Host-Pathogen Interaction (Immunology)
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Lecture: 11
Immune organs - 3

Hi, so in this session we will discuss about the another immune organ and in previous session you have learned about immune organs such as thymus, bone marrow, spleen you also learned about the lymph node and the lymphatic system. So, in this session we will discuss about the one of most important lymphoid tissue or it is a cluster of tissue sometimes we call it as an organ as well. So, we will discuss about that.

So, before that I would like to discuss that how the pathogen enter in the host there are some key roots through which these pathogen enters.

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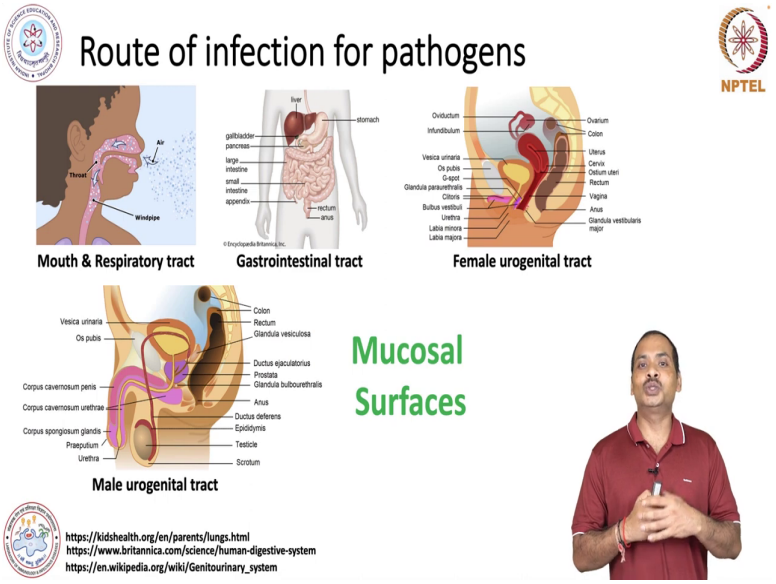

And the most common route which you are all aware that it is the mouth and respiratory roeute. So, through this route there are so, many infections discussed to the host and that results to the various complicated diseases right. So, for example you understand that there is a there is a rotavirus infection which is quite common in kids or in young infants right. So, this is a one of example this basically infect the host through this through this mouth or oral routeot.

And there are several other infection like bacterial infection you may know that salmonella infection. So, all those things are basically entered through the mouth. And there are also gastrointestinal tract and this gastrointestinal tract is a also one of the important route for the infection of various pathogen it also includes various kind of bacteria, virus as well as parasites you may aware about that.

Another route is another the most important route is a urogenital tract in both female and male and this is a this is a one of the very key route for the entry of pathogen and you know there are some very dangerous disease for example AIDS acquired immunodeficiency syndrome which is caused by virus. So, this is basically in this virus basically entered through this route through urogenital tract.

This is a one-off root of course there is another route if individual usual receives some contaminated blood or infected needle and then that will cause to cause this disease. So, overall what I want to say that these if you see very carefully this mouth and respiratory tract and gastrointestinal tract and urogenital tract all these tracts are basically covered or we call it as a mucosal surfaces right.

So, these mucosal surfaces are a very important gate for the entry of pathogen and this gate should be well guarded and the nature made it like that. So, we have a huge surfaces of huge mucosal surfaces and these mucosal surfaces are very important and it should be well guarded by the well guarded against the pathogen otherwise that will cause the havoc and to show the importance of this mucosal surfaces.

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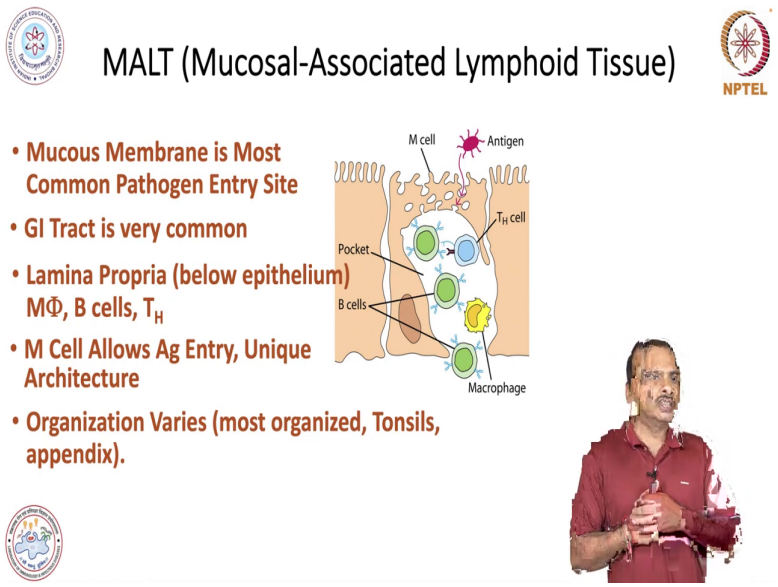

I have gave this introduction that most of pathogen infected through this through this gate this mucosal surfaces. And therefore the nature made it to a very robust kind of defence systems against these or on the mucosal surfaces and if it is very interesting to know that this mucosal surface is a quite big it is about 400 meter Square which is if you if you know about the size of kabaddi ground which is 130 meter Square this is a almost more than three times bigger than this kabaddi~~covered~~ the ground.

So, in your body that huge surfaces are there right. So, these mucosal surfaces are basically guarded by a very important lymphoid tissue and it is present on digestive tract, respiratory tract, and urogenital tract and overall we call it as a mucosa associated lymphoid tissue and this mucosa associates sometimes people also call it as a mucosal associated lymphoid tissue. So, there is no big deal you can call it whatever.

So, in short form we call it as a MALT Mucosa Associated Lymphoid Tissue. So, now we will look at how this mucosal associated lymphoid tissue is basically work and when this when we talk about the gut system then we call it as a gut associated lymphoid tissue. So, we will take up this structure basically they are a mass of tissue and this mass of tissue is I will not say precisely like a lymph node.

But it is a very small level of lymph node but not lymph node it is they do not have a perfect afferent and efferent lymphatic vessels and all those things but this is a mass of tissue where there is a presence of this primary follicle, secondary follicle or germinal centers are also

there if needed. So, let us look at this mucosal associated lymphoid tissue. So, this is a one of section of the epithelial lining of intestine.

Here you can see that there is a there is a one unique cell which we call it as a M cell. I will tell you what is the M cell in a short while. And this M cell is a is playing a very important role in mucosal surfaces. You can imagine that the food which you are taking it is a mixture of complex thing right complex biomolecules you can understand lipid, carbohydrate, proteins.

And there are a lot of flavonoid, alkaloids and all those things and if there is a some pathogen then this pathogen will be selectively sensed transported and then there will be a ~~double~~ development of appropriate immune response but there is no immune response against the food. So, in normal situation in some individual there is a some immune response against some food molecule probably you might have noted that there are some individuals who are sensitized with some proteins such as gluten or egg white protein.

So, those are different cases here I am talking about the normal immune system. So, if the if the food is consist of all this thing along and if it has some pathogen then this will be transported to the right place that is mucose of associated lymphoid tissue and then there will be a development of immune response. So, this mucous membrane is the most common pathogen entry as I have explained you.

And gastrointestinal tract is a one of a very common passage through which this pathogen can make a make entry and cause disease. And there is a structure known as lamina properia which is just below the epithelium and basically this is a all immune active places this lamina properia and there is a one more structure which will come probably next to in the slide which we call it as a P~~i~~yer's~~ous~~ patch.

And this lamina properia is immune active area and this is consists of as you can see this is a macrophage consists of macrophages, B cells and T cells. So, this is basically a guarding against the infection and M cell plays a very important role in taking the sample or transporting the pathogen or antigen or some immune cell across the lining and how it is basically taking place I will show you.

Besides this there are several other mucosal associated lymphoid tissue these are tons topenesils appendix and one more structure will become that is a Pyer'sious patch. Now let us look at how this M cell works. So, there is a one phenomena which probably you have you have not studied you probably have studied the phagocytosis and you have studied the pinocytosis. So, this is M cell is basically involved in transcytosis.

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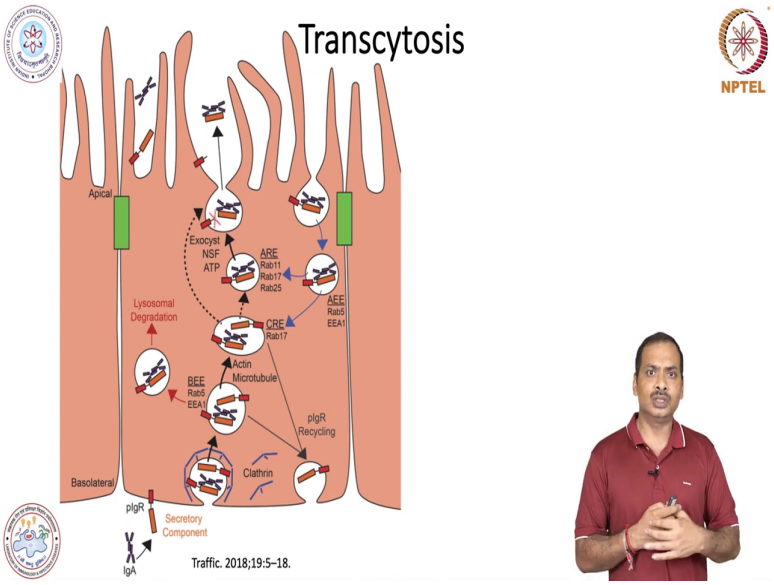

And what is transcytosis it is a very interesting a phenomena. So, here you can see do not look or don't care about all the labelling here you just focus on the cargo which is basically present at epical side on top or you can see. And this cargo is basically taken up by the cell and then this cargo is delivered on another side of the cell. So, this phenomena we call it as a transcytosis and this transcytosis is it is it is not only for a foreign entity or it is not only for own entity.

Basically, this on cytosis is the transportation of it could be a pathogen it could be some cell or it could be some molecule. A pathogen you can you know there are variety of pathogen and cells it could be a dendritic cells it could be macrophages it could be T cells it could be a B cells or this can also transport the antibody molecule there is a one class of antibody molecule which we call it as a IgGA.

This IgGA is present in huge amount on the mucosal surfaces. So, this IgGA is also transported through transcytosis. We will take up this thing when we will discuss about the antibodies. So, here I gave the concept of transcytosis.

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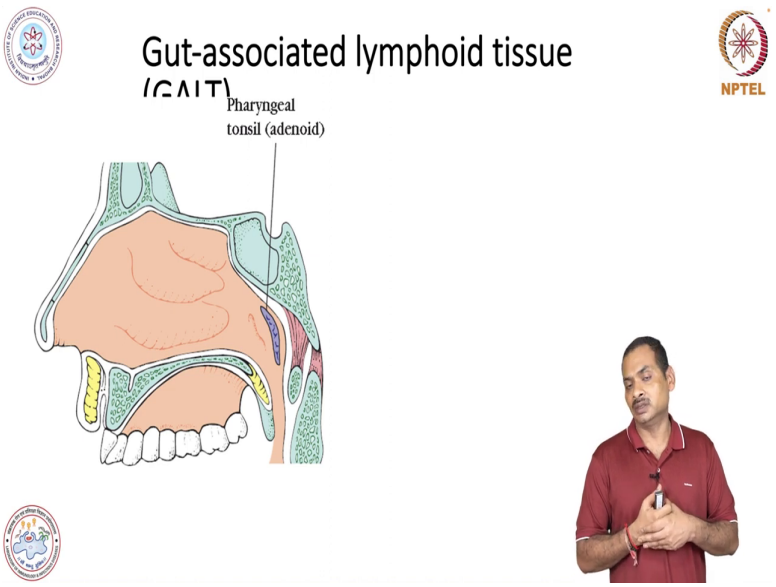

Now we can move on to the mucosal associated lymphoid tissue or gut Associated lymphoid tissue. So, these are the structure which is a palatine tonsil, lingual tonsil and this in fact in our tongue there is a some places are there where this immune active activity is going on and if you see this lingual tonsil there is a lymphoid tissue in there is a some B cell and T cell or immune active areas are there even in our tongue or just behind the tongue.

So, another is here you can see that there is a pharyngeal tonsil. This pharyngeal tonsil is also consists of variety of immune cell. So, this is another very important or gut associated lymphoid tissue.

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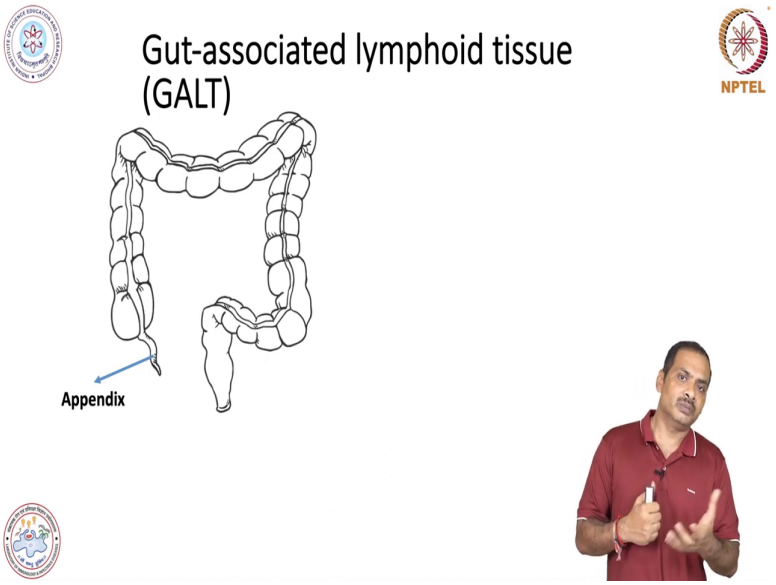

There is appendix which is this appendix is also playing a very important role in defence because they are harbouring all these immune cell. And if you remember my previous session

in that session I have explained in some animals like rabbit the appendix is playing a very important role in defence they somehow take over the bone marrow. So, in human also this appendix is playing a very important role.

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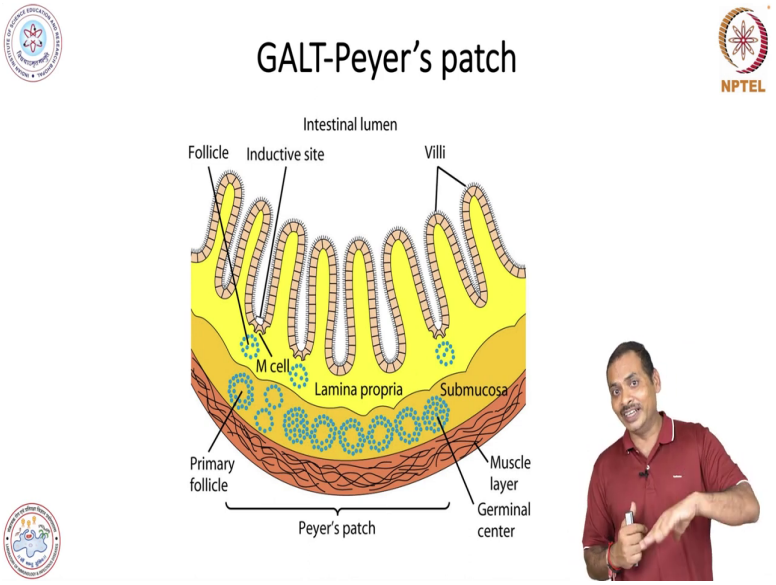

Here I have told you there is a one another very important lymphoid or gut a ssociated lymphoid tissue that is ~~pious~~yer's patch and this P~~ious~~yer's patch is a one of very important lymphoid tissue and here you can see that there are a germinal center. There are primary follicles and there are a secondary follicle which we call it as a germinal center which is an active form of a primary follicle. So, all these structures are present in our gut.

So, throughout the gut all these things are there and there are some specialized sensors are also there in the gut which sends the pathogen and then they elicit~~ate~~ appropriate immune response that is a very very important field because. So, this mucosal Immunology here I just want to give a note that this mucos Immunology field is a very very promising and very hot field.

Here you can understand that this pathogen because as I have explained you the food and there is a pathogen but food is also foreign material but our immune system does not react. So, this is a very interesting right but it reacts with the pathogen. So, there is a very fine balance between tolerance and immune response. So, it is a very delicate balance right. So, this delicate balance is maintained in the gut system and there are variety of cells which suppresses the immunity some are activating the immunity.

So, this is a very important field and we understand to some extent the cellular and molecular mechanism but still there is a lot of thing to learn and a lot of thing to discover about this tolerance and immune response in the gut.

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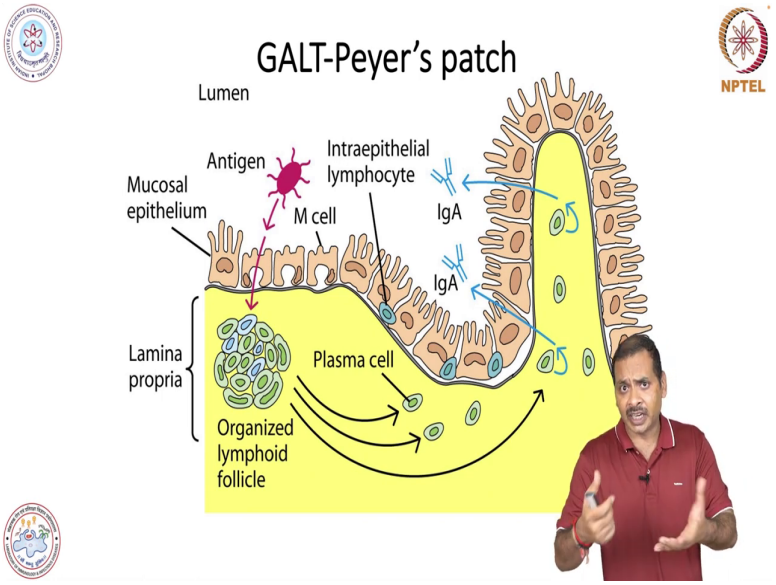

So, here there is a more detailed cross section of as you can see in this slide. There is a antigen and there are organized lymphoid follicles which we call it as a lamina properia and there is a some of this primary follicle is converted into the germinal center which is active form of a prime primary follicle and then there will be a differentiation of B cells and these B cells are differentiated into the plasma cell which is actively secreting the antibodies. So, this is all detail about the Pyer's~~spas~~ patches

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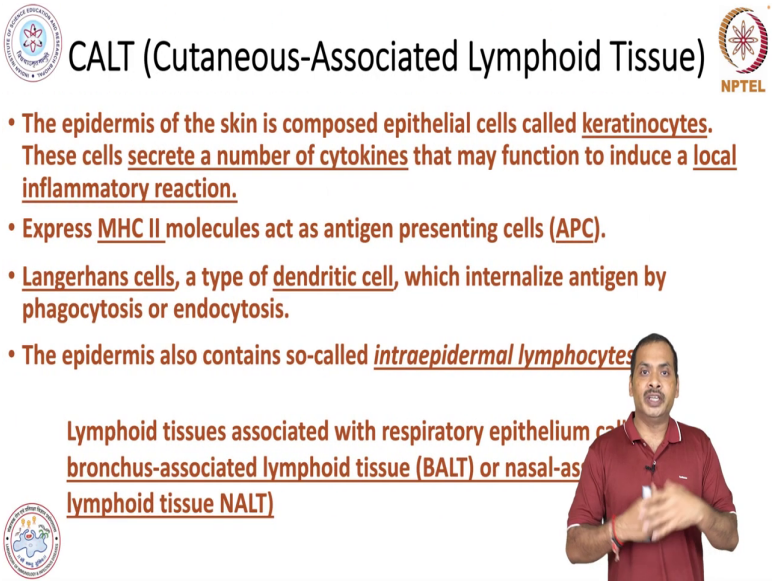

And there are another very important lymphoid tissue which we call it as a CALT it is a Cutaneous Associated Lymphoid Tissue and This cutaneous lymphoid associated lymphoid tissue is present over the skin this is the outer epithelia. So, you can you can understand that this surface the our skin is also vulnerable to the to the pathogen entry. So, pathogen can enter through this skin also.

And over there also we have a very good defence system of course the skin itself is a very impermissive ~~impervative~~ to the pathogen or any foreign thing it is a very tight tight presence of the skin cells and this over the skin there is a secretion of sweat and sebaceous. And this sweat and sebaceous is basically playing a very important role in defence against the microbial pathogen they inhibit the growth or multiplication of these microbial pathogens.

So, this is a one way but if they breach this system then they will encounter the another layer of cells and these cells can also secrete some cytokine there are keratinocytes ~~keratonocytes~~ and these cells can secrete cytokine and they can inhibit to some extent. And there are some cells which is basically expressing MHC Class 2 molecule and these cells we call it as antigen presenting cells and I think I have explained you in previous session about the antigen presenting cells.

So, antigen presenting cells are those cells which present the antigen to the T cells to elicit~~ate~~ appropriate T cell mediated immune response. So, in skin also there are cell and these specialized cells we call it as a langerhan~~k~~s cells which is like a dendritic cells. I have explained you a lot about the dendritic cells and I will explain further when I will take the immune cells.

So, these dendritic cells or this is a these dendritic cells which is present in the skin which we call it as a langerhans cell they can they can present the antigen and elicitate appropriate immune response. There are some intra epidermal lymphocytes are also there and these cells are also playing a very important role in defence against entry of microbial pathogen through skin.

In addition, another mucosal ~~surfaces~~surface are respiratory tract and there is a bronchus associated lymphoid tissue over there or you can call it as a nasal associated lymphoid tissue. So, all these things are basically they are a mass of cell or mass of a tissue and which contain

B cells, T cells, macrophages, dendritic cells and other very important immune cell and they basically play an important role in difference against entry of the pathogen on all over the surfaces.

So, in this is I am stopping here and in this next session we will discuss about the various kinds of immune cells. And then in that way you are basically well with a system level and organ level then cellular level and then I will take you to the molecular level and over there I will talk about various kind of secretion produced by the immune cell which we call it as a cytokine, thank you.