Journal of Mucosal Immunology Research

Chen, J Mucosal Immunol Res 2022, 6:3

Short Communication Open Access

Structure and Function of IgA in the Mucosal Immune System

Tongxin Chen*

Department of Rheumatology/Immunology, Children's National Medical Center, Shanghai Children's Medical Center, Shanghai Jiao Tong University School of Medicine, Shanghai, China

Immunoglobulin A (IgA) is that the most abundant antibody isotype within the mucosal system. Structurally, IgA within the mucosal surface may be a polymeric structure, while serum IgA is monomeric. Secretory IgA (sIgA) is one of the polymeric IgAs composed of dimeric IgA, J chain, and secretory component (SC). Most of sIgA were generated by gut and have effects in situ. Besides the function of "immune exclusion," a nonspecific immune role, recent studies found it also played a crucial role within the specific immunity and immunoregulation. Thanks to the critical role of sIgA during the mucosal immune system homeostasis between commensal microorganisms and pathogens; it has been an important field exploring the relationship between sIgA and commensal microorganisms [1].

Mucosal surfaces provide a physical barrier to defend foreign pathogens also on involve the tolerance of the commensal microbes or harmless food antigens. The protection of those surfaces is ensured by the mucosal system, designated because the mucosa-associated lymphoid tissues (MALT), which consists of mucus layers and epithelium cells, alongside lymphoid tissues and immune molecules in the mucosal lamina propria. The immunoglobulin A (IgA) is the predominant antibody isotype in the mucosal immune system, which widely exists in the gastrointestinal tract, respiratory tract, vaginal tract, tears, saliva, and colostrum. Normally, serum IgA shows a monomeric structure, while the mucosal IgA shows polymeric. The function of the former is still unclear. Distinctively, we designated the subtype of IgA composed of two monomeric IgA, secretory component (SC), and J chain as secretory IgA (sIgA), which is the major effective form of mucosal IgA. However, selective IgA deficiency, a common primary immunodeficiency, often presents an asymptomatic phenotype or mild consequences, which may question the significance of IgA. In this review, we will discuss the mechanism of sIgA generation and their function during the mucosal immune response [2].

Structure

As an immunoglobulin, IgA has two identical heavy chains and two identical light chains. There is a flexible hinge region to separate above chains into two Fab regions-binding the antigens and an Fc region-mediating the effects. In human, IgA has two subsets termed IgA1 and IgA2.

Dimeric IgA (dIgA) was made of two monomeric IgAs linked in the penultimate Cys residues of their Fc regions via J (joining) chain and IgA2 is preferred. J chain may be a small polypeptide to make pentameric IgM and dimeric IgA, but little is understood about the function of J chain thanks to the technical limitation. When one dIgA is bound to the polymeric immunoglobulin receptor (pIgR) at the basolateral side of the epithelium thereby transported to the luminal side, the dIgA-binding portion of the pIgR is cleaved to form the molecule sIgA. The pIgR fragment of sIgA is called secretory component (SC) to support the stability of sIgA.

Although both IgA1 and IgA2 can form sIgA, the variability of subclass proportions will happen in several tissues. For example, there are 80 to 90% IgA1 in nasal and male genital secretions, 60% IgA1 in saliva, and 60% IgA2 in colonic and female genital secretions [3].

Functions

As a primary antibody class found in various external secretions, sIgA has unique structural and functional features not observed in other antibody classes. Classically, sIgA eliminates the pathogens with immune exclusion via nonspecific immunity. Apart from that, sIgA plays an indispensable role in specific immunity elicited by pathogens. For example, sIgA are often elicited by mucosal vaccines against influenza virus and colitogenic bacteria in inflammatory bowel disease (IBD). One of the hallmark characters within the mucosal system is that the microbe colonization. A study has confirmed that both TI and TD immune responses are involved in coating different commensal bacteria with sIgA. In conclusion, response to the pathogens and induction of tolerance under normal conditions like innocuous food antigens or commensal bacteria are dual functions of sIgA to take care of the homeostasis in mucosal sites [4].

Immune Exclusion

Traditionally, IgA is assumed as a no inflammatory antibody at mucosal sites. Due to its polymeric structure and the oligosaccharide side chains of SC, sIgA is concentrated in the mucus out layer, no covalently cross-linking microorganisms, promoting microorganisms clump together in situ. Furthermore, the abundant hydrophilic amino acids of IgA Fc and glycosylation of IgA and SC result in the hydrophilic of sIgA, to entrap microorganisms, and then peristaltic bowel movements help remove the bacteria clumps. The process of agglutination, entrapment, and clearance processes are called immune exclusion.

Multiple Neutralizing Properties

Immune exclusion presents the nonspecific immunity function of sIgA. SIgA have more extensive protective functions. Firstly, sIgA coating and therefore the steric hindrance help block microbial adhesions to interact with the epithelium, sIgA also can inhibit specifically pathogens by direct recognition of receptor-binding domains such as reovirus type 1 Lang (T1L). The advanced glycosylated IgA heavy chain and SC function competitive inhibitors of the pathogen adhesion process. Blocking pathogens from interacting with epithelial

***Corresponding author:** Tongxin Chen, Department of Rheumatology/Immunology, Children's National Medical Center, Shanghai Children's Medical Center, Shanghai Jiao Tong University School of Medicine, Shanghai, China, E-mail: tongxinc@yahoo.com

Received: 01-May-2021, Manuscript No. jmir-22-63172; **Editor assigned:** 03-May-2021, PreQC No. jmir-22-63172 (PQ); **Reviewed:** 19-May-2022, QC No. jmir-22-63172; **Revised:** 25-May-2022, Manuscript No. jmir-22-63172 (R); **Published:** 31-May-2022, DOI: 10.4172/jmir.1000148

Citation: Chen T (2022) Structure and Function of IgA in the Mucosal Immune System. J Mucosal Immunol Res 6: 148.

cells isn't the exclusive mechanism by which sIgA exerts its protective function. In addition, sIgA may have direct effects on impacting the bacterial viability or changing pathogenicity. For example, sIgA can interact with flagella to inhibit the Salmonella bacterial motility, as well as protect from cholera toxin-induced fluid accumulation in a ligated intestinal loop model. SC is proved to interact with a surface protein of Streptococcus pneumonia, choline binding protein A (CbpA). And the galactose residues of free SC could also neutralize Clostridium difficult toxin A and enteropathogenic E. coli intimin [5].

Conclusion

The mucosal system is that the first line of immune defense while the sIgA is that the first line of mucosal immunity. In this review, we've described the many dual function of sIgA for maintaining immune homeostasis in mucosal compartments and therefore the complexity of the sIgA action modes. SIgA presents an excellent latent capacity in shaping both the infant mucosal immunity and commensal microbial environments. Since breast milk is that the main source of sIgA also as a fundamental immune component for neonates, it offers a possible therapy within the clinics.

Acknowledgement

None

Conflict of interest

None

References

1. Woof JM, Russell MW (2011) Structure and function relationships in IgA. J Mucosal Immunol 4:590-597.
2. Suzuki T, Kawaguchi A, Ainai A (2015) Relationship of the quaternary structure of human secretory IgA to neutralization of influenza virus. Proc Natl Acad Sci 112: 7809-7814.
3. Macpherson J, McCoy KD, Johansen FE, Brandtzaeg P (2007) The immune geography of IgA induction and function. Mucosal Immunol 1: 11-22.
4. Macpherson J, Yilmaz B, Limenitakis JP, Ganal-Vonarburg SC (2018) IgA function in relation to the intestinal Microbiota. Annu Rev Immunol 36: 359-381.
5. Corthesy B (2013) Multi-faceted functions of secretory IgA at mucosal surfaces. Frontiers in Immunol 4: 185.