Hello students, I'm Doctor Dilecta D'Costa,

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Today we shall study Hypersensitivity 3
Ooutline - definition

mechanism of hypersensitivity.

Three phases of immune complex reaction.

Arthus reaction,

serum sickness and autoimmune diseases.

Learning outcomes -

The student will be able to describe

the background features of immune

complex reactions and differentiate

between the major types of immune

complex diseases and discuss

their physiological effects.

So what is the definition

of type 3 hypersensitivity?

It involves the reaction of soluble

antigen with antibody and the deposition

of these complexes in basement.

Membranes of epithelial tissue resulting

in an abnormal inflammatory response.

Type 3 hypersensitivity differs from

type 2 because its antigens are not

attached to the surface of a cell.

The interaction of these antigens

with antibodies produces

free floating complexes that can

be deposited in the tissues,

causing an immune complex reaction

or disease.

This category includes:

A - therapy related disorders wherein we will study

about Arthur's reaction and serum sickness.

B - autoimmune diseases like Glomerulonephritis and

Systemic Lupus Erythematosus

Mechanism - After initial

exposure to a profuse amount of antigen,

the immune system produces large

quantities of antibodies that

circulate in the fluid compartments.

When this antigen enters

the system a second time,

it reacts with the antibodies to

form antigen antibody complexes.

These complexes summon various

inflammatory components such as

complement and neutrophils which

would ordinarily eliminate antigen

antibody complexes as part of

the normal immune response.

In an immune complex disease,.

however, these complexes are so abundant

that they deposit it in the

basement membranes of epithelial

tissues and become inaccessible.

In response to these events,

neutrophils release lysosomal granules

that digest issues and cause a

destructive inflammatory condition.

This gives rise to the pathologic

state of Type 3 hypersensitivity.

So in this diagram we can

see the immune complexes,

that is the antigen antibody complexes.

Which are formed and then these complexes

will also be activated by the complement.

So the immune complexes then

deposit on the tissues and

they activate the complement.

Reactions of complement with immune complex

attracts neutrophils which releases

lysosomal enzymes causing inflammation

in that particular area.

Arthus reaction and serum sickness

are like anaphylaxis in requiring

sensitization and preformed antibodies.

Characteristics that set them

apart from anaphylaxis,

are they depend upon IgM.

IGA or IgG antibodies rather than IgE

So in anaphylaxis we only talk about Ige,

but here they depend upon the other

types of immunoglobulins; they require

L
large doses of antigen and their

symptoms are delayed (a few hours to days).

Phases of immune complex reaction.

First,antibody combines with excess

soluble antigen,

forming large quantities of

antigen antibody complexes,

circulating immune complexes become

lodged in the basement membranes

of epithelia in blood vessels,

kidney skin and other sites.

This is followed by the complement

factors which trigger release

of histamine and other

inflammatory mediators.

And lastly neutrophils migrate to sites

of antibody antigen complexes and release

enzymes and chemokines that severely

damage the target tissues and organs.

Arthus reaction versus serum sickness,

The Arthus reaction and serum sickness differ

from each other in some important ways.

The Arthus reaction is a

localized dermal injury due to

inflamed blood vessels in the vicinity

of an injected antigen in a person with

high levels of circulating antibodies,

Arthus reaction was named after the

French immunologist Maurice Arthus.

Serum sickness, on the other hand,

is a systemic injury.

initiated by antigen antibody complexes

that circulate in the blood and settle

in the membranes at various sites.

This was first characterized by

Clemens von Pirquet and Bella Schick.

So let's see what is Arthus reaction.

It is an acute response to

a second injection of vaccines,

or boosters or drugs at the same

site as the first injection.

in a few hours the area becomes red, hot,

swollen and very painful due to inflammation.

Reaction is usually self

limiting and rapidly cleared.

Intravascular blood clotting can occasionally

cause necrosis and loss of tissue.

Mechanism of inflammation by Arthus reaction -

The antigen antibody complexes

diffuse into the vessel walls.

They activate the complement,

followed by chemotactic

complement components,

which attract neutrophils and induce

intra vascular clumping of platelets.

Then the neutrophils ingest these

complexes and release lysosomal

enzymes which damage neighbouring

cells and cause necrosis

and inflammatory reaction.

Finally, aggregation of platelets causes

vascular occlusion or blocking,

leading to ischemic necrosis

of blood vessels.

Serum sickness was named

for a condition that appeared in

soldiers after repeated injections

of horse serum to treat tetanus.

So they used the anti tetanus serum.

It can also be caused by injections

of animal hormones and drugs.

The immune complexes enter the circulation.

They are carried throughout the

body and are eventually deposited

in blood vessels of the kidney,

heart, skin and joints.

People with serum sickness

usually have fever,

enlarged lymph nodes,

decreased numbers of circulating leukocytes

and swelling at the injection site.

Most people recover from serum sickness

as the complexes eventually are cleared

from the blood and tissue repair

occurs in the glomeruli.

The condition, however,

can become chronic causing symptoms

such as enlarged lymph nodes,

rashes, painful joints, swelling,

fever and renal dysfunction.

This disorder became chronic in

many diphtheria patients because

they received horse serum daily

over the course of the disease.

Here they would have received

the anti-diphtheritic serum.

Autoimmune diseases are also part of Hypersensitivity 3

The first one is Glomerulonephritis - It is an immune

complex condition usually resulting from an infection,

that causes inflammatory damage

to the kidney glomeruli,

which are sites of blood filtration.

The other one is Systemic

Lupus Erythematosus SLE

It is caused by autoantibodies

directed against soluble self antigens

like nucleo proteins and DNA.

Antibodies bind to these soluble proteins,

producing insoluble immune complexes,

and these complexes deposit in

different body tissues resulting in

inflammation and severe cell damage.

So here is a picture of a person

suffering from systemic lupus erythematosus

wherein you can see the

rash which has a particular

shape known as the butterfly rash,

which is usually a classical symptom

of SLE.

These are my references.

Thank you.