

Contents

Preface: “Doctor...I’m Pregnant”!	xiii
Edward S. Schulman	
Gestational Development of the Human Immune System	1
Laura Jardine, Ina Schim van der Loeff, Iram J. Haq, and Thomas D.R. Sproat	
<p>Building an immune system is a monumental task critical to the survival of the fetus and newborn. A functional fetal immune system must complement the maternal immune system in handling in utero infection; abstain from damaging non-self-reactions that would compromise the materno-fetal interface; mobilize in response to infection and equip mucosal tissues for pathogen exposure at birth. There is growing appreciation that immune cells also have noncanonical roles in development and specifically may contribute to tissue morphogenesis. In this review we detail how hematopoietic and lymphoid organs jointly establish cellular constituents of the immune system; how these constituents are organized in 2 mucosal sites-gut and lung-where early life immune function has long-term consequences for health; and how exemplar diseases of prematurity and inborn errors of immunity reveal dominant pathways in prenatal immunity.</p>	
Longitudinal Changes in Upper and Lower Airway Function in Pregnancy	17
Vanessa E. Murphy and Megan E. Jensen	
<p>Physiologic changes during pregnancy have implications for both upper and lower airway function. Upper airway resistance increases, and total lung capacity decreases. Upper airway symptoms increase; some women develop pregnancy-induced rhinitis and there is an increased prevalence of sleep-disordered breathing compared to prepregnancy. Longitudinal studies examining changes in upper and lower airway function parameters are limited, particularly in women with asthma. Some studies have observed reduced lung function with advancing gestation; however, changes are small and unlikely to be of major clinical significance. Spirometry is therefore a useful tool for clinical assessment of women with asthma during pregnancy.</p>	
Maternal Macro- and Micronutrient Intake During Pregnancy: Does It Affect Allergic Predisposition in Offspring?	27
Katherine Stumpf and Julie Mirpuri	
<p>This review article explores the available literature on the association of maternal nutrient intake with development of allergies in offspring. It examines the mechanisms for maternal diet-mediated effects on offspring immunity and dissects recent human and animal studies that evaluate the role of both maternal macro- and micronutrient intake on offspring susceptibility to asthma, eczema, food allergy, and atopy.</p>	

Advancing Exposomic Research in Prenatal Respiratory Disease Programming 43

Rosalind J. Wright

Disease programming reflects interactions between genes and the environment. Unlike the genome, environmental exposures and our response to exposures change over time. Starting in utero, the respiratory system and related processes develop sequentially in a carefully timed cascade, thus effects depend on both exposure dose and timing. A multitude of environmental and microbial exposures influence respiratory disease programming. Effects result from toxin-induced shifts in a host of molecular, cellular, and physiologic states and their interacting systems. Moreover, pregnant women and the developing child are not exposed to a single toxin, but to complex mixtures.

Management of the Upper Airway Distress During Pregnancy 53

Jean Kim, Michael Z. Cheng, and Robert Naclerio

Pregnancy can induce significant upper airway distress in women by the induction of rhinitis of pregnancy (ROP). Pregnancy can also exacerbate underlying rhinopathies. Little is known regarding the pathophysiology of the ROP. Diagnosis of other coexistent rhinopathies is key. Treatment regimens closely mirror standard treatments for other rhinopathies that are independent of pregnancy and are generally accepted as safe. Early recognition of the progression of rhinitis in the pregnant patient into complications of rhinosinusitis is important to prevent harm to both mother and fetus.

Chronic Management of Asthma During Pregnancy 65

Jennifer A. Namazy and Michael Schatz

Asthma is one of the most common potentially serious medical problems to complicate pregnancy. Optimal management of asthma during pregnancy is thus important for both mother and baby. Treating asthmatic women requires understanding the effects of pregnancy on the course of asthma, and, conversely, the effects of asthma on pregnancy outcomes. Successful management also requires an understanding the barriers to asthma control in this population of patients. Evidence has shown that it is essential that the allergist-immunologist, obstetrician, and patient work as a team during pregnancy to achieve optimal maternal and neonatal outcomes.

Status Asthmaticus Gravidus: Emergency and Critical Care Management of Acute Severe Asthma During Pregnancy 87

Charles B. Cairns and Monica Kraft

One-third of women with asthma have deterioration of their asthma during pregnancy, and one-fourth of pregnant women with asthma will experience severe exacerbations necessitating emergency department (ED) visits or hospitalizations. Early recognition of acute severe asthma, including life-threatening status asthmaticus, and aggressive medical interventions with β_2 -agonists, anticholinergic agents, and systemic corticosteroids are necessary to treat maternal airway bronchoconstriction, support maternal and fetal oxygenation, and avoid adverse fetal

outcomes. This review describes management of acute severe asthma in pregnancy, including status asthmaticus, in the ED and intensive care unit.

Anaphylaxis in Pregnancy

103

Margaret M. Kuder, Rachael Baird, Maeve Hopkins, and David M. Lang

Anaphylaxis in pregnancy is a rare event, but has important implications for the pregnant patient and fetus. The epidemiology, pathophysiology, diagnosis, and treatment all carry important considerations unique to the pregnant patient. Common culprits of anaphylaxis are primarily medications, particularly antibiotics and anesthetic agents. Diagnosis can be difficult given the relative lack of cutaneous symptoms, and normal physiologic changes in pregnancy such as low blood pressure and tachycardia. Apart from patient positioning, treatment is similar to that of the general population, with a focus on prompt epinephrine administration.

Management of Allergic Skin Disorders in Pregnancy

117

Eleanor M. Pope, Leah Laageide, and Lisa A. Beck

The safe management of allergic skin disorders during pregnancy is essential to maternal and fetal health. Poorly controlled allergic skin disease affects the health of mother and child. This article reviews the disease course and treatment of atopic dermatitis, chronic urticaria, and allergic contact dermatitis in pregnancy. It focuses on topical and systemic therapies in the context of pregnancy and breastfeeding. Because disease activity may vary in pregnancy, prescription stewardship is imperative; a balance among disease control, minimum effective dosing, and medication safety profiles should be maintained. Secondary complications and risks to maternal or infant health should also be avoided.

Primary Antibody Immunodeficiency and the Pregnant Patient

133

Shouling Zhang and Charlotte Cunningham-Rundles

An overview of primary antibody immunodeficiency in pregnancy is presented. Indications for immunoglobulin replacement therapy (IGRT), dosing, and safety considerations are highlighted. Uses of immunizations and antimicrobial therapy are also discussed. In general, IGRT, both intravenous and subcutaneous, is considered safe in pregnancy.

Hereditary Angioedema During Pregnancy: Considerations in Management

145

Marc A. Riedl

In recent years, hereditary angioedema (HAE) management has substantially advanced but also become more complex with additional therapeutic options. Pregnancy significantly influences the clinical symptoms of HAE in many women because of estrogen effects or other physiologic factors, and also introduces important safety concerns related to HAE medications. Management of HAE during pregnancy requires clinicians to be familiar with the potential clinical course, triggers, and recommended treatment strategies to provide guidance and optimal medical management to women and families affected by the condition. This review provides an

overview of data, considerations, and recommendations related to HAE and pregnancy.

Mastocytosis in Pregnancy

159

Nonie Arora, Cem Akin, and Anna Kovalszki

Mastocytosis is a rare neoplastic disorder of the mast cell lineage resulting in unregulated proliferation and activation of mast cells. Symptoms worsen in about one-third of pregnant patients. Treatment focuses on management of symptoms with antimediation therapy (H1 & H2 antihistamines, glucocorticoids, and epinephrine, if required). Medication selection requires care during labor and delivery. Although it is generally considered safe to use a medication patient tolerated before, some common medications may need to be avoided or used with caution (eg, codeine, morphine, nonsteroidal antiinflammatory drugs, vancomycin) if the patient does not have any history of exposure to them.

Use of Asthma Medication During Gestation and Risk of Specific Congenital Anomalies

169

Ruth P. Cusack, Christiane E. Whetstone, and Gail M. Gauvreau

Poorly controlled asthma can affect neonatal outcomes including congenital anomalies, which can be reduced with appropriate asthma care during pregnancy. Although there is a concern regarding the safety of asthma medication use during pregnancy and congenital anomalies, the risk of uncontrolled asthma outweighs any potential risks of controller and reliever medication use. Patient education before and during pregnancy is critical to ensure good compliance to therapy and reduce the risk of poor asthma control.

Monoclonal Antibodies (Biologics) for Allergic Rhinitis, Asthma, and Atopic Dermatitis During Pregnancy and Lactation

187

Courtney L. Ramos and Jennifer Namazy

Asthma, allergic rhinitis, chronic urticaria, and atopic dermatitis are common diseases that affect hundreds of thousands of pregnant women each year. The authors discuss the use of biologics in women who are pregnant or lactating, indications, available safety information, and knowledge gaps. There are pregnant patients for which standard treatment is either inadequate or contraindicated; in those cases, monoclonal antibodies (biologics) should be considered despite the unknown risk to the fetus. In severe asthma, omalizumab is the best studied with reassuring available safety data. Insufficient safety data exist on mepolizumab, reslizumab, benralizumab, dupilumab, and tezepelumab use during pregnancy and lactation.

Improving Asthma Outcomes During Pregnancy in Underserved Communities

199

Alan Gandler, Edward S. Schulman, and Erika J. Yoo

It is known that poor asthma control is common in pregnancy, and asthma in general disproportionately affects underserved communities. However, there is a paucity of data examining strategies to improve asthma control

specifically among pregnant women from vulnerable populations. Identified barriers to optimal asthma care in other underserved groups include health literacy, financial constraints, cultural differences, and poor environmental controls. These deficiencies may also be targets for multimodal interventions geared toward improving asthma outcomes for underserved women during pregnancy.