

23 February 2023

Baby M

+ Nurse witnesses re Baby L

CONTENTS

DR JOHN GIBBS (recalled)

Examination-in-chief by MR ASTBURY

MS MINNA LAPPALAINEN (affirmed)

Examination-in-chief by MR ASTBURY

MS CLARE BEVAN (sworn)

Examination-in-chief by MR ASTBURY

MS ASHLEIGH HUDSON (recalled)

Examination-in-chief by MR ASTBURY

MS LISA WALKER (recalled)

Examination-in-chief by MR ASTBURY

Witness statement of DR ARJAMAND SHAUQ (read)

DR DEWI EVANS (recalled)

Examination-in-chief by MR JOHNSON

Cross-examination by MR MYERS

Witness statement of PROFESSOR STAVROS STIVAROS (read)

DR SANDIE BOHIN (recalled)

Examination-in-chief by MR JOHNSON

Cross-examination by MR MYERS

Summary of interview with LUCY LETBY re [Baby M] (read)

Housekeeping

Thursday, 23 February 2023

(10.30 am)

(Delay in proceedings)

(10.38 am)

(In the presence of the jury)

MR JUSTICE GOSS: Sorry you've been kept waiting for 10 minutes: there was a technical issue, but we're able to proceed now.

MR ASTBURY: Thank you, my Lord. I recall Dr John Gibbs, please.

DR JOHN GIBBS (recalled)

Examination-in-chief by MR ASTBURY

MR ASTBURY: Could we, for the recording, start with your name?

GIBBS: John Gibbs.

ASTBURY: You have given evidence before and you have come to assist us today with your dealings with a baby by the name of [Baby M] --

GIBBS: Yes.

ASTBURY: -- back in April 2016. You have prepared a statement in this matter?

GIBBS: Yes.

ASTBURY: In that statement, by way of introduction, you reminded yourself that he was born on 8 April 2016?

GIBBS: Yes.

ASTBURY: You noted that his Apgar scores were high and thus he was in good condition?

GIBBS: That's right, yes.

ASTBURY: Because he was small and premature, he was admitted with his twin, [Baby L], to the neonatal unit at Chester?

GIBBS: That's right.

ASTBURY: The purpose was to monitor and establish feeds?

GIBBS: Yes.

ASTBURY: Is it right that on the first day of [Baby M]'s life his blood was taken to check for infection?

GIBBS: Yes.

ASTBURY: And that subsequently that blood did not reveal any bacterial infection?

GIBBS: That's correct.

ASTBURY: Is it right that his C-reactive protein, one of the indicators of infection, as we've heard, was less than 1 during the first day of life and indeed the next few days?

GIBBS: That's correct, and it's not just an indication of infection, it's also an indication of any inflammation in the body and it indicated neither of those were likely to be present.

ASTBURY: Thank you. We have heard of events on the afternoon of 9 April 2016 when [Baby M] was attended by Doctors Ukoh and Jayaram as a consequence of a collapse that day. Is it right that you first met [Baby M] at 9.35 am on 10 April 2016?

GIBBS: Yes.

ASTBURY: Which would be his third day of life?

GIBBS: That's correct.

ASTBURY: And you took a note of your examination of [Baby M] on that occasion?

GIBBS: Yes, I did.

ASTBURY: I wonder if we could go to that note, please. Tile 348, Mr Murphy.

Would you wish to refresh your memory from the note before we go through it?

(Pause)

We have not only heard about the events of the preceding day, we've also heard about some treatment that [Baby M] received through the early hours of the morning on 10 April. Would you have familiarised yourself with that from the notes before you examined him?

GIBBS: Yes. Partly from the notes and partly because we always have handover at about 8.30 in the morning of all the patients on the neonatal unit, so I would have been told a summary of what had happened to him the previous afternoon and during the night.

ASTBURY: Thank you. We've heard from a [Dr A] who treated him on the 9th. Does that accord with your recollection of the handover?

GIBBS: Yes.

ASTBURY: Was it with [Dr A] you spoke before you examined [Baby M]?

GIBBS: He would have led the handover, yes. This is the Sunday morning, yes, about 8.30.

ASTBURY: Thank you. If we could then look at your note, you begin with the age and the corrected age.

GIBBS: That's correct.

ASTBURY: Then if you could take us through your note.

GIBBS: The problems for [Baby M] when I saw him on the Sunday morning at about 9.35 -- the main problem was he'd had a cardiorespiratory arrest on the previous day, that was in the afternoon. I put down "query septic", was it probably due to infection, or "query NEC", necrotising enterocolitis. But it subsequently transpired he didn't have either of those, so there was no proper explanation for his cardiorespiratory arrest.

Then the second problem, he's the second of two twins, and that DCDA just means they were just likely, but not definite, to be non-identical twins.

Number 3, he had born by lower segment caesarean section, and caesarean section because of IUGR, intrauterine growth retardation in the first twin, that's his twin, [Baby L].

Then he'd also, number 4, become jaundiced on the first day of life and we call that early jaundice because jaundice in premature babies is not uncommon by 3 or 4 days of age, less common in the first day of life.

Then number 5, he'd been suffering from recurrent brief -- and I originally wrote "apnoea", crossed it out and initialled it above. Apnoea would mean he stops breathing but I decided it was more accurate to say bradyapnoea, abnormally slow breathing, with oxygen desaturations, desats, and that "brady" there means slowing of the heart rate, bradycardia.

ASTBURY: Thank you. So slowing but not stopping, that being the distinction?

GIBBS: Most of the time, yes.

ASTBURY: You have then noted the drugs that he was receiving?

GIBBS: Yes, those are three different antibiotics he was on at that time.

ASTBURY: Then fluids. Intravenous?

GIBBS: Yes, intravenous and that's the volume, 90ml per kilogram per day of TPN, total parenteral nutrition.

He was not receiving anything by mouth at the moment while he was recovering from his cardiorespiratory arrest the previous afternoon.

ASTBURY: We have heard that he went nil by mouth shortly before that --

GIBBS: That's correct. He was still nil by mouth on the Sunday morning.

ASTBURY: Is that on examination?

GIBBS: Yes. Well, actually, probably just -- it's meant to be just before on examination. I have inserted a line:

"Minimal bili [that's bile stains] nasogastric aspirates overnight."

Then I put "on examination", and then I record my findings on examining [Baby M]. So he was quiet, and by quiet he's only a little baby, 3 days old, a 33-week premature baby. By quiet I just meant he was not moving much at all, not just not making sounds.

He was receiving CPAP support for his breathing. So he's breathing by himself but with a little extra pressure to help keep his lungs open and he was needing a modest amount of oxygen, 26% rather than the normal 21% that's in air. And the pressure of the CPAP, I have just recorded it for information, was 6.5 centimetres of water.

ASTBURY: Thank you. Can I just interrupt for a moment, we heard yesterday that overnight his ventilation had moved from mechanical ventilation, intubation, he had then been extubated, he'd gone from BiPAP to CPAP. Does that tell you anything with your experience?

GIBBS: It meant he was needing less support progressively with his breathing, so from that point of view he was improving, yes.

ASTBURY: The next note, please.

GIBBS: He had clear -- that's -- the "BS" is breath sounds. So listening to his chest, it was clear on both sides.

Heart sounds were normal. That's the first and second heart sound plus nil, meaning no murmurs. Then I've written he had a soft abdomen and it was not tender.

ASTBURY: Thank you. If we can scroll down a little bit. You've set out a plan in light of your notes and examination.

GIBBS: Yes. The plan was to add caffeine, but I've written an explanation for that. His carbon dioxide levels on his blood gases were moderately increased. That's the upper arrow. And I have put in brackets "in the 7s".

Normally they should be up to about 6.5, so it's an increase in his carbon dioxide levels, with a corresponding drop in his pH, meaning he was a little bit acidotic and I put in brackets 7.25. That's acceptable but we generally don't like to allow the pH to drop much below 7.25.

And because of the fact he was having episodes of bradyapnoea, slowing of his breathing, in fact looking at his observation chart, his breathing level was relatively slow for a premature baby and the fact that his carbon dioxide level was slightly elevated, meaning he wasn't quite breathing enough, I felt we should add caffeine, which is a respiratory stimulant, it helps to stimulate breathing in premature babies.

ASTBURY: Okay.

GIBBS: Then to continue with the ABs, the antibiotics, and remain NBM, nil by mouth. And then to repeat some blood tests, a further CRP, full blood count and U&Es.

That CRP and full blood count showed no increase in the CRP level, no increase in the white cell count, so all remaining normal and making it unlikely he was suffering from infection or NEC.

ASTBURY: We see then your signature. Is that the conclusion of that particular examination?

GIBBS: Yes, at that time.

ASTBURY: We can see that there follows, fairly soon after, another note. Were you asked to review [Baby M] shortly after you'd finished that examination?

GIBBS: Yes. And from memory, in between those two, in the 40 minutes in between, I'd seen his brother, [Baby L]. So I was still with the twins but I had moved on to [Baby L], when something happened to [Baby M] and I was called back to him.

ASTBURY: So you'd looked at [Baby L] for about 40 minutes or so. Do you remember who asked you to look again at [Baby M]?

GIBBS: I can't remember exactly. It was likely to be the nurse looking after him and I know from the notes who that nurse was.

ASTBURY: We heard a statement yesterday, I think, from Laura Eagles; is that correct?

GIBBS: That's correct, that's the nurse who's recorded in the notes, yes.

ASTBURY: What did you find when you asked -- what were you told first and then what did you find?

GIBBS: Well, at that time, [Baby M] had recovered because Staff Nurse Eagles had provided some support for his breathing, but his breathing had slowed down again, that's bradyapnoea, going to briefly stopping breathing, that's the apnoea, and the oxygen level had dropped to 60% instead of remaining above 90%.

And at the end of that line I put:

"Not responding to tactile stimulation..."

That's stroking or flicking [Baby M]'s feet. That was being done by the nurse, I didn't do that:

"Not responding to tactile stimulation and increased facial oxygen."

So the oxygen was turned up from the 26% to between 60% and 100%. But he didn't respond to that, but he did then respond to being Neopuffed, so giving him some ventilation breaths just through a mask on his face.

That was for about 90 seconds.

The plan I made before that that we've already referred to was to give caffeine. It hadn't been given by this stage, so given that [Baby M] was continuing to have slowing of his breathing, I felt it was time to make sure the caffeine was given as soon as possible to stimulate his breathing.

ASTBURY: Thank you. We'll come to that in a moment. From your notes, what you found, the treatment that he received, what concerns would that raise?

GIBBS: Well, the concern was that although he was recovering from the need for full ventilation, he was still needing stimulation intermittently because his breathing was slowing down, and therefore we needed to give him more help, in addition to continuing antibiotics for any infection that might have been

there that we never proved, but he needed some extra help with his breathing.

ASTBURY: You mentioned the caffeine. If I can ask Mr Murphy, please, to go to the next tile, 354. We probably don't need to go behind it. We can see that the caffeine was then administered at 10.31. That would be following on from your instruction at 10.15?

GIBBS: Yes.

ASTBURY: After the caffeine and in the days that followed, are you aware whether [Baby M] continued to suffer with any breathing difficulties?

GIBBS: I don't believe he did. I didn't see him every day after that, but looking at his observation charts, the caffeine coincided with an improvement in that he didn't have episodes where he needed stimulation for his breathing after that, as recorded by the nurses.

ASTBURY: Was his breathing support escalated in any way?

GIBBS: No. I think it was a couple of days later he managed without the CPAP and then, I can't remember exactly when, the additional oxygen was no longer needed. So he did steadily improve after that.

ASTBURY: So his breathing continued in the same trajectory as in the morning of the 10th and in the days that followed?

GIBBS: Yes, but with the change being the episodes where he would slow or sometimes stop his breathing stopped after the caffeine had been given.

ASTBURY: Did the antibiotics continue?

GIBBS: They did whilst waiting for the blood cultures and then were stopped some days later when the cultures were negative and yet again there had been -- over 48 to 72 hours after the time I saw [Baby M], his white cell count and his CRP remained normal, indicating it was unlikely he was suffering from an infection.

ASTBURY: So no evidence of an infection?

GIBBS: That's correct.

ASTBURY: Was an X-ray taken of [Baby M] at the time?

GIBBS: Various X-rays were taken from [Baby M], the first one being after his cardiorespiratory arrest.

ASTBURY: Were you able to look at those X-rays whilst treating him?

GIBBS: Yes.

ASTBURY: What did they tell you about the collapse that had occurred on 9 April?

GIBBS: Well, to me, they did not provide any explanation. In particular, his lung fields were clear on those X-rays -- the X-rays taken, I think, an hour after the first one, an hour after his cardiorespiratory arrest had begun, showed clear. Subsequent X-rays were mainly taken to look at various lines that were inserted to him over the next -- into him over the next few days.

ASTBURY: Any evidence on those X-rays of what we've heard of as NEC or necrotising enterocolitis?

GIBBS: No.

ASTBURY: Did the investigation, if I can put it that way, extend to a heart scan?

GIBBS: Yes.

ASTBURY: Is that an ultrasound scan undertaken by your colleague, Dr Brearey?

GIBBS: Yes, Dr Brearey, I think on the 13th. It was a couple of days after I'd seen [Baby M].

ASTBURY: Thank you. Did that ultrasound scan of the heart reveal any explanation for events on 9 April?

GIBBS: No. The reason I hesitate is that Dr Brearey thought, looking at the comments he made in the notes, there might have been a thrombus in one of the chambers of the heart but on review a few days later it was normal, and on discussion with the heart specialist in Liverpool, their view was probably it was a variation of normal that he'd seen and not a thrombus in the heart. If there'd been thrombus in the heart, it would be very uncertain whether that had caused any cardiorespiratory arrest or in fact the result of the heart having stopped for a period of time, so whether it was cause or effect from the cardiorespiratory arrest. But the overall conclusion, and Dr Brearey would be able to tell the court more, was that probably the scan was completely normal.

ASTBURY: In fact, we will hear from the consultant who he spoke to, so thank you for the introduction. How would you characterise [Baby M]'s recovery from the event on 9 April?

GIBBS: He made a steady recovery, but when I saw him on that morning of the 10th, he still wasn't behaving normally in that he was quiet and his breathing was slow. But that's explicable for a child who had very nearly died the previous afternoon. So it could have been a consequence of that that he wasn't behaving normally and had some breathing difficulties. And also, it could be partly the consequence of all the medication he'd required to be mechanically ventilated for 10 hours or so after the cardiorespiratory arrest.

ASTBURY: Thank you. Did [Baby M]'s recovery continue to the extent that he was discharged about 3.5 weeks later?

GIBBS: Yes. So he did make a good recovery and, in particular, managed to get back on to feeds and was feeding well by the time he was discharged, which is an encouraging sign for a premature baby.

MR ASTBURY: Thank you. I have no more questions for you, Dr Gibbs. Thank you. If you could wait there, please.

MR MYERS: We have no questions, my Lord.

MR JUSTICE GOSS: Thank you, Mr Myers. I have no questions either. Thank you, Dr Gibbs, for coming back and giving evidence this morning. You will be giving evidence again I see from the list, so what I have said to you before still applies: no conversation with anyone about anything to do with this case. Thank you very much indeed.

(The witness withdrew)

MR ASTBURY: My Lord, Minna Lappalainen, please.

MS MINNA LAPPALAINEN (affirmed)

Examination-in-chief by MR ASTBURY

MR ASTBURY: Could we start with your full name, please?

LAPPALAINEN: My full name is Minna (inaudible) Lappalainen.

ASTBURY: Even though I'm asking the questions, and I know it's very artificial, could I ask you to keep your voice up, please, so that the ladies and gentlemen at the back of the room can hear you clearly.

LAPPALAINEN: Okay. Can you hear me? Yes?

ASTBURY: Thank you. Your occupation, please?

LAPPALAINEN: I'm a retired senior neonatal nurse.

ASTBURY: Were you employed in that capacity at the neonatal unit at Chester in 2016?

LAPPALAINEN: Yes.

ASTBURY: You've been reminded that in that capacity, you were working a night shift on the neonatal unit between the 8th and 9 April 2016; is that right?

LAPPALAINEN: Yes.

ASTBURY: We've heard about various bands of nurses, the banding process. What band would you have been considered that particular night shift?

LAPPALAINEN: A band 6.

ASTBURY: Thank you. I think you have seen the notes from your night shift?

LAPPALAINEN: Yes.

ASTBURY: And you were able to confirm that you were not the designated nurse for a baby called [Baby L]?

LAPPALAINEN: That's correct.

ASTBURY: And you were able to check the notes. Can you confirm whether or not insulin was prescribed for [Baby L] on that particular night shift?

LAPPALAINEN: No.

ASTBURY: Did you counter-check any insulin prescription or otherwise that particular night?

LAPPALAINEN: No.

ASTBURY: And did you administer insulin to [Baby L] during that night shift?

LAPPALAINEN: No.

MR ASTBURY: Thank you.

MR MYERS: No questions, thank you.

MR ASTBURY: Thank you, nurse.

We anticipate we will hear from Nurse Lappalainen again.

MR JUSTICE GOSS: That completes your evidence at this stage. Thank you very much for coming this morning and giving evidence. You will, I gather, be required again later on in the trial. You'll be told when that is, obviously. In the meantime please don't talk to anyone about anything to do with this case, any of the babies or anything to do with it. All right?

LAPPALAINEN: Okay.

MR JUSTICE GOSS: Thank you very much indeed.

(The witness withdrew)

MR ASTBURY: My Lord, Claire Bevan, please.

MS CLARE BEVAN (sworn)

Examination-in-chief by MR ASTBURY

MR ASTBURY: Could we begin with your full name, please?

BEVAN: Clare Elizabeth Bevan.

ASTBURY: Your occupation, please?

BEVAN: Mortgage and protection consultant.

ASTBURY: Were you in 2016 employed at the Countess of Chester Hospital?

BEVAN: Yes.

ASTBURY: Were you employed there as a nurse?

BEVAN: Yes.

ASTBURY: And specifically, were you employed in the neonatal unit at that hospital?

BEVAN: Yes.

ASTBURY: We've heard a little about banding. What band nurse would you have been considered in April 2016?

BEVAN: Band 6.

ASTBURY: Thank you. You've been reminded that you worked a night shift from 8 April into 9 April in that year.

BEVAN: Yes.

ASTBURY: A baby in the unit at that time was named [Baby L].

May I ask you, did you at any stage administer [Baby L] with insulin?

BEVAN: No.

ASTBURY: Were you aware of anybody else administering insulin to [Baby L]?

BEVAN: Not that I'm aware of.

MR ASTBURY: Thank you.

MR MYERS: No questions, thank you, my Lord.

MR JUSTICE GOSS: Thank you very much. That completes your evidence this morning. Thank you very much for coming and giving it. Required again, Mr Astbury?

MR ASTBURY: We don't think so.

MR JUSTICE GOSS: It doesn't seem as though you are required to give evidence again during the course of this trial.

Is that your understanding?

BEVAN: I think so.

MR JUSTICE GOSS: You've not been told otherwise?

BEVAN: No.

MR JUSTICE GOSS: Just in case for some unexpected reason you are required to come and give further evidence, would you please not talk to anyone about anything to do with this case until it's all over?

BEVAN: Of course.

MR JUSTICE GOSS: Thank you very much.

(The witness withdrew)

MR ASTBURY: My Lord, I recall Ashleigh Hudson, please.

MS ASHLEIGH HUDSON (recalled)

Examination-in-chief by MR ASTBURY

MR ASTBURY: Could I just ask you to state your name for the record, please?

HUDSON: It's Ashleigh Hudson.

ASTBURY: Thank you. We know that you were employed at the neonatal unit at Chester back in 2016.

HUDSON: Yes.

ASTBURY: And you have, I think, been reminded that you two worked two day shifts in 2016 on 8 April -- I'm sure you worked more than this, but you worked two in particular on the 8th and 9 April 2016?

HUDSON: Yes.

ASTBURY: And you've been asked about your involvement with a baby called [Baby L].

HUDSON: Yes.

ASTBURY: Have you had the opportunity to check the notes from those two day shifts before today?

HUDSON: I haven't looked at the notes, I looked that I was on shift that day.

ASTBURY: From your recollection, did you have cause to administer [Baby L] on either of those two day shifts with insulin?

HUDSON: No.

ASTBURY: Were you aware of anybody else having done so?

HUDSON: No.

MR ASTBURY: Thank you.

MR MYERS: No questions, thank you.

MR JUSTICE GOSS: Right. Thank you for coming back and giving that evidence. That completes your evidence at this stage. It's not anticipated that you're going to be required again to give evidence. But just in case, I will repeat what I've said to you

before: don't talk to anyone about anything to do with this case until it's finished.

HUDSON: Okay, thank you very much.

MR JUSTICE GOSS: Thank you very much for coming.

(The witness withdrew)

MR ASTBURY: My Lord, we'll need a short break.

MR JUSTICE GOSS: I have just seen that. The screens have to be put up. Just a few minutes' break, please.

(11.09 am)

(A short break)

(11.11 am)

(In the absence of the jury)

MR JOHNSON: Because we can only call Professor Hindmarsh tomorrow, we're going to deal with the expert evidence of a piece about [Baby L] tomorrow because we also anticipate that once Professor Hindmarsh has given his evidence and the battle lines, if there are any, between the parties --

MR JUSTICE GOSS: You needn't say anymore, especially as the defendant's not present. Can I just say I understand why that is the case and it seems eminently sensible.

MR JOHNSON: Thank you. Which means that after this next witness and another witness to be read, there will only be the two experts for [Baby M].

MR JUSTICE GOSS: Right. Obviously, you've discussed this with Mr Myers?

MR JOHNSON: Yes, of course.

MR JUSTICE GOSS: And you're content?

MR MYERS: We are. As your Lordship has observed on many occasions, and it holds true, the volume of material being dealt with in this case is enormous, therefore where there are shortenings of the day, it's crucial for ongoing preparation and we can make good use of that time.

MR JUSTICE GOSS: Thank you very much. We've mentioned this in the absence of the defendant, but obviously she will be aware of this?

MR MYERS: Yes.

MR JUSTICE GOSS: When we get to the stage, which will be presumably after Dr Shauq -- am I correct in pronouncing his name correctly?

MR ASTBURY: Yes.

MR JUSTICE GOSS: Then you can explain that in the presence of the jury and I'll say that I entirely approve of it and I'm sure the jury will understand the logic and sense of that.

MR JOHNSON: Thank you. Just in the longer term, we think 22 March or thereabouts will be the last evidence relating to individual cases.

MR JUSTICE GOSS: Right. Thank you very much. I hope you're not tempting fate.

MR MYERS: It seems extraordinarily precise to me. 11.20, Mr Driver says, my Lord, but we question that as well!

MR JUSTICE GOSS: Thank you very much. We'll see how we get on. Anyway, thank you very much.

The defendant can come back into court, as can the -- oh, we need the witness in, of course we do.

I was getting ahead of myself there with the excitement.

MR MYERS: Whilst we talk about the timings, I know the defendant isn't here, but this is merely administrative and we can relay the detail of this to her, there's a matter that the prosecution and defence have been assessing and that is the transition from the case of [Baby K] to [Baby N]. We anticipate commencing the evidence...

MR JUSTICE GOSS: Just one moment, please. Thank you.

MR MYERS: I'll be brief. We anticipate commencing the evidence of [Baby K] on Monday. That will conclude, we all believe, on Wednesday at some point. The question then arises of when we start the case of [Baby N], which is an entirely different case, it's not like [Babies L & M] and [Babies A & B] where there is an obvious connection.

Plainly, if the case of [Baby K] finished well within the morning slot, we understand that court may well take the view we should move on with [Baby N] and that may well be possible to do. But if the case of [Baby K] runs up to lunchtime or beyond it, certainly from our point of view we would be grateful if we could commence [Baby N] on the Thursday morning.

There are two reasons for that --

MR JUSTICE GOSS: You needn't expound the reasons. I'm sure everyone -- Mr Driver?

MR DRIVER: On our current projection, we'll be calling Dr Evans and Dr Bohin (inaudible: off microphone) on that Wednesday morning (inaudible: off microphone) Wednesday and Thursday.

MR JUSTICE GOSS: If it's an earlier day, it's an earlier day. It won't cause any witness difficulties thereafter?

MR DRIVER: No, no, and the [Family of Baby N] would appreciate certainty.

MR JUSTICE GOSS: Exactly. They don't want to come here not knowing when the case concerning their child is going to start. Yes, all right.

MR DRIVER: Thank you.

MR MYERS: Thank you.

MR JUSTICE GOSS: The witness, please.

(In the presence of the jury)

MS LISA WALKER (recalled)

Examination-in-chief by MR ASTBURY

MR ASTBURY: I know you have given evidence before, but if I could ask you to state your name for the record, please?

WALKER: It's Lisa Walker.

ASTBURY: Nurse Walker, we know that you were employed as a nursery nurse in the Countess of Chester Hospital in the neonatal unit in 2015.

WALKER: That's correct.

ASTBURY: Did that extend into 2016?

WALKER: Yes.

ASTBURY: Were you employed in April of 2016 on the unit?

WALKER: I was, yes.

ASTBURY: Thank you. You've been asked about your recollections of a night shift that you worked between the 8th and 9 April 2016 specifically --

WALKER: Yes, that's correct.

ASTBURY: -- and in particular, a baby called [Baby L]. Did you at any point during that shift administer insulin to [Baby L]?

WALKER: No, I didn't.

MR ASTBURY: Thank you.

MR MYERS: No questions, thank you, my Lord.

MR ASTBURY: Thank you, my Lord.

MR JUSTICE GOSS: Required again?

MR ASTBURY: We don't think so.

MR JUSTICE GOSS: Thank you very much for coming and giving that evidence. It is not anticipated you will be required again, but I will, just out of an abundance of caution, say to you what I've said before just in case for some unexpected reason you do have to come back and give evidence: please don't talk to anyone about anything to do with this case until it's all over. All right?

WALKER: Yes.

MR JUSTICE GOSS: Thank you very much.

WALKER: Thank you.

MR JUSTICE GOSS: Please just remain seated there. Very short, members of the jury. You'll be back quicker this time, it will be a much shorter delay.

(Pause)

Witness statement of DR ARJAMAND SHAUQ (read)

MR ASTBURY: My Lord, read evidence next, please, following on from the evidence of Dr Gibbs is a statement from a Dr Arjamand

Shauq. He is a consultant cardiologist and in his statement dated 28 March 2018 he says as follows:

"I am employed as a consultant cardiologist at Alder Hey Children's Hospital in Liverpool. Shortly after 13 April 2016, I received a letter dated 13 April 2016 from Dr Stephen Brearey, a consultant paediatrician at the Countess of Chester Hospital.

"The letter referred to the sudden collapse of a baby called [Baby M] on day 2 of life. Dr Brearey had carried out an echocardiogram (ultrasound) scan of [Baby M]'s heart and was asking me for my advice on whether a structure within the heart visible on the echo images could be a thrombus.

"At or around the same time, I received a CD containing echocardiogram images of [Baby M]'s heart. The disc contains a number of moving images of [Baby M]'s heart and clearly shows the structure queried by Dr Brearey. Having viewed the images, I can state that the structure queried by Dr Brearey is not a thrombus and is in fact a structure called a eustachian valve. A eustachian valve is perfectly normal in infants as it is a remnant of the foetal structure of the heart."

That concludes, my Lord, the relevant part of that statement.

MR JUSTICE GOSS: We have heard evidence about the eustachian valve before, haven't we, I think?

MR ASTBURY: I think that was the PFO, the patent --

MR JUSTICE GOSS: That was a different valve? This is another valve, the eustachian valve. Anyway, the point is it's perfectly normal.

MR ASTBURY: Described as perfectly normal. Thank you.

MR JOHNSON: We're moving on to the expert evidence now, my Lord. It's slightly earlier than the normal break, but it's a matter for my Lord.

MR JUSTICE GOSS: You've been in and out, in and out. This is entirely for you or any one of you. Do you want to have a break now or would you rather have a break in about half an hour's time? About half an hour.

MR JOHNSON: Very good. Dr Dewi Evans then, please.

DR DEWI EVANS (recalled)

Examination-in-chief by MR JOHNSON

MR JUSTICE GOSS: Mr Johnson, I think you're going to explain what evidence the jury is going to hear from Dr Evans and then Dr Bohin at this stage and the reason for that.

MR JOHNSON: Yes.

MR JUSTICE GOSS: This is something I was told this morning and you're now going to hear what Mr Johnson told me in your absence. It's to do with -- you'll understand exactly why this is happening when he explains it.

MR JOHNSON: You know, ladies and gentlemen, that we're dealing with both [Babies L & M] together in effect, although we've tried, insofar as we've been able with witness issues, to compartmentalise the evidence for each. We are now moving to the stage of calling the expert evidence for each. Professor Peter Hindmarsh will be here tomorrow to deal with the issue of insulin.

And because he's the pre-eminent expert in that narrow field, we will call him first. Therefore we will call Dr Evans here and Dr Bohin after Dr Hindmarsh tomorrow.

So it follows that what you're about to receive is evidence relating simply to [Baby M], so we have reversed the order to use the time, obviously. So Dr Evans first on [Baby M] and then Dr Bohin on [Baby M].

MR JUSTICE GOSS: If I could just say that that was explained to me and you knew last week that Professor Hindmarsh couldn't come until later this week to give evidence because of commitments. It's obviously eminently sensible and appropriate that it's done this way. There would be no point hearing the experts and then hearing what Professor Hindmarsh has to say about it. So that's why it's being done and now Dr Evans will simply be confining himself to the second twin. We'll hear Dr Evans and Dr Bohin again later after Professor Hindmarsh has given his evidence.

MR JOHNSON: Thank you very much.

MR JUSTICE GOSS: You were told about that, obviously, as well.

EVANS: Yes, my Lord.

MR JUSTICE GOSS: So you're prepared for that. Thank you very much.

MR JOHNSON: Welcome back, Dr Evans. For the recording, would you identify yourself, please?

EVANS: Dr Dewi Evans.

JOHNSON: Thank you, doctor. In relation to [Baby M], you have written several reports; is that right?

EVANS: I have.

JOHNSON: I'll do my best to get it right this time. Your sift report was 21 November 2017; is that right?

EVANS: Correct.

JOHNSON: You followed that with your more substantive report on 2 June 2018?

EVANS: Yes.

JOHNSON: There was a pagination issue which you dealt with in a short report on 24 June 2018?

EVANS: Yes.

JOHNSON: Then was there a -- sorry, we then move on to 17 October 2021; is that right?

EVANS: Yes, that's correct.

JOHNSON: Then another pagination issue that had arisen dealing with the records and technicalities involving the records or administrative issues involving the records, 21 October 2021?

EVANS: Yes.

JOHNSON: A very short report on 11 September 2022?

EVANS: Yes.

JOHNSON: And then finally, 13 September 2022?

EVANS: Yes, that's correct.

JOHNSON: Very good. So starting, if we may, just to recalibrate our view of the overall position regarding [Baby M], can we turn to your report of 2 June 2018?

EVANS: Yes.

JOHNSON: There you noted that [Baby M] was born on 8 April 2016?

EVANS: Yes.

JOHNSON: And if anyone wants to keep a note of where this information is, it's tile 2. You recorded his birth weight?

EVANS: Yes.

JOHNSON: His gestational age?

EVANS: Yes.

JOHNSON: The fact that [Baby M]'s case was the 24th that you were asked to review from the Countess of Chester Hospital?

EVANS: Yes.

JOHNSON: So far as material that you were sent at that stage -- and I insert in parentheses that subsequently you received further information, but at the stage you were writing this report the information you received was restricted to, in effect, the medical records from the Countess of Chester Hospital?

EVANS: Yes, that's correct.

JOHNSON: Just to give the jury an idea of what that involves, it's 670 pages of paper if it was printed out?

EVANS: Yes, that's correct.

JOHNSON: Just looking -- I'm looking at your paragraph 5 now.

You recorded the fact that [Baby M] was born by C-section?

EVANS: Yes.

JOHNSON: His mum had received steroids antenatally?

EVANS: Yes.

JOHNSON: His gestational age was 33 plus 2?

EVANS: Yes.

JOHNSON: The Apgar scores, which at 1 minute was 9, at 5 minutes was 9, and 10 at 10 minutes?

EVANS: Yes.

JOHNSON: The fact that he was admitted to the NNU at 10.30 that same morning?

EVANS: Yes.

JOHNSON: And you record various vital signs, including temperature, heart rate, respiratory rate, oxygen saturation?

EVANS: Yes.

JOHNSON: You observe that he received fluids and was commenced on antibiotics?

EVANS: Yes.

JOHNSON: And that at 11.15 that same morning, so about an hour after birth, the doctors' view was that he was in good condition?

EVANS: Correct.

JOHNSON: You refer to some gas entries?

EVANS: Yes.

JOHNSON: Or gas readings, I should say.

EVANS: Mm. Yes, I do.

JOHNSON: Subsequently, you moved on to material that related to [Baby M]'s collapse?

EVANS: Yes.

JOHNSON: Medical records?

EVANS: Yes.

JOHNSON: So far as the -- we'll come back to the medical position a bit later and what happened after [Baby M]'s collapse.

But so far as the nursing entries were concerned, so your paragraph 14 and it's the material in tile 96 in the sequence, did you reproduce the material that's in the feeding charts or the --

EVANS: I did, yes.

JOHNSON: -- the fluid charts that we have if anyone wanted to look at them, behind divider 16 of jury bundle 2?

In particular, did you note that on 9 April, so the day after his birth, the day of his collapse --

EVANS: Yes.

JOHNSON: -- [Baby M] was tolerating enteral feeds?

EVANS: Yes.

JOHNSON: So in other words, he was receiving milk in addition to the volume of fluid that he was receiving via, I think, a cannula at that stage; is that right?

EVANS: That's correct.

JOHNSON: The nursing notes on the feeding charts recorded a small posset at 11.00 hours that morning?

EVANS: Yes.

JOHNSON: I think that was one of the nurses, Mary Griffith, who recorded that, I think, she told us in evidence.

EVANS: Yes.

JOHNSON: You recorded or you observed that at 12.15, there was a nursing record of his stomach being "a little distended and the work of breathing increased"?

EVANS: I did.

JOHNSON: A 5ml aspirate of stomach acid with partially digested milk, which was discarded?

EVANS: Yes.

JOHNSON: And followed with a feed?

EVANS: Yes.

JOHNSON: The fact that the next feed -- at the next feed, an aspirate of 1.5ml, which was bile-stained, was recorded?

EVANS: Yes.

JOHNSON: And then I believe that [Baby M] was put nil by mouth?

EVANS: Yes, that's correct.

JOHNSON: And that his NGT was on free drainage?

EVANS: Correct.

JOHNSON: Thus oral feeds stopped and he was being fed or his calorific requirements were being provided via a dextrose drip?

EVANS: Intravenous fluid, yes.

JOHNSON: Intravenous fluid, yes.

EVANS: Yes.

JOHNSON: The next thing you record from the nursing notes is that at 16.00 hours, [Baby M] became apnoeic, had a profound bradycardia and desaturated?

EVANS: Yes.

JOHNSON: And that full resuscitation was started at 4.02?

EVANS: Correct.

JOHNSON: You then record the nursing entries which post-date the time at which [Baby M] collapsed?

EVANS: Yes.

JOHNSON: The jury will remember, I'm sure, for example, at 21.00 hours, references to his posture being stiffened in all limbs, particularly his upper limbs?

EVANS: Yes.

JOHNSON: His fingers and toes being curled and feet and hands being inwardly rotated?

EVANS: Correct.

JOHNSON: Together with the fact that it was recorded he was sucking on the ET tube?

EVANS: Yes.

JOHNSON: You record that in the early morning on 10 April, he was extubated?

EVANS: Yes.

JOHNSON: The evidence [Dr A] gave us yesterday, I think. His oxygen saturations dropped at that stage and he required bagging and received BiPAP support, as [Dr A] told us yesterday?

EVANS: Yes, he did.

JOHNSON: He was then, as [Dr A] told us, put on to CPAP?

EVANS: Yes.

JOHNSON: Subsequently, after these events, looking at your paragraph 18, you summarise the medical notes as showing that [Baby M] had made satisfactory progress, there was no record of any subsequent untoward event?

EVANS: Yes.

JOHNSON: And that he was well enough to go home on 3 May 2016?

EVANS: That's correct, yes.

JOHNSON: Were you at this stage, so at the stage you were providing this report in June 2018, given an extract -- looking at your paragraph 28, Dr Evans, were you given an extract of a witness statement that had been made by Dr Jayaram?

EVANS: I was, yes.

JOHNSON: Without recounting the detail of the statement, the point that was referred to by Dr Jayaram was his evidence that what he saw on [Baby M] was the same as what he'd seen on [Baby A]?

EVANS: That is correct, yes.

JOHNSON: And of course you have listened to Dr Jayaram's evidence yesterday?

EVANS: I did.

JOHNSON: As you have listened to pretty much all the evidence relating to both the [Surname of Babies L & M] boys?

EVANS: Yes.

JOHNSON: So moving, please, if we may, to paragraph 29 of your report of 2 June, would you tell the jury what -- first of all, your observations so far as [Baby M], not your opinions or conclusions but your observations, first of all, concerning [Baby M]'s collapse at about 16.00 hours on the afternoon of Saturday, 9 April 2016.

EVANS: Right. Prior to his collapse, he was born in good condition, he was a preterm baby, but he was born in good condition and prior to his collapse there were no concerns regarding his clinical stability.

The only concern was that his feeds, his oral feeds, were discontinued at 15.00 hours, 3 pm, because of a bilious aspirate. But there were no other concerns.

In other words, as we have discussed before, there was no change in heart rate, no change in respiratory rate, so the collapse was completely unexpected and quite precipitous. So I did not think that his collapse was in any way the result of the fact that there was a couple of millilitres of aspirate from the feed, especially as oral feeds had been stopped anyway, so his stomach was empty.

JOHNSON: All right. Can we just pause just for a second there, please, Dr Evans, and try and put that into slightly different format. If you would, please, look at the number 2 jury bundle there that's in front of you. Look behind divider 16, please, and go to page 18782, which is the third page behind divider 16.

This is the paper copy of the vital signs observations, the heart rate, the respiratory and the temperature.

EVANS: Yes.

JOHNSON: We can see, just to orientate ourselves with the document, it begins in effect at birth or on admission to the NNU --

EVANS: Yes.

JOHNSON: -- on 8 April at 10.40 --

EVANS: Yes.

JOHNSON: -- as written in by the nurse concerned. It runs through to 24.00 hours?

EVANS: Yes.

JOHNSON: Then we have observations every 2 hours up to midday on the 9th, which then -- there's then a couple of hourly ones at 13.00 and 14.00, we know that the collapse was at 16.00 and then hourly observations thereafter.

EVANS: Yes.

JOHNSON: Is that in effect a graphic description or representation of what you have described of the fact that [Baby M] was stable and there was nothing to suggest that he was likely to collapse?

EVANS: Yes, it is. I haven't got control of the mouse, but if you look at the top yellow, his heart rate is nice and stable throughout this period. The second series of respiratory measurements, again they're all very, very stable, very normal.

MR JUSTICE GOSS: Sorry to interrupt you, but I'm told that you have got control of the mouse.

EVANS: Got it now.

MR JUSTICE GOSS: Sorry, I interrupted you there, Dr Evans, for which I apologise.

EVANS: So that's the heart rate (indicating). So a nice and stable pattern of about 140 beats per minute. Normal for a prem baby. Respiratory rate... It's sticking.

If I put it on something else, it'll work a bit better.

(Pause)

Right. So that's the respiratory rate (indicating).

MR JUSTICE GOSS: I think we can all see.

EVANS: And then the lower one is the temperature, which is absolutely normal.

MR JOHNSON: Yes.

EVANS: So the heart rate, respiratory rate, and temperature, all satisfactory and all normal, really.

JOHNSON: Yes. Now, looking at your paragraph 30, please, Dr Evans, what were you thinking about the potential causes from a -- until we get to the -- I'm not asking you to tell us what you think actually happened, but your review, if you like, of the circumstances or your observations of the circumstances of [Baby M]'s collapse at 16.02.

EVANS: Right. I think I've said -- from my paragraph 30, and this is what I wrote down at the time -- I did not think that his collapse was due to aspiration of feed, it was not a complication of the feeding issues, and also I was surprised that he did recover following a very, very robust resuscitation. So the question I put to myself and I quote:

"This begs the question whether [Baby M] received some noxious substance just prior to his arrest or whether he received a bolus of air intravenously via his long line."

So that was the view I formed at the time.

JOHNSON: Yes, okay. Did you consider the potential of pneumonia or some other type of infection --

EVANS: I did.

JOHNSON: -- that he might have --

EVANS: I did, I did. My next paragraph said:

"[Baby M]'s collapse cannot be explained on the basis of pneumonia or any other infection. He was able to breathe within 4 hours of his collapse. If the collapse was due to pneumonia or another lung problem such as aspiration or infection anywhere else, that is where I would not expect him to have made such a prompt respiratory recovery."

JOHNSON: You were looking at the breathing issue here, were you?

EVANS: Yes.

JOHNSON: His breathing function?

EVANS: Yes.

JOHNSON: He was breathing well before the collapse and he was breathing well within a reasonable time after the collapse?

EVANS: Within a reasonable time. He had a few problems the following morning, which we know about, not as serious as this one, and not unexpected given his experience.

My other concern about him was that his collapse had caused some neurological damage, some brain damage, which is why the staff noted the stiffened posture in the limbs, his fingers and toes curled, and his feet and hands inwardly rotated, because those are the features we expect in babies who have experienced lack of oxygen to the brain.

JOHNSON: Yes. So a classic example that we've heard about recently, [Baby G]?

EVANS: Correct.

JOHNSON: And [Baby J].

EVANS: [Baby J]? Yes. And [Baby J], yes.

JOHNSON: So the same idea.

EVANS: The same idea.

MR MYERS: Sorry, just in terms of neurological damage, not in terms of posture.

MR JOHNSON: Posture.

MR MYERS: I was just confirming it wasn't a question of neurological evidence in the case of [Baby J].

MR JUSTICE GOSS: It was appearance, posture.

MR JOHNSON: Exactly.

MR JUSTICE GOSS: No evidence of neurological damage.

MR JOHNSON: No. Well, the jury will hear some evidence about this in due course.

So at that stage then, did you -- what was your opinion as to what had caused the cardiorespiratory arrest of [Baby M]?

EVANS: My opinion at the time, which I had also mentioned in my original report, was that his collapse -- I did mention could have been due to airway obstruction, but I'm happy to exclude that. But my opinion was that this was a consequence of some substance or air getting into his circulatory system. In other words, he received air intravenously. That was my opinion at that time.

JOHNSON: Okay. Were you asked further questions about the issue of air embolus and how that could happen in a scenario in which the fluid that was being administered to [Baby M], that we know from the evidence was timed as having been changed or administered about 15 minutes before his collapse, how that could happen with the safeguards that were built into the equipment?

EVANS: Right. I think we've discussed how babies who are on intravenous fluids, the fluids are given through a pump, which regulates the volume accurately, and the pump also has a feature so that if there's any air in the plastic tubing, the pump will alarm and stop. But from the end of this pump to the cannula that goes into the baby, there is still a fair bit of plastic tubing that contains fluid.

In addition to that, one normally attaches some form of tap so that it's possible for babies to receive fluid but also if you need to give them antibiotics or some other substance, you can give an injection of antibiotics or fluid without disrupting the continuity of the plastic tubing. Okay? So therefore, that

ensures that no air can get into the circulation, no air can get into the fluid accidentally.

There is what I would call a dead space between where this tap where you give this injection is positioned and the end of the cannula, which goes into the baby's vein. This dead space usually contains a small amount of fluid. So if an injection of fluid is given into that tap or bung, and there's more than one way of doing this, if some air is injected at the same time, that air could -- if there's a lot of air, the air would go directly into the circulation of the baby, get into the heart, get into the lung and cause the collapse.

But if some or all of the air is within this dead space then that air will not get into the circulation as promptly and as suddenly. This baby was on about 4ml an hour, I think.

JOHNSON: Can I just stop you there and recap on what you've just explained to us to ensure that I understand. There is a cannula going into the baby, whether in the hand, the arm or wherever?

EVANS: Yes.

JOHNSON: Between the cannula and the pump, there is a tube?

EVANS: A plastic tube, yes.

JOHNSON: And the fluid, in this case dextrose --

EVANS: Yes.

JOHNSON: -- is being pumped at a very slow rate?

EVANS: Yes.

JOHNSON: I think about 5 and a bit millilitres an hour?

EVANS: Yes.

JOHNSON: In this particular case at this particular time?

EVANS: Yes.

JOHNSON: Being pumped by the pump into the tube and into the child?

EVANS: Correct.

JOHNSON: Through the cannula?

EVANS: Yes.

JOHNSON: Between the air detector in the pump and the cannula, somewhere along the tube there is a point of access?

EVANS: There's a point of access where we have a tab or a bung, yes.

JOHNSON: That can be opened by medical staff?

EVANS: Or nursing staff, correct.

JOHNSON: So that, for example, antibiotics can be administered without interrupting the flow of the dextrose?

EVANS: Yes.

JOHNSON: All right so far?

EVANS: Yes.

JOHNSON: If instead of antibiotics being injected, air is injected, and it fills all or part of the dead space, in other words the space between the tap and the cannula; yes?

EVANS: Yes.

JOHNSON: The air will then be pushed slowly into the baby by the fluid which is coming in behind?

EVANS: Correct.

JOHNSON: Now, if that happens, obviously the speed, the amount of air is regulated by however much somebody may choose to inject?

EVANS: Correct.

JOHNSON: But the speed of the injection is regulated by what?

EVANS: Well, two. If you're giving what we call a bolus, in other words if you're giving an antibiotic, then you'd be giving that antibiotic over a minute or two, you know, a slow injection through this bung or tap. And the antibiotic would normally be a volume of, you know, 1ml or maybe less. So small volumes.

So therefore, if there was any air in that syringe, that air would then get into what we call the dead space, in other words the bit of tubing between the bung and the end of the cannula that connects to the baby.

Once that air is in there, then the rate of flow of that air into the circulation is far slower because that is determined by the rate of fluid in the 10% dextrose, which I think was 5ml an hour --

JOHNSON: Yes.

EVANS: -- or 5.3ml an hour, whatever. So therefore the rate of air or bubbles getting into the baby's circulation is then determined by the volumetric pump, the 5ml an hour.

JOHNSON: Okay. Would it also follow that if somebody chose to do it that way, they wouldn't necessarily be standing over the baby at the time the baby collapsed?

EVANS: That's right because you would not get an instant collapse because you'll only get an instant collapse if you have a significant amount of air directed directly into the baby's circulation and going directly into the heart and lung. So in that kind of scenario, then the collapse would be more or less instantaneous. But if the air is in this dead space then the deterioration in the baby's condition would occur at a later time.

JOHNSON: So taking all that you have said into account, and taking into account the description that you heard from Dr Jayaram about what he saw, the descriptions that you heard from the nurses about the circumstances immediately surrounding the collapse, what in your opinion was the reason why [Baby M] collapsed the way he did at 16.02 on 9 April 2016?

EVANS: I think his collapse was due to an air embolus. I think his collapse was due to air being administered to him some time before 16.02. It could have occurred over several minutes prior to 16.02 and was due to the fact that the air -- a significant part of the air was in the dead space and as that air trickled through, that led to his collapse. So that is the mechanics of what happened to the little baby.

JOHNSON: Thank you. Would you exclude infection of any type as a reasonable counter-explanation?

EVANS: Yes, I did. There was no evidence of infection and the blood tests that look for infection before his collapse and after his collapse all showed results that were negative, normal.

JOHNSON: And so far as his "difficulties" in the 24 hours or so following his collapse, what was the cause of that?

EVANS: I would expect that to be the result of oxygen deprivation to his brain and the complications arising from his hypoxic event, lack of oxygen to the brain.

MR JOHNSON: Thank you, Dr Evans. Those are all the questions I have for you at this stage. That may be a good point.

MR JUSTICE GOSS: Yes, certainly. We'll have the ten-minute break now, members of the jury, and resume at 12.10, please, Dr Evans.

(12.00 pm)

(A short break)

(12.10 pm)

Cross-examination by MR MYERS

MR MYERS: Dr Evans, you were asked some questions about the question of neurological damage. We're talking about [Baby M] in this case.

EVANS: Yes.

MYERS: Are you aware of his discharge history and his progress after discharge?

EVANS: No.

MYERS: Right. In that case I won't ask you about that. I'll deal with that with a different witness then.

EVANS: Sorry, I just don't know his --

MYERS: That's all right. In any event, during the course of the period at the hospital that you have seen, he appeared to recover and was discharged after about 3.5 weeks, wasn't he?

EVANS: That's correct, 3 May.

MYERS: And you have not been provided with any other evidence that suggests any ongoing issue after that, have you?

EVANS: I'd need to check that. I haven't got any follow-up records or anything.

MYERS: So far as cause is concerned, what lies behind this, in your report there were two principal mechanisms. For one of them you did raise the question of whether there had been airway obstruction?

EVANS: Correct.

MYERS: The other mechanism you considered was the administration of a substance or of air?

EVANS: Yes.

MYERS: Airway obstruction isn't really something that seems to apply when one steps back and looks at this, is it, so far as one can tell?

EVANS: I agree.

MYERS: Air embolus, the reasons that you raised that include the fact that this was something which, you would say, caused a rapid collapse; is that correct?

EVANS: Correct.

MYERS: And also the question of whether there was any discolouration that might be characteristic of an air embolus; is that correct?

EVANS: Not at the time, because when I prepared my first report, which was dated November 2017, I was not aware of the information about his colour/discolouration at all. In my report of 21 November 2017, my last paragraph but one contains the term:

"His collapse could be due to some substance or air getting into his circulatory system, given intravenously."

In other words -- so I had considered air embolus or air embolism as the cause of his collapse prior to receiving the information about the discolouration.

MYERS: So far as the information on discolouration is concerned, do you agree that's going to be as reliable as Dr Jayaram's account given 17 months after the event?

EVANS: Yes.

MYERS: So far as rapid collapse is concerned, the fact the collapse is rapid doesn't of itself prove that this is an air embolus, does it?

EVANS: In this case, I think it does actually.

MYERS: Is that because your position is there's no apparent medical explanation by way of an alternative?

EVANS: That is true.

MYERS: So almost by default you come to the setting or the position this must be an air embolus then?

EVANS: It's not by default. First of all, it's the only cause.

We've ruled out lots of other things. I've ruled out aspiration pneumonia, as did everybody else. We've ruled out infection. Therefore what all clinicians do, we make a mental list, a differential diagnosis, if you like, of causes of sudden collapse in a baby. None of the other potential causes apply in his case.

MYERS: There can in fact be rapid collapse for which no immediate medical cause is identified but which may still have a medical cause; that's possible, isn't it?

EVANS: I'm afraid there are too many hypotheticals in that, I'm sorry. This is a baby on a neonatal unit, on full monitoring, under the care of nursing and medical staff.

MYERS: There can be rapid collapse, can't there, without an obvious medical reason that has still got a medical cause; that's possible, isn't it?

EVANS: I think the only rapid collapse I can think of is a blocked endotracheal tube, which is not the case here because the baby was not on ventilatory support. But not really, no.

MYERS: If there is air in the system sufficient to cause cardiac arrest, that much air, there isn't going to be a recovery as rapidly as this or as well as this within 30 minutes, is there?

EVANS: Well, I disagree with that. First of all, the resuscitation required was absolutely incredible.

He had six doses of adrenaline, he had sodium bicarbonate. The cardiac compressions carried out must have been extremely effective and were required for I think up to about 25 minutes. That's an incredibly prolonged period of cardiac instability in a baby. And I think we've heard that they'd almost given up.

So therefore, the resuscitation required in this baby was absolutely extraordinary in terms of the duration of it, the drugs used to sustain his heart, and the mechanism -- the mechanistic approach, in other words, the cardiac massage, the cardiac compression.

This is a very, very robust period of resuscitation that was required and you just don't get that with blocked tubes or

suffocation. They start breathing, they respond pretty quickly. Therefore this is something that is entirely consistent with a little baby having had air into his circulation and I cannot think of any other cause.

MYERS: Dr Evans, whatever the resuscitation, air does not just vanish within 30 minutes if it's been sufficient to cause cardiac arrest, does it?

EVANS: Well, it does. Now, the problem we have is this, okay?

There are three problems. The first problem is that it's not possible to conduct research where one can say with any accuracy how much air you need to cause collapse in a baby. But the volume required is very, very small and we all know there's no nurse or doctor would allow a bubble of air into a circulation. You know, you really have to be utterly meticulous in ensuring that no air goes in because the tiniest amounts of air, we're talking less than a millilitre of air.

If we apply experiments to dogs -- and, of course, dogs and humans are different, but it is impossible to do case -- controlled studies involving babies because if you injected air into a baby, the baby would collapse and could well die. It would be wholly unethical, it doesn't happen.

The second problem we have is because of the care that nurses and doctors take in the management of babies on intravenous fluids and the sophistication of the equipment used, accidental air injection is virtually unheard of. So therefore it just doesn't happen. We'd have to go back to 30 years to quote papers.

MYERS: This isn't dealing with the question I asked.

EVANS: It is, I'm sorry. You're welcome to ask it again.

MYERS: Air sufficient to cause cardiac arrest is not going to go within just 30 minutes, is it?

EVANS: Right.

MYERS: That's what I asked.

EVANS: Okay. So the air -- right. So the air gets into the baby's circulation and gets into the right side of the heart and into the lung. That's where it is. If you conduct cardiac massage, the bubbles of air, as any bubble, will dissipate, will get into the lung and spread into the lung.

The other place the baby's air will go to is into the left side of the heart and this is where you have a difference between the effects of air embolus in a baby compared to the effect of air embolus in an older child or adult because the baby has, in simple terms, a hole in the heart, a hole between the right side of the heart and the left side of the heart this. The hole is the foramen ovale, oval hole.

If air gets from the right side of the heart into the left side of the heart, then where it goes after that depends on a number of factors, but it will dissipate. So if it gets into the blood vessels supplying the abdomen, you'll get this discolouration.

If it gets into the blood vessels supplying the brain, you could find air in the cerebral blood vessels and you could also get neurological abnormalities.

If the air goes from the right side of the heart to the left side of the heart and into the coronary artery, which is the artery supplying the heart itself, then you're going to have a heart attack, and that'll cause acute immediate distress and pain. We've heard of that with little [Baby D] [Surname of Baby I] (sic).

So where the air gets to, if it stays on the right side it will over a period of time, thanks to the cardiac massage and the efforts, will dissipate, will go from the right side of the heart into the lung and absorb there because we're talking small volume. That part of the air that gets across the hole in the heart from the right side to the left side, that will dissipate into -- and spread into the various arteries that the left side of the heart supplies.

So this is the mechanism, the anatomy, if you like, and the physiology of what happened in this particular baby.

MYERS: Air is 78% nitrogen, isn't it, about?

EVANS: It's 80% nitrogen.

MYERS: 78.2.

EVANS: Whatever.

MYERS: Nitrogen is largely insoluble at atmospheric pressure in blood, isn't it?

EVANS: Yes, it is.

MYERS: It doesn't just vanish in the blood from whatever is being done to a body, does it?

EVANS: It would dissipate somewhere or other and there are -- you'd never know where it is because we're talking about such a small volume. Some of it, if it stays in the right side of the heart, it'll find its way into the lung and disappear through the membranes of the -- small blood vessels of the lung. It would end up somewhere.

MYERS: Actually, you have no empirical, by which I mean research basis, or experience basis beyond your say-so that air would simply dissipate within 30 minutes.

You have no basis for that, do you, in terms of research or empirical support?

EVANS: Right. First of all, as we've said, one cannot conduct research on this subject. You can't do that.

Secondly, because of the care nurses and others give, accidental injection of air does not -- is not recorded in babies to any -- apart from the occasional case report that I have produced in evidence earlier.

Therefore one has to rely on one's knowledge of basic anatomy and basic physiology. And this is what happens: air will dissipate.

MYERS: I'm going to repeat this once and then I will move on: do you have any empirical or research basis for what you say about the way air is dissipating in blood after an air embolus has caused a cardiac arrest?

EVANS: My evidence is based on basic anatomy and physiology knowledge, which is the sort of stuff that medical students would be taught in medical school.

MYERS: So the answer to the question is "no", isn't it?

EVANS: There is no research evidence because you cannot have research evidence, it's as simple as that.

MYERS: The best evidence of an air embolus would be on a chest X-ray, wouldn't it?

EVANS: No.

MYERS: Right. You disagree with that. I won't pursue that.

You don't think that would be the best evidence of an air embolus?

EVANS: You'll only get abnormalities on a chest X-ray -- and I've seen reports of this -- if you have a massive volume of air in babies who collapse and die and where the chest X-ray carried out soon afterwards shows air in one or other chamber of the heart. So that's a completely different scenario to the scenario we've got here. So you're not comparing like with like.

MYERS: As a matter of record, as it happens, [Baby M] did exhibit signs in terms of his physical condition that were not normal prior to collapse, didn't he?

EVANS: You're talking about the bile-stained fluid?

MYERS: Yes. There are signs which are indicators of something that isn't normal in a healthy baby, aren't there?

Would you agree generally with that, first of all?

EVANS: Sorry?

MYERS: Do you agree generally with that question or do you not?

EVANS: Not particularly. He was a premature baby. There were some bile aspirates, some milk aspirated, so they stopped feeds, an entirely correct thing to do.

Premature babies can take a bit of time to get going as far as feeding is concerned. They're not designed to absorb milk when they're born 7 weeks prematurely. We know from subsequent events that he was able to tolerate milk, so therefore that proves that he didn't have any significant or serious problem causing this bile. So that was not a factor in causing his collapse in any way or form.

MYERS: As a matter of record, we know his stomach was a little distended at 12.15, wasn't it?

EVANS: It was.

MYERS: He had increased work of breathing?

EVANS: Yes.

MYERS: His temperature was slightly raised, slightly raised, round about the 12.30 feed time?

EVANS: Well, we're talking minor features here, none of which would explain this sudden cardiac arrest.

MYERS: He had, around the time of the feed at 14.30, the 1.5ml bile-stained aspirates didn't he?

EVANS: Yes.

MYERS: That's not a good sign, is it?

EVANS: It's what happens very commonly with premature babies.

It is something that nurses would act upon as they did.

It is not a marker or a warning of sudden, impending cardiac arrest.

MYERS: The nurses didn't act upon it, Dr Evans. We have heard they were advised to put [Baby M] nil by mouth at that time by a doctor.

EVANS: They sought the advice of the doctor. They were aware of the significance of it sufficiently to speak to the doctor, who said give nil by mouth, yes. We work as a team, so...

MYERS: That may indicate a potential problem, the bile may indicate a problem?

EVANS: No. The significant thing -- did you say central?

Sorry, did you say central?

MYERS: Potential problem.

EVANS: A potential problem. Oh yes, yes. A potential -- there was a potential issue that he was not absorbing his feed and that the feed was not going through. Check the records. He was passing a meconium, several passages of meconium, so there was stuff coming out the other end.

So it was unlikely that he had an intestinal obstruction. Therefore the cause of this bile stain and a little amount of bile was that he was a premature baby and his digestive system hadn't got going properly.

It's as straightforward -- not a cause for concern: stop oral feeds, continue with intravenous feeds and see where you are in a day or two. So not a marker of impending collapse in any way or form.

MYERS: The fact I move on doesn't mean I'm agreeing, but I'm not going to repeat the questions. We've heard the questions.

Dr Ukoh reviewed [Baby M] at 10.25 that morning?

EVANS: He did.

MYERS: No other doctor reviewed [Baby M] in terms of making a record in the clinical notes before the collapse, did they?

EVANS: As far as I know.

MYERS: So we have no clinical assessment of what his condition was between 10.25 and the time of collapse, do we?

EVANS: The nursing team is part of the clinical team so you have the nursing records of what he was like.

MYERS: The nurses have told us they called for a doctor to assess him, didn't they?

EVANS: Yes, because they'd found 5ml of aspirated milk, got some bile, speak to a doctor, what do you do, stop oral feeds. Standard teamwork.

MYERS: If we look in the blood gas record in bundle 2, Dr Evans, ladies and gentlemen, behind divider 16, page 18808. Can you see that, Dr Evans?

EVANS: Yes.

MYERS: Looking at that -- thank you, Mr Murphy. If we just enlarge the top half of that.

We can see the blood gas readings taken on 8 April, can't we, the first four lines?

EVANS: Yes.

MYERS: Can you see those?

EVANS: Yes, we can.

MYERS: In fact there's no blood gas reading taken between 18.00, so 6 pm on the evening of 8 April, and the time after the collapse at 16.22 on 9 April, is there?

EVANS: That's correct.

MYERS: So first of all we do not know with any certainty what the blood gas was doing or how it would have appeared in that period between the two, do we?

EVANS: No need to do a blood gas. He was SVIA, spontaneous ventilation in air.

MYERS: One of the reasons for monitoring blood gas is to identify, for instance, problems that may be developing, isn't it?

EVANS: Yes.

MYERS: And we don't have that assistance when we look at this record, do we?

EVANS: Well, we have other records. You try to avoid sticking pins and needles into babies if you can help it.

Therefore as I mentioned a few minutes ago, his heart rate was normal, his respiratory rate was normal, his oxygen saturation was normal and he was in air. Those features are sufficient for a nurse or a doctor to say, "Let's not do a blood gas".

MYERS: Well, once he has produced bile-stained aspirate and was made nil by mouth on the advice of a doctor, it would have been preferable to monitor his blood gas, wouldn't it?

EVANS: Not particularly.

MYERS: And we don't know --

EVANS: Sorry, not particularly. You monitor blood gas if you're concerned about breathing difficulties. This was a bit of bile in his NG tube. That's it.

MYERS: And it's not wise to assume the ongoing good health of a neonate like [Baby M] on the unit, is it?

EVANS: He was a stable baby. We've heard that from the local people -- from the people looking after him. He was a stable baby right up until his collapse and the only marker of concern was the bile and they dealt with that.

Again, I think it's worth noting that the amount of bile was very, very limited, yet he collapsed. If you compare that with a baby we discussed before, little [Baby J], she was a little baby who required emergency surgery within 24 hours because she had a serious problem, she had a dead piece of bowel in her abdomen.

Despite having a very serious life-threatening condition, and vomiting bile, not just a bit of bile coming up the tube, she was vomiting bile, they were getting bile up the nasogastric tube as well and they had to transfer her to Liverpool, to Alder Hey, and she didn't collapse. It's not how babies with a bit of bile behave clinically. Little [Baby J], despite having a serious gastrointestinal problem, did not collapse. The presence of a bit of bile and a bit of abdominal distension in this

little baby does not explain his collapse. The presence of air in his circulation explains his collapse.

MYERS: We can assume nothing about the state of his health so far as blood gas is concerned without evidence of it in the 10 or so hours leading up to the collapse, can we?

EVANS: There were no grounds for doing a blood gas and if there are no grounds for doing a blood gas, you don't do a blood gas.

MYERS: And we have heard repeatedly from experienced practitioners that collapses can be sudden and unexpected with little babies in neonatal units.

EVANS: This collapse was sudden and unexpected and has a cause and I have explained to what you the cause is and I've explained the anatomy of it and the physiology of it.

MYERS: And actually we cannot know with any certainty the extent to which what we can see at 16.22 reflects an underlying condition any more than it reflects just what had happened at 16.00. We don't know the extent to which it might.

EVANS: Well, I do, I do: this baby had a cardiac arrest requiring God knows how much adrenaline and sodium bicarbonate and cardiac massage. Therefore his blood gases were very abnormal, which is what I would expect.

MYERS: And so far as breathing issues in the day or so that followed are concerned, again that could be due to the incident on the 9th, due to the collapse?

EVANS: Yes.

MYERS: That's what you say. It could be due to some residual underlying medical issue?

EVANS: No, I disagree. There were no residual medical issues because he had recovered and he didn't recover because they did something different. All they did was they managed him in the way that you would manage a baby who had suffered a life-threatening event and his breathing improved pretty quickly. He had a couple of apnoea episodes, as we know, I have explained why that is.

Then he made what we call an uneventful recovery.

Subsequent investigations ruled out infections, et cetera. So there were no other events.

There was this one event and I -- and the event can be described -- can be explained on the basis of air getting into his circulation in the minutes prior to his collapse.

MYERS: For which, apart from the fact this is a rapid collapse, you actually have no supporting evidence whatsoever?

EVANS: The presence of the discolouration in the abdomen, described by Dr Jayaram, is an additional factor, as we discussed in other cases. It's not up to me to comment on the veracity of Dr Jayaram's observations, but I did listen to it and he was here and he was quite clear about what he saw. The fact that it was so difficult to get the little baby's heart going once more, again that is typical of air embolus. After all, most babies do not recover from air embolus. We know [Baby B] did, the others did not.

And to repeat myself, we've ruled out -- or I have ruled out -- everyone has ruled out other causes for this baby's collapse.

MYERS: Most babies do not recover, do they?

EVANS: Most babies do not recover.

MYERS: Air embolus doesn't just go away, it's invariably fatal, isn't it?

EVANS: It is not invariably fatal. I have produced research papers for this trial which show that the occasional baby does survive.

MYERS: The occasional baby?

EVANS: That's in the document somewhere. So I'm not making this up. So there are -- there is the occasional survivor. Whether you survive or not depends to some extent on how much air goes in and also the rate at which the air goes in. So therefore, where you have this catastrophic air embolus in cases that have been written in the papers, the bolus of air is so large the baby collapses and recovery is impossible. Not the case in this particular baby and thanks to the remarkable efforts on the part of his nursing and medical team, they got him round.

MYERS: You don't know, Dr Evans, in fact, as a matter of --

EVANS: Sorry?

MYERS: You don't know as a matter of fact how much air is required to cause a collapse, do you?

EVANS: No. Very little is all one can say.

MYERS: Well, you don't know how much.

EVANS: Well, very little.

MYERS: Very little might be 5ml?

EVANS: I suspect it'd be far less than that.

MYERS: You suspect.

EVANS: But because you cannot do clinical research on it and because it doesn't occur accidentally, this is why a phenomenon of this nature is so unusual.

MYERS: Right. I'm interested to see what we can know with any degree of certainty, Dr Evans, all right?

EVANS: I am satisfied with my evidence in this case and I'm satisfied with the cause of this baby's collapse.

MYERS: Right. Let me go back to what I'm dealing with now. In terms of how much air is required, first of all to cause a collapse, you do not know?

EVANS: Experiments on dogs go on about 0.4ml per minute.

MYERS: We have 3 to 5 elsewhere on dogs and rabbits.

EVANS: This research is 40 years old, I think. So therefore no one is going to -- nobody knows to the nearest millilitre or to the nearest 0.1ml how much air you need for a baby to collapse. That information is not going to change any time soon.

MYERS: It takes seconds to inject 5ml or 10ml of air into a system, doesn't it?

EVANS: It depends how it gets in there. If you inject air into the system then you can get 10ml in quite quickly.

MYERS: The apparatus that's being used for the administration of antibiotics, let me just ask you about that because you told us something about this in your evidence.

[Baby M] was receiving fluids and, when he received them, medication through a peripheral line into a cannula, wasn't he?

EVANS: Yes.

MYERS: So the cannula is attached to him. We've heard that when the infusion is hung up, it comes down through a giving set and that will be fixed, that will go through that peripheral line?

EVANS: The giving set goes through the volumetric pump and then the tube comes out of the other side of the volumetric pump. There's this connector that we have heard about, the different types of connectors. Then that gets into the cannula. That's the way it works.

MYERS: Are you telling us about something called a three-way tap?

EVANS: Well, that's one of the systems. I don't know whether there was a three-way tap in place or whether there was what we call a rubber side bung. I don't know which type was used, but whatever one was, you end up with a bit of dead space between that connector and the baby.

MYERS: And the bore of these tubes is incredibly narrow, isn't it?

EVANS: Yes.

MYERS: And the dead space, as you call it, is a very small volume indeed, isn't it?

EVANS: The dead space of the cannula is very narrow, the dead space of the actual tube, the bit that's outside of the baby, is standard -- you know, is the same width as the rest of the tube from the giving set.

MYERS: I'd just like to look at an image that comes from one of the reports prepared by Dr Bohin. I'm going to ask Mr Murphy to put this on the screen. It's from page 5343. Let's have a look at that and we can envisage some of what we're talking about.

Dr Evans, looking at this, looking at the top part first, this comes from Dr Bohin's report, but since you've been telling us about this let's have a look with you. Looking at the item at the top, first of all, if we look -- I'm going to start at the top right. You can see the part of that set-up with the yellow bung on top of it. Can you see that?

EVANS: Yes.

MYERS: When this type of connector is used, the yellow bung is at one end, below that there's a thicker cylinder.

That's what attaches to the cannula going into the baby, isn't it?

EVANS: Yes. The flow of fluid is this, using my mouse (indicating). This end comes from the bag, from the IV bag, and the fluids goes this way (indicating) through there (indicating), and then that...

MYERS: Into the baby?

EVANS: That bit is connected to the cannula, sorry, which is connected to the baby, yes.

MYERS: The cannula is the bit which is on the baby's skin, isn't it?

EVANS: Yes, the cannula is the bit which goes from there (indicating) downwards.

MYERS: What we have below that is something you considered from the unit, something called a three-way tap; is that correct?

EVANS: That is another option, yes.

MYERS: Right. The three-way tap is down at the bottom and that allows material, whether it's -- whatever it is, whatever is introduced to come in through more than one housing in effect, more than one route?

EVANS: Yes. Where I'm pointing my cursor (indicating), that comes from the pump, from the bag.

MYERS: Yes.

EVANS: The fluid goes through there. Now, this quite often would not be connected directly to the cannula because we're talking small babies, small legs, small arms. So you could quite often, to make the cannula more secure, you could connect that bit (indicating) to that bit (indicating). You could connect that bit to that bit, so that (indicating) would be your dead space again.

And then that goes to the cannula.

So anyway, whatever it is, you've got a fair bit of dead space there because if -- yes. So anyway, so that -- I... I didn't visit the unit, so what they used, it could be one or more of those things.

MYERS: Let me ask this to carry on so we can put this together.

If we look at the three-way tap at the bottom, we can see what looks like a grey collar above where it says "to patient" on the arrow.

EVANS: Yes.

MYERS: If that's being used, that would be connected to what we have on the left-hand side of the T-piece at the top?

EVANS: Possibly, but this is a matter that you should ask the nurses looking after the baby at the time.

MYERS: You've been telling us about this so I'm going to what follows from what you've been saying to us.

EVANS: Yes. Right. The principle of how we deliver fluid to small babies is the same irrespective of what kind of connector one uses.

MYERS: Right. As it happens, if we take that three-way tap and connect it to the part of what's called the T-piece up above it, where it says "to IV bag", you have a dead space of about 0.32ml, don't you?

EVANS: Where is your dead space?

MYERS: From the end of the three-way tap if it's connected --

EVANS: From there to there, yes.

MYERS: That's about 0.32ml, isn't it?

EVANS: I've done quite a lot of measurements. I don't think I did a measurement on this. If you've got this from Dr Bohin's report, you need to ask her about this.

MYERS: No, didn't you do a measurement where you looked at a catheter?

EVANS: Yes, I did.

MYERS: And you got about 0.32ml?

EVANS: That is about 0.32ml.

MYERS: 0.32ml. Let's hold that in our minds. That is the dead space we're talking about, something like that?

EVANS: Something like that, yes.

MYERS: Now, if somebody injects 1, 2 or 3ml straight in. In fact if somebody injects anything more than 0.32ml in, that's going to go straight in, isn't it?

EVANS: Well, you still have the cannula going from there to the baby, a small volume, you still have that, yes.

MYERS: If they inject, let's say 1ml, in it goes, that's going to go straight in, isn't it, that's rapid?

EVANS: Some of it will go straight in and some of it will stay here, yes.

MYERS: And the purpose is that this does enable rapid delivery when something is injected through the port with the syringe, doesn't it?

EVANS: Yes, you can inject something through this bung here, this thing, or you can inject it through this part (indicating). You unscrew that and you inject it through there. But you'd only inject something rapidly if you're giving something like an antibiotic, for instance, or you're giving a bolus of saline if the baby's blood pressure is low, say.

MYERS: So in the course of giving an antibiotic, it is injected straight in, isn't it?

EVANS: It is.

MYERS: Just to give us an example of how quick small quantities can be, if we look at Dr Ukoh's clinical notes at page 18237, which is at tile 149, Mr Murphy. So we can take the picture down and look at this. If we just roll down just to see what was happening.

We can see there the adrenaline that was given to [Baby M], can't we?

EVANS: Yes.

MYERS: And we can see the quantities -- let's look at the first one where it says "Adrenaline 0.18ml"; do you see that?

EVANS: Yes.

MYERS: That is a very small quantity, isn't it?

EVANS: Yes.

MYERS: And that has to be injected through the connector in the way we've been looking, doesn't it?

EVANS: Yes.

MYERS: We don't hang around for adrenaline. That has to act very quickly, doesn't it?

EVANS: It does.

MR MYERS: Thank you, Dr Evans. Those are the questions I wanted to ask.

MR JOHNSON: Does your Lordship have any questions?

MR JUSTICE GOSS: I don't, thank you.

Thank you, Dr Evans. That completes your evidence in relation to the issue at this stage.

(The witness withdrew)

MR JOHNSON: We can fill the time with some reading and call Dr Bohin after lunch.

MR JUSTICE GOSS: Right. Thank you very much, yes.

Witness statement of PROFESSOR STAVROS STIVAROS (read)

MR JOHNSON: This relates to the brain injury suffered by [Baby M]. It's a further statement, ladies and gentlemen, from Stavros Stivaros, who was the neuroradiologist from whom you have already heard in at least one other case.

"I am Stavros Michael Stivaros. My specialist field is paediatric neuroradiology. I am the lead consultant paediatric neuroradiologist at Royal Manchester Children's Hospital.

"I have been asked to comment on the neuroimaging relating to [Baby M], date of birth 8 April 2016, specifically an MRI scan of his brain dated 27 May 2016 from the Countess of Chester Hospital."

He then sets out the references for the images and other material that he has considered:

"[Baby M] had an MRI scan of his brain performed on 27 May 2016 at the Countess of Chester Hospital.

"Brain appearances: the brain appearances are abnormal. I think that it is likely that the cause of these imaging findings is the cardiorespiratory collapse suffered by [Baby M] on 9 April 2016. However, the imaging can only describe the brain damage

resultant from this episode. It cannot determine the underlying cause of the collapse, about which I defer to clinical opinion."

He then says this:

"Summary/analysis of imaging. Summary of findings: [Baby M] was born prematurely but in very good condition. Although he was transferred to the neonatal intensive care unit, the clinical narrative appears to suggest he was well, with no signs of respiratory distress or illness until his sudden cardiorespiratory collapse on 9 April 2016. I am afraid that this collapse is the most likely cause for the brain imaging changes which are in keeping with such an event. My reading of the clinical history has not identified any other point in time when such neurological injuries are likely or even hypothetically likely to have arisen.

"The damage to [Baby M]'s brain is sadly not recoverable and over time he may well deviate from his peers in regards to attainment and cognitive/motor function. Clinical assessment of his development will be necessary to determine the degree to which this is occurring. The imaging cannot determine the underlying cause for the cardiorespiratory arrest. There are no congenital structural or developmental abnormalities seen in [Baby M]'s brain that could explain this. Beyond this, I defer to clinical opinion."

So that's the neuroradiological evidence. We're still slightly short of the normal time for the short adjournment, my Lord. I can carry on if you wish me to.

MR JUSTICE GOSS: No, we'll have the break then. I know it's been a sort of regularly interrupted session or series of sessions this morning, but we'll have a proper break now and resume at 2 o'clock with Dr Bohin.

Thank you very much.

(12.53 pm)

(The short adjournment)

(2.03 pm)

DR SANDIE BOHIN (recalled)

Examination-in-chief by MR JOHNSON

MR JOHNSON: Dr Bohin, just for the sake of the recording would you identify yourself, please?

BOHIN: Yes, I'm Dr Sandie Bohin.

JOHNSON: Thank you. Dr Bohin, have you written three reports in the case of [Baby M]?

BOHIN: Yes.

JOHNSON: Are they dated 29 April 2019, 15 October 2021 and 17 August 2022?

BOHIN: Yes, that's correct.

JOHNSON: Can we start, please, with your first report, 29 April 2019. Was the approach that you took in this case similar to that which you took in the cases in respect of which you've already given evidence?

BOHIN: Yes.

JOHNSON: Were you initially approached by Cheshire Police in February 2019 to carry out your task?

BOHIN: Yes.

JOHNSON: So far as the documentation that you were given at that stage of the process is concerned, and looking at your paragraph 4.3, did it consist of a copy of medical notes and other material from the Countess of Chester Hospital?

BOHIN: Yes.

JOHNSON: Including X-rays?

BOHIN: That's correct.

JOHNSON: And also Dr Dewi Evans' report dated 31 May 2018?

BOHIN: That's correct.

JOHNSON: Thank you. Did you set out your understanding of the chronology between [Baby M]'s birth and his collapse at about 16.02 on 9 April?

BOHIN: Yes.

JOHNSON: Did that review of his treatment include the material that Dr Evans was questioned about this morning concerning observations of [Baby M] in the 6 to 8 hours immediately prior to his collapse?

BOHIN: Yes.

JOHNSON: Which resulted in him being put nil by mouth that afternoon?

BOHIN: That's correct.

JOHNSON: All right. I don't think it's necessary for the doctor to deal with all that material, my Lord; we've heard it rehearsed many times.

Did you go on to note [Baby M]'s collapse at 16.02 here?

BOHIN: Yes.

JOHNSON: And did you summarise the treatment that [Baby M] received?

BOHIN: Yes, I did.

JOHNSON: Thereafter, and looking at your paragraph 6.14, did you observe that which was recorded of [Baby M] having episodes of stiffened posture in all four limbs?

BOHIN: Yes, I did.

JOHNSON: And his intubation and extubation?

BOHIN: Yes. Unfortunately, the paragraphs are the wrong way round: 6.14 takes place before 6.13 in time, but yes.

JOHNSON: Can we move on to your opinion and comment then, please, Dr Bohin. It's section 7 of the report. So far as [Baby M]'s condition prior to his collapse was concerned, what conclusion did you draw?

BOHIN: I felt that [Baby M] was a premature infant, he was stable and well immediately prior to his collapse. There was some early jaundice for which he was receiving phototherapy treatment, that's ultraviolet light treatment. But there was nothing to suspect that any medical problem was imminent. The team had started intravenous antibiotics as a precaution because of the early jaundice, but actually there were no biochemical markers of infection either then or later.

JOHNSON: All right. Just dealing with that issue of the light treatment for jaundice, in front of you there's a bundle of documents, it's the left-hand one as you're looking at them, that's it. It's bundle 2. If you could look at divider 16, please, and go to page 18782, which is the third page in and it's the observation chart.

BOHIN: Yes.

JOHNSON: Do we see there in the bottom couple of inches of the page the nursing ticks denoting the fact that [Baby M] was still receiving that light treatment?

BOHIN: Yes, we do.

JOHNSON: We see that a couple of boxes above, but below the bottom yellow section of the temperature chart, there is a section that says, "Cooling infant"; do you see that?

BOHIN: Yes.

JOHNSON: Then at five stages during the time span covered by this chart there are arrows pointing down, one of which appears to be at midday or 12.30 pm?

BOHIN: That's correct.

JOHNSON: It says 33 degrees or something like that?

BOHIN: Yes.

JOHNSON: We can see that immediately above that, [Baby M]'s temperature rose very slightly from the thick black line?

BOHIN: Yes.

JOHNSON: Which, as a non-medic, I assume is "normal" temperature?

BOHIN: Yes.

JOHNSON: Up 0.2 of a degree, if those --

BOHIN: Yes.

JOHNSON: -- markings are 5 per degree. Is there a causal connection potentially between photo/light therapy and a raised temperature?

BOHIN: Yes. When babies are under phototherapy they are usually put in an incubator to receive that kind of treatment because, particularly premature, babies are very small, they lose heat very rapidly. So when they receive phototherapy they're naked because you want the light to be exposed to as much of their skin as possible. They have some eye shields or goggles to protect their eyes from the ultraviolet light, but other than that they are naked. So other than they are put in an incubator which is heated but the very fact that they've got ultraviolet

lights, usually above the incubator, means that they quite often get hot, so it's not uncommon for them to get a slight temperature and the nursing staff to have to alter the temperature of the incubator to allow for that.

Also, when babies get hot they tend to breathe a bit quicker, so their work of breathing may well increase during that time. Either their rate of breathing or just their work of breathing may increase because they're hot, and this temperature was very -- was still in the normal range in fact, but the nurse did absolutely the right thing and reduced the incubator temperature by half a degree and thereafter the temperature settled.

JOHNSON: Yes. So that's [Baby M]'s position immediately before his collapse. You note at your paragraph 7.5 that a new bag of dextrose was started at about 3.30.

BOHIN: Yes.

JOHNSON: And that he was given benzylpenicillin, which is an antibiotic; is that right?

BOHIN: That's correct.

JOHNSON: At a time which was noted as being 15.45?

BOHIN: That was what was noted in the notes, yes.

JOHNSON: Can you tell us what happened thereafter, please?

BOHIN: Well, as far as the notes tell me, he was given the antibiotics at 15.45. But at just after 4 o'clock, he stopped breathing suddenly and became very bradycardic, so his heart rate fell dramatically and that was associated with a desaturation. This led to the team giving him prolonged and sustained resuscitation over a significant amount of time.

He didn't respond initially to the usual things that one would do with resuscitation, so he then went on to require, in total, six doses of adrenaline and two doses of bicarbonate as well as being intubated. All of that took nearly half an hour, which is an extremely long time for a baby to be in cardiorespiratory arrest for.

They did eventually manage to get him to recover and it was noted that he began gasping and had a heart rate of over 100 at about 27 minutes after the cardiac arrest started.

JOHNSON: We heard that he was ventilated in the sense of he was given -- put -- an ET tube was inserted; is that right?

BOHIN: Yes. He was bagged initially with a Neopuff that we've heard about before and was receiving chest compressions, but when Dr Ukoh came, he intubated him and therefore he had a more secure airway and that was at around between 10 and 11 minutes.

JOHNSON: Yes. We've heard about the blood gas taken by [Nurse B], a printout from that. What did that show?

BOHIN: It was a very abnormal blood gas. But I would say it's quite unusual to take a blood gas in the middle of a resuscitation. I can only assume the clinical team decided to take this blood gas because at that stage [Baby M] had been resuscitated for quite some time without showing signs of improvement, and as we heard from the clinical team, they were considering stopping treatment.

So I think probably that the blood gas was taken so that they could see kind of how bad things were on the blood gas.

The difficulty is that this blood gas was taken from a capillary sample, which is done from a heel prick by a little needle jabbing into the baby's heel. And that's always going to be very abnormal if you're in the middle of a cardiac arrest. And also it is quite difficult to get the blood because the baby really has no circulation if the baby is receiving cardiac compressions.

So ideally, if you wanted to get a true picture of what was going on, you'd do an arterial sample, but this baby didn't have an arterial line, so they did the best they could, but it showed a very, very abnormal blood gas with a marked respiratory acidosis and a metabolic acidosis and showed a very high lactate, which indicates that the baby's metabolism was ongoing without oxygen for some time -- the lactate was in double figures, I think.

JOHNSON: It's in that -- it's actually 9.8.

BOHIN: Yes, it's very abnormal.

JOHNSON: That also, of course, gives you a reference point to compare to what happened after then when periodically blood gases were taken, doesn't it?

BOHIN: Well, he needed blood gases afterwards (a) to chart his recovery, but he was also receiving respiratory support.

So babies receiving any sort of respiratory support tend to get regular blood gases. The frequency of them depends on what sort of respiratory support they're on, so if they're on a lot of ventilation, they're extremely sick, they may get blood gases

every hour or so. When they're stable on CPAP, they might get blood gases twice a day. There is no set pattern. So he did need to have blood gases subsequently just to check his progress.

But if you're not on any respiratory support, you don't get any blood gases taken.

JOHNSON: Yes. Just taking up the point to which Dr Evans was directed this morning about the hours leading up to [Baby M]'s collapse, would you agree with Dr Evans in that respect that because he wasn't on respiratory support and because there was no suggestion that he was going to become ill, you wouldn't expect the hospital to have taken blood gases?

BOHIN: No. A baby of 33 weeks' gestation, so although premature, relatively mature for a premature baby, who was in air and was well, you wouldn't subject that baby to regular blood gases, no.

JOHNSON: Thank you. So what did you think, looking at your paragraph 7.9 now, about the circumstances of [Baby M]'s collapse?

BOHIN: I was concerned about the collapse because it was highly unusual. There were no clinical hints that he was about to have a sudden and catastrophic cardiorespiratory arrest. And that is unusual in premature infants and I've certainly said that before when giving evidence.

Premature infants who are unwell, you usually get some sort of hint that something is going on, which informs you that you need to keep a special watch on them, maybe screen for sepsis. There are very few things that cause a baby to collapse in this way and I considered some of those, although I felt that the clinical picture didn't fit with those, but I did consider things like infection because that's always a possibility in premature babies.

This didn't fit with an infection.

Aspiration is one thing, where milk feeds go down into the lungs rather than into the gut. But of course he was nil by mouth, so that was not a likely cause.

Necrotising enterocolitis, but again I felt that was unlikely as well. Electrolyte disturbance can sometimes cause a collapse, that wasn't the case here. And a congenital heart problem was the final thing that I excluded from my differential diagnosis because he didn't have a congenital heart problem and he was monitored and so there was no rhythm disturbance noted prior to his collapse. So this was completely unexpected.

JOHNSON: So far as the electrolyte disturbance was concerned, is that the electrolytes in the circulation?

BOHIN: Yes, blood electrolytes. Electrolytes are salts that are in the blood and they can be measured by sending samples to the laboratory or the main ones that we're concerned about in premature infants are -- you get a readout from the blood gas machine. So neonates of this age may get a once a day electrolyte problem (sic).

There was no reason to suspect he should have one, his kidneys were working okay, so there was no reason to suspect an electrolyte problem.

JOHNSON: Is this the sodium and --

BOHIN: Sodium and potassium.

JOHNSON: So you had results for that and they failed to suggest that anything was abnormal?

BOHIN: That's correct and he wasn't receiving additional sodium or potassium in any intravenous fluids.

JOHNSON: So having, in your opinion, reasonably excluded the obvious possibilities, did you take anything else into account?

BOHIN: Well, my conclusion was that I had to find some way to explain that a baby who was previously well had suddenly collapsed, had a very prolonged cardiorespiratory arrest from which he almost did not recover, and then, within a very short space of time, appeared relatively stable again. And I could think of no other things that could cause that other than an air embolus.

JOHNSON: In that context we had some evidence from the treating medics that, on being ventilated, [Baby M]'s chest was rising, falling, the capnograph was registering CO2 coming out, and yet his sats were still dropping. Does that set of observations -- is that consistent with the suggestion of an air embolus?

BOHIN: Well, what that does is exclude a respiratory cause, so a breathing cause, for this collapse because if the clinical team can see his chest moving and then once he was intubated, could see that the breathing tube was in the correct place by the capnograph working, that means oxygen is delivered to his lungs yet we are still in a cardiac arrest state. So it excludes a respiratory cause and the only other cause I was left with was that of an air embolus.

JOHNSON: And so far as -- you have listened to all the evidence of those who treated [Baby M] during the material time; is that right?

BOHIN: Yes, I have.

JOHNSON: And so far as that evidence -- taking it as a whole, is that consistent with your opinion?

BOHIN: Yes. I heard Dr Jayaram yesterday, who described the changes in skin discolouration and they are compatible with that of an air embolus and we've discussed that in other cases in this trial.

JOHNSON: Yes. Later on in the preparations for this trial, you provided a witness statement dated 17 August; is that right?

BOHIN: That's correct.

JOHNSON: That was last year I should have said. Were you asked in that context to consider the mechanism by which it would be possible for somebody with a malevolent intention to introduce air into the circulation of [Baby M]?

BOHIN: Yes.

JOHNSON: In considering that issue, what material did you take into account?

BOHIN: I was provided by some videos by the police, who had prepared these videos for Operation Hummingbird. And one of the videos was entitled "Cannulation", which showed the process of cannulation and the equipment used at the time at the Countess of Chester Hospital. Then the second video was titled "Infusion pumps", which showed how an infusion bag of fluid was set up using the Alaris volumetric pump that was in use at the time at the Countess of Chester Hospital.

JOHNSON: I think we've seen these videos --

BOHIN: We have, yes.

JOHNSON: -- in the course of the evidence, haven't we?

BOHIN: Yes.

JOHNSON: And the cannulation -- I think we have seen the infusion pump video more than once, and the cannulation one, to bring it back to mind, it has a sort of -- it looks like one of those sort of hands from a joke shop almost.

BOHIN: Yes, it has an adult arm, yes.

JOHNSON: So putting that material together with your specialist knowledge of what goes on in these sorts of situations, what conclusions did you come to?

BOHIN: I concluded that there were three possible mechanisms whereby air could have been administered into [Baby M]'s line. The first was that air could have been injected into the bung on a T-piece. There was a photograph shown this morning by Mr Myers of a T-piece.

JOHNSON: Yes. Let's just get the photograph up because it might help you if we can just -- if Mr Murphy wouldn't mind reminding us of what we saw (inaudible: off microphone).

That's the (inaudible: off microphone) report, isn't it?

BOHIN: It is. Once a IV cannula is put in, it is possible to attach the giving set directly to the end of the cannula, but in a baby where the cannula is really very small, the weight of the tubing of the giving set can pull the cannula and dislodge it. So it's absolutely standard practice to have an extra piece of tubing between the giving set and the cannula to prevent -- you tape it in a particular way to prevent the giving set tubing being dragged out and losing the cannula because they are not easy to place, so you don't want to keep replacing them.

So the top piece of equipment is called a T-piece.

I was told by the police that this was the type of T-piece that was used at the Countess of Chester Hospital at the time.

JOHNSON: I'm sorry to interrupt you. Could you show us --

BOHIN: Sorry, it wasn't working before. This is a T-piece (indicating). This bit (indicating) goes to the baby and this bit connects to the giving set of the intravenous infusion (indicating).

These connection tubes come in a variety -- there are a variety of makes, a variety of sizes. This is a rather old-fashioned one and I don't think they're made anymore, but I was told this was what was available at the Countess of Chester at the time. You can see it has this extra bung at the top there (indicating). This bit (indicating) attaches to the cannula, this bit (indicating) would be primed with saline before you attach it to the baby and this bit (indicating) could either have a bung on the end and be left with nothing attached to it or it could be attached to a giving set and fluid infused in it.

In addition to that, if you want to be able to access the intravenous line to give antibiotics, rather than keep undoing this, if it's got fluid infusing through it, you can also put this within this mechanism so there would be this bit going to the baby, a T-piece here, this three-way tap attached there, and then the giving set attached on to that.

This is also primed, but clearly all of this -- and this has a potential to be a dead space so you have to prime it with fluid before attaching it to the baby, otherwise it's full of air and that can cause a problem.

So my conclusions were that there were three possible ways where [Baby M] could have had air administered. Firstly, it could have been through this bung (indicating) because that was the kind of T-piece used at the time.

JOHNSON: Just for the transcript, that's the yellow-coloured --

BOHIN: Yes. It's a self-sealing rubber bung.

MR JUSTICE GOSS: That's what I was just going to ask you.

A bung means different things to different people.

BOHIN: It's a self-sealing rubber bung.

MR JUSTICE GOSS: A rubber bung. So in order to administer it, you do -- put what through the --

BOHIN: A syringe, a needle through that. You'd have to do that in order to get anything, fluid or anything else, through there.

MR JOHNSON: It's the same idea as what there is, as a matter of fact, on the top of a vial of insulin?

BOHIN: Yes, exactly the same. Exactly the same.

The second way is if a three-way tap was in situ, and I'm not sure if they were in use at the time at the Countess of Chester, three-way taps would have been in use but I'm not sure if this was their standard way of administering IV fluids. I think it probably was fairly standard. Clearly, if this white bung on the three-way tap is attached there (indicating), and this blue bung is attached to the giving set giving intravenous fluid, this other bung can be used to give antibiotics, but also air could have been injected via that route as well.

MR JUSTICE GOSS: Sorry, just for the sake of completeness, how through that spare portal, I'll call it?

BOHIN: Just with a syringe. You don't need a needle then because that is just open. Once that yellow one is removed, it's open. So you just screw a syringe on and then you can inject air, fluid, or whatever you need to inject. Usually antibiotics or other drugs are given via that route directly.

If no three-way tap was in place in this set-up, which I think would be unusual because [Baby M] was on antibiotics, air could have been injected using a syringe directly into this T-piece once the IV fluids had been disconnected. So at the time of administering antibiotics, if you haven't got a T-piece you'd have to undo the IV fluids and then give the antibiotics by attaching a syringe at that end and so obviously antibiotic, other fluids, or air could be administered in that way.

MR JOHNSON: Did you consider the alternative factual scenarios of what would induce an almost immediate collapse of a baby and what might induce a delayed collapse?

BOHIN: Well, as I've said, in giving evidence before, the actual volume of air that causes a baby to collapse and die is unknown. But if a large volume of air was injected by whichever of the three means I've suggested -- if a large volume of air was injected, that would immediately cause some sort of air lock in the heart and the baby would have a cardiac arrest and die and would not be able to recover.

If the amount of air injected was of a smaller volume and was not injected as a big push but was in the dead space of this and then all of this was filled with air, which is a small volume, but the fluids were then reconnected, that would take some minutes to get to the baby because [Baby M] was only on, I think, 5.5ml an hour or 5.3ml an hour of fluids, which is 0.8ml per minute.

So a really, really -- very slow infusion and so if air was in these pieces of equipment it would take some minutes to actually get into the patient and get to the heart to cause the collapse.

But because the volume was not sufficient to cause the air lock and cardiac arrest, it didn't cause a sudden death. It did cause an arrest, but something from which he was resuscitated from.

MR JOHNSON: Thank you very much. I have no further questions for you at this stage, thank you. If you'd wait there, please.

Cross-examination by MR MYERS

MR MYERS: Dr Bohin, I've got a copy of the report, the first report, you were following, your report dated 29 April 2019.

BOHIN: Yes.

MYERS: So starting with that, and in your conclusion, final conclusion, to that report, at paragraph 7.15, you say that:

"[Baby M]'s collapse could be due to an obstruction of the airway or, more likely, an air embolus."

BOHIN: Yes.

MYERS: That's what you say there, isn't it?

BOHIN: Yes.

MYERS: I just want to look at the reasoning at that time that took you to those conclusions, so I'm going to go to the start of section 7. Those are the conclusions you reached. I want to go through the process you went through to get to those conclusions. I'm not going to read it word by word because we've just been through it.

At section 7 you start by setting out that [Baby M] was a premature infant, stable and well, apart from some early jaundice.

BOHIN: Yes.

MYERS: Is that correct?

BOHIN: Yes.

MYERS: And you cover in paragraph 7.2 through to 7.3 how he was receiving antibiotics and there was a peripheral cannula in place.

BOHIN: Yes.

MYERS: You then deal with the question of mild abdominal distension and the events earlier on in the afternoon of 9 April at paragraph 7.4, don't you?

BOHIN: Yes.

MYERS: You deal with a new bag of dextrose starting at 15.30 and the antibiotics at 15.45 at paragraph 7.5; is that correct?

BOHIN: Yes.

MYERS: At paragraph 7.6, you describe the deterioration and collapse shortly after 16.00, don't you?

BOHIN: Yes.

MYERS: At paragraph 7.7, you say how he recovered relatively quickly with a heart rate over 100 and gasping at 27 minutes after the collapse?

BOHIN: Yes.

MYERS: At paragraph 7.8, you deal with the question of his blood gas as it was taken during the resuscitation and afterwards?

BOHIN: Yes.

MYERS: Just to remind us, I'm heading towards your conclusion at paragraph 7.15.

At paragraph 7.9 you say:

"The collapse is concerning. There were no physiological hints of him becoming unstable."

And you enlarge upon that, don't you?

BOHIN: Yes.

MYERS: At paragraph 7.10, you exclude any biochemical disturbance, don't you?

BOHIN: Yes.

MYERS: And you exclude anything to do with aspiration by feeding?

BOHIN: Yes.

MYERS: And you exclude infection?

BOHIN: Yes.

MYERS: At paragraph 7.11, you exclude any cardiac issue, don't you?

BOHIN: Yes.

MYERS: I'm looking at the reasoning. At paragraph 7.12, you make reference to Dr Jayaram's descriptions as set out in Dr Evans' statement, don't you?

BOHIN: Yes, I'd not seen Dr Jayaram's statement at that point or since.

MYERS: At paragraph 7.13, you make reference to the fact that there's no blotchiness elsewhere in [Baby M]'s record and he is described by medical staff as "pale +++", don't you?

BOHIN: Yes.

MYERS: Then at 7.14, you make reference to what the nursing records show but that doesn't add any other part to the reasoning in that way?

BOHIN: Yes.

MYERS: Then having set that out, at paragraph 7.15 you then come to what I started with:

"In my opinion, the events surrounding [Baby M]'s sudden collapse requires further investigation. It could be due to an obstruction of the airway or, more likely, an air embolus. Neither of these would have occurred accidentally."

That's what you say there, isn't it?

BOHIN: Yes.

MYERS: And then you conclude with this at 7.16:

"I agree with Dr Evans that [Baby M] was a well baby and therefore his collapse was unexpected with no evidence of impending illness."

You say that, don't you?

BOHIN: Yes.

MYERS: You say:

"I agree with Dr Evans that the events surrounding the collapse need further scrutiny."

Then you conclude with:

"I agree with Dr Evans that the most likely cause of the collapse was air embolus or obstruction of the airway."

That's what you say, isn't it?

BOHIN: Yes.

MYERS: Just pausing for a moment, in terms of airway obstruction that's really not very likely in this case, is it, Dr Bohin?

BOHIN: It isn't very likely, but needs to be considered because the other things I'd gone through. An obstruction of the airway, at that point no one knew whether [Baby M] had a congenital anomaly of his airway and subsequently we found out he didn't have it. But obstruction of the airway is something to consider. You wouldn't expect a baby to collapse and then recover as quickly as he did with an obstruction of the airway, but clearly if you relieve the obstruction, a baby is going to recover.

MYERS: But you need to have some basis for your opinions, don't you?

BOHIN: That's the differential diagnosis. You go through what you think might have caused the sudden collapse and then cross them off as you go through. So a blocked airway is always likely to be a cause of a sudden collapse.

MYERS: It's not blocked in terms of an accident, you're saying deliberately blocked, aren't you?

BOHIN: Yes, because -- yes.

MYERS: Would you seriously have suggested that if Dr Evans hadn't suggested it in his report first?

BOHIN: Yes, I would have suggested it.

MYERS: For what we have here, there's plainly no physical evidence of anything tantamount to airway obstruction, is there?

BOHIN: No, there's not.

MYERS: I have gone through the reasoning that you set out in your report, Dr Bohin, for this reason. There's not really in that reasoning much to support air embolus apart from the fact that there is no other explanation that you can give?

BOHIN: Well, there's a sudden collapse, a prolonged cardiorespiratory arrest in a baby that was previously well. And so something had caused that. The baby almost died, thankfully was resuscitated, and then was relatively well. Babies who have had a prolonged cardiac arrest are not usually very well afterwards, they certainly are not extubated and on to CPAP and starting feeds a day or so later. So the recovery was as perplexing as the collapse and, for me, air embolus fitted with such a scenario.

MYERS: First of all, most babies who have a rapid collapse from air embolus do not recover at all, do they?

BOHIN: But they can recover.

MYERS: But if we're looking at the way these things go generally, they don't, do they?

BOHIN: Well, we haven't got much evidence to support that, so some babies will die depending on the volume of air that's injected, other babies don't die and survive. So it's not inevitable that babies will die of an air embolus.

MYERS: Next, on the question of discolouration, you heard me say this over the link, I am sure, when you listened when I said this to Dr Evans. Whatever we make of discolouration really depends on the reliability of what Dr Jayaram says in his statement, doesn't it?

BOHIN: Yes.

MYERS: As to a rapid collapse, I'm not disputing it is rapid, but that doesn't mean that it is inevitably an air embolus that has caused that?

BOHIN: No.

MYERS: An air embolus is a possibility?

BOHIN: It's the possibility that I think caused his collapse.

MYERS: I think you said to the jury that when you considered all of this, the words you used were you had to find some way to explain the collapse in a baby who you say was stable.

BOHIN: Yes.

MYERS: But as a medical exercise and as an expert, Dr Bohin, it isn't inevitable that you have to reach for some explanation if no explanation is equally suitable?

BOHIN: Well, you don't make an explanation up. You look for a differential diagnosis of possible causes and then either confirm or exclude them, which is what I did.

MYERS: Sometimes there can be a cause, a medical cause, that is nevertheless unascertained, can't there?

BOHIN: I can't think of a situation where that would occur, no.

MYERS: Does it not remain the case that one can't exclude the possibility of a medical explanation?

BOHIN: I think that is the explanation.

MYERS: What you've done is to look for some sort of explanation, some sort, and reached for air embolus, haven't you?

BOHIN: No.

MYERS: The factors you rely on for air embolus or the fact, really, is the speed of the collapse and then the recovery; that's right, isn't it?

BOHIN: No, it's not just that. It's the fact that the baby was well before, so this baby had a precipitous cardiac arrest and that is just incredibly unusual of babies of that gestation who were well beforehand. And babies who have an underlying cardiac cause or other cause, having been resuscitated, remain very, very unwell for some time and that is just not what we saw in this case. And air embolus fits with what the medical staff and the team on the ground at the time saw.

MYERS: There is no specific evidence, as it happens, of an air embolus at all, is there?

BOHIN: There's no single diagnostic feature of an air embolus, but this clinical scenario fits with an air embolus.

MYERS: When you say, as you say in the report, "There were no physiological hints of him becoming unstable", again I'm not going to rehearse everything we've gone over through what happened in the day before the collapse. I am going to suggest there are actually, to use your word, hints that something wasn't right with [Baby M]?

BOHIN: No.

MYERS: You don't accept that any of the material we have been through in terms of what the nurses identified and being made nil by mouth is any indication of being unwell?

BOHIN: No, I don't think he was unwell. I think he was under phototherapy, which made him hot, which made him breathe quicker. He had 1.5ml of bile-stained aspirates -- so I think we need to make it clear it wasn't pure bile, it was bile-stained aspirates, so gastric juice along with bile. That potentially may have been a problem. The medical (sic) staff did exactly the right thing by asking the doctor to review it and they were being very cautious and stopped his feeds. But as we found out, he did not have an underlying gastrointestinal cause for his collapse.

MYERS: Whatever the reason for there not being a blood gas check in the 22 or so hours between the last one and the collapse, as

a fact we cannot know what his blood gas was like over that period, can we?

BOHIN: Well, no, because one wasn't taken and there was no clinical indication to take one.

MYERS: You can't assume therefore everything where that is concerned is fine, can we?

BOHIN: We only undertake blood tests on babies if we think they're unwell, to try and find out why they're unwell.

The medical team treating him clearly didn't think he was unwell or they would have undertaken some tests.

We don't do blood tests willy-nilly on babies. It's not appropriate, it's not ethical to do that.

MYERS: They thought there was potential problem enough for him to be made nil by mouth, didn't they?

BOHIN: That was a precautionary measure and the medics at the time decided to adopt a watch-and-wait approach, which is very common. If things had changed after that, they may have investigated further, but as it happened, things didn't change until he collapsed.

MYERS: Being made nil by mouth is a deviation from the norm, isn't it?

BOHIN: Not for a baby of that gestation. They are put on and off feeds on a very regular basis.

MYERS: And one can't disregard the possibility that the collapse that happened at 16.00 is medically connected to what had happened before?

BOHIN: I don't think it is, no.

MYERS: As to what happens afterwards, we know there are bradycardias and desaturations in the 12 to 24 hours that followed?

BOHIN: Yes.

MYERS: They could be linked to the collapse at 4 pm on the 9th, obviously?

BOHIN: Yes.

MYERS: They could be linked to an underlying issue that plays a part in that collapse? That's a possibility, isn't it?

BOHIN: I think it unlikely given the description of the posturing that was given by the medical and nursing staff. The description of the posturing shows a baby who's suffered some sort of hypoxia in the clenching -- the sucking on the endotracheal tube and the posturing of his limbs is very characteristic of a baby who's suffered a hypoxic insult and, so far as I'm aware, there were no other hypoxic insults around that time.

MYERS: When we get to 10.15 on the 10th and there's bradyapnoea and apnoea and desaturating to 60, that isn't the time of the fist clenching or the sucking on the tube.

BOHIN: No.

MYERS: And that could be part of an underlying issue as much as it could be a consequence of what had happened on the 9th at 4 pm?

BOHIN: No, I think it was a consequence of his collapse on the previous day.

MYERS: Can I confirm, are you able to discount entirely an underlying issue or is that possibility?

BOHIN: I think you can discount it because he didn't go on to have any other problems that you could relate to that time. So if he had an underlying issue it would have emerged and we would have known about it. He had no other underlying issue that emerged subsequently.

MYERS: Do you accept that when one considers cause in a medical situation like this, there has to be consideration of the possibility of a medical cause that has not been identified?

BOHIN: There has to be consideration, but looking at the entire history, which is what I did, nothing else came out of the history or his clinical presentation which would lead me to think that there was an underlying cause which, up until the point of his collapse, had not been discovered. Not then, not since.

MYERS: You settle on air embolus?

BOHIN: Yes.

MYERS: And you do that principally because of the unexpected nature of a rapid collapse and then a recovery?

BOHIN: In a baby that was previously well and the findings of Dr Jayaram with the skin changes.

MYERS: Can I just ask this -- oh, so you do rely on what Dr Jayaram says there?

BOHIN: I had to take that into consideration.

MYERS: Right. That forms part of your basis for the conclusion that it is an air embolus?

BOHIN: Yes.

MYERS: I want to move next to the question of mechanism. When you've considered how this could happen, you've relied upon material provided to you by the police; is that correct?

BOHIN: Yes.

MYERS: You've listened to the evidence over the past few days.

There's not actually been a description from any member of staff as to the precise set-up of this kit, has there?

BOHIN: No.

MYERS: And you have no information directly from anyone who's working there as to the use of three-way taps at the Countess of Chester, have you?

BOHIN: No. As I said, it would be standard practice. If a baby was receiving intravenous fluids and having antibiotics and only had one line, it would be standard practice to have a three-way tap in situ because what you don't want to do is to keep unlocking the fluids and have to inject antibiotics and then out the fluids back on because that poses an infection risk. So I would say although I don't know for absolutely sure, it is absolutely standard in every hospital I've worked at for a three-way tap or a similar device -- now we have something called an octopus -- to be in place to allow multiple ports.

MYERS: That's what I was going to ask you actually. There is an alternative which is an octopus connection, isn't it?

BOHIN: There is an alternative. I asked -- I am not quite sure when octopus devices came in. When I asked the police what was in use by the Countess of Chester at the time, I was given a picture of that T-piece, which is a fairly old-fashioned device and we don't use them anymore. Now we would use an octopus

device and I believe the Countess of Chester do use octopus devices now but when that was brought in, I don't know.

MYERS: Just to assist anyone who isn't immediately up on what an octopus is, that's the connection with possibly any number of little tubes coming off it individually that hang loose?

BOHIN: Yes. So whereas that T-piece that I showed just had one arm, an octopus can have two, three, four or more.

MYERS: And that's how you deal with the question of needing multiple ports, you use a different arm for different entries?

BOHIN: Yes.

MYERS: If we carry on with the T-piece that you were provided with just to confirm some issues relating to that.

You've described the three possible ways that air could be introduced with the T-piece and three-way tap set-up that you have given us.

BOHIN: Yes.

MYERS: You accept, Dr Bohin, it's simply not possible to provide an accurate timescale as to how quickly air would travel and how quickly collapse would follow; that's right, isn't it?

BOHIN: It is.

MYERS: You can't do that. You agree, don't you, that rapid injection of a volume of air into any of those three points could cause an almost immediate collapse?

BOHIN: A large volume of air, yes.

MYERS: By large, we're talking maybe a millilitre?

BOHIN: Millilitres, yes.

MYERS: As we heard earlier, the bore of these tubes is very narrow, isn't it?

BOHIN: Yes.

MYERS: If you squeeze a little bit in, it's going to travel quickly.

BOHIN: It depends how strongly you push it, I suppose.

MYERS: All right. But we have seen also with the insulin infusions during the resuscitation, we are talking about 0.18ml of insulin is given to [Baby M] as a --

BOHIN: Adrenaline.

MYERS: Sorry, 0.18ml of adrenaline is given to [Baby M].

BOHIN: Ah yes, but that would be followed by -- because 0.18ml may just sit in that T-piece, so that has to be followed by a bolus of saline, which is normally -- in a baby of this size is normally 2ml, so that ensures that the adrenaline is pushed through all of that tubing and gets to where it needs to go. So if you just gave 0.18 of a millilitre it would just sit in the tubing.

MYERS: Because it's not long enough, is it? It has got to be more than the volume of the tube --

BOHIN: Yes, it's got to go into the circulation.

MYERS: And the tubing is possibly anything from 0.35ml to 0.5ml in volume, something like that?

BOHIN: It is. I've measured the equipment used in my own unit, but clearly that's not the same as that T-piece, so it would just be an estimate. I think with the three-way tap and a current -- the current octopus that we use, it's about 0.3 of a millilitre.

MYERS: Is it standard to flush the port with saline whenever anything's being put through it?

BOHIN: Yes, every port -- yes, any port you would flush before and you flush after.

MYERS: So if antibiotics are put in, you flush after with saline as well then?

BOHIN: Yes.

MYERS: You raised the possibility of what happens with a very small volume of material going into the dead space.

Of course if that's flushed through after the saline that's going to flush it through in any event, isn't it?

BOHIN: It is if it's flushed through, but if it's not and the IV fluids are just reconnected it will go very, very slowly.

MYERS: But if somebody injects whatever they are injecting into that port, say a course of antibiotics, and then it is flushed with saline, which is what would follow in the course of antibiotics, that flushes it through?

BOHIN: Yes.

MYERS: Again, just as you were talking about being difficult to and unable, really, to establish exactly what volume would travel at what speed and in what way, even if we're talking about very small volumes being used, it's impossible to gauge precisely how much would travel how quickly at what rate?

BOHIN: I don't know that.

MYERS: No. But we do know that certainly once we're getting to about 0.3 or 0.4ml, approaching the volume of those tubes, if that's pushed in, that's going to go right the way through?

BOHIN: If it's pushed in, but if it sits in the plastic chamber of the T-piece and the three-way tap and it isn't pushed, but it's just connected to the fluids, it won't be pushed it'll go very, very slowly after that because the rate was 0.8ml per minute.

MYERS: There's no way of knowing how slowly it would go, is there?

BOHIN: No. Well, only if it's attached to the IV fluids and then we do know how slowly it would go because it would be going at 0.8ml a minute.

MYERS: But then, as you say, in any event if it was then flushed with saline, that pushes it in in any event?

BOHIN: But why would somebody push saline through afterwards?

MYERS: After the use of antibiotics.

BOHIN: If you -- after the use of antibiotics, yes. But not if you've put air in there.

MYERS: No, no. I'm just looking at the timings we have and what we've seen on the review, Dr Bohin --

BOHIN: Oh, okay.

MYERS: -- which is antibiotics at 15.45, isn't it, when they were administered?

BOHIN: Yes, that's the time signed yes.

MR MYERS: Thank you.

MR JOHNSON: Does your Lordship have any questions?

MR JUSTICE GOSS: No, I don't, thank you very much.

Thank you, Dr Bohin. You'll be back tomorrow, I assume --

MR JOHNSON: Yes.

MR JUSTICE GOSS: -- to give evidence about [Baby L].

Thank you very much.

(The witness withdrew)

MR JOHNSON: That's the rest of today's business.

MR JUSTICE GOSS: Thank you.

We're up against the Professor Hindmarsh issue now.

You know what's coming. It's the summary of the interviews in relation to [Baby M].

Summary of interview with LUCY LETBY re [Baby M] (read)

MR JOHNSON: When interviewed on 5 July 2018, Lucy Letby remembered [Baby M] and the day he collapsed on 9 April 2016 in some detail.

The nursery had been very busy and he was the fifth baby in nursery 1, which usually only held four babies.

As a consequence, she said that [Baby M] was attached to a portable Massimo monitor located in a corner space of the nursery, which was not a usual space. He was not on a full Philips monitor.

Lucy Letby recalled the Massimo monitor going off and attended at the monitor. Prior to this, Lucy Letby was checking drugs with Mary Griffith. On hearing the monitor, Lucy Letby went to start an airway for [Baby M] whilst Mary Griffith went for help.

Lucy Letby said that [Baby M] collapsed at about 4 pm.

She agreed that she had co-signed for medications at 3.30 and 3.45 pm but was not sure if she had administered them.

During the interview on 12 June 2019, Lucy Letby repeated that she could remember being in the same room, nursery 1, as the check nurse for medication being prepared by Mary Griffith at the workbench when they heard [Baby M]'s alarm activate. Lucy Letby could not remember if [Nurse B] was in the room at the time and she confirmed that she was, in other words Lucy Letby, the first at his cot side in response and she denied doing anything to harm [Baby M].

Lucy Letby was questioned about the exhibit PMB/8, which are those notes on the paper towel. It was put to her that this was recovered from one of the bedrooms at her home address during a police search. She said that the notes were not all in her handwriting and she thought that she must have taken the paper towel home inadvertently. Lucy Letby could think of no reason why she had kept it but felt that it was an error on her part in not emptying her pockets before leaving work and then inadvertently taking the note home. She said that it may have been put to the side and forgotten about and she denied it was to remind her of an attack on [Baby M].

She was shown her diary and she agreed that she had recorded LD for long day and "twins" on 8 April 2016.

She said that she had put that in her diary because she attended the twins' delivery and she had also entered "LD extra twin resus" on 9 April 2016. Lucy Letby said she had documented this as she had done an extra shift and she had documented what had happened that day and she said that the resuscitation was a significant event on that day.

So that's very much a short summary of the material that you will receive in due course. I'm not sure we can take it any further today, I'm afraid.

MR JUSTICE GOSS: I think from what you said earlier, I don't think you can because all that's left is Professor Hindmarsh and then Dr Evans and Dr Bohin coming and giving their opinion after his evidence, which will be tomorrow.

MR JOHNSON: If it's any consolation to the juror that asked a question, there will be a table provided tomorrow with the readings on.

MR JUSTICE GOSS: Yes. We go back to that question that was asked a long time ago. That note, do you remember, that came from one of you? The answer is in the affirmative that you're going to get a table.

MR JOHNSON: It is, although it has not been done by Professor Hindmarsh.

MR JUSTICE GOSS: There will be one.

So 10.30 tomorrow then, please, members of the jury.

Thank you very much.

(In the absence of the jury)

Housekeeping

MR JOHNSON: There is one issue I would like to mention. It concerns the evidence of [Father of Babies O, P & R], who is the father of [Babies O & P]. His evidence was recorded as an interview, an audio video interview, an AVE type interview, because of his personal circumstances, if I could put it in that neutral way. Those personal circumstances are set out in the recording.

This material was served 2 years ago, I think.

[Father of Babies O, P & R] has never been required as a witness, therefore in accordance with what we understood was the normal procedure, we thought that we'd be able to play the material to the jury. We're now told that there will be an objection to that, although the objection hasn't been formalised as yet. I'm not complaining about the fact it's not been formalised and I don't want to get into an argument about it, but we understand the position is going to be that your Lordship is going to be required to adjudicate on this issue.

The relevance of it is that he describes, in possibly the most graphic way you could, the discolouration, the flitting pattern, colours changing, on his son's stomach, which is obviously highly significant and the way he describes that is highly significant, so we're very keen for the jury to see it as he described it at the time.

The problem is that if we're going to have to edit this video, that is not the work of a couple of hours, and so we would prefer to have a ruling as soon as possible. This may be something we can do tomorrow once we've completed the evidence with the jury because time is very much of the essence as far as we are concerned.

MR JUSTICE GOSS: Yes, right. Mr Myers, I think I've understood what the issue is here. Can we deal with it tomorrow afternoon?

MR MYERS: Yes, I'm sure we can, my Lord. I don't anticipate it's anything which is lengthy. I won't begin to set out --

MR JUSTICE GOSS: No, don't start.

MR MYERS: Your Lordship is acquainted with what we're going to be dealing with. It's not a lengthy matter, I'm sure we can deal with it tomorrow after the evidence is finished.

MR JUSTICE GOSS: Yes.

MR JOHNSON: I'm helpfully reminded, what we're seeking to do is to send to Mr O'Leary a link to the material which is on EGRESS(?) so your Lordship can at least watch it before tomorrow, if possible, to get an idea of --

MR JUSTICE GOSS: I was going to say that would be helpful so I can actually see. About how long is this interview?

MR JOHNSON: The whole interview takes a while. We wouldn't seek to deploy the whole thing. What we're concentrating on is that issue, primarily.

MR JUSTICE GOSS: Is there a transcript of it in the DCS?

MR JOHNSON: Yes.

MR JUSTICE GOSS: If when you send the link to my clerk for the recording itself, could you give me the reference for the transcript as well, please?

MR ASTBURY: The interview itself is 1 hour and 30 minutes.

We proposed some substantial editing, so we wouldn't want to play the entirety of it. We can also give the court the timing of the relevant passage.

MR JUSTICE GOSS: I was going to ask, could you identify the salient parts?

MR ASTBURY: Yes.

MR JUSTICE GOSS: Thank you. I think there's a note from the jury.

(Pause)

Mr Murphy, the very problem that I had on my iPad.

Documents behind each child seem to all be [Baby A] and [Baby B]'s rather than those relating to each child.

(Pause)

Before Mr Johnson stood up, I was just going to say that I still have the problem that when you click to the additional documents, and I haven't been clicking on the tiles because I just wanted to find a J document, and it's still...

MR MURPHY: I didn't want to make any changes during a session.

MR JUSTICE GOSS: Don't worry at all. What I'm proposing to do then is, rather than have the jury come back into court, is to ask the usher to thank the jury for their note, say it's a common problem that I had actually ascertained before we had the lunch break, and it is being addressed, but tell them not to worry, it's a known problem and it's trying to be resolved.

Thank you very much.

MR JOHNSON: Just in relation, going back to the video, the common practice, as I understand it, is that unless witnesses are required, the formal special measures application isn't made under section 27 of the Youth Justice and Criminal Evidence Act. So my reading of section 27, and as always I'll defer to your Lordship's better view, is, whether or not objection is made, an application needs to be made. So we have regularised that position now and an application has been disseminated, just for completeness.

MR JUSTICE GOSS: I have not encountered the situation before where there is a video recording and there is no application if it is to be played, but that's usually because it's such an obvious witness who's required to attend.

MR JOHNSON: Quite. And it's a prerequisite to the section 27 procedure (overspeaking) so that's why one normally has it.

MR JUSTICE GOSS: This can all be looked at and if we can deal with it tomorrow, we will. If not, we'll deal with it at the very beginning of next week. I've got some time now. If I can have access to the material, I'll do it.

MR MYERS: A different matter, of course, but as per usual we'd be grateful if we could speak to Ms Letby at the conclusion of the hearing today.

MR JUSTICE GOSS: Yes. The senior officer has acknowledged that. Thank you very much.

(3.10 pm)

(The court adjourned until 10.30 am on Friday, 24 February 2023)