Environmental Medicine Update

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Environmental Chemicals and Female Factor Infertility

Introduction

Infertility is a rising problem. It is estimated that greater than 6 million couples in the US, or 1 in 6, have impaired fertility. Over 10 million couples have sought infertility services. The medical definition of *infertility* is no conception after 12 months of intercourse without contraception in women under age 35, no conception after 6 months of intercourse without contraception in women aged 35 to 40, and no conception after 3 months of intercourse without contraception in women over age 40.[1] Trouble conceiving can strain a relationship and be the source of heartache, stress, and unexpected medical expense.

Factors

Obviously a woman's age is a factor in infertility. But many factors account for fertility problems in couples, and often they want to know who's to blame. Well, 35% to 40% is due to male factors, 35% to 40% to female factors, and 20% to 30% to a combination of male and female factors. Common female factors include[1,2]:

Pelvic

Infection: pelvic inflammatory disease, STDs, septic abortion, endometriosis

Prior surgery: D & C, appendicitis, fibroids, endometriosis, adnexal surgery

Contraception and pregnancy history: hormones, DES exposure, eccysis, miscarriage

Menstrual cycle issues: oligo- or amenorrhea, menorrhagia, endometriosis, pelvic pain

Ovulatory

Secondary amenorrhea
Abnormal uterine bleeding
Luteal phase defect
Premature ovarian failure
Polycystic ovarian syndrome (PCOS)
Elevated prolactin (associated with endometriosis, lactation)
Hypothyroidism
Prior use of antiestrogens (Lupron, Depo-Provera)

Systemic

Delayed childbearing
Over- or underweight (BMI > 25 or < 18)
Insulin resistance
Kidney and liver disease
Substance use (alcohol, marijuana, caffeine, tobacco)
Malabsorption (celiac, IBD)

Unexplained

Environmental chemicals

Environmental Chemicals

Women are exposed to chemicals through food, water, air, cosmetics, lotions, plastic bottles, and food storage containers, to name just a few sources. These chemicals, which are called xenobiotic toxicants, hormone disruptors, or estrogen mimickers, can be linked to reproductive issues in women and cause infertility. They have estrogenic, androgenic, antiestrogenic, or antiandrogenic properties. Endocrine disruptors can act through changes in metabolism of endogenous hormones, cross-talk between genomic and nongenomic pathways, interference with hormonal feedback regulation and neuroendocrine cells, changes in DNA methylation, and binding to classical nuclear receptors and estrogen-related receptors.[3] Through these various mechanisms of action they can cause several conditions linked to infertility, such as PCOS, fibroids, and endometriosis, and be the cause of unexplained infertility.[4] There are numerous chemicals associated with infertility. Here are a look at the most common toxicants and their source of exposure.

Cigarette smoke is by itself an environmental toxin. The link to infertility was discovered in 1983 when a study

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linked decreased fertility in couples to smoking cigarettes. A review of 12 studies published between 1985 and 1997 linked infertility in women to smoking cigarettes. Women undergoing expensive fertility procedures such as egg retrieval and in vitro fertilization had poor outcomes if they were smokers.[5]

Lindane is a common pesticide used on humans to treat scabies and lice. Studies have shown that lindane interacts with sperm and affects its lipid bilayer and may inhibit sperm's response to female hormones in the uterus at the site of egg fertilization.[6]

Pentachlorophenol is used as a pesticide and a wood preservative. It is no longer available to the general public. It is still used industrially as a wood preservative for utility poles, railroad ties, and wharf pilings. It is found in the air, water, and soil and can be in fish and other foods. This chemical can cause hormonal effects in a woman, lowering ovarian and adrenal function, thus leading to infertility.[6]

Polychlorinated biphenols (PCBs), once used in electrical equipment, plasticizers, and adhesives, have now contaminated our fish, meats, and dairy products. PCBs decrease fertility by lowering progesterone levels, and altering estrogen and the ovulatory cycle.[7]

Chlorinated hydrocarbons are a group of chemicals that include pesticides such as DDT, solvents such as chloroform, polyvinyl chloride products, and others. We are exposed to these chemicals every day while bathing, eating, and drinking. They are known to alter the hypothalamic-pituitary-ovarian axis, alter estrogen and progesterone in a woman, and directly affect the maturing egg from the ovary.[8]

Perfluorooctane sulfonate (PFOS) and perfluorooctanoate (PFOA) belong to the class of chemicals called perfluorinated chemicals (PFCs). These are used in clothing, fire-fighting foams, carpet, furniture, and personal care products. They have contaminated our soil, water, and air. PFCs have accumulated up the food chain and are present in food as well as products. In a study published in 2009, PFOS and PFOA have been linked to longer time to pregnancy. Blood levels of these chemicals were elevated in women with menstrual irregularities, longer times to pregnancy, and increased odds to infertility.[9]

Fish consumption and mercury levels are also linked to infertility. One study of infertile couples found that they had high blood levels of circulating mercury compared with couples who were not infertile. It went on to correlate the high mercury levels directly to fish consumption. The more fish the infertile couples ate, the higher levels of mercury in their blood.[10]

Bisphenol A (BPA) is a chemical found in plastic baby bottles, water bottles, and the lining of metal food cans. It can contribute to the risk of PCOS, a common cause of infertility.[11] A recent study showed that increasing levels of urinary BPA reduced viable oocyte harvesting in IVF patients, possibly through estradiol suppression.[12]

Phthalates are chemicals found in soft plastic beverage bottles, plastic food storage containers, cosmetics, and plastic food wrap. They are linked to endometriosis, another common cause of infertility in women. One study showed that women with endometriosis showed significantly higher blood levels of phthalate concentrations than controls.[13] In a study in India, 49 infertile women with endometriosis showed significantly higher blood concentrations of the phthalates metabolites di-n-butyl phthalate (DnBP), butyl benzyl phthalate (BBP), di-n-octyl phthalate (DnOP), and diethyl hexyl phthalate (DEHP) compared with controls.[14]

Summary

When evaluating women for infertility, there are many factors to consider, including the link to environmental chemicals. The evidence is clear that hormone-disrupting chemicals contribute to female factor infertility. It is important that physicians identify common toxicants linked to infertility and how a patient is being exposed. The first step in addressing environmental factors is education on avoidance techniques and offering safe alternatives. If it is clear that a woman has been exposed to chemicals linked to infertility, laboratory testing is available to check for body burden of chemicals. Physician prescribed chelation and detoxification methods can be used to help remove chemicals from the body and improve fertility. Prevention is truly the best medicine, and women should be educated on avoiding hormone-disrupting chemicals while they are young to maintain optimal fertility. The importance of this approach to health care for young women preparing to become pregnant cannot be overemphasized.

Notes

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