Management of Medical Emergencies in Dental Practice
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ACUTE ADRENAL INSUFFICIENCYI

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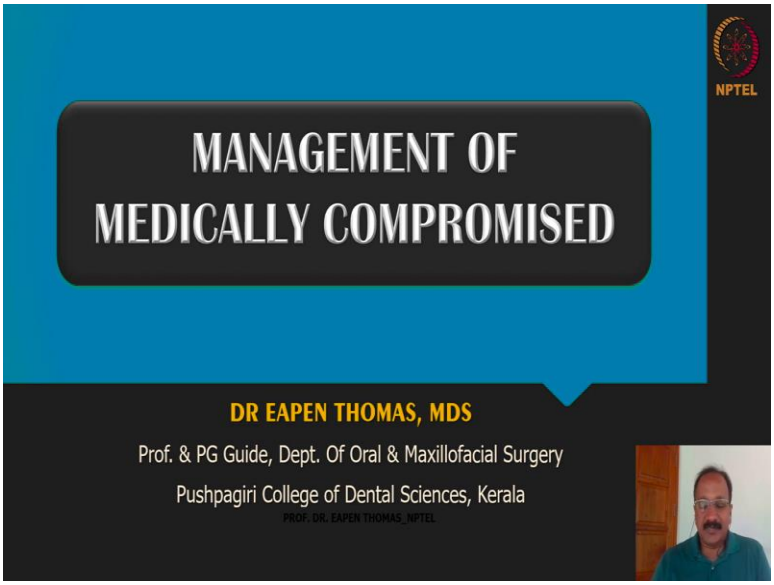

Hello, welcome to another episode of the lecture on Management of Medically Compromised Individuals. Myself, Doctor Eapen Thomas, I am the professor and PG guide and Department of Oral and Maxillofacial Surgery, Pushpagiri College of Dental Sciences, Kerala.

And in today's lecture, we will talk about patients dealing or patients on long term steroid therapy. We do get many patients in our dental department who is to undergo dental treatment, who are on long term steroid therapy for various reasons or various conditions. Nowadays, steroids are being used so extensively by anyone and everyone that these things might not be noticed, and these things might be overlooked.

So, it is very important to take a proper history and elicit any significant therapy of steroid that patient is taking, for any reasons for any sort of systemic disorders or disorders, which can actually give us a lot of complaints and trouble later if it is not noted, and the necessary measures are not taken.

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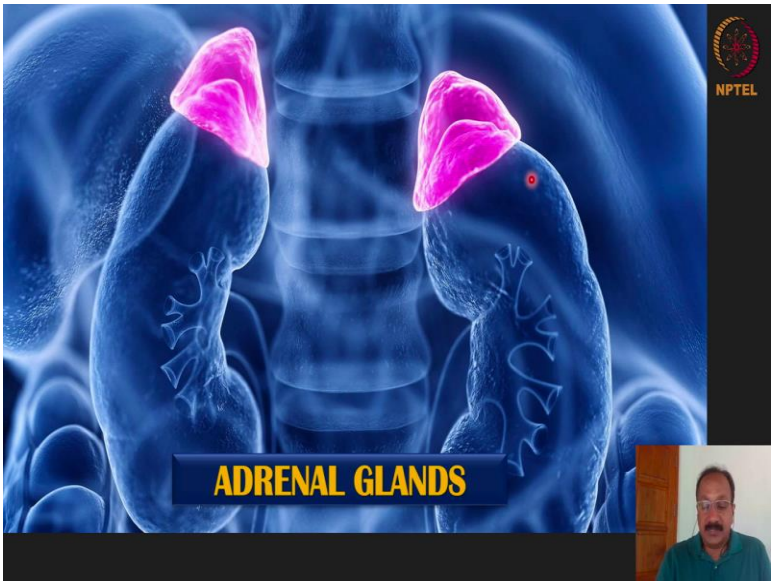

So with that brief overview let me just move on to systemic steroid therapy or steroid therapy and dental tape and management. We will have a brief overview about the adrenal glands, the various hormones of adrenal glands, and what are each hormones, the main functions of the most important of those that is a cortisol hormone, and how it affects the various systems of the body.

Why is it so important to have a detailed notice on this cortisol and its various functions? And what are the dental considerations that one should think about a patient on long term therapy? How will we deal in case a patient develop adrenal crisis? And how to take measurements or what are the precaution measurements that one should take to prevent such problems?

Well, just remember, just think about these two small glands, the ones in the pink, the magenta color, ones they are the two adrenal glands, adrenal glands are actually nothing but a pair of two plants situated on top of the kidney on either side. So, they are paired plants, and they are situated on the kidney or the suprarenal surface on either side.

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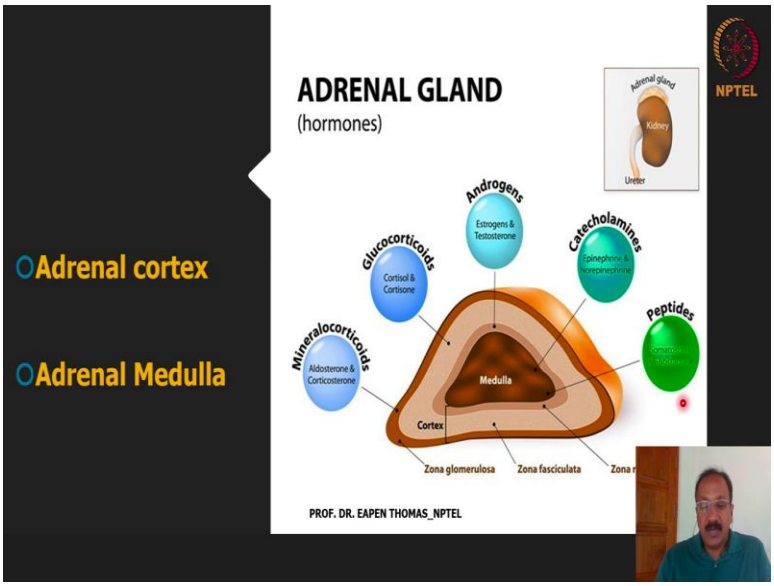

And now if you think about these adrenal glands, they are basically two structures. This is a cross section of that adrenal glands. It is comprising of two main structures from one, the outer one, what we call it as the adrenal cortex, what we see here and the outer three layers here, and the second one is that medulla, and these are the two core, the inner core is called as the adrenal medulla and outer core is called as the adrenal cortex.

Now, this adrenal cortex and adrenal medulla are actually comprises of different layers or different zones. The outer cortex is comprising of three different zones, the first one being called as zona glomerulosa. What you see as a brown layer all around this cross section is the zona glomerulosa. The second one is the zona fasciculata.

The cream colored, off white color, what do you see a thicker layer after the zona glomerulosa is the zona fasciculata and the last layer is called the zona reticularis that is innermost layer, immediately next to the medulla, the innermost thing is the medulla. So, the three layers from outside to inside are zona glomerulosa, zona fasciculate, and zona reticularis.

Now, the important hormones of the adrenal gland are produced from various layers of these adrenal glands. Now, that you have an idea about three layers, let us see what each layer actually forms. The first layer, the outer layer or the zona glomerulosa, actually secretes the mineralocorticoid hormones that is aldosterone and corticosterones. So, these are mineralocorticoids and secrete from the zona glomerulosa the outermost layer.

The second layer, the second layer, the thicker layer, what we call it as zona fasciculata actually secretes the glucocorticoids, that is a cortisol and cortisone. And these are the two important hormones or the main hormone which is actually secreted by the middle layer of the zona fasciculata. And the innermost layer, the innermost layer, what we call as zona fasciculata actually secretes the sex hormone or the androgens that estrogen and testosterones.

These are the three layers and different hormones secreted by the adrenal cortex. Let us have a look at the medulla too. The innermost core medulla is actually responsible for two types mainly the catecholamines, epinephrine and norepinephrine and also a few peptides which are comprising of the somatostatins and substance P.

Now, this is in brief about the adrenal gland which is situated or located on top of the kidney of the suprarenal surface, which has two major components adrenal cortex and adrenal medulla. And the adrenal cortex is responsible for secretion of the hormones called as the glucocorticoids, mineralocorticoid and sex hormones, but the adrenal medulla is response for the hormone secretion, exactly called us catecholamines and peptides. Now, we will discuss these things one by one.

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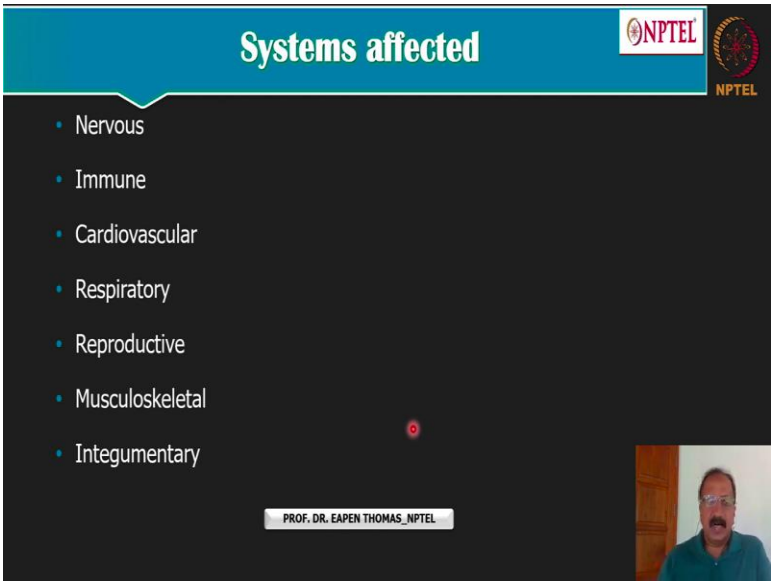

Now, all these hormones the adrenal glands and adrenal hormones actually have a very wide extensive role and it affects the nervous system, the immune system in various manners. It affects the nervous system, immune sustainable, nervous system, it is actually responsible for a lot of conductions, then immune system it affects the cells, the lymphoid cells.

The cardiovascular cells, it has got a play, it plays a role in the cardiac output and the blood pressure, respiratory system, sex hormones, the muscular system based on the electrolytes, then other integumentary systems, all, so it is got extensive all over the body actions. This particular group of drugs what we call it a steroids in general and those hormones which is secreted by the adrenal cortex and adrenal medulla.

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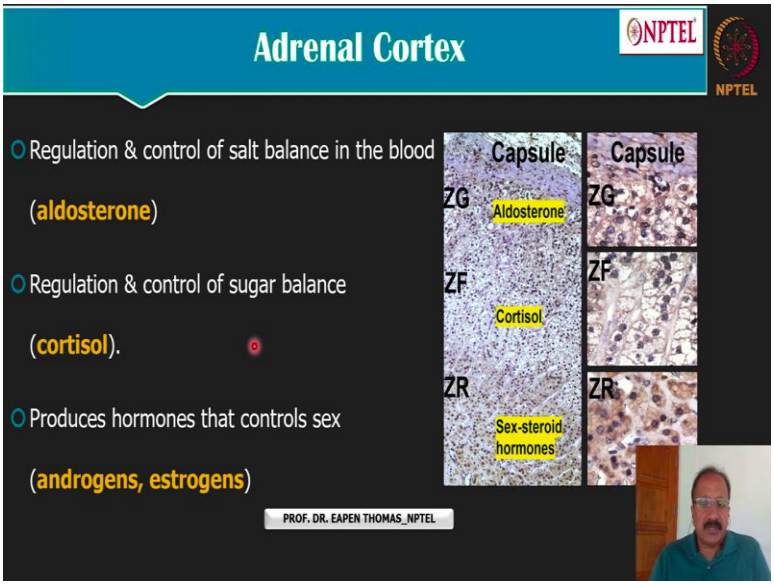

Now, let us see the about the adrenal cortex hormones one by one, the first one is the aldosterone. If has got a very important role in the regulation and control of salt balance in the body, salt and water retention is actually a very important part of the homeostasis. So, these hormones play a very important role in maintaining the salt balance in the blood, that is the principal hormone response for that is the aldosterone that is secreted by the like what we have seen the outermost layer that is zona glomerulosa.

And the next is you have second layer actually, or the third layer, the regulation and control of sugar balance, this is again the most important hormone in what we call it as, this thing part of these steroids. And that is called a cortisol hormone. And that actually plays a very important role in control of sugar balance. So, that is something what we have to think about is from the zona fasciculate.

So, this particular hormone comes from zona fasciculata and actually plays a vital role. Now, let us see what the third hormone that is actually coming from the zona reticularis that actually comprises of the sex hormone or the androgens and estrogens. So, these are the principal hormones, which is actually synthesized and secreted by the adrenal cortex.

And they do have their important role in controlling salt and water retention, that is aldosterone secreted by the zona glomerulosa, then very important role in the control of sugar and sugar

balance that is zona fasciculate, so this hormone called cortisol. And of course, definitely plays a vital role in the sexual hormone that is the androgens and estrogens. Now, that you know these hormones and the adrenal cortex, let us talk about the adrenal medulla.

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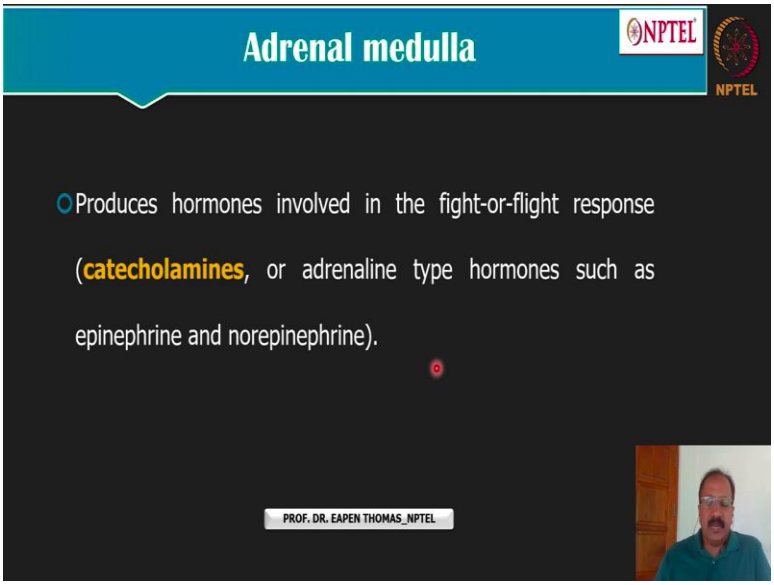

The adrenal medulla actually principally, they actually secretes the hormones called catecholamines. And these are involved in fight or flight response, actually connected with the sympathetic activities of the body. And the principal hormones are epinephrine and norepinephrine, that something about the adrenal medulla.

Now, that we have an idea about the hormones of the adrenal cortex, how are they form, how are they secreted, and also that in medulla what are the hormones and where does it secretes, let us move on to the next part about the functions of the steroids.

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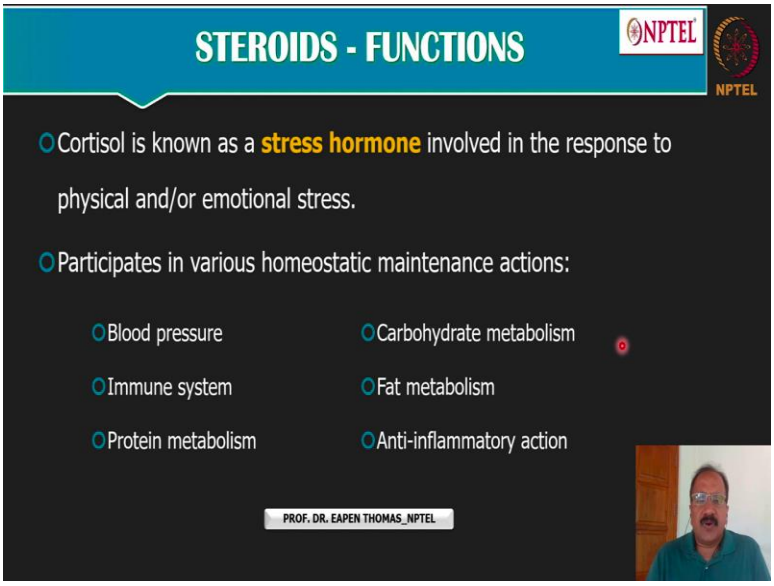

Now, the steroids cortisol is predominantly called as a stress hormone, it is involved in the various form of stress in responses, whether it is physical stress or emotional stress. Stress does not mean it is always or anything connected with the fear or anxiety, anything which concerns with emotion, anything which concerned with an increased demand of the body.

It could be, when you are sick, it could be a fever, it could be any injury, it could be trauma, whatever it is, that is emotional or physical demand of a body, whenever there is an increased metabolic response demand, your body is at stress. So, the cortisol is very important to maintain this particular balance and to make you capable of meeting the stress.

So, it is a very important hormone. So, that is something what you have to keep in mind. It actually takes part in many of the homeostatic maintenance actions, homeostatic means, something which regulate reactions and maintenance actions in various types of in a systemic action. So, predominantly blood pressure.

Now, by virtue of its action on the heart by virtue of its actions of the sympathetic system by virtue of its action on the aldosterone, the salt and the water retention, it plays a very important role in controlling the blood pressure. Immune system, so the principle agents of the immune system are your WBCs or the leukocytes and the T lymphocytes. And this steroids has got a predominant role and in mild doses it is exactly immunostimulatory.

But on a proper therapeutic dosage, it actually compromised, it actually suppresses the immunity, and in general or in grossly these are called as immunosuppressant drugs too. It actually make a system more susceptible, it actually inhibits this system under the thymus and the cells produced by the thymus and the lymphocytes, the T lymphocytes and WBCs, the complement systems, all these are under the influence of steroids, they are little bit kept down, they are inhibited, thereby reducing your immunity or immune system and that is the reason they are called us immunocompromised drugs or immunocompromising drugs.

Protein metabolism, well in doses therapeutic doses, it actually breaks down in excess doses of this thing, the proteins are broken down for the purpose of generating energy and the process of formation of glucose or gluconeogenesis. And this actually catabolism of the proteins is actually giving rise to wastage of the muscles and other features. So, you should be thinking about this particular part, about the steroids giving rise to protein, metabolism an important role in that.

Carbohydrate metabolism, well, the control of blood sugar is very important necessary factor, because that actually gives us a lot of energy, the glucose is a main source of energy. And this metabolism of glucose is very important. And this carbohydrate metabolism is taken care of by the steroids to much extent, they actually always increase the blood sugar level by various mechanisms, the principal one being gluconeogenesis.

They help to generate glucose from non carbohydrate sources like I told you earlier, the protein from the fat and things like that, they also decrease the peripheral utilization of glucose, and they also increase the glycogenolysis. These are the mechanisms by which the steroids are principle hypoglycemic agents are increasing the blood glucose level.

Fat metabolism, again, for the purpose of generating energy to meet the stress, the steroids acts on the fats and break downs and they create a lot of energy and calories and even sugar in extremes actually is taken or generated from these fat metabolism modes. Another one very important action of the steroids is anti-inflammatory action, this got a very massive anti-inflammatory reaction when compared to NSAID, it acts at the higher levels, it act as a force for diastase level.

And it actually has got an action the WBCs, it actually reduces the function of the WBCs, the phagocytic activities actually cut down, the chemotactic factors cut down, the prostaglandins are active mediators of inflammation or inhibited the muscles, they actually stabilize the muscles, so that degranulation and release of these inflammatory mediators does not happen and various, various other ways, various other ways in all of the different mechanisms, the steroids has got a very important anti-inflammatory action. These are a few of the growth and the major actions and the functions of the steroid that one should be having a knowledge about.

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With that knowledge, let us move on to the next part, how is the regulation happening in terms of these cortisol? Now, always remember there is always a balance, as you can see, there is a balance of the requirement of the cortisol, your blood levels are maintained with adequate homeostatic mechanism, depending upon the demand and depending upon the supply.

So, all these are under the normal level, an average daily secretion of cortisol is about 25 to 30 milligrams. The secretion of cortisol or these particular steroids is maximum seen in the early hours in the morning hours, when you sleep and get up and when your system is one is going to start functioning with all the properties, then you need to have this lot of steroids which actually gives a lot of energy.

So, in the early days actually about 20 in the early morning times about 200 to 300 milligrams is seen as a spike release of these steroids to meet the early demands when your body wake up from sleep, then onwards the secretion slowly comes down. So, an average of 25 to 30 milligrams of steroids is actually required per day. Now, let us see this how these have been regulated.

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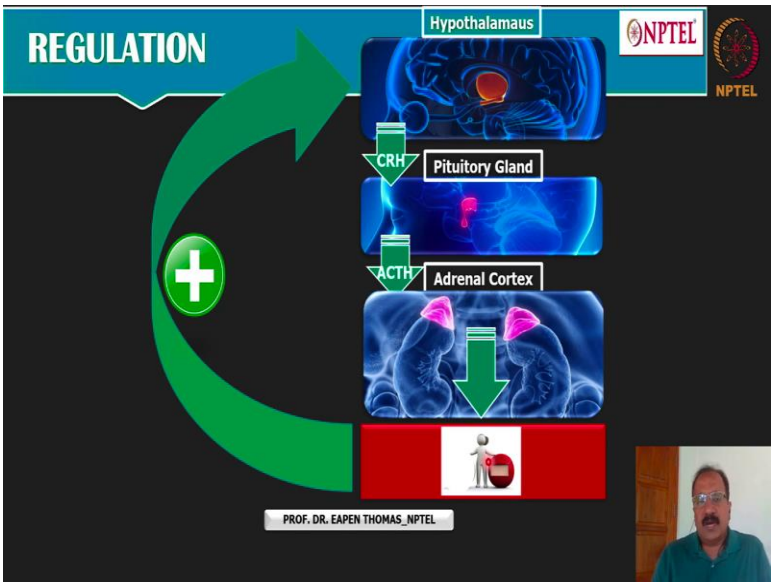

So, whenever there is secretion is less, whenever the levels of your steroids in the blood is less, there is always a sudden stimulatory impulse or a stimulatory positive feedback mechanism which is sent to the hypothalamus, the hypothalamus receives a positive stimulus. So, whenever there is a reduced level of steroids.

So, this hypothalamus in turn secretes the pituitary gland, the anterior pituitary gland is part of the anterior part of the pituitary gland is what are called stimulated by the hormone by which is called as CRH or corticotropin releasing hormone. The CRH is released from the hypothalamus to the pituitary which stimulate the anterior pituitary and anterior pituitary in turn stimulate the adrenal glands through hormone which is called us ACTH or the adrenocorticotropic hormone.

So, in response to stimulation on the hypothalamus, the pituitary gland releases the adrenocorticotropic hormone, which actually stimulates the adrenal gland to release the steroids into the blood and the levels are met with. So, this is in brief how whenever there is a demand of

the steroids, whenever there is a stress in the system, the increased demand of the steroid is met with.

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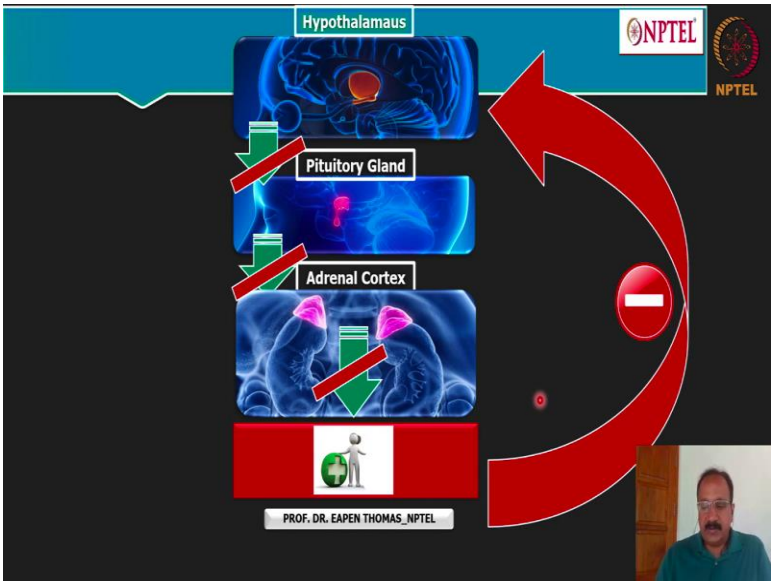

Now, let us see what happens the other way around, whenever there is an excess of steroids what happens. Now see, here I can see there is an excess level of steroid again, it has to be having a balance, how does the control happen? So, immediately whenever there is an excess level of steroid likes for a patient who is taking exogenous steroid, a patient who is taking steroid tablets, preparations for something or the other.

So, all these patients who are medicated with a steroid therapy will always have an excess level of blood, excess level of steroid. So, whenever there is an excess steroid level in the plate, a negative feedback goes to the hypothalamus. Whenever there is a level excess in the blood, the negative feedback goes the hypothalamus.

The hypothalamus, then later actually do not send any stimulatory impulse to pituitary gland, pituitary gland actually do not send any stimulatory effects to the, your adrenal glands, and there is no release of other corticosteroids or steroids into the blood system. So, that is why it is controlled. Now, this is what is happening whenever there is an excess level of steroid.

Now, let us see a patient who is on a long term steroid therapy, any patient who is on long term steroid therapy actually will have higher levels of blood steroid always, there is a blood cortisol

level, or blood hydrocortisone level will be always higher on the higher side. So, the problem is, this system is always active. I have told you the negative feedback system is always active.

So, what happens when the negative feedback, no hypothalamic stimulation, no pituitary stimulation, no adrenal gland stimulation. So, when this lack of stimulation continues for a long period of time, what happened that adrenal gland undergoes atrophy, lack of function and atrophy is called disuse atrophy.

So, whenever levels of, remember this is how it happens simply, now whenever the blood levels of steroids are always on the rise or at a higher level because of these exogenous steroid therapy taken for various reasons, this symbols the hypothalamus is always negative feedback, hypothalamus symbols to the pituitary second negative and adrenal cortex negative, no simulation happens.

So, when this continued face of non usage of the adrenal gland happens, it undergoes disuse atrophy. So, the problem with that is whenever there is a severe stress situation, which requires more than the actual levels in the blood, otherwise body always compensate. But in this particular case, that compensate to secretion of the adrenal cortex does not happen, and patient will end up in adrenal crisis, real fatal emergency situation.

That is how these things, that is the reason why you should understand that all these medically complex conditions does have its own significance and there is a pathophysiology underneath it. So, one should be actually on a very thorough knowledge about all these pathophysiology. So, you can identify, you can manage, you can also prevent all these medically complex conditions.

And definitely and certainly you can prevent complications. I have told you earlier in the previous classes also, 80 to 90 percent of the complications that arise in dental practice are because of lack of managing properly, patients with medically compromised conditions. So, that is why I said and the significance of this pathophysiology.

Now, that you know, what is disuse atrophy, what happens to the patient who is on long term therapy, why is that patient unable to cope up with stress when there is a additional stress, for example, the procedure what we are doing a surgical procedure, patient is in under stress in a more than the normal. So, in such situations, what happens, the adrenal gland will not release

steroid because it is already undergone disuse atrophy, and patients end up in a fatal complications like adrenaline crisis.

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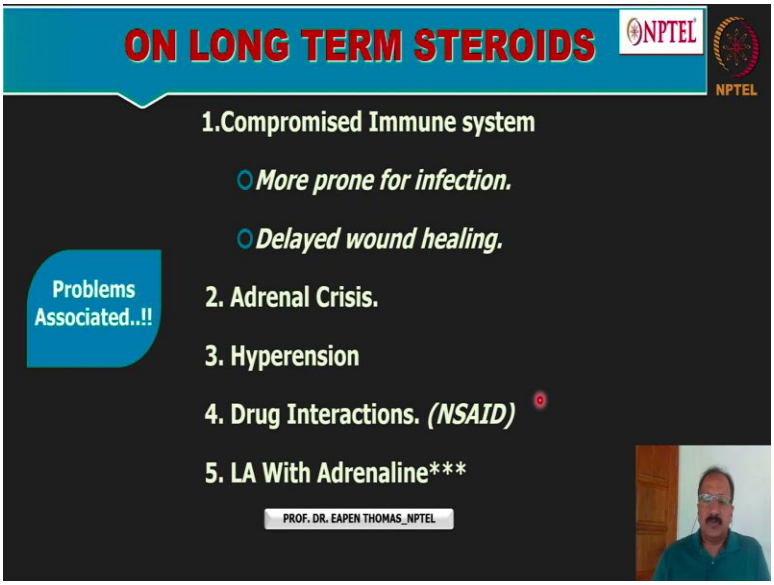

Now, I have told you what disuse atrophy, all these things has to be kept in mind. Now, what are the problems that we face in patients with long term steroids, that is something what we should understand. I have told you earlier, any systemic condition, when we take it up for considering the dental management, we should always take it heads in the different types like what is the problem associated, and what are the risk factors?

And how will you manage the patients? And what are the measures of preventing those? So, let us see what are the problems associated, they have a compromised immune system I have told you earlier, because of the inhibition of the WBCs, and the primary line of defense the leukocytes, the polymorphonuclear cells, the complement, the mediator systems, all these the T lymphocytes are being inhibited by the steroids, they have immune mechanisms, we decided to compromise for the same reason.

They are more prone for infection, and they have a delayed wound healing also, because of these problems, because the macrophages phagocytic property and healing and all these are simultaneously delayed in these individuals. Then they are another one problem is I have told you earlier, patients who are a long term steroid there are prone, they are prone for developing

this adrenal crisis, a fatal complication, when some real stress invoking procedure is performed in them without taking adequate precautions.

Then they also have an tendency to have hypertension because of excess levels of glucocorticoids or the steroids, have shown to create an increase in blood pressure. And then patients on long term steroids, when you prescribe by NSAID have to be very careful, because they inhibit the prostaglandins and this is also this particular steroids on long term.

But the gastric mucosa, the gastric lining actually has got a protective edgy to landing on the prostaglandin which is actually totally washed out in patients on long term steroid because of the lack of prostaglandin synthesis. So, again, when you are giving NSAID which is again acting by inhibiting the prostaglandin, so the gastric prostaglandin is also is inhibited.

So, it leads to further irritation, acidity, ulcerations and problems like that. So, you have to be careful in prescribing NSAID in patient with long term steroids. Well you are using with LA with adrenaline, adrenaline is actually are known to be hypoglycemic agent, and again it increases the blood glucose level by various mechanisms.

And steroids you know, the patient who is taking steroid long term, steroid therapy, as well as also having a hypoglycemic. That is why you see diabetes or hyperglycemia as a side effect in patients with long term steroid therapy. Because all these patients on long term therapy has got this effect on the carbohydrate metabolism, where in which there is gluconeogenesis, from the non carbohydrate sources glucose is generated, thereby leading to increase in the blood glucose level, the peripheral utilization of glucose is reduced.

So, thereby again increase in the blood glucose level. Glycogenolysis breakdown of the stored glucose and given the liver that is again another reason for (())(22:54). So, all these contribute to a hyperglycemia situation. So, adrenaline, which is again a notorious hypoglycemic agent when used to in patient long term steroid has to be dealt with carefully, avoid intravascular administration and all these procedures has to be done with care.

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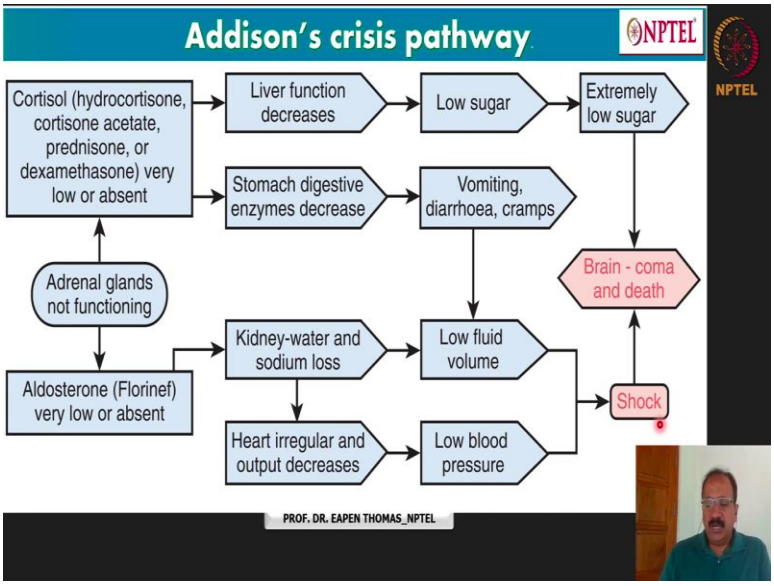

Now, let us see a little bit about what is this Addison's crisis or adrenal crisis or this why is it fatal? Now, when the adrenal glands are not functioning because of this disuse atrophy, like I have told you earlier, the long term high dose of steroids in the blood actually makes these adrenal glands non functioning, when such a non functional adrenal glands arise, what happens, you have a situation where is this hardly or any sort of steroid which is actually present to meet the stress what is created by your dental procedure or any such matter.

And overall the indirect effect when these hormones are less in number or in quantity, the liver function is also affected because there is a decreased liver function. And again, stomach digestion seems to decrease leading to indigestion problems and gastric mold become the complaints. When the liver function decreases, what happened, the stored glucose is not released and there is a low sugar level which is actually in the blood hypoglycemic situations.

And all these stomach digestive complaints give rise to industrial mortality, increased mortality and diarrhea and abdominal cramps and vomiting. And all these together when there is a severe low sugar condition, patients will undergo a situation wherein which is leading to brain coma, and finally death. So, this is in brief, what happens in a non functioning adrenal glands which is by because of a long term steroid therapy.

And there is a continuous low levels of the endogenous steroid, which actually affects the liver function which is decreased, again, the stored glucose and levels is actually cut down. So, there is a resultant hypoglycemia or low level and when it goes below your normal level, it comes to a situation where the brain undergoes coma and fatality and death.

That is one way it is happening. Another ways basically, when it affects (())(25:04) corticoids, when there is overall steroid or cortisol or the adrenal context suppression, what happened the aldosterone is also a similarly very low or absent situation. So, what happens we have learned that this is responsible for salt and water retention. So, hormone of aldosterone is less what happened, the salt and water gets excreted with a kidney, which was otherwise always being absorbed by this hormone.

So, when these get excreted by the kidney, that is the heart irregularities and the cardiac output decrease, the blood pressure falls, the cardiac output degrees, the electrolytes very important that the sodium, potassium all this very important electrolyte that affects the concerned bodies, the cardiac properties alter, and when there is a lot of volume loss, the lower blood folium or the no fluid volume, and then leads to a low cardiac output and a blood pressure, again giving rise to a patient's condition called shock, what is talking about this and finally, brain and comma and death.

Now, this is in general the pathway how Addison's crisis or adrenal crisis actually finally ends up or how it becomes fatal in individual. So, this is how I hope you understood basically how an adrenal gland suppression give rise to all the different hormonal inhibitions and when these hormones are inhibited, and when there is lack of these hormones, how are these multiple organs are affected in a bad state which is finally leading to shock and then brain, coma and death.

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Let us move on to the next one. The signs and symptoms of adrenal crisis, early signs you can patient can make a patient will come in a weakness, acute abdominal pain, nausea, vomiting, altered sensorium, poor judgment, uncooperativeness, these are all signs and symptoms.

The weakness, the abdominal pain is I can suggest you I have told you earlier because of the intestinal gastric juices and the intestinal motility problems and muscle cramps, and nausea, vomiting all these are connected to that gastrointestinal complaints and altered sensorium, poor judgment and uncooperativeness are connected with the loss of severe sodium and potassium levels on the body and electrolytes level.

And hypotension, again, because of the excess salt and water excretion in the water fluid volume is lost, hypotension happens fever because it responds up the body to compensate. Hyponatremia, I told you when the sodium and potassium is excreted the blood sodium and the sodium levels in the body comes down. And that is the reason it is a compensatory hyperkalemia.

Hyperglycemia, because I have told you the liver functions is not happening. So, there is not mobilization of glucose from the liver. So, I will find it that gives a situation where there is a shortage of blood glucose level. And the hypoglycemia for the liver functions since it is altered because of these situations that is in the hypercalcemia. There is again mobilization of excess

calcium that is also possibly part of this adrenal crisis. So, these are the signs and symptoms of adrenal crisis.

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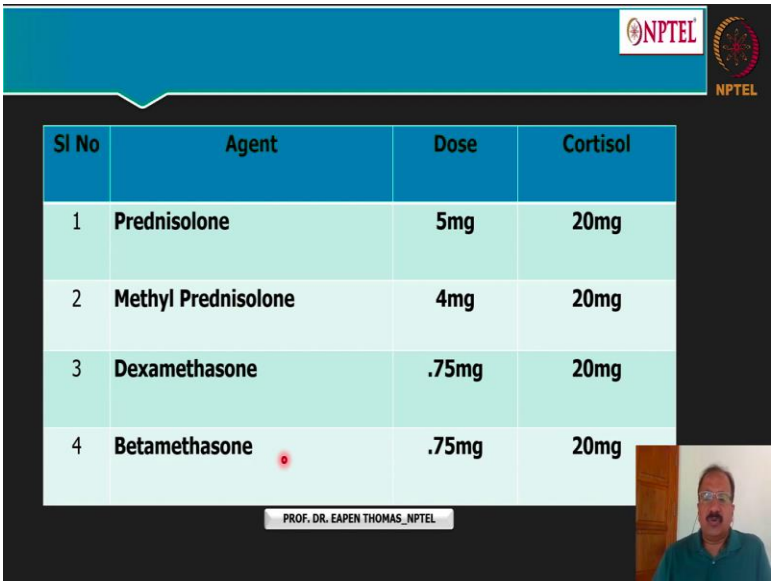

And let us see, this is just a chart just to show you how it is actually connected with other drugs prednisolone, methyl prednisolone, dexamethasone, betamethasone, these are the synthetic forms of corticosteroids, which are used for therapy.

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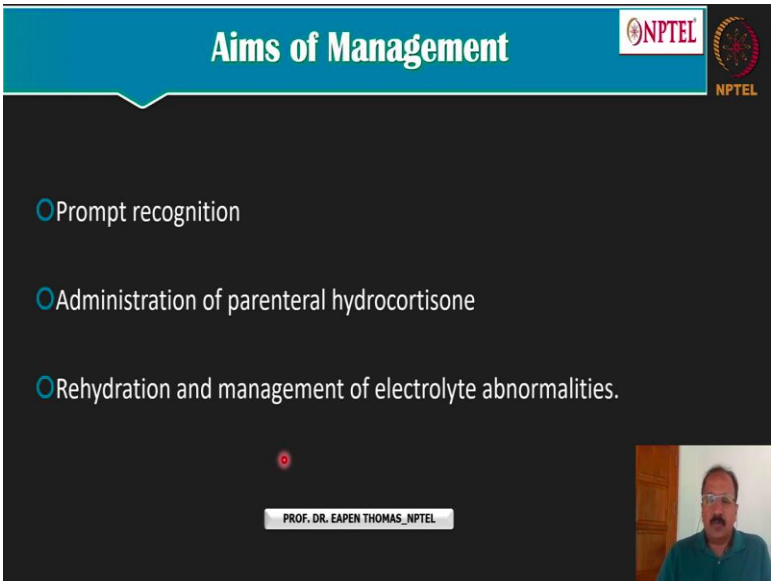

And now such patient once you have diagnosed based on sign and symptoms, how do you manage? Let us see what is the aim of manage. A prompt recognition, based on the history part, based on signs and symptoms part, early diagnosis is very much essential and prudent for managing the patient successfully ad administration of parental hydrocortisone substitution or replacement of plaque.

What is it? Replacement of a steroid? I mean, parental hydrocortisone has been very important and crucial. Rehydration and management of electrolyte imbalance, I have told you there is a lot of fluid loss through because there is no salt and water retention because of the lack of aldosterone. There is a lot of fluid which is being excreted in the kidney leading to dehydration. So, rehydration, and management of the electrolyte abnormalities again very important key.

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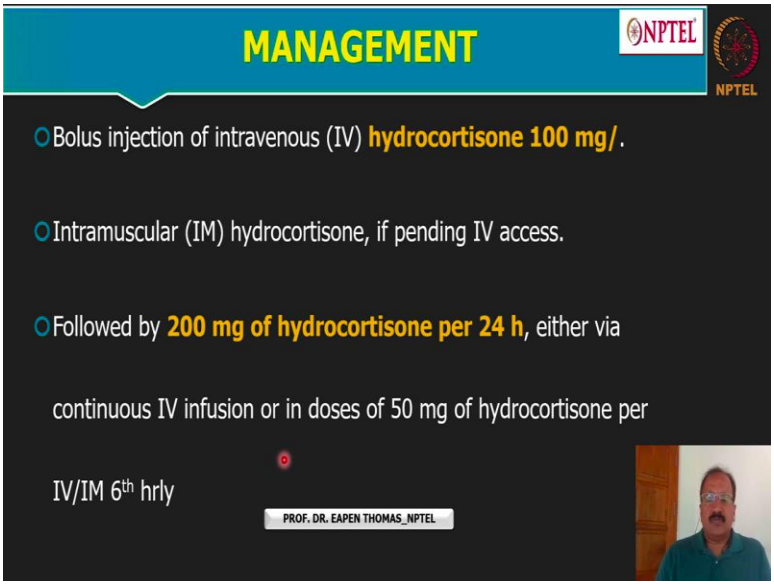

How do you manage? Let us see. Now, what were those aims in mind, just remember, those are the aims what we have to think about. Now, what are the, how do we manage? Nolus injections, so hydrocortisone, I have told you supplementation of hydrocortisone is very much essential. 100 milligrams in IV bolus dose can be injected. If IV line, sometimes because of the severe hypertension you might not get the IV line.

So, in such situation, you can even go for intramuscular hydrocortisone. And it has to be followed. So, initially the data followed by 200 milligrams of hydrocortisone per day, per every

24 hour, either you can actually have in the form of infusion, a continuous infusion, or if you want to split it, you can actually give it as 50 milligrams of hydrocortisone per IV or IM every 6th hourly, four times a day.

So, this is how the early first part the bolus injection of hydrocortisone. Then if your IV line is difficult, you can go for IM hydrocortisone, then you have to follow 200 milligrams of hydrocortisone every 24 hours or BD dosage. Or you can even give 50 milligrams hydrocortisone every 6th hour four times a day.

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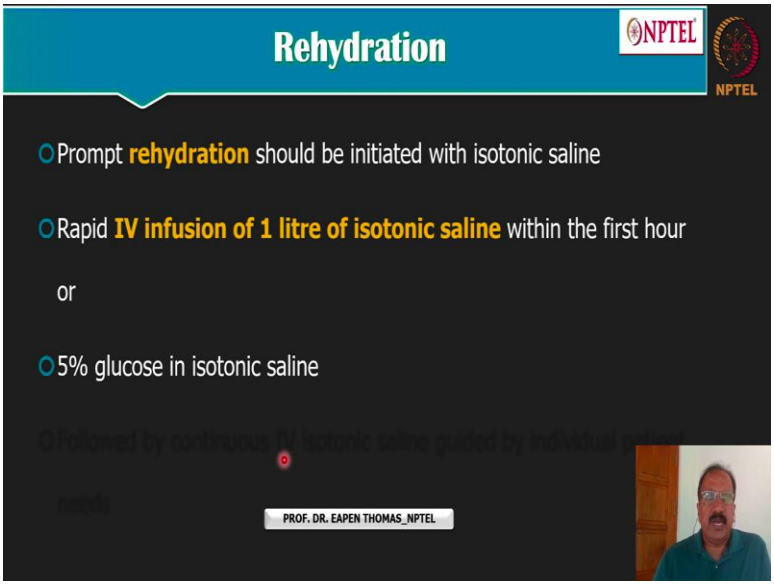

Then rehydration I have totally because of severe water loss associated with this excretion of the fluid you have to go for rehydration has to be done with isotonic saline is ideal one because it contains sodium and electrolytes also, and rapid infusion of 1 liter of isotonic saline within the first hour is very crucial to get the rehydration back.

Or it can also give a 5 percent glucose in isotonic saline because I have told you there is a severe hypoglycemia also, there is a hypoglycemia, severe hyperglycemia, there is a loss of this salt and so another one lot of volume of water is also loss. So, rehydration should be aimed in all these things and followed by continuous IV, isotonic saline. Then you can continue that later depending upon the patient situations.

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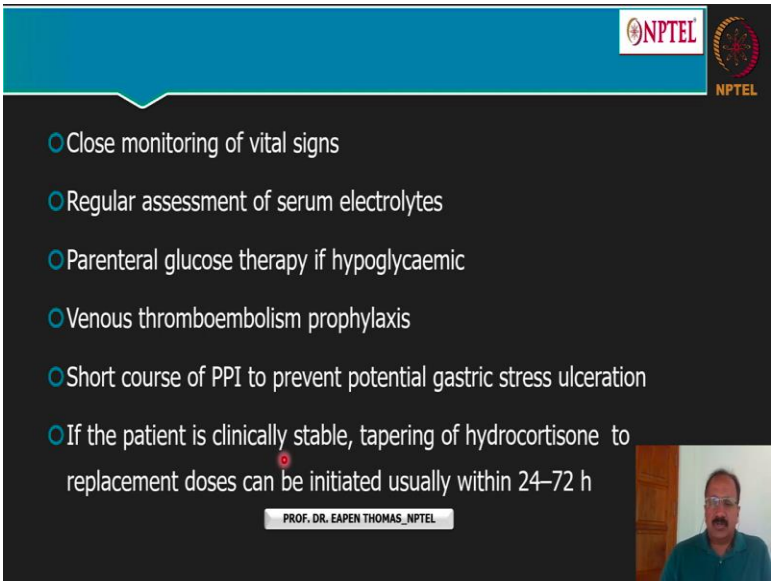

And after each and every step, you have to monitor the patient closely monitor the vital signs that BP, pulse, temperature, respiration, all those has been regularly monitored. And the serum electrolytes we should know whether after supplementation of these IV fluids, whether the (())(31:16) levels are picking up, then whether the hyperglycemia status are picking up.

So, based on that you have to either continue that parenteral glucose therapy, then venous thromboembolism is actually recommended in some individuals due to some reason not very sure about, the exact mechanism is not mentioned. And the short course of this proton pump inhibitors of antacids is actually recommended to prevent this gastric stress isolation because the stress induced by such a situation will actually prevent or which create a lot of trouble for the gastric mucosa. So, a proton pump inhibitor would be ideal.

And if that patient is clinically stable, if the patient's responding well to the medications, what you actually prescribe, then you can taper hydrocortisone and the replacement doses can be initiated usually within about 2 to 3 days. So, after all these, rehydration and replacement of hydrocortisone if the patient’s gradually vital signs are within normal limits and the patient becomes stable. We can think about tapering this hydrocortisone in 2 to 3 days time.

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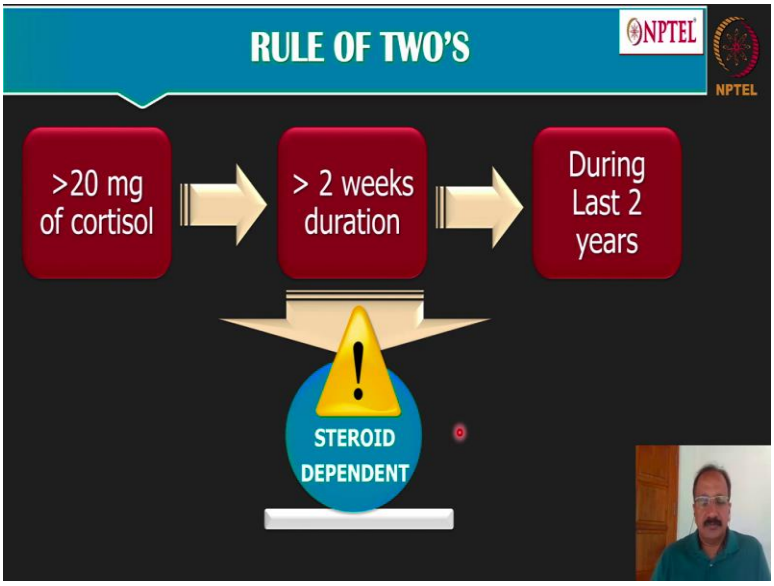

You might have heard about this rule of Two's like how do you make out if the patient is actually steroid dependent or not, whether the patient's adrenal gland are atrophied or not. So, there is something called a rule of Two's you might have heard it earlier. Now just remember, if the patient any patient who has been taken more than 20 milligrams of cortisol, or any drug therapy, which is equivalent to more than 20 milligrams of cortisol, if a patient is taken per day for more than 2 weeks duration continuously.

In the last 3 years anytime. I repeat any person who has taken more than 20 milligrams of cortisol or equivalent drugs per day, for more than 2 weeks continuously duration anywhere during the last 2 years, such patients should be considered as steroid dependent and has to be dealt with carefully whenever you are doing any procedure, which is evoking a lot of stress. So, that is about the rule of Two's. I hope it is clear.

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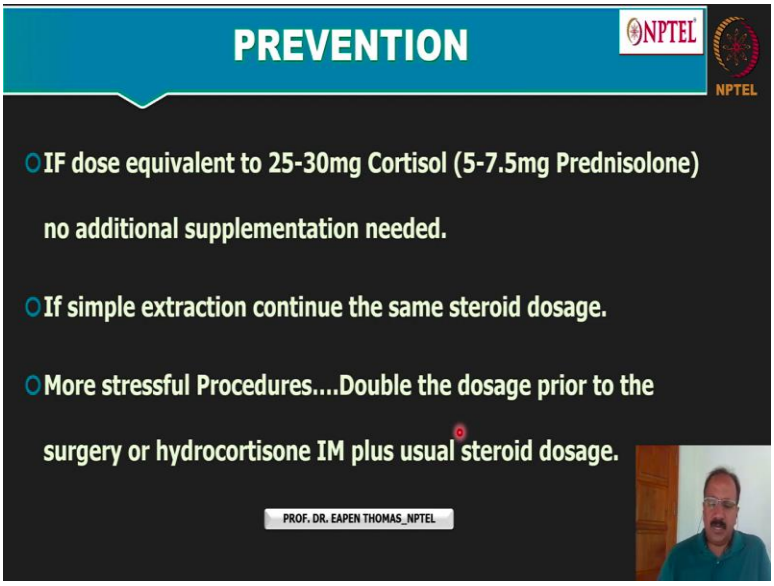

Now, prevention is very important. Now, that you see the main thing I have told you all these complications arise because you have either overlooked or you have not done the necessary homework. Now, if you know the patient's details in history, and you have realized these particular steroid therapy, and patient is on long term therapy, then the best thing is to take adequate precautions with those, or preventive with those.

How we do that? If the patient's medication, the external medication is something equal to 25 to 30 milligrams of cortisol per day, that means that somebody connect to the normal routine dose only. So, if the patient's drug is in that range, you need not actually give additional steroids. You do not have to (())(34:06) same drug has been continued, that is all. If symbol extraction is required, then continue the same steroid dose if this type of drug is being taken.

If you are doing a more subtle procedure like surgical extraction, long time consuming flap surgery, at difficult canine impaction or anything of that sort under local anesthesia which induce or which evokes a lot of stress for the patient, then such patients the dose has to be doubled, the double on the morning, that is something very important. And I know one thing is prior surgery in that hydrocortisone should be kept handy with you so that in case any emergency come that has been given to the patient.

So, I repeat, so simple extraction or a scaling or any other non surgical procedures which does not evoke any stress in patients on long term therapy, the same drug steroid therapy has to be continued, no other additional medication required. If it is a stressful procedure, ask the patient to take the dose double on that particular morning.

So, double the dose for every stressful procedures on patient with long term steroid therapy. Similar procedures similar extraction, no need for additional dosage, same dosage to be continued. So, that is we have to be thinking about.

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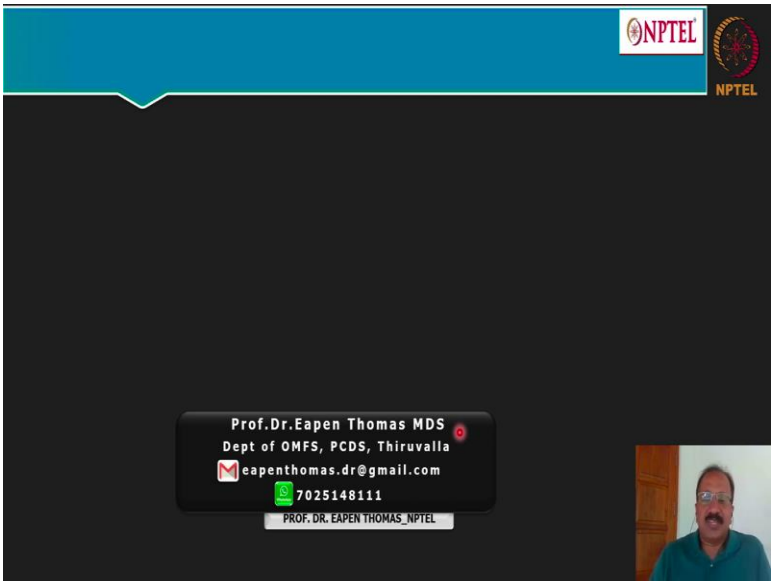

And I hope that things so far have been very clear. Today we have discussed about the adrenal gland, the adrenal hormones, what are the various hormones, its functions, its actions, its effects on various systems. What is the role of Two's? What are the problems associated with that adrenal glands? How were the hormones secretions regulated and the complications arising out of it and how to manage complications? Thank you. Thank you for your patient listening. Thank you.