

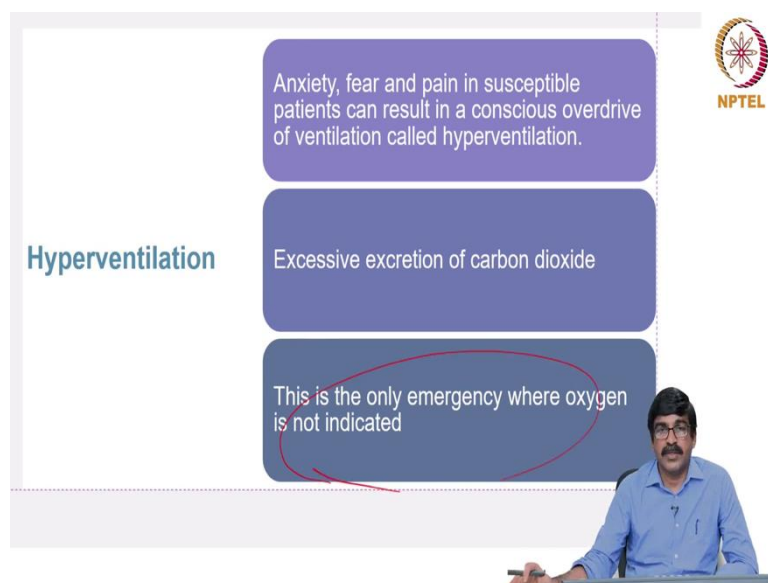
Management of Medical Emergencies in Dental Practice
Professor Doctor P. Suresh Kumar
HYPERVENTILATION

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Hi friends. Another session to discuss about Hyperventilation. As one of the medical emergencies in our dental office. I am sure you would have seen these kinds of problems in dental office. And sometimes it is really confusing. The diagnosis is confusing. And so, the management is a little bit tricky. So, that is the reason why we should be familiar about hyperventilation. Is not a very serious complication, but if it is left untreated, probably it can lead to more severe causes.

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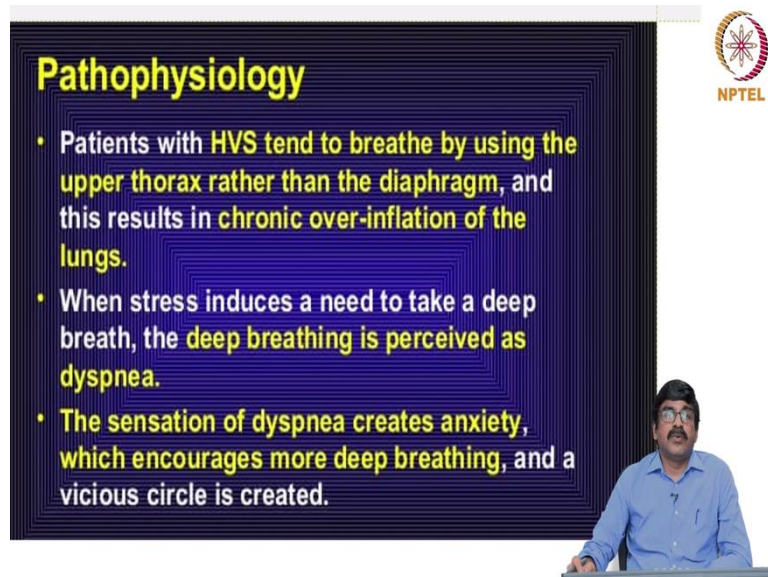


So, what is hyperventilation? The anxiety, fear and pain in susceptible patients can result in a conscious overdrive of ventilation called hyperventilation. That is, in simple words, the patient will start breathing more frequently that is the respiratory rate is abnormally high. What will this do? So, what is wrong in breathing in more number?

There is excessive excretion or the whole carbon dioxide in your respiratory tract is exhausted. And so, there is less carbon dioxide in the blood which is called hypocarbia. A particular level of carbon dioxide in the blood and respiratory system is important. Otherwise, this will lead to respiratory alkalosis.

The respiratory alkalosis can cause problems in our body, there may be some chemical changes or hemodynamic changes. And just make a note, not all the emergencies in dental office require oxygen therapy, immediately whenever the patient is not feeling good, you tend to give oxygen but in hyperventilation please do not give oxygen for the patient, it is very important to remember.

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Pathophysiology

- Patients with HVS tend to breathe by using the upper thorax rather than the diaphragm, and this results in chronic over-inflation of the lungs.
- When stress induces a need to take a deep breath, the deep breathing is perceived as dyspnea.
- The sensation of dyspnea creates anxiety, which encourages more deep breathing, and a vicious circle is created.

So, how does it happen? Patients with hyperventilation syndrome will tend to breathe by using the upper thorax rather than with the diaphragm and this results in chronic over inflation of the lungs, overinflated lungs, beyond the limit. When stress induces a need to take a deep breath, that is you are doing a treatment and the patient is stressed up. So, the patient thinks okay we are in stress.

So, we need to take a deep breath to counteract the situation. So, he will try it but the brain interprets this as a deep breathing. So, instead of taking a deep breath, there will be continuous

many deep breaths leading to dyspnea or hypopnea. The sensation of dyspnea creates more anxiety that is the patient knows we are not able to breathe, because of the anxiety he feels or he imagines he is not able to breathe.

This will encourage more deep breathing. He has started breathing deeply already because of the anxiety. And the feeling of insecurity caused by the sensation of dyspnea will create more and more deeper breathing, increasing the rate of breathing. And this forms a vicious cycle. So, the patient continues to take deep and more breathing.

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The slide is titled "Hyperventilation syndrome" and features the NPTEL logo in the top right corner. It contains a bulleted list of symptoms: "Minute ventilation exceeds metabolic demands", "CO2 reserve is exhausted; low CO2 in the blood", "Respiratory alkalosis", and "Hemodynamic changes and chemical changes". The terms "low CO2 in the blood", "Respiratory alkalosis", and "Hemodynamic changes and chemical changes" are underlined in red. A small video inset in the bottom right shows a man in a blue shirt speaking.

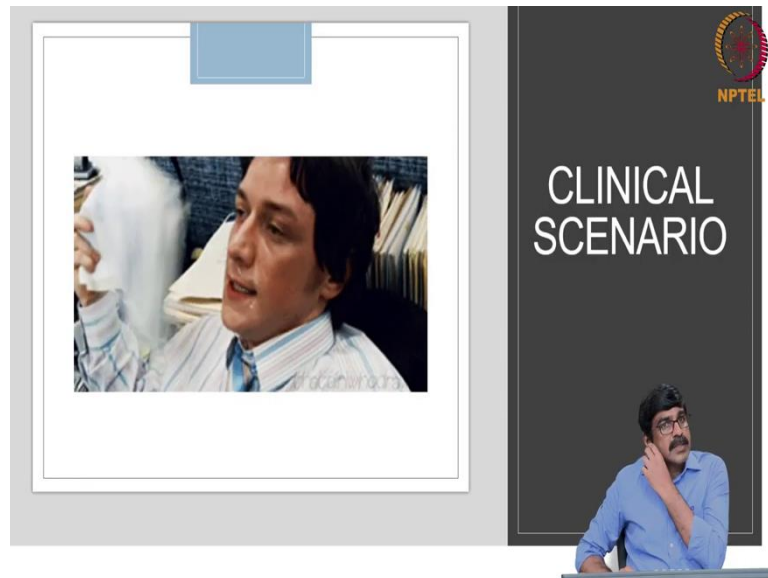
Hyperventilation syndrome

- Minute ventilation exceeds metabolic demands
- CO2 reserve is exhausted; low CO2 in the blood
- Respiratory alkalosis
- Hemodynamic changes and chemical changes

So, here in hyperventilation syndrome, the minute ventilation actually exceeds the metabolic needs, the body might be needing only 10 litres of oxygen, but the respiratory work done is to gain 15 or 20 litres of oxygen. At the expense of carbon dioxide, the patient needs the body thinks, the thinks we need more oxygen, so it tries to breathe more.

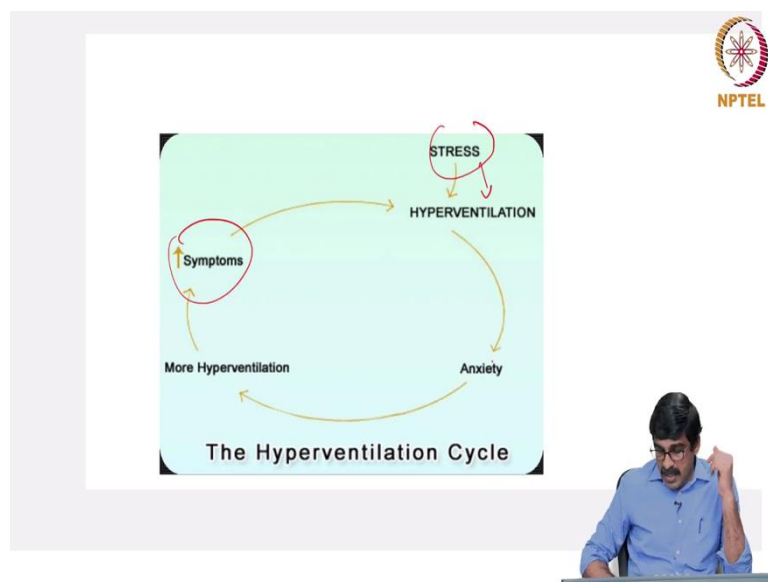
But it exhales the carbon dioxide it exhausts all the reserves of carbon dioxide leading to respiratory alkalosis. So, low carbon dioxide in the blood is the important problem here, leading to respiratory alkalosis. This alkalosis will induce or cause him a lot of hemodynamic changes and chemical changes in the body which are manifested clinically as various signs and symptoms which you have to recognize and treat.

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If the patient is prone for developing hyperventilation, this is how he will look. If you can look at the video, you can see the patient breathing rapidly as well as deeply, this is the problem of hyperventilation syndrome in patients. Though he is breathing more he will be thinking that he is struggling for breath. So, he will keep doing it again and again this is a vicious cycle.

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So, if you look at the picture here, the stress will cause hyperventilation. And the hyperventilation itself will induce more anxiety leading to more hyperventilation and more of clinical symptoms. So, this is becoming a cycle now, so it does not stop unless you do something to the patient.

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Manifestations of hyperventilation syndrome:

Neurologic Dizziness ✓ Numbness of fingers, ✓ toes, lips ✓ syncope ✓	Cardiac Palpitations, tachycardia ✓
Respiratory Increase rate and depth of ✓ breath ✓ Feeling of shortness of ✓ breath ✓ Chest pain ✓ xerostomia ✓	Musculoskeletal Myalgia, muscle spasm, ✓ tremor, tetany ✓
	Psychologic anxiety ✓

So, when the vicious cycle is already found, what will happen, the patient is hyperventilating, breathing deeper and faster what will happen actually. It is manifested clinically in many systems neurology, respiratory, cardiac, musculoskeletal and psychological symptoms. Neurologically, there is going to be dizziness that the patient is not well oriented, he says I am not oriented well, dizziness.

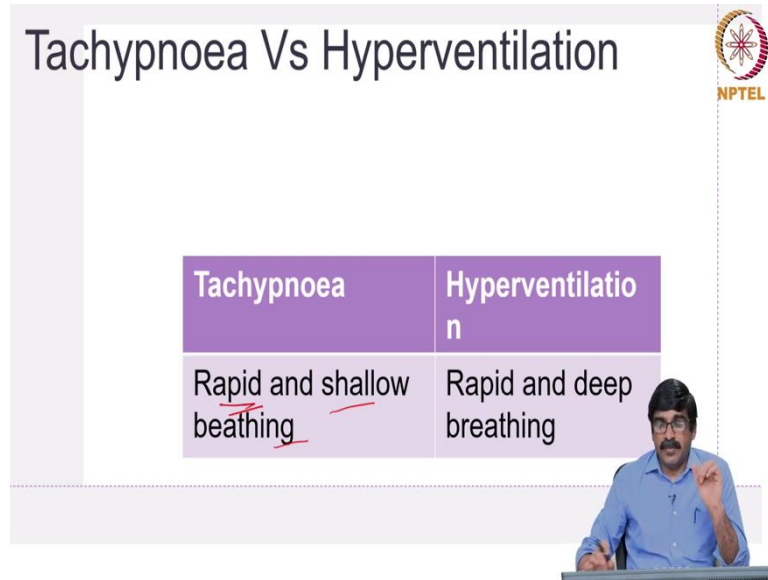
And these are very typical symptoms numbness of the fingers, toes and lips, there is a tingling sensation otherwise known as. And if left untreated, they will undergo syncope these are neurologically related signs and symptoms of hyperventilation. Of course, the respiratory system is the main thing which will show us the patient is hyperventilating.

If you look at this is very important. Increased rate and depth, this is important, both the rate and the depth are increased in the in the breathing cycle. However, the patient will still feel shortness of breath. Another important point to be noted. Patient is breathing a lot but still he will feel that he is not breathing adequately, shortness of breath. And these frequent moments of the lung will lead to chest pain.

And because of the lot of air passage, it will also lead to something called xerostomia, dry mouth. In the CVS, the cardiovascular system, the patients because of the anxiety will develop palpitations and tachycardia. And it is manifested in the musculoskeletal system too. The patients will start feeling myalgia that is especially in the muscles in the oral facial region, shoulders in the chest region, there is going to be some muscle spasm because of the over activity because the ancillary muscles of respirations are brought into action.

There can be tremors of the hands and feet or there can be tetany is nothing but carpal piddle spasm, the fingers because of the fittingness and the respiratory alkalosis. There is spasm here in the hands and the feet. Psychologically there is a lot of anxiety because of too many manifestations. The patient thinks something is seriously wrong and there is more anxiety more stress, taking the patient into more of hyperventilation, that becomes a cycle.

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Tachypnoea	Hyperventilation
Rapid and shallow breathing	Rapid and deep breathing

One important thing or condition to be differentiated from hyperventilation is Tachypnoea. You know Tachypnoea in simple words, it means increased respiratory rate. So, sometimes patient starts breathing faster, the respiratory rate, the normal rate, you are all familiar it is somewhere between 8 and 14 per minute is the normal respiratory rate. Suppose, I am in a dental procedure, I start breathing rapidly because of anxiety for example, 20, 25 per minute or even more. So, that shows there is some problems.

So, will you name it as Tachypnoea or hyperventilation? The Tachypnoea is a physiological response to stress that is when you give more activity to the body suddenly that is you are working out in a gymnasium or you are climbing up on a hill where there is low oxygen saturation. These are the places where automatically your body will increase the respiratory rate. So, this is called.

Now, also the rate is going to be more not 14, it will be some 20, 25 per minute, but this is not hyperventilation, this is Tachypnoea. Tachypnoea again I want to remind you it is due to some overactivity. The body is trying to compensate by increasing the respiratory rate. Whereas, hyperventilation is triggered by anxiety the body is fine, but because of the anxiety


body thinks there is some problem and we have to breathe deeply and fastly, so that is hyperventilation. The more unwanted, more of an unwanted thing.

Tachypnoea is a wanted thing. Hyperventilation is an unwanted thing. So, how will you differentiate. So, patient is having 25 to 30 respiratory rate per minute. So, how will you differentiate is it Tachypnoea or hyperventilation? In Tachypnoea, the heart rate is increased there is rapid respiration.

But look at the rhythm. It is shallow breathing. Otherwise, it is normal breathing, there is faster breathing, but the depth of respiration is normal or shallow. Whereas in hyperventilation, the patient is breathing faster as well as deeper too much both are increased here that is hyperventilation. So, this is an easy tip to differentiate the Tachypnoea from hyperventilation.



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Old technique - treatment



Rebreathing into a paper bag

- 1- Have the hyperventilating person breathe slowly into a paper bag that's held closely around his or her mouth and nose.
- 2- The person should breathe like this for five to seven minutes.
- 3- Talk to the individual the entire time. Try to distract him or her and make the person feel comfortable and safe.
- 4- If symptoms fail to improve or the person loses consciousness, take him or her to the emergency room.



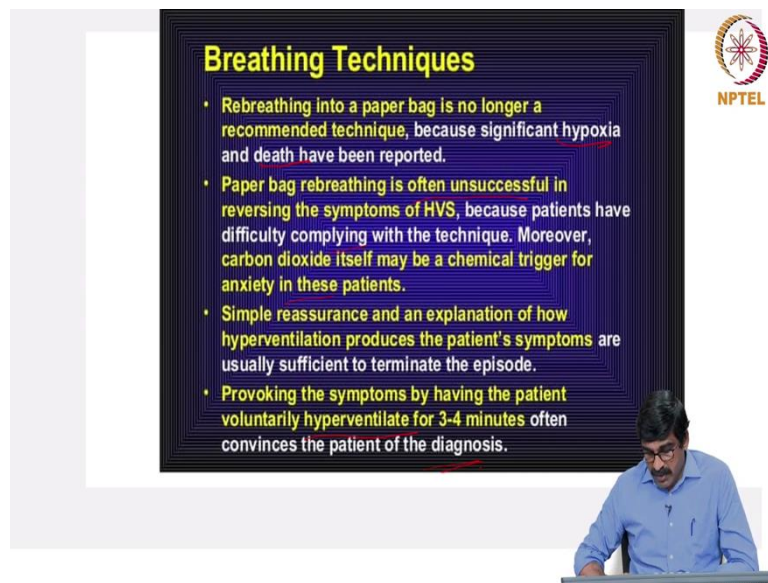
So, in olden days, there used to be a very common treatment for hyperventilation. Hyperventilation, once it is recognized has to be treated. We cannot just leave it like that, because hyperventilation can lead to more serious problems if it is untreated. So, previous or olden days, what they used to do is they ask the patient to breathe slowly into a paper bag, you can see there is a close to paper bag, which is kept around his nose and the mouth both are closed by the bag.

And you ask the patient to breathe inside the bag without opening the bag, inhale and exhale with the bag in place with the nose and mouth occluded. So, the person breathes like this for

at least 5 to 7 minutes. At the same time, you keep talking to the patient about the entire thing, this is not a major complication this can be corrected this is only hyperventilation.

When you are not anxious, you are going to become alright, just keep talking to the patient when the patient is doing this respiratory exercise in the back. And the patient will improve or regain the consciousness very soon after he regains you can take him to the emergency room or if the patient does not improve, you can take him to the emergency room to make the airway and breathing better. So, this is one of the olden techniques.

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Breathing Techniques

- **Rebreathing into a paper bag is no longer a recommended technique**, because significant hypoxia and death have been reported.
- **Paper bag rebreathing is often unsuccessful in reversing the symptoms of HVS**, because patients have difficulty complying with the technique. Moreover, carbon dioxide itself may be a chemical trigger for anxiety in these patients.
- **Simple reassurance and an explanation of how hyperventilation produces the patient's symptoms** are usually sufficient to terminate the episode.
- **Provoking the symptoms by having the patient voluntarily hyperventilate for 3-4 minutes** often convinces the patient of the diagnosis.

What happened why did I say it is an olden technique is because later on they found out that the rebreathing into a paper bag is no longer a recommended technique because significant hypoxia and death have been reported by the paper bag breathing because you are breathing in a very small contained space. So, what do we exhale you are inhaling back only carbon dioxide there is no oxygen.

So, this can lead to a severe hypoxia and sometimes death. So, because they have noticed these kinds of problems, the paper bag breathing is often not recommended nowadays. And they also found out that it is not very successful in reversing the symptoms of hyperventilation syndrome, because patients have more compliance issues like they are not able to breathe with the bag closed occluding the nose and the mouth simultaneously.

So, there are compliance issues. Moreover, the carbon dioxide which is inhaled from the bag itself can be a chemical trigger for the anxiety, you know what the anxiety will do. So, the anxiety in turn will increase the hyperventilation issue. So, it is not a recommended technique

anymore. It is better to do only a simple reassurance and an explanation of how hyperventilation produces the patient's symptoms, these are more than sufficient.

So, it is important to calm down the patient verbally that is the best thing to do when the patient is hyperventilating. So, provoking these symptoms like you ask the patient to you induce anxiety, which will cause hyperventilation. So, indirectly this will demonstrate, whenever we are anxious, we are hyperventilating. So, the patient will understand and that will be the diagnosis for the patient. So, the patient will try to calm down by himself or herself.

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Pharmacology

- Benzodiazepines ✓
 - Diazepam ✓
 - Lorazepam ✓
- Anxiolytics ✓
 - Alprazolam

Anxiety

NPTEL


Sometimes in your verbal commands or verbal soothing of the patient does not work out, we can shift over to drugs pharmacological therapy for hyperventilation. So, you have two group of drugs which are used for hyperventilation syndrome, one is benzodiazepines, other one is anxiolytics.

Under benzodiazepines, we have diazepam as the commonest injection that can be used to bring down hyperventilation, these are hypnotic agents and the Lorazepam. So, they are sedative and hypnotic. The moment it is injected, as IM or IV, it makes the patient sleep and by calming down the brain. So, basically in hyperventilation symptoms, the anxiety level has to be brought down.

We tried by verbal techniques, that is talking to the patient making him comfortable, but if it does not work out, we need not hesitate to shift over to pharmacological therapy by using injections like benzodiazepines, diazepam, or lorazepam are we can also use anxiolytics like

alprazolam to reverse the situation. So, all the target here is to address the anxiety. That is the main thing which we have to address. Once that is gone, everything is back to normal.

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Management:

- 1- terminate all procedures'
- 2- Patient in almost fully upright position
- 3- No oxygen.
- 4- verbally calm the patient

Symptoms persist ; ✓

- 5- Diazepam 10mg IM or slowly IV until anxiety is relieved.
- 6- monitor vital sings
- 7- perform all further dental procedures using anxiety reducing measures



So, to sum up the management of hyperventilation. So, now you are familiar, what causes hyperventilation, how to diagnose hyperventilation, how to differentiate it from tachypnoea, and then how to manage it. So, to sum up the management technique alone, what we have to do is to terminate all the procedures, so do not do any procedure now, anxiety has to go.

So, finish I mean, stop all the procedures, whatever you are already performing, and make the patient sit down in our most fully upright patient. This is what I said like in this is the only complication where we want the patient to be sitting upright. And we do not give any oxygen these two are very important here because most of the complications in dentistry whatever happens in the dental chair, we immediately change the chair position so that the patient lies down flat and immediately.

We give them oxygen but this is one complication where we do not want the position to be flat we want them to be more upright so that the patient feels comfortable in breathing and no oxygen because the patient wants more of carbon dioxide all the carbon dioxide is exhausted. So, we want carbon dioxide. So, do not give pure oxygen to the patient in this hyperventilation situation.

And very, very importantly, verbally calmed down the patient, this is the very important thing to be done. Hyperventilating the patient, do not do anything, just talk to the patient, then talk

to the patient, this is a very, very small complication, you are very tensed up. If you relax, everything will be back to normal and keep measuring the respiratory rate and other vital signs alone.

If the patient is okay with your verbal calming down, that is all the treatment is done for hyperventilation. But sometimes rarely, as we just saw, the symptoms may be persisting and so we give injections. The ideal injection easily available injection in your surroundings will be diazepam, benzodiazepines, you give it us intramuscular injection or a slow intravenous injection until the anxiety is relieved and then keep monitoring the vital signs that is very, very important.

And then perform all other dental procedures using anxiety reduction measures. Do not continue a dental treatment in that particular visit. Ask them to go home take rest and come back on some other day. And make sure that you explain everything very well to the patient and make him very comfortable in the dental chair and split his dental appointments into very short dental visits.

Do a filling one-day, extractions one day, scaling on day like that is split the appointments the patients are going to be more comfortable and there is very less chance for the hyperventilation to take place.