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Characterization of Babies Discharged from Cabell Huntington Hospital During the Calendar Year 2005 with the Diagnoses of Neonatal Abstinence Syndrome

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Abstract

Recent concern regarding the impact of maternal drug abuse on neonatal well being was the impetus for this retrospective cohort study of newborns diagnosed with neonatal abstinence syndrome that were discharged from Cabell Huntington Hospital during the calendar year 2005. Medical records of the neonates and their mothers were analyzed for a variety of health related outcomes and healthcare cost.

Forty-eight neonates were diagnosed with Neonatal Abstinence Syndrome in 2005, forty of which required NICU assistance. The average maternal age at delivery was 26; gravity was 3.1 and most were single, separated or divorced. The majority had poor or inconsistent prenatal care. Twenty-one delivered by cesarean section most often for fetal distress. Most delivered prematurely with an average gestation of 35.9 weeks. Half of the mothers went into preterm labor with half of those having premature ruptured membranes. Opiates were the most common maternal substance found, while neonates most often tested positive for methadone. Nearly 90% of the mothers smoked. Thirty-four of the mothers were found to continue illicit drug abuse while pregnant, while another eight were seen in a methadone clinic for a history of abuse. Most of the neonates required weaning with methadone. The majority of our study cases were funded by Medicaid, mostly by West Virginia with total hospital costs exceeding 1.7 million dollars. Direct cost attributed to detoxification was in

excess of \$180,000. The number of neonates diagnosed with Neonatal Abstinence Syndrome has nearly tripled from 2003 to 2007.

The problem of maternal drug abuse and addiction during pregnancy has dramatic effects on both their unborn children and our local healthcare system. Increased awareness of this growing problem is needed so that earlier interventions can be implemented. It is our opinion that all obstetrical patients at risk should be screened early and often so that those affected individuals can be managed more aggressively to improve neonatal outcomes.

Introduction

Neonatal Abstinence Syndrome (NAS) consists of a group of symptoms caused by neonatal withdrawal from maternal use of narcotics. The definition has also been expanded to include other substances (selective serotonin reuptake inhibitors, nicotine, amphetamines, marijuana, and alcohol). Incidence has been difficult to ascertain due to poor reporting of maternal drug abuse, however, estimates range from 3 to 50% depending on the patient population and area of the country studied. At birth, the neonate's drug supply is lost, leading to withdrawal within days to weeks depending on the half-life of the substance, maternal and fetal metabolism, and hydration. As many as half of the fetuses exposed to narcotics will experience withdrawal; while long term mortality is extremely low, the risk of SIDS (sudden infant death syndrome) is increased by 3.7% in methadone users and 2.3% in cocaine users. Withdrawal causes central nervous system over stimulation as evidenced by high-pitched cry, restless sleep lasting less than 1-3 hours, hyper-reflexia, tremors, increased muscular tone,

myoclonic jerks, and convulsions. The gastrointestinal system is also affected with excessive suckling, poor feeding, regurgitation, emesis (often projectile), and loose stools. Metabolic, vasomotor and respiratory effects include diaphoresis, fevers, yawning, sneezing, nasal flaring, respiratory rates often greater than 60/min. (without retractions) and apneic episodes. The rate of intrauterine growth restriction, preterm rupture of membranes, preterm delivery, oligohydramnios, low APGAR scores, meconium staining and intrauterine fetal demise are all increased. Infants with NAS, as well as their mothers, ultimately require greater care and often longer hospitalizations with many requiring neonatal intensive care unit (NICU) assistance. The cost impact of these interventions nationwide is largely unknown. It has been our observation that the diagnosis of NAS has been increasing in frequency in our NICU in the past five years. It is not the intent of this study to establish cause and effect but rather to bring attention to the scope and the potential impact of the problem to our healthcare system.

Materials and Methods

A retrospective cohort study of neonates discharged from Cabell Huntington Hospital (CHH) was performed during the calendar year 2005 with the diagnoses of NAS (N=48). CHH, an academic tertiary care center in Huntington, West Virginia, is the site of over 2500 live births yearly. The year 2005 was chosen so that all of the records and billing would be finalized and so that a comparison of the number of affected neonates with the two preceding and two post characterization years could be

made. Before initiating the study, The Marshall University Institutional Review Board approval was obtained.

To select the patient population, the medical records department compiled a list of all infants that were discharged from our facility during 2005 with an ICD-9 code (779.5) for NAS. These neonate's charts were recovered and used to identify their mothers whose charts were also recovered. Information was extracted from both the neonate and mother's charts. Fourteen of the maternal charts were not available for review since they delivered at outlying facilities and only the newborn infant was transported to our facility. The neonate's chart, however, often contained extensive maternal information.

CHH had 2549 live births in 2005. Thirty-four (1.3%) of these neonates were diagnosed with NAS. Some required the services of the NICU (N=26), while others were able to go to the newborn nursery (N=8). Our facility also provides NICU services for the surrounding area and receives neonatal transfers from many outlying hospitals. From these, another 14 babies were identified with NAS during the time frame of our study. The resulting study population numbered 48 babies. Of the 48, five were twins; therefore, our study involved 46 mothers.

Data was extracted from the neonates' charts (N=48) as well as the available maternal charts (N=32, since 14 delivered elsewhere). This information was recorded onto standardized data collection forms by the author. Items retrieved included

drugs used during pregnancy, quality of prenatal care, insurance status, maternal age, gravity and parity, pregnancy and delivery complications as well as the mode of delivery. Other data collected included the percent of expected birth weight, gestation age at delivery, postpartum complications, and total hospital days, which were divided into NICU, newborn nursery and pediatric days. Maternal information was recorded onto the corresponding neonate's data sheet.

To maintain confidentiality, the data collection forms were coded by numbering 1-48 corresponding to the neonates in the study. All patient identification information was listed separately with the corresponding codes and known only to the author. The data collection forms were maintained and stored confidentially in the OB/GYN office at Marshall University. The code sheet was stored separately by the author. Once the study was completed, the identification code sheet was shredded.

The drugs involved were determined by examination of both the neonate's and their mother's charts. Maternal drugs were identified by a positive maternal drug screen, positive neonatal urine, meconium testing, or admission by the mother of using a substance during her pregnancy. Neonatal drugs were determined only by positive testing of the infant's urine or meconium.

The total cost of hospitalization for the 48 neonates was compiled by the billing department of CHH. The

average cost of stay was calculated by dividing the total by 48. A comparison between the average cost of stay of a healthy newborn with the average cost of stay of a newborn with NAS and no other health issues was made. The difference in the cost of caring for these two neonates was the direct cost of detoxification for the treatment of NAS. This number was multiplied by 48 for the total cost of care directly attributed to detoxification.

Raw numbers of infants carrying the diagnoses of NAS were obtained (by ICD-9 code search by our medical records department) for the two years prior and two years after 2005. Neither maternal nor neonate charts were examined for this purpose.

Results

During the calendar year 2005, forty-eight neonates were discharged with the diagnosis of neonatal abstinence syndrome. Of these, 33 were delivered at our facility, 14 were transported to our facility after being delivered at outlying hospitals and 1 delivered at home. Of the 33 delivering at Cabell Huntington Hospital, 7 arrived as maternal transports for pregnancy complications. Forty three of the cohort were singletons (89.6%) and 5 were twins (10.4%) [One corresponding twin was not transported from the outlying hospital where delivered]. Interestingly, 37 were male (77.1%) while 11 were female (22.9%).

Maternal age at delivery ranged from 18 to 38 years old with an average age of 26.1 years. Most were

Table 1. Prenatal Care Patterns

PRENATAL CARE	FIRST APPOINTMENT	CONSISTENCY	WOMEN
GOOD CARE	Starting in 1st trimester	No missed appointments	13
LATE CARE	Starting after 1st trimester	+/- missed appointments	4
VERY LATE CARE	Starting after 2nd trimester	+/- missed appointments	9
INCONSISTENT CARE	Starting in 1st trimester	Missed >2 appointments	17
NO CARE	-----	-----	2
UNKNOWN CARE	-----	-----	1

in their 20's (N=36, 78.3%), 9 were in their 30's (19.6%) and one was less than 20 (2.1%). Gravity ranged from 1 to 12 with an average of 3.1 pregnancies per mother. Parity ranged from zero to 6 yielding 71 children delivered to this population previously, of which 15 were preterm (21.1%) and 5 were documented fetal demises at greater than 20 weeks gestation (7.0%). Twenty-nine previous spontaneous abortions were also reported. Most mothers were single (N=20, 43.4%), 15 were married (32.6%), 10 were divorced or separated (21.7%) and one was widowed.

Twenty-one cesarean sections (45.7%) were performed and comprised of 12 primary low transverse, 1 primary classical and 8 repeat low transverse. Reasons for caesarian section included: fetal distress (8), severe preeclampsia (1), abruption (2), malpresentation (3), Hepatitis C (3), twins (3) and unknown (1). The remaining 25 mothers delivered vaginally (54.3%) with one requiring vacuum assistance and another necessitating forceps. One delivery was a vaginal birth after cesarean.

The average gestational age at delivery was 35 6/7 weeks with a range of 26 0/7 to 42 0/7 weeks (Figure 1). Prenatal care was frequently either late and/or inconsistent or no care at all (Table 1). Eleven mothers were seen by maternal fetal medicine

and every obstetric practice in our area was involved in the care of some of these women.

Opiates were the most common maternal substance found, while neonates most often tested positive for methadone (Figure 2). Drug test results could not be found for 11 of the mothers and 14 of the neonates. It was unclear if these tests were ordered. Negative testing was identified in 2 mothers and 9 neonates. Seven mothers (15.2%) readily admitted to using alcohol during the reference pregnancy, with one admitting to drinking "almost every day." Forty one mothers smoked (89.1%) while three denied smoking (6.5%) and 2 were undeterminable (4.3%).

Of the 19 mothers positive for methadone, 6 were buying the drug on the street, 2 had prescriptions from their physicians, while the remaining 11 went to methadone clinics. Eleven of the 13 were taking methadone due to a history of narcotic abuse and for the prevention of withdrawal while pregnant. The remaining two had chronic low back pain, both from motor vehicle accidents. Methadone doses ranged from 20 mg to 140mg daily (average dose 98.5mg daily).

Prescription medications other than methadone were used by 6 mothers. One took oxycodone/acetaminophen for low back pain (spinal stenosis), while another took oxycodone/acetaminophen for osteoarthritis. One mother

was prescribed oxycodone CR for restless leg syndrome and another took acetaminophen with codeine for a childhood sports injury to her thoracic spine. One woman took both oxycodone and alprazolam for chronic pain caused by an automobile accident and its provocation of anxiety attacks. The last took clonazepam for her anxiety.

While none of the mothers spent excess time in the hospital postpartum, six spent time on the antepartum unit. The longest stay was for 17 days for "fetal well being" following an ethics consult. One was directly admitted from the Emergency Department after presenting in withdrawal. She stayed 9 days before having an emergent cesarean section for fetal distress. Other antepartum admissions included one for oligohydramnios, one for preeclampsia, and two for pre-term labor.

Within this cohort (N=46) there were numerous complications with both the pregnancies as well as the deliveries. Half of these women went into preterm labor (N=23). Twelve had premature rupture of membranes (26.1%) with 9 occurring preterm (19.6%). Many placental complications were seen including: abruption (N=6, 13.0%), previa (N=2), velamentous cord insertion (N=1), and accreta (N=2) with one requiring a hysterectomy. Documentation revealed 5 cases of chorioamnionitis, 14 cases of meconium stained amniotic fluid and 4 cases of oligohydramnios. Non-reassuring fetal heart tracings were noted in 15 of the pregnancies (32.6%). Five precipitous deliveries occurred – with one delivery at home. While most of the fetuses were in the vertex presentation at delivery (N=42, 91.3%), 5 were malpositioned. Of these, three were breech (two frank and one footling), one was transverse, and one was direct occiput posterior. Two had undocumented presentations, but delivered vaginally.

Neonatal complications were numerous. By design, all of the neonates had neonatal abstinence

Figure 1.
Gestation at delivery.

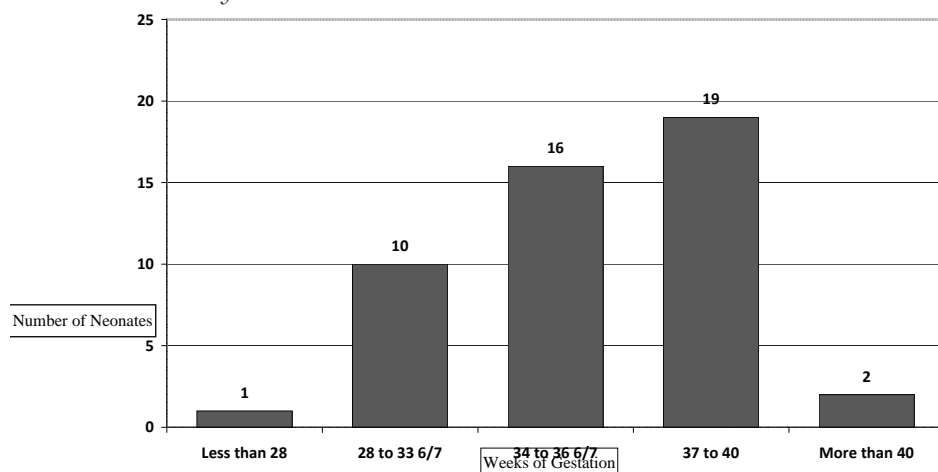
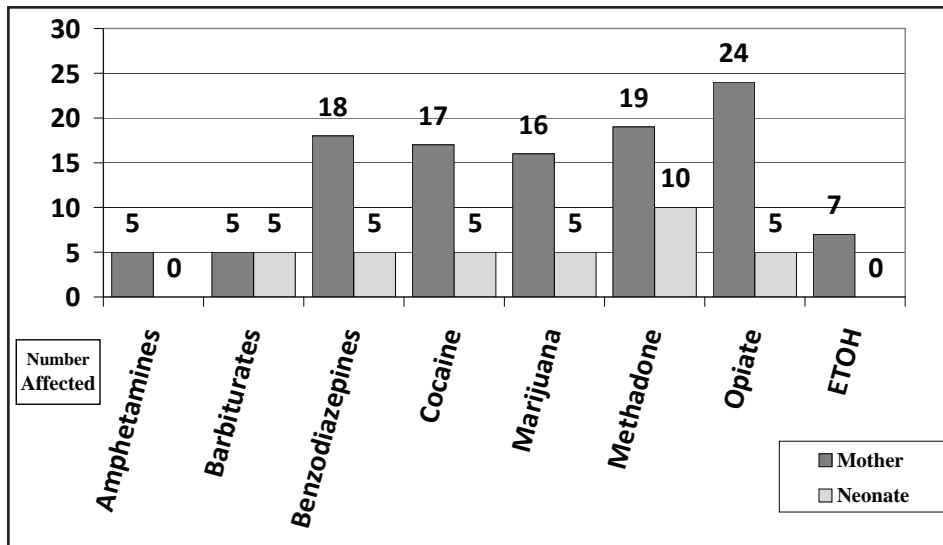


Figure 2.
Substances involved during the reference pregnancy.



syndrome (N=48), most of which were directly related to current or past use of illicit substances (N=42, 91.3%) (Figure 3). Because of their dependence, twenty six (54.2%) of the neonates required weaning with methadone totaling 215 days with 23 going home on this medication for continued weaning as an outpatient. Of these: 11 necessitated outpatient apnea monitoring as

well. Thirteen required respiratory assistance totaling 7 days of high frequency ventilation, 19 days regular ventilation, 83 days of continuous positive airway pressure (CPAP), and numerous days of oxygen assistance. Two neonates were lethargic at birth and one required cardiopulmonary resuscitation and administration of naloxone. One was noted to have elevated liver enzymes caused by in

utero anoxic hepatic injury. Fifteen other neonates were found to have hyperbilirubinemia requiring 63 total days of light therapy. One child had culture proven septicemia with MRSA, while 21 others had suspected sepsis, but with negative cultures. These children were given IV antibiotics for a total of 127 days. Thirteen were diagnosed with anemia of which 5 needed transfusions and 4 received epoetin alfa. Two also received fresh frozen plasma.

Other serious complications included intraventricular hemorrhages (2), bilateral pneumothorax (1), pulmonary hemorrhage (1), GI bleed (1), intrauterine growth restriction (9) and large for gestational age (3) (Figure 4). In addition to serious complications there were an unusual number of anomalies identified which included distal rectal atresia (1), peripheral pulmonary artery branch stenosis (1), microcephaly (1), syndactyly (2), umbilical/inguinal hernias (1) and three failed hearing examinations.

Of the 48 neonates, 40 required NICU assistance (83.3%) for a total of 650 days (range 1-55 days, average stay 16.25 days). An additional 36 days were spent in the well child nursery and 13 days on the pediatric

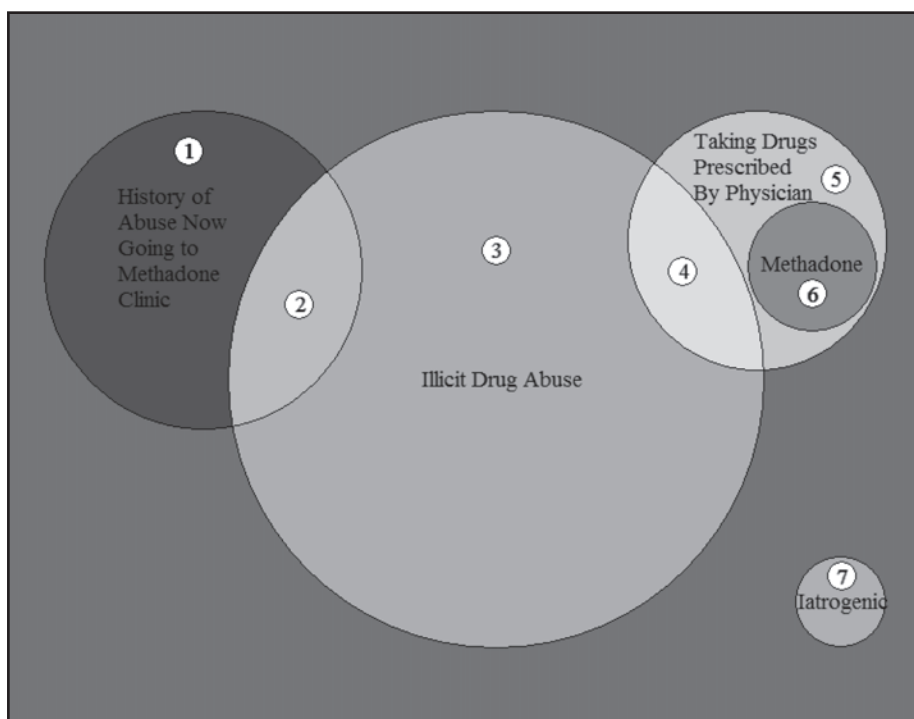
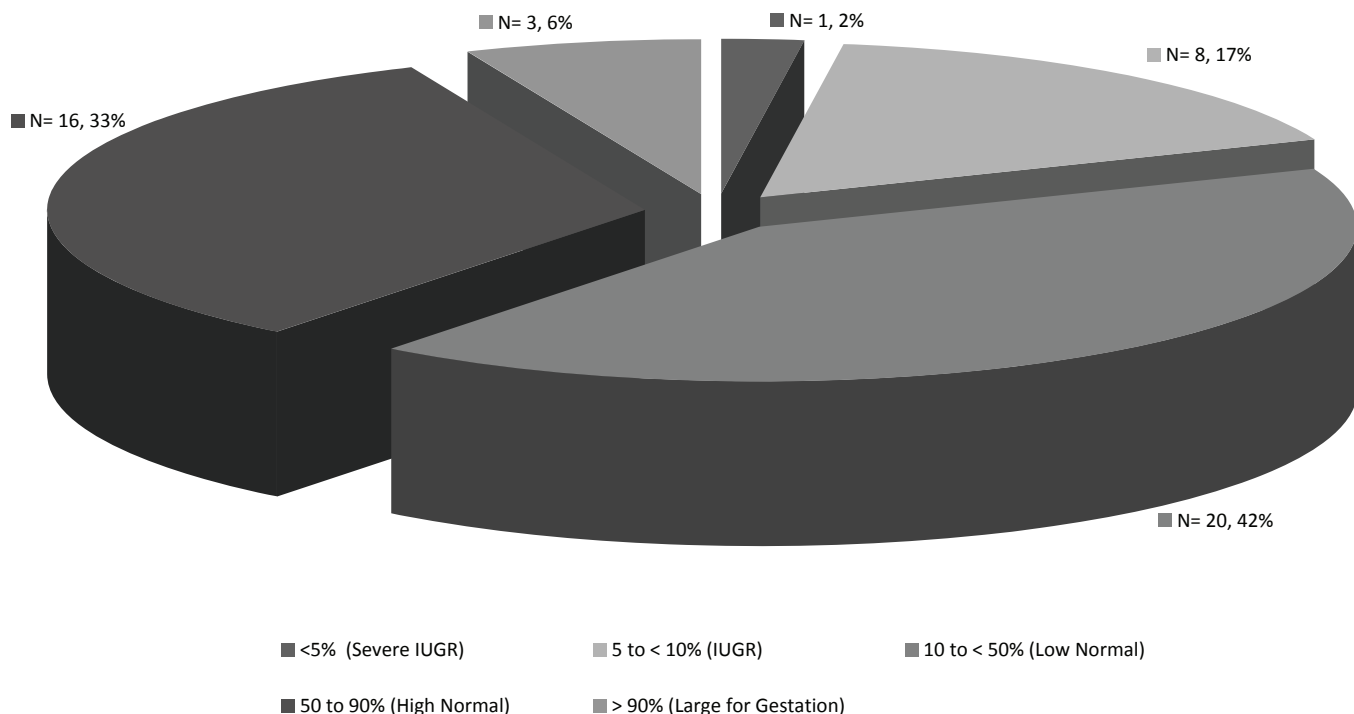


Figure 3.
Substance Source by Neonate [N=48]: 1) History of illicit drug abuse now going to Methadone Clinic, with no evidence of continued abuse [N=8]. 2) History of illicit drug abuse now going to Methadone Clinic and continuing illicit abuse [N=4]. 3) Continued illicit abuse [N=27]. 4) Prescription medication from a physician and continuing illicit abuse [N=3]. 5) Prescription medication from a physician, with no evidence of illicit abuse [N=3]. 6) Methadone from a physician [N=2]. 7) Given long term narcotics in the NICU for pain relief [N=1].

Figure 4.

Birth weight expressed as the percentage expected for gestational age at delivery.



service. Two babies were transported back to outlying hospitals prior to discharge. Most of the neonates were discharged home with their mothers (N=31, 64.6%), while 5 went with relatives (usually a grandparent), 11 went to foster care (22.9%) and one was unknown. Of interest, one child reported to the emergency department in cardiopulmonary arrest just 9 days after being discharged home with his mother and grandmother. He had severe anoxic ischemic encephalopathy and died 3 days later.

The majority of our patients had health insurance and were covered by Medicaid (N=38, 79.2%) most of which were from West Virginia (N=22) but neighboring states Ohio (N=11) and Kentucky (N=5) were also well represented. Three had no coverage at delivery, but later received Medicaid and only a few had private insurance (N=7, 14.6%). Total cost for the care of these 48 neonates while hospitalized exceeded \$1,761,582 at an average of \$36,700 per child. This figure represents

hospitalization costs only for the neonates, not their mothers, and does not include physician costs. The hospitalization cost for a healthy newborn going to the newborn nursery was determined by averaging the cost of all such neonates in 2005. This group had an average stay of 2.3 days at a cost of \$1,964.16 each. The average cost for neonates with NAS who were otherwise healthy was then calculated. This group spent an average of 5 days at a cost of \$5,898.71 each. The difference between these two groups (\$3,934.55) is the excess charge attributed to detoxification of one neonate. Multiplying this amount by 48, (the number of neonates in our study) produces \$188,858.40 spent in 2005 for detoxification alone. It was not possible to relate the remaining NICU costs directly to maternal drug abuse but an obvious inference can be made since the rate of NICU admissions from our cohort is much greater than that of the general population.

Lastly, review of the raw numbers of neonates diagnosed with NAS in

the two years prior to 2005 as well as the two years after 2005 demonstrates a clear upward trend (Figure 5).

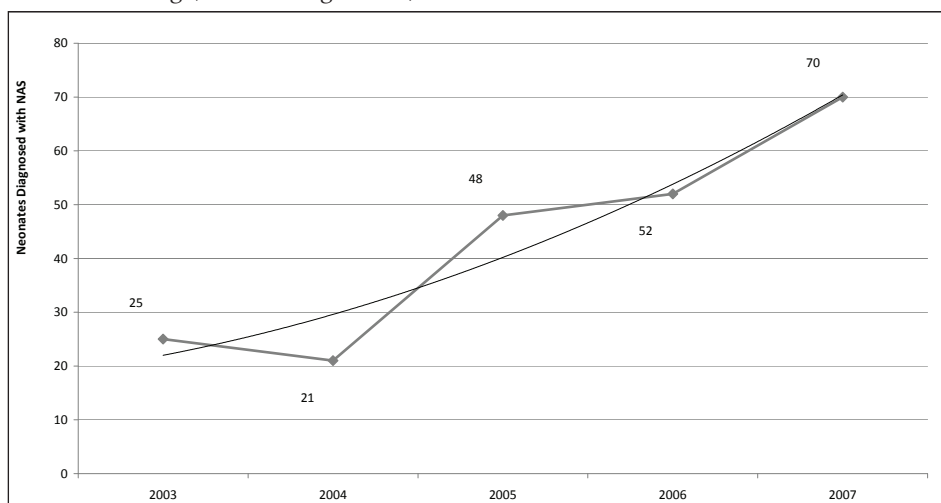
Discussion

All cases of Neonatal Abstinence Syndrome caused by maternal drug abuse are preventable. Throughout history, men and women have used a wide array of substances to cause various effects within their bodies and this experimentation is very unlikely to change. Unfortunately, within our pregnant population this trend is increasing bringing with it an increase in neonatal morbidity and mortality as well as increasing strain on our healthcare system.

Most of the women in our cohort study received either late or inconsistent prenatal care with some receiving no care at all (Table #1). Forty-one neonates were either covered by Medicaid at the time of delivery or shortly thereafter. This group represents 85.4% of our study population indicating the involvement of socioeconomic factors. It is essential, however, that

Figure 5.

Neonates diagnosed with Neonatal Abstinence Syndrome by year. Dashed line shows trend increasing (binomial regression).



the physician practicing obstetrics be mindful that the problems leading to NAS cross all socioeconomic levels.

The population characterized in this study ranged from 18 to 38 years of age, which encompasses the full age range of fertile women. It is apparent that no age group can be excluded from scrutiny when thinking about the possibility of substance abuse in pregnancy.

The greater majority of those studied were either single, separated or divorced (N=30) indicating a potential lack of stability and commitment in their lives. Practitioners need to note however, that fifteen of the women were married; once again making it difficult to determine whom to screen for potential problems with abuse.

Most drug abusers will not be identified unless all obstetric patients are screened. Even then, denial is a major obstacle, especially in the pregnant population. Women may not admit to drug abuse for fear of loss of custody, legal ramifications, or guilt. Careful history taking is important. The interviewer must be respectful, attentive and understanding while asking neutral open-ended questions. It is useful to begin asking about legal substances

such as cigarette smoking, alcohol consumption and prescription medication. Marijuana, while illegal, carries less social stigma and women may respond truthfully if asked about its use. Questions about clearly illegal substances such as cocaine, heroin, and methamphetamines will complete the review.

For each substance, ask the dosage, frequency and the last time used. The route of dosage is important since IV drug abuse is closely related to infectious diseases, many of which have serious consequences for both the mother and fetus. A history of sharing needles is particularly worrisome.

Risk factors include late or inconsistent prenatal care, past history of spontaneous abortions, premature birth, growth retardation, abruptions, precipitous delivery, or stillbirths. Trouble with law enforcement, child protective services involvement, and having children removed from the home should raise questions. Family history of substance abuse as well as substance abusing spouses, especially in patients with risk factors of their own, are especially worrisome since often a family member or the spouse is the initiating factor. Mothers of children

with neurological or developmental problems should also raise concern.

Certain infectious diseases and illnesses are often associated with substance abuse. HIV, hepatitis, endocarditis and sexually transmitted diseases should raise questions about IV drug abuse or trading sex for drugs. Physical findings such as needle tract marks, atrophy of the nasal septum, tachycardia, and abnormalities of pupil size, diaphoresis, or behavior that is deemed as abnormal should raise concern.

Practicing physicians treating female patients must be cognizant of the possibility of drug abuse in pregnancy recognizing that the problem crosses all socioeconomic, age and race boundaries. An increase in awareness leads to opportunities for early interventions and aggressive management that in turn leads to better outcomes. Proper screening techniques, good history taking skills and thorough physical examinations are necessary to alert the clinician to potential substance abuse. Risk factors must be evaluated carefully and tactfully. Once abuse is identified, it becomes imperative to develop a treatment plan with the patient. Special consideration of the desire to quit, the substance involved, the dosage, and gestational age must be considered. With ample time, psychiatric counseling, and social services support, almost any motivated patient can be detoxified. If any of these requirements are absent, the mother can be placed on a methadone maintenance program with reasonable success, understanding that the newborn will require detoxification.

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