**Common Neurological Disorders and Headaches Part 1 Webinar Transcript.**

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**Dr Rhys Davies Consultant Neurologist, BCUHB.**

0:01 **Chair:** Welcome everybody. Thanks for joining us and welcome to those who are joining us on demand in a few days’ time. We are very fortunate today to have Dr Rhys Davies who is our neurologist oracle. I have to say we're very lucky in North Wales to have Rhys around and he's going to take us through some neurological cases.

0.33 **Speaker:** Well thank you for inviting me and thank you everyone for joining. I’ve got two quick points of reassurance before we move on so you may be able to see as I do at the bottom of the screen here that this is slide one of 37. The good news is that that covers both the two hours of this session! Previously the session that kind of stimulated me to be invited to do this is a sort of two-hour session that we do at once, but this is going to be two hours separately because that's better for kind of lunchtime learning sessions. So that's the first bit of reassurance. It's kind of 18 slides not 37. The second bit of reassurance is that in line with what David just said, please don't be afraid of the of the chat box. Take it as a point of pride to try and make sense out of the wisdom in every answer that gets given. So, you can give the answer and it's my job to make sense out of it. Also, in general a bit of reassurance – in neurology and neuroanatomy, as in life, what one finds is that the questions are difficult, so you need to concentrate really hard on the questions, but actually the answers are surprisingly easy. You know it's like the retrospect scope clinically. You know it's easy when you know the answer, isn't it?

2.20 **Speaker:** All right so let's see if I can get this started. So, the agenda for today the first of these two sessions, is that we're going to go through six cases that are designed really is to teach you everything that I think you ought to know about neuroanatomy and how neuroanatomy ought to be interpreted in clinical practice. So that's the six cases and then just at the end of this session we'll do a little bit of reflection. Because the intention today is to discuss as we go through, I think I’m going to deliberately leave rather little time for discussion right at the end so that we can get through what we need to get to. But we'll have more time for discussion at the end of the second of these two sessions in a couple of weeks’ time. So, I’ll try perhaps to leave five minutes or even less for discussion today, just to forewarn you of that. In the second of these sessions we'll do a little bit of revision from today's session, then there's a seventh case which is kind of similar but there's an another lesson that comes out of it and then a succession of triplets that are helpful for our neuro knowledge and remembering key points in neuro and the neuro triads, as I put them, and then some tips for drawing inferences usefully from neurological clues that our patients may give us.

4.08 **Speaker:** Okay, so this is another final bit of reassurance - the next 40 minutes or so is going to be quite heavy on anatomy. Fortunately, no PM dissections on display at lunch lunchtime, but you know we really want to make this friendly and non-pompous.

You know this chap, this painting by Rembrandt. This chap - I don't know what his original name is, but the picture is called ‘The Anatomy Lesson of Dr Tulp’ and it's believed that this chap changed his nameto Tulp because he thought it sounded like tulip and everyone was you know crazy about tulips in that time in Holland, but really that's the kind of ostentation that we want to steer well clear of for the next 40 minutes.

5.08 **Speaker:** Now then, here we go Case 1. Mrs Jones is aged 55 she developed right-sided head and neck pain suddenly last night. This morning she had weakness of her left arm with difficulty in using her left hand while making breakfast. This lasted 10 minutes. On examination she has a constricted right pupil and slight drooping of the right eyelid, but no other signs.

So that's the case. They are sort of the mini vignettes, these cases really. So here are the Case 1 questions and Just to reassure you that the biggest chunk of time this lunch time is going to be on part one of Case 1. So, this question here: Describe the root of the main neural pathway involved in controlling movement in the left arm. So, describe the root of the main neural pathway involved in controlling movement in the left arm. So, it's obviously revision and as I say we're going to spend a fair number of minutes doing this, whereas we'll spend less time on each of the questions that remain.

6.50 **Speaker:** Okay so how are we going to start? So, are we going to start at the top end or the bottom end? So, I think sort of the most difficult way of doing it and the way to get us limbered up thinking, is to start at the start at the periphery. So what's the way of doing that? So what's the most distal structure that's involved with controlling the movement? This is going to be on the chat. So what's the most distal (and you know do bear in mind I’m not an Orthopaedic surgeon!) So, there's bits of gristle and bone and so on, that I’m not interested in. So, what's the most distal bit of the neural pathway?

The efferent nerve. Thank you, Julia. That's an excellent answer. I like the word efferent. So, I’m going to go even more distal than that. So, what's even more distal? I mean it's a reasonable answer. That's definitely the furthest out bit of the peripheral nervous system. Ah, the neuromuscular junction. Thank you, Dr Lupton. Okay and what's on the other side of the neuromuscular junction? The muscle. Thank you, Ashgar. So, you know muscle is a funny tissue, isn't it? It's the tissue I have least of, I think! So basically of course inflammatory diseases are primarily in the domain of the rheumatologists but that we as neurologists see quite a lot of people with degenerative muscle disease of one sort or another. So then, there's the neuromuscular junction which David mentioned and then the main answer that Juliet gave to recycle that answer. So, it's the nerve, Okay. Anyone want to give me a nerve that is involved in controlling movement in the left arm? Give me a nerve of the arm while we're at it.

9.18 **Speaker:** Radial nerve. Thank you. Probably the biggest one. The ulnar; median and ulnar. Yes - two for the price of one. Brilliant! Yes those are the main ones, aren't they? Those are the ones that go distally and there's one other nerve that is involved with one of the reflexes that we elicit in the upper limb, if anyone mentions that.

9.50 **Speaker:** Yes - we're coming to that David, so I wouldn't say that. So brachioradialis is the muscle but that's supplied by one of the distal branches of the radial nerve. So, the biceps are supplied by a different nerve from the ones you've mentioned. Not that it matters. No, it's not the deltoid but that's really useful as well; that's the muscle that abducts. The nerve to the biceps is the musculocutaneous nerve. Yes, that's the most nostalgic word you'll hear this morning. Okay so now then maybe our host Dr Lupton will recycle an answer.

10.42 **Speaker:** So, the next question is where do the peripheral nerves of the upper limb arise? What structure do they arise from? This is a bit of a complex answer. The brachial plexus. Brilliant! Okay, excellent! Wow, no flies on you guys! So now then, what is it that forms the brachial plexus? What neural structures form the brachial plexus? There's a bit of a clue - it's a word that sounds the same although not written the same as one of the words in the question. The third word in the question to be precise.

So, what structures? The nerve roots. Thank you. Brilliant. So does anyone remember which nerve roots they are going to the brachial plexus? Brilliant, Zahara. Thank you so much. Excellent C5 to T1. Perfect.

Okay now then, where are these nerve roots before they contribute to/from the plexus? Well they're in the neck yes, that's true. So, where are they? I’m going to give a little prayer here because actually the correct answer – oh - Spinal cord. I like it but, that's too quick. You're too much ahead. Oh, anterior horn cells. I like it, Haren. Thank you. But it's too premature. So, the correct answer to the question (all of these are correct answers) but the best answer is a word that rhymes with the end of a prayer. Ah, the pyramidal tracts, yes. It doesn't rhyme with a prayer I don’t think. We've not got there yet it's about getting the sequence right. See how much knowledge you've all got, but it's about getting the sequence right. Okay so what word in anatomy? Foramen - oh thank you Lord. Yes ‘Amen’. So, the exit foramina of the roots the intervertebral foramina. Okay. Excellent.

13.36 **Speaker:** So, what is the tissue here around these nerve roots in the foramen? What are they lined with? What fluid is bathing them?

CSF. Excellent, brilliant. CSF and what about the lining layers? What are the lining layers of your skull and the rest of your axial skeleton? The dura – yes, so one of the meninges. Absolutely Natalie, thank you very much. So now we're done we're not quite there yet but we're now going to go into this very exciting space. Okay so within the dura, there's this space that's filled with CSF. What's it called, this space that we're in?

The subdural space, yes. It's actually the subarachnoid at this point because the dura and the arachnoid are there and then there's this kind of space within the spinal column. So, what's the space inside the spinal column called? There’s a big hole. A hole that also rhymes with the end of the prayer. At the top of it. The foramen magnum is at the top and then below the foramen magnum there's this kind of space with CSF. So what are we going to call that? It's kind of an unfamiliar name but it's … yes, so the spinal column, and inside the spinal column … Yes, it's one of the systems. You could say that but we would call it the spinal canal and at the bottom of it we've got the lumbar system which is of course the bit below the chordal end of the spinal cord where you can do a lumbar puncture to get a CSF sample.

15.42 **Speaker:** So, this is the spinal canal. So these roots now are going in. There's a big moment coming up now chaps. We're going to go from the peripheral nervous system into something else. So, what are we going to go into from the peripheral nervous system?

The central nervous system. Excellent, thanks.

So, the CNS Okay. And the little nerve roots, it's a little bundle which would be called a fascicle Okay, and then it goes where? This bit of the CNS is not the brain, it is the spinal column. Someone said this earlier - I think it was Ashgar.

16.44 **Speaker:** So, the spinal cord. Excellent, you're right. So which bit of the cross-section of the spinal cord are these axons in the nerves coming from? So Haren can give this answer, I think. So, these axons that go to the motor efferent nerves are in which bit of the spinal cord? The cross-section of the spinal cord.

Okay they're the ventral nerve roots, absolutely. So, the ventral and the anterior refer to the same thing and these nerve cells are in the central gray matter - you know, the H shape or the butterfly shaped bit within the spinal cord. That's the gray matter where these cells are. Okay and Haren has called them anterior horn cells. I think for our purposes I’d like you to call them one but by another name than that.

So, what's the other name that I like to call them by because it helps me to remember the clinical signs?

So, the anterior horn cell - It's sometimes called the alpha motor neuron. Okay, but it also has another name that we neurologists like to use. Maybe we don't want to be too high brow here. We don't want to be too high brow.

Most neurons - yes absolutely.

And in terms of clinical syndromes, there's two types of motor neurons. There's the upper one and the lower one. Okay excellent, thanks Sonia. Exactly - LMN. Thank you, Haren.

Okay so something very exciting happens just at this point in this pathway. It's a word actually that was invented by a scientist in Liverpool at the time Charles Sherrington. But there's something very exciting, the most exciting thing in the nervous system happens just on the other side of the lower motor neuron. The synapse, thank you.

19.18 **Speaker:** So, the axon terminals that are on the other side of the synapse belong to which cell? So, which is this cell now? It's a cousin of the LMN. I’ll give you that clue.

The upper motor neuron - exactly.

Okay so these endings they're at the ends of a bundle of axons and I think someone has given this answer already. What is the name of this bundle of axons?

Yes, you're right. So, a dendron would be the name of an axon branch at the end but the bundle of axons that are the uppermost neuron axons. They have a special name. They have two names, actually. No, the nerve roots are in the peripheral nervous system. So, this bundle of axon is the one that comes down from the brain and that's what gives us its name. So, it's something spinal tract. It's the pyramidal tract.

Okay so that's a good one to say.

Columns? - but the dorsal columns are the sensory pathways going up Okay, but this is the pyramidal tract Okay and it's also called the corticospinal tract.

Okay so I’m going to now do an exercise for everyone to do. So, if we're talking about controlling the left arm and if we're thinking about the pyramidal tract or the corticospinal tract within the spinal cord Okay, on which side of the spinal cord is the corticospinal tract that controls the left arm?

21.15 **Speaker:** So, someone has said right. Okay. Oh lots. Someone's saying left now. Lots for right and some for left. Okay well democracy has spoken but not quite correctly. So now then within the spinal cord the corticospinal tract is on the same side as the side that's controlled because we need to go up to - what's the bit of the brain that's next to the spinal cord?

Yes, it's ipsilateral absolutely, but what's the name of the bit of the brain that's next to the spinal cord?

The brain stem - brilliant. And the medulla of the brain stem specifically. There are structures on the front of the medulla and there's something that happens at the medulla that reminds us of coconuts a little bit. Well not coconuts they cross over – decussation. Thank you, Dr Lupton, obviously someone who's a devotee of cakes with jam and desiccated coconut as I am. So, the decussation happens at the medulla and so it's only in the brain and not within the spinal cord that the pathways are on the other side so they're contralateral rather than ipsilateral. So, we're going up now up the brain stem the pons, the midbrain and the white matter of the hemisphere and then there's a bit of cortex that we get to - so what cortex would this be in the motor system?

What should we call it if it’s the main motor bit of the cortex? Yes, the primary motor cortex. Excellent and does anyone remember what sulcus of the brain (this will not really help any of your patients, but just going for glory) What's the sulcus that it's in the banks of, do you remember?

23.44 **Speaker:** Oh, it's the central sulcus and it's on the front side of the central sulcus. Okay fine. So, you know what you learnt there is as much neuroanatomy really as you need and those two key points the decussation of the medulla so above that you get symptoms on the opposite side and below that if you get a lesion of the spinal cord, the symptoms will be on the same side. So that's one key milestone in the anatomy. And the other key milestone is that synapse between the uppermost neuron and the lower most neuron and of course if you have an upper motor neurone syndrome you get brisk reflexes as well as the weakness. Whereas with the lower motor neuron you get loss of reflexes. Those are the two keys.

All right fine. I’m just aware of the pressure of time. I think this that doing this with the chat takes more time than doing it with a smaller number with audio. So, I’m going to sort of just stick to the highlights with these ones.

25.00 **Speaker:** So, two types of nerves supply both the muscles of the pupil and both the muscles of the eyelid. Name them and match the eye abnormalities, one to one or the other. So basically, does anyone remember the names of the muscles of the pupils? You just give them descriptive names from what they do.

Yes. They've got sympathetic and parasympathetic nerve supply. That's absolutely right, Haren. So, the ciliary muscle is the one that is near the pupil. Oh, Kim yes! So, the ciliary muscle is the one that that does your lens and orbicularis oculi (we're coming to that okay). But there's another. Oh - the pupillary muscles the sphincters and the dilators. Absolutely, but the muscle of the eyelid is a triple barrelled one. I mean I can't deny Kim, that orbicularis oculi is a bit of a smart name, but there's a triple-barrelled one that's the main muscle of the eyelid. It lifts it, in Latin … Oh yes that's right Haren. There's somatic nervous system. Yes, levator palpebrae superioris. Yes, exactly.

Okay so we've got the bits of information here, I reckon. Okay so levator palpebrae superioris is a somatic muscle, okay, whereas the muscles of the pupil are autonomic muscles or smooth muscles, as is a tiny muscle of the eyelid called the superior tarsal muscle. Now levator palpebrae superioris and the pupillary sphincter muscle are supplied by the third cranial nerve. So, the parasympathetic nerve fibres to the pupillary sphincter pass with the third cranial nerve and the fibres to levator palpebrae superioris pass with the third cranial nerve called the oculomotor nerve. The other ones, the little muscle of the eyelid and the dilator of the pupil, are supplied by the sympathetics.

27.52 **Speaker:** Okay so the syndrome this person had was constricted pupil and a drooped eyelid so does anyone remember? Horner Syndrome. Thank you, Kim. Excellent. Okay so the root of this affected neural pathway - what's the bottom bit of this pathway? How far down does this pathway go because the sympathetics they start in the brain in the hypothalamus, but the fibres don't take an easy route to get to the orbit. They certainly don't. Does anyone know?

C1 that's right, Haren. So basically, there's a pathway within the brain stem and within the spinal cord and it's only at C1. Not C1 but T1. So, the bottom end of the cervical chord and the top end of the thoracic cord is where the sympathetics exit the nervous system. There's a particular group of diseases that have a particular site in the body that are relevant. So which specialists other than neurologists are interested in Horner’s syndrome?

Respiratory, yes.

So basically, the apex of the lung where you can have TB lesions or neoplastic lesions can infiltrate the sympathetics as they go up.

So now then, the final question before we move on.

What anatomical structure links the clinical features the right-sided neck pain the right eye findings and the left-hand symptoms? Oh, this is a bit cryptic and it's all about how sympathetic fibres reach the periphery of the body, quite often. So, they catch a lift with certain other structures. I wonder if anyone knows which structures they pass with?

30.23 **Speaker:** That's right, Haren. Wow, Haren is a bit of an anatomy guru. I like it! So basically, you're quite right that from the thoracic cord. Yes, so Nicola is right as well. The cavernous sinus. Zonia is right, too. So basically, there's the sympathetic chain of ganglia and then the superior cervical ganglion is the last one and at that point the sympathetic fibres enter the wall of the carotid artery. And that's what this case is. So, this patient suffered trauma to the wall of the carotid artery which then goes through the cavernous sinus, as Nicola says eventually. So, there's trauma to the wall of the carotid artery, a carotid artery dissection and the local trauma in the wall of the carotid artery causes the Horner’s syndrome on that side ipsilateral. But because there's trauma to the vessel wall you get thrombus formation and that then can embolize and this patient when she was trying to make breakfast the other day, the embolus had travelled to the motor cortex on the right and that caused contralateral left arm weakness. Okay so that's the anatomical correlation in that case.

31.55 **Speaker:** Okay very good. We'll motor through the rest of these ones.

Mr Smith now. A 35-year-old man tripped over and injured his arm today. However, he gives a one-week history of worsening weakness in the right leg and numbness of feeling in the left leg. Weakness in the right leg and numbness of feeling in the left leg. On examination he's four out of five hip flexion and right ankle dorsiflexion, with reflexes +++ on the right. Pinprick sensation is subjectively impaired on the left, up to the level of the umbilicus.

Give the levels of the key decussations of the descending motion pathway from brain to cord and of the ascending somatosensory pathway.

Okay so we discussed where in which structure I can't remember if it was Nicola who gave it as an answer. The corticospinal tract that we just followed up - at what level does that decussate? What level of the central nervous system did that cross over?

I’m going to wait.

The medulla. Thank you, David. Brilliant. Okay so that decussates within the brain stem at the lower part of the medulla of the brain stem. For your purposes you know, knowing it's the brain stem I think is sufficient. So, the main ascending pathway - there's a funny one which is the dorsal column which sends sensory information that's involved with kind of position and movement and vibration. Actually, that bit of the sensory system also decussates with the main motor pathway at the medulla.

Okay but the rudimentary/basic semantic sensory pathway the spinothalamic, decussates at another level. So what level is the one where the ascending spinothalamic sensory pathway levels? There's a special word for this. There are several ways of answering, but there's one way of answering that's kind of better than the others, I think. My preferred way.

The *same* level. Exactly. The segmental level. All these are good answers. My preferred word is at the dermatomal level, but those are excellent answers.

34.52 **Speaker:** Okay all right now then so here we are Mr Smith's presentation depends on understanding these pathways and the pattern described has an eponym attached to it. So, this patient had worsening weakness in the right leg and numbness of feeling in the left leg.

Brown Séquard, Natalie. Wow! What a posh one. So yes, he was half Scottish, from Mauritius. That's how he came to be called Dr Brown Séquard. Anyway, so Brown Séquard. So, does anyone want to tell me what the site of the lesion is here?

T12 - yes so that's good. I'll take T12. T10/T12.

So, because the sensory level was at what? What anatomical structure was there?

Yes, it is the umbilicus. Brilliant. So T10/lower thoracic - perfect.

So where is the lesion? Is it going to be in the brain? In the radial nerve? Where should we say?

Within the spinal cords - perfect. Yes, at T12.

And which side of the spinal cord is it going to be on?

So, the hemi lesion is on the right. Yes, I think that's right isn't it, because that's the same side as either the weakness or the same side as the sensory impairment.

Natalie, do you mind my asking you? Sorry to press you a bit, I can see you've got this concept off pat.

So, it's the same side as the weakness. Opposite side to the numbness. Beautiful. Thank you so much for that.

37.16 **Speaker:** Case 3. Mrs Brown is age 65. For a few weeks she's had slight drooping of the left eyebrow. The drooping was said to have been very pronounced and commented on by her partner, as Mrs Brown was watching television last night. On examination she has very mild left-sided ptosis and slight weakness of eye closure on the left.

Okay so I know (it might even be Natalie, that I was in conversation with just now) I know someone knows the name of the muscle that's responsible for closing the eyes. So, I know someone gave this name of a muscle earlier.

I don't know if you can see my face.

Orbicularis oculi, yes thank you.

So, weakness of eye closure, will be due to weakness of orbicularis oculi.

Okay, now ptosis. That's a different thing - opening the eye. So what muscle was that? So what muscle was that, I wonder?

Levator. Absolutely Kim. Thank you.

38.50 **Speaker:** Okay. But guys you know I’ve got a problem here. I’ve got a problem. I’ve got a numerical problem. We've got a bit of a …. you know interestingly, Haren and I are kind of on the same wavelength even though the answer is wrong. Because my numerical problem here is the number 4. Okay, but Kim and Zaw are absolutely right, that levator palpably superioris is innovated by the oculomotor, the third cranial nerve. So where does the 4 come in? It's three plus four actually.

Cranial nerve 7. Yes, so orbicularis oculi. So, you're right, Haren that the fourth cranial nerve is the cochlear nerve and it supplies the superior oblique muscle. But the orbicularis oculi is supplied by the facial nerve, the seventh nerve.

 Okay, but we've got a problem here you know. As practitioners have applied neuroanatomy, we've got a problem. We've got Mrs Brown who's not bad really, except that two of her cranial nerves aren't working - the third nerve and the seventh nerve.

So, what else is going on? This is a bit weird isn't it? So, there's one important bit of the nervous system which I think can't really be affected in this case. How can eyelid opening, and eye closure be impaired together?

So, there's a bit of the nervous system, a bit of the central nervous….

Okay so someone says a cerebellar pontine angle.

Mmm - that's what you think.

The midbrain? Okay. So Haren and Wisdom have given me some answers there and I think there's some sense in what they've said. But what I want to emphasise is the aspect which doesn't quite make sense in what they've said, because you see Mrs Brown isn't dead yet, okay. So, Mrs Brown is still alive. She's conscious. She's not got paralysis or anything and she's just got these two functions that are impaired.

41.36 **Speaker:** Okay so what I propose to you is that you can't have a structural disease at the cerebellopontine angle or the midbrain causing this problem. You've got to have a diffuse disease process and I’m agreeing with Kim, that this is a disease of that neuromuscular junction, you know. So, when we were talking about the efferent nerve, it's that little step further out from the nervous system that's worth thinking about, okay. So, a slightly different form of anatomy from cases one and two.

42.08 **Speaker:** Case 4. Miss Young is age 25. She noticed pins and needles in her feet two days ago and noticed slight difficulty in walking upstairs that evening. By yesterday morning she was struggling to stand from bed and had some difficulty in using her hands. Last night, in hospital, she suffered a respiratory arrest but was fortunately intubated very promptly. She's now in ITU. Limited neurological examination in this intubated patient finds her to be areflexic.

Okay so what do we call the syndrome of weakness in all four limbs?

We've got some answers here. So, what do we call a syndrome of weakness in all four limbs and what would be the site of the smallest lesion that might cause this syndrome?

So, I’m going to ask Haren here. So yes, I think that the majority here is right as to the exact diagnosis but I’m going to ask Haren - what do you call weakness in all four limbs? What should we call it? It's got two names. One that's kind of a bit Latin and the other is mainly Greek in terms of its origin.

Quadriparesis or tetraparesis.

Yes brilliant. Okay, coming back Haren, to your answer. So, myelitis means inflammation of the spinal cord so if this person has got weakness in all four limbs and the disease is in the spinal cord where would it be in the spinal cord? Above what level?

It would be in the c-spine and above what did we say was the upper contributor?

Yes, it would be C3 above the outflow to the brachial plexus, which was C5 to T1, wasn't it?

So, the smallest site of a lesion that could cause a tetraparesis would be C3 C4 C5 and that could be myelitis, so that that could be inflammation in the spinal cord. So that could just about be correct, but there's something that makes it quite a lot less likely in the clinical history. There was a word, there was a big clue that says…

So, the ascending symptoms - yes that's the clue, but it's not quite the biggest clue, Kim.

Yes, symptoms with the y that's right yes.

Respiratory arrest. Yes, well I think you can get a respiratory arrest from a from an upper cord lesion.

There's something about the examination.

Shall I go back to it? She was this was areflexic. Thank you, Natalie.

So, the key thing is the areflexia, okay. So, we're back to the Greek again. So, what is the anatomy here? What's the one word that conjures up this anatomy? So, it's not a radiculopathy as such, although you could say it is. It's not a myelopathy or an encephalopathy. It's a peripheral neuropathy. Okay and if we're being Greek you know if you've got a shape and you want to call it by a Greek name and it's got too many sides to count, what's the beginning - it's not a hexagon or an octagon it's a ?

Polyneuropathy. Excellent Okay so this is a diffuse polyneuropathy. Brilliant! Excellent!

46.14 **Speaker:** Case 5 - Mr Silva is age 50, he's been troubled by difficulty in using his right hand for writing and doing up buttons over six months. His walking has become slower and he's had abdominal pain which his wife attributes to constipation from too little exercise. She says yesterday he became very concerned about some children who did not recognise playing at the bottom of the garden. Mrs Silva saw nothing but the neighbours’ cats. The same thing happened today on examination Mr Silva is alert and fully orientated. He walks with short steps and has slowed movement in both hands.

What do we call slowness of movement and what is the likely sight of the lesion if there is slowed movement in the right hand?

So what do we call slowness of the heart? Bradykinesia got to bradykinesia before the bradycardia. Brilliant. Okay - bradykinesia/slowed movement. Excellent.

So where is the lesion if you've got slowed movement in the right hand?

Okay so that may be the disease - early Parkinson’s. Is it early Parkinson’s though? Kind of yes, but what's the site of the lesion? In the in the brain as it were.

47.43 **Speaker**: Yes, corpus striatum. Wow. Yes, so it's near that bit of the diencephalon, Gillian, and actually there's the subthalamus which is involved which is next to the hypothalamus, but the basal ganglia more generally or corpus striatum.

So, Mr Silva has got this on both sides. But he's alert. So, is it possible to have disease in your basal ganglia and be fully alert?

So, what does that tell us?

I very much draw the sort of spectrum from Parkinson’s disease, dementia to Lewy body disease but basically this patient has got involvement of the brain very widely, you know, so there's the bradykinesia bilaterally and concurrently this patient seems to be having misperception. Okay, so this is a this is a Lewy body dementia. Okay and this is a different type of anatomy again from the cases that we've encountered so far.

49.12 Speaker**:** So, the last of today's cases - Mrs Gold is aged 42. She's been troubled by difficulty in concentrating especially in noisy environments for three months. She also has episodes of blurred vision with or without imbalance, difficulty with word-finding, pins and needles in both arms and pain in the neck and occiput over the same period. She describes two episodes of ‘zoning out’ for about 10 minutes. She says that all the symptoms are entirely new to her. She's attended alone and her physical examination is normal.

What bits of the nervous system could be affected here?

There's a free-for-all here.

The menopause - thank you Zonia. Yes, I often feel I have that. So, what are among the sites of the nervous system?

The optic chiasm. Yes, why not.

Does anyone want to give me any anatomical site?

Oh, the chat has come to a halt.

The pituitary adenoma, the fifth cranial nerve, the cerebellum.

Okay brilliant.

The occipital lobe. Okay thank you, David.

Any more?

Okay so what about my next question - Are there any red flags?

Vertical arteries to nurses, I don't know about that.

New onset, yes maybe.

I think that's true actually, Asghar. I think that's the main thing that raises concern but what I would say is that the from my point of view as a professional in applied neuroanatomy is that this patient has just too many red flags.

So basically, this patient has a condition which is affecting her entire nervous system and yet the neurological examination is normal. So, I might have someone with a visual agnosia or something like that or a funny type of eye movement abnormality with the lesion in the optic chiasm or a visuospatial symptom in the posterior cortices. But for me the wider the range of neurological symptoms, anatomically speaking, with preserved clinical findings, the more reassured I am. And some people have used the term ‘functional’ in the chat – yes, we talk about functional neurological disorder. I often find that there's a there's an element of migraine or variant migraine at play. Of course, there's a whole range of mental health conditions that can trigger these things and as Zonia said, there's a whole range of systemic things that are worth considering as well, whether they be endocrine or infective and so on.

So let me just think if we were to sort of think about (before we go to the final slide of the morning uh or it's afternoon by now) there's one type of disease that is particularly worth thinking about with these very strange cases that are the least coherent anatomically and we come back to the little prayer that I was saying. So, what would the linings and the tissues and the fluids when we were saying our little anatomical prayer?

53.52 **Speaker:** MS? But the timing? I would say you can get a bit of decompensation, but that is a diffuse disease that you could consider. But there's an anatomical structure that we were talking about. The word that rhymes with the prayer. The one with amen at the end of it. So, there was the fluid and there were the linings around the foramina. So, the fluid, the meninges, and the CSF.

Okay so there are CSF pressure disorders, increasingly low CSF pressure and chronic meningitis - you know, the infamous Lyme disease. So those are things that can sometimes catch us out. But in general, the key message here is that the more anatomically diffuse the syndrome in the absence of objective abnormalities, paradoxically the more reassuring that is.

55.01 **Speaker:** Okay so we're just going to reflect in the last couple of minutes.

I would say that today we've learned a bit of anatomy. We've learned about the clinical anatomical correlation within the motor system. So, the synapse with the upper and the lower motor neuron syndromes on either side and the decussation at the medulla where you have the contralesional and the ipsilesional syndromes.

We've seen a couple of cases. Case 1 and Case 2 where there's a focal lesion, where you understand the anatomy by finding the single focal lesion where the abnormality is located. That was Case 1 and Case 2. In Case 3 and 4, it wasn't a focal lesion, but it was a diffuse disease. It was neuromuscular junction disease, Myasthenia gravis and Guillain-Barré syndrome. Case 5 was a degenerative disease in this case Parkinson’s disease. Of course, the most common neurodegenerative disease is Alzheimer’s disease, affecting the motor the memory pathway. Perhaps the most sinister of neurodegenerative disease - motor neurone disease. Okay, so that's degenerative disease. And finally, Case 6 is a patient with a reactive neural syndrome. So, I think in that situation for the most part you need to look somewhere other than neuroanatomy as a way of formulating your case. And I do think it's very important especially in this COVID and post-COVID time, that it's really important to actually take some heart from that anatomically diffuse scenario. All right, that's us done. Thank you very much.

57.10 **Chair:** Thank you so much my head's spinning, but I could have listened for three hours. Seriously! Brilliant! Excellent!

**Speaker:** Okay well thank you everyone and we'll reconvene I think it's a fortnight on Wednesday for the second of these sessions.