

Objectives

Upon completion of this activity, the learner will be able to:

1. Define the incidence and pathophysiology of anaphylactoid syndrome of pregnancy (ASP).
2. Discuss the maternal and fetal sequelae and multidisciplinary response after a diagnosis of ASP.
3. Describe post-resuscitation care measures and nursing practice implications for the response and care of a woman with ASP.

Continuing Nursing Education (CNE) Credit

A total of 1.2 contact hours may be earned as CNE credit for reading "Anaphylactoid Syndrome of Pregnancy" and for completing an online posttest and participant feedback form.

To take the test and complete the participant feedback form, please visit <http://learning.awhonn.org>. Certificates of completion will be issued on receipt of the completed participant feedback form and any processing fees.

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Anaphylactoid Syndrome of Pregnancy CNE

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ABSTRACT: Anaphylactoid syndrome of pregnancy (ASP) is a widespread, proinflammatory, anaphylactic-like reaction that can occur when amniotic fluid enters the maternal blood circulation. ASP is characterized by four cardinal findings: respiratory distress, altered mental status, hypotension, and disseminated intravascular coagulation. ASP is commonly associated with maternal and neonatal mortality. Early recognition followed by prompt and aggressive treatment can improve survival rates and are among the most critical activities for nurses and other clinicians caring for women with ASP.

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Anaphylactoid syndrome of pregnancy (ASP) is a rare but serious complication of pregnancy in which maternal and neonatal mortality rates are dismal. In developed countries, ASP is one of the leading pregnancy-related causes of maternal mortality and was the cause of 5.5% of maternal deaths in the United States from 2011 to 2013 (Centers for Disease Control and Prevention, 2017; Kramer, Rouleau, Baskett, & Joseph, 2006). ASP continues to be a mystery to some, because there is little

information about its causes, and its occurrence is unpredictable (Kramer, Abenhaim, Dahhou, Rouleau, & Berg, 2013).

In this article, we define ASP, outline the maternal and fetal sequelae, and discuss diagnosis and the multidisciplinary response needed to care for a woman with ASP in the antepartum and postpartum periods. Post-resuscitation care measures and nursing practice implications of ASP are also described, and a case example is offered (see Box 1) to illustrate important clinical points.

CLINICAL IMPLICATIONS

- *Anaphylactoid syndrome of pregnancy* (ASP) is the preferred term for a condition previously known as *amniotic fluid embolism*.
- ASP is a rare but serious condition that causes a widespread, proinflammatory, anaphylactic-like reaction after amniotic fluid enters the maternal circulation.
- ASP is characterized by four cardinal findings, including respiratory distress, altered mental status, hypotension, and disseminated intravascular coagulation.
- Early recognition with prompt and aggressive treatment are the most imperative measures for nurses and other clinicians to undertake to reduce the odds of maternal and neonatal mortality.

Definition

The term ASP was recently introduced to replace the term *amniotic fluid embolism* (AFE), although these terms continue to be used interchangeably by many. The name change was initially proposed because the manifestations of the syndrome aligned similarly to those of septic or anaphylactic shock rather than to those of an embolic event (De Jong & Fausett, 2003). The etiology of the syndrome is still being debated; therefore, both terms are still being used. Both of these terms refer to the introduction of amniotic fluid into the maternal blood circulation and a maternal reaction characterized by hypoxia, cardiopulmonary collapse, and coagulopathy (Kramer et al., 2013; Moore & Baldisseri, 2005). In this article, we use the term ASP.

Incidence

ASP is one of the leading causes of pregnancy-related maternal mortality, surpassed only by cerebrovascular and hypertensive disorders in pregnancy (Kramer et al., 2006). With the solely retrospective view on the syndrome combined with its uncommon occurrence, limited data with much variation have been published regarding the incidence and prevalence. Studies indicate that ASP occurs in anywhere from 1 in 80,000 to 1 in 20,000 pregnancies (De Jong & Fausett, 2003). The large range in incidence can be attributed to multiple factors, one of which is inconsistency in both data recording and categorization using the International Classification of

Diseases—a system that is used in many retrospective studies of ASP. Another factor is the difficulty in diagnosing ASP, because, until very recently, there was no diagnostic laboratory testing available, and the clinical diagnosis was entirely dependent on the exclusion of other diseases by way of differential diagnosis, or on autopsy after death (Moore, 2006; Moore & Baldisseri, 2005).

Recent study results indicate an improving maternal survival rate of 15%, as opposed to rates closer to 86% reported in older research (Benson, 2017; Moore & Baldisseri, 2005). Neonatal mortality rates are estimated to be between 21% and 50% (Benson, 2017; Perozzi & Englert, 2004). Even

BOX 1 CASE EXAMPLE

A 36-year-old White woman, pregnant for the third time with a history of two live term births, arrived to the labor and delivery triage area of a medium-sized metropolitan hospital in the southern United States in active labor. A sterile vaginal examination was conducted, indicating that her cervix was 8 cm dilated, 100% effaced, and –1 station. Shortly after the examination, the woman developed sudden shortness of breath.

The nurse applied oxygen via a non-rebreather mask and called for assistance. Shortly afterward, the woman began having a seizure that lasted for roughly 1 minute. After the seizure, the woman was not breathing and did not have a pulse, and a code was called. Cardiopulmonary resuscitation was immediately initiated by nursing staff. The full obstetric team arrived to the triage room shortly after the code was called, and the neonate was born via vacuum extraction.

A viable boy was born with Apgar scores of 5 and 8 at 1 and 5 minutes, respectively; he needed minimal resuscitation but needed continuous blow-by-oxygen and was, therefore, transferred to the NICU. The woman was intubated, and a central line was placed for medication administration. After approximately 15 minutes of advanced cardiovascular life support, the woman regained a pulse and was transferred to the ICU for post-resuscitation care.

Shortly after arriving to the ICU, the woman developed disseminated intravascular coagulation, which was able to be corrected with the transfusion of blood products and fluid resuscitation. She continued to recover in the ICU and 24 hours after the event was awake and talking. The neonate was maintained in the NICU for 48 hours after birth and was able to make a full recovery with no lasting neurologic impairments. The woman continued to recover and was discharged from the hospital about a week later with no signs of neurologic deficits. In this case, the successful outcomes for mother and newborn have been attributed to the quick recognition, response, and treatment from the nursing staff.

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ASP is a rare but serious complication of pregnancy in which maternal and neonatal mortality rates are dismal

with survival of the event, morbidity is significant, with as many as 85% of women and 50% of neonates sustaining permanent neurologic injury (Moore & Baldisseri, 2005; Perozzi & Englert, 2004).

Pathophysiology

The pathophysiology of ASP continues to be researched and debated; however, one aspect remains constant throughout: it begins with the introduction of amniotic fluid into a woman's circulation. This can occur during labor through tears in the uterus or cervix; during a cesarean birth; or occasionally during other procedures, such as an amniocentesis or dilation and curettage (Moore & Baldisseri, 2005). The mechanism for entry of amniotic fluid into a woman's circulation is not fully understood. There is a hypothesis that the entry is due to a pressure gradient between the woman's blood and the amniotic fluid; other researchers suggest that it depends on the amount or type of debris in the amniotic fluid (i.e., lanugo or meconium; Perozzi & Englert, 2004). In addition, some researchers purport that many women are exposed to introduction of amniotic fluid into their circulation, but for reasons that are not entirely understood, a negative reaction occurs in some women but not others (Perozzi & Englert, 2004).

Once introduced into the circulation, amniotic fluid travels throughout a woman's venous system and into the pulmonary circulation (Perozzi & Englert, 2004). This path is where much of the debate regarding the name (ASP vs. AFE) begins.

The term *AFE* identifies the cascade of events starting from a physical blockage of an emboli in the pulmonary system, whereas the term *ASP* describes a proinflammatory response occurring with the release of cytokines and arachidonic acid metabolites (Moore & Baldisseri, 2005; Perozzi & Englert, 2004). The cytokines act as the cell-signaling molecules for prostaglandins (which control the process of inflammation) that are derived from arachidonic acid metabolites in amniotic fluid (Moore & Baldisseri, 2005). In both theorized etiologies, the next signs are pulmonary hypertension and edema with occasional bronchospasms, ultimately ending in acute respiratory distress syndrome, hypotension, hypoxia, and cyanosis (De Jong & Fausett, 2003). Pulmonary edema leads to left-sided heart failure, and cardiac arrest occurs in 80% of cases (Perozzi & Englert, 2004). It is during this time that major neurologic disability can occur if maternal and fetal oxygenation and circulation are not adequately maintained. The final main factor, coagulopathy, is thought to occur because of a cascade caused by procoagulant components of amniotic fluid that initiate the clotting cascade and result in excessive fibrinolytic activity and, consequently, disseminated intravascular coagulation (DIC; Perozzi & Englert, 2004).

Etiology

ASP is a rare and sudden event. Although data are limited, some risk factors have been identified, most which are non-modifiable (De Jong & Fausett, 2003). Although ASP is a pregnancy-related disorder, there are identified risk factors unrelated to pregnancy. The most prevalent is maternal age greater than 35 years, which more than doubles the risk of ASP (adjusted odds ratio [aOR] = 2.7, 95% confidence interval [CI] [2.1, 3.6]; Kramer et al., 2006).

During pregnancy but before labor and birth, there are several things that can go wrong, disease processes that can occur, or procedures that can take place, and many have been identified as risk factors for ASP. These include eclampsia (aOR = 26.5, 95% CI [12.3, 57.0]), diabetes (aOR = 2.6, 95% CI [1.2, 5.5]), amniocentesis (aOR = 1.9, 95% CI [1.0, 3.4]), and placenta previa or placental abruption (aOR = 17.0, 95% CI [12.8, 22.7]; Kramer et al., 2013). Methods of birth played a major role in the risk factors associated with ASP, with cesarean births being associated with a much greater risk of ASP compared with spontaneous vaginal birth (aOR = 15.0, 95% CI [9.4, 23.9]; Kramer et al., 2013). Instrumental vaginal births, such as those using forceps or vacuum, were also associated with greater risk (aOR = 6.6, 95% CI [4.0, 11.1]; Kramer et al., 2006).

Some researchers believe that pharmaceutical induction of labor is a primary risk factor for ASP, because there is a strong association between the use of uterine stimulants such as oxytocin and the incidence of ASP (aOR = 1.7, 95% CI [1.2, 2.5]; Kramer et al., 2006; Moore, 2006; Wagner, 2005). Pharmaceutical induction of labor is one of the few modifiable

risk factors for ASP, and induction should not be undertaken without serious consideration of all risks.

Short-Term Maternal Sequelae

Within 1 minute of the initial event of the mixing of amniotic fluid and maternal blood, a woman can begin to experience additional sequelae (Perozzi & Englert, 2004). The first symptoms to occur are usually dyspnea and cyanosis, quickly followed by acute respiratory distress syndrome and respiratory arrest (Moore & Baldisseri, 2005). Constriction of the pulmonary artery eventually leads to left-sided heart failure—the most commonly reported sequela of ASP—which very often progresses into full cardiac arrest (Gilmore, Wakim, Secrest, & Rawson, 2003).

Lack of oxygenated blood leads to an additional cascade of detrimental effects for a woman. The decrease of oxygen to the brain begins to cause altered mental status, confusion, and agitation and can cause seizures, coma, brain injury, and even brain death (De Jong & Fausett, 2003; Gilmore et al., 2003; Moore & Baldisseri, 2005). Hemodynamic shock is identified in most cases of ASP, but it does not always happen at the same time in all women. Some women experience cardiogenic shock and hypotension earlier on as a result of left-sided ventricular failure, whereas others have been noted to experience more of a hypotensive shock resulting from hemorrhage after DIC (Moore & Baldisseri, 2005). The majority of women who survive 1 hour after the event and into the postpartum period develop DIC, a life-threatening condition characterized by clotting in the small blood vessels, using up platelets and clotting factors, which leads to massive hemorrhage (Gilmore et al., 2003; Healy, 2013). In most cases, uterine atony accompanies DIC and uncontrolled hemorrhage, and in many cases, a hysterectomy is the only treatment option (Kramer et al., 2013). Massive hemorrhage has also been found to cause metabolic acidosis from a decrease in blood pH and bicarbonate concentration (Healy, 2013). The cascade of responses often ends in multiorgan system failure and maternal death (Moore & Baldisseri, 2005).

Long-Term Maternal Sequelae

Although maternal mortality rates have decreased in recent years because of increased recognition of ASP and decreased response time, the odds of maternal mortality are still extremely high (aOR = 1,116.2, 95% CI [733.7, 1,697.8]; Kramer et al., 2013). If a woman survives, the risk for associated morbidity is significant. The most commonly seen long-term sequelae are encephalopathy and brain injury caused by hypoxia (Nair, 2016). According to Moore and Baldisseri (2005), “As many as 85% of women may suffer permanent

Even with survival of the event, morbidity is significant, with as many as 85% of women and 50% of neonates sustaining permanent neurologic injury



neurological sequelae as a result [of ASP]” (p. 281). The severity may vary, but most women who survive ASP will have some kind of neurologic deficit, and it is recommended that women receive mental health support once recovered from the initial trauma (Healy, 2013).

ASP is a traumatic event for women and their families, and risk is increased for posttraumatic stress disorder (Healy, 2013). Myocardial ischemia may also follow a cardiac arrest (Moore & Baldisseri, 2005). Emergency hysterectomies are often performed to help control hemorrhage in a woman

experiencing DIC (Kramer et al., 2013). The loss of future reproductive capabilities can be devastating for many women, especially if they are younger, are a primigravida, or lost the child during the event. Women who are able to get pregnant after ASP and who do become pregnant are considered to be high risk and are more likely to have preterm cesarean birth to reduce the risk of uterine tearing in subsequent pregnancies (Gilmore et al., 2003). Women who survive are likely to have an increased length of hospital stay and admission to the ICU, where they are at greater risk for hospital-acquired infections, with an infection risk that increases by 1.6% per each additional night in the hospital (Hauck & Zhao, 2011; Kramer et al., 2013; Moore & Baldisseri, 2005). In addition, a significant event such as ASP has profound implications for the economics involved in the care of the woman and neonate.

Short-Term Neonatal Sequelae

When ASP occurs after birth, effects on the neonate are minimized; however, ASP can occur during labor. Fetal

distress during labor can be a presenting sign of ASP, seen as changes in the fetal monitoring strips showing late decelerations and bradycardia (Moore & Baldisseri, 2005). Emergency cesarean births are commonly performed in instances in which the neonate is not yet born, and although rare, perimortem cesarean and emergency bedside births can occur (Benson, 2017). Neonates born to women with ASP tend to have lower Apgar scores, which is believed to be a result of the lack of oxygen causing hypoxemia during the event (Gilmore et al., 2003). Maternal hypoxia has also been shown to cause profound fetal respiratory acidosis and a low fetal pH, in turn causing bradycardia, hypotension, and neurologic injury (De Jong & Fausett, 2003).

Long-Term Neonatal Sequelae

There has been limited study of the long-term effects on health outcomes in infants born to women during an ASP emergency. The effects of hypoxia to fetuses can be so detrimental that many are stillborn (aOR = 2.1, 95% CI [0.8, 5.5]; Kramer et al., 2013). Of neonates who survive, approximately 50% experience permanent neurologic injury (Perozzi & Englert, 2004).

Recognizing the Signs

Early recognition and the use of immediate resuscitative measures significantly improve the chances of survival for the mother and newborn after an incidence of ASP (Nair, 2016). Research indicates a better likelihood of positive maternal outcomes when prompt aggressive treatment grounded in knowledge of ASP pathophysiology is used (Mato, 2008; Stein, Matta, & Yaekoub, 2009). ASP has four cardinal signs (see Box 2) that can appear in any order, and some may not be present at all. It is essential that nurses and other clinicians in the antepartum, intrapartum, and postpartum areas know these signs and be prepared to implement prompt resuscitation and supportive measures, because ASP has been known to occur up to 48 hours after birth (Healy, 2013; Moore & Baldisseri, 2005; Romero, Kadar, Vaisbuch, & Hassan, 2010).

BOX 2 FOUR CARDINAL SIGNS OF ANAPHYLACTOID SYNDROME OF PREGNANCY

Respiratory failure
Altered mental status
Hypotension
Disseminated intravascular coagulation

Source: Moore and Baldisseri (2005).

Four Cardinal Signs

Respiratory Failure

Respiratory failure is the initial manifestation in half of ASP cases (Mato, 2008). Sudden respiratory distress, dyspnea, tachypnea, and cyanosis are the most common initial presenting symptoms (Gilmore et al., 2003; Mato, 2008). If sudden respiratory distress occurs, an immediate rapid response is required, with notification of the physician and anesthesia provider, because further symptoms can come rapidly, and additional help is warranted. Resuscitation and supportive care for symptoms is the priority for women with ASP, because once the initial insult has occurred, controlling the cascade of symptoms is nearly impossible (Mato, 2008). For example, when respiratory complications occur, women should be treated so as to keep oxygenation to physiologic normal by applying oxygen, inserting an advanced airway, and giving rescue breaths as needed.

Altered Mental Status

Neurologic changes are generally the next symptoms to present and can range from confusion and altered levels of conscious to unconsciousness, seizures, and even coma (Gilmore et al., 2003). Safety of the woman is a priority, because seizure activity is one of the presenting symptoms in 10% of women with ASP (Mato, 2008). Identifying other symptoms, acknowledging a woman's health history, and thinking critically all come into play when a seizure occurs to prevent misdiagnosing a woman with eclampsia or vice versa. Continuous fetal heart tracing should occur throughout resuscitative efforts. Depending on the gestational age, the stage of labor, and the station of the neonate, forceps or vacuum can be used to expedite birth (Kramer et al., 2013). If the fetus is not in a position for an operative vaginal birth, an emergency cesarean birth is indicated (Kramer et al., 2013). If the fetus's gestational age is younger than that deemed necessary for viability in the facility, resuscitation measures are focused solely on the woman (Baraka, 2016).

Hypotension

Hypotension is another hallmark sign of ASP (Mato, 2008; Moore & Baldisseri, 2005). Pharmacologic means, such as use of vasopressors and fluid boluses, can be used to treat hypotension, but this symptom is commonly and rapidly followed by complete circulatory collapse (Healy, 2013). In the event of cardiac arrest, cardiopulmonary resuscitation should be initiated immediately. Uterine displacement should be executed to avoid compression of the inferior vena cava and compromising of the blood flow to the uterus and fetus (Moore & Baldisseri, 2005; Perozzi & Englert, 2004). Some health care providers, including those in critical care, can feel uncomfortable when resuscitating a pregnant woman, but it is important to remember that the initial principles of resuscitation are the same in any pregnancy-related emergency as they are in any other resuscitation: support airway, breathing,

and circulation (Perozzi & Englert, 2004). In 65% of the instances of ASP, birth has not yet occurred (Moore & Baldisseri, 2005). If cardiac arrest occurs and return of spontaneous circulation does not result within 4 minutes, a perimortem cesarean birth should be completed within 5 minutes of maternal cardiac arrest (Baraka, 2016; Moore & Baldisseri, 2005). Birth of the neonate under these circumstances is associated with increased maternal and neonatal survival rates (Baraka, 2016). Resuscitation of the neonate should be anticipated in the event of ASP, because hypoxia is much more prevalent (Gilmore et al., 2003).

Disseminated Intravascular Coagulation

If the woman survives more than 1 hour after the initial onset of ASP, DIC is almost inevitable (Gilmore et al., 2003). DIC occurs in up to 83% of cases of women with ASP in the postpartum period (Moore & Baldisseri, 2005). DIC usually presents in these cases as massive uterine hemorrhage, refractory to hemorrhage medications (Healy, 2013). Blood products such as packed red blood cells, fresh-frozen plasma, and platelets are essential for these women, because the blood loss can be severe (Perozzi & Englert, 2004). DIC can also lead to uncontrolled bleeding from the intravenous site, incisions, and lacerations and can cause epistaxis and hematuria (Gilmore et al., 2003). Activation of the mass transfusion protocol is typically initiated when a woman is showing signs of DIC (De Jong & Fausett, 2003). Unfortunately, when the uterine bleeding cannot be controlled, a hysterectomy may be necessary (Mato, 2008).

Management

The treatment for ASP is supportive in nature and is provided as symptoms arise with the ultimate goal of maintaining oxygen homeostasis. Each problem should be dealt with separately and in order of severity, such as initiating advanced cardiovascular life support (ACLS) for cardiac arrest or starting transfusions to begin to correct DIC (Healy, 2013). In recent years, a newer treatment measure has been introduced (Conde-Agudelo & Romero, 2009). At the onset of symptoms, the initiation of the therapeutic regimen of atropine, ondansetron, and ketorolac (termed A-OK; see Box 3) has been shown to cause reversal of symptoms (Rezai, Hughes, Larsen, Fuller, & Henderson, 2017). It has been suggested that the atropine and ondansetron inhibit serotonin and vagal stimulation, thus improving cardiovascular

function and systemic vascular tone, improving cardiac output and hypotension (Rezai et al., 2017). Ketorolac is used to inhibit thromboxane and block the cause of the coagulopathy (Rezai et al., 2017). The suggested doses for this therapy are listed in Box 3 (Copper, Otto, & Leighton, 2013; Rezai et al., 2017).

Diagnosis

Unfortunately, there is no easy or gold standard test to diagnose ASP; suggested diagnostic criteria are listed in Box 4. The actual diagnosis typically comes after the fact, based on a process of exclusion (De Jong & Fausett, 2003). A differential diagnosis (see Box 5) is usually begun after initial resuscitative measures have commenced and continues until other possible diagnoses have been ruled out (Moore, 2006). The differential diagnosis for ASP usually includes hemorrhagic shock, sepsis, pulmonary thromboembolism, air embolism, eclampsia, placental abruption, uterine rupture, myocardial infarction, cardiomyopathy, anaphylaxis, anesthetic complications, aspiration, and transfusion reactions (De Jong & Fausett, 2003; Moore, 2006). The only known valid way that has been discovered to confirm a diagnosis of ASP is an autopsy after death (Aguilera, Fernandez, Plaza, Gracia, & Gomar, 2002). During an autopsy, histopathologic confirmation comes from the examination of samples of the pulmonary vasculature that have been known to show fetal debris, such as epithelial squamous cells, mucin, lanugo hairs, bile, and meconium (Aguilera et al., 2002; De Jong & Fausett, 2003; Legrand et al., 2012).

ASP continues to be a challenging diagnosis, and because of that, it has the potential to be misdiagnosed. These misdiagnoses can also be contributing factors in the inconsistencies in recorded rates of occurrence and maternal mortality. Several case studies have been published regarding concerns of possible misdiagnoses of ASP. One article described a woman who experienced a postpartum cardiovascular collapse followed by DIC that was initially diagnosed as ASP (Romero et al., 2010). Later, it was concluded that this woman had a subclinical intra-amniotic infection that led to a systemic infection and septic shock but presented with symptoms almost

BOX 3 A-OK REGIMEN

Atropine 0.2–1 mg
Ondansetron 8 mg
Ketorolac 15–30 mg

Sources: Copper, Otto, and Leighton (2013); Rezai, Hughes, Larsen, Fuller, and Henderson (2017).

BOX 4 SUGGESTED DIAGNOSTIC CRITERIA

- Sudden onset of cardiopulmonary arrest or both hypotension and respiratory compromise
- Documentation of overt disseminated intravascular coagulation after appearance of initial signs and symptoms
- Clinical onset during labor or within 30 minutes of passing of placenta
- No fever during labor

Source: Clark et al. (2016).

BOX 5 DIFFERENTIAL DIAGNOSIS

- Hemorrhagic shock
- Sepsis
- Pulmonary thromboembolism
- Air embolism
- Eclampsia
- Placental abruption
- Uterine rupture
- Myocardial infarction
- Cardiomyopathy
- Aortic dissection
- Anaphylaxis
- Anesthetic complications
- Aspiration
- Transfusion reactions

Sources: De Jong and Fausett (2003); Moore (2006).

indistinguishable from those of ASP (Romero et al., 2010). Another study described multiple cases in which there was debate between the diagnoses of ASP or drug-induced allergic anaphylaxis (Harboe et al., 2006). These examples only reinforce the need for a gold standard diagnosis, and not one that can be obtained only via autopsy. The reliability of histology has been challenged by declinations of autopsies postmortem (Legrand et al., 2012). Regardless, clinical suspicion combined with aggressive treatment is vital to achieving greater survival rates (Aguilera et al., 2002).

Currently, there are no laboratory tests that can confirm the diagnosis of ASP, but one is in development (Moore & Baldisseri, 2005). Research is being conducted on a factor that has been identified as a possible biomarker of amniotic fluid that has passed into the maternal circulation (Legrand et al., 2012). In research by Legrand et al. (2012), serum levels of insulin-like growth factor binding protein-1 (IGFBP-1) were much greater in women who experienced ASP (mean = 234 µg/L, range = 134–635 µg/L) compared with those in the non-ASP group (mean = 56 µg/L, range = 36–91 µg/L), the postpartum hemorrhage group (mean = 65 µg/L, range = 35–91 µg/L), the uncomplicated labor group (mean = 49 µg/L, range = 30–78 µg/L), and the normal pregnancy groups (mean = 54 µg/L, range = 36–83 µg/L and mean = 66 µg/L, range = 48–89 µg/L during the second and third trimesters, respectively). Each of these results was significantly different from the ASP group, indicating that it is unlikely that they differed by chance ($p < .0001$; Legrand et al., 2012). IGFBP-1 was shown to be a valuable tool in recognizing the passage and circulation of amniotic fluid into the maternal bloodstream (Legrand et al., 2012). This test may be the first laboratory test that will be able to confirm the diagnosis of ASP in survivors, although it is not commonly in use at this time (Benson, 2017).

Maternal Post-Resuscitation Care Measures

A multitude of things occur in a woman's body during ASP. Multiple cascading events can trigger cardiopulmonary arrest and DIC. Halting and stabilizing these events are just the first steps toward recovery for these women. Ideally, women with ASP will recover in an obstetric ICU, but most hospitals lack these and, therefore, care is undertaken in the medical or surgical ICUs, where clinicians often lack pregnancy-related knowledge (Perozzi & Englert, 2004). If a pregnant woman has experienced cardiac arrest and has needed full resuscitation, there is a possibility that she will be put under targeted temperature management (TTM; Kirkegaard et al., 2017), a treatment that is done after cardiac arrest whereby the body temperature is lowered to 32 °C to 34 °C for 24 to 48 hours (Buanes, Hufthammer, Langørgen, Guttormsen, & Heltne, 2017). This treatment has resulted in increased survival rates and improved neurologic functioning compared with standard care (Buanes et al., 2017).

Respiratory support and ventilation of the woman, along with other supportive treatments such as vasopressors, are routinely used during TTM (Kirkegaard et al., 2017). Continuation of laboratory monitoring will take place in the ICU after resuscitation (De Jong & Fausett, 2003). It is important that the ICU nurses continue routine postpartum care, even for these women who have experienced ASP. Some pregnancy-specific nursing interventions that may easily be overlooked in an ICU setting are performing fundal checks, supporting lactation and breastfeeding, assessing the epidural site, providing routine perineal care, providing breast care, and promoting mother–newborn bonding (De Jong & Fausett, 2003). If a woman has required a cesarean birth or hysterectomy, assessing the incision site is a must as well.

Many ICU nurses may not be confident in performing these pregnancy-specific nursing interventions. It is critical for maternity nurses to work collaboratively with ICU nurses to ensure that these needs are met. In addition to nursing care, emotional support may be one of the greatest needs of women who have experienced ASP. They have just gone through a near-fatal event and may have even lost a child in the process or the ability to bear children in the future. We, as nurses, need to be aware of these women's emotional needs and do our best to meet them.

Neonatal Post-Resuscitation Care Measures

Depending on whether a neonate was born before or after the ASP event, the neonate may be unharmed or may need extensive neonatal resuscitation. Neonates have a 21% to 50% mortality rate with ASP, which is why clinicians need to be adequately trained in the Neonatal Resuscitation Program (NRP) and STABLE (sugar, temperature, airway, blood pressure, lab work, and emotional support) programs to ensure that these vulnerable newborns have the best possible



Care of the Family in Cases of Maternal and/or Fetal/Neonatal Demise

Caring for a family after a loss is no easy task, especially when the loss is unexpected. Open communication and keeping the family informed are imperative in helping a family cope with and interpret this experience (Nair, 2016; Perozzi & Englert, 2004). Not only is a loss from ASP sudden, but it may take more than one life. This can turn what was supposed to have been the happiest day of family members' lives into the worst. In many cases the mother dies, but the newborn survives (Perozzi & Englert, 2004). When this occurs, resentment toward the child can occur, so

fighting chance (Benson, 2017; Perozzi & Englert, 2004). If NRP has to be initiated to restore circulation and ventilation, "the infant should be maintained in or transferred to an environment where close monitoring and anticipatory care can be provided" (Weiner, Zaichkin, & Kattwinkel, 2016, p. 287).

After resuscitation, these neonates will likely be admitted to the NICU, where closer, more extensive monitoring can be performed and where ventilation support can be provided as necessary. If a hypoxic-ischemic event is suspected, systemic hypothermia may be used to treat these neonates (Papile, 2005). Hypoxic-ischemic encephalopathy can occur after a long, difficult labor or birth; if prolonged resuscitation is needed; or occasionally, in the case of ASP, if the woman has arrested and a perimortem cesarean birth is warranted (Papile, 2005). Systemic hypothermia is similar to TTM in adults, and the goal for its use is to lower the neonate's core body temperature to 32 °C to 35 °C for 72 hours, but the method of cooling differs slightly from TTM (Papile, 2005; Zanelli, Buck, & Fairchild, 2010). In neonates, hypothermia is accomplished through head cooling or whole-body cooling (Papile, 2005; Zanelli et al., 2010). If done correctly and within 6 hours of birth, systemic hypothermia has shown to yield many neuroprotective properties and to reduce the overall severity of ultimate brain damage (Papile, 2005). Long-term neurologic effects for the newborn can and should still be assessed at follow-up visits.

Facilitating family bonding is especially important. When the neonate dies and the mother survives, it is often difficult for the parents and family to cope with the loss of the newborn because they do not have any memories other than the pregnancy and the traumatic situation of ASP (Al-Maharna, Abujaradeh, Mahmoud, & Jarrad, 2016). During these times, creating mementos, such as hand- and footprints, locks of hair, photos, bracelets, and cards, among others, can be especially important. Because ASP can be such a traumatic event, and can potentially take the life of the mother, a family may refuse any photos or mementos or refuse to spend any time with the deceased neonate. Mementos should still be gathered and saved, and they can be offered at a later time when the family has been given time to grieve and are more emotionally ready to accept them.

Early recognition and immediate resuscitative measures significantly improve the chances of survival of the mother and newborn after an incidence of ASP

Any time there is a death, nurses should consider what additional personnel, such as a chaplain and social workers, are available to assist the family and also to provide support

to health care staff. Even perinatal providers are often unprepared to deal with perinatal or maternal death (Dietz, 2009). In the event of maternal or perinatal loss, maternity care nurses are encouraged to debrief each other and use other methods of coping so that they can assist the family with coping as well (Dietz, 2009). Many resources are available for professional staff and for the women and families affected by traumatic pregnancy experiences such as ASP. Some of these organizations include Prevention and Treatment of Traumatic Childbirth, Solace for Mothers, Postpartum Support International, and the Amniotic Fluid Embolism Foundation (Morton, Price, & Lyndon, 2016). Health care providers involved in these incidents are often referred to as the *second victims* (Edrees et al., 2016). Establishing resiliency programs for staff focusing on peer support has been shown to be the most successful staff intervention after an unanticipated adverse event (Edrees et al., 2016).

Nursing Practice Considerations

Early recognition followed by prompt and aggressive treatment are the most critical activities for nurses (Aguilera et al., 2002). Nurses especially need to be well educated about the signs and symptoms and the appropriate response measures because they spend more time at the bedside than any other health care provider. Nurses typically spend 35% to 46% of their 12-hour days at a woman's bedside, whereas a typical medical intern spends roughly 8 minutes with each patient (Hurst, 2010; Lichstein, 2015). In the maternity care realm, where nurses are frequently assigned a 1:1 staffing ratio, nurses are the ones able to identify minute changes in a woman's condition and are the first to spring to action with a response. Nurses are a woman's best advocate, but this only holds true if nurses are fully educated on the signs and symptoms of potential complications and emergencies.

ASP is so rare that many nurses will never experience it in their entire careers, but in the slim chance that they do, the actions of nurses can mean life or death for the mother and neonate (see Box 6). Formal education in pregnancy-related emergencies should not only be offered but should be a requirement for all those who work on a labor and birth or postpartum unit. In-service sessions are a simple and easy way to educate staff on a variety of topics, and obstetric emergencies, including the recognition of and response to ASP, should be included. Nurses in charge of the unit need to be certain that all staff acquire and stay current with all life-saver certifications, including ACLS and NRP. Although NRP is commonly used in the obstetric world, many maternity nurses have never experienced a full adult cardiac arrest with the implication of ACLS before. Thus, it is imperative that training and simulations be done regularly and often to ensure the preparedness of the staff. Other specialized courses in resuscitation, such as Advanced Life Support in Obstetrics and Managing Obstetrical Emergencies and Trauma, may improve mortality rates through standardization of care (Moore & Baldisseri, 2005). All nurses working in maternity care should have NRP and STABLE

BOX 6 NURSING CARE PRIORITIES

- Identify symptoms of anaphylactoid syndrome of pregnancy
- Activate the rapid response team/obstetric emergency team
- Maintain the ABCs (airway, breathing, circulation)
- Begin cardiopulmonary resuscitation (as indicated)
- Prepare for rapid birth (whether urgent cesarean or operative vaginal, as indicated)
- Initiate/prepare for fluid resuscitation and blood product administration
- Prepare for ICU admission
- Provide emotional support to the woman and family after the event

training. Although NRP covers the initial steps in the resuscitation of a neonate, the STABLE program teaches health care providers about the steps to take after resuscitation. Because ASP is impossible to predict, being prepared with the appropriate advanced clinical skills, along with using a woman-centered, multidisciplinary team approach, will ultimately yield the most favorable results for a mother and her fetus or newborn (De Jong & Fausett, 2003).

Conclusion

ASP is a rare but serious obstetric complication that claims too many lives each and every year. Although mortality rates for women and newborns are improving with increased awareness and advances in technology, ASP continues to be a leading cause of maternal mortality (Aguilera et al., 2002; Centers for Disease Control and Prevention, 2017; De Jong & Fausett, 2003; Perozzi & Englert, 2004). For the best chances of survival, early recognition and prompt treatment are necessary (Moore & Baldisseri, 2005). Understanding the early symptoms and the cardinal signs will help with earlier recognition and increase survival rates for these women (Moore & Baldisseri, 2005). As frontline caregivers, nurses have a critical role to play in improving the odds of survival in a case of ASP. **NWH**



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Posttest Questions

Instructions: To access this CNE activity online, visit <http://learning.awhonn.org>.

CNE for this activity is available online only; written tests submitted to AWHONN will not be accepted.

1. What are the four cardinal signs of anaphylactoid syndrome of pregnancy (ASP)?
 - a. Blurred vision, numbness, weakness, confusion
 - b. Chest pain, lightheadedness, shortness of breath, heartburn
 - c. Respiratory failure, altered mental status, hypotension, and disseminated intravascular coagulation
2. Some research shows maternal mortality for ASP to be as high as
 - a. 52%.
 - b. 86%.
 - c. 100%.
3. The diagnosis of ASP is
 - a. confirmed by a simple chest x-ray.
 - b. confirmed through a series of blood tests.
 - c. difficult and done through a process of exclusion.
4. The most critical action(s) for nurses with regard to ASP is/are
 - a. early recognition followed by prompt and aggressive treatment.
 - b. ensuring the fetal heart rate is correctly recording.
 - c. notification of anesthesia and obstetric providers.
5. If ASP occurs during the intrapartum period, the most important care action is to
 - a. ensure that the woman does not have a seizure.
 - b. get the neonate birthed quickly and safely.
 - c. have suction available.
6. Many women and neonates will have which of the following after a diagnosis of ASP?
 - a. No harm
 - b. Permanent neurologic injury
 - c. Permanent physical injury
7. What is the most common initial symptom of ASP?
 - a. Dyspnea
 - b. Nausea
 - c. Weakness
8. ASP is also frequently referred to as which of the following?
 - a. Amniotic syndrome of pregnancy
 - b. Amniotic fluid embolism
 - c. Anaphylactoid fluid embolism
9. ASP is
 - a. an acute condition that always results in cardiac arrest in the pregnant women.
 - b. caused by the physical blockage of debris in the fetal lungs.
 - c. the widespread, proinflammatory, anaphylactic-type reaction to amniotic fluid in the mother's circulation.
10. The treatment for ASP is which of the following?
 - a. Epinephrine
 - b. Supportive treatment
 - c. There is no treatment because death is imminent.