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Neonatal Abstinence Syndrome: A Guide for Caregivers

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Abstract

Neonatal Abstinence Syndrome (NAS) is a condition that affects infants who have faced exposure to certain drugs in utero. The incidence of NAS is dramatically rising in the United States. This increase is primarily due to the growth in opioid prescribing to pregnant women. NAS has an immediate effect on four primary areas of occupation: activities of daily living (ADLs), sleep, social participation, and play. This paper aims to review the background of NAS, then describe how this condition impacts an infant's occupational performance. Moreover, this paper identifies models of occupational therapy intervention that can guide the treatment of NAS. This information culminates with a resource guide for parents that details the best practices for caring for an infant with NAS.

Keywords: neonatal abstinence syndrome, occupational therapy, intervention, nonpharmacological

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Definition and Description

Opioid addiction is a current crisis in the United States. Opioid addiction impacts a wide variety of populations, including pregnant women. Neonatal Abstinence Syndrome (NAS) is a disease that affects infants who have faced exposure to certain drugs, most commonly opioids, in utero. These infants experience withdrawal from the substance within 24 hours up to seven days after birth (Hammer, 2016). The incidence and prevalence of NAS have increased in recent years and continue to rise (McQueen & Murphy-Oikonen, 2016).

The first recorded uses of opium occurred around 3400 BCE, and the first cases of opioid addiction occurred in the eighteenth century (Kocherlakota, 2014). Rates of opioid addiction rose after the commercialization of morphine and heroin in the nineteenth century. The first recorded case of opioid withdrawal occurred near the end of the nineteenth century; however, treatment of the condition did not begin until years later, in 1903. NAS treatment began with the use of morphine, then methadone and buprenorphine. The management of NAS has further evolved since its first treatment.

Etiology

The physiology of opioid withdrawal is not entirely understood; however, it is evident that opiates can easily move across the placenta and blood-brain barrier during pregnancy as a result of their chemical properties (Kocherlakota, 2014). Furthermore, opiates move across the placenta more readily in the later stages of pregnancy. Infants experience opioid withdrawal upon birth as a result of the instant removal of the substance. Removal of the substance causes opioid receptors to become overactivated, and the infant's central nervous system (CNS) becomes overstimulated.

Many types of drugs can lead to the development of NAS. Common drugs used by pregnant mothers include: “codeine, fentanyl, heroin, methadone, meperidine, morphine, pentazocine, propoxyphene, barbiturates, caffeine, chlordiazepoxide, cocaine, amphetamines, diazepam, lorazepam, diphenhydramine, ethanol, nicotine, phencyclidine, and selective serotonin reuptake inhibitors” (Hammer, 2016, p. 957). Multiple factors increase the risk of NAS. For instance, it is difficult for some mothers to admit that they are using substances out of fear of being judged (McQueen & Murphy-Oikonen, 2016). Mothers may also fear being criminally charged (McQueen & Murphy-Oikonen, 2016). These factors make early intervention difficult. The amount of time that a drug was used during pregnancy impacts the severity of the condition (Logan et al., 2013). The third trimester is most vulnerable due to the increased penetrability of the placenta (Logan et al., 2013). Other factors that increase the severity and intensity of NAS include the term the infant was born in, the infant’s birth weight, and the infant’s exposure to more than drug type (Kocherlakota, 2014).

Incidence

The incidence of NAS has escalated in recent years (McQueen & Murphey-Oikonen, 2016). This increase is mainly due to the rise of prescription opioid use and addiction in the United States (Logan et al., 2013). In 2008, 2.2 per 1,000 hospitalized newborns were diagnosed with NAS in the United States, and this rate increased to 5.8 in 2012 (Agency for Research and Healthcare Quality, 2020). This amount continued to rise to a drastic national rate of 7.3 in 2017 (Agency for Research and Healthcare Quality, 2020). Some states, such as West Virginia and Tennessee, have higher incidence rates of NAS, and NAS appears to be significantly more prominent in rural areas than urban areas (Sanlorenzo et al., 2018). In 2019, 6.6% of pregnant women had used opiates, and 21.2% of these women reported abuse of opiates at some point in

their pregnancy (Ko et al., 2020). Approximately 55-94% of the children exposed to opiates neonatally go on to develop NAS (Hammer, 2016).

Signs and Symptoms

NAS impacts multiple systems throughout the body, causing a wide variety of signs and symptoms (Kocherlakota, 2014). The main systems affected are the central nervous system, the autonomic nervous system, and the gastrointestinal system (McQueen & Murphy-Oikonen, 2016). Typical signs involving the central nervous system include irritability, muscle tremors, and crying (Kocherlakota, 2014). Visual-motor problems are also frequent symptoms in infants with NAS (Anbalagan & Mendez, 2019). Abnormalities in body temperature, muscular tone, and heart and respiration rate are common signs of the autonomic nervous system (Kocherlakota, 2014). Lastly, gastrointestinal symptoms may include feeding difficulties, vomiting, and diarrhea (Kocherlakota, 2014).

Course and Prognosis

The onset, severity, and length of this condition differ based on various factors (Kocherlakota, 2014). The type of substance used by the mother during pregnancy is one example. The onset of withdrawal varies from 24-48 hours with heroin, 48-72 hours with methadone, 36-60 hours with buprenorphine, and 36-72 hours with prescription opiates (Kocherlakota, 2014). The duration of heroin withdraw is 8-10 days, which is significantly shorter than methadone and buprenorphine withdrawal, which lasts around 30 days (Kocherlakota, 2014). The dose and duration of drug exposure also affect NAS symptoms (Kocherlakota, 2014). In particular, drug dose in the third trimester correlates with more extended stays in the hospital (Logan et al., 2013). In addition to a higher dose, a longer gestational age puts the neonate at a higher risk of developing NAS symptoms (Logan et al.,

2013). This is due to the placenta's increased permeability in the later stages of pregnancy (Logan et al., 2013).

NAS is associated with poor long-term developmental outcomes (Anbalagan & Mendez, 2019). Although there has been research done on the long-term outcomes of NAS, it is difficult to connect these poor outcomes solely to neonatal drug exposure. This is due to the inability to isolate one variable during research. Environmental risk factors, such as low socioeconomic status and sustained maternal substance use, may also influence the child's development. Although it is challenging to ascribe NAS as the single cause, studies have shown poor long-term effects on visual-motor skills, cognition, school performance, psycho-behavioral health, rehospitalization, and mortality rates.

Diagnosis

There are currently many methods to detect NAS, as there is insufficient evidence backing one particular evaluation tool (Clark & Rohan, 2015). Although responses are often guarded, clinicians frequently perform interviews of the mothers (Clark & Rohan, 2015). In addition to self-report, a toxicology confirmation using urine or meconium can help determine the types of drugs the mother was using during pregnancy, but these tests are costly, timely, and require skill to administer (Kocherlakota, 2014). Moreover, they do not always verify nor eliminate the presence of substance abuse or addiction (Clark & Rohan, 2015). Various scoring systems exist to determine the severity of NAS (Bagley et al., 2014). However, there is limited validity and inter-observer reliability on commonly used assessment tools (Bagley et al., 2014). Modified versions of the Finnegan scores are currently the most common systems used across the United States (Kocherlakota, 2014). These tools assess the infant approximately every 3 to 4 hours for withdrawal signs (Clark & Rohan, 2015). Other tools include the Lipsitz Score, the

Ostrea System, the Neonatal Narcotic Withdrawal Index, and the Neonatal Withdrawal Inventory (Clark & Rohan, 2015). These tools all assess the infant at routine intervals and result in a score that determines the need for intervention (Clark & Rohan, 2015).

Medical Management

Due to insufficient evidence, there is not currently one particular treatment used for the management of NAS (Bagley et al., 2014). Medications are not always the first option in the treatment of NAS. They typically are used when nonpharmacological interventions, such as swaddling and frequent feeding, cannot manage signs and symptoms, high withdrawal scores persist, severe symptoms occur, or symptoms lead to severe dehydration (Kocherlakota, 2014). After determining the severity of NAS using a scoring system, the need for pharmacological intervention is determined (Kocherlakota, 2014). Scoring is continued throughout treatment to track any changes (Kocherlakota, 2014).

Although medications vary in the treatment of NAS, the most common choices include morphine, methadone, and buprenorphine (Clark & Rohan, 2015). “Morphine decreases the incidence of seizures, improves feeding, eliminates diarrhea, decreases agitation, and can control severe symptoms” (Kocherlakota, 2014, p. 554). However, morphine increases the threat of sedation and hypoventilation (McQueen & Murphy-Oikonen, 2016). It is also associated with a longer treatment length and hospital stay (Bagley et al., 2014). Due to its short half-life, morphine is administered every 3-4 hours and removed gradually every 24-48 hours (Bagley et al., 2014; Kocherlakota, 2014). This contrasts with methadone, which is only given twice daily due to its longer half-life (Kocherlakota, 2014). Buprenorphine is a newer treatment option that has shown benefits, including shorter treatment length and hospital stay and less severe opioid

withdrawal (McQueen & Murphy-Oikonen, 2016). The disadvantage of both methadone and buprenorphine is that they contain ethanol (McQueen & Murphy-Oikonen, 2016).

Impact on Occupational Performance

Occupational performance is the execution of a particular occupation that occurs from the interaction between the client, the context and environment, and the occupation (American Occupational Therapy Association [AOTA], 2020). Client factors, performance skills, and performance patterns can either facilitate or inhibit occupational performance (AOTA, 2020). As discussed previously, it is difficult to connect the long-term outcomes of NAS due to the potential influence of environmental factors (Anbalagan & Mendez, 2019). Therefore, it is inconclusive what long-term impact NAS has on areas of occupational performance. However, it is clear that NAS has an immediate effect on four primary areas of occupation: activities of daily living (ADLs), sleep, social participation, and play.

As for ADLs, the primary area involved is feeding. Insufficient feeding is a typical gastrointestinal symptom of NAS (Oostlander et al., 2019). There are various challenges associated with feeding infants with NAS, including fussing, sleeping, and crying (Maguire et al., 2015). Infants who do participate in feeding often fail to intake enough calories to make up for those lost due to hyperactivity, vomiting, and diarrhea (Oostlander et al., 2019). Poor motor and tone control can also contribute to low caloric intake (Velez & Jansson, 2008). For instance, an infant who struggles latching to a breast or bottle may spill milk out the sides of their mouth (Velez & Jansson, 2008).

Sleep is another area of occupation that is complicated by NAS due to poor autonomic functioning. Sleep disturbances may further impact the signs and symptoms of withdrawal experienced by an infant in the acute phase of NAS (O'Brien & Jeffery, 2002). An infant's sleep-

wake states can be seen on a continuum, ranging from a heavy sleep state to a crying state (Velez & Jansson, 2008). Infants with NAS may struggle to shift between states or spend too much or too little time in a particular state (Velez & Jansson, 2008). Therefore, NAS may impact both sleep quality and quantity. Sleep deprivation is common among neonates requiring treatment and those not requiring treatment (O'Brien & Jeffery, 2002). This is due to heightened alertness during early withdrawal (O'Brien & Jeffery, 2002). Moreover, treated neonates demonstrate disorganized and fragmented sleep patterns (O'Brien & Jeffery, 2002). Since infants requiring treatment present with more severe withdrawal, it can be concluded that the severity of withdrawal impacts the level of sleep disturbances (O'Brien & Jeffery, 2002).

Social participation, particularly the connection between the infant and mother, is also impacted by NAS (Velez & Jansson, 2008). Clinical signs present in the neonate, such as muscle tremors, facial expressions, and excessive crying, may affect the mother/infant dyad (Velez & Jansson, 2008). Attachment is a child's perception of being lovable, desired, and capable (Champagne, 2011). Attachment is essential to create a positive self-concept and establish resiliency and overall well-being (Champagne, 2011). Sensory processing challenges can further complicate an infant's connection with a caregiver (Velez & Jansson, 2008). Infants with NAS demonstrate sensory reactivity, but it is marked by maladaptive, disorganized responses that can interfere with social interaction (Velez & Jansson, 2008). For instance, an infant may look away from their mother when feeding to decrease sensory stimulation (Oostlander et al., 2019). As discussed previously, an infant's sleep can influence other symptoms of NAS (O'Brien & Jeffery, 2002). Difficulty maintaining a quiet, alert state presents challenges for social participation (Velez & Jansson, 2008). Depending on their response to the environment, an infant may be challenging to awaken or become irritable and fussy during communication (Velez &

Jansson, 2008). Lastly, crying that is inconsolable can impact the relationship between the mother and infant (Velez & Jansson, 2008). It may lead to maternal anxiety, depression, or feelings of guilt, further complicating their relationship (Velez & Jansson, 2008).

Another area of occupation that is affected by NAS is play. Play is an occupation that underlies co-regulation and attachment. The disruption of formative, developmental experiences impacts the antecedent behaviors of play. NAS symptoms may influence the cognitive, motor, and social/emotional skills necessary for play. For instance, increased muscle tone, tremors, seizures, or myoclonic jerks may impact gross motor, manipulation, and construction skills. Moreover, visual-motor deficits and hyperirritability may affect the infant's attention to and interest in their environment. Frequent yawning, high-pitched crying, sleep disturbances, or irritability may complicate an infant's ability to imitate actions. Social interaction is another component of play. As mentioned previously, infants with NAS may present with sensory processing challenges, sleep disturbances, and inconsolable crying that can interfere with social interaction (Velez & Jansson, 2008). Play in infants is rarely, if ever, solitary and requires an available and ready play partner. If the parent struggles with substance abuse or mental illness, they may have a reduced capacity to be present and fully engaged with their child.

Models of Occupational Therapy Intervention

There are various models of occupational therapy intervention that can help guide the treatment of NAS. These models include self-regulation/co-regulation, sensory integration, and co-occupation. Self-regulation is one's ability to control their level of arousal (Belford, 2012). This allows one to tune out unnecessary information and attend only to important sensory stimuli (Belford, 2012). Self-regulation is learned first through co-regulation (Belford, 2012). Whitney (2020) describes co-regulation between a mother and an infant as the mother's ability to regulate

the child's arousal level. She notes that adverse childhood experiences can disrupt this co-regulatory system between the mother and infant, yet various strategies can mitigate the effects of this experience (Whitney, 2020). These include treating sensory processing challenges, promoting routines, and providing occupational engagement opportunities to improve the connection between the parent and the child (Whitney, 2020). There is strong support for touch-based interventions in the treatment of infant self-regulation, and there is moderative evidence supporting their use to improve maternal stress and anxiety (Kingsley et al., 2020). Parent training is also beneficial in facilitating mother-infant attachment, involving interpreting and responding to the infant's cues (Kingsley et al., 2020). Providing a "just right" amount of structure, engagement, nurture, and challenge is an essential part of the intervention process.

As discussed previously, infants with NAS may demonstrate maladaptive responses to sensory input (Velez & Jansson, 2008). Various sensory strategies have proven to be effective in the management of NAS. Prone positioning, swaddling, gentle handling, and sustaining a stable body temperature are all interventions that help manage NAS at a personal level (Oostlander et al., 2019). Control of environmental stimuli can also help reduce various neurological symptoms (Oostlander et al., 2019). Some of these strategies include low or dim lighting, a quiet environment, the mother's scent or calming scents, and non-nutritive sucking agents (Oostlander et al., 2019).

A parent can also be taught how to read their child's cues to provide appropriate sensory feedback. The Zones of Regulation is a framework that can help the parents identify their child's arousal level to help regulate their behaviors (Kuypers, 2013). In this framework, there are four zones: green, red, yellow, and blue. The green zone is characterized by "a calm state of alertness and neutral emotions" (Kuypers, 2013, p. 1). A child learns and develops optimally in this zone.

An infant in this zone may demonstrate minimal movement, regular breathing, and a desire to interact. The red zone is characterized by "extremely heightened states of alertness and intense emotions" (Kuypers, 2013, p. 1). In an infant, this may present as tensing of the muscles, increased respiration, skin color changes, or full intensity crying (UC Davis, n.d.). The yellow zone is characterized by "a heightened state of alertness and elevated emotions" (Kuypers, 2013, p. 1). An infant may demonstrate increased body movement, abnormal breathing, and sensory sensitivity (UC Davis, n.d.). Lastly, the blue zone is characterized by "low states of alertness and feelings" (Kuypers, 2013, p. 1). In an infant, this may present with reduced body movement, postponed reactions, or drowsy eyes (UC Davis, n.d.). A parent can use many of the previously mentioned sensory strategies to help get their child back to the green zone. For instance, if an infant is in an irritable state, in the red zone, a non-nutritive sucking agent may create a calming and organizing effect (Velez & Jansson, 2009). Some infants may also attempt to self-soothe by moving their hands to their mouth (Velez & Jansson, 2009).

Co-occupation is an occupation involving another person where one person's performance influences the other (Whitcomb, 2012). It is essential to view infants' contribution in co-occupations, rather than view them as passive participants because the involvement of both the mother and the infant is an integral part of attachment (Whitcomb, 2012). Various interventions target the mother-infant dyad, including "education and support, rooming-in and skin-to-skin contact" (Oostlander et al., 2019, p. 216). For instance, improvements in sleep quality can occur by teaching parents the variances in cries and how to help calm their child (Gronski & Doherty, 2020). Developing routines with everyday occupations is another strategy that can promote engagement in co-occupations. For example, creating a sleep routine after returning home from the hospital can help boost a mother's confidence and improve her ability

to calm her child (Oostlander et al., 2019). This, in turn, has a positive impact on the mother-infant dyad (Oostlander et al., 2019).

Summary and Conclusions

Overall, NAS has a significant impact on an infant's occupational performance, and there are various models of occupational therapy intervention that can guide treatment. The clinical presentation of NAS is variable, and more research is needed to determine the long-term effects that NAS has on development. There are many methods of diagnosis and intervention, and occupational therapy is valuable in the management of NAS because of its focus on infant occupational performance development and caregiver support. Caring for an infant with NAS can be challenging; fortunately, occupational therapy strategies can help improve both caregivers' and infants' quality of life.

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