephalus, namely, maternal age that is too young (<20 years), radiation exposure, contact with infectious agents, smoking, drug consumption, twins, diabetes in pregnancy, heredity, low sociodemographics, and pre-eclampsia. Pre-eclampsia is a risk factor 3 times greater than other risk factors (Scala et al. 2017). Low economic income or low sociodemographics indirectly causes congenital hydrocephalus, where 94% of congenital abnormalities occur. These risk factors are also related to lack of access to sufficient and nutritious food for pregnant women, increased exposure to agents or factors such as infection, alcohol, and low levels of health service screening. A gestational age that is too young, namely less than 20 years, is a risk factor for congenital abnormalities such as hydrocephalus. This is because the mother's age is too young for pregnancy which can increase the occurrence of chromosomal abnormalities, and can cause abnormalities such as Down Syndrome and hydrocephalus (World Health Organization (WHO) 2023).

A hereditary history of hydrocephalus is also a significant risk factor for the occurrence of congenital hydrocephalus. This is related to inherited genes creating an anomalous code that suddenly changes the genetic structure, which is called a mutation. Consanguineous relationships also double the risk of prevalence of congenital hydrocephalus. The mother's health history of diabetes mellitus is also a risk factor for congenital hydrocephalus. Based on experimental studies, it shows that hyperglycemia is the main teratogenic in diabetic pregnancies, which affects fetal outcomes, one of which is fetal malformations such as hydrocephalus (Allen and Armson 2007).

In general, fetal hydrocephalus is a congenital abnormality, which means the fetus is born with it, but babies and children can also experience it. There is no specific cause of congenital hydrocephalus. However, it is usually related to a genetic defect, or is the result of another disorder such as spina bifida or encephalocele (sac-like protrusion of the brain). Congenital hydrocephalus usually appears due to obstruction to the normal flow of hydrocephalic fluid (Van Landingham et al. 2009). Congenital hydrocephalus is divided into communicating and non-communicating hydrocephalus. Communicating hydrocephalus occurs due to excess production of cerebrospinal fluid (rare) and impaired absorption of cerebrospinal fluid (most common). Noncommunicating hydrocephalus occurs when the flow of cerebrospinal fluid is

obstructed in the ventricular system or in the outlet to the arachnoid space, resulting in a decrease in cerebrospinal fluid from the ventricles into the subarachnoid space (Fox et al. 2018).

Hydrocephalus can be caused by ventriculomegaly which is defined as pathological dilatation of the brain's ventricular system due to increased pressure which is usually caused by obstruction. Fetal cerebral ventriculomegaly was defined when the atrial diameter was ≥10 mm on prenatal ultrasound examination. The atrium of the lateral ventricle is the junction between the posterior end and the temporal end. The atrial diameter will remain stable at 15-40 weeks of gestation. The average diameter of the lateral ventricles is reported to range from 5.4 – 7.6 mm, and a measurement of 10 mm is 2.5-4 mm above average. The results of an ultrasound measurement that is <10 mm must be considered normal. Ventriculomegaly categories include mild (10-12 mm), moderate or moderate (13-15 mm), and severe (>15 mm), where the possibility of worsening fetal outcomes due to other abnormalities is higher when the ventricular measurement results are 13-15 mm. Ventriculomegaly is a medical term used to describe enlargement of the ventricles of the brain (Sethna et al. 2011). Hydrocephalus pregnancy can trigger preterm labor. Apart from triggering premature labor, a continuing hydrocephalus pregnancy can cause fetal distress (Tully, Capote, and Saltzman 2015).

CASE PRESENTATION

A female 30 years old, G3P2A0, gestation age 34 weeks 4 days, came to practicing midwife because she had been feeling tight. Examination was done with the results of a calm vulva, urethra, smooth vaginal walls, thick portion, opening 2 cm, blood mucous gloves positive, amniotic fluid negative. The results of the Fetal Heart Rate (DJJ) examination were 90 times/minute. The diagnosis was made with Partus Prematurus Iminens (PPI) and fetal distress, then referred to RSIA Allaudia. The diagnosis made at RSIA Allaudia was Partus Prematurus Iminens (PPI) with fetal hydrocephalus based on the results of the ultrasound during pregnancy examination history. Then Patient was referred to Wonosari Regional Hospital.

Based on the KIA book, first day of last menstruation was obtained on May 7 2018. Patient said that he carried out routine ANC at the Ponjong Community Health Center and at RSIA Allaudia, she recorded 8 ANC times, namely 1 time in the first trimester, 1 time in the second trimester, and 6 times in the third trimester. There were no significant complaints or

problems recorded during the first trimester ANC, however during the second trimester ultrasound examination (24 weeks 1 day) the Biparietal Diameter (BPD) of Patient is larger than the normal size, namely 5.94 cm, so Patient indicated ventriculomegaly, and on the third trimester ultrasound examination (32 weeks) the Biparietal Diameter (BPD) of Patient is 9.49 cm so Patient indicated congenital hydrocephalus.

Patient underwent an examination in Wonosari Hospital with the results of good general condition, compos mentis consciousness, BP 130/90 mmHg, N 86 times/minute, RR 23 times/minute, T 37°C, BW 74 kg, TB 167 cm, and LLA 27 cm. Physical examination showed no facial edema and cloasma gravidarum, white eye sclera and pink conjunctiva. There are no surgical scars on the abdomen, TFU 35 cm, examination of Leopold I palpable buttocks, Leopold II on the left side there is a small part of the fetus and on the right side the back of the fetus can be palpated with FHR 80 times/minute, Leopold III palpable head, Leopold IV fetus has entered the door above the pelvis. Uterine contractions were palpable 3x/10 minutes with a duration of 40 seconds. On examination of the upper and lower extremities there was no edema. The results of the external genital examination showed that there was bloody mucus discharge, there was no enlargement of the Bartholin's glands, and there were no varicose veins in the vagina.

Next Patient underwent an internal examination and the results showed that the vulva urethra was calm, the vaginal walls were smooth, the portion was soft, the dilation was 7 cm, the amniotic membranes were intact, the presentation was posterior, the fontanelle minor was located anteriorly, molasses was 0, the head was lowered in Hodge II plane, the amniotic membranes were intact, positive blood mucus gloves. Patella reflex Patient positive. Furthermore, laboratory supporting examinations were carried out with results of hemoglobin levels 12.6 gr/dl, leukocytes 10,200 µL, hematocrit 37%, erythrocytes 5.03 x 106 µL, platelets 193,000 µL, Time Blood Sugar (TBS) 90 mg/dL, urine protein negative, HBsAg Non-reactive, Anti-HIV Non-reactive.

The management carried out based on this condition is normal vaginal delivery. Patient gave birth to a male baby, birth weight 2000 grams, body length 38 cm, head circumference 34 cm, chest circumference 24 cm, upper arm circumference 10 cm, born without crying, negative muscle tone, pale bluish skin color. From the results of this examination, By. Patient was confirmed to be suffering from congenital hydrocephalus based on the physical appearance of a head size that was larger than the normal size of a premature baby's head in general. Although

By. Patient is normal, but does not match By's body proportions. Patient who was born prematurely. Baby Patient was declared stillbirth.

DISCUSSION

Patient came to the emergency room at Wonosari Regional Hospital on referral from RSIA Allaudia with complaints of regular loudness and bloody mucus coming out of the birth canal. There are signs of the start of labor, namely the discharge of bloody mucus from the vagina, as well as pain due to contractions that are starting to be felt. Based on subjective data, patient stated that the First Day of Last Menstruation was on May 7 2018 means that the gestational age was 34 weeks 4 days. It could be said that patient experienced preterm or premature labor. As is the case according to prematurity or preterm labor, it is labor that occurs at 20 to 36 weeks of gestation. The mechanism for preterm labor begins with uterine contractions and cervical dilatation as well as rupture of the membranes, this event is a pathological condition (Waites et al. 1988). The history of the mother's main complaint then becomes subjective data supporting the presence of preterm labor.

Referring to prenatal examination historical data, the patient underwent an ultrasound examination in the second and third trimesters twice to determine the gestational age and estimated fetal weight. At 32 weeks of gestation (third trimester) there were quite significant results of biometric measurements using ultrasound. This measurement is carried out by measuring fetal biometry with Biparietal Diameter (BPD) and Abdominal Circumference (AC) parameters. From the history of the ultrasound results of Patient in the third trimester on December 17 2018, BPD and AC were measured to determine gestational age, namely with a BPD measurement of 9.49 cm, Patient is 38 weeks 5 days, while with AC measuring 28.12 cm, Patient is 32 weeks. From these two measurement results, there is a significant difference in gestational age. Biometric measurements on AC resulted in 28.12 cm with a gestational age of 32 weeks, this is in accordance with determining gestational age using the calculation of first day of last menstruationhistory on May 7 2018, namely 32 weeks of pregnancy. Meanwhile, in measuring the BDP biometry of Patient is 9.49 cm, so the gestational age is 38 weeks 5 days. This does not correspond to Patient is actually based on first day of last menstruationcalculations.

Apart from that, Patient is also performed to measure lateral ventricular enlargement. The first ultrasound examination was carried out at 24 weeks 2 days of gestation, with the results of the ultrasound showing an enlargement of the diameter of the lateral ventricle atrium by 11

cm. Fetal brain ventriculomegaly occurs when the atrial diameter is ≥10 mm on ultrasound examination. To Patient the atrial diameter is 11 mm (3.5-5 mm above average). Lateral ventricular atrial enlargement ≥10 mm and ≤12 mm is included in the mild ventriculomegaly category (Cunningham 2016)

During the ultrasound examination, Patient in the third trimester, namely at 32 weeks of gestation, the results showed that there was an enlargement of the lateral ventricle atrium by 14 mm (6.5-8 mm above average). From these subjective data, the pregnancy results of Patient experienced ventriculomegaly which developed into congenital hydrocephalus. Lateral ventricular atrial enlargement of 13-15 mm is categorized as moderate ventriculomegaly, while moderate and severe ventriculomegaly is said to be congenital hydrocephalus (Sethna et al. 2011).

Apart from being based on the results of the history of the ultrasound examination, subjective data supporting the incidence of hydrocephalus is also traced from the results of the abdominal height of the uterine fundus physical examination which is closely related to the estimated fetal weight. Estimation of fetal weight is monitoring of fetal growth whether the fetus is normal or not. Based on the history of height of the uterine fundus measurement results patient at 32 weeks of gestation, the result was 29 cm with an estimated fetal weight calculated using the Johnson-Thousack method of 2635 grams. However, based on the history of Patient at 32 weeks of gestation, the estimated fetal weight was 2413 grams. The two results of fetal weight estimation using height of the uterine fundus and ultrasound do not match the normal fetal weight at 32 weeks' gestation, namely at 32 weeks' gestation the fetus weighs around 1500-1700 grams. This significant difference in estimated fetal weight which does not correspond to the gestational age of the fetus indicates an abnormality in the fetus (Cunningham 2016).

The causes of blockage of cerebrospinal fluid flow are often found in infants and children, namely congenital abnormalities, infections, neoplasms and bleedin. Based on the causes of hydrocephalus, the cause is Dandy-Walker Syndrome due to congenital abnormalities. Based on the history of ultrasound examinations in the second and third trimesters, there was enlargement of the ventricular system, especially in the fourth ventricle, which caused the fetus to experience ventriculomegaly. This enlargement of the ventricular system causes cysts in the foramen of Luschka and Magendi (Tully et al. 2015).

The space inside the human head is limited by a rigid structure, all of these intracranial compartments cannot be compressed, this is due to the constant intracranial volume (Monro-Kellie's Law). Therefore, if there is an abnormality in one of the contents that affects the increase in volume there will be an increase in intracranial pressure after the compensation limit (compliance) has been exceeded. The disorder in the form of congenital hydrocephalus is a type of disorder that can increase intracranial pressure to the limit of compensation if it continues progressively. This increase in intracranial pressure causes shifting of brain tissue, resulting in herniation syndrome and the general signs of Cushing's triad (hypertension, bradycardia, irregular respiration) appear. That is why at 34 weeks of gestation, the intracranial pressure of the fetus is getting higher until it reaches the compensation limit and gives rise to one of the signs of Cushing's triad, namely bradycardia in Patient with a FHR range of 80-86 times/minute (Little 2008).

Apart from increasing intracranial pressure and triggering fetal distress in the form of bradycardia, many studies state that premature labor is the main risk of pregnancy with hydrocephalus. This is different from the case of hydrocephalus which only appears immediately after the baby is born. Because hydrocephalus which appears immediately after the baby is born is a complication of premature labor due to intraventricular hemorrhage or intracerebral hemorrhage. Patient premature labor experienced at 34 weeks of gestation is one of the risks of having a hydrocephalus fetus. Establishing a diagnosis of hydrocephalus that appears in the womb or some time after birth is important, because it is associated with two different types of hydrocephalus and also different treatments. Hydrocephalus that occurs in the womb and is born prematurely is a form of congenital hydrocephalus disorder. Meanwhile, hydrocephalus appears after the baby is born prematurely due to the possibility of intraventricular hemorrhage or intracerebral hemorrhage (Indah, Firdayanti, and Nadyah 2019).

Early diagnosis is very important because hydrocephalus is known to be very simple to treat. On the other hand, if it is not detected early it can be disastrous because it can cause uterine rupture during delivery. Uterine rupture in hydrocephalus can occur with incomplete opening, even in pregnancy. This is where ultrasound monitoring plays an important role until delivery approaches. Progressive hydrocephalus allows the ventricles to enlarge beyond the size of the ventricles in the previous 2 weeks of gestation. Therefore, an ultrasound examination must be carried out to ensure that there is no pelvic disproportion with the fetal head, and that the fetal head does not harm the mother's uterus (Raboel et al. 2012).

In this case, there are several ways to confirm Patient. discrepancy was that an ultrasound examination was not carried out when Patient arrived at the hospital or at 34 weeks of gestation. Ultrasound examination is very important to monitor the welfare of the fetus. In progressive hydrocephalus fetuses, an ultrasound examination is very necessary to determine the enlargement of the ventricles so that it can anticipate serious fetal conditions if the enlarged ventricles are pressing on the brain tissue and causing high intracranial pressure to reach the compensation limit with signs of bradycardia. An ultrasound examination also needs to be carried out to ensure that the fetus can be delivered vaginally or by caesarean section if there is disproportion in pelvic size between the mother's pelvis and the fetus's head. Other examinations, namely tests for genetic abnormalities, tests for the etiology of fetal infection, and fetal MRI are not carried out because these examinations require quite a long time and are complicated procedural actions and the fetus is in serious condition which requires prioritization of appropriate supporting examinations. Examinations should be carried out as soon as the fetus is diagnosed with ventriculomegaly or hydrocephalus in the prenatal examination history.

During pregnancy, congenital hydrocephalus is given observational management. Currently, there is no specific treatment for pregnancy with a hydrocephalus fetus. If the fetus has been diagnosed with hydrocephalus, regular and careful monitoring is needed to look for signs of complications that may indicate the need for early delivery (Roux 2016).

Childbirth with a hydrocephalus fetus requires special management. Pregnancy with a hydrocephalus fetus can cause labor dystocia. Labor dystocia is labor that is long, difficult or abnormal, which arises due to various conditions related to dysfunctional labor, changes in pelvic structure, causes in the fetus, maternal position and the mother's psychological response. One of the management of pregnancy with hydrocephalus is caesarean section (Waites et al. 1988).

If the biparietal diameter (BPD) of the fetus is <10 cm or the fetal head circumference is <36 cm then vaginal delivery can be performed. Meanwhile, in some cases, a large head size reduces the ability to give birth normally even during a Caesarean section. It will be easier if the cerebrospinal fluid is removed first before making an incision on the uterus in the extension circle when making a vertical incision or you can make a fairly long uterine incision (Mehta and Levine 2005). Removal of cerebrospinal fluid, commonly known as cephalosynthesis, was once used as the main care in the management of labor with a hydrocephalic fetus. However,

since 1985 this has been stopped due to the increasing rate of fetal death due to intracranial hemorrhage (M. Hansmann, B.J. Hackelöer 2012).

In the history of the results of the ultrasound examination, Patient at 32 weeks of gestation, the BPD measurement obtained at that time was 9.49 cm. However, at 34 weeks of gestation, another ultrasound examination was not carried out so that the BPD results of Patient is unknown. Fetal BPD below 10 cm can be delivered vaginally and does not require a Caesarean section. The fetal head being pushed while passing through the birth canal does not increase the intracranial pressure of the fetus. So that fetuses with hydrocephalus can be delivered vaginally. Therefore, taking into account the results of the Leopold IV examination which showed that the fetal head had entered the pelvis and was descending in the Hodge III plane, vaginal birth management was determined.

Emergency SC surgery for indications of fetal distress is not carried out considering the half-time that must be taken to prepare for emergency SC surgery, as well as waiting for the effacement of the cervix to complete dilatation (Campbell 2013). Fetal distress experienced by Patient is an emergency condition so that the fetus in Patient womb immediately terminated.

For treatment related to fetal distress experienced by Patient has been advised to turn to the left during birth, rehydrating fluids by administering 3 liters of O_2 nasal cannula per minute, administering 500 ml of RL infusion fluid intravenously at a drip rate of 24 liters per minute. However, the fetal distress experienced by Patient is a fetal emergency condition (bradycardia) which can cause ischemic fetal brain tissue and permanent disability or even death. The choice of termination of pregnancy is also considered. To prepare for an emergency SC operation it takes at least 45 minutes for the epidural anesthesia given to function optimally and it takes up to 60 minutes for patient mobilization and preparation for surgery. In general, the problems faced in meeting response time are preparation for surgery (starting from informed consent to the operating room), anesthesia consultation, patient transportation to the operating room, preparation for anesthesia, time waiting for the anesthetic to work effectively, the presence of operating personnel (obstetrician, pediatrician or neonatal officer, surgical nurse) and operation team collaboration. Meanwhile, Patient had experienced cervical effacement of 7 cm. The length of time for cervical dilation from 7 cm dilation to 10 cm complete dilation in multigravida mothers takes the same time as emergency surgery with a smaller risk of mortality and morbidity for the mother, but there is no significant difference in risk to the fetus between the choice of vaginal or vaginal delivery. Based on these considerations, vaginal birth management was chosen.

CONCLUSION

Diagnosis of a fetus with hydrocephalus needs to be done early with appropriate and appropriate examinations. Appropriate examinations, both physical examinations and supporting examinations, can be a reference for the appropriate type of management for the mother, especially determining the type of delivery. According to experts, the appropriate types of diagnosis for hydrocephalus pregnancy are physical examination, ultrasound examination, genetic abnormality test, fetal infection etiology test, fetal MRI, and fetal heart rate examination. This examination was carried out to determine the type of cause of hydrocephalus in Patient and also determine appropriate delivery management for Patient, there were several supporting examinations that were not carried out, including an ultrasound examination upon arrival at Wonosari Regional Hospital. This is the unknown cause of ventricular enlargement which has compressed the brain tissue, causing intracranial pressure to reach the compensation limit and fetal distress occurs. Apart from that, an ultrasound examination is also needed to determine the appropriate type of delivery considering the size of Patient which is larger than the size of a normal fetus.

Apart from management in the form of an appropriate type of delivery, other management that supports the mother's recovery process after losing her baby is using a multidisciplinary approach characterized by strong communication, both between the medical team and the family.

REFERENCES

Allen, Victoria M., and B. Anthony Armson. 2007. "RETIRED: Teratogenicity Associated with Pre-Existing and Gestational Diabetes." *Journal of Obstetrics and Gynaecology Canada : JOGC = Journal d'obstetrique et Gynecologie Du Canada : JOGC* 29(11):927–34. doi: 10.1016/S1701-2163(16)32653-6.

Alluhaybi, Abdulelah A., Khalid Altuhaini, and Maqsood Ahmad. 2022. "Fetal Ventriculomegaly: A Review of Literature." *Cureus* 14(2):18–21. doi: 10.7759/cureus.22352.

Campbell, S. 2013. "A Short History of Sonography in Obstetrics and Gynaecology." *Facts, Views & Vision in ObGyn* 5(3):213–29.

Cunningham. 2016. *Obstetric Williams*. Jakarta: Penerbit Buku Kedokteran EGC.

Fox, Nathan S., Ana Monteagudo, Jeffrey A. Kuller, Sabrina Craigo, and Mary E. Norton. 2018. "Mild Fetal Ventriculomegaly: Diagnosis, Evaluation, and Management." *American Journal of Obstetrics and Gynecology* 219(1):B2–9. doi: 10.1016/j.ajog.2018.04.039.

Indah, Indah, Firdayanti Firdayanti, and Nadyah Nadyah. 2019. "Manajemen Asuhan

Kebidanan Intranatal Pada Ny 'N' Dengan Usia Kehamilan Preterm Di RSUD Syekh Yusuf Gowa Tanggal 01 Juli 2018." *Jurnal Midwifery* 1. doi: 10.24252/jmw.v1i1.7531.

Van Landingham, M., T. V Nguyen, A. Roberts, A. D. Parent, and J. Zhang. 2009. "Risk Factors of Congenital Hydrocephalus: A 10 Year Retrospective Study." *Journal of Neurology, Neurosurgery, and Psychiatry* 80(2):213–17. doi: 10.1136/jnnp.2008.148932.

Little, Robert D. 2008. "Increased Intracranial Pressure." *Clinical Pediatric Emergency Medicine* 9(2):83–87. doi: https://doi.org/10.1016/j.cpem.2008.03.003.

M. Hansmann, B.J. Hackelöer, A. Staudach. 2012. *Ultrasound Diagnosis in Obstetrics and Gynecology*. Canada: Springer Science & Business Media.

Mehta, Tejas S., and Deborah Levine. 2005. "Imaging of Fetal Cerebral Ventriculomegaly: A Guide to Management and Outcome." *Seminars in Fetal & Neonatal Medicine* 10(5):421–28. doi: 10.1016/j.siny.2005.05.002.

Raboel, P. H., J. Jr Bartek, M. Andresen, B. M. Bellander, and B. Romner. 2012. "Intracranial Pressure Monitoring: Invasive versus Non-Invasive Methods-A Review." *Critical Care Research and Practice* 2012:950393. doi: 10.1155/2012/950393.

Roux, Peter Le. 2016. "Intracranial Pressure Monitoring and Management." *Translational Research in Traumatic Brain Injury* 315–37.

Scala, C., A. Familiari, A. Pinas, A. T. Papageorghiou, A. Bhide, B. Thilaganathan, and A. Khalil. 2017. "Perinatal and Long-Term Outcomes in Fetuses Diagnosed with Isolated Unilateral Ventriculomegaly: Systematic Review and Meta-Analysis." *Ultrasound in Obstetrics & Gynecology : The Official Journal of the International Society of Ultrasound in Obstetrics and Gynecology* 49(4):450–59. doi: 10.1002/uog.15943.

Sethna, Farah, Peter W. G. Tennant, Judith Rankin, and Stephen C Robson. 2011. "Prevalence, Natural History, and Clinical Outcome of Mild to Moderate Ventriculomegaly." *Obstetrics and Gynecology* 117(4):867–76. doi: 10.1097/AOG.0b013e3182117471.

Tully, Hannah M., Raquel T. Capote, and Babette S. Saltzman. 2015. "Maternal and Infant Factors Associated with Infancy-Onset Hydrocephalus in Washington State." *Pediatric Neurology* 52(3):320–25. doi: 10.1016/j.pediatrneurol.2014.10.030.

Waites, K. B., P. T. Rudd, D. T. Crouse, K. C. Canupp, K. G. Nelson, C. Ramsey, and G. H. Cassell. 1988. "Chronic Ureaplasma Urealyticum and Mycoplasma Hominis Infections of Central Nervous System in Preterm Infants." *Lancet (London, England)* 1(8575–6):17–21. doi: 10.1016/s0140-6736(88)91002-1.

World Health Organization (WHO). 2023. "Congenital Disorders." Retrieved (https://www.who.int/news-room/fact-sheets/detail/birth-defects).