JOGNN

CASE REPORT

Case Study of Intrapartum Antibiotic Prophylaxis and Subsequent Postpartum Beta-Lactam Anaphylaxis

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Keywords
beta-lactam allergy
anaphylaxis
intrapartum antibiotic prophylaxis
maternal group B Streptococcus

ABSTRACT

Universal screening for maternal group B Streptococcus (GBS) in the prenatal period has led to administration of intrapartum antibiotic prophylaxis (IAP). Although IAP decreased the rate of early neonatal GBS disease, exposure of childbearing women to penicillin and other beta-lactam antibiotics has increased. Beta-lactam-induced anaphylaxis in the breastfeeding woman during the postpartum period illustrates risk factors for beta-lactam allergy and anaphylaxis. Treatment and nursing implications for this adverse reaction are suggested.

JOGNN, 44, 610-617; 2015. DOI: 10.1111/1552-6909.12732

Accepted May 2015

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The authors report no conflict of interest or relevant financial relationships.

Because of the morbidity and mortality of neonatal early-onset group B streptococcal (GBS) infection, national guidelines were established in 1996 to treat maternal colonization of this organism that can infect the neonate (Centers for Disease Control and Prevention [CDC], 2010). With the introduction of intrapartum antibiotic prophylaxis (IAP), early-onset neonatal GBS disease has declined by 80% (CDC, 2014). Between 10% and 40% of women giving birth receive IAP (CDC, 2010; Hanson & VandeVusse, 2010). Penicillin (PCN) is the drug of choice for IAP but is also a drug to which approximately 10% of patients have reported an allergy or adverse reaction (Chang, Mahmood, Teuber, & Gershwin, 2012). In addition, PCN or other beta lactams may be prescribed for treatment of postpartum infections such as mastitis, endometritis, wound infections, and urinary tract infections. The purpose of this case study is to present the risk factors for PCN and beta-lactam allergy and anaphylaxis, discuss treatment of anaphylaxis, and suggest implications for nurses caring for women who experience this adverse reaction. When the woman is breastfeeding, treatment of anaphylaxis also affects the nursing infant.

Beta-Lactam Use, Allergy, and Anaphylaxis

Even though anaphylaxis was recognized and first described more than a century ago, no universally accepted definition of *anaphylaxis* has been established (Ring, Brockow, & Behrendt, 2004). Experts at the Second Symposium on the Definition and Management of Anaphylaxis noted that anaphylaxis is a serious allergic reaction that is rapid in onset and may cause death (Sampson et al., 2006). Although foods and insect stings are the two most prevalent causes of anaphylaxis, medications accounted for 13.7% of reactions in one 10-year epidemiologic study (Decker et al., 2008). Beta-lactam antibiotics are commonly prescribed and are used frequently in the intrapartum and occasionally in the prenatal and postpartum periods.

Intrapartum Antibiotic Prophylaxis

PCN is the antibiotic recommended in IAP guidelines (CDC, 2010), which call for testing of pregnant women for GBS at 35 to 37 weeks gestation by culturing swabs from the lower vagina and rectum. Urine can be tested for bacteria at any time during pregnancy. For those who test positive at

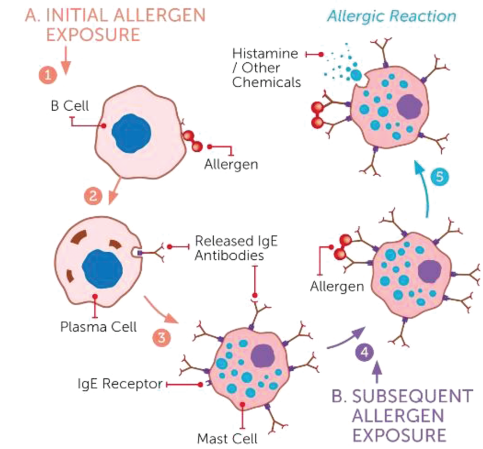

Figure 1. Development of an allergy. Figure used with permission from Zahler. Retrieved from http://zahlers.com/cms/wp-content/uploads/2011/11/Allergies2.jpg

any time during pregnancy, IAP should be initiated during labor. PCN G 5 million units administered intravenously followed by 2.5 to 3.0 million units every 4 hours until delivery is the recommended regimen. An acceptable alternative is ampicillin 2 grams initially then 1 gram every 4 hours intravenously until birth (CDC, 2010). PCN is a narrow spectrum antibiotic, whereas ampicillin is a broad spectrum antibiotic and more likely to lead to antibiotic-resistant organisms (Bizzaro, Dembry, Baltimore, & Gallagher, 2008). Although IAP is recommended to prevent early onset GBS disease related to ß hemolytic streptococcus, late-onset GBS disease as well as infections due to other organisms, such as *e. coli*, are not prevented by IAP (Nandyal, 2008; Russell & Murch, 2006). When IAP use was evaluated in a large hospital system, late-onset serious newborn infections with ampicillin resistant organisms were significantly related to ampicillin IAP (odds ratio [OR] = 4.95, 95% confidence interval [CI] [2.04, 11.98]) whereas IAP with PCN was not associated with serious infections of resistant organisms (Glasgow et al., 2005). Thus, using PCN for IAP is recommended, especially when anticipating preterm and very low birth weight neonates (Bizzaro et al., 2008).

Development of Beta-Lactam Allergy

Repeated exposure to a drug is necessary for allergy development and anaphylaxis response. As 10% to 40% of laboring women receive IAP (Hanson & VandeVusse, 2010), increased exposure to antibiotics may increase the incidence of beta-lactam allergy and possible anaphylaxis. Not

Intrapartum treatment of group B Streptococcus has increased mothers' exposures to beta-lactam antibiotics that can prime them for anaphylactic reactions during treatment of infections in the postpartum period.

all allergic reactions trigger anaphylaxis. Although definitions and attributes of anaphylaxis may vary, there is agreement that a severe allergic reaction can be life threatening and unpredictable (Sampson et al., 2006).

Allergic reactions to drugs are a result of immunologic mechanisms. Most allergic reactions are IgE dependent, although PCN non-IgE-mediated reactions or T cell–mediated reactions can occur (Schofield, & Calhoun, 2011; Worm, Babina, & Hompes, 2013). This immunologic change occurs first when the drug enters the lymph nodes and is taken up by dendritic cells. These dendritic cells have the primary function of processing pathogens by attaching to a protein and traveling via the lymph system (see Figure 1) (Schofield & Calhoun, 2011). This complex is presented to T and B cells that produce IgE antibodies to the specific drug complex. The next time the body recognizes this complex, an inflammatory response is triggered that releases histamine, prostaglandin D2, tryptase, and many different cytokines. The result is an allergic reaction.

Seventy percent of antibiotic anaphylaxis episodes involve a type of PCN or a cephalosporin, which belong to the beta-lactam class of antibiotics, so named because of their chemical structure (Caimmi et al., 2011). Immediate reactions (including anaphylaxis) are usually IgE mediated and classically develop within an hour of the administered dose of the drug, however, timing can vary depending on drug absorption and other factors that may influence absorption such as food ingested with an oral antibiotic. The incidence of anaphylaxis induced by PCN is one to four episodes per 10000 administrations (Solensky, 2013). Anaphylaxis is triggered with exposure to a dose of the drug and may be characterized by when the symptoms appear (immediate is within one hour or late is 72 hours or more) (Salkind, Cuddy, & Foxworth, 2001).

Risk Factors for PCN and Beta-Lactam Allergy

Several factors put one at risk for allergy and anaphylaxis: prior exposure, route of administration,