Advanced Neural Science for Engineers
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Lecture Number - 46
Neurosurgery-based MEA Implantation – I

Hello everyone. So, now we have seen epilepsy, we need to see little bit about Parkinson we have not thought about that right now, but we have discussed that I will be showing it in one of the lectures what is Parkinson and how the current methodology to treat the Parkinson is there and from the Neural Science perspective, from the experimental neurophysiology perspective what are we doing, how we are using the electrodes to implant in that brain.

Whether it is surface or cortical implant or whether it is the brain stimulation. So, we will look into those lectures in a few days. Today, the idea is to show you the surgical procedure in rodents and in our case the rats are the animal model and how the surgery is done, what kind of rat we use, what kind of anesthesia we use, how the surgery is done and then how the implants are done.

So, now it is really a 120 minutes of videos. So, what I have done is I have divided those things into 4 different videos. So, I will be talking about each video before you can see that. So, that will give you the gist and a base to understand what exactly we are talking about. So, in the video 1, we will be looking at the local anesthesia, we will be looking at how the craniotomy is used to open the motor cortex.

SME region somatosensory cortex, some parts and the coordinates from rat at last. So, we will just show you that coordinates. Let us not too much worry about the coordinates right now. Particularly when you want to implant the device in a certain region you should know the rat atlas like a brain atlas. So, you understand that where exactly you need to implant the device from that atlas.

In all this videos we have used a rat which is called Sprague Dawley, the age is about 3 to 4 months, the weight is around 360 grams and we are using a general anesthesia which consists of ketamine and xylazine. So, these are some of the constant thing the rat breed is constant, the age group is between 3 to 4 months, the weight is almost similar and the anesthesia technique is also similar.

So, that when we get the data from multiple rats the constraint should not be the procedure, we can optimize the device, but let us not have lot of different explorations when it comes to surgery, we do not have to lot of exploration, different methods to explore and see which one is better no it is already know. So, we keep it as it is. So, what I have done is the first video which is the rat surgery video 1.

Like I said we have 4 videos as surgery video 1, 2, 3 and 4. The first video for that let me show you the slide and then you can see the video. So, the module is done into 3 or 4 different sessions and the module is on neurosurgery of rat for MEA implantation. As all of us now know what is MEA? MEA stands for microelectrode array. Now, we need to use this electrode and implant in that (())(05:20) that means you have to do a craniotomy. Craniotomy is removing the part of the skull or the spherical implant the device.

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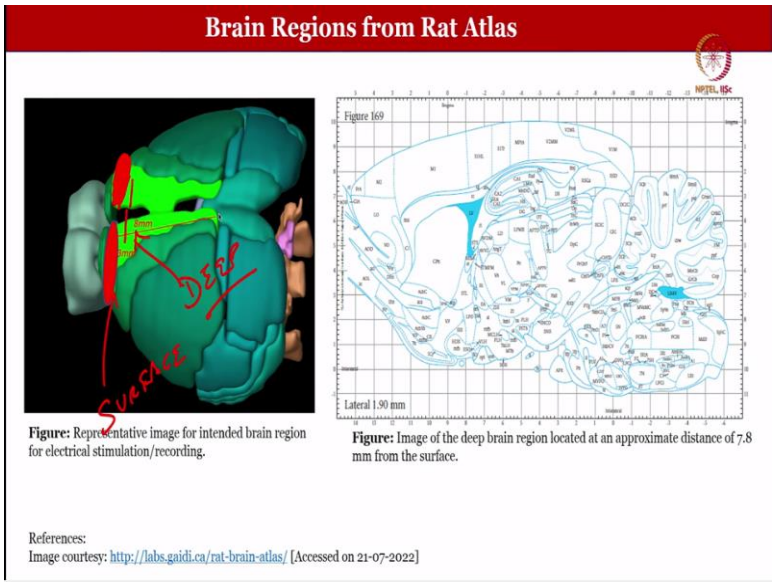

So, if you see the slide what you can see there is a image of the brain region located at approximately 7.8 millimeter from the surface this is somewhere all the way down, but here we do not have to worry about it this is when we are looking at the Parkinson because for Parkinson disease. The way to treat is by using deep brain stimulation that means you have to go deep down in the brain and then stimulate a certain area.

We will discuss that later, but this is how actually if you just go and understand that how the brain atlas looks like it is not so easy to understand for at least for the engineering perspective, it will take some time for us to understand which area is what, but on a bigger

picture if you want to understand what happens when we apply electrical stimulation on the surface versus when you apply the electrical stimulation a deep down in the brain.

And an effect of that on the motor area. So, this is the rat's brain representative image for the intended brain region and the red colour circle that you can see which is this one is the area of our interest your second one fact that how we are using it and we need to implant the device deep in the brain in these two regions. This is surface and this one are deep for applying electrical stimulation.

Now to do that what we have done is that we have first shown in the video what are the local anesthesia technique and we use something called lignocaine for the local anesthesia then in the same video you will be able to observe how the craniotomy is done and how the motor cortex, SME and then somatosensory cortex as well as when you open how the things are done when we have to first remove the hair.

And then you have to put the ethanol white and then of course anesthesia is given and then you have to how the skin is removed, how the skull is removed and how the dura is open all these things would be a part of it, but right now we are just showing the skull removal in the video 1. So, I hope that you would like the video. If you have any questions you can always ask just see the complete module that means video 1, 2, 3 and 4. And then try to be curious and start asking questions. So, let us play the video now.