

20 January 2023

Baby H

DR RAVI JAYARAM (recalled)

Examination-in-chief by MR ASTBURY

Cross-examination by MR MYERS

Re-examination by MR ASTBURY

DR JOHN GIBBS (recalled)

Examination-in-chief by MR ASTBURY

Cross-examination by MR MYERS

Further cross-examination by MR MYERS

Friday, 20 January 2023

(10.30 am)

(Delay in proceedings)

(10.35 am)

(In the presence of the jury)

MR JUSTICE GOSS: I've received your request, members of the jury, for A4 notepads or paper. Regrettably, there are none in the building, so they're going to be ordered and you'll get them when the order has been delivered. I'm sorry about that. I don't know if you know about government procurement, but it's not as simple as just going to a stationer's and buying it, it has to go through all sorts of things, so don't expect it on Monday morning.

MR ASTBURY: Thank you, my Lord. May I call, please, Dr Ravi Jayaram.

DR RAVI JAYARAM (recalled)

Examination-in-chief by MR ASTBURY

MR ASTBURY: Dr Jayaram, could you introduce yourself, please, for the record?

JAYARAM: I'm Dr Ravi Jayaram, I'm a consultant paediatrician at the Countess of Chester Hospital.

ASTBURY: Thank you. May I remind you, of course, that it is some time since you gave evidence last, but you are still bound, of course, by the oath or affirmation that you took on that occasion. And as you have just reminded the jury, you are still a consultant and you were a consultant in the paediatric department over the period with which this jury are concerned?

JAYARAM: That's correct, yes.

ASTBURY: Thank you. I want to ask you, please, about your involvement with a baby by the name of [Baby H].

Were you the on-call consultant for the children's unit on the night of 24 September 2015?

JAYARAM: I was the consultant on call that night, yes.

ASTBURY: Thank you.

Did you attend, as a consequence of that, the afternoon handover that took place towards the end of that particular day?

JAYARAM: That's correct. So at around 4 pm the consultant on call meets with the teams that have been looking after children through the day to get a handover of the patients that are around.

ASTBURY: Thank you.

Forgive me if it's an obvious question, but the purpose of you being at that handover?

JAYARAM: Because I'm the consultant on call with ultimate responsibility for the care of children on the unit until the next morning I need to be aware of the patients that are in hospital, particularly those that are more unwell or may be at risk of becoming more unwell, just so that I have an overview of what might be about to happen over the next few hours.

MR JUSTICE GOSS: Sorry, there's a difficulty -- yes, if you pull the microphone. That's it. That should be better.

Sorry about that. Thank you very much.

MR ASTBURY: Do you happen to recall what you were told about [Baby H] during the course of that handover?

JAYARAM: So I recall that [Baby H] had been born and had been on CPAP and had a pneumothorax, which essentially, I suppose, in lay terms is a collapsed lung. That means at some point she developed what's called an air leak, so as air was going into the lungs, a small hole would have been present in one of the alveoli, one of the air sacs, or a number of them, which meant that air then came out of the lung and accumulated in the space between the lung and the chest wall. And she'd been treated, I believe, with a chest drain, which means that that accumulation of air around the lung doesn't cause the lung to collapse down

further and compress the lung and stop gas going in out of the lung. But at the handover, she was considered to be stable.

ASTBURY: Okay. The purpose of the drain being to allow the air that's trapped to escape (overspeaking) --

JAYARAM: Absolutely. Because if that air remains in that space, each time a baby breathes more air will leak out of the lung, which means there's less space for the lung to inflate. And over time, if that accumulates, the lung then cannot inflate and it actually causes increased pressure inside the chest which can have an adverse effect on breathing and then on the circulation as well.

ASTBURY: Did you in fact during the course then of that night when you were on call receive further communication concerning [Baby H]?

JAYARAM: I did. Again, referring back from my statement, it was -- in the early hours of the morning, the registrar called me because she was concerned about [Baby H] because, in spite of the chest drain being in, she was having difficulties with ventilation in terms of getting her oxygen saturations up.

ASTBURY: We heard from that registrar yesterday. Do you recall the name of that registrar?

JAYARAM: I think it was Dr Alison Ventress.

ASTBURY: Thank you. Did Dr Ventress call you?

JAYARAM: She called me. I can't remember the exact time, it's in my statement, but I think it was after 1 am.

ASTBURY: Your recollection was 1.32.

JAYARAM: Okay.

ASTBURY: Does that accord with your recollection?

JAYARAM: Yes, absolutely.

ASTBURY: Okay. Do you recall what you were told during the course of the call over and above what you just mentioned?

JAYARAM: I think -- I can't remember the timings of things without looking at my statement but I think that she'd told me that there were difficulties with getting [Baby H]'s saturations up in spite of turning up the oxygen with her being on CPAP. Alison Ventress had examined her and felt that she possibly had re-accumulation of air and I think at that point, but correct me

if I'm wrong, she'd done what was called a needle thoracocentesis. That's a procedure, when one suspects there's a pneumothorax, to drain air out rapidly in an emergency fashion. And I think at that point she'd done that when she called me first, but I will have to refer back to my statement.

ASTBURY: Perhaps at this stage we don't need to do that but you mentioned the need for that to be done rapidly. We heard yesterday about tension pneumothorax -- different types of pneumothorax.

JAYARAM: A tension pneumothorax means that each time a baby breathes in more air leaks out into the pleural cavity, which is the name of the space between the chest wall and the lung. So a simple pneumothorax means there's a small amount of air there but it's not getting bigger and sometimes simple pneumothoraces can be undiagnosed, sometimes they can be treated conservatively without any specific treatment. But in this situation, if a pneumothorax is considered to be compromising ventilation, then the air needs draining out rapidly.

The definitive treatment is to put a chest drain in or a chest tube in. [Baby H] already had a chest tube in.

If you have a chest tube in and a pneumothorax is re-accumulating one has to assume either the chest tube is in a position that -- it's not, for whatever reason, draining air that's there or the chest tube could be blocked.

But ultimately in an emergency situation, in a tension pneumothorax, it's a critical emergency because as that air in the wrong space accumulates it causes compression of the lung, it affects how blood can then return back to the heart, and how blood can be pumped around the body by the heart, and so it needs draining out as an emergency procedure.

Now, a chest tube itself, a chest drain or a pleural drain, can be put in reasonably quickly.

ASTBURY: Can you pause there? Someone somewhere else is taking a note of what you say and I'm very grateful for the information, but --

MR JUSTICE GOSS: You naturally speak very quickly.

JAYARAM: I'm trying to learn to slow down!

MR JUSTICE GOSS: All right.

MR ASTBURY: It's my fault, doctor, I'm here to assist.

So you were saying that the drain -- I think you were saying that in certain circumstances the drain can stop working; is that --

JAYARAM: It's unusual, but it can happen. So whether [Baby H] had popped another pneumothorax, so there'd been another air leak, whether the air was -- generally the cavity, the pleural cavity around the lung, is contiguous, so it's all one area. So in theory if there's air there, if you have a drain in that space, air should drain out.

Sometimes the tip of the drain could be against the chest wall or the lung and a drain can get blocked, but if you have a chest drain in and air appears to re-accumulate, you need to get that air out and then think later about why that air wasn't coming out of that drain. But the important thing is to get that air out.

ASTBURY: Is there a way that you can tell whether the drain is working?

JAYARAM: You can look at the drain so the drain itself --

ASTBURY: Slow down a bit.

JAYARAM: The drain itself -- there's two ways you can tell. So the original way these things used to work is that drains were connected to what was called an underwater seal, so you could actually see bubbles of air coming out of the end of the drain into water and you could see, as the baby breathed, a column of air going up and down that told you that the drain was patent, that it was open, and the child was breathing.

There are also mechanisms which we used here called flutter valves, so there's a valve that goes on the end of the chest drain with a little rubber or plastic valve and you can see that flutter as the baby breathes -- and if the flutter valve is moving you know that the drain must be patent, it must be moving. So that's how you know a drain is working.

In terms of diagnosing a pneumothorax, in a small baby we have a technique using a thing called a cold light. So it's a light source that doesn't generate heat and when you put the cold light on to the chest wall, ordinarily, because the lung is inflated and there's tissue there, it doesn't light up. In a pneumothorax, because the chest cavity is full of free air that's not in the lung, it tends to light up. The phrase people use is it lights up like a Hallowe'en pumpkin, just to give you an idea of what it looks like, and you compare the two sides. And certainly if you see the chest light up like that when you

do a cold light you have to make the assumption that there is a pneumothorax that needs -- that is significant.

MR JUSTICE GOSS: We have actually seen a video of cold light, so thank you.

MR ASTBURY: That's very helpful, thank you.

MR JUSTICE GOSS: That just provides an oral description of what we've seen.

MR ASTBURY: Just going back to the drain and when you were talking about fluttering, if the drain were to stop fluttering what would that tell you?

JAYARAM: If a drain stops fluttering it suggests that as the baby is breathing air isn't coming out through the drain.

Now that can actually happen if the pneumothorax has resolved, so if the lung has re-inflated completely and there's no more air leak, and actually the drain -- if there isn't really any significant amount of air coming into the pleural space you will see the drain stop fluttering. And in the clinical context of that if a baby is well and is getting better from a respiratory point of view, one could infer that actually the lung has re-inflated.

ASTBURY: Slowing down again a little, sorry.

JAYARAM: But in the context of a baby where the oxygen requirement is increasing and we're having increasing difficulty, having to turn up the oxygen and the saturations are dropping, it can also be a sign that the drain, for whatever reason, is no longer draining air.

ASTBURY: Right. So --

JAYARAM: And that could be a blockage, it could be the drain is misplaced.

ASTBURY: So the information from Dr Ventress was that [Baby H] was deteriorating?

JAYARAM: Yes.

ASTBURY: Did she mention the chest drain at all (overspeaking) --

JAYARAM: I can't remember at what point she told me but I was aware that it had been noted that the valve was not fluttering.

ASTBURY: And were you aware or not at that stage that she had either performed a thoracocentesis or --

JAYARAM: I think when she called me she'd performed -- I think -- and again it's the timings, but I think at that point she had performed thoracocentesis and had drained a significant amount of air out.

ASTBURY: So air coming out and the drain not fluttering?

JAYARAM: Yes, which suggests there was re-accumulation of a pneumothorax.

ASTBURY: Thank you. Did you attend?

JAYARAM: I did. I can't remember exactly what time, I think it was before 2 am.

ASTBURY: Well, we'll go to your note, if we may, because I hope that's the most reliable source in these circumstances.

JAYARAM: Thank you.

ASTBURY: Can I ask Mr Murphy, please, to go to tile 76.

If we scroll down, we can see, towards the end there of Dr Ventress' note, what was happening before your arrival. If we could concentrate, please, on what you did, and if we go down to your note, it's written in retrospect at 4.55. But you've indicated there that you were called at 1.32 and you arrived at 1.50. Could you take us through your note, please --

JAYARAM: I'd made the comment that the story from Alison Ventress, the registrar, was that [Baby H] had been gradually deteriorating and then suddenly deteriorated, with her oxygen saturations going low and she looked pale with poor chest movement. The cold light had been put on and it looks like the left chest looked bright, suggesting there was free air. Dr Ventress had done a needle thoracocentesis and had aspirated quite a lot of air but the chest was still moving poorly.

We then organised a chest X-ray, which showed a left tension pneumothorax. That means that there was an accumulation of air and the position of the heart and the structures in the middle of the chest had been pushed to the other side.

At that time the existing chest drain was looked at.

It didn't look like there were any -- it didn't look like there were any obvious blockages in it. Because that pneumothorax was still present and it appeared to be under tension, we did a

further needle thoracocentesis in a different area, so the fourth interspace -- what that means is between, basically, the third and fourth ribs -- and aspirated more air.

ASTBURY: Okay. So that's another needle into the baby to release air in a slightly different position?

JAYARAM: Yes.

ASTBURY: That was based on the X-rays that you had seen?

JAYARAM: Based on the X-rays and the clinical picture. So if she had been improving we would have perhaps not done that, but we'd seen, in spite of the needle thoracocentesis and the chest drain being in, she still had evidence of a tension pneumothorax. So that was an emergency procedure to try and aspirate some of that air, to give the lung a chance to inflate.

ASTBURY: If we could just pause there and have a look at the X-rays that you would have seen during the course of that period. If we can look first at tile 48, please.

Bearing in mind you arrived at 1.50, this is an X-ray that was taken at 1.40. Is this the X-ray that you were describing to us?

JAYARAM: Yes, that would have been the one I was just describing.

So one can see there is a chest drain, which is the tube that's coming out of the left side of the chest with the curl(?) on. One can see the needle that's in the top and the pneumothorax -- you can see a rim if -- just where the cursor is now you can see a rim going down where the lung looks blacker and there's no lung markings, so that's a pneumothorax.

But if one looks at the size of the left hemithorax, the left side of the chest compared to the right, you can see, I think quite clearly, even if you're not an X-ray expert, that it just looks bigger and that's basically because there's a large amount of air in there and a lot of that air is probably anterior, so although the rim of the pneumothorax looks relatively thin, you can see also that the heart has been pushed slightly across the right-hand side as well.

ASTBURY: Okay. Just pausing there, so as we look at the page, it's on the right-hand side of the picture?

JAYARAM: On the right as we look at it.

ASTBURY: And by the view of the air being anterior, that's towards the front of the chest, is it?

JAYARAM: Yes, anterior means the front of the chest. Obviously this X-ray is looking front to back, so you can see certainly a rim of pneumothorax there. If one looks down to the bottom there are lung markings all the way out to the edge, but you can see also that that half of the thorax is much bigger than the other half and that's basically because of accumulation, it's pushing the diaphragm, which is the muscle that separates everything in the chest from everything in the abdomen, it's pushing the diaphragm down.

ASTBURY: If we pause there. We can see, I hope I can put it this way, sort of a cream-coloured border and it rises from right to left as we look at the picture; is that right?

JAYARAM: When you say cream-coloured?

ASTBURY: I think you're pointing at it. Thank you, Mr Murphy, for rescuing me. Is this where the diaphragm would be?

JAYARAM: Yes, that's the diaphragm. Where the cursor is now is following -- is at the lateral end of the diagram. So where that sort of whiteness is. So the line between white and black is where the diaphragm is.

ASTBURY: And we can see it's much higher on the other side.

JAYARAM: You can see also it just looks blacker from the other side as well, which is a sign that there's more air there outside of the lung.

ASTBURY: I wonder if we could go back to your note, please, which is at 76, by way of reminder.

I think we'd reached the foot of page 1. If we can just check there's nothing else you need to -- I think you mentioned the fourth space at the bottom on the left side. It says something aspirated?

JAYARAM: "Air was aspirated."

ASTBURY: Thank you. If we go on to page 2, please.

JAYARAM: So in spite of this, in spite of draining this air, she continued to have poor chest movement and poor air entry. She was on a ventilator and then she suddenly dropped her saturations. So we'd treated the pneumothorax in the sense that we had a chest drain in, we had two needle thoracenteses and she dropped her saturations. And in that situation we then have to think, well, why are the saturations dropping.

So we removed the endotracheal tube, which appeared to be blocked with a mucus plug. And after the endotracheal tube was taken out she was bagged up. That means we used a self-inflating bag with a rubber mask/silicon mask over her nose and mouth and actually ventilated her quite easily and she was re-intubated by Dr Varghese, who's one of the SHOs.

ASTBURY: Thank you. Pause there again. Second drain.

JAYARAM: Well, she hadn't had a second drain at that point.

ASTBURY: So the air had been released --

JAYARAM: With the needle thoracocentesis.

ASTBURY: It didn't seem to fix the problem so the ventilation was checked and there was (overspeaking) --

JAYARAM: It looked like there was a (overspeaking) --

ASTBURY: -- ET tube. But that was resolved by use of the mask that you told us about?

JAYARAM: We removed that tube, then hand-ventilated her with a bag and mask, and then re-intubated her. And then when she was re-intubated she was put on to the ventilator settings that we can see here, so pressures of 24/5. That means that the ventilator was delivering a constant background pressure of 5 centimetres of water, which is kind of standard for a baby with respiratory distress syndrome. We have to deliver that background pressure because if it's not there actually there's a tendency for the airways internally to collapse down.

And each breath she had was delivered at a pressure of 24 centimetres of water, which is enough to move the chest and inflate the lungs at a rate of 40. Where it says "T in 0.45" (?) that means each breath we gave her lasted for 0.45 of a second. And she was in roughly 40-50% oxygen. And then we repeated her chest X-ray, both to check the position of the tube but also to see what was happening with the lung.

ASTBURY: I'm going to ask you to pause there. We'll see if we can look at that X-ray, please, which I think is at tile 55. This is timed at 2.29, doctor.

JAYARAM: So when you look at this, you can see that the rim of pneumothorax at the top is still present but not as great but the lung -- the lung field is still bigger.

So certainly from a ventilation point of view she was more stable than she was. But we put a second chest drain in. Number

1, after this, because you don't want to be leaving needles in. And given that the pneumothorax had re-accumulated we wanted to be sure we didn't want it to re-accumulate again.

ASTBURY: Right.

JAYARAM: So the pneumothorax hadn't resolved completely but it was better than it was but there was a single chest drain in and we felt that actually putting a second one in would be appropriate at this time.

ASTBURY: You discussed that between you?

JAYARAM: Yes. It was my decision to do that but we agreed.

ASTBURY: If we go back to your notes then please at 76. We've moved into page 2 now.

JAYARAM: So in terms of putting in a chest drain there are different techniques and equipment available. The more traditional/old-fashioned way is to use a more sort of surgical method where we dissect down, using a scalpel, cut through the skin, down to -- through the muscle, down to the pleura, and then we insert a drain with artery forceps, which are -- I'm thinking how to describe them -- very thin forceps. We hold the end of the drain and push it in through the pleura, which is the lining of the chest wall, between the chest wall and lung, and get that drain into the space.

We prefer these days to use what's called a pigtail drain, which is put in using a technique called the Seldinger technique. That involves putting a needle on a syringe and slowly inserting that needle between the ribs, aspirating/pulling out on the syringe as we go, until we hit air and aspirate air. At that point we take the syringe off the needle, leave the needle in.

We put a thin wire through the needle and take the needle out. So we now have a direct passage with a wire into the pleural cavity, the space between the chest wall and the lung.

We use a tool called a dilator, which is a plastic tube to make that track a big bigger. We take that out and then we insert the drain over the wire, and then we take the wire out and then the drain is secured and connected to a seal.

And I think it's easier to put those in. In my training we didn't really have those available so I've done several old-fashioned drains and, for whatever reason, no pigtail drains were readily available, so we put in an 8 gauge Argyle catheter, which is an old-fashioned chest drain, and I described there how we put that in.

ASTBURY: Can I ask you to pause there and actually read what the note says.

JAYARAM: So we used an 8 gauge -- 8 fringe(?) Argyle catheter and we made an incision in the fifth interspace, in the anterior axillary line. That's an anatomical description for -- the anterior axillary line is if you --

ASTBURY: Nice and slowly, please, doctor.

JAYARAM: Sorry, sorry.

If you drew a line from the front of the armpit downwards, that's to sort of say where, on a vertical plane, we inserted the line and it's in the fourth -- what did I say? The fifth interspace. "Blunt dissection" means we make a small incision and rather than cutting all the way down with a sharp scalpel, once we're through the skin, we use the forceps to gently tease the tissues apart and then we basically advance and make a hole in the pleura, the membrane that separates the chest wall from the chest cavity, and then use those forceps to insert the drain in.

Once it is in, it is then connected to an underwater seal, and we saw that this was oscillating -- going up and down -- with breathing, which means we know it's in the right position. And then it was sutured in with a size 3 silk suture.

ASTBURY: Before we move on from there then, you have described to us in detail how it's put in. I think you mentioned -- does it you say "No Cook drain available"?

JAYARAM: Yes. Just scroll back up again. The pigtail drains are manufactured by a company called Cook and there's different manufacturers, so they are the ones that we would normally have in stock at that time.

ASTBURY: There just happened to be none available?

JAYARAM: None available.

ASTBURY: So an alternative was used?

JAYARAM: And we needed to get one in reasonably quickly.

ASTBURY: Just towards the end of your description you mentioned how it went into the water and you could see movement.

Could you just explain that to us?

JAYARAM: So imagine this is a small bottle of water (indicating) and the end of the drain goes into that water (inaudible). What we will see is -- with respiratory movements we will see a column of water moving up and down the end of the tube that's in there. And that indicates that the drain is in the right place and it indicates that the drain is patent, it indicates that actually the drain -- the -- it indicates that the drain isn't blocked.

ASTBURY: Okay. Is there a term for that movement up and down?

JAYARAM: Oscillation or swinging is the more sort of colloquial term for it.

ASTBURY: Thank you. Then we can see that --

JAYARAM: And then we re-X-rayed it.

ASTBURY: I'm sorry, you anticipated what I'm about to point out.

That says that -- your note says:

"Drain in good position."

Perhaps if we could look at tile 66, please. This is an X-ray at 3.05 in the morning. Is this the one to which you're referring? Please say if not.

JAYARAM: Can we look at the time on there?

ASTBURY: 3.05.

JAYARAM: If you can recall what the previous... Um... I'm not sure --

ASTBURY: There is a later X-ray if that's not the right one.

JAYARAM: I don't think that's the one I'm referring to because that's one we've done -- I think this is the one that we did after I'd done the second needle thoracocentesis because there isn't a second drain in here --

ASTBURY: Perhaps if we could go then to tile 75, please.

JAYARAM: Can I just comment on this X-ray?

ASTBURY: Sorry, of course.

JAYARAM: Sorry, can we go back to that one? Apologies for the timing. You can see here that the second chest drain isn't in.

This is the needle thoracocentesis that I've referred to -- we discussed earlier that I had done --

ASTBURY: Yes.

JAYARAM: -- because we'd seen the re-accumulation of the pneumothorax.

What one can see here, and I don't know if you can remember what the previous X-ray looked like, but first of all, if you look at the colour of the lung field that's on the left of the baby but on the right of the screen, you can see it's not as black as it was and it's similar in density to the lung on the other side.

You can see that the diaphragm isn't pushed down as much. You can still see it's not completely right, there's still probably a little bit of free air in there, as evidenced -- if you can see just next to the heart shadow, there's a slightly blacker area. But there's considerably less air and that's I think what I referred to earlier when I said that the lung appeared to have re-inflated.

So at that point we thought, okay, we can't leave a needle in, we need to put a second definitive drain in. So the next X-ray, I think, will be the one which showed (overspeaking) --

ASTBURY: Timed at 4.37. Tile 75, please.

JAYARAM: You can see here there's two drains. The original pigtail drain is -- they go in -- they're called pigtails because they curl around and you can see the other drain I've got in here. You can see again with that in, that if you compare the --

ASTBURY: Can we just confirm where that second drain is?

JAYARAM: Exactly where the little cursor is now. You can see there's a sort of white line that comes in.

ASTBURY: Yes.

JAYARAM: If you go to the --

ASTBURY: If we look outside the body, it gives it a bit more (overspeaking).

JAYARAM: It is exactly where the cursor is going now.

ASTBURY: Thank you.

JAYARAM: These drains have a hole at the end and they have two or three holes in the sort of last 2 centimetres so there's more than one hole. If you look at the lung fields now, you can see that the previous pneumothorax, where it looked -- there was -- that black rim has resolved. And even the little bit around the heart, it's still slightly blacker and it is likely there was still a little bit of air in there, but that air was now able to drain out.

ASTBURY: That's why you could see the oscillation that you mentioned to us a moment or two ago?

JAYARAM: Yes.

ASTBURY: Or swinging. Could we go back to the notes, please, at 76. We'd got as far as chest X-ray in the centre of the page. If you can go all the way down, please.

JAYARAM: [Baby H] was on a ventilator setting of 24/5, which are not too high settings. And then she had a period of desaturation and required bagging. We put the pressures up to 28/5, which seemed to improve her saturations.

And then I commented -- and although I have no actual physical recollection of this -- that she had a (inaudible: coughing) where her right hand, after this, looked a bit pale. Her pulses felt fine and that just improved over 5 minutes.

I commented then that once she was stable we needed to repeat her blood gas, check her blood -- and I put down:

"Does she need a repeat head scan?"

When a baby deteriorates we have to think why have they deteriorated. One of the things that can happen in premature babies, although not -- it would be unusual in somebody of [Baby H]'s gestation -- is that they can have intracranial bleeds. And I was just sort of thinking really through things that might have gone on that we needed to actively exclude.

ASTBURY: Okay.

JAYARAM: And I think -- I'm not sure after that whether I wrote any more. I would have handed over to the day team in the morning --

ASTBURY: Right.

JAYARAM: -- and that would have been my final --

ASTBURY: You also indicated on your note that mum, dad and -- is that grandmother -- were updated through the night on progress?

JAYARAM: I have to be honest, I can't remember speaking --

ASTBURY: Okay.

JAYARAM: -- but I -- I wouldn't have written that they'd been updated had they not been updated.

MR JUSTICE GOSS: I know you're very familiar with your handwriting and it's not always easy to --

JAYARAM: This is why I'm a doctor!

MR JUSTICE GOSS: Just so we can see exactly what the notes said at the time:

"Noted to have pallor" --

JAYARAM: "(Overspeaking) right hand. Query cause. Good radial pulse. Over 5 minutes perfusion improved."

MR JUSTICE GOSS: Right. So that's as you described a few minutes ago. Then the mum, dad and grandmother updated.

Then bottom left -- (overspeaking) P for plan --

JAYARAM: -- (overspeaking) and repeat of full blood count.

MR JUSTICE GOSS: "Repeat gas" and -- (overspeaking) that means full blood count?

JAYARAM: (Overspeaking).

MR JUSTICE GOSS: And then query --

JAYARAM: Consider doing a head scan.

MR JUSTICE GOSS: Right. I was just checking. Thank you.

MR ASTBURY: Thank you. That concludes your note. Does anything else stick in your mind from that particular event?

JAYARAM: There was one comment that I made in my statement and again it's a very vague recollection. So ordinarily, in this situation with a drain, we're putting it in for a pneumothorax. Sometimes we put drains in for other reasons, if there's an accumulation of blood or fluid in the pleural cavity, and I made a comment that there was a valve -- we often have devices called three-way taps, so they're three-way valves and I have a

recollection that at some point in the proceedings there was a three-way tap and I can't remember whether it was on the original drain or the one I put in. And I noted that that three-way tap was actually closed to the baby and I opened it again. But again I cannot and I would not be able to remember -- we wouldn't ordinarily put a three-way tap on to a chest drain for a pneumothorax, but it is sometimes done.

Sometimes you can put one if there's a pneumothorax and you need to drain more air out urgently you can put a syringe on the end of it, but that's the only other recollection I have. But I would be hard pushed to -- I honestly couldn't tell you which drain it was on.

I suspect it might have been on the original drain because I would have remembered putting one on to the second drain, but the honest answer is I can't really remember much else about that.

ASTBURY: Okay. You've described in some detail how the drain is comprised. Where would that three-way tap have been in the apparatus?

JAYARAM: So ordinarily the drain goes in and the flutter valve connects directly on to it if you've got a flutter valve. If you have an underwater seal you have the drain, you have a pack that has got another tube, one end of which goes into the drain, one end of which goes into the underwater bottle -- the bottle of water to which the other end of the drain -- and it would normally, if there was one in, probably go in at that point where it joins the chest drain --

ASTBURY: Okay.

JAYARAM: -- if you were going to put one in.

MR ASTBURY: Thank you. I have no more questions, doctor, thank you. If you could wait there, please.

Cross-examination by MR MYERS

MR MYERS: Dr Jayaram --

JAYARAM: Good morning, Mr Myers.

MYERS: Good morning, Dr Jayaram.

Just on that last point, I've got the statement, and you say that you have a vague recollection and you describe it as a valve --

JAYARAM: Yes.

MYERS: -- that was closed. You said a three-way tap just then.

Do you recall that it was what's called a three-way tap or some other (overspeaking) right.

JAYARAM: I honestly can't remember but I can't think if I -- I've described it as a valve and I can't think what else it might have been.

MYERS: All right. I'm going to ask you some questions about chest drains first, please.

Putting in chest drains is potentially a risky procedure with a baby, isn't it?

JAYARAM: It can be.

MYERS: It can be. The very process itself can put the baby under stress, can't it?

JAYARAM: How would you define putting the baby under stress?

MYERS: We've heard a lot about babies being handled and cares and just touching them in that way can put them under stress. So I'm just asking you to consider whether the act of putting in a chest drain could also have the similar type of effect.

JAYARAM: Putting a chest drain in can potentially cause a rise in heart rate, which is a response to being disturbed.

Absolutely.

MYERS: That's what I mean, thank you.

JAYARAM: And ordinarily, when we've put a chest drain in, we have to make a judgment in terms of what we do in terms of sedation/analgesia and it really depends on the urgency of the situation.

MYERS: A chest drain, once it's been put in, can block with fluid outside the lung but inside the chest wall, can't it?

JAYARAM: It can. There's always a small amount of fluid in the pleural cavity normally but it wouldn't be enough to block things -- as I mentioned, sometimes we put chest drains in because there is what we call a pleural effusion, which means there's fluid in there. And when a chest drain is put in there is a small amount of bleeding because you're cutting through tissue and sometimes there can be blood. And there is a

potential for chest drains to get blocked, although it's unusual in a pneumothorax.

MYERS: A pneumothorax can re-accumulate, the air can re-accumulate, if the tear in the lung doesn't heal and air is gathering out of reach of the chest drain (overspeaking) --

JAYARAM: Yes. So ordinarily, the whole pleural cavity is contiguous, but essentially it is one area. Now, you can have situations where you drain a pneumothorax, a bit of the lung re-inflates, so the drain is in an air and it's draining that bit, but air is accumulating in another area, or you can develop a further air leak as well.

MYERS: I'm just looking under the headings of things that can make chest drains difficult with babies. There can be a problem if a chest drain moves, that is the chest drain moves once inserted?

JAYARAM: It can be, but then having seen the X-ray, certainly from when I was called in, the chest drain was in an appropriate position.

MYERS: If a chest drain moves where it's passing into the baby, that could create a small hole with the outside, couldn't it?

JAYARAM: Sorry? Can you expand on that?

MYERS: If a chest drain moves, so where the tube comes out, and there's leakage around the hole that could create a --

JAYARAM: So if a tube came out completely --

MYERS: But if it moves within the chest --

JAYARAM: Not really because you've got the tissues that close down around the actual -- basically you've got a tube and the tissue is gripping it, so if it moved a little bit it shouldn't really -- there would be really very, very low chance of that causing a fistula, a direct route out around the edge of the tube.

MYERS: So can I be clear, do you disagree that a chest drain, where it comes out of the wall, that position could move so that, for instance, liquid could leak out? Do you disagree with that?

JAYARAM: Number 1, I don't think there was a particularly huge amount of liquid in the chest cavity. You can get some bleeding around it, absolutely, and if you've made a very big hole and there's a very small tube and there's a leak around it. But

generally when we put these things there we put them in in a way that we minimise that.

MYERS: At this stage I'm asking you general questions about chest drains, Dr Jayaram.

JAYARAM: Okay.

MYERS: We will come to your one, which is chest drain number 2, shortly. But what I was suggesting was that if the tube, where it goes into the chest can move, liquid can leak, could I check --

JAYARAM: It's possible. I have to say in my career I've never seen that happen in a chest drain for a pneumothorax.

MYERS: Right. Inside the chest it's possible, isn't it, for the end of the chest drain to come into contact with structures like the heart or the vagal nerve, which could create problems for that reason?

JAYARAM: I have never seen that happen. It shouldn't come into contact with the heart because the heart has lung surrounding it. So I can't see that a chest drain could come into contact with the heart unless you have actually gone through a lung, which doesn't happen. So I would disagree with that.

Again, the vagus nerve I have never, ever seen that happen.

MYERS: Just so it's clear, I'm going to suggest there is a risk of interference with a chest drain that can come into contact with internal structures like the heart and the vagal nerve. You're saying you have never known that to happen?

JAYARAM: No, and I'm struggling anatomically to think how it could come into contact with the heart and, if it does, it wouldn't come in contact with the muscle of the heart at all because the heart is surrounded by a membrane called the pericardium.

MYERS: Yes, so it could come into contact with the pericardium?

JAYARAM: Yes. And that would be very unusual for that to happen.

MYERS: And if it did, could that interfere with the heart if something like a chest drain is touching the pericardium?

JAYARAM: I don't think it would.

MYERS: Do you agree that generally there is less use of chest drains in neonates now we've got surfactant that can be given to them after they have been born to help with breathing?

JAYARAM: Surfactant has been in existence since sort of the 80s and 90s -- and actually one of the risks of giving surfactant in babies that are intubated and ventilated is that they can develop pneumothoraces. One of the risks of being on a ventilator is developing a pneumothorax. One of the risks of being on CPAP, a non-invasive ventilation, is pneumothorax.

And pneumothoraces can happen spontaneously. They can happen in premature babies with immature lungs, with respiratory distress syndrome. They can happen in newborn term babies spontaneously as well.

We probably see fewer pneumothoraces than we used to, certainly when I first started training in paediatrics in the early 90s, because generally antenatal steroids are given to mums who are in premature labour so we see less severe lung disease.

But pneumothorax -- we see fewer of them but they still happen.

MYERS: Is one of the reasons you see fewer that there's a wider use of surfactant which helps lungs be pliable so they are not under the same stress and don't have pneumothoraces in the same way?

JAYARAM: That's one of the reasons. It can happen as well just because they have less severe lung disease.

MYERS: Generally speaking, doctors now are likely to have less practice in using chest drains than they might have done 30 years ago?

JAYARAM: I wouldn't disagree with that and that's probably one of the reasons why, when babies develop pneumothoraces, it's quite often the consultants that are having to do them because we are from a generation where we've done a lot of them. As a trainee, as a senior house officer and as a registrar, I probably have done several dozen.

I actually -- in babies and in older children as well.

MYERS: It's -- chest drains at the time we are looking, 2015, at the Countess of Chester Hospital, they were procedures you had to use occasionally; would you agree with that?

JAYARAM: Occasionally.

MYERS: It was very unusual to have three chest drains in one baby, as we ended up with [Baby H], wasn't it?

JAYARAM: It's unusual, yes, because ordinarily with a pneumothorax with one drain one would anticipate that it ought to drain all the air out. And certainly with the second drain, with my last involvement with [Baby H], it appears that the lung had re-inflated.

MYERS: You have mentioned the types of chest drain. Just help us with this, there's one sort -- I'm going to describe it as a pigtail drain.

JAYARAM: Yes.

MYERS: We'll have a look at the radiograph shortly. The other sort I think you described in the notes as an Argyle catheter.

JAYARAM: Yes. That just refers to the manufacturer.

MYERS: All right. If I call it a non-pigtail drain, a straight drain, we have the difference?

JAYARAM: Yes.

MYERS: All right.

JAYARAM: But the difference is also the technique for inserting them as well.

MYERS: Yes, of course. The pigtail drain has the benefit, doesn't it, that once it has been inserted, because of the way it curls, it helps it to stay in place inside the chest?

JAYARAM: It does, yes.

MYERS: And your opinion also is that it's easier to use (overspeaking) straight drain?

JAYARAM: It is definitely easier if you are an experienced -- to put in and it causes less scarring. It's probably quicker to put in as well.

MYERS: The way it works, just so we've all got this, is -- let's stay with the pigtail first of all. The drain is inside the chest cavity, inside the pleural cavity --

JAYARAM: Yes. So it's between the chest wall -- between the ribcage and the lung.

MYERS: What those of us who aren't doctors would call the space -- what we think of as the space in the chest?

JAYARAM: Yes.

MYERS: And there is a hole in the end of the drain?

JAYARAM: There's a couple of holes -- a few holes, yes.

MYERS: And further perforations next to it?

JAYARAM: Yes.

MYERS: Just so we can all understand how the air comes out, if we imagine that pleural cavity with air in it and you want to get the air out, as the lung expands, because the baby breathes or it's ventilated, that pushes into the pleural space, doesn't it, the lung expansion does?

JAYARAM: So when you -- as we're all breathing in our lungs expand, yes.

MYERS: And that pushing in means the air has to go somewhere and it will go, in theory, into the holes in the chest drain and pass out of the chest?

JAYARAM: Well, yes, because what's happening in a pneumothorax is the air isn't staying in the lung, it's leaking out of the lung into the pleural space, and then it will go into the holes on a chest drain --

MYERS: That's right.

JAYARAM: -- and come out.

MYERS: So --

JAYARAM: The idea then is that the pneumothorax isn't getting bigger and bigger, you're actually trying to make it smaller.

MYERS: So we can all just follow the mechanism, it is as the lung -- either because the baby is being ventilated or may be breathing, as the lung expands into the space, the air that is gathered there is then forced through the holes of the drain and out of the baby.

JAYARAM: It is not so much forced out, it will drain out.

There's a pressure gradient form -- compared to what's in the chest to outside atmospheric pressure, but yes...

MYERS: All right, A pressure gradient then, but that's how it works?

JAYARAM: Yes.

MYERS: Or how it's meant to work.

If we have a look at the pigtail drain. I'm going to ask Mr Murphy to put up T55 please. This is the image at 2.29 am on the morning you were there, Dr Jayaram, before the chest drain you inserted was put in.

So T55 please. This is 25 September, 2.19. We can just see the timings so we don't need to go down to them.

JAYARAM: Can I just clarify: this was after Dr Ventress had done her needle thoracocentesis?

MYERS: That's right -- well, there's no needle in it at this point in fact.

JAYARAM: I think she'd done one before she called me.

MYERS: All right. I am just looking at this at this point for us to look at the pigtail drain that's inserted.

Can you see that, Dr Jayaram?

JAYARAM: Yes.

MYERS: We can all see that. And perhaps looking at that we can see why that's called a pigtail drain because there's curl on the end of it.

That drain is in the optimal place for a chest drain going into the pleural cavity, isn't it?

JAYARAM: Looking at it a two-dimensional image of a three-dimensional thing -- if you look where it is -- you could look at that and say, look, is it on the front of the chest (inaudible: witness off mic) within the pleural cavity.

MYERS: The optimal position for a chest drain going in is what's called the fifth intercostal space, isn't it?

JAYARAM: The optimal position is really to get it into the place where it's going to drain air.

MYERS: I'm going to suggest to you, Dr Jayaram, it's not quite as flexible as that. There is an optimal position and it's the fifth intercostal space. Isn't that the proper practice?

JAYARAM: It doesn't matter because in a pneumothorax, as long as a drain is in, it's going to drain air out. So you may use the fourth, you may use the sixth.

MYERS: Do you --

JAYARAM: You put them in where you can.

MYERS: Do you agree that as a -- wherever it is you put it in, the standard practice, the optimal position is the fifth intercostal space?

JAYARAM: Ideally, yes.

MYERS: Ideally, right. And whilst you're right this is a 3D picture and it may be difficult to count, if we look where that pigtail drain has gone in, drain number 1, that appears, as far as we can tell from this, to be in or about the region of the fifth intercostal space, doesn't it?

JAYARAM: It appears to be. If you count down from the top (inaudible: witness off mic) 1, 2, 3, 4, 5.

MYERS: That's right. It may be apparent from the question, but the intercostal space is the space between the --

JAYARAM: Between the ribs.

MR JUSTICE GOSS: Sorry to interrupt you. Slow down, please.

MR MYERS: I apologise.

Once you get below the fifth intercostal space and you're inserting a tube into the area of the pleural cavity, you're getting close to areas like the base of the heart and the diaphragm, aren't you?

JAYARAM: If there was no pneumothorax one would be and there's a risk of it. If there's a pneumothorax then actually the heart is pushed away, so if you've already got a chest drain in and you need to put another one in you can't put one in right next to it and one would go to a different space. And the accumulation of air here, as you can see from the X-ray, when you look at the left chest, so the right side of the X-ray, is very much lower down. So it would be entirely appropriate in this situation to drain that, aiming at where the air is.

And you would not hit the heart because there's a huge amount of air.

You can see actually looking, even -- (inaudible) there's several centimetres of space between the air and the edge of the heart.

MYERS: I just want to check I'm clear about the answer to the question I asked, Dr Jayaram. I'm not being rude. Let me just check. I asked you that once you go below the fifth intercostal space and insert something in there -- let's take a pneumothorax out of it for a minute -- you are getting closer to the base of the heart (overspeaking) --

JAYARAM: Why would anybody be inserting anything unless there was something to drain out that was between what you were draining out and the heart? You're correct, if (overspeaking) --

MYERS: Thank you, that's what I wanted to check.

JAYARAM: -- if there was no pneumothorax and I put something in there's a risk you might approach the heart, but we wouldn't be putting these things in in that situation.

MYERS: And that's -- as it happens, if you went in on the right-hand side, you'd be getting close to the liver, wouldn't you?

JAYARAM: The liver sits, as you can see here, at around the seventh or eighth, again but there's a risk -- but if you had a pneumothorax on the right you would be hitting air first. And we have to be aware anatomically of these other structures, yes.

MYERS: And that's the reason, following this through, that the correct place to insert one (overspeaking) --

JAYARAM: It's the recommended place.

MYERS: The recommended place is the fifth intercostal space.

JAYARAM: It's to reduce risk.

MYERS: To reduce risk, thank you.

Let's go to the chest drain you inserted. Could we go to the clinical notes for Dr Jayaram please at T76.

You arrive on the unit at 1.50 or thereabouts; is that correct?

JAYARAM: That's what I've documented so it would have been there or thereabouts, yes.

MYERS: And did you understand that you were dealing with a tension pneumothorax when you arrived?

JAYARAM: At the time we knew that this child, [Baby H], had a pneumothorax and it was likely to be tension. That's why, when Dr Ventress had been dealing with her, she did the cold light, she diagnosed clinically a pneumothorax, she put a needle into the interspace and aspirated a lot of air. And then it was confirmed with an X-ray.

MYERS: And your view is that a tension pneumothorax would be a critical emergency or could be a critical emergency?

JAYARAM: It can be and it needs to be drained, which is why the needle thoracocentesis took place.

MYERS: We've seen the X-ray for 2.29 am. Let's move forwards, please, to tile 66 for the X-ray or radiograph for 03.05.

You can see just at the top of the radiograph, 3.05, 25 September. We can see the needle for the thoracocentesis, can't we?

JAYARAM: Yes.

MYERS: That's the straight line that's white coming in on the left of the arrow that's just gone --

JAYARAM: Yes.

MYERS: Thank you. And we can see chest drain number 2 in position, can't we -- sorry, number 1, the pigtail.

JAYARAM: (Overspeaking) number 1 is there.

MYERS: Is the area of the heart right at the centre behind the ribs as we look at it?

JAYARAM: So the heart is the kind of big white blob in the middle.

MYERS: I would like us all to keep an eye on that as we go through the images we're going to look at.

But that large sac in the middle above the liver -- I wonder if the cursor could move to the left of the pigtail drain, to the centre of that -- there we. That area is the heart; is that correct?

JAYARAM: You can trace the border of it round where it goes from black to white.

MR JUSTICE GOSS: Sorry to interrupt you. I'm going to ask the clerk to move the microphone slightly because there's difficulty. Thank you.

(Pause)

MR MYERS: You have identified the heart for us. This is 3.05. You'd arrived on the unit about 1.50, hadn't you?

JAYARAM: Roughly, yes. I had said that.

MYERS: You have described there were various procedures carried out when you got there, weren't there? But in fact the second chest drain, the one you inserted, went in shortly before after you took the X-ray of it, would that be right?

JAYARAM: Yes. After this needle (overspeaking) --

MYERS: Let's go to the X-ray for 4.37 in the morning, which is at tile 75. If we look there, this is for the X-ray at 4.37 in the morning. We can see the pigtail drain, drain number 1, can't we?

JAYARAM: Yes.

MYERS: And we can see the drain you've inserted, what I'm going to call the straight drain, travelling in below that.

Now, going by the timings, it's about 2.5 hours before that drain was inserted; that's right, isn't it?

JAYARAM: Yes.

MYERS: There were some procedures taking place, weren't there?

JAYARAM: Yes.

MYERS: Did you actually have to make enquiries to find another chest drain to use?

JAYARAM: I honestly can't remember what the situation was. I do remember, as I've documented, that the pigtails weren't available, but these were.

In terms of the timings, once you have some stability with a needle thoracocentesis, it buys you some time and it's far better to put these formal chest drains in, if you can, in a more controlled manner than an emergency procedure. Sometimes you have to, but if you have some stability and some time bought with a needle thoracocentesis one can do these in an elective manner.

I would have liked to have been able to do the definitive chest drain earlier and I can't remember, because I documented retrospectively, exactly at what stage we did the drain, although it is likely that the X-ray was done shortly after the drain was put in. So an inference could be that the drain was probably put in in the quarter of an hour before the X-ray was taken.

MYERS: I'm just going to ask you to cast your memory back and I apologise, I am not sure if you did answer this, was some time spent looking for a drain to use?

JAYARAM: I don't think so. I think I would have been told there weren't any and would have said we just need to put in a -- what you call a straight drain.

MYERS: We will have to move between your notes and the images, but I am going to ask Mr Murphy, please, to put up the second page of your notes at T76, tile 76. We're coming back to this X-ray shortly. If we just scroll down to the centre of the page.

We can see it says:

"Formal [something] chest" --

JAYARAM: "Second chest drain."

MYERS: "Formal second chest drain inserted by myself. No Cook pigtail drains available."

Do you see that? I'm going to ask you, is this what happened? It would have been desirable to use a pigtail drain if you had any; do you agree?

JAYARAM: I agree because it's easier.

MYERS: In fact there were no other pigtail drains available that could be found on the unit at this point, were there?

JAYARAM: I believe so.

MYERS: And did an Argyle catheter, a straight drain, have to be taken from the children's unit for this, someone had to go and get one from the children's unit?

JAYARAM: I can't remember whether it was in the stock cupboard on the neonatal unit or whether somebody had to go next door to the children's ward. The children's ward is a one-minute walk away but I can't remember, I have no recollection where it came from.

MYERS: Perhaps that suggests the fact that using chest drains like this is something that doesn't generally happen all that often on the unit; would you agree?

JAYARAM: I can't remember the numbers but we would probably maybe -- there would be two or three a year, maybe, there or thereabouts, just from informal recollections.

MYERS: Now I don't know if everyone's got the notes up on the iPads at the moment. You may not have your iPads open, but I'm going to have to move between the notes and the screens. Those of you with the notes on your iPads may want to leave the notes there and we'll ask Mr Murphy to put the radiographs on the screen otherwise we will jump between the two if you are not doing it that way.

I have the notes in front of me here and I'd like to put back up the radiograph after it had been inserted at tile 75 please. I do apologise, Mr Murphy, could you go back to the note before we do that? There's something I'd like to clarify. Then we'll come back to this image.

Just down to the page we were on. Thank you.

If we just look below what you've said:

"No Cook pigtail drains available. Used 8 gauge Argyle catheter."

And you put this:

"Insertion in fifth interspace."

Do you see?

JAYARAM: I think that's probably meant to say, it looks more like an 8. It's probably my writing. But it's clearly not in the fifth interspace as you can see from the X-ray.

MYERS: Well, let's pause first of all with the evidence you gave this morning when the prosecution asked you questions and you said -- "Insert into fifth interspace" is what you said; yes?

JAYARAM: That's probably because I read that as 5 and wrote it on my statement but it's clear from the X-ray it's not in the fifth interspace --

MYERS: No, it's not. Let's just -- there's a reason I'm asking these questions.

JAYARAM: Yes, yes.

MYERS: I'm suggesting your evidence this morning was insertion in fifth interspace. I suggest that what's you have written there.

JAYARAM: Yes.

MYERS: Yes. And if we go down a few lines we can see, on its own:

"Chest X-ray. Drain in good position."

Where you say "drain in good position" that's linked to you saying it's in the fifth interspace, isn't it?

JAYARAM: No, it's linked to looking at the chest X-ray -- can I discuss what "good position" means? If we can go back to the X-ray, it might perhaps might make a little more sense with some context.

MYERS: I wonder if I could just finish this question (overspeaking) like us to be clear about it and then we will go to the X-ray.

JAYARAM: Of course.

MYERS: The aim was to put this in through the fifth interspace, wasn't it?

JAYARAM: The aim was to drain the pneumothorax.

MYERS: And you, at the time, recognised the correct way in was through the fifth interspace, didn't you?

JAYARAM: The ideal place to put it in is the fifth interspace but, as one can see from the earlier X-rays, this was an extensive pneumothorax. There was already a drain in the fifth interspace -- in fact I'm not sure why I documented fifth interspace because it's quite clearly not, but actually the drain is in a good position -- and if we go back to the X-ray I can discuss what I mean in terms of "good position".

MYERS: Let's go to 275.

MR JUSTICE GOSS: Can I just be clear at this stage? Do you accept that it says fifth?

JAYARAM: I think I've written fifth. I accept I've written fifth.

One can see it's down... eighth interspace. That would have been based on the fact that when one looked at the original X-ray with the big pneumothorax, you can see at the eighth interspace there was a vast accumulation of air.

What do I mean by "good position"? Number 1, it's in the pleural cavity, so it's not too short. Number 2, it is working because the lung has re-inflated. The tension part of the pneumothorax, if you look at the position of the heart, the heart has come back to the centre of the chest X-ray, so therefore we've actually treated the tension pneumothorax.

One of the questions I anticipate you're going to ask from the questions you've asked already is, could this potentially be touching the heart? And one has to remember that this is a two-dimensional image of a three-dimensional thing. So the position of this is anterior to the heart. It is in the pleural cavity.

There is lung between the drain and the heart, it won't be touching the heart, and it's actually draining air out. Sorry if I've anticipated what you were going to ask wrongly.

MYERS: There's a number of things I want to ask, Dr Jayaram, and that's amongst them.

First thing. We've discussed about what you say in the notes about fifth interspace, which it is. We've discussed what the recommended place is. We have discussed that. Next, this is going in somewhere around the seventh or eighth interspace, isn't it?

JAYARAM: It is.

MYERS: When you gave evidence earlier you said, well, when there's a pneumothorax, it doesn't matter if you're going in through the seventh or eighth since the lung field -- the pleural cavity has expanded, the risk to heart or coming into contact with the heart or the vagal nerve is less.

You have explained to us several times looking at these X-rays how the lung cavity, the pleural cavity, has closed after draining here, hasn't it?

JAYARAM: Yes.

MYERS: Yes. So --

JAYARAM: Well, after the needle thoracocentesis or after the chest drain?

MYERS: After the needle thoracocentesis and before the chest drain?

JAYARAM: It hasn't completely re-inflated.

MYERS: Yes. But first of all, you weren't inserting it into a pleural cavity that was expanded with a lot of air at that point, were you?

JAYARAM: There still would have been air there as evidenced by the previous X-ray because it hadn't re-inflated completely.

MYERS: We've seen the X-ray and you have pointed out how it had gone down, haven't you?

JAYARAM: It had gone down, but it was still present.

MYERS: Secondly, that chest drain is in the wrong place, isn't it?

JAYARAM: No, it's in the pleural cavity.

MYERS: The pleural cavity is the bit in the chest before you get to the lungs; yes?

JAYARAM: Well, it's around the lungs.

MYERS: It's quite a big area, isn't it?

JAYARAM: It's a big area and it's in the pleural cavity draining a pneumothorax.

MYERS: So for an experienced doctor, getting it into the pleural cavity isn't going to be that difficult to do, is it?

JAYARAM: No.

MYERS: Right. But within the pleural cavity there are various places it could can go, aren't there? And this is in the wrong place, isn't it?

JAYARAM: No, it's in the pleural cavity. The purpose -- I think you're concentrating on process rather than outcome and this drain needed to be put in. The pneumothorax had accumulated more inferiorally, lower down the lung, as evidenced by the previous X-ray. It actually made more sense to put a chest drain in lower down than in the same place -- assuming this pigtail drain was draining if we put a drain in the same place, you wonder whether we would have been able to drain that air that was more inferior. I didn't really understand why it wasn't draining in

the first place, but it was entirely appropriate, in my opinion, to have it where it is.

MYERS: From looking at that X-ray you can't tell, in fact, just how close the tip of that drain is, or any part of it, to the heart or the pericardium, the membrane around the heart?

JAYARAM: Well, if one understands the anatomy then you know it's in the pleural space and it's going to have lung between the drain and the pericardium. And if it was touching the pericardium, it isn't going to have any great effect on heart rhythm or heart function.

MYERS: I am going to make it plain we disagree with that, Dr Jayaram, but you say it doesn't.

JAYARAM: We will agree to disagree.

MYERS: There is also the vagal nerve that travels through this area, isn't there, and it could come into contact with the vagal nerve or offshoots of the vagal nerve, couldn't it?

JAYARAM: Potentially.

MYERS: And contact with the vagal nerve can interfere with breathing, can't it?

JAYARAM: Contact with the vagal nerve can cause bradycardia, it can cause apnoeas.

MYERS: So heartbeat and breathing, it can interfere with both?

JAYARAM: (Overspeaking) can, but I would argue that where this drain is -- because this drain is anterior, this drain is in front of the diaphragm, it's in the front part of the chest, it is not going to come into contact with those structures.

MYERS: And if that drain begins to move around within the pleural cavity, that increases the chance of it coming into contact with a structure that could cause bradycardia or desaturations?

JAYARAM: What do you mean by moving around?

MYERS: If the tip of it is moving, free to move within the pleural cavity.

JAYARAM: It will move with respiration but it won't move up and down and in and out because it's stitched in on the outside.

MYERS: The tip of it can move up and down around the pleural cavity, can't (overspeaking) --

JAYARAM: With respiration but still anteriorally.

MYERS: Yes, but it could still come into contact with items inside there, couldn't it?

JAYARAM: It could.

MYERS: We have this one at 4.37. Can we look at the next image please at 14.53 on the 25th, which is at tile 137. So we can just hold in our minds where this is and then we will have a look at where it has got to at 14.53, please.

If we pause (inaudible) kind of illumination, but we can now see your drain, chest drain number 2, has actually moved up to the area of the pigtail drain, hasn't it?

JAYARAM: Yes. So the mechanism for that is -- remember that the pleural space is contiguous and as the lung expands -- it's secured on the outside and as the lung has expanded it has pushed the drain upwards. You can see quite clearly it's in the pleural space.

MYERS: The pigtail drain hasn't really moved, has it?

JAYARAM: That's the nature of a pigtail drain because it's curled up.

MYERS: Yes. But the one you put in could have been moving anywhere in the hours between --

JAYARAM: Are you saying (overspeaking) flapping up and down and obviously we don't do X-rays every hour. What that reflects is that the lung -- the pneumothorax has continued to resolve.

MYERS: You don't know how much it's moved in the hours that have gone between 4.37 and 14.53, do you?

JAYARAM: Why would it be moving up and down? I'm struggling to understand the mechanism you are proposing that it could have been up and then down. I am really struggling with that surmise.

MYERS: First of all you agreed it has moved --

JAYARAM: Of course (overspeaking) --

MYERS: Something has happened, hasn't it?

JAYARAM: The pneumothorax has lessened, has decreased.

MYERS: As a baby moves, the drain may move; do you agree?

JAYARAM: Depending on the position of the baby it may move internally, but it's more likely to move as the pneumothorax resolves.

MYERS: As the baby breathes, it may move around?

JAYARAM: To a small extent.

MYERS: When the nurses move or handle a baby, inadvertently the tube may move, the draining?

JAYARAM: It may move.

MYERS: It could even be moved deliberately by a practitioner who's adjusting it.

JAYARAM: It would be very hard to move a chest drain deliberately that's stitched in because you can't move the internal bit physically.

MYERS: If it hasn't been stitched in properly, if it's moving, if it's loose where it goes into the chest, that could cause it to move around, couldn't it?

JAYARAM: If it's not secured properly it could potentially move in and out.

MYERS: And the movement around the drain could cause it to move inside, couldn't it?

JAYARAM: As in go further in?

MYERS: Just move, Dr Jayaram.

JAYARAM: They can move. By the nature of things this is a dynamic situation (overspeaking) --

MYERS: Why is you are meant to stitch a chest drain?

JAYARAM: Pardon?

MYERS: Why are you meant to suture a chest drain where it goes into the chest?

JAYARAM: It's to try and stop it in sliding in and out -- and actually there are -- sometimes now we don't suture, we tape them down, but it was standard practice to suture.

MYERS: And you sutured this one, did you?

JAYARAM: Yes.

MYERS: Could we look, please -- and this may not be in the sequence of events -- at the radiograph for 5.25 on the 25th. We can see where drain 2 is here, so 5.25 on the 25th, which is at J12670. We can see at that point the chest drain has moved down slightly, hasn't it? If you look at the right-hand side it is now below the pigtail drain.

JAYARAM: Yes. So the tip of it is just at the bottom of the circle of the pigtail drain.

MYERS: Do you regard the way that you'd inserted and fitted this drain as optimum practice, Dr Jayaram?

JAYARAM: In the circumstances of a baby with an extensive tension pneumothorax who needed a drain put in -- and in this tension pneumothorax, the air had accumulated inferiorly in the lung -- I think absolutely. I think that ideally I would have preferred to have put in a pigtail drain, but the important thing here, for me as a clinician, is if there is free air in the pleural cavity, particularly under tension, it needs to get out, which we achieved with the drain. I do not believe that the position of the drain actually caused any other effects. I can see here that the position of the drain appeared shorter, but bear in mind again we're dealing with a two-dimensional image of a three-dimensional thing and I don't know what events happened during the day after. I don't know whether it was pulled back or whether it had slipped.

MYERS: Dr Jayaram, I'm going to suggest to you, you put it in through the wrong part of the chest; do you agree or disagree with that?

JAYARAM: I would disagree entirely. I put it in in a place that it needed to be put in to drain the air that was there.

I think this is a very important point that in terms of clinical medicine, yes, there are optimum recommendations, but pragmatically one has to actually deal with the problem in front of you. And I agree entirely that the recommendation for the fifth interspace is simply to reduce risk. In a situation of a pneumothorax particularly, one that is quite visible to be a large pneumothorax inferiorly and anteriorly, the position of the drain at the time it was put in was entirely appropriate.

MYERS: And I suggest to you, for whatever reason, that drain was moving about within the chest cavity after the time that you had secured -- put it in.

JAYARAM: So it's clear from the X-rays that the position of it has changed but that also doesn't surprise me, certainly with the previous X-ray, in the sense that as the lung re-expands clearly it's going to move. I would disagree that it has been, for want of a better term, flapping in the breeze inside there.

MYERS: The movement of it inside, I'm going to suggest to you, so we are clear, risks triggering desaturation, bradycardia, interfering with the baby in that way.

JAYARAM: Sorry, are you thinking about vagal nerve stimulation?

MYERS: Just so I am quite clear, I'm suggesting to you there is a risk of that or interference with the heart so that breathing or heart function are interfered with. Do you agree or disagree with that?

JAYARAM: I'd disagree about heart function. The possibility of vagal nerve stimulation is possible. As I say, I have never seen it happen.

MYERS: And I suggest to you, Dr Jayaram, that this was suboptimal performance and you had meant to put it in through the fifth and you put in the wrong place?

JAYARAM: I didn't put it in the wrong place. The recurring theme with your conversations with me so far is you very much focus on process and I think we have to look here that the process is to achieve an outcome and the outcome here was to drain the pneumothorax, which was the crucial thing at the time. It was absolutely the right thing to get that chest drain in. The fifth interspace already had a drain in it and we succeeded. And we succeeded: we drained the pneumothorax and we actually made [Baby H] more stable.

MYERS: Are you aware of the fact, you talk about outcome, that in the hours that follow this, the day that followed, there are a series of quite serious desaturations that take place?

JAYARAM: I'm aware of those, yes.

MYERS: But you wouldn't see that as linked in any way to what has (overspeaking) --

JAYARAM: I would disagree.

MYERS: Disagree with what?

JAYARAM: And I think -- that it's linked to the position of the chest drain. And interestingly, I'm not sure of the timings of

these X-rays, if you actually look at the position of the chest drain here (indicating), it doesn't seem to be in the position it was where it could potentially be touching the heart or the vagus nerve.

So I would humbly agree to disagree with you.

MR MYERS: You don't have to be humble about it, Dr Jayaram; just disagree.

Thank you, my Lord.

Re-examination by MR ASTBURY

MR ASTBURY: Two matters arising, please.

Why do you say that the chest drain and its position is not linked to what happened during the rest of the day?

JAYARAM: Because I don't think that that chest drain was in a position where it would have been interfering with the heart or interfering with the vagus nerve. I can't comment because obviously we haven't done serial chest X-rays to see where it was at different times. But I don't believe that it was actually causing stimulation of -- abnormal stimulation of the heart muscle or the vagus nerve.

ASTBURY: Okay. You've been criticised for the positioning of the second drain that you inserted and it not being in the fifth intercostal space. Is there a reason why it didn't go into fifth intercostal space?

JAYARAM: I think there are two reasons. Number 1, there was already a drain in there and, number 2, we could see that there was a drain in that position and the air had accumulated lower down and more anteriorally.

ASTBURY: A conscious decision?

JAYARAM: It would have been a conscious decision at the time.

I can't explain why I wrote fifth intercostal space apart from the fact it was early hours of the morning but it clearly wasn't, as anyone can see on the X-ray.

MR ASTBURY: Thank you. I have nothing further. Does my Lord have any questions?

MR JUSTICE GOSS: I don't. Thank you very much. That completes your evidence.

MR ASTBURY: We expect Dr Jayaram back.

MR JUSTICE GOSS: We will see you again later in the year.

Thank you very much.

Please remember what I said to you before about not talking to anyone about this case or anything to do with it.

That's a convenient moment to have the break. We'll have our ten-minute break, members of the jury.

(11.55 am)

(A short break)

(12.05 pm)

MR ASTBURY: My Lord, I call, please, Dr John Gibbs.

DR JOHN GIBBS (recalled)

Examination-in-chief by MR ASTBURY

MR ASTBURY: Dr Gibbs, could I ask you to introduce yourself, please, for the record?

GIBBS: I'm John Gibbs, I was a consultant paediatrician at the Countess of Chester Hospital in 2015/2016, retired in 2019.

ASTBURY: Thank you. You have provided a statement in relation to your involvement in the care of [Baby H], who was born on 22 September 2015.

GIBBS: That's correct.

ASTBURY: May I ask, have you had the opportunity to refresh your memory from that statement and the relevant notes arising?

GIBBS: Yes, I have, thank you.

ASTBURY: Thank you. By way of context your statement sets out a summary of [Baby H]'s treatment. Is it right that you were the consultant paediatrician of the week when she was born?

GIBBS: Yes.

ASTBURY: And as a consequence, does that mean that she falls under your general umbrella of care?

GIBBS: Yes, but various consultant colleagues were on call overnight and at other times.

ASTBURY: Yes. We've heard about [Baby H]'s gestation, that she was born in good condition, but then was admitted to the neonatal unit.

GIBBS: Yes.

ASTBURY: Your first, I think, involvement with [Baby H] was when you met her on 23 September 2015; is that right?

GIBBS: That's correct.

ASTBURY: And you examined [Baby H] at 10.50 in the morning?

GIBBS: Yes, that was part of the neonatal ward round.

ASTBURY: Thank you. If necessary, we can go back to this, but would this be fair to say, that due to her increasing blood carbon dioxide level, her breathing support was increased from what's described as CPAP to BiPAP?

GIBBS: That's correct, yes.

ASTBURY: Which is a higher level of support than that which she was on?

GIBBS: Yes, but short of full ventilation, yes.

ASTBURY: Thank you. She was not receiving feeds by mouth at that stage?

GIBBS: That's right.

ASTBURY: But instead her nutrition was intravenous?

GIBBS: Yes.

ASTBURY: She was also receiving intravenous antibiotics?

GIBBS: She was, yes.

ASTBURY: And I think that was your only contact with her on the day of 23 September?

GIBBS: As far as I recall yes, and as far as is recorded in the notes, that's correct.

ASTBURY: Thank you. Yesterday we heard from doctors in different ways, from Doctors Varghese and Ventress, about [Baby H]'s

treatment during the morning of the following day, 24 September, when you will be aware she was intubated.

GIBBS: Yes.

ASTBURY: And we also heard from Dr Harkness, who treated [Baby H] that day. This is all included, of course, in your overarching statement, that he conducted a thoracocentesis and fitted a chest drain on the 24th.

GIBBS: That's right. He discussed that with me before he did that and we'd agreed on that treatment plan.

ASTBURY: Thank you. We've heard a little about this morning about tension pneumothorax and the treatment thereof.

Is that the type of thing you discussed with Dr Harkness that morning?

GIBBS: Yes.

ASTBURY: Are you aware that at 11.24 that morning, the treatment showed a partial re-expansion of the left lung?

GIBBS: Yes.

ASTBURY: But there was still a pneumothorax present?

GIBBS: Yes.

ASTBURY: At 3.30 on the afternoon of the 24th, I think it was another registrar, Dr Soni --

GIBBS: Yes.

ASTBURY: -- has recorded that -- is it he or she?

GIBBS: She.

ASTBURY: She has recorded that she spoke to [Baby H]'s parents on the unit because they had not been informed of the treatment that morning to relieve the pneumothorax.

GIBBS: Yes. I think Dr Soni was recording my discussion with [Baby H]'s parents.

ASTBURY: Right. Is it right that you also apologised, but the treatment of the baby came first, as it were?

GIBBS: Yes. [Baby H]'s parents were obviously understandably concerned at her deterioration and needing a chest drain, which

is quite a dramatic procedure, particularly for parents to see on their premature baby, and they felt they hadn't been told early enough about her deterioration. So we apologised for that, but although it's extremely important to keep parents informed of their own children's treatment, our first priority as doctors and nurses is to stabilise a child who's deteriorated so that came first. And I'm sorry if there was a delay in letting the parents know about that problem.

ASTBURY: Thank you. We've heard in fact this morning, but you will be aware of this, please confirm, that in the early hours of 25 September, just following the chronology, Dr Jayaram, who was on duty overnight, was called out and fitted a second chest drain to [Baby H].

GIBBS: Yes, because of another tension pneumothorax.

ASTBURY: Thank you. That brings us to the morning of 25 September, which I think is when you next had contact, both directly and indirectly, with [Baby H].

GIBBS: Yes. Well, during the 25th I did.

ASTBURY: Yes.

GIBBS: I can't remember all the times exactly.

ASTBURY: All right. Can I ask you, first, please, about a -- do you recall a conversation with Dr Harkness on the 25th about [Baby H]'s condition?

GIBBS: I recall on the 25th one problem in [Baby H] was her haemoglobin had dropped, she'd become anaemic, so we talked about needing a blood transfusion.

ASTBURY: I wonder whether we could go to tile 217, please, Mr Murphy. We saw it yesterday. This is Dr Harkness' note of what he found and his discussion with you in this regard.

GIBBS: Yes. It's coming back. I think he was doing the ward round that morning, so he would have looked at [Baby H] then.

ASTBURY: I would like you please to look at the note -- maybe I've got the wrong note. I'm looking for Dr Harkness later that morning. It's clearly my mistake.

Dr Harkness at 10 am on 25 September. It's further back.

It's 117, I'm sorry, not 217. My typo.

I appreciate this isn't your note, but as you accurately recalled it's the ward round. It's Dr Harkness. He describes at the top of the page the problems, if I can put it that way, that [Baby H] had encountered, that is that two chest drains and she'd experienced five needle thoracenteses?

GIBBS: Yes.

ASTBURY: We can see just below, next to ventilation, is that right, the pressure she was receiving by way of ventilation?

GIBBS: Yes, 20/5.

ASTBURY: And to the right, does that indicate she was receiving 28% by way of oxygen?

GIBBS: Yes.

ASTBURY: Thank you. Can I ask about the chest drains which are below. Is that "fifth space"?

GIBBS: Yes.

ASTBURY: "Not swinging", which indicates what, please?

GIBBS: That it wasn't draining air at that time.

ASTBURY: Okay. The seventh space on the other hand is described as "swinging and bubbly"?

GIBBS: Yes. So there would be air draining out of that drain.

ASTBURY: Thank you. If we just run down again, please, to the next page, where there's a section entitled "Lines", would you have been told during the course of your conversation that there were two chest drains in place, one described as a Cook in the fifth space? I'm not sure what the second one is -- is that trocar?

GIBBS: Yes.

ASTBURY: In the seventh space.

GIBBS: I can't remember a specific conversation at this particular time on the morning of the 25th about these drains, no --

ASTBURY: Right.

GIBBS: -- but I knew she had had two drains in.

ASTBURY: So you were aware of that situation?

GIBBS: Yes.

ASTBURY: If we scroll down again, please, to the bottom of the page. There's a plan. Would you have discussed the plan with Dr Harkness?

GIBBS: Well, it was my routine procedure to come to the neonatal unit after the ward round on the main ward -- this would have been -- the 25th was a Friday -- and yes, at some stage would have discussed. Now, I don't know, and Dr Harkness hasn't recorded, did I discuss at the time he wrote this note here. I can't remember whether I had or not --

ASTBURY: Right.

GIBBS: -- but at some stage I would have known what he was going to do.

ASTBURY: And this was the blood transfusion?

GIBBS: The blood transfusion came a little bit later. I think the main new treatment here is to insert a long line.

That's the last entry on that line there.

ASTBURY: Do you recall having any conversation with Dr Harkness about a blood transfusion?

GIBBS: Yes. Later on in the afternoon, I think -- well, later on on the 25th.

ASTBURY: I wonder if we could go to the next tile, please, 118.

We heard yesterday about [Baby H]'s haemoglobin level, which should be on this form, I think it's about -- if you could look at it, please, Dr Gibbs. It's halfway down the page.

GIBBS: It's coming up to halfway up the screen. The Hb is 122 and you can see the normal range given on the right-hand side. It should be 155 to 212, so it's lower than normal.

ASTBURY: Was that the feature that you discussed with Dr Harkness?

GIBBS: Yes, whether or not to transfuse. Even though the haemoglobin is low, it doesn't always mean you have to give a blood transfusion. It depends on the patient's condition. But knowing that [Baby H] was experiencing problems with her breathing, needing, slightly unusually, two chest drains, I felt

that it was appropriate to try and maintain a good level of haemoglobin, so agreed to go ahead with a blood transfusion.

ASTBURY: Thank you. If we go next, please, to tile 160. We will see the notes of the afternoon's events that involved you, Dr Gibbs. We can see at the top of the page the long line insertion which you mentioned a few moments ago and an entry concerning the haemoglobin level and that discussion that you've just described to us regarding transfusion.

GIBBS: Correct.

ASTBURY: Would that be consistent with your recollection? That's 3 o'clock in the notes.

GIBBS: Yes. Well, it's at some time in the afternoon, but Dr Harkness has recorded it at 3 o'clock, yes.

ASTBURY: Thank you. If we scroll down, please, and I think you were aware of this, but there was an incident recorded at 16.45 when [Baby H] suffered a desaturation.

GIBBS: Yes.

ASTBURY: And I think that's your handwriting at the bottom of the page.

GIBBS: Yes. Just before my handwriting there's an entry by Dr Austin, one of our registrars, and in it she says, the third line down of her entry:

"ETT removed by N/S [nursing staff] [something] blocked [or query blocked]."

So the nurses had removed the endotracheal tube, which is the tube down into the windpipe through which [Baby H] was being ventilated, because they thought it had blocked. And if it's blocked it's producing no benefit at all and preventing any air or oxygen getting into the lungs, so it's appropriate to take it out if you think it is blocked.

And then Dr Austin has written "ETT replaced". So she's put another one in and asked for a chest X-ray and I have now recorded what I have seen on the chest X-ray as well.

ASTBURY: I wonder if we could pause there, please, and go to tile 158. We saw from your note that you arrived at 5.45. This is an X-ray taken at 5.25, about 20 minutes before. I don't know whether you're able to confirm or not whether that's the X-ray you saw when you arrived.

GIBBS: Yes.

ASTBURY: Thank you. If we can go back to your notes, please. If you could explain to us, please -- I'm hoping it's the second page --

GIBBS: I think that's the end of my entry there. I've signed it at the bottom.

ASTBURY: Your signature is cut off. Could you explain your entry to us, please?

GIBBS: Right. So it says:

"ETT withdrawn..."

So the tube that she was being ventilated through was withdrawn:

"... 0.5 centimetres prior to the chest X-ray because of decreased [that's the arrow down] air entry on the left."

So because we couldn't hear or I couldn't hear air entry very well on the left, there's various reasons why that might be so. But a common reason is that the tube is a little too low. If an endotracheal tube is pushed too far down a windpipe it tends to go down into the right lung -- anatomically the right lung's tube is more in line with the windpipe -- and that's why it was pulled back a little.

Then it says:

"... to 8 centimetres at the lips."

Then the X-ray had shown a satisfactory position of this ET tube, so it had been right to pull it back a little. It says:

"Darker appearance in the left hemithorax."

So the left side of the chest was a little darker but you couldn't see a lung edge. That suggests there's still a pneumothorax but only a thin layer of air around the outside of the lung. If there's a lot of air around the lung, the lung collapses down and you can see the edge of the lung. The only way you could tell there was likely to be a small pneumothorax at this stage on the X-ray was because it looked a bit blacker on the left side compared to the right.

Then it says "cold light". I think it says -- the code number, but "cold light normal". I'm fairly sure that says. I put "normal" in capitals.

ASTBURY: We've heard a little about cold light tests and seen a video. So you were satisfied that what you saw was normal. Could you read the next line?

GIBBS: Sorry, what I saw on that X-ray -- there is a pneumothorax but it's not causing a tension problem, and the lung looks fully expanded. Also, although there was a small pneumothorax there on the chest X-ray, the cold light did not detect it because it can't detect all pneumothoraces, particularly small ones.

ASTBURY: So a diagnosis for a pneumothorax comes from the X-ray rather than the cold light?

GIBBS: The X-ray is more sensitive than a cold light.

ASTBURY: Cold light is indicative perhaps?

GIBBS: Yes and a cold light you can perform immediately on the neonatal unit, whereas an X-ray takes time to be taken, and then to be processed so you can see the picture. So a cold light is a quick assessment, a chest X-ray is more accurate but slightly slower assessment.

ASTBURY: Thank you. Your next line begins with a "left" again.

Is it "left"?

GIBBS: Yes, "Left standard", and that means non-pigtail drain.

Earlier someone had called that the trocar drain as opposed to the pigtail drain, which is also called a Cook drain. So one of the chest tubes, the left standard non-pigtail drain, which is the one Dr Jayaram had put in during the previous night, had moved outwards. When I say it moved outwards, an X-ray earlier from that day, about 4.30 in the morning, had shown that the tube was well inserted into the chest.

This X-ray, about 12 hours later -- well, 5ish in the afternoon, had shown the tube looks further out of the chest. It's still in the chest but it's moved a bit so I have then written down:

"Fixed more securely to chest wall to try and prevent it moving any more."

ASTBURY: Okay.

GIBBS: So to stop it falling out.

ASTBURY: You detected some movement, movement out of the body?

GIBBS: Yes, compared to the previous chest X-ray roughly 12 hours earlier.

ASTBURY: Did anyone in particular draw your attention to that or did you notice that yourself?

GIBBS: I noticed it myself.

ASTBURY: Right.

GIBBS: Other people might have noticed it. Dr Austin, the registrar, might have noticed it, but I noticed it myself and I recorded it in my observations here.

ASTBURY: Okay. I'm just going to pause there if I may.

Are there any potential consequences of a chest drain moving out in that way?

GIBBS: The main worry is it moving out completely and falling out and therefore being useless. So that's why I fixed it so it wouldn't move anymore. The answer to, are there any other consequences, is: it depends. A chest drain has a hole at the end and along the side of it near the top of it, the tip of it, so it drains from several places. If it's moved across the chest, it should still be effective at draining any air that shouldn't be there on the outside of the lung. But the worry is if it keeps on moving out, it'll become ineffective and fall out completely.

ASTBURY: Okay.

GIBBS: So it hadn't become ineffective, it was still functioning at this stage, it was still well inside the chest but had moved several centimetres from a previous X-ray.

ASTBURY: Any risk to the internal structures by a chest drain moving in that way?

GIBBS: Not that I am aware of. You wouldn't want to keep on pushing and pulling on a chest drain, and you wouldn't do that, so you're pushing it in and pulling it out the chest because that would be rubbing against the lung.

And also, if you pushed it very far into the chest, you're pushing against the heart. But at this stage the chest drain was moving outwards away from the heart and across the lung. But I wouldn't have expected that to cause any problems as in trauma, damage, to [Baby H] at all. It's just the worry that it may go out further and become ineffective and fall out.

ASTBURY: Right.

GIBBS: So it wouldn't be preventing a pneumothorax or draining a pneumothorax if it has fallen out.

ASTBURY: So that, as you've pointed out, is the end of your note for that particular visit to [Baby H] that evening.

GIBBS: Yes.

ASTBURY: But I think you were consultant on call that night as well?

GIBBS: Yes.

ASTBURY: Is it right that -- and we heard from Dr Ventress yesterday -- in the early hours of 26 September she called you as you were on call?

GIBBS: Yes.

ASTBURY: Do you recall what you were told by Dr Ventress at that stage?

GIBBS: Dr Ventress was experiencing -- [Baby H] was experiencing difficulties with her ventilation. I think from an hour or two before midnight, so the end of the 25th, Dr Ventress had been concerned about [Baby H] dropping her oxygen levels intermittently and she had manoeuvred one of the drains to try and improve any drainage of a pneumothorax. I think -- we don't have to, but, if we wanted to, we could look at the notes that Dr Ventress made. I think the cold light by her had shown some recurrence of a pneumothorax.

ASTBURY: I'm not going to ask you to guess. If we can go to tile 216, please. We have there the note. Really, I'm interested in what you understood to be the position when you -- you did then go into the unit, didn't you?

GIBBS: Despite having two X-rays, [Baby H], very unusually, seemed to have developed another tension pneumothorax. And that was partly from the cold light and I think there had been an X-ray done late on the 25th or early on the 26th, which had shown a tension pneumothorax again having reoccurred. It was compromising ventilation, [Baby H] was needing a lot of oxygen through the ventilator and higher pressures, which is what you'd expect if you have a tension pneumothorax, so the tension pneumothorax needed to be treated.

ASTBURY: Right.

GIBBS: Dr Ventress had tried to treat it by manipulating the drain and I'm not sure, because it was done so many times, whether she had inserted -- no, she hadn't at this stage inserted a needle into the chest again, but she had tried to drain it through the drain.

ASTBURY: Okay. Did you look at that X-ray when you arrived on the unit?

GIBBS: Yes.

ASTBURY: I wonder if we could go, please, to tile 200. This was taken just before 11 o'clock.

GIBBS: Yes. So maybe a couple of hours before, I think, the telephone conversation with me at about 1 in the morning of the 26th, yes.

ASTBURY: Okay.

GIBBS: And the two chest drains can be seen on the left side.

Does my pointer work here?

ASTBURY: Yes, thank you for reminding me. We've connected a mouse that should enable you to point things out.

GIBBS: You can see a pigtail -- and you can see why it's called a pigtail, a curly tail, chest drain. Here is the straight -- this is the one Dr Jayaram had inserted, this is the one the day before Dr Harkness had inserted.

That's the tube through which -- the endotracheal tube through which [Baby H]'s being ventilated. This other line running down here is just a nasogastric tube going into the stomach.

The main problem on this X-ray is that the heart, which -- this is mainly the heart down here. That's part of the thymus there. The heart should sit slightly to the right and mainly to the left in the chest and it's shunted across to the right-hand side of the left, it should be more than in the middle and left side.

This is a normal sort of appearance of a lung on the right, just a very faint greyish appearance. Here you can see there's a lot more blackness around here. That blackness is air, it's not air inside the lung, which would look like this on the right, it's air outside the lung, which is why it looks a lot blacker, and the lung is compressed, collapsed down underneath that, which is unusual because there are two chest drains in the chest that should be draining air out of this side of the chest, air that's outside the lung, and yet these are not effective enough.

ASTBURY: Okay. So if we can perhaps -- that's what you saw when you arrived. Can we go to your note next, please, which is at tile 228. If you could explain your note to us, please. I think you already embarked upon that process because it reads:

"Chest X-ray shows re-accumulation of --

GIBBS: Left tension pneumothorax. Most air collecting medially, and that means to the middle of the chest, to the inner side of the left lung, and I've even described that further in brackets.

That means against the mediastinum, the mediastinum being the central structures in the middle of the chest.

Two existing chest drains, and I say:

"Blocked with yellow serous fluid and unable to obtain air."

In other words, we've talked before about the tube showing fluttering, which means air is coming out of them. There's no fluttering or bubbles coming out of them, despite aspirating, sucking on the drains. At this stage [Baby H] was needing a lot of oxygen, 80 to 100% O₂, to maintain sats in the mid-90s. So at least that was providing good, satisfactory, safe oxygen saturations levels in her blood, but needing a lot of oxygen to do that.

The pressure now has increased to 27/4. I think a figure we saw a bit earlier from earlier in the day was 20/5. Now it's gone up from 20 to 27, which you expect because the tension pneumothorax causes extra pressure inside the chest, pressing on the lung from the outside, making it more difficult to ventilate. If [Baby H] was breathing by herself she'd find it very difficult to breathe against that pressure, so we needed a much higher pressure on the ventilator to achieve adequate ventilation.

ASTBURY: I think the next line beginning "plan" indicates what you concluded?

GIBBS: Yes:

"Plan. Needs further chest drain"

And then:

"Anteromedially sited."

So that means -- antero, to the front, and medially, to the middle of the chest. The difficulty, though, is that the air seemed on the X-ray to be collecting in the middle of the chest

and towards the front of the chest. We try to avoid as far as possible inserting a chest drain right through the front of the chest, partly because you may hit major structures like the heart and great vessels in the chest going into the middle, but also from a cosmetic point of view, which is a long-term consideration, although the immediate consideration is to help a patient and as a life saving measure you might do things that have consequences long-term.

But long-term, any scarring from the chest drain looks more obvious in the front of the chest and may interfere with breast development in a girl, so we try to insert the chest drains at the outer side of the chest. But this was a challenge to get the chest drain from the outer side of the chest, but to get the end of it in the right place inside the chest.

ASTBURY: Right, okay.

GIBBS: And I just describe how I inserted a chest drain there.

ASTBURY: Is it unusual to insert a third chest drain in these circumstances?

GIBBS: I have only ever done it once in my career and that was this night.

ASTBURY: And why?

GIBBS: And I'd never heard of other patients needing -- there may be other patients that need three chest drains.

I've never heard of another patient needing three chest drains on the same side. I have been involved with patients needing a chest drain, one on each side, but never needing three together on the same side.

ASTBURY: So there are two already in place.

GIBBS: Yes.

ASTBURY: We've heard between the fifth -- the fifth and seventh spaces to the left side.

GIBBS: Yes.

ASTBURY: Why did you need, did you feel, to take this unusual course?

GIBBS: Because despite these two chest drains being present in [Baby H], she was still developing -- had developed yet another tension pneumothorax, which is a potentially life-threatening

complication. We could see on the chest X-ray there was air collecting but probably, and we have to assume this, not in an area where the two existing chest drains were able to drain it. So I inserted the chest drain, as I say here. I put fourth, crossed out fifth, around the fourth or fifth, and it's quite difficult in a little baby, even in an adult, but difficult in a small baby to count exactly which rib space you're in. So it was around the fourth or fifth space. But what I did, slightly differently, was more anteriorally, more to the front of the chest, where the air seemed to be, but still keeping on the outer side of the chest.

ASTBURY: Just so we understand, you're indicating -- obviously the recording won't pick it up. You indicated that I think the two were in the area under the arm; would that be right?

GIBBS: Yes, on the lateral side, outer side of chest.

ASTBURY: And yours in relation to those was closer to the centre?

GIBBS: It was in a similar position to the two existing drains but slightly more anteriorally, more towards the centre.

But, for reasons I've said, you try -- I would try, and one is advised to try, to avoid putting a chest drain right through the centre of the chest. So it was still at the side of the chest, but more towards the end, more anteriorally, and when I inserted it I try to -- and there's a wire you use to insert the chest drain with, to angle that wire to the front of the chest.

ASTBURY: Again, because, as you've told us, there are vital structures in there that require care?

GIBBS: Yes.

ASTBURY: So you mentioned a Seldinger technique?

GIBBS: Yes. Seldinger is the person who invented it. It's the name of the wire used to insert the chest drain.

ASTBURY: Thank you. At the end of your note, you were aiming to site proximal end?

GIBBS: Yes.

ASTBURY: Could you read the last couple of words?

GIBBS: The proximal end, the inner side, to site it anteriorally and medially to the front and the middle of the chest.

ASTBURY: All right. "Underwater seal" is the next line. Could you explain that?

GIBBS: The outer end of the drain that's hanging out of the chest is placed under water so you can see air bubbling out, but also that's a seal, it prevents air being sucked into the chest and making a pneumothorax re-accumulate. So it's a one-way valve mechanism to let air out of the chest but not into the chest, and also by the bubbles you can see and confirm air is being drained out of the chest.

ASTBURY: The drain there is described as swinging. Is that right?

GIBBS: Yes.

ASTBURY: What does that mean?

GIBBS: It means the water level was moving up and down as -- I was going to say [Baby H]'s breathing in and out but actually it's the ventilator doing it for [Baby H]. As the ventilator breathes in and out for [Baby H], the water level swings up and down, showing that the tube is patent, not blocked, so doing its job.

ASTBURY: Okay. The next line, please. Is that volume?

GIBBS: Volume/pressure. That's press. But volume pressure loops show improved compliance. On the ventilators we were using you can show little graphs, electronic graphs, which you can use to interpret how well you're ventilating a patient and how stiff a patient's lungs are, and this shows better compliance, so the lungs were moving better with the ventilator after putting this third chest drain in. That says FiO₂, the amount of oxygen has dropped. It was 80 to 100%. It's now down to 30%. So there'd been a marked improvement in [Baby H] having inserted this three chest drain.

ASTBURY: Okay. That's in relation to the amount of oxygen in the air with which she is being ventilated?

GIBBS: Yes.

ASTBURY: So that's reduction in the need for oxygen?

GIBBS: Yes, come down from 80 to 100% down to 30%.

ASTBURY: Is that last note, is that for chest X-ray?

GIBBS: Yes, to look at the position of the chest drain.

ASTBURY: Did you look at the chest X-ray that followed?

GIBBS: Um... I did, but I haven't written any comment down here.

ASTBURY: All right. Can we go, please, to tile 229? This may or may not be the one. This is timed, I think, at 2.30 am.

Tell us what you can see on that, please.

GIBBS: I'll try and use the pointer.

ASTBURY: Please do once the screen settles down.

GIBBS: So previously, we saw in [Baby H]'s chest X-ray one long straight drain and one pigtail, curly, drain. This is now the third drain. It's a curly one but the way it's been cut, you can't see the coils as well as this top drain. But it's the one I've tried to insert more anteriorly and more medially. Having a pigtail, the curly bit, slightly prevents you getting it to exactly where you want because it coils up on itself inside the chest. But anyway this is more anteriorly nearer to the front of the chest.

Now we can see the chest -- the heart here with the thymus at the top. We don't have to, but if we've got the two X-rays side by side. It's moved to the left-hand side, it's not as thrust over to the right-hand side as it was before, and here we can see a left lung that's now fully expanded, not that different to the right lung. And there's no blackness like out here, there's no blackness around it. Before, the blackness was up against the edge of the heart and in the middle here. That has disappeared. It's been drained away. That was air that was outside the lung, compressing the lung, has now gone.

ASTBURY: So as of -- if we can just remind ourselves of the time on that X-ray, 2.30. As of 2.30 what does that X-ray tell you about [Baby H]'s condition as far as it can in itself?

GIBBS: Just from the X-ray, there's no pneumothorax and both lungs look well expanded, but again we don't -- we need to look at [Baby H] herself, her other observations and so on. But it shows there's no pneumothorax here. So the third chest drain has been very helpful and we knew that from the way the oxygen had come down and all the parameters indicating how easy or difficult it is to ventilate a patient had improved in [Baby H].

ASTBURY: Right. If we come out of that tile, please. I want to ask you about tile 231 for the sake of completeness.

It would appear that you have prescribed a medication called lidocaine. Is that right?

GIBBS: Yes.

ASTBURY: Could you explain that to us, please? Lidocaine hydrochloride.

GIBBS: Could I see the time here? Administered...

ASTBURY: It looks like it's administered at 2.36 and filed at 2.36. So shortly after that X-ray was taken.

GIBBS: Mm... Oh, the lidocaine is a local anaesthetic and it is given by injection before undertaking a painful procedure. So I would have assumed I had given lidocaine, injected it, before inserting the chest drain. What I'm pausing about now, and I haven't looked at this for a long time, in fact I don't recall seeing this particular prescription since 7 years ago when it happened. The timing is slightly odd. You give the local anaesthetic before you insert the chest drain.

I'm not quite sure why the chest drain has been inserted and now there's a local anaesthetic here. What does sometimes happen is that we give a medication and then we record it later on the computer, and this is a computer recording, so sometimes the time of a medication is not exactly the time it was given. It looks like it is, but it's the time it was recorded as having been given.

ASTBURY: Well, we can see that the third drain is in at 2.30.

GIBBS: Yes.

ASTBURY: Your recollection is that you administered that particular medication before inserting the third chest drain?

GIBBS: Yes.

ASTBURY: So we know it must have been before 2.30 and it's entered on to the computer a little after you've checked the X-ray.

GIBBS: Yes, because in order to insert a chest drain -- I know in a way it sounds bad that we say -- and it does happen in medicine. We say this medicine was given at 2.32 and I'm telling you now that I think it was given before 2.32. But to insert a chest drain, you put a gown on, you put gloves on, you do it as a sterile procedure, and you cannot then go to the computer and start typing up the medication you're giving at the same time, so that's why sometimes entries are made after the event.

ASTBURY: Very good. Okay. So by the sound of it then, the X-ray has been taken, the third chest drain has done the job, you've updated the computer with the medication. Did you stay on the unit at that stage, did you continue to monitor [Baby H] or did you leave?

GIBBS: I left because I think I was called back shortly after.

ASTBURY: Right. Do you remember where you were when you were called back?

GIBBS: No, unless I've written it down.

ASTBURY: No, all right. Do you remember why you were called back?

GIBBS: Yes, because [Baby H] had deteriorated again.

ASTBURY: Okay. Again, just as far as your understanding was, the message you received, what did you understand to be the problem?

GIBBS: A very serious problem, that [Baby H] was requiring cardiopulmonary resuscitation, including adrenaline. So she had collapsed in that sense.

ASTBURY: Okay. The significance of adrenaline?

GIBBS: That's used in cardiac arrest. In babies, though, sometimes the heart has not stopped completely. If the heart rate has slowed down significantly -- and babies have a much faster heart rate normally than older people -- we would give adrenaline in that situation, particularly if you could not feel a pulse.

ASTBURY: Dealing with the NNU, was the use of adrenaline in these circumstances a commonplace occurrence?

GIBBS: No, it's not common to give adrenaline. It was becoming more common as events continued on the unit with repeated collapses of babies.

ASTBURY: But generally?

GIBBS: Generally not, no. Until 2015, uncommon.

ASTBURY: At what stage did you arrive by way of [Baby H]'s resuscitation, do you recall?

GIBBS: Well, I recall by having read the notes. I think, if we look at the note, I think I wrote down that I was called at about 3.30 in the morning and arrived at 3.36.

ASTBURY: Let's go to the note rather than ask you to guess. 262, please.

GIBBS: But a lot of my recall of what happened 7 years ago is based on what I wrote or others wrote about me or events at the time --

ASTBURY: Of course.

GIBBS: -- than having a vivid memory of exactly what was going on 7 years ago.

ASTBURY: Perhaps if we could go down a little bit nearer the top.

We can see there on the left is a list of times. This represents -- I think we've seen it before -- a resuscitation in the way in which they're recorded in the medical notes?

GIBBS: Yes. If you wouldn't mind, just the top there, where Dr Ventress, the registrar, has written that on my arrival, being bagged and so on. That means Dr Ventress wasn't on the neonatal unit at the time and that's why I wouldn't have been there because she wouldn't have had to start intervening if I was there. I wouldn't have been there standing there doing nothing, so I think she was called urgently to the unit and then that's why I think I had gone home after inserting the chest drain and then I was called back in.

ASTBURY: Right, okay. If we go down to the entry at 3.35, that's certainly when Dr Ventress records your arrival. If we go down to your note, please, next, which is more important, could you take us through your note, please?

GIBBS: Right. I was called in from home at around 3.30.

Arrived 3.36. Dr Ventress had just put down it was 3.35. I don't think that minute makes much difference.

CPR, cardiopulmonary resuscitation, was in progress.

That means [Baby H] was being ventilated, not with the ventilator anymore, but through the Neopuff, through the endotracheal tube, and I think the jury know all about the Neopuff now.

ASTBURY: Yes. So disconnected from the ventilation and physically being done by a nurse using -- I think we've seen a device with a button on the top; is that right?

GIBBS: Yes, but the breathing was being done for [Baby H] through her endotracheal tube that was still in her windpipe.

And also, someone would have been pressing -- I can't remember who -- pressing regularly on her chest to help circulation. Then I say that [Baby H] appeared pale, there was no pulse to be felt when the chest was compressed.

Sorry, no pulse when chest compression stopped. And then I put in brackets "femoral". This meant feeling the femoral pulse, which is the pulse at the top of the leg, a large artery that you can feel a pulse through.

When someone stopped pressing on [Baby H]'s chest, you couldn't feel a pulse. And obviously, the whole point of pressing on the chest is to try to stimulate and provide some circulation. So when someone was pressing on her chest, there was a pulse. When someone stopped pressing on her chest briefly, there was no pulse. This is why we say she was in cardiac arrest.

ASTBURY: Okay. You then go on to describe a bradycardia?

GIBBS: Yes. So bradycardia means a slow heart rate on the monitor, 50 to 70, and for babies it should be well above 100. Sinus bradycardia is just a type of bradycardia, an abnormally slow heart rate. Then I say:

"Had been given adrenaline, two doses".

I think two doses on my arrival. It would have been around the time I arrived, she'd already been given two doses.

ASTBURY: Yes.

GIBBS: Then the cold light was used. Because we knew that [Baby H] had suffered a whole series of tension pneumothoraces, so we performed the cold light again.

No evidence of a pneumothorax. Having already explained a very small pneumothorax may not be detected with a cold light, a life-threatening pneumothorax is a tension pneumothorax and it ought to show on a cold light. So the cold light did not suggest there was a tension pneumothorax.

I undertook a limited cardio echo. I am not -- I was not at that stage particularly expert at doing cardiac echoes, but this was just to check whether there was an abnormal amount of fluid collected around the heart, no more detailed assessment of the heart. I say here there was no obvious pericardial fluid, meaning fluid around the heart, because that can cause cardiac arrest and that could be the result of trauma, for example chest

drains that had been pushed against the heart, but the ultrasound did not show that that had happened.

ASTBURY: Okay.

GIBBS: I say in brackets:

"Tiny rim of [query] air against the left side of heart."

So the ultrasound, the cardiac echo, did suggest a black line against the heart, and that could be air, but it would only be a tiny amount of air and we already know the cold light did not show that there was any significant tension pneumothorax.

ASTBURY: Right.

GIBBS: This is an emergency situation. [Baby H]'s in cardiac arrest. I said the best way of detecting a pneumothorax, tension or otherwise, is the chest X-ray. There is no time to do a chest X-ray when you're trying to save a little baby's life, so we had to rely on cold light. Ultrasound can be done very quickly, we have the machine on the unit and we get the image immediately.

ASTBURY: Right. So the cardiac echo. What sort of device is that?

GIBBS: An ultrasound machine.

ASTBURY: That is the ultrasound machine?

GIBBS: Yes. It is a cardiac ultrasound. An image of the heart using ultrasound.

ASTBURY: Thank you. Further bolus of adrenaline?

GIBBS: Yes. This is the third one now that was given, so two just before I arrived, a third one after my arrival, and then a medication called atropine, which isn't often used in cardiac arrest situations, it's sometimes used and it helps to speed up the heart. The reason that was given is we had already given [Baby H] two doses of adrenaline, this was the third one. Adrenaline speeds up the heart but, very importantly, also makes a contraction stronger. Atropine just helps to speed up the heart rate and I felt that may help [Baby H].

ASTBURY: Okay. You've given a measurement there rounded up.

Is that to 60?

GIBBS: Yes, 60 micrograms. It's 20 micrograms per kilogram, but [Baby H] was only about 2.5 kg, but rounded it up to 60

micrograms. The exact dose isn't vital. Giving the right drug is very important. Then at this stage we now have a spontaneous output. By "spontaneous" I mean it didn't require someone pressing on [Baby H]'s heart. When you stopped pressing on her chest -- when you stopped pressing on her chest now you could feel pulses, so she was producing her own pulses.

ASTBURY: Her heart was working again?

GIBBS: Yes. The heart rate increased to 160 after 22 minutes.

That's not from giving these medications now, it's from the bradycardia first starting, but I wasn't there when it first started, I'm going by Dr Ventress' recollection of when it first started.

ASTBURY: That 22 minutes is from the start of the resuscitation process?

GIBBS: Yes, the start of the cardiac arrest and resuscitation.

ASTBURY: Until the point where you've detected spontaneous --

GIBBS: Spontaneous heart rate at a good rate of 160.

ASTBURY: That gives us an idea of how long this went on.

GIBBS: Yes. But 22 minutes without a cardiac output would be catastrophic, really, and likely to cause severe brain damage if no one was doing anything. Fortunately, [Baby H] had been given cardiopulmonary resuscitation. She was being ventilated, she was given a circulation by someone pressing on her heart, and that's why hopefully she hadn't been compromised by having a cardiac arrest or very slow heart rate for 22 minutes.

ASTBURY: Right. You then go on to make some post-CPR recordings; is that right?

GIBBS: Yes. The heart rate is remaining good, high-ish, 170 to 190. It wouldn't be unexpected for the heart rate to be even slightly faster than usual after the doses of adrenaline and atropine, and, importantly, [Baby H] was making good respiratory effort, which is very good because she was being ventilated before she collapsed with a cardiac arrest, but she's actually making her own respiratory efforts now:

"Fair AE [air entry] bilaterally."

I've put "crackles on the left". So there was reasonable air entry both sides of her chest. If she had a tension pneumothorax you wouldn't hear -- you'd expect to hear little or no air entry

on that side of the chest. So it's reassuring there is air entry on both sides of the chest, but a bit crackly, meaning probably secretions in the lung on the left side.

ASTBURY: So the cold light has suggested no pneumothorax at this point or no significant -- is that right?

GIBBS: I -- sorry, yes. Well, slightly earlier -- have I got control? Going back up my -- I said there was cold light, no evidence of a pneumothorax. And then it's probably some minutes later, recording these observations here, the post-cardiopulmonary resuscitation. So a few minutes earlier, no pneumothorax on cold light. I don't think we did another cold light -- I haven't recorded doing another cold light examination here. I'm just saying by listening to the chest and the fact she's only requiring 30% oxygen, remembering before the third chest drain she needed 70 to 80% oxygen, now only 30% means it's very unlikely there's a tension pneumothorax there.

ASTBURY: Right. Your next entry, is it "colour"?

GIBBS: "Colour is now pink and only requiring 30% oxygen".

ASTBURY: Thank you.

GIBBS: Now I'm trying to work out why [Baby H]'s arrested. We know she's had three tension pneumothoraces, requiring three chest drains at night, and it's unclear, but this is a cardio -- this is a cardiac arrest without any obvious pneumothorax and certainly without a tension pneumothorax. So why had [Baby H] suffered this cardiac arrest? I'm saying it's unclear why she had, but it began with a desaturation, so oxygen levels dropping.

I'm guided by what Dr Ventress and what [Baby H]'s observations showed because I wasn't there when it started. It started with the oxygen level dropping, desaturation. I'm now running through the various causes of a cardiopulmonary resuscitation, but particularly the causes for which you can provide some treatment, so you have to think what can we do to improve the situation.

So in view of normal electrolytes -- and I put "checked within the past 24 hours". That's a blood test to look at sodium, calcium and other chemicals in the blood; if they are very abnormal that can affect the heart and cause a cardiac arrest, but they had been checked within the previous 24 hours. Not immediately here because we'd have to send them off and it would take many minutes or an hour or two to get a result, but I'm just saying within the last 24 hours the electrolytes were

normal so they were not likely to be the cause of the cardiac arrest.

There was no obvious lack of a pneumothorax and lack of a tamponade, and that tamponade is fluid around the heart squashing or compressing the heart, which can cause a cardiac arrest. The reason I was a little concerned about that was simply because of these chest drains being inserted. Had that caused some irritation to the coverings of the heart, which can cause this fluid to accumulate outside the heart and cause tamponade? But there was no evidence of that. That's why I did the ultrasound.

ASTBURY: Yes.

GIBBS: And then hypoglycaemia. That's low blood glucose.

[Baby H] -- I can't remember the exact details -- [Baby H] had been having blood sugars checked intermittently and her blood sugars had been normal, so that wasn't a cause of the cardiac arrest.

No evidence of toxins. That's difficult to know without sending blood off and waiting weeks for a result, or days for a result, for toxins, but there was no reason to suspect that [Baby H] had any toxins in her blood.

ASTBURY: No.

GIBBS: And no evidence of a thromboembolism. That means a big blood clot affecting her heart. That's very rare in a child, very rare in a premature baby, but just looking for causes for this cardiac arrest because it had been unexpected.

ASTBURY: We've heard about differential diagnoses. Is this a process of ruling things out?

GIBBS: I'm running through the differential diagnosis of a cardiac arrest, yes.

Normal temperature because if you're very cold it can cause a cardiac arrest, but I mean extremely cold as in fallen into a frozen lake. These are all very unlikely. So then hypoxia, lack of oxygen, leading to profound bradycardia, that's low heart rate, and hypotension, low blood pressure, is the likely cause.

But that doesn't tell us why she got the hypoxia leading to these problems.

ASTBURY: Okay.

GIBBS: I think looking back at Dr Ventress' note, and it's a benefit -- I didn't write this in the statement, I don't think, but it's a benefit of preparing for court, reading through the notes yet again. Dr Ventress did think -- did drain, I think, some air from the chest.

ASTBURY: Yes. We can go back to that note if you wish.

GIBBS: So although, when I arrived, I could find no evidence of a pneumothorax, a tension pneumothorax, the fact that Dr Ventress, a little earlier before my arrival, had drained some air from outside the chest would suggest that a pneumothorax might have re-accumulated, but Dr Ventress had successfully treated that.

ASTBURY: Right.

GIBBS: So although I say it's all due to hypoxia, lack of oxygen, why should there be lack of oxygen on someone who's been ventilated with oxygen? Well, maybe the pneumothorax, despite the third chest drain having recently been -- a third chest drain having recently been inserted, a pneumothorax had re-accumulated because Dr Ventress has recorded she aspirated or sucked out some air.

ASTBURY: Right.

GIBBS: But I explained to [Baby H]'s parents at that time that [Baby H] was precarious, because, firstly, needing three chest X-rays is very unusual, but it's very worrying that, having done that within an hour or so later, she suffered a cardiac arrest. So I was worried that her condition was quite precarious.

ASTBURY: You then set out a plan at the end of your note.

GIBBS: Yes.

ASTBURY: "If BP", is that how it begins?

GIBBS: Yes:

"If blood pressure is less than 34 millimetres of mercury..."

The mean pressure -- and it's been measured regularly by the nurses in [Baby H]. If it drops down then to start inotropes. That's medication continuously given to help improve the blood pressure. The reason I was concerned about this is after a cardiac arrest, the heart may be compromised and may not maintain an adequate blood pressure, so if [Baby H]'s blood pressure was not adequate she would need support with inotropes.

As it turned out, she did very well and didn't need inotropes. And then to continue with her ventilation.

ASTBURY: Okay. I think for 26 September, where we now are, that concluded your dealings with [Baby H] that particular day when you finally left the NNU; is that right?

GIBBS: That's right, yes. The next entry is at 9 o'clock in the morning and I wasn't involved then.

MR ASTBURY: Okay. I'm conscious of the time, but I think I can probably finish in 2 or 3 minutes.

MR JUSTICE GOSS: Well, it might be more convenient just to finish the evidence-in-chief, not, obviously, cross-examination.

MR ASTBURY: I'm not going to go through what followed in any great detail. But you were aware because, as you have told us, you were her nominated consultant.

You were aware there was another collapse in the following hours of the morning?

GIBBS: Yes.

ASTBURY: You are aware that at 5.25 or thereabouts, a transport team on the 27th arrived and took [Baby H] to Arrowe Park Hospital?

GIBBS: Yes.

ASTBURY: That she was there for 3 days?

GIBBS: Yes.

ASTBURY: Where she managed without mechanical ventilation and in fact no longer required supplemental oxygen; is that right?

GIBBS: Eventually, yes. They gradually weaned that off and removed the chest drains.

ASTBURY: She returned to the Countess of Chester on 30 September?

GIBBS: Right, okay.

ASTBURY: Without any chest drains, as you've just told us. And I think the remainder of her stay at the NNU was uneventful.

GIBBS: That's right, just establishing her milk feeds.

ASTBURY: I think you have in an outpatient clinic seen [Baby H] since on a number of occasions?

GIBBS: Yes. She attended my outpatient clinic about seven times, I think, looking at the notes. I didn't see her every time, sometimes the registrar saw her. I saw her several times, including her final attendance, which is when she was 16 months old, doing very well indeed by that stage, and her early development was normal at that stage, which was very reassuring given all the problems she'd experienced. So I discharged her when she was 16 months old.

ASTBURY: Thank you.

GIBBS: She did have problems with gastro-oesophageal reflux and some other difficulties, which have settled down by this stage, but I don't know whether it's relevant to go into the relatively -- the other problems she had with feeding that we were dealing with in the clinic.

MR ASTBURY: No. I'm sure if someone does think that's relevant, they'll ask you. I'm not going to. I have no more questions. Thank you.

MR JUSTICE GOSS: Thank you, Dr Gibbs. We'll break off there. Obviously, you're going to be asked more questions. We'll resume at 2.10, please.

(In the absence of the jury)

MR JUSTICE GOSS: I gather that A4 paper is going to be provided to the jury. Will that be done today or on Monday?

MR JOHNSON: I think the police officers went off to -- apparently, there's a shop in Manchester called WH Smith and they bought some.

MR JUSTICE GOSS: Good. So that can be given to them now.

MR JOHNSON: Yes. I was suggesting that perhaps the court staff could say that they'd found some and just leave it at that.

MR JUSTICE GOSS: Yes. We'll just say some paper's been found for them and they can have it. The usher is not here, but perhaps that could be in their places for when they come back and we needn't waste any time distributing it at that point. Thank you.

(1.08 pm)

(The short adjournment)

(2.10 pm)

(In the presence of the jury)

Cross-examination by MR MYERS

MR JUSTICE GOSS: In front of each of you there's a A4 pad and a tag to keep it together because it's of the kind where sometimes the sheets become loose as you're working through them, so you can just tag them together to keep them in order. Thank you.

Yes, Mr Myers.

MR MYERS: My Lord.

Dr Gibbs, I'm sure you'd agree, it's very unusual to have three chest drains in one baby like this?

GIBBS: I have never experienced that before apart from [Baby H].

MYERS: So an exceptional experience for you?

GIBBS: Yes.

MYERS: And you are a very experienced doctor of many years' standing?

GIBBS: Yes, and I was at that time.

MYERS: Yes. You made reference at one point to the drains being put in at night. Just as a point of detail, just to remind us all, the first one, certainly, was put in at 10 o'clock in the morning on the 24 September by Dr Harkness.

GIBBS: Right. But that was put in in response to the tension pneumothorax that had occurred at night.

MYERS: Yes, but it goes in at that time.

GIBBS: But all the tension pneumothoraces occurred at night and all over three specific nights consecutively, which is extremely unusual and difficult to explain.

MYERS: Yeah. It just goes to show what an exceptional case [Baby H] was, doesn't it?

GIBBS: From the point of view of experiencing repeated tension pneumothoraces, yes.

MYERS: So one of them went in at 10 o'clock in the morning.

The second one, we know, was fitted by Dr Jayaram at about 2.30 on 25 September. And the third one by you in the early hours of the morning of the 26th.

GIBBS: Yes.

MYERS: Do you recall where the actual drain came from that you used?

GIBBS: No.

MYERS: Do you recall whether it was one that was taken from the resuscitation trolley to be used?

GIBBS: No, I don't remember where the drain came from, no.

MYERS: Do you recall whether there was any shortage of drains on the unit?

GIBBS: There had been a shortage because we don't expect three drains in three consecutive nights on one patient.

MYERS: So you wouldn't have more than several drains available at any one time?

GIBBS: We don't normally need to insert more than several drains at any one time.

MYERS: So it's something that there's not a lot of regular experience of in the unit then, Dr Gibbs?

GIBBS: No, but many of us on the unit had experience of inserting drains into premature babies.

MYERS: With regard to things that can be problematic with chest drains, one problem is that they can block with fluid outside the lung but still inside the chest wall, can't they?

GIBBS: Yes.

MYERS: And a pneumothorax can re-accumulate if a tear in the lung doesn't heal and air gathers out of reach of the chest drain or drains that are there?

GIBBS: To some extent it can. The bigger the tension pneumothorax becomes, the more the air then becomes within reach of any drain that's inserted.

MYERS: Both of those problems that I have identified are problems that you referred to in the statement that you wrote on [Baby H], aren't they?

GIBBS: Yes.

MYERS: I've got a copy here if you wish to see it and I can give it to you so you can follow the wording. Can I just give you a copy of your statement, please?

(Handed)

GIBBS: Thank you.

MR MYERS: My Lord, this is at page 15 of 16.

MR JUSTICE GOSS: Thank you.

MR MYERS: Statements page 2127, pages 14 into 15.

Dr Gibbs, if you look at the top right-hand corner; yes?

GIBBS: Yes. I've got page 14.

MYERS: Page 14, paragraph 80 is where you refer to the fact that chest drains can block with fluid outside the lung but inside the chest wall.

GIBBS: Yes.

MYERS: Paragraph 81 is where you say that:

"Even if a chest drain isn't blocked by the fluid, a pneumothorax can re-accumulate if the tear in the surface of the lung has not yet healed and air escapes out of the lung and is trapped within the chest wall out of reach of the chest drain that had previously been inserted."

GIBBS: Yes.

MYERS: So you're describing there how air can still escape and cause a pneumothorax to recur?

GIBBS: But I'm not describing accurately what happened to [Baby H]. A pneumothorax can re-accumulate. As I said, if a tension pneumothorax develops, that's a lot of air under pressure collapsing the lung, you would expect then it to become within reach of any chest drain that's inserted when you've got a lot of air accumulating.

MYERS: At paragraph 82, you say this:

"Each of these complications [so what we have just looked at] with the chest drain have been noted with [Baby H]: fluid

accumulating within a chest drain, a pneumothorax re-accumulating outside the area being drained by previously inserted chest drains."

Do you see that?

GIBBS: Yes.

MYERS: "These complications are likely to explain why the pneumothorax recurred on some occasions in [Baby H], causing a marked deterioration in her condition due to compression of the left lung."

GIBBS: Yes.

MYERS: Yes.

GIBBS: But what I did not realise, with the benefit of doing this statement 4 years ago and now coming to court now when I have the opportunity to review the notes, it surprised me to note that Dr Ventress on the night of the 25th to the 26th aspirated air out of the first of the drains that had been inserted over 2 days earlier showing that drain was still patent, it wasn't blocked.

I hadn't noticed that before when I did my statement.

Otherwise I might have said in fact they were not blocked.

MYERS: Looking at this objectively, you agree that complications like air escaping from a pre-existing pneumothorax can explain why there's a later pneumothorax that develops?

GIBBS: Yes, but usually there is a reason why another pneumothorax develops. That's because the biggest risk factor is the pressure needed to ventilate a baby. And reviewing [Baby H]'s notes on each of the nights she developed a tension pneumothorax, up until she deteriorated, the pressure she'd been receiving to help her ventilation had been steadily reducing, so you would not have expected her to develop a tension pneumothorax.

MYERS: Give me one moment, please.

(Pause)

Mechanical ventilation and the pressures of mechanical ventilation can put the lungs in a neonatal baby under strain, can't they?

GIBBS: Yes.

MYERS: A baby that's preterm may not have lungs that are very robust; do you agree?

GIBBS: Yes. Well, they may have lung complications, yes.

MYERS: And [Baby H] had respiratory distress syndrome, didn't she?

GIBBS: Yes.

MYERS: Are you aware a possible pneumothorax was identified for the first time on the morning of 24 September 2015 --

GIBBS: Yes.

MYERS: -- at about 8.40 am?

GIBBS: Yes, but she started to deteriorate from 7 am.

MYERS: Now, there are ways of dealing with a neonate's lungs to make them more pliable and more robust, aren't there?

GIBBS: Yes.

MYERS: One of them is to provide surfactant; do you agree?

GIBBS: Yes.

MYERS: If we look, please, at the clinical notes at T5, Mr Murphy. Scroll down, please, a bit further down.

Thank you very much.

Could we see the note by Dr Ventress, 8.20 on 24 September 2015?

GIBBS: Yes.

MYERS: Could we scroll down to the bottom of that, please?

We can see that this is 8.20 in the morning after [Baby H] was born. Part of the plan is for surfactant to be given once the ET position has been confirmed; do you see that?

GIBBS: Yes.

MYERS: The ET tube was inserted at 9 o'clock. Just scroll up to see that, please. We need to go up for that.

I can be corrected, but as a matter of record the ET tube is inserted at 9 o'clock, Dr Gibbs. Surfactant wasn't actually given to [Baby H] until 11.49 that day.

I can show you the ICU chart if you want to see that but it's a matter of record.

GIBBS: If that's what it says on the ITU charts then that presumably is correct. But I have already said earlier this morning that sometimes administration of medication is given later than the actual event. It depends when someone has the chance to type it into the computer.

MYERS: But a delay in giving surfactant in those circumstances, I'm going to suggest to you, is below the optimal performance.

GIBBS: It's best generally to give surfactant as soon as reasonably possible. You've already mentioned why there was a delay. If the endotracheal tube is not in the right place, you are not giving surfactant, which is administered down the endotracheal tube, correctly to a baby, so you need to get the chest X-ray first to see where the tube is before giving the surfactant and that's what Dr Ventress had written.

MYERS: But in this case what had happened was, with a baby who had RDS, mechanical ventilation began on her before she was given surfactant, didn't it?

GIBBS: Yes, because you need an endotracheal tube inserted through which you ventilate a child before you can give surfactant.

MYERS: As it happens, right at an early stage, that is capable of putting the lungs under stress, isn't it?

GIBBS: Sorry, what is capable of putting the lungs under stress?

MYERS: Mechanical ventilation can.

GIBBS: Yes, it can, yes.

MYERS: So one potential cause at the start of this for pneumothorax is pressure from mechanical ventilation?

GIBBS: That is a possible cause of a pneumothorax, yes.

MYERS: I want to ask you something else about risks associated with chest drains.

GIBBS: Sorry, can I just finish this point you're on? I think the chest X-ray that was done, that Dr Ventress wanted to wait

to give surfactant until it was done, showed a tension pneumothorax. That's a life-threatening emergency and Dr Harkness went on to treat that. So delaying giving surfactant because you're treating another life-threatening disorder is entirely appropriate.

MYERS: I'm not going to make any criticism of that, Dr Gibbs.

GIBBS: But that is the sequence of events, though.

MYERS: We'll confirm that.

Is there also a risk with chest drains of what happens if the tips of them inside the body come into contact with structures in the chest cavity?

GIBBS: Yes, inserting any foreign body, an instrument, a drain, into a body, you need to be careful, yes.

MYERS: You made reference a little earlier that you have to be careful that, for instance, it's not pushed or pulled so that it rubs into a lung and that it stays away from the heart.

GIBBS: I said repeatedly pushed or pulled, yes.

MYERS: I have got not pushed or pulled. But you agree there is a risk it could come into contact with a lung or a heart?

GIBBS: The chest drain always comes in contact with the lung.

It does naturally. Once the air has been drained, the lung re-expands and the chest drain is lying against the lung.

MYERS: You have to be careful a chest drain doesn't rub up against the heart or the pericardium, don't you?

GIBBS: Ideally yes.

MYERS: You went into some detail to explain why you can't go into the front of the chest because you don't want it to come into contact with the heart.

GIBBS: I don't think I said you don't want it to come into contact, I said there are major organs, the heart and the blood vessels. So you don't want to -- when you insert a -- a drain is a soft, plastic, pliable Silastic tube and it can lie against the heart or it can lie against the surface of the lung, and it always does end up against the surface of the lung.

When you're inserting it, it depends on the technique. The Seldinger technique, briefly mentioned, is a wire being pushed

into the chest and you need to be careful you don't insert that wire into an organ. But the end of the wire has a soft flexible tip to limit any damage.

The trocar insertion, which is the second drain that Dr Jayaram put in, is inserted with a metal rod and that can cause serious damage.

So it's the instruments you're using to insert the chest drain rather than the chest drain itself that might damage organs.

MYERS: Could we look at tile 341, please. This is a note made by a witness of whom we're going to hear a statement a little later this afternoon, Dr Soni. We can see it's 11.45 on 26 September 2015. Do you see that?

GIBBS: Yes.

MYERS: That's the morning after the incidents we're dealing with. Dr Soni was in contact with Dr Rath, who's a consultant neonatologist at Arrowe Park Hospital.

Do you see that?

GIBBS: Yes.

MYERS: Are you familiar with Dr Rath?

GIBBS: I don't know Dr Rath well. I know of Dr Rath.

MYERS: Are you aware there was consideration given as to whether [Baby H] should be transferred in fact to Arrowe Park Hospital?

GIBBS: Yes.

MYERS: And there are a number of things that follow here, but I'm just interested in the first couple. It says:

"Explained [Baby H]'s clinical condition..."

This is Dr Soni explaining it to Arrowe Park:

"... if they want her to be transferred out. They wouldn't at present as difficult to transfer drains and stable but advised to (1) clamp drain 1, which was done 48 hours ago. To repeat chest X-ray in 6 hours. If no re-accumulation can take that drain out."

Can we scroll up to see 2? That's what I'd like to show you:

"Possible cause for cardiac arrest could be that a drain is too close to the heart and touching pericardium. Can pull drain out if too far in. Shouldn't be close to midline."

Do you see that?

GIBBS: Yes.

MYERS: At Arrowe Park the doctor there certainly seems to recognise there's a danger if the drain is too close to the heart or touching the pericardium. Is that the same understanding at the Countess of Chester or do you have a different view of things there?

GIBBS: The doctor at Arrowe Park at this stage, by the morning of the 26th, had known and the history that was given was that [Baby H] had then started to experience recurrent episodes of bradycardia. That was from the late 25th, the 26th and then the night of the 27th. It was the recurrent episodes of bradycardia, I think, that had occurred on the 25th and 26th that the neonatologist was wondering, and he said possibly, could have caused the bradycardia.

MYERS: Do you accept there's a potential risk that a deterioration could follow if a chest drain is too close to the heart or touching -- and touching the pericardium?

GIBBS: Yes, there's a potential risk of inserting any chest drain into anyone.

MYERS: And do you agree that could happen if the chest drain is in, for example, too far?

GIBBS: Possibly, because it won't touch the heart unless it is in too far. But a problem we had with [Baby H] was, despite the drain she'd had put in, and I won't go through each one at a time, air was still accumulating.

I did spend some time this morning discussing how the third chest drain had to be carefully angled and pushed anteriorly and medially, that means towards the heart, because that was where the air was collecting so you have to try and drain the air and the other drains at that time were not doing it. So we deliberately tried to angle the chest drains further into the chest than we would normally do because of the problems [Baby H] was experiencing.

MYERS: So that would increase the chance that it could come into contact with the heart and pericardium, wouldn't it?

GIBBS: Yes, it, would, but just coming into contact with the heart and pericardium does not necessarily cause any problems.

MYERS: But plainly it would appear from this note it could do?

GIBBS: The neonatologist wondered whether the bradycardias might have been caused by a drain too medially.

MYERS: Could we look, please, at a note that you --

GIBBS: Sorry, can I just finish that? After the chest drain was removed at the request of the neonatologist, [Baby H], the notes will show, on the night of 26th and early morning of 27th continued to suffer episodes of bradycardia. I would suggest that means taking the chest drain out did not stop the problem that the neonatologist thought might have been caused by the chest drain. Therefore it wasn't the chest drain causing her heart rhythm problems.

MYERS: Well, I'm looking at a variety of factors that may or may not play a part, working through them. I am dealing with that.

GIBBS: You're right: the chest drain pushed up against the heart, deliberately so because that's where the air was accumulating, might have caused rhythm problems in the heart. Removing that chest drain did not stop [Baby H] carrying on having episodes of bradycardia. So in [Baby H]'s case, rather than suggesting what might have caused it, we know that chest drain wasn't causing it.

MYERS: Well, we don't -- I'm not going to debate that further.

GIBBS: We took the chest drain out and she continued to have episodes of bradycardia and needing full cardiorespiratory resuscitation in the early hours of the 27th.

MYERS: And we're going to come to that in due course. And there can be different reasons why a baby may have bradycardia and desaturate, can't there?

GIBBS: Yes.

MYERS: Different clinical reasons.

GIBBS: There can be many reasons, yes.

MYERS: Yes.

Now, let's deal with what you were involved with leading up to the nights you've told us about. Could we look, please, at the clinical notes, yours, at tile 2160. Sorry, my fault, T160.

We've got your note here at 17.45, Dr Gibbs.

If we look at the end of your note you refer to fixing the chest drain more securely to the chest wall.

Do you see that?

GIBBS: Yes.

MYERS: This is the second chest drain, isn't it, that you're talking about?

GIBBS: Yes, at this stage.

MYERS: It is. The third one is yet to be fitted?

GIBBS: That's right.

MYERS: This is the non-pigtail drain, the one fitted by Dr Jayaram, isn't it?

GIBBS: Yes. Yes.

MYERS: You described in your evidence earlier that there had been movement out compared to the previous X-ray 12 hours earlier; is that right?

GIBBS: About 12 hours earlier, yes.

MYERS: So however this chest drain had been secured, it certainly appeared to have moved from the time it was inserted?

GIBBS: Yes.

MYERS: Do you recall whether the nurses on duty brought this to your attention at the time, which is why you then dealt with it in this way?

GIBBS: No, I can't remember, but it's very likely -- it's likely it was the appearance on the chest X-ray that brought it to my attention because you can see the difference in the position of the drain on the two chest X-rays, this one -- one done at this time and one done about 12 hours earlier.

MYERS: I am just going to show you something in the nursing notes and ask --

GIBBS: Can I bring something to your attention in my note here?

The interesting thing is that at 17.45, when the chest X-ray did show an appearance of a pneumothorax but not a large pneumothorax and not a tension pneumothorax, just a pneumothorax, and that was confirmed on the chest X-ray, the cold light, as I mentioned this morning, was negative, normal, did not show a pneumothorax.

I think in retrospect, on the morning of the 24th, early in the morning, as you say, the chest drain wasn't inserted until 10 o'clock. The tension pneumothorax was noted after mechanical ventilation started at around 7/8 o'clock in the morning. But for some reason [Baby H] had suddenly deteriorated around 7 am and the cold light was negative at that stage. This here confirms that a cold light does not detect all pneumothoraces, even ones that are there on an X-ray.

I think it likely that the pneumothorax in [Baby H] started when she suddenly deteriorated at 7 in the morning, not at the time the chest X-ray was taken an hour or two later and was showing the tension pneumothorax after mechanical ventilation.

MYERS: All right.

GIBBS: So we have three tension pneumothoraces developing on three consecutive nights, which is very unusual.

MYERS: As is putting in three chest drains?

GIBBS: Yes, because the tension pneumothorax kept occurring at night.

MYERS: You're making quite a point of that, aren't you, of course? We all know that.

GIBBS: But they didn't occur at any other time throughout her stay on our unit or at Arrowe Park.

MYERS: Just so we can follow that, that's a deliberate point you're making, your repeated reference to night, isn't it?

GIBBS: All the tension pneumothoraces occurred on three consecutive nights.

MYERS: I'm going to ask you to answer the questions that I ask if I would, please. These three gentlemen will do the prosecution's case, all right?

GIBBS: Okay.

MYERS: If you look, please, at tile T144 next, please. Scroll down to the second page. We have seen these notes before. Just

so you can see, could we look at the first page so Dr Gibbs can see who made the notes and the time we're dealing with. We are looking at a note made by [Nurse D], a nurse. Could we go up to the bottom of page -- the first part of the tile. It's tile 144.

Thank you. The note begins at 20.31 by [Nurse D] on 25 September 2015. Do you see that at the bottom where it says "addendum", Dr Gibbs?

GIBBS: Right, okay.

MYERS: Let's read it and then I can ask you a couple of questions about this:

"Went up to the Cestrian to update mum at 16.00 whilst Dr Harkness carried out a head scan. At 16.21 [Baby H] started to desaturate. No air entry heard. ET tube suctioned and help summoned from colleague. Crash call placed for paediatrician. No secretions obtained on suction. [Baby H] bagged with Neopuff but no colour change on capnograph. Still no air entry so ET tube removed. Doctors arrived. [Baby H] being bagged with Neopuff, spontaneously breathing, 30% oxygen with saturations 100%. Re-intubated by Dr Austin on second attempt at 16.40."

And it gives the size of the tube:

"On moving [Baby H] back in position, noted bedding to be wet and stained, probably with secretions from chest drain. Air entry good on right but none on left. Improved if tube held back slightly. Doctors contacted and Dr Gibbs then pulled ET tube back to 8 centimetres as possibly slipped when tying in. Chest X-ray taken. ET tube in good position. Second chest drain noted to be in a different position and holes close to chest wall. Further Tegaderm applied and chest drain tubing position altered. Both chest drains bubbling ++."

We see as we look down later on, just after [Nurse D] had used the IV line, the long line, there was a further desaturation at about 19.00 to 56% but I'm not asking you about that.

This dovetails, doesn't it, with the entry that we have seen in your notes where you secured the chest drain; is that correct?

GIBBS: Yes, and where the chest X-ray shows a pneumothorax, small pneumothorax, not tension, but the cold light didn't indicate a pneumothorax.

MYERS: Mm. It would appear that the chest drain that Dr Jayaram had inserted in the early hours of the morning had, certainly at some point, moved; is that correct?

GIBBS: Yes.

MYERS: Where it says, about eight or nine lines down:

"Noted bedding to be wet probably with secretions from chest drain."

Did that refer then though leakage around the chest drain through the chest, out of the chest?

GIBBS: Presumably it does.

MYERS: And that can happen, can't it?

GIBBS: Yes.

MYERS: In any event, you then secured that; is that correct?

GIBBS: Well, I secured it or I might have asked Staff [Nurse D] to secure it. It was secured with more Tegaderm, which is like a sort of sticking plaster that's quite gentle on the skin because premature babies have more delicate skin.

MYERS: I'm going to move forwards next now to when you attend the unit at 2.15 on the morning of 26 September. That was at tile 228, please, Mr Murphy.

You told us you identify a tension pneumothorax, we can see that in the first line; is that correct?

GIBBS: Yes, because of the chest X-ray appearance.

MYERS: You described earlier about how the ventilation pressure had been increased at some point and I wasn't clear, so I'd be grateful if you could help me, and maybe the jury, in relation to when you identified the tension pneumothorax and when was the ventilation pressure increased?

GIBBS: I can't remember exactly, but I know that Dr Ventress, the registrar, had been summoned to the unit and has written several entries from a little before -- I think her entry was just before midnight of the night of 25th into 26th, so 2 hours before this, saying that there had been problems, and so presumably during that time she might have increased the ventilation --

MYERS: Right.

GIBBS: -- or asked for the ventilation pressure to be increased.

MYERS: As it happens, you identifying this tension pneumothorax follows an increase in ventilation pressure, probably by Dr Ventress; is that correct?

GIBBS: I'm trying to remember what was in the notes previously.

I think Dr Ventress herself had thought the pneumothorax had re-accumulated. She repositioned one of the drains before midnight to try and drain it, and at some time over those couple of hours the ventilation pressure was increased. So yes, the ventilator pressure had been increased before this chest X-ray was taken showing the tension pneumothorax, but it was increased in response to increasing difficulties in ventilating [Baby H] properly and Dr Ventress' entry suggested a pneumothorax had re-accumulated at that time. That's an hour or two before this X-ray was taken.

MYERS: One reason why there may be difficulty with breathing or oxygenation is if the ET tube is blocked; do you agree?

GIBBS: Yes.

MYERS: Moving away from the desaturations that took place that afternoon that we've just looked at, and we can look at Dr Ventress' note if this helps you, starting at page 12547, and that's -- I'm looking for the T number.

The J number is 12547. We'll get the T number later if we need it.

MR JUSTICE GOSS: It's 216.

MR MYERS: I'm grateful, my Lord. T216.

23.50:

"Several episodes of desaturation in the past 2 hours. First one after gas taken. Became agitated. Yellow serous fluid coming from drain, 8ml. Improved eventually with bagging. One episode associated with poor chest movement. Bradycardia. Suctioned ET and thick mucus suctioned. Chest movement improved."

Do you see that? And the sats rise.

GIBBS: Yes.

MYERS: That's consistent with some sort of blockage with the ET which is then cleared and breathing improves, isn't it?

GIBBS: Maybe a partial or complete blockage, yes, and then the next -- it carries on, she aspirated air out of the drain so

there was a pneumothorax there, and this is an hour or two before the chest X-ray was taken.

MYERS: Looking through what happened, there's a blockage and a blockage can be sufficient to interfere with breathing, can't it?

GIBBS: Yes.

MYERS: I would like to move down then to 21.00 when ventilation pressures change, increase. If we scroll down, I don't think we're there yet. 01.00 now. Oxygen -- is that "increased to 70%"?

GIBBS: It looks like it, yes.

MYERS: Does that involve an increase in ventilation pressure?

GIBBS: No.

MYERS: Right:

"No further profound desaturations since midnight, but poor gas."

Do you see that?

GIBBS: Yes.

MYERS: This is the point, if we read through, the readings are there, "Now in 100% oxygen". Is that:

"Breathing up to 60"?

GIBBS: "Increase the ventilator rate to 60."

MYERS: So the ventilator rate increases at that point. That looks like:

"Cuff BP starting to drop."

What does that mean from what you understand?

GIBBS: Blood pressure was beginning to drop.

MYERS: Right. And a cold light test is still the same, slightly brighter on the left, but not transilluminating the whole chest, and you were called to come in. That's where we get to.

GIBBS: Yes, but I would call that a positive test as it's transilluminating on the left, so it is showing a pneumothorax.

And we've already established a cold light won't show a pneumothorax until it is quite significant, quite large. So there's a large pneumothorax at the time Dr Ventress then pushed the pressure up. It had happened before the pressure was put up.

MYERS: And can an increase in pressure make or exacerbate a problem with a pneumothorax?

GIBBS: Yes.

MYERS: You inserted, after you arrived, the third chest drain, didn't you?

GIBBS: Yes.

MYERS: If we look at your notes, I'm going to ask if we can scroll down, please, to the lower part of the page. We might need to go to tile 228, please.

Picking up where we were then, Dr Gibbs, you insert another pigtail drain, don't you?

GIBBS: Yes.

MYERS: And you have put there, it's centre of the entry:

"8.5 pigtail drain inserted in..."

Can you read that? Interpret that for us.

GIBBS: "Via Seldinger technique."

MYERS: "Via Seldinger technique in..."

GIBBS: I wasn't sure if it's the fourth or fifth and I have ended up deciding it must be the fifth, but I have explained in a small baby it's hard to know exactly which number space between the ribs you're inserting a drain.

MYERS: We know there was already another pigtail drain around that area, the first one.

GIBBS: Yes.

MYERS: Why did you go for the area of the fourth or fifth intercostal space?

GIBBS: Because that's a recommended place to insert a chest drain, but I did not put it in exactly the same place.

I said here, as we discussed this morning, I inserted it more anteriorally, more to the front of the chest, and then when it was inserted, using the wire that you use to insert it, tried to aim it more to the front of the chest and across into nearer the middle of the chest where the air seemed to be accumulating in the pneumothorax.

MYERS: All right. I asked you why you went for the fourth and fifth, that's what I wanted to know and you've explained that, thank you.

You left the hospital after this briefly, didn't you?

GIBBS: Yes.

MYERS: And then you returned when there was a serious deterioration round about 3.30. The deterioration started shortly before then; is that correct?

GIBBS: Yes.

MYERS: And by the time of this final deterioration in this sequence there had been a large number of desaturations in [Baby H]'s condition over a period of days, hadn't there?

GIBBS: Yes.

MYERS: And some of them, from your reading of the notes, do you agree, had been significant desaturations?

GIBBS: Yes.

MYERS: She'd undergone a significant number of medical and clinical interventions, hadn't she?

GIBBS: Yes.

MYERS: And three chest drains is a significant amount of intervention, isn't it?

GIBBS: An extremely unusual amount of intervention, yes.

MYERS: And significant in terms of impact on a little baby, isn't it, potentially?

GIBBS: Potentially, but otherwise if you leave a tension pneumothorax, you have a dead patient. So sometimes the trauma or the complications or the stress you may cause is necessary to save a life.

MYERS: Yes.

GIBBS: So we had to put those drains in. If we'd left her with a tension pneumothorax, it is a life-threatening problem.

MYERS: I'm not going to disagree that, of course, you do what's necessary to save life. But one observation you made in your report, Dr Gibbs, it was at paragraph 75, statements page 2125, page 13 of 16 -- you put:

"[Baby H] suffered from respiratory distress syndrome after birth, which is a common problem in premature babies due to immature stiff lungs. She needed initial CPAP support and then BiPAP support before requiring mechanical ventilation because of a deterioration in her breathing. This sequence of events is well-known in some premature infants because the respiratory distress syndrome often worsens in the early days of life before stabilising and then improving. Also a small infant with any breathing difficulties can become increasingly fatigued because of the continuing increased effort to breathe and this can lead to deterioration in their overall condition."

That's what you said, wasn't it?

GIBBS: Yes.

MYERS: If we look at [Baby H]'s course over the 3 days or so leading up to this, this was a protracted and severe sequence of breathing difficulties, wasn't it?

GIBBS: Yes.

MYERS: And medical intervention?

GIBBS: Yes -- well, that required medical intervention, yes.

MYERS: And the cumulative effect of that on her was potentially quite gruelling, wasn't it?

GIBBS: Yes, as it is for any patient needing intensive care and multiple procedures, yes.

MYERS: And of course you have no experience yourself, for all your years of clinical experience, of what happens to a baby like this if a third chest drain is put in in these circumstances, do you?

GIBBS: I have never seen three chest drains put on one side before, yes.

MYERS: So it is entirely possible that she could deteriorate significantly with the cumulative stress of what she had undergone over a period of days?

GIBBS: Yes, by the end of all of that you mean?

MYERS: By the time we get to this event at about 3.20 on 26 September.

GIBBS: Yes, that was associated with another pneumothorax.

MYERS: But I'm saying --

GIBBS: It wasn't unexplained. It's not as though it was all the stress: she had another pneumothorax at that time and that was causing her deterioration.

MYERS: I suggest to you that if a little baby has been through everything she's been through, it's not inconceivable she may collapse in a fashion such as the one we encounter on that morning.

GIBBS: Yes, but we know she collapsed with -- associated with another pneumothorax, which is very unusual. This is another pneumothorax despite there being three chest drains in her at that stage.

MYERS: It may be unusual, but the cumulative effect of all of this could be enough to cause her collapse, couldn't it?

GIBBS: It could be, but we know her collapse was associated with yet another pneumothorax, which is very unusual with three chest drains in.

MYERS: Well, we all recognise that's an unusual situation.

That's what I wanted to establish with you and you agree, that can lead to the collapse.

GIBBS: I'm sorry, I don't quite get your point. We know that the reason she collapsed in the early hours of the 26th was because she had another pneumothorax despite three chest drains. Of course she has also undergone many procedures up until then, but it wasn't as though there's no explanation for her collapse: it was another pneumothorax associated with that collapse.

MYERS: So you are not in any doubt and no one is in any doubt about my point, and I apologise if it is not clear, she had undergone a huge amount by then under clinical conditions with the doctors, with the treatment, and with what was going on in

her lungs, and it is no surprise off the back of all of that that she had a collapse. That's what I'm putting to you.

GIBBS: After I'd inserted the third chest drain on the morning of the 26th, in the early hours, she was stable, her ventilation was stable, her oxygenation had come right down to 30%. Otherwise I wouldn't have left the hospital. So I was surprised she collapsed again having been stable after the third chest drain was inserted.

MR MYERS: Thank you, Dr Gibbs.

Re-examination by MR ASTBURY

MR ASTBURY: Just one matter, my Lord, arising, please.

MR JUSTICE GOSS: Yes, certainly.

MR ASTBURY: Dr Gibbs, you were asked about the delay between the initial intubation and the administration of surfactant on the morning of 24 September. You were shown the notes -- we're going to go back to them, but the note at 8.10 from Dr Varghese, indicating that he had intubated and a note from Dr Ventress in retrospect indicating that that's what had happened and that a chest X-ray was planned. Do you remember being shown that during cross-examination?

GIBBS: Yes.

ASTBURY: All right. Would the result of that chest X-ray, and thus the position of the endotracheal tube, in any way cause a delay for the administration of surfactant?

GIBBS: As I tried to make clear, it showed a tension pneumothorax, a life-threatening problem, and I think attention was then directed to treating that tension pneumothorax. So that -- because attention is then directed towards a more important problem, that's why -- and I don't know exactly why there was a delay in the surfactant, but I know her tension pneumothorax had to be treated urgently.

ASTBURY: Okay. And that followed during the course of that morning?

GIBBS: Yes, and giving surfactant helps to reduce the pressure you need to ventilate a lung, but if you're given the choice between do you administer surfactant or do you treat a tension pneumothorax, you treat the tension pneumothorax first; it's life-threatening.

MR ASTBURY: Thank you. I don't need to take that any further.

Further cross-examination by MR MYERS

MR MYERS: There is one matter I would be grateful if I could just confirm.

MR JUSTICE GOSS: Yes, certainly.

MR MYERS: Thank you.

Dr Gibbs, you'll recall that I showed you a note where Dr Soni had a conversation with the doctor at Arrowe Park. So you're not at any disadvantage, I'll just remind you what it was and we can all see it. It's at T341. Paragraph 2, please, Mr Murphy:

"Possible cause for cardiac arrest could be that a drain is too close to the heart and touching pericardium."

Do you recall that?

GIBBS: Yes.

MYERS: You made the observation that -- did you say the drain has been removed before the following night?

GIBBS: Yes.

MYERS: Just so we can be clear, I'd like to put up radiograph 12680. This is an image from the early hours of the morning of the following night, 27 September 2015. It's an image at 1.34 on 27 September 2015.

Can you see there, there's a pigtail drain that's inserted, isn't there?

GIBBS: Yes.

MYERS: And there's also -- is that the second drain that Dr Jayaram had inserted, the straight non-pigtail drain?

GIBBS: Yes.

MYERS: So as it happens, whatever drain had been removed, the second drain is still in when we get to 27 September in the early hours of the morning, wasn't it?

GIBBS: Yes.

MYERS: Right. That's what I wanted to confirm, thank you.

GIBBS: But can I just point out on this X-ray, you cannot tell from this view how close it is to the heart.

MYERS: No. It could be very close or it might not be.

GIBBS: Yes.

MR MYERS: Right, thank you.

MR JUSTICE GOSS: I just have one matter. I really, I think, need Mr Myers' assistance in relation to this first of all. It's just this, Mr Myers: are you putting to the doctor that by reason of the various medical problems that [Baby H] had experienced and the procedures that had been carried out that the emergency that required the resuscitation at about 3.30 that morning was a consequence of what had gone before and the medical procedures and was not attributable to her having another pneumothorax, tension pneumothorax?

MR MYERS: As for the procedure, which Dr Gibbs has engaged in, that was to deal with the situation as he saw as he has described it to us.

MR JUSTICE GOSS: I just want to be clear so I know what it is that's being put. I think that maybe where Dr Gibbs was having difficulty in the question. So I just wanted to see if we could clarify it and then, if necessary, Dr Gibbs can answer that point if that is the point. It may be that I'm misunderstanding the point.

MR MYERS: I am just looking at the accumulation of treatment that [Baby H] had received, looking at the position of the drains in the course of the time they were there, and therefore looking at what took place at each stage. I wasn't questioning whether or not there was a pneumothorax that needed to be drained. We're not debating that. Plainly, in the views of Dr Gibbs, there was a reason to insert the drain and we don't suggest he was wrong to do so.

MR JUSTICE GOSS: No, no. I knew you weren't suggesting that.

MR MYERS: We don't give the same clean bill of health to everything that happened to [Baby H] during this. We've looked at what Dr Jayaram did and we're interested in that in that context. So we're interested in looking at what happens with that second drain, where it goes and what it could have done, and we're also interested in looking -- and we say it's important to consider the whole picture with [Baby H]. Of course, we heard the clinicians say many times, don't just take one or two things, look at the whole picture. That's what we're doing over those 3 days, my Lord. So we're looking at the

cumulative effect, or what could be the cumulative effect, of all the procedures she underwent upon her.

MR JUSTICE GOSS: So that could be responsible for the actual emergency situation. I needn't go through what it was because we've had it rehearsed in evidence.

That's what --

MR MYERS: Yes.

MR JUSTICE GOSS: So --

GIBBS: And my response to that, my Lord, is that it is true, Mr Myers is correct, it is true that repeated procedures and having three chest drains inserted into the chest, and repeated intubations because of a blocked tube, adds a stress to a neonate. But each one was done for a very good, important reason. At the end of all of that was after I'd put the third chest drain in, before I went home, before being called back an hour or two later.

She was stable, her oxygen had come down and then she deteriorated an hour or two later. So I don't think you can say that having repeated chest drains was the reason she deteriorated at 3 in the morning because after all those chest drains, and I put the last one in, she was stable, oxygenation had come down, and why then would she suddenly deteriorate a couple of hours later?

I don't think it's tenable to say it's the stress of all the previous episodes. She was in a good condition at the end of the third of those chest drains.

MR JUSTICE GOSS: All right.

MR MYERS: I make it plain, my Lord. We certainly don't accept for one minute that the mere fact an hour went by before it happened explains that at all. These things can happen unexpectedly and in far less dramatic circumstances than what was going on with [Baby H].

That's where we are with this.

MR JUSTICE GOSS: Right.

GIBBS: But in that hour that went by --

MR JUSTICE GOSS: Well, I don't think we --

GIBBS: There was another pneumothorax. Dr Ventress had confirmed that.

MR JUSTICE GOSS: I think we understand where the differences lie now and what Mr Myers is suggesting and what your response is.

MR ASTBURY: Thank you, my Lord. Anything further?

MR JUSTICE GOSS: No. Thank you very much, Dr Gibbs.

You will be returning later in the trial, so please remember what I said to you before. Don't talk to anyone about this case or anything to do with this case, any of the patients concerned. Thank you very much.

(The witness withdrew)

MR ASTBURY: My Lord, I'm afraid that's as far as we can go this afternoon.

MR JUSTICE GOSS: Oh, we're not having anything read?

MR ASTBURY: No, there's been a change.

MR JUSTICE GOSS: All right.

Well, I did say yesterday there was a prospect we might finish slightly earlier today and I've been proved right. So that's it for today and obviously for this week. 10.30 on Monday morning, please, when we will continue.

Just so that the jury know, I think it's anticipated that we will complete the evidence in relation to [Baby H] on Tuesday.

MR ASTBURY: Tuesday afternoon, we think.

MR JUSTICE GOSS: All right. That's so you know how we're proceeding. Then we'll move on to the next baby after that. Thank you very much. Please, of course, remember your obligations. No research, no conversations with anyone unless you're all together. Thank you very much.

(In the absence of the jury)

Mr Myers, will someone want to see --

MR MYERS: Yes, we're grateful, my Lord, thank you.

MR JUSTICE GOSS: Someone will be down very shortly.

Thank you very much.

(3.02 pm)

(The hearing adjourned until 10.30 am on Monday, 23 January 2023)