Chapter 4

The impact of pre and postnatal medical interventions on infant gut microbiota

A.L. Kozyrskyj, S.L. Bridgman and M.H. Tun

Abstract

Established during infancy, the initial colonization and development of the complex gut microbial community of our gastrointestinal tract can be shaped by common medical interventions, such as caesarean section and antibiotic use. This chapter provides evidence on the gut microbial impact of four medical interventions: i) caesarean delivery, ii) maternal intrapartum antibiotic prophylaxis (IAP), iii) hospitalization post birth, and iv) postnatal infant antibiotic treatment. Reductions in bifidobacteria and members of the *Bacteroidaceae* family (e.g. *B. fragilis*) are by far the most common perturbations in microbial composition following each of these interventions, especially after elective or emergency caesarean section. On the other hand, genus *Clostridium* and the *Enterbacteriaceae* (e.g. *Klebsiella, E. coli*) are likely to become more abundant in infants delivered by caesarean, exposed to maternal antibiotics, hospitalized post birth and treated with antibiotics. Often, the enterococci and staphylococci also become more abundant. Differential impact on gut microbiota is observed by type of caesarean delivery and antibiotic administered to the mother or infant. IAP with penicillin or cefazolin, or newborn treatment with intravenous penicillin (plus gentamicin) is associated with higher abundance of *Enterococcus* and *S. aureus*. *Klebsiella* emerge after newborn intravenous ampicillin (plus gentamicin) treatment. The *Veillonella* become more abundant in the infant gut after emergency (but not elective caesarean), whereas they are found to be depleted two months after newborn treatment with oral cephalexin. Of note, dysbiosis from perinatal medical interventions also occurs in the early breastfed infant and is enhanced by prematurity.

Chapter 6

The intestinal microbiota and the child's immune system

Jenmalm, M.C. and Prescott, S.L.

Abstract

The microbiota provides crucial signals for the development and function of the immune system. The intestinal microbiota in mammals represents the ecological site on Earth with the highest density of bacteria, and this complex ecosystem seems to provide a primary signal for establishment of an adequate mucosal barrier function and the maturation of a balanced postnatal innate and adaptive immune system. Our modern lifestyle and the declining biodiversity diminish the exposure to microbes with which we have co-evolved, and this is considered a major factor driving abnormal postnatal immune development. Early microbial exposures occurring during critical periods of immune maturation seem to have long-term impact on development of immune mediated diseases, and the maternal microbial environment during pregnancy may also crucially influence immune programming. In this chapter we explore the interaction of the intestinal microbiota and the host immune system in early life, with focus on studies in humans. We propose that future detailed studies on the complex interactions between the developing infant microbiome and immune system are important for establishing strategies to promote childhood health and prevent development of immune mediated diseases.

Chapter 9

The role of intestinal microbiota in infant allergic diseases

H. Szajewska

Abstract

In many countries, particularly in populations with a Western lifestyle, allergic diseases are on the rise. As genetic factors have not changed, environmental factors must be playing a role. Recently, attention has been focused on the role of the gut microbiota. However, despite many years of extensive research, the link between the gut microbiota and allergic diseases still has not been fully clarified. The primary objective of this chapter is to provide an overview of the role of the gut microbiota in the development of allergic diseases. The role of probiotics and/or prebiotics as microbiota modifiers for the prevention and treatment of allergic diseases is reviewed. The focus is on allergic diseases typically found in infants.

Chapter 16

Probiotic interventions to optimize the infant and child microbiota

Y. Vandenplas and K. Huysentruyt

Abstract

In many countries, particularly in populations with a Western lifestyle, allergic diseases are on the rise. As genetic factors have not changed, environmental factors must be playing a role. Recently, attention has been focused on the role of the gut microbiota. However, despite many years of extensive research, the link between the gut microbiota and allergic diseases still has not been fully clarified. The primary objective of this chapter is to provide an overview of the role of the gut microbiota in the development of allergic diseases. The role of probiotics and/or prebiotics as microbiota modifiers for the prevention and treatment of allergic diseases is reviewed. The focus is on allergic diseases typically found in infants.