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Review Article

FAECAL MICROBIOTA "AN IMMUNE PRIMER" FOR CAESAREAN BABIES

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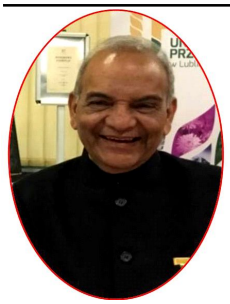
Abstract: Human being get immune primer from birth during vaginal delivery; caesarean babies are debarred from this dose that is why they suffer more with infectious diseases during their early childhood period. In this paper we described methods of priming the c-section babies with mother's microbiota for developing their immune system. It is now well established that mother's faecal micobiota is the most appropriate immune primer for caesarean babies. We have also discussed here the mode of delivery of mother's microbiota to the new born.

Keywords: Immunity, Mucus fluid, vaginal fluid, metabolic diseases

INTRODUCTION

The human microbiota plays important roles in maintaining health from birth to death. They fall under 3 categories namely, commensal, symbiotic and pathogenic [1]. The residing population, whether beneficial or pathogenic maintain a perfect balance between those which benefit or harm the host [1]. Though they are omnipresent in our body and they influence indirectly the organs because they take part in synthesis of essential amino acids and vitamins, such as the vitamin K group and vitamins B12 and B3. Their role in digestion of food and regulation of immune system has been established from scientific studies [2,3].

There are two types of immune systems, viz., the innate (non-specific) and the adaptive (specific). Innate immunity is the defense system with which we were born with. It protects against all antigens. The innate immunity involves barriers to keep harmful materials from entering the body. Both of these subsystems are closely linked and work together whenever a germ or harmful substance triggers an immune response [4]. The mucosal immune system is equipped with unique innate and acquired defense



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mechanisms which provide a first line of protection against ingested and inhaled infectious agents [5].

C-section babies have weak immunity:

The foetus gets the first major exposure to bacteria during birth when it gets passage through the birth canal, and then as soon as he/she makes oral, skin and respiratory contact with the exterior which the C-section babies are missing. Immune system develops throughout life as babies are exposed to different germs that can cause disease. Many of the bacteria that colonize the gut and other mucosal sites are essential for healthy life discussed earlier [6].

Newborns delivered by C-section not exposed to microbiota present in birth canal of the mother, tend to harbour in their guts disease-causing microbes commonly found in hospitals (e.g. Enterococcus and Klebsiella), and lack strains of gut bacteria found in healthy children (e.g. Bacteroides species); they have lower numbers of Lactobacillus, Escherichia, and Bacteroides in their guts [7]. More so, in such babies, mucus is not pushed out of the lungs due to lack of the pressure of the birth canal to help empty fluid from the lungs, many caesarean babies have excess mucous and fluid in their lungs and not enough to protect babies from hospital infections. The mucus and the fluid from the lungs need to be suctioned to help them start breathing. However there are usually no long-term problems. The mucus serves as a first line of innate defence and is produced by surface goblet cells, other epithelial cells, and glands that are all intimately coupled to other parts of the innate and adaptive immune systems. The mucus is composed of many different molecules (antigens) with mucins. C-section babies lack mainly mucosal immunity –the first line of defense.

Besredka [8] proposed the existence of local immune system that function independently of systemic immunity. Davies [9] observed the presence of local immunity in humans; this observation indicated that bacterial agglutinins could appear in dysentery stools several days earlier than in the blood. The molecular basis for local immunity was established by Tomasi et al. [10] and confirmed that external secretions contained a unique immunoglobulin (Ig) subsequently called secretory IgA (SIgA).

In addition to regulating immune system, their involvement of gut microbiota especially in maintaining immune homeostasis and autoimmunity falls under the focus of the study in the recent past [11]. Literature survey gives enough evidences to certain their influence in reproduction [12]. A child is born with an immature, innate and adaptive immune system that develops as it ages, peaks in young and decline in old age [13]. The recognition of self and non self by the system to protects the self and destroys the non self is crucial role of the immune system [14]. This all done by joint affords of the thymus, spleen, lymph nodes, special deposits of lymphoid tissue (as in the gastrointestinal tract and bone marrow), macrophages, lymphocytes including the B cells and T cells. When the body senses foreign substances (called antigens) against which a specific chemicals (antibodies) are produced by B cells that protects the body; then T cells kill the non self and the cell debris is removed by the macrophages [15].

Vaginal fluid smear v/s Faecal transplant therapy:

Many studies show that there is a difference in microbiota population between vaginally delivered and C-section babies. Instead, their guts harbour harmful microbes that are common in hospitals and this can persist up to 12 months of age. As far as baby's immune health is considered, research shows that delivery by vaginal canal is better than caesarean section. It is surprising to understand from new research that babies born via caesarean section may have an impaired immune system in later life due to the lack of exposure to maternal bacteria that would occur during the standard birthing process [16]. Caesarean section birth disturbs mother-to-neonate transmission. Babies born by caesarean section have common microbiota with the babies born through vaginal canal because some of them can pass through placenta [17]. This gives some protection to caesarean babies when they are born.

Because babies born by C-section have higher rates of immune-related disorders later in life, researchers think this early-life bacteria could "prime" the immune system during a critical period of development.

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Immune Primer:

To lessen the damage, many gynaecologists have "seeded" C-section babies with their mothers' vaginal microbiota by swabbing. But de Vos says such transplants didn't seem to make the babies'

microbiomes match those of infants born vaginally. De Vos and colleagues [18] then theorized that vaginally born babies might get their microbes from accidentally ingesting a smidgen of their mother's stool during the birthing process. So they recruited 17 mothers preparing to give birth via caesarean section. The practice may be linked to healthier infant development, but safety and efficacy concerns still remain.

This proof-of-concept study demonstrates that the intestinal microbiota of CS-born infants can be restored post-natally by maternal faecal transplant therapy (FMT) after careful clinical and microbiological screening to avoid the risk of harmful microbes' exposure to the baby. In addition to much health discomfort to the mother, children delivered by CS are at increased risk of disease associated with immune function prompting speculation that this may have long-term health consequences. The CS babies are affected by mainly diseases involving the mucosal immune system [19]. Researchers have performed beneficial microbial transplants in neonates after C-section mom-to-infant developed by de Vos (18). In the microbial transplant technology was developed by the group lead by Andersson [20], at the Pediatric Research Center, Helsinki University Hospital, University of Helsinki, Helsinki,

Modes of Delivery:

All humans get the seeds of microbes from mother during the birth except those who take birth by caesarean section [21]. FMT is a procedure that delivers healthy human donor stool to a patient via colonoscopy, enema, nasogastric (NG) tube, or in capsule [22]. FMT has emerged as highly effective, safe, and cost-effective treatment option at least for recurrent Clostridioides difficile infection (CDI) with a success rate around of 90% . The U.S. Food and Drug Administration recently approved the latest faecal microbiota transplantation, or FMT, therapy product for recurrent CDI. Formal approval was granted for Rebyota® for patients 18 years and older who have completed antibiotic treatment for recurrent CDI but had ineffective results [23]. In addition to CDI infection this technique give positive results from animal model as well as human trials in treating brain diseases such as Alzheimer's [24], Huntington's [25], Parkinson's [26] and non-nervous bacterial diseases such as diabetes mellitus [27], obesity [28], polycystic ovary [29] and endometriosis [30] etc.

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