

## **CHAPTER II**

### **LITERATURE REVIEW AND ASSOCIATED RESEARCH**

In an attempt to examine the risk factors associated with birth asphyxia in newborn, the variety of literatures and relevant researches have been reviewed. These include the definition of intrapartum or birth asphyxia, mechanism of birth asphyxia, assessment of the incidence of birth asphyxia in newborn, diagnosis of birth asphyxia including the risk factor of birth asphyxia.

#### **1. Definition of Birth Asphyxia**

Intrapartum or birth asphyxia refers to a condition, which consists of hypoxia, hypercarbia and metabolic acidosis due to insufficient pulmonary ventilation and/or pulmonary perfusion after birth for several minutes. This causes a lack of oxygen and blood which result in multi-organ dysfunctions in newborns (Kriengsak, 1993). It is also defined as an inability of the child to breathe and apnea associated oxygen deficiency in blood flow during delivery. It can lead to multi- organ systems dysfunction.. In particular critical organ and system may be affected, for instance, pulmonary, cardiovascular system, liver, renal and brain (National Health and Medicine Research Council, 1995).

Widtaya et al (1997) also gave a definition of birth asphyxia that it is the state or condition which the the decrease of blood gas exchange between oxygen and carbon dioxide in the fetal respiratory system which cause acidosis. In case of severe condition, it may result in acute fetal death.

Thewaporn (2001) defines birth asphyxia as an event during intrapartum period that is likelt to severely reduce oxygen delivery and lead to acidosis and hypercarbia due to the insufficiency of pulmonary ventilation and blood gas exchange.

Suganya Taksaphan (2002) also defined birth asphyxia that it is the condition which the fetus can not adapt to the change in respiratory system and blood flow between the uterus and the external environment. It can occur in the antenatal period, perinatal period or after delivery period. Asphyxia can be both acute and chronic condition which the immediate and appropriate neonatal resuscitation is needed to prevent the medical complication arising and neonatal death.

It can be concluded that birth asphyxia is the state which gas exchange between oxygen and carbon dioxide in respiratory system of the fetus lack of oxygen. hypercarbnia, and metabolism acidosis causing the cellular damage and multi-organ systems can be affected and damage. The critical affected organ systems include lung, heart, liver, kidney and brain. Finally, it may lead to the neonatal death.

## 2. Mechanism of the Birth Asphyxia in Newborn

Birth asphyxia is a significant problem to address in improving newborn survival as almost all the newborns who suffer severe asphyxia at birth die or develop multiple disabilities. The mechanism which causes birth asphyxia consist of (Pimonrat, 2002)

1. The blood flow in umbilical cord was interrupted, for example, umbilical cord compression.
2. Inadequate oxygen supply through the placenta, for instant, abruption placenta
3. Lack of oxygen or nutrition from mother to the fetus, for example, pregnancy induced hypertension.
4. Immaturity of lung and blood flow not change according to the anatomy after birth , such as, fetal asphyxia.

## 3. Assessment of Birth Asphyxia

In the present, the advance in medical technology go so fast, the birth asphyxia can be detected or predicted when the fetus is in the uterus by diagnosing from the clinical symptom. During the antenatal and perinatal period by a variety of medical equipment which help plan for the neonatal resuscitation appropriately (Johnson & Oski, 1997). The following predictors have been assessed for their ability to predict the birth asphyxia in newborn (Supawit, 2000):

1. **Fetal movement counting** is a way that mother can help monitor the movement of her unborn baby by counting the number of kicks in a certain time period. Actually, during 16-20 weeks gestation, the

pregnant women are able to feel their unborn baby's movement. But movement varies in frequency, strength, and patterns depending on the maturity of the fetus. However, the movement can be perceived if it last at least 20 seconds. The night time between 9.00 pm – 01.00 am is often a good time for fetal movement. Fetal movement counting is applicable universally, and is considered as a convenient, cost-free and simple method of assessment. This also can help reduce the fetal mortality rate due to the incidence of asphyxia. When there is a perception of drastic decrease in fetal movement or the fetus has stopped moving, it can lead to the fetal death in the next day. As a result, the nurse should instruct the pregnant women to observe and count their baby's movement when reaching at 28 weeks gestation. If the fetus is not moving as much as usual, or takes longer to move in the usual length of time, the pregnant women should call or consult the obstetrician right away in order to diagnose it with the other method of assessment (Thawanwongse Rattanasiri, 1999). Currently, there are two ways of fetal movement counting. The first is to check how long 10 movements are felt. Usually, at least 10 movements should be felt within 1-2 hour period. Another way is to check how many movements are felt within one-hour period. Normally, more than 3 movements should be felt within one hour (Supawit, 2000).

2. **Electrical fetal monitoring** is a tool to help avoid fetal asphyxia and death during pregnancy. It is used to monitor the fetal heart rate pattern

consisting of Non Stress Test and Contraction Stress test (Thawanwongse Rattanasiri, 1999).

**2.1 A Non Stress Test (NST)** is a safe, painless way to check on the fetal heart rate. This test is to measure the fetal heart rate acceleration with normal movement. When there is a fetal movement or kick, it will accelerate the fetal heart rate for a while. The average of the normal fetal heart rate acceleration is about 15 times or more per minute and it will persist for at least 15 seconds, which called 'reactive acceleration'. This will signal a well being fetal with a good central nervous system (CNS) and cardiovascular system. If there is a 'non-reactive acceleration' result, it can merely imply that the baby sleeps or not getting enough oxygen.

The fetal heart rate monitoring can be done by using Doppler ultrasound transducer test. A handheld instrument, transducer, is passed lightly over the skin above a blood vessel. The test uses reflected sound wave to evaluate blood as it flows through a blood vessel. It normally takes about 10-20 minutes. In case there is no acceleration of fetal heart rate, it is recommended to spend more 20 minute testing time. With this duration, it is sufficient to get the result. Alternatively, we can stimulate the fetus by using the fetal acoustic stimulation test. The result of the Doppler ultrasound test can be translated as following:

- Reactive result means the acceleration of fetal heart rate is about 2 times or more within 20 minutes period regardless of

fetal movement. This normal result may predict that the fetus is likely to be fine for the next week. It is recommended to repeat NST every week or more often in case of having a high-risk pregnancy.

- Non-reactive result refers to only one time of acceleration of fetal heart rate or none is perceived after 40 minute period. However, if the result is non-reactive, the other test should be taken to reconfirm the result, such as contraction stress test

## **2.2 Contraction Stress Test (CST) or Oxytocin Challenge test**

(OCT) can be used to measure the fetal heart rate during uterine contractions in order to make sure the fetus can get the necessary oxygen from the placenta during labour. During uterine contractions, the flow of blood and oxygen to the placenta temporarily decrease. As a result, the fetal heart rate will slow after a contraction. The test lasts until three contractions are observed, each lasting 40-60 seconds, within ten-minute span. This may take up to 90 minutes. The result of the test can be interpreted as following:

- Negative or normal result means no late deceleration is founded. Normal results of a contraction stress test occur when the fetal heart rate does not slow in response to the contractions. This typically means the fetus is reacting fine and will do so for at least the next week. In case of having a

high-risk pregnancy, the pregnant women will be encourage to repeat a CST every week in order to avoid the fetal death which may occur within a week after

- Positive or abnormal result refers to a late deceleration following 50% or more of contractions or the fetal heart rate does slow down in response to a contraction. The test results will be positive and signal that the fetus maybe under stress.

3. **Fetal acoustic stimulation test: FAST** will stimulate the fetus with a deep sleep to have a movement by sending the 80 Hz sound wave to the fetus. This stimulation will help decrease NST testing time. After being stimulated by FAST, if the test result of NST is reactive, this can be predicted that the fetus is being well. In contrast, if the result is non-reactive, it may indicate that the fetus is not getting enough oxygen or fetal asphyxia is present.

4. **Fetal biophysical profile (BPP)** usually includes fetal breathing movement, fetal movement, fetal tone, fetal activity and qualitative amniotic fluid volume, and fetal heart rate by electronic monitoring. It is a clinical tool that predicts the presence or absence of fetal asphyxia more accurately and reliably. This can help decrease the chance of getting the false positive or false negative result in case of one test being taken. However, BPP test usually takes 30-60 minutes by skilled personnel. There are two tests reasonably substituted of BPP as an alternate test. The first modified BPP is fetal acoustic stimulation combined with amniotic fluid index. Another is Non Stress test

ต้นฉบับ หน้าขาดหาย

ต้นฉบับ หน้าขาดหาย

ต้นฉบับ หน้าขาดหาย

#### **4. The Assessment of Birth Asphyxia in Newborn**

For all newborns, the neonatal resuscitation in the first 2-3 minutes after birth is more necessary than other period. By using the Apgar score as an initial assessment in the delivery room/labor ward will help the obstetrician and nurses to quickly determine whether the infants need immediate medical care or further treatment and it can also be used for the reflex irritability monitoring. The Apgar score is the very first given way of quantifying the newborn's initial condition and response to any resuscitative effort (Kriengsak Jiraphaet, 1993). This scoring system has been widely used since obstetric anesthesiologist, Dr. Virgin Apgar developed it in 1952 (Rutherford, 2001). It aims to convey information about the newborn's condition at one minute and five minutes after birth. It can also be a determination of immediate neonatal resuscitation (Bloom, 1997).

The one-minute Apgar score will indicate the severity of the incidence of birth asphyxia and need of resuscitation and the five-minute Apgar score will show the effectiveness of neonatal resuscitation and how the newborn responds to any resuscitation efforts which associated with the newborn survival and incidence of cerebral palsy or brain damage (Kriengsak Jiraphaet, 1993). Five factors are used to evaluate the newborn's condition and the presence of birth asphyxia and each factor is scored on a scale of 0 to 2 : heart rate, respiratory effort, muscle tone, reflex irritability and skin color (Karlowiez, Karlotkin & Goldsmith, 1996) The Apgar scoring can be scored as shown in the below table.

Score Apgar sign	0	1	2
Heart rate	Heart rate	Slow (below 100 beats per minute)	Normal (above 100 beats per minute)
Respiratory effort	Absent (no breathing)	Slow or irregular breathing	Good, crying
Muscle tone	No movement Floppy tone	Arms and legs flexed with little movement	Active, spontaneous movement
Reflex irritability	Absent (no response to stimulation)	Facial movement or (grimace) with stimulation	Sneeze, cough, pulls away
Skin color	Blue-gray, pale all over	Acrocynosis	Pink all over

The assessment score can be interpreted as follow (Schreiner et al, 1988); a score of 0-3 is considered severe birth asphyxia is present and an immediate resuscitation needed, while 4-7 might require some resuscitation measures and a baby with apgar of 8-10 is considered normal but the extra monitoring still required.

Therefore, the Apgar score test is designed to help assess a newborn's overall physical condition and incidence of birth asphyxia immediately. This test is also seen as the communication tool between the carer and newborn (The American College of Obstetricians & Gynecologist, 1998).

## **5. Risk Factors of Birth Asphyxia in Newborns**

According to the review of literature and relevant research concerning the risk factor associated with birth asphyxia in newborn, Widhaya et al (1997) states that the risk factor of birth asphyxia in antenatal period is associated directly with high risk pregnancy. These factors can be summarized as following

### **1. Socio- Economic status factor**

- 1.1 Socio-economic status is the indicator to assess the nutrition and well being of pregnant women. The pregnancy women with low socio-economic status, the chance to give birth resulting in asphyxiated newborn which caused by the intrauterine growth retardation and premature delivery is higher. The cause can not be determined clearly. However, it is believed that these pregnant women always get married when they are very young (adolescent marriage) and malnutrition occurs during pregnancy.
- 1.2 Occupation of pregnant women and spouses: With reference to the study in UK, it shows the pregnant women who have no occupation or lack of support from family or their spouses have no occupation or being separated from their spouse , for example, being a soldier in the battle field or being in the prison, these may put her at increased risk of postnatal depression or giving birth resulting in asphyxiated newborn. It is because they are more likely to have a premature delivery and intrauterine growth retardation than a normal pregnancy.

- 1.3 Marital Status can indicate the relationship between members in family which Apichart and Sompol (1994) agree that the expectant mothers with illegal marriage experience severe complications in pregnancy than those with legal marriage. Due to the concealment of pregnancy, the appropriate antenatal care is absent. Thus it results in complications during pregnancy. In case of complicated pregnancy, improper antenatal care caused more severe problem. In previous studies in abroad, the findings show that the pregnant women without marriage are put more increased risk of giving asphyxiated newborn due to complications in pregnancy compared to those married pregnant women.
- 1.4 Mental depression: The pregnant women who have a mental depression during pregnancy are more likely to suffer the incidence of complications in pregnancy, for example, preterm delivery than those who do not.

## **2. Biological factor**

- 2.1 Maternal age: The most appropriate maternal age is between 20-30 years. Women with the first pregnancy at 35 years or more and those of pregnancy after 40 years old are considered as high-risk pregnancy which at increased risk of complications in pregnancy and delivery (Sompol, 1994). The teenage pregnant women are also at increased risk of malnutrition and the immaturity of physical and mental growth. This will result in a

asphyxiated newborn which is caused by placental abruption and premature rupture of membrane. Women with high maternal age, more than 35 year, are at increased risk of preterm delivery, toxemia of pregnancy and preterm abnormality. Moreover, the incidence of birth asphyxia is higher in complicated pregnancies, particularly those associated with diminished placental reserve including hypertensive disease of pregnancy or pre-eclampsia or anaemia (Widhaya et al., 1997)

- 2.2 Nationality : Different nationality can cause different complications of pregnancy or different abnormalities, for example, the pregnant women in Thailand are more likely at risk of blood disorder, Thalassaemia, that is caused by abnormal gene than those in European countries. Likewise, the sickle cell disease is most common among the pregnant women from Africa. In addition, African pregnant women are more likely to have narrow pelvis as men more than other groups (Widhaya et al, 1997).
- 2.3 Height : Clearly, height is correlated to the size of pelvis. The pregnant women with less 150 cm height are put more increased risk of birth asphyxia due to obstructed labour and delivery, instrumental extraction delivery and cesarean section.
- 2.4 Weight and weight gain during pregnancy: The pregnant women with less than 40 kg weight or more than 10 kg weight gain during pregnancy will be at increased risk of experiencing giving

birth lower than 2500 grams. On the other hand, if the weight is more than 70 kg or weight gain is more than 15 kg during pregnancy, the pregnant women will have a higher risk of experience complications in pregnancy. Examples include Toxemia of pregnancy, obstructed delivery or prolonged delivery due to macrocosmic infant. Moreover, these complications can cause the birth asphyxia in newborn.

**3. Previous obstetric factors** It can be used to predict or assess the risk of birth asphyxia for the current or next pregnancy due to the reproductive pattern. The pregnant women with a bad obstetric history are at risk of adverse event recurring in subsequent deliveries. The previous obstetric factor consists of:

3.1 History of infertility

3.2 History of previous stillbirths or neonatal deaths: In case of having experience in previous stillbirths or neonatal deaths without an ascertained cause, this can be predicted that the chance of neonatal death will be 2-3 folds of the normal pregnancy (Withoon, 2002).

3.3 Previous low – birth weight or growth – retardation

3.4 Previous preterm labor / delivery: It can be the most critical cause of the presence of birth asphyxia. Due to the insufficiency of fetus's respiratory system in preterm infant, this will cause of a higher rate in perinatal mortality and morbidity than full term infants. Women with previous preterm labor or delivery will be at

increased risk of adverse event recurring in subsequent deliveries. The chance of adverse event recurring is about 25-20 per cent. Moreover, if women who used to experience preterm labor or delivery more than once, the chance of event recurring in subsequent delivery will be greater (Withoon, 2002). Infants delivered following preterm labor are at varying degrees of increased risk depending on the gestational age at the time of delivery and the etiology of the preterm labor. The earlier the preterm labor is, the greater risk of neonatal deaths or disabilities will be. In general, the preterm infant will have a very low birth weight, all organs are immature. This will cause them suffer severe complications, particularly the incidence of respiratory distress syndrome which is the main cause of fetal death (Phong, 1999).

- 3.5 Previous macrosomic infant: Macrosomic infant refers to the newborn more than 4,000 gram birth weight. Women with previous macrosomic infant will be at increased risk of gestational diabetes. This will cause more complications in pregnancy and the greater chance of incidence of fetal asphyxia due to placenta insufficiency or obstructed delivery.
- 3.6 Number of parity: Nulliparous (parity =0) women are at increased risk of birth asphyxia associated with obstructed labor and prolonged delivery. Grand multiparous women (>4) have a greater

risk of birth asphyxia due to anemia, toxemia of pregnancy, placenta previa or placental abruption.

3.7 Previous difficult / obstructed or prolonged labor: Women with a history of poor obstructed delivery are at risk of adverse event recurring in subsequent deliveries which associated with birth asphyxia significantly.

3.8 Previous cesarean delivery: Women with history of caesarean delivery are at increased risk of uterus abruption if prefer to have a normal delivery in subsequent deliveries. This can cause the presence of birth asphyxia in newborn. In some cases, if there is no indicator or examination of the maturity of baby's lung, it will result in a higher risk of preterm delivery and birth asphyxia.

**4. Maternal medical history:** Women with medical conditions will be at higher risk of complications in pregnancy. The medical conditions are shown as following:

4.1 Rheumatic heart disease and congenital heart disease: Women complicated by rheumatic heart disease or congenital heart disease can expect an abnormal pregnancy outcome. Heart disease associated with pregnancy contributes significantly to intrauterine grow retardation, very low birth weight due to the presence of chronic perinatal asphyxia and preterm delivery.

4.2 Respiratory disease: Women with asthma will experience shortness of breath, which affect to the fetus oxygen supply. If shortness of breath often occurs, it will cause adverse outcomes of pregnancy,

such as, fetal growth retardation, stillbirths, high neonatal mortality rate.

- 4.3 Diabetes, a medical complication frequent found in pregnancy. It is a condition resulting from too much glucose or sugar in the blood. When the body is incapable of producing enough insulin, the blood glucose level elevates and many metabolic problems can arise. The increase of glucose metabolism will cause an adverse affect to the fetus. In particular, women with the fasting blood glucose more than 105 mg/dl can result in stillbirth and a macrosomic infant. The macrocosmic infant will get injury during delivery due to shoulder dystocia. Mother with hyperglycemia will cause the fetal hyperinsulinemia in the fetus. During delivery, the presence of hyperglycemia in newborn will occur (Withoon , 1999). Further, this can cause a number of complications in mother and newborn, such as toxemia of pregnancy, large for dates and obstructed labor. In case of toxemia of pregnancy, it will be increasingly found in diabetic pregnancy for 4-fold of normal pregnancy. This complication will result in birth asphyxia in newborn (Widhaya et al, 2001).
- 4.4 Thyroid disorder: The pregnant women with thyroid disease will have a higher chance of resulting in asphyxiated newborn due to low birth weight. Thyrotoxicosis or hyperthyroidism is a condition in which the thyroid gland produces (Withoon Prasertchareonsuk, 1999) excess thyroid hormone (thyroxine)

which results in effects on the whole body. The chance of women with hyperthyroidism resulting in a low birth weight infant, thyrotoxicosis infants will be higher than non-hyperthyroidism women. Moreover, it will cause a higher neonatal mortality rate. In case of women with hypothyroidism, they can also result in hypothyroidism infants and stillbirths

4.5 Chronic hypertension: Woman with chronic hypertensive disorder will be at increased risk of suffering pregnancy induced hypertension and premature rupture of membrane. This will cause the fetal growth retardation.

4.6 Renal disease: Women with pre-existing renal disease will be more at increased risk of resulting in the asphyxiated newborn due to the preterm delivery, intrauterine growth retardation and placenta insufficiency. Urine tract infections are the most common renal disease occurring during pregnancy and range from asymptotic bacteria to acute pyelonephritis. Acute pyelonephritis can cause the preterm delivery.

5. **Current obstetrics status:** Several risk factors in current pregnancy are possibly caused by the previous pregnancies although they never found before include:

5.1 No antenatal care visit , late in antenatal care visit or less than minimum of four visits can put a higher risk for the incidence of preterm delivery or low birth weight less than 2500 gram and stillbirths due to lack of oxygen.

- 5.2 Antepartum hemorrhage or bleeding before delivery can be a sign of placental complications. Such complications include placenta previa and abruptio placenta. These can cause the danger in both mothers and newborn health because of the presence of birth asphyxia (Pisek, 1999) and preterm delivery (Thawanwongse, 2001).
- 5.3 Multi-fetal pregnancy can also put a higher risk of asphyxia to the fetus than a singleton. The single main cause is preterm delivery. The other causes can be placenta previa, intrauterine growth retardation, prolapsed umbilical cord, placental abruption and congenital anomalies.
- 5.4 Congenital Abnormality: The abnormal fetus will be at increased risk of birth asphyxia.
- 5.5 Mal presentation and mal position of fetus can also put greater risk of the incidence of birth asphyxia due to prolapsed umbilical cord or instrumental extraction (Widhaya et al, 1997) or prolonged delivery (Srinaree , 2001).
- 5.6 Pregnancy induced hypertension is a condition that cause a vasoconstriction or vasospasm of blood vessel in uterus and kidneys. The disseminated intravascular coagulation will result in the dysfunction of amniotic membrane. If it is very severe, it is willl cause the fetal growth retardation or birth asphyxia (Kanok et al, 1999). Moreover, Widhaya et al (1997) support that the severe

hypertensive disorder will cause placental abruption and preterm delivery.

- 5.7 Premature rupture of membrane is an event occurs during pregnancy when the sac containing the sac developing fetus and the amniotic fluid burst or develop a hole prior to the start of labor. If premature rupture of member occurs, it will cause the risk of fetal asphyxia due to preterm labor. Further, it can cause an increased risk of complications in pregnancy, such as, intrauterine growth restriction, bacteria infection of placenta and amniotic membrane and respiratory distress syndrome due to preterm labor.
- 5.8 Intrauterine growth retardation: IUGR is defined as less than 10 percent of predicted fetal weight for gestational age, may result in significant birth asphyxia during delivery.
- 5.9 Prolonged pregnancy refers to pregnancy with more than 42 weeks gestation. Pregnancies extending many weeks beyond the average length are at increased risk for adverse outcomes, both because certain fetal anomalies, such as, wrinkle on the fetal skin like an elderly, long nail, long and skinny body. Besides, the fetus may experience the fetal distress because the amniotic fluid volume decrease (oligohydrammios) and cause the umbilical compression during labor. The distressed fetus may pass meconium into the amniotic fluid before birth and breathe into the lungs (Juthawadee, 2001).

Regarding to the review of relevant literature which associated with the risk factors of birth asphyxia in newborn, the risk factors can be categorized into 3 groups (Soonthorn Horpaowphan, 1997) as following

1. Maternal factor: This includes high maternal age, grand multiparity, anemia, low blood pressure, bleeding, placenta previa, placental abruption, toxemia of pregnancy, diabete, medicine induction. Karlowieze et al (1996) state that the risk factor significantly associated with birth asphyxia is maternal factor. Examples include pre-existing medical conditions in the mother (renal disease, heart disease, blood vessel disease), history of previous dead fetus in uterus or birth with abnormalities, premature rupture of membrane, placental previa, antepartum haemorrhage, blood disorder or toxemia of pregnancy. The finding concerning the factor of birth asphyxia in newborn from Praput et al (1992) also depict the factor significantly contributed to birth asphyxia in newborn is maternal factor. The factor consist of high maternal age, antepartum haemorrhage, hypertensive disorder, diabetes, narcotic drug intake within 2 hour prior to delivery. In addition, the study of birth asphyxia at Patumthani hospital by Suchada (2000) presents that the maternal factor is a cause of birth asphyxia consisting of low maternal age (< 18 years), high maternal age (>40 years), toxemia of pregnancy, anemia, premature rupture of membrane, antepartum haemorrhage, thalassaemia, drug addicted, cyst in uterus and so on. Likewise, the study of factor associated with birth asphyxia in newborn at Trang hospital conducted by Wanthana (2001) express that women older than 40 years are at higher risk of birth asphyxia. Regarding to the finding from the study of 8,397

expectant mothers giving births resulting in asphyxiated newborn at Maharaj Nakhon Sri Thammarat hospital, it is found that maternal factor can cause birth asphyxia include rupture of member before labor more than 12 hour. Dilok (2000) and Thewaporn (2001) report that all asphyxiated newborn at Chaophraya Yommaraj Supanburi hospital are caused by maternal factor which include low maternal age (< 20 years) or high maternal age (> 35 years), rupture of member before delivery more than 24 hours, pregnancy induced hypertension, anaemia, antepartum haemorrhage, diabetes, asthma and HIV infections. Meanwhile, the study of the factor which resulting in birth asphyxia in newborn at one minute after birth for 367 newborns in Suratthani province, the finding clearly shows that women referred from the community hospital and women with pregnancy induced hypertension are part of the maternal factor which can cause birth asphyxia in newborn infants (Lawan, 2002). Additionally, the study of risk factor associated with birth asphyxia in newborn at Nopparat Ratchathani hospital depicts that women with narcotic drug intake during antenatal period will be at greater risk of birth asphyxia in newborn than those without narcotic drug intake (Ratchanee et al, 2002).

2. Fetal factor include premature infant, intrauterine growth retardation, toxemia of pregnancy, congenital abnormalities, high maternal age, antepartum haemorrhage, anemia, hypertensive disorder, diabetes, narcotic drug intake within 2 hours before delivery. Karlowicz et al, 1996) also state that the fetal factor associated with birth asphyxia in newborn consists of multiple gestation, poly hydromios, low amniotic

fluid volume, preterm labor/deliver, postterm delivery, large-for-gestational age infant, small-for-gestational age infant, meconium stained amniotic fluid, abnormal fetal heart rate and fetal abnormalities. Regarding to the study of risk factor of birth asphyxia in newborn by Praput et al (1992), it clearly shows that the fetal factor comprises bacteria/virus infection of uterus, congenital abnormalities, preterm labor/delivery, 24 weeks gestation, and small or large-for-gestational age infants. The study of birth asphyxia in newborn at Patumthani hospital by Suchada (2000) also suggests that preterm labor/delivery is one main fetal factor of birth asphyxia in newborn. From the finding of birth asphyxia in newborn at Maharaj Nakhon Si Thammarat hospital, it is found that the fetal factor associated with birth asphyxia in newborn include breech presentation, below 2,500 gram birth weight or greater than 4,000 gram birth weight, less 37 weeks gestation or more than 42 weeks gestation (Dilok, 2000). According to the study of asphyxiated newborn at Chaophraya Yommaraj Suparnburi by Thewapom (2001), it depicts that the fetal factor associated with birth asphyxia in newborn consists of preterm delivery, meconium stained amniotic fluid, fetal distress, fetal abnormalities, and intrauterine growth retardation. In the study of risk factor in the delivery with Apgar score at minute of 7 or less by Sarawut (2001), it is shown that the fetal factor is the risk factor of birth asphyxia. Such factor include breech presentation, less than 37 weeks gestation and below 2,500 gram birth weight.

3. Intrapartum factor includes malpresentation, multiple pregnancy, shoulder dystocia, cephalo pelvic disproportion, prolapsed umbilical cord and forceps extraction. Karlowicz et al (1996) state that the intrapartum factors associated with birth asphyxia in newborn include cephalo pelvic disproportion, early delivery and obstructed delivery. The result of study by Praput et al (1992) also express that the intrapartum factor associated with birth asphyxia include cephalo pelvic disproportion, shoulder dystocia, prolapsed umbilical cord, multiple gestation, mal presentation /lie, and instrumental extraction. In previous study of Thewaporn (2001) regarding birth asphyxia in newborn at Chaophraya Yommaraj Supanburi, it is found that the intrapartum factor associated with birth asphyxia include cephalo pelvic disproportion, vacuum or forceps extraction, narcotic drug intake prior to delivery. Suchada (1999) also points that vacuum extraction and breech presentation can put more increased risk of birth asphyxia in newborn than other routes of delivery. Further, the study of birth asphyxia in newborn at Samutprakan hospital by Natthakorn (1999) also illustrate that the acute asphyxiated newborns are caused by the breech presentation and other malpresentation, preterm delivery and fetal distress. In the study of risk factor in the delivery with Apgar score at minute of 7 or less by Sarawut (2001), it is shown that the intrapartum factor is an important risk factor of birth asphyxia. Such factors include cephalo pelvic disproportion. Likewise, the study of birth asphyxia in newborn at Satool hospital by Theera (2002)

also pointed that breech presentation and cephalo pelvic disproportion are risk factor of birth asphyxia in newborn.

Pompimol et al (1997) pointed that the obstetric history or intrapartum factor can signify the greater risk for the presence of birth asphyxia. Such factors include:

1. Fetal factor includes malpresentation/lie, preterm delivery, prolonged pregnancy or multiple pregnancy.
2. Factor concerning placenta, amniotic fluid and umbilical cord consist of placenta previa, placental abruption, infection in amniotic fluid, mild and moderate or thick meconium stained amniotic fluid, rupture of membrane more than 24 hours, blood in amniotic fluid and prolapsed umbilical cord.
3. Intrapartum factor include caesarean section, earlier delivery, prolonged delivery (> 24 hours), second stage of delivery and narcotic drug induction within 24 hours
4. Maternal factor consists of mal presentation / lie, placenta prevail, caesarean section, preterm rupture of membrane, infected amniotic fluid and breech presentation.

Bloom (1997) summarizes that the factor which associated with birth asphyxia include complications of pregnancy (diabetes, toxemia in pregnancy, chronic hypertensive disorder, previous dead fetus in uterus, bleeding in semester and trimester, infections, twin pregnancy, postterm pregnancy, malpresentation) and intrapartum factor (caesarean section, malpresentation, preterm delivery, rupture of membrane

before labor 24 hours, early delivery, prolonged delivery, long second stage of delivery, uterine enencia, narcotic drug induction within 4 hours before delivery, meconium stained amniotic fluid, prolapsed umbilical cord, placenta abruption and antepartum haemorrhage.

Soonthorn (2000) explains that the preventive action of birth asphyxia is very important. To prevent an adverse effect to the infants' organs, these following actions will help increase the newborn survival. These include the essential antenatal care, risk identification and assessment of high risk pregnancy, appropriate delivery, effective resuscitation, immediate initial assessment of birth asphyxia including effective preliminary neonatal care.

Gabbe (2000) concludes the risk factor of birth asphyxia in newborn as following:

1. Maternal medications and complicated conditions include diabetes, pregnancy-induced hypertension, antepartum hemorrhage in third trimester of pregnancy and preterm rupture of membrane.
2. Fetal conditions include preterm delivery, multi gestation, intrauterine growth retardation and congenital abnormalities.
3. Intrapartum condition includes abnormal fetal heart rate, meconium stained amniotic fluid, breech presentation and medicine induction

Further, antenatal care service provided for the pregnant women is significantly important to the quality of pregnancy and the fetus in the uterus. Yuen Tannirun (2000)

also confirms that the antenatal care services from the health care provider play more vital role in reducing the incidence of birth asphyxia in newborn. These care services include:

1. Effective antenatal care focus attention on the quality in each time, which consists of periodic physical check-up, detailed history assessment, pathology test and appropriate laboratory test.
2. Assessment and treatment of high risk pregnancy: High risk factors consist of poor obstetric history, such as, high and low maternal age, prolonged pregnancy and mal presentation.
3. Assessment and management of disease and complications in pregnancy: Complications and diseases include anaemia, hypertensive disorder, sexual transmitted disease (STIs), pre-existing medication in mother, such as, diabetes and cardiac disease.
4. Essential fetal monitoring tests include ultrasound transducer, fetal movement counting, Non Stress test, Stimulation test, Contraction Stress test and Doppler ultrasound.

Sarawut (2001) mentions that the antenatal care service provided factor can influence the presence of birth asphyxia in newborn. He indicates that the provision of effective antenatal care will have an impact in reducing the risk of the incidence of birth asphyxia. These cares include effective antenatal care, obstetric care and monitoring, routine use of partogram in delivery progress monitoring, clean and safe delivery with appropriate competency and skill, availability and effectiveness of neonatal resuscitation, including effective referral system. Besides, the frequency of

fetal monitoring, analysis and assessment will help decrease and prevent the presence of birth asphyxia in newborn infants.

According to the management of mother and children health care system at Health Promotion Bureau, Department of Public Prosecution (1998), there is a guideline for the provision of service for the Safe Motherhood hospital program and the practice for maternity care during the antenatal period, perinatal period and newborn care. The relevant items include item 3, 4, 5 and 6 as shown below:

Item 3: Essential standard of antenatal care include physical check-up in the laboratory, identification of possible risk factor at initial visit, screening the expectant women with 10 risk assessment criteria, instruct the expectant women about the minimum standard of 4 antenatal care visit, instruct the women for breastfeeding, blood test for screening anemia disorder and syphilis infection, voluntary blood test for screening HIV, at least one time antenatal visit with obstetrician for a normal pregnancy, routine use of antenatal care logbook for all expectant women, Tetanus toxoid immunization and iron/folic acid supplementation.

Item 4: Minimum of one maternity care training for pregnant women together with family or their spouses. Such training consists of focus group discussion, group training for all pregnant women, encourage the family or spouse to participate the training. The subject related to how to use the antenatal logbook, instruction during pregnancy for expectant women, the importance of antenatal care visit. Besides this, the venue, training plan, and instruction for pregnant women's family and spouses should

be clearly determined. Moreover, the subjects should include Tetanus immunization, preparation for breast feeding, self check-up during pregnancy, risk factor of pregnancy, Sexual transmitted disease and antenatal visit with obstetrician.

Item 5: Essential standards for delivery service include routine use of partogram for monitoring delivery progress, availability of resuscitation equipment and supplies, availability of skilled attendant for maternal resuscitation, operation for caesarean section or facilitation of an immediate referral, ratio of patient to obstetric and nurse not less than 1:3.

Item 6: Essential standards for newborn care include Newborn temperature control, respiratory monitoring, infections prevention, eye drop, vitamin supplementation, promotion of breast feeding in delivery room, provision of basic equipment and skilled attendant for newborn resuscitation and appropriate care for newborn with abnormalities.

In conclusion, intrapartum or birth asphyxia is caused by the insufficient ventilation at newborns' lung after delivery. It results in hypoxia, hypercarbia and metabolic acidosis. The rapid assessment of incidence of fetal asphyxia is use of Apgar score at 1 minute. There are 5 factors need to be assessed: color, fetal heart rate, and reflex irritability, muscle tone and fetal breathing, by giving each factor from 0, 1 and 2. If the total score is at most 7 or less, it can be predictable that fetal asphyxia is present. There are a variety of methods for assessment of fetal asphyxia. Examples include fetal movement counting, Non Stress Test and ultrasound transducer Test.

Based on the review of associated literature and research, it is clear that the risk factors associated with birth asphyxia in newborn consisting of maternal factor, fetal factor, intrapartum factor, maternity care service received factor and antenatal care service provided factor. In each individual factor, there are also more detailed factors. As a result, to solve birth asphyxia problem in newborn at Maharaj Nakhon Sri Thammarat according to the right causes, it is necessary to examine the risk factor of incidence of birth asphyxia by outlining the conceptual framework from the review of relevant literature and researches.

There are number of risk factors that have been shown to be associated with the development of birth asphyxia in newborns. Firstly, maternal factor includes maternal age, number of parity, disease and complications in pregnancy. Secondly, fetal factor consists of gestational age, aspects of amniotic fluid, fetal presentation, birth weight. Thirdly, intrapartum factor includes first stage of delivery, second stage of delivery and route of delivery. The next is maternity care service received factor includes neonatal visit, narcotic drug intake, oxytocin induction and time of birth. Lastly, antenatal care service provided factor include antenatal care, maternity care training for pregnant women and family or spouses, delivery service, neonatal care and referral system.