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Alyson Brady

The Effects of Adderall on the Mother and Fetus Health

Honors College Thesis

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Thesis Chair: Nicholas Andreadis

Abstract

Information available for woman prescribed Adderall to treat ADHD and the effects that it may have on her fetus is limited. However, Adderall and methamphetamine have similar pharmacological and addictive qualities. This paper is concerned with whether there is an adequate approach to treatment that balances the needs of the mother and the fetus. With Adderall use becoming more prevalent, it is essential that society is aware of the physiology and pharmacology of this drug, as well as, the need for more research on this subject to be produced.

Preface

As a senior student-athlete in college I have experienced the highs and lows of college life. Looking back, there is no way to have fully prepared myself for what college actually is. In short, the stress of being homesick, studying for finals, soccer practice everyday, plus trying to figure out what you want to do for the rest of your life is more than a full-time job. However, the positives of being independent, getting all A's, long summers and taking everything day by day makes you want to stick around and get that degree.

Getting acclimated to the workload and reality of college are challenging. So when you overhear one of your friends discussing this "super-pill" called Adderall, that will enable you to be focused and motivated to get your studying and work done, temptation might take over. Most people do not want to do more work than they have to and nearly everyone is hungry to do as well as they can. Seriously, how

could one tablet/ pill harm you, right? You start to reassure yourself that it's okay because you are doing it for school.

From my experience of peers taking this medication Adderall is not a one-time experience. The thought process is "it helped me before, it'll help me again," stays imbedded in their mind. Unlike me, most students aren't interested in the negatives of this drug,, which include becoming addicted, failing a drug test or possibly overdosing due to misuse.

I have surrounded myself with fellow students and peers for the last four years. These students and peers range in age typically from 17-24 years old including women who are of childbearing age. Which brings me to the point of this paper. With students taking Adderall as often as the statistics presented below mention, I wonder what effects this drug might have on the mother and fetus.

Introduction

In recent years, there has been increasing discussion about the incidence, diagnosis, and treatment of ADHD, or attention-deficit hyperactivity disorder. Approximately 4% percent of the population has been diagnosed with ADHD (Milanovic, 2010). This 4% is comprised of children, men and women of all ages including women of childbearing age. The most common age group diagnosed with ADHD ranges from 5 to 19 years. However, researchers note that it is much more difficult to diagnose ADHD in adults than children (“Attention Deficit,” n.d.). There is no difference in incidence according to race or ethnicity. More men have been diagnosed with ADHD than females (CDC, 2015). The CDC also demonstrates that over the years there has been in an increase in the prescribing of ADHD medications.

The focus of this paper is on the mother taking these amphetamines during pregnancy and the direct or indirect effect it has or may have on their fetus.

Common symptoms of ADHD are difficulty staying focused, hyperactivity, making careless mistakes, fidgeting and interrupting others before they finish speaking (“Attention Deficit,” n.d.). ADHD is difficult to diagnose and treat, as there is a lack of adequate research and knowledge on the subject. For this reason, many health care providers offer different forms of treatment based on their own experience and/or bias. The most common form of treatment for ADHD is the use of psycho-stimulants.

College students are another population that must be mentioned when discussing ADHD and the use of medications used to treat this condition. In a study on college students completed in 2011, it was reported that 61.8% of college students were offered ADHD medication at some point throughout college and 31.8% used this medication without a prescription (CDC, 2015).

Physiology of Neurotransmission

Neurons communicate through chemical messengers called neurotransmitters. Once the neurotransmitter arrives at its destination, another neuron cell, the transmitter delivers a “message” from which a predetermined response is anticipated. This response can be either excitatory (stimulating) or inhibitory (not stimulating). Adderall is a stimulant and therefore promotes an excitatory response.

Two types of neurotransmitters influenced by amphetamine are dopamine and norepinephrine. Dopamine is responsible for reward, motivation, pleasure and motor function (“DrugFacts: Methamphetamine,” n.d.). The presence or absence of dopamine can determine a range of feelings from how focused one is to how depressed someone feels. The sympathetic nervous system (classically remembered by “fight or flight”) is activated, by increasing the amount of dopamine and norepinephrine, Increased stimulation to the nervous system causes an increase in heart rate and blood vessel constriction. One consequence of concern occurs when a pregnant woman is taking prescribed or illicit drugs that cause her blood vessels to

constrict. Such constriction of blood vessels results in reduced oxygen delivery to the developing fetus.

There is not much research on possible direct neurotoxicity of the brain in children and adults caused by Adderall.

Pharmacology of Adderall

The generic names for Adderall are amphetamine and dextroamphetamine. Adderall is a schedule II drug, highly regulated due to its potential for abuse. This drug is made by a variety of manufacturers and is made in two forms IR (immediate release) and XR (extended release). Like most schedule II drugs, a number of possible side effects of Adderall exist. According to FDA regulated labels some of these side effects affect the heart, central nervous system, cardiovascular system endocrine system and the skin. These warnings from the FDA range in severity from minor to fatal. Frequently reported side effects include decreased appetite, insomnia and anxiety (FDA, 2010).

The half-life of amphetamine is dependent on the pH of urine. The more basic the urine is, the longer the half-life will be. Amphetamines are typically excreted through urine though it can be excreted through other bodily function such as breast milk.

Due to the lipid soluble characteristics of amphetamines, this drug is able to cross mostly every kind of membrane with little to no assistance (Fitzgerald, 2013). Accordingly amphetamines can cross the placenta.

Crystal methamphetamine

Most of us are aware of the dangerous effects that methamphetamine causes to drug abusers. So how similar are they actually?

Crystal methamphetamine or glass commonly looks like clear crystals. Methamphetamine, otherwise known as crank, is a typically white color powdered substance. Methamphetamine can be snorted, smoked or injected. It is most commonly smoked to achieve its effects.

Methamphetamine is an addictive stimulant (“Methamphetamine,” n.d.). It has few uses other than recreational use. The effect people feel by using methamphetamine is a high, euphoric effect. This euphoric effect produced by methamphetamines is caused by a rapid increase in the amount of the neurotransmitter dopamine in the brain. As discussed in the previous section, dopamine is responsible for reward, motivation, pleasure and motor function. A human will receive 12 times the amount of pleasure from methamphetamine than pleasurable activities such as sex or eating (“How meth destroys,” n.d.).

A common abused dose of methamphetamine is 100-1,000mg daily and up to 5,000 mg/day for chronic users (“Drugs and Human,” n.d.). Methamphetamine is converted in the body to the active form, amphetamine. Tolerance is quickly achieved requiring frequent increases in doses to maintain this drugs effects.

Though information is limited, negative effects have been reported in those who have used methamphetamine during pregnancy. Premature delivery, placental abruption, and many effects on the baby including low birth weight heart and brain

abnormalities and extreme tiredness have been reported (“Methamphetamine,” n.d.).

Methamphetamines can easily penetrate the fetal placental barrier. Because the placental barrier is dependent entirely on the mother for survival (nutrients, blood flow etc.), drugs used by the mother will more greatly impact the fetus than they would if the fetus were injected directly by the drug itself.

The use and abuse of methamphetamine has increased since the late 1980’s. In contrast to opiates, alcohol and tobacco, research and knowledge on the effects of methamphetamine in pregnancy are far more limited (“Methamphetamine abuse in,” 2011).

Teratogenic effects in rats and rabbits have been reportedly linked with the usage of Adderall. The only information available on human usage of Adderall while pregnant are the accounts from mothers willing to admit this information.

As demonstrated by the FDA, when providing pregnant animals with a normal oral dose of amphetamine (the same amount in Adderall), no abnormal physical changes to the fetus were visible. When the pregnant animals were provided with a dosage that was 6 times the legal 30mg/day maximum human dose, fetal malformations and fetal death were both reported along with maternal toxicity (FDA, 2002).

However, even though external physical malformations are limited at a normal dose in rats, long-term behavioral alternations were found. These behavioral effects include slowed locomotor activity, changes in sexual function and memory deficits.

The FDA discusses one report of a pregnant mother who admittedly took Adderall during the first trimester. Severe malformations were visible in the born baby including congenital deformity, trachea-esophageal fistula and anal atresia. Other nonteratogenic effects have also been reported to shown premature delivery of infants with low birth rate (FDA, 2002).

In an article by Dr. Milanovic from Massachusetts General Hospital, she discusses the use of stimulant medications during pregnancy. An important point that Dr. Milanovic makes is that a majority of the data we have on the use of stimulants during pregnancy comes from studies on drug abuse. From a study done on 50, 282 women, 367 of which were taking Dextroamphetamine and 215 taking unspecified Amphetamines within the first trimester, external defects were not recorded in any of the exposed infants. She concludes that there is not enough information on stimulants to conclude that stimulants have any effect on reproductive safety (Milanovic, 2010).

A local obstetrician relayed this story to me. A woman being treated for ADHD medication became pregnant. In addition to Adderall, the woman was also prescribed narcotics for pain and antidepressants. The woman also was a smoker. When referred to an MFM (Maternal Fetal Medicine Specialist), she was advised to continue her Adderall. The woman was compliant as far as she was concerned and the baby was born small, but healthy (Hoffman, 2015).

Is there a maternal-fetal conflict of interest?

A subject that is commonly debated is the rights of the mother and those of the fetus within. Who has priority when it comes to well-being in a particular situation is not easily decided. Pregnancy is an area taken with great care and sensitivity. Yet, with that care and sensitivity is a lack of adequate research

From a quick Google search on healthy pregnancy, you can find articles upon articles on what to take and what not take. Reading further you can find a lot of words such as “may, can, could, most” broad terms with little to no conclusion. There is a lack of adequate evidence as to what is actually beneficial or harmful to a fetus.

Should we assess the mother-fetus connection as a whole when making a health decision? When is the fetus considered viable? Should we judge priority according to trimester? What is the risk-benefit profile?

When a woman is diagnosed with a condition such as ADHD, to what extent is it considered disabling? Is there valid testing to determine how disabling ADHD is? Is there even a consensus on how to diagnose ADHD? It is important to maintain the physical and emotional health of the woman carrying the child. Yet, if the treatment is even possibly harmful to the fetus, does a provider continue with treatment? If a woman elects to stop Adderall is that the best form of treatment for her ADHD, if any? Can we insist on no treatment of the woman when we have little evidence of harm to a fetus? Would the judgment call be dictated according to legal dosing? Could we decrease the dose to benefit the fetus?

According Dr. Jennifer Hoffman-Thome, in her obstetrics practice, if a woman who is prescribed a stimulant for ADHD becomes pregnant, she would refer the

patient to a MFM to ensure optimum health of the woman and the fetus. It is her understanding that a MFM would continue the medication throughout pregnancy(Hoffman, 2015).

I asked Dr. Hoffman whether she would ask the woman to cease use of medication or allow the woman to continue for the same reason. She replied that the decision would be individualized for each patient. Dr. Hoffman continued on to say that she would likely counsel the patient in hopes to have her discontinue the medicine (Hoffman, 2015).

In conclusion, Dr. Hoffman-Thome said that most obstetricians do not have much experience with prescribing ADHD medications such as Adderall. Many health care providers refuse to continue dosing, asking the obstetrician to takeover their plan of care. Generally obstetricians consult MFM doctors for guidance when high-risk pregnancies present (Hoffman, 2015).

It is hard to answer any of these ethical questions to their full extent with the given knowledge we have on the effects of Adderall on a fetus. For this reason, I offer this paper as a cause for concern.

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