ABO Grouping & Its Implication in Oral Diseases

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Abstract

Blood is one of the important fluid in the body that maintains health and harmony of an individual. Blood grouping not only helps in identifying and categorizing individual but literature review also shows that they can help in eliciting the risk factors and cancer susceptibility in individual. This review article aims at highlighting interrelationship and suspceptibility of varied lesions between ABO blood grouping and certain oral lesions.

Introduction

Blood is a connective tissue in fluid form. It is considered as the fluid of life because it carries oxygen from lungs to all parts of the body and carbon dioxide from all parts of the body to the lungs. It is known as fluid of growth as it carries nutritive substances from the digestive system and hormones from endocrine gland to all the tissues. The blood is also called the fluid of health because it protects the body against the diseases and gets rid of the waste products and unwanted substances by transporting them to the excretory organs like kidneys.[1]

Blood Groups and Oral Lesions[2]

Cancer incidence in humans has gradually increased over the last century. Surgical, radio, chemotherapeutic and biological treatments have experienced important advances, with concomitant reduction in the morbidity associated with the radical surgical practices of the past. The term "oral cancer" includes a diverse group of tumors arising from the oral cavity (Khalili, 2008) usually included are cancers of the lip, tongue, pharynx, and oral cavity.

The World Health Organization (WHO) reported oral cancer as having one of the highest mortality ratios amongst all malignancies (Parkin et al., 2000). Although oral cancer is rare and attracts little attention, it is more common than Hodgkin's disease tumours affecting other organs. It ranks 12th among all cancers (Jemal et al., 2002).

It is important to diagnose oral cancer in its early stages, since the management of small and localized tumors involves less morbidity and mortality than more advanced-stage disease, where treatment must be more aggressive.

Biochemical and molecular genetic studies have contributed to our molecular knowledge of blood group-associated molecules in the past few years. Among the 30 blood group systems presently identified, among which ABO, Hh, Lewis and Secretor are the main representative species, are indirect gene products (Hakomori et al., 1967). They are synthesized by Golgi-resident glycosyltransferases, which are the direct products of the blood group genes. Cell-surface carbohydrates are built up in a stepwise fashion when monosaccharides are tranferred from their sugar nucleotide derivatives to appropriate acceptors. Each particular type of transfer is catalyzed by a unique specific glycosyltransferase.

In tumors, changes in glycosylation are found in both glycolipids and glycoproteins (Hakomori, 1999; Le Pendu et al., 2001). Altered glycosylation plays a major role in most aspects of the malignant phenotype, including signal transduction and apoptosis. Historical studies associating the Lewis system antigens and/or ABH system secretory antigens with disease are varied and generally inconclusive.

Fucosyltransferase is an enzyme that transfers an L-fucose sugar from a GDP-fucose (guanosine diphosphate-fucose) donor substrate to an acceptor substrate. The acceptor substrate can be another sugar such as the transfer of a fucose to a core GlcNAc (N-acetylglucosamine) sugar as in the case of N-linked glycosylation, or to a protein, as in the case of O-linked glycosylation produced by O-fucosyltransferase. Some of the proteins in this group are responsible for the molecular basis of the blood group antigens, surface markers on the outside of the red blood cell membrane. Most of these markers are proteins, but some are carbohydrates attached to lipids or proteins. It creates a soluble precursor oligosaccharide FuC-alpha ((1,2) Galbeta) called the H antigen which is an essential substrate for the final step in the soluble A and B antigen synthesis pathway.[7]

Association of ABO Blood Grouping with Oral Lichen Planus[3]

Lichen planus is a chronic autoimmune mucocutaneous disease characterized by multiple clinical presentations. Oral Lichen Planus (OLP) commonly involves buccal mucosa, tongue, or gingiva with a prevalence of 1-2%. It is a potentially malignant disorder with malignant transformation rate of 0.4-5%. Erosive and atrophic forms of OLP have relatively more potential for malignant transformation.

Alexzender in 1921 was first to describe the possibility of association between ABO blood groups and malignancy. A close association between gastric cancer and blood group A (Aird et al. and Walter). In Indian population, the patients with blood group A have predisposition for oral cancer (Tyagi et al). Studies show that there is increased risk of oral cancer associated with blood group A (Jaleel & Nagarajappa).

It is a disease of unknown etiology and with multifactorial pathogenesis which is a CD8+ T cell-mediated autoimmune disease. The CD8+ T lymphocytes induce keratinocyte apoptosis and cause epithelial basal cell layer damage. Genetic factors, lifestyle, and emotional stress can also contribute in the pathogenesis. In adults, women are affected more commonly than men.

A relationship between ABO blood groups and Oral lichen planus has been established. People with blood group A have a greater tendency to develop Oral lichen planus, a premalignant disorder. Blood group antigens, apart from being present on red blood cell membranes, are also present on epithelial cells of various other tissues, including the oral mucosa. The relative down regulation of glycosyl transferase, which is involved in the biosynthesis of A and B antigens, can be seen during the development of oral lesions (Mendel et al., Orntoft). Partial or complete deletion of epithelial blood group antigens due to aberrations in their synthesis brings about changes in their cell surface.

The altered antigen pattern on the cell surface is a tumor-related change, which can also be seen in precancerous condition like Oral lichen planus. H antigen is a blood group antigen present in all the individuals irrespective of blood group types. It is the precursor for the formation of A and B antigens. In people belonging to A and B blood groups, the precursor H antigen is converted to A and B antigen, respectively, whereas in O blood group individuals it remains in the original forms. People with O blood group have the highest amount of H antigen, which affords protection against Oral lichen planus. Hence, O blood group people were least susceptible to develop Oral lichen planus, which is consistent with the results in the oral cancer patients.

Treatment of lichen planus is to control the episodic outbreaks that occurs, but the lesions are usually not completely cured. Reticular and plaque forms usually do not require treatment other than reassurance and follow up. The mild cases of erosive lichen planus are treated with topical corticosteroids combined with antifungal agents.

ABO Blood Group and Periodontal Disease[4]

Periodontal disease comprises a heterogenous group of infectious disease that lead to pathologic destruction of the periodontium. It is well known that periodontal disease can vary with respect to bacterial etiology, host response and clinical disease progression. Even though differences exist among the various types of periodontal disease, all share the common characteristic of complex host – bacterial interactions and the disease onset and progression reflect the balance between homeostasis and destruction of the periodontal tissue.

Bacteria, environmental influence, various host factors such as diabetes, smoking and genetic predisposition are considered to be major cause of periodontitis.

The tissue localization of the histo-blood group antigens show that antigens in the tissues correspond to the erythrocyte blood group, but the tissue expression is dependent on the secretor status of the individual. Secretor status is secretion of blood group antigens ABO (H), which may be a factor influencing the development of systemic oral diseases in the stratified epithelium. The expression of histo-blood group antigens depends on the level of cellular differentiation and maturation, and there is a sequential elongation of the terminal carbohydrate chain during the life span of the cell.

Basal cells usually exhibit the short carbohydrate chains that are A/B precursors, whereas A or B antigens may be seen in the spinous cell layer. Variation in the differentiation patterns among keratinized against non-keratinized epithelium plays a vital role in the expression of blood group antigens. Keratinized squamous layer may express A or B antigens in only very a small number of highly differentiated cells, leaving the precursor H antigen expressed on spinous cells.

Greater propensity for periodontal disease among O blood group individuals while the propensity was least among AB blood group individuals have reported in several studies. A significant association of periodontitis with Rh factor was seen with more individuals being Rh positive as compared with Rh negative.

ABO blood groups, Rhesus factor, and Behçet's disease[5]

Behçet's disease is a recurrent multisystem vasculitis characterized by oral ulcers, mucocutaneous disorders, and ocular findings. Behçet's disease may be life-threatening, affecting the central nervous system, large vessels, or gastrointestinal tract. A strong association with human leukocyte antigens (HLA)-B51 and TNF-α, IL-10, and IL-23R gene polymorphisms has been indicated in Behçet's disease.

Blood groups, red cell isoenzymes, hemoglobin variants, and serum proteins are the genetic markers in

human blood used for identifying human genetic variation. Antigens of the ABO blood group family have been known for a long time. The genes that determine the A and B phenotypes are found on chromosome 9p and are expressed in a Mundelein co dominant manner. ABO blood group is a useful and valuable source because inheritance of blood groups is not affected by any environmental factors. Trial case studies have shown significant associations of particular HLA antigens and also ABO blood groups with various autoimmune diseases such as juvenile diabetes, multiple sclerosis, rheumatoid arthritis, psoriasis and celiac disease.

ABO (H) Antigens of Blood Types in the Saliva of Patients with Oral Cancer[6]

Relation between the A or B blood group antigens and malignant tumors have been studied. Rat colon carcinoma cells indicate that cells with a expressions are tumorogenic but cannot be compared with human carcinogenesis because the expression of blood group antigen is opposite that seen in the human which was done experimental species.

In the normal oral cavity, keratinized epithelium in the palate or gingiva shows little or no expression of A or B blood group antigen. Since a change from a non- - keratinized to a keratinized differentiation pattern is a characteristic of many oral carcinomas and potentially malignant lesions, the lack of expression of blood group in such lesions could be due to a change in differentiation pattern of the epithelium.

Leukoplakias that developed in the buccal mucosa show expression of A antigen, while histologicaly it appeared as keratinized lesions which indicate that loss of antigen is not necessarily associated with hyperkeratinization or even with oral cancer. The secretor status in saliva of a group of patients with chronic hyperplastic candidiasis with control group where 68% of those having the disease were non-secretors, whereas the percentage of non-secretors in the control group was statistically significantly lower (Lamey et al, 1991).

Candidal leukoplakia was considered as belonging to precancerous lesions, therefore, a hypothesis that the non-secretor status may have an impact in the pathogenesis of oral cancer in non- secretors needs to be considered. Non-secretors have a more intensive disease, with higher probability of gaining epithelial dysplasia leading to a conclusion that non-secretors might be more prone to the development of oral carcinoma.

Precancerous lesion that has a more significant malignant alteration is erythroplakia, but Vidas et al. research did not include a single examinee with such an alteration in oral cavity. Significantly larger percentage of non-secretors found in patients that have precancerous lesion with strong epithelial dysplasia, therefore more non-secretors can be found among patients with oral carcinoma.

Conclusion

Identification of blood grouping not only helps in blood transfusion, but also helps in predicting the risk of infection and oral lesions in particular blood group. Each blood group are predisposed to certain lesions which can be detected on regular monitoring and screening. Apart from adverse habits predisposing to oral lesions, identifying the blood group and appropriate cessation therapy and counselling will help in controlling the rapidly growing oral cancer.

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