London Bridge Inquests

Day 14

May 24, 2019

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(10.06 am)

MR HOUGH: Good morning, sir. Our first witness is Dr Ashley Fegan-Earl.

DR ASHLEY FEGAN-EARL (sworn)

THE CHIEF CORONER: Good morning, Dr Fegan-Earl.

A. Good morning.

THE CHIEF CORONER: Please do make yourself comfortable. If you wish to sit or stand, whichever you feel more comfortable doing. Can I simply ask if you have the microphone close to you.

A. Of course.

THE CHIEF CORONER: And much of what you are going to say I suspect is going to be translated so we will take things at a pace that will help those who are translating for others to hear in another language.

A. Yes, of course, sir.

THE CHIEF CORONER: Thank you.

Questions by MR HOUGH QC

MR HOUGH: Would you please give your full name for the court.

A. Dr Ashley William Fegan-Earl.

Q. Dr Fegan-Earl, you understand I'm asking you questions first on behalf of the Coroner?

A. Yes.

Q. You may then be asked some questions by other lawyers. What is your profession?

A. I am a Home Office pathologist and consultant forensic pathologist.

Q. Could you summarise your relevant qualifications, please.

A. I hold the degrees of Bachelor of Science, Bachelor of Medicine, Bachelor of Surgery. I hold the Diploma in Medical Jurisprudence. I'm a fellow of the Royal College of Pathologists and a fellow of the Faculty of Forensic and Legal Medicine of the Royal College of Physicians.

Q. In your capacity as a pathologist, did you perform a post mortem examination on Christine Archibald on 8 June 2017?

A. I did, yes.

Q. Did you perform a post mortem examination on Sara Zelenak on 6 June 2017?

A. Yes, that's right.

Q. Did you make reports as a result of both of those examinations?

A. Yes.

Q. You may refer to those as you wish.

A. Thank you.

Q. And you appreciate you're being called to provide the conclusions of those reports?

A. Indeed, sir.

Q. I'm going to address Christine Archibald first, and then you may be asked questions by others about her, and then I shall ask you some questions about Sara Zelenak and you may be asked questions about that report after that.

A. Yes, I understand.

Q. Let me just make this clear also: that it will be necessary during your evidence to give some graphic details of injuries and examinations?

A. Yes.

Q. But we shall be using body maps to illustrate the injuries, which are obviously stylised images rather than personalised images, but they are nevertheless graphic in that they illustrate some very serious injuries.

A. Indeed, sir, yes.

Q. May we begin, then, with Christine Archibald and the external examination you carried out on her. Looking at your report on page 4, what were the findings of your external examination relating to her head and neck and, while you are answering this question, may we have on screen, please, {PM0094/4}?

A. This view of the head we see a series of abrasions or grazes covering the right-hand side of the face.

You can see the entire aspect of the nose, right cheek, around the right eye, right forehead and onto the chin, together with lacerations or tears to the lips.

Q. And then the next page, please, {PM0094/5}, is, I think, a view of the crown?

A. Yes, an aspect looking at the back of the head and, at number 8, there was a laceration, a tear through the tissues of the scalp.

Q. May we then have page 3 of the same document, please, Oli. {PM0094/3}.

A. A full view of the face showing that there are abrasions not only on the right but also extending back onto the left-hand side of the face. Number 10 refers to the presence of blood within the ears, indicative of a very serious head injury.

Q. I'm now about to ask you about your examination and findings external to the anterior or forward-facing torso. Even the body map in this respect is quite graphic.

A. Yes.

Q. I make that clear before I show it. May we have page 6 of the same document, and could you please explain your findings there? {PM0094/6}.

A. This graphic shows very extensive grazing over much of the front of the torso and the breasts, and it also

includes an extremely deep tear, a laceration, which is indicated at number 13.
Q. The next page, please {PM0094/7}. What were your findings to the posterior torso, the back?
A. Similarly, there's extensive grazing covering the entirety of the lower back consistent with extensive grazing and friction against the skin.
Q. What's the finding denoted by the number 16?
A. Number 16 represents within that area of grazing a puncture wound, so an object entering the skin at that point, but not a stab wound.
Q. The next page, please, I think we will look at the left shoulder and back area {PM0094/8}.
A. We see there in addition to that grazing to the back, higher up areas of lighter grazing with some slightly patterned area of bruising at number 17, that may be the weaving print of clothing.
Q. {PM0094/9}, please. This is the lateral aspect of the left thigh?
A. Yes.
Q. What was your finding here?
A. So looking at the outer part of the left thigh, there was an area not only of grazing, but also of burn-type injury, the nature of which would be consistent with contact with a hot surface and in this context, the

undersurface of a vehicle.
Q. At {PM0094/10}, please, the left knee, outer aspect.
A. There there was a deep laceration, a tear just in the front of the left knee, associated with grazing, extending down part of the left lower leg.
Q. Then the next page, please {PM0094/11}, the inner aspect of the left knee?
A. Where you see further areas of bruising and grazing.
Q. Next page, please {PM0094/12}.
A. Looking at the top of the lady's left foot you can see a series of skin tagged abrasions, so grazes which have raised small flaps of skin.
Q. Now moving to the right lower limb, the right leg {PM0094/13}, please.
A. Extending over the outer part of the right thigh, we see a mixture of grazing and bruising, but you can clearly see there within that injury is a patterned element consisting of intermittent parallel lines. So this may be a patterned abrasion as an object has compressed this area.
Q. What sort of object?
A. Potentially a tyre.
Q. The next page, please, {PM0094/14}, the right knee?
A. In a similar vein to the left knee, there were areas of grazing to the inner aspect of the right knee.

Q. And finally on the right leg, the right foot, page 15, please {PM0094/15}.
A. In comparison with the left foot, similarly small areas of skin grazing on the great toe.
Q. Moving to your examination of the upper limbs, {PM0094/16}. What were your findings in relation to the left upper limb, the left arm?
A. Not only was there bruising and grazing of that limb, there were also fractures to the bones of the limb.
Q. And we'll look at those fractures in a moment.
A. Yes.
Q. Then page {PM0094/17}, please, what findings have you made here?
A. Over the backs of the fingers, knuckles and on the backs of the hand, you can see further small areas of grazing.
Q. And then moving to the right arm, the right upper limb, {PM0094/18} at the elbow.
A. An injury complex over the right elbow comprising grazing, and you can see there deep tears passing into the elbow joint.
Q. And finally for the external examination, {PM0094/19}, the right shoulder.
A. Grazing you can see passing in a tongue from the back top right shoulder downward in the region of the right shoulder blade.

Q. May we now move to your internal examination, take up page 20 of the body maps {PM0094/20}, looking at the section of your report headed "Central nervous system", what fractures and other signs of internal injury did you find to the head?
A. That image demonstrates some of the various bones that make up the skull. There was extensive damage to these bones, with a fracture to the occipital bone, which is the bone at the back of the head, the temporal bone, that on the side, either side of the head, the maxilla, which is the upper jaw and the nose, and those fractures on the side of the head further extended onto the base of the skull, which would explain the bleeding that I identified from her ears.
Q. What findings and signs of associated haemorrhage did you find?
A. There was patchy subarachnoid haemorrhage, which is bleeding beneath one of the fine membranes that covers the brain, typical of impact-type trauma causing that bleeding.
Q. I think associated with the damage to the maxilla, you also found a fracture of the nose and loss of teeth?
A. Absolutely, so a relatively small area, so damage to that region can cause extensive bony damage to a number of areas.

Q. Moving to the head and neck, what findings did you make there?
A. In addition to the fractures to the jaw and loss of teeth and the fracture to the nose, there were some bruises within the sternomastoid muscles, which are the large muscles that help us turn our head from side to side. The spine in that region was intact.
Q. Next the cardiovascular system. What findings did you make on internal examination in that respect?
A. The heart was completely healthy and without any natural disease, however, there were two tears of the aorta, which is the largest artery in the body, which leaves the heart, arches up and passes down the spine, a tear just as it left the heart and complete transection, so cutting in two, lower down the spine. So that is a significant critical and fatal injury.
Q. Thank you. The respiratory system next. What findings did you make in that respect?
A. So there we're considering the ribcage and the lungs. There was extensive bleeding, particularly over the left-hand side of the chest wall. Blood was present in the space between the lungs and the ribs and there were fractures to each and every one of the ribs, both right and left-hand side. This had given rise to tearing of the lungs, collapse and bleeding.

Q. Consistent, again, with massive pressure to the torso?
A. Yes, absolutely, and extensive contact given that all the ribs were multiply fractured, both right and left-hand side.
Q. The gastrointestinal system, what findings did you make in your internal examination in that respect?
A. In regard to the large tear that was shown on the torso graphic, that extended into the abdominal cavity, causing some bleeding, but no further critical findings there.
Q. The liver and the remainder of the hepatobiliary system?
A. The liver showed an area of crushing, and that's not surprising when one considers that the liver sits behind and around the ribs on the right-hand side.
Q. Then the spleen and the reticuloendothelial system?
A. The spleen which lies beneath the ribs on the left-hand side was part avulsed. In other words, its principal blood vessels had been torn.
Q. Before we move to fractures, were there any other significant findings of your internal examination?
A. No, in essence it showed that Ms Archibald was fit and well at the time of her death; there was no natural disease.
Q. May we have page 22 on the screen of the body maps {PM0094/22}. By reference to this, what findings of

fractures and other musculoskeletal injuries did you make?
A. We discussed fractures to the skull and, in passing, fractures to the bones of the left arm. In addition to the rib fractures that you can see there, if you look at the diagram on the right-hand side, that is labelled T10, which refers to the tenth thoracic vertebra. That had been fractured completely in two which also would have transected the spinal cord, it is an extremely serious injury to the spine at that point.
There was, in addition, not only bruising of the fat, but liquefaction of the fat, which will occur when there is extreme pressure applied to those tissues, and finally the tips of the vertebrae, the small knobs that you can feel when you run your finger down your spine, were sheared away, so indicative of major shearing forces applied to the spine.
Q. Thank you. Did you also find in your musculoskeletal examination findings consistent with the massive tearing of the abdomen which you saw externally?
A. Yes.
Q. Moving to your conclusions, please, what were the principal conclusions of these various findings?
A. I found that Christine Archibald was a well nourished lady who showed no natural disease that could either

have caused or have contributed to her death. In my opinion, she died as a consequence of an act of terrorism. The circumstances I rehearsed briefly. In my view, the injuries demonstrated were wholly consistent with vehicular impact and, given the nature of this incident, I can confirm there was no evidence of any wound arising from a knife, nor was there any evidence of any gunshot wound.
The injuries themselves are indicative of a high-energy impact, and they were devastating, and in my opinion, therefore, taking into account the extent and gravity of those injuries, death would have been near instantaneous. There is no medical treatment that could have saved her life, however early that was provided.
Q. May I just pause you there. One or two questions arising from that, you say that death would have been near instantaneous. Is it therefore your opinion that Christine Archibald would not have suffered to any great degree?
A. It is.
Q. Second, you say that no medical intervention, no matter how early, could have saved her life. Do you mean by that, no medical intervention even of the kind that can be achieved in hospital?

A. It would not matter if a full operating theatre was present: she could not be saved, given the extent of those injuries.
Q. You were about to continue with your conclusions to deal with the consistency of the findings with the mechanism of injury.
A. My view was that the features are consistent not only with a strike to an upright body by a vehicle, but also with overrun, beneath the wheels of the vehicle. I say this on the basis of the severe crushing injuries that are present, the patterned areas on the legs, which may be consistent with a tyre, and the presence of burn-type injuries, which would be expected when there was contact with hot surfaces of a vehicle beneath. My understanding is that this accords with witnesses who saw a body beneath the vehicle.
Q. The witness evidence and, indeed, the CCTV evidence, suggests that Ms Archibald was struck, was then pushed forward by the vehicle over the road surface, and was released as she was driven into a central kerbed reservation?
A. Yes.
Q. I gather from your explanation that all the injuries are consistent with that mechanism?
A. Entirely so.

MR HOUGH: Thank you. Those are all my questions. There may be some more for you.

Questions by MR PATTERSON QC

MR PATTERSON: Dr Fegan-Earl, I ask questions on behalf of the family of Christine Archibald.

We have had evidence from the CCTV footage which confirms that from the moment her body was released and deposited in the middle of the carriageway, having been carried forward some distance by the van, there were no visible movements?
A. Yes.
Q. And, secondly, we've had evidence from members of the public who were with her in the minutes that followed this who have confirmed that there were no signs of life at any stage. Does all of that support your findings that death would have been near instantaneous?
A. Yes, that is entirely consistent with the pathological findings, yes.
Q. The facial impact, and you've described the fracture to the nose, to the jaw, the fractures plural to the skull --
A. Yes.
Q. -- of them themselves could have rendered her immediately unconscious, perhaps?
A. Certainly so. A skull fracture is evidence of

application of severe force to the skull, and therefore I would expect the delicate nerve fibres to be damaged and therefore her to lose consciousness as a consequence of that even if it had been the only injury.
Q. So before we even get to those critical and fatal spinal injuries and the chest compression and all those other terrible injuries, immediately she would have been unconscious?
A. Yes, I can say that with confidence.
Q. So one thing that her family can perhaps take from your evidence is that there would not have been any enduring of any real significant period of pain?
A. Yes, that is right.
Q. We've had evidence that the estimated speed of the van was something in and around 34 miles per hour at the point of impact. Those injuries that you found, Dr Fegan-Earl, both externally and internally, they were horrific injuries, weren't they?
A. Yes, they were.
Q. You used the word "devastating" in your report?
A. Yes, they are, yes.
Q. And do they show only too graphically just how lethal vehicles can be if they are used as weapons against the public?
A. Indeed. I've stated this before. Even though 34 miles

an hour may not sound like much, the energy transfer when a body is struck is immense. If one then adds to that an overrun, it clearly demonstrates that a vehicle can produce multiple independently fatal injuries as are demonstrated here.
Q. And a few months ago you had the sad duty of giving similar evidence in relation to victims of the attack on Westminster Bridge?
A. Yes.
Q. And, again, the evidence on that occasion was of rather modest speeds by the terrorist's vehicle.
A. Absolutely. But nonetheless, it's clear to see the devastating injuries that such a vehicle even at low speed can produce.
Q. And the vulnerability of the public if a terrorist chooses to attack with a vehicle?
A. Plainly so.
MR PATTERSON: Thank you very much. That's all I ask.

Questions by MS SIMCOCK

MS SIMCOCK: Doctor, I ask questions on behalf of the London Ambulance Service. Given your conclusions that, sadly, Christine Archibald died near instantaneously, is it likely that at that time -- I appreciate you are not a clinician -- but is it likely at that time her heart rhythm would have been asystolic?

A. It would have been asystolic. I have no doubt in that at all.
MS SIMCOCK: Yes, thank you very much, thank you, sir.
Further questions by MR HOUGH QC
MR HOUGH: Dr Fegan-Earl, may we now move to your report concerning Sara Zelenak.
Once again, do you record in your report a number of external examination findings?
A. Yes.
Q. May we begin with your findings concerning Sara's left leg, and for that purpose bring up {PM0104/3}. What were the findings you made in relation to the left thigh that are depicted on this body map?
A. For orientation here, we're looking at the front of the lady's left leg, you can see two injuries, marked 1 and 2. On the outer part of the upper left thigh there was a stab wound and my examination has shown that that travelled through the muscles of the leg and exited at injury number 2. This is therefore what is termed to be through-and-through injury, and is consistent with the passage -- the single passage of a knife passing from her left to her right.
Whilst undoubtedly an injury such as this would bleed, it did not damage major blood vessels so would not have been an independently fatal injury.

Q. It was, however, a knife blow driven through the upper thigh from the outer aspect to the inner aspect. Would it have required considerable force to drive the knife through the leg in that way?
A. When pathologists are asked to consider force they do so by applying a relatively subjective scale of mild, moderate and severe, based on the strength of the structures damaged during the passage of a wound. In this case, the skin would have been the most resistant structure, and once that gave, the other tissues would be relatively easily cleaved. However, it has had to pass through a significant quantity of muscle and one also has to take into account other factors, such as the protective effect of clothing and the sharpness or otherwise of the inflicting weapon. This would take, in my view, when we think it's gone through the leg, moderate to severe force.
THE CHIEF CORONER: And she was wearing jeans.
A. Indeed so, so therefore force is required to breach those before one considers that. So, yes, that's why the totality of that must be taken together.
THE CHIEF CORONER: Yes, thank you.
MR HOUGH: Just to be clear, you were provided with information about her clothing which, at the time, was denim jeans and a white shirt?

A. Yes. Yes.
Q. Next, please, {PM0104/4}. Does that show the size of the entry wound of the knife on that occasion?
A. It does, and you can see it almost appears to be a right-angled triangle, that would be indicative of movement of the knife while in the wound.
Q. Does that also suggest a blow going directly in from the side of the leg?
A. Oh yes.
Q. Next, please, may we have {PM0104/6} of the body map on the screen. What finding here did you make of an injury below the left knee?
A. What we have here is a slash wound. Briefly, the difference between a stab and a slash is that a stab penetrates deeper into the body than it measures long on the skin, whereas a slash measures longer upon the skin than it penetrates deeply into the body. That therefore infers different planes of movement, a stab wound occurring when the knife point moves towards the body, a slash wound when it is moving in a parallel fashion. It therefore would support a dynamic assault.
Q. Dynamic either because of the attacker moving or the victim moving, or both?
A. Quite so, yes. The interplay between those two individuals would be dynamic in nature.

Q. How deep did the wound penetrate in this area?
A. It's penetrated down into the muscle and it has, in fact, scored the head of the fibula which is the thin bone, one of the two lower bones in the leg.
Q. May we now move to your findings in relation to the right lower limb, and {PM0104/7} of the body map provides some degree of illustration here, but what were your findings at the level of the right ankle?
A. This is a minor injury but it is an important one in the overall interpretation, in my view. You can see over the outer aspect of the lady's right ankle there was a rounded bruise, and I found that the foot was inverted, in other words, it was turned inward, such that the big toe was higher than the little toe. So there has been an injury here whereby the ankle has turned, causing bruising of the overlying skin.
Q. You'll deal with the interpretation of that in your conclusions, I think.
A. Yes.
Q. May we now move to the posterior torso, the back, on {PM0104/8} of the body map. Did you find a stab wound on the left side of the back?
A. Yes, indeed, a stab wound. It showed features that allowed me to consider the use of a single-edged knife. It passed for a number of centimetres through skin, fat

and into the muscle by the spine, but it did not enter the abdominal cavity. The wound would bleed; it would not be independently fatal.

Q. Using the same approach to force that you described earlier, what would have been the force of this knife blow?

A. Probably at least moderate on that scale of mild, moderate and severe.

Q. {PM0104/9}, please, did you find a further sign of a knife wound to the left side of the body?

A. Yes. Number 6, you can see a relatively superficial wound passing into the fat only, and beneath that, a further and slightly smaller wound passing into fat only. The salient observation is that when one looks at the relative orientation of those two injuries, they are similar, if one uses the hands of a clock, 10 to 4 plane, the fact that they are closely located and similarly oriented in my view would suggest a rapid sequence of infliction in which there is little time for relative movement between the victim and the assailant.

Q. So that would suggest a repeated and rapid stabbing at the same area of the body?

A. A repeated and rapid stabbing, yes.

Q. Then page 10, please {PM0104/10}, did you find a further stab wound to the upper back?

A. Yes, this was a stab wound which, once again, the surface features suggested the use of a single-edged knife. It penetrated through the skin, fat and muscle of the back before scoring the inner part of the left shoulder blade, but it did not penetrate into the chest cavity. Whilst that wound would have bled, it would not likely have represented an independently fatal injury.

Q. Given the degree of penetration and the degree of scoring to the shoulder blade that you found, what force would you say that injury represented?

A. It's a relatively limited score mark to the left shoulder blade. I would say at least moderate force.

Q. Then the anterior torso, the front of the torso, page 11 of the body map. Did you find a further stab wound to the left side of the chest {PM0104/11}.

A. Yes, we see a stab wound on the left side of the chest there. In terms of its penetration, it entered through skin, fat and muscle before bisecting, cutting in two, the left fifth rib. It did not enter the chest cavity, the reason most likely being that it was significantly decelerated by impact against the rib. Therefore, for this wound, severe force would have been required in order to cause that fracture. The bleed would not be independently fatal.

Q. Then page 12, please, and continuing to your examination

of the right arm, the right upper limb, what findings did you make around the right elbow {PM0104/12}.

A. At the back of the right elbow were two minor grazes, so certainly not life-threatening, consistent with contact against a roughened surface such as pavement.

Q. So not a knife wound, but --

A. Not a knife wound, no, this is blunt injury, and the most likely scenario would be pavement or some such.

Q. So of some assistance to your interpretation?

A. Yes.

Q. And then before we move to the head and neck, I think it's right that you've indicated in respect of all the injuries discussed so far that none of them would have been independently fatal?

A. That's correct.

Q. Now moving to {PM0104/13}, please, and your examination of the head and neck. Do we see here a number of stab wound injuries which you found to the left side of the neck, below and slightly behind the ear?

A. We shall observe once again with this group the close location of the three injuries, and the similar orientation, so the same applies in terms of a rapid stabbing action. Number 11 is a stab wound with features suggesting the use of a single-edged knife. The wound has passed through the structures of the jaw,

struck the lower jaw, the mandible, and that has been fractured, therefore severe force has been used for that injury. It would bleed; it would not be independently fatal.

Number 12, a slightly larger but relatively superficial cutting wound, scoring into the muscle of the outer part of the neck, but with no injury to any of the major blood vessels or the nerves. So more of a slash wound than a stab wound.

And 13, behind the ear, a gaping wound which went on to represent a communicating through-and-through injury.

Q. I think we can see that if we go to the next page, {PM0104/14} and we see an associated sign?

A. Absolutely, so those two injuries, 13 and 14, represent the passage of just one pass of a knife, but which traversed -- traverses the neck entirely.

Q. I think it's your view that that is the critical injury?

A. That is without doubt the fatal injury.

Q. And it's an injury inflicted, is this right, by a knife being stabbed in from the left side and going through the back of the neck from side to side?

A. Yes, 14 you see there is the exit of that wound track, 13 is the entrance located on the left-hand side of the neck.

Q. We see {PM0104/15}. Have you here, or has the body map

here with your assistance depicted the track of the wound?
A. It's confirming that it traverses the full thickness of the neck from left to right.
Q. If we leave that image on screen as we move to your internal examination, and the central nervous system, did you make findings in relation to the internal examination, the central nervous system, which were linked with that injury?
A. Yes, I found that at the point at which the brainstem leaves the skull to enter into the spinal column as the spinal cord, it had been cut in two.
Q. So a complete severing of the spinal cord?
A. A complete severing of the spinal cord at an extremely high level, and at that level, those are the areas which are crucial to the control and maintenance of heartbeat and breathing.
Q. Would that severing have occurred immediately the knife went through?
A. Yes, and it has also damaged the bone, of course, to access the spinal cord, the spinal cord passing through the centre of the spinal column.
Q. May we look, please, at {PM0104/16}. Using this illustration, what was the associated bony injury?
A. So there we are looking from the back, you can see the

bones of the neck, known as the cervical vertebrae, they are numbered from 1 to 7, 1 being the highest, and 1 being at the junction of the head and the neck, so the wound entered behind the left ear, traversed the muscles, cut through that vertebra, including the spinal cord and thereafter exited at number 14 on the right-hand side.
Q. What degree of force would have been required for that through-and-through injury?
A. Severe force.
Q. If we look at {PM0104/17} next, you have already described many of the musculoskeletal injuries in association with your other findings, but can you just summarise what the other bony injuries were?
A. The injury to the scapula, the shoulder blade, was relatively minor, it was a nick. There was a score mark to the fibula, that bone in the lower left leg. The more significant bony injuries were that to the mandible, the lower jaw, and in my view, most particularly, the left fifth rib, you can see highlighted there, which had been fractured horizontally.
Q. Were there any other abnormal or significant findings in your internal examination other than tissue damage associated with the various stab wound tracks which you

have described?
A. There were no additional novel findings, nor was there any evidence of any natural disease: she was fit and well at the time of this incident.
Q. Moving, then, to your conclusions, based on the post mortem examination findings and the information you received about the attack on Sara Zelenak, what conclusions did you reach as to the cause and mechanism of her death?
A. I found that Sara Zelenak was a well nourished young lady with no natural disease that could have caused or contributed to her death. In my view, she died as a consequence of an act of terrorism.
My examination shows a number of stab wounds which I've described as showing a distinct lateralisation to the left-hand side of the body. If one reviews the graphics, one sees that all of the principal injuries are to the left-hand side of the body, none to the right-hand side, the most critical injuries being that to the neck.
Q. May I just pause you there for a moment.
A. So sorry.
Q. The injuries are, therefore, consistent with a knife being applied repeatedly to the left side of the body specifically?

A. Yes.
Q. A number of the injuries involved the application of severe or moderate to severe force?
A. Yes.
Q. Some of the injuries were also indicative of speed in the attack?
A. Yes.
Q. Rapid iterative use of the knife?
A. Yes.
Q. The evidence suggests that this attack took place over a relatively short compass of time.
A. Yes.
Q. No more than 20 or 30 seconds.
A. Indeed.
Q. Are all these injuries then consistent with a short and furious attack on the left side of the body?
A. Absolutely, and then one has to also consider why they are not further distributed, which I come to later.
Q. Thank you. You were going to tell us about the most critical injury.
A. Yes, the most critical injury to the neck, a transfixing injury passing through the cervical spine and the spinal cord. I would expect her to have died extremely rapidly given the importance of the structures of the brainstem and the spinal cord at this extremely high level.

Q. What are the further injuries to which you attached significance?
A. To rehearse them: an injury to the face causing a fracture to the left-hand side of the jaw; a stab wound to the left-hand side of the chest, cutting the left fifth rib in two; the wounds to her left loin and those to her leg did not damage any critical structures and would not have been fatal. What there was not was a presence of defence wounds, in other words, injuries to the hands or to the arms which are very frequently seen in cases of fatal stabbing, given that an almost reflexive reaction in anticipation of a blow from an individual wielding a knife is to raise the hands, rendering them vulnerable to injury.
Q. May I pause you there a second. Is that absence of defence wounds therefore consistent with the incapacitating injury being delivered quite quickly, quite early in the attack?
A. Yes, given that she was a young and fit lady, one would expect after a delivering of a single blow for her to try and mount some form of defence. The absence is therefore important in that it suggests very rapid incapacitation and therefore in the context of the injuries that we have discussed, the injury to the neck occurring early on within that attack sequence.

Q. When that injury was inflicted, the through-and-through injury to the back of the neck, would that have achieved immediate incapacitation?
A. Yes.
Q. Would it have ended all pain?
A. Yes.
Q. So if it is right that that was inflicted early, any pain would have ended, similarly, early in the attack?
A. Yes.
Q. Now, you noted the blunt force ankle injury --
A. Yes.
Q. -- and the turning of the foot, which you said were important to your interpretation. Can you explain how they were important to your view of the case?
A. On my initial examination I found that she was wearing a pair of high-heeled shoes with straps extending up and around and above both of her ankles. It would therefore suggest, given that the foot is turned in, that she may have turned her ankle on her heels, causing her to fall to the floor. If that is the case, and she were to fall onto her right-hand side, then her left-hand side would be the only part presented to an attacker, and that may therefore explain the lateralisation of injuries to the left-hand side of her body.
Q. There has been some evidence to suggest that Sara may

have been running away from the attackers towards the top of some steps --
A. Yes.
Q. -- which may explain a stumble, a turning of the foot when wearing high-heeled shoes. That would, I gather, be consistent with your finding both of the ankle injury and the lateralisation of the stab wounds?
A. When one takes those two factors into consideration together, that is the conclusion that I draw.
Q. Thank you.

Now, turning to the wounds and the implement involved, may we bring up, please, {DC7283/85}. Now, Dr Fegan-Earl, we know that the knives used in the attack were those which can be seen in a row at the bottom of this page. Were the injuries consistent with blows from a knife of that kind?
A. I've mentioned earlier that there were features on some of the wounds showing the use of a single-edged knife. There we have presented knives which bear a single cutting edge. They appear to me to be of a typical cook's, chef's knife, and the approximate size of the stab wounds would be in keeping with the width of the knife as we see there. Therefore, in my view, they would be consistent with producing those injuries.
Q. In conclusion, what cause of death do you give at the

end of your report?
A. Stab wound to the neck.
Q. Dr Fegan-Earl, is there any other information we need in interpreting Sara Zelenak's death, based on your examination and findings?
A. No, I don't think so. No.
MR HOUGH: Thank you very much. Those are all my questions. There may be some more.

Further questions by MR PATTERSON QC

MR PATTERSON: Dr Fegan-Earl, on behalf of the family of Sara Zelenak, can I have your assistance, please, on the family's behalf to try to piece things together chronologically?
A. Yes.
Q. Do I understand your evidence to be that with the wearing of the high-heeled shoes and that injury to the right ankle, this may all have begun with her losing her balance and going to the ground, or close to the ground, and then being attacked?
A. Sadly so, yes.
Q. You've highlighted the absence of defensive wounds to her hands or forearms. I think when you analysed her fingernails, they were painted --
A. Yes.
Q. -- and not a single one was damaged?

A. No.
Q. Which, again, would be consistent with somebody unable to even raise a hand against this rapid attack?
A. It all points towards rapid incapacitation.
Q. From the CCTV evidence we've had and the evidence of a member of the public, Erick Siguenza, it appears as though the attack was over within just seconds. That fatal injury through the neck would have very rapidly caused death; is that right?
A. Yes, as a consequence of the sheer importance of those structures at such a high level in the neck. The basic functions of life are controlled within that area.
Q. So as opposed to a rupture of the column or the cord further down --
A. Yes.
Q. -- at that position?
A. Yes, in my view it would cause a near instantaneous death because of loss of control of the normal functions of heartbeat and breathing.
Q. So consciousness would have ended immediately?
A. Yes.
Q. And, therefore, from the family's perspective, pain and suffering would have ended immediately that that happened?
A. I can say that with confidence.

Q. And as for treatment, even in the best conditions in a hospital, would there have been any treatment that could be given for such a significant injury?
A. No.
Q. You have highlighted two different areas where the closeness of the wounds and the angle or orientation suggests rapid infliction?
A. Yes.
Q. So to the face, the side of the neck?
A. Correct.
Q. And further down on the left side?
A. That's right.
Q. So little or no time for movement by her, if she was conscious, to get out of the way of the ongoing assault?
A. Yes. Either very rapid infliction or, indeed, at that point she's unable to move, and therefore unable to change orientation between blows.
Q. Defenceless?
A. Yes.
Q. In two different parts of the body you have highlighted what you have called through-and-through injuries?
A. Yes.
Q. Through the neck and through her thigh?
A. Yes.
Q. And in three different places you have been confident

that severe force was needed to fracture the rib, to fracture the mandible, the jaw, and to fracture the spinal cord; is that correct?
A. That is true. I think I should add that when pathologists comment, they're commenting on the minimum force required. What we cannot, therefore, do, is if we say something is requiring moderate force, we can't exclude the fact that severe force was also employed.
Q. But in those three locations, it's the damage to the bones, isn't it? It's the severing of a rib?
A. Yes.
Q. It's the fracture of the jaw and it's the severing of the spinal cord that confidently allows you to say severe force?
A. All of which are substantial bones which would ordinarily put up resistance to the passage of a knife.
Q. If we consider those injuries to her neck, injuries 11, 12 and 13, and I should say, that isn't the order in which they were inflicted, that was just numbering that you gave for --
A. Simply the order in which I have identified the injuries. It's not intended to denote the sequence.
Q. And you have already suggested that they may well have been inflicted very early on in this attack?
A. Yes.

Q. But just considering those neck injuries, were any of the major blood vessels damaged?
A. No.
Q. But the targeting of her neck, from what you've told us, is what caused her death, that transfixing injury?
A. Yes, the neck is a small area that contains many structures vital to life.
Q. So in this case we have one example of a particular mechanism of death, but I don't know if you are aware, but we have had evidence of casualty after casualty that night who suffered neck injuries with those knives, some of whom died. A very large number of neck injuries were suffered. What are the dangers from stab injuries to the neck area?
A. Well, a small area which is tightly packed with critical structures, which include the carotid artery, the pulse we can feel in our throat on either side; the jugular vein, the vein draining blood from the head to the chest; critical nerves; the windpipe and, of course, the spinal column with the cord in it. All of those packed in really a very small area, so any penetrating injury to the neck brings with it an attendant risk of very serious, if not fatal, injury.
Q. It's self-evidently an area of the body that is usually unprotected?

A. Correct.
Q. And life-threatening injuries can be suffered?
A. Yes, and as forensic pathologists we do encounter such.
Q. For example, the carotid artery involves blood at high pressure being pumped from the heart to the head?
A. Yes, correct.
Q. And there can be rapid and heavy bleeding from an injury to the carotid artery; is that right?
A. Indeed, and they are relatively superficial beneath the skin. They're not buried deep within the body.
Q. So from public protection and public safety perspectives, if you have a determined group of terrorists acting very quickly, with multiple casualties, life-threatening injuries can very quickly be inflicted by targeting a vulnerable part of the body like the neck?
A. Given the concentration of critical structures, yes.
MR PATTERSON: That's all I ask. Thank you, again, for your help.

Further questions by MR HOUGH QC

MR HOUGH: Before you leave, just one final matter. One notable feature of the London Bridge and Borough Market attack is that all those who suffered fatal injuries from stabbing suffered those injuries in the first few minutes of the attack, but the attack continued with

a number of other people stabbed, including with wounds to the neck.
A. Yes.
Q. There may be many explanations of that, I just want to ask you about one of them.

Does the infliction of multiple injuries in this way require a lot of force and energy from the attackers?
A. Certainly if one looks at the presence of multiple wounds and wounds that necessitate the use of severe force, then one can infer that, yes, it will require effort and energy to inflict and, of course, with an increasing number of victims, that energy requirement increases.
Q. Is it, therefore, possible -- and I only ask you this based on all your experience -- that a loss of energy as the attack goes on, by the attackers, may cause the injuries to be penetrating less deep and with a less high propensity for fatality?
A. I think that's difficult to answer with certainty. It really depends on the dynamics of the assault. I'm not sure I could answer that in a meaningful way.
MR HOUGH: That's very fair. Thank you very much. Those are all the questions I have for you.
THE CHIEF CORONER: Thank you very much indeed, Dr Fegan-Earl, for coming. As always, very clear

explanations. Thank you very much.
A. Thank you, sir.
MR HOUGH: Sir, our next witness is Mr Savage but I wonder if it might be convenient to take a short mid-morning break at that point?
THE CHIEF CORONER: Yes. What I'm going to say, Mr Hough, is because we are all anticipating that we will conclude the evidence that we're going to take today before the luncheon adjournment, what I'm going to suggest is that we simply have a short, and I mean a short comfort break now, and I think that way we are aiming to finish by about 12.45, so at least everyone knows that's the plan.
MR HOUGH: Yes.
THE CHIEF CORONER: So what I'm going to say, by that clock up there we will sit in 10 minutes' time.
MR HOUGH: Yes.
(11.07 am)

(A short break)

(11.20 am)
MR HOUGH: Sir, the next witness is Paul Savage.
THE CHIEF CORONER: Thank you.

MR PAUL SAVAGE (affirmed)

THE CHIEF CORONER: Good morning, Mr Savage.
A. Good morning, sir.
THE CHIEF CORONER: Please do make yourself comfortable. If

you wish to take a seat, that's fine.
A. Thank you.
THE CHIEF CORONER: If you do sit down just bring the microphone closer to you so that we can all hear what it is you have to say. Again, if you can answer questions not too quickly because much of what you are going to say is likely to be translated.
A. Thank you, sir.
THE CHIEF CORONER: Thank you.

Questions by MR HOUGH QC

MR HOUGH: Would you please give your full name for the court?
A. My name is Paul Victor Savage.
Q. Mr Savage, you understand I'm asking you questions first on behalf of the Coroner and you may then receive some questions from some other lawyers?
A. I do, sir.
Q. Is this right: you are giving evidence as an expert having been instructed to prepare a report and give evidence as to possible causes and mechanisms of death for Xavier Thomas?
A. That is correct, sir.
Q. Would you please summarise your relevant qualifications and experience as set out on page 2 of your report?
A. Yes, sir. So I am the immediate ex-Head of Medicine of

the Royal National Lifeboat Institution, having been their clinical lead and clinical operations manager from 2005 to 2014. I now currently work in a variety of portfolio roles, one of which being a visiting fellow lecturing on university paramedic science degrees. Operationally I have been 31 years as a search and rescue medic, 23 of those with the RNLI, eight with the Coastguard and more importantly, the last six years serving at Tower lifeboat station in central London.

I am the SAR advisor to the main board of the Faculty of the Royal College of Surgeons, Edinburgh. I am the chairman of the UK Search and Rescue Medical and Survival Group which feeds up through the UKSAR Operators and Strategic Group to form UK Government policy on pre-hospital medicine and I have a specialist interest in submersion, immersion, hypothermia and drowning.

THE CHIEF CORONER: And SAR I think is search and rescue?

A. SAR is search and rescue, sir, yes.

MR HOUGH: In very brief summary, you are an extremely experienced and expert search and rescue medic?

A. Yes, sir.

Q. May I begin with some explanation of terms. Can you explain shortly what is submersion and the mechanism of drowning referred to as submersion drowning?

A. When a person enters the water you can be in one of two states: even the medical profession don't fully agree on the definition of submersion, but the wide agreement on submersion is the airway, being that the mouth and nose, completely underwater. That can be your patient completely underwater or that could be somebody having their head in a bucket of water, but the complete respiratory mechanism is underwater, as opposed to immersion, where the person is floating in water with their head clear, eg, swimming, bobbing in a lifejacket, or kicking water.

Q. What is the means and mechanism of drowning by submersion for an unconscious person who is free-floating in water?

A. An unconscious patient free-floating in water will usually be face-down. Unconscious they would not have a voluntary breath hold, and therefore you would expect them to breathe normally. Breathing normally in this case, they would actually breathe water as opposed to breathing air. That water will enter their lungs. If it is saltwater, the water tends to sit in the lungs, actually physically filling them up. If it is freshwater it tends, at times, to pass through the lungs into the bloodstream, but in doing so, takes away a specialist chemical which holds the very end of your

lungs open. Either which way, saltwater you end up waterlogged; freshwater, your lungs end up collapsed. Either way you cannot get oxygen into your bloodstream. Either way proceeds to an oxygen-deprived cardiac arrest.

Q. That, I think, is because oxygen can't pass the lung membrane into the bloodstream?

A. That is correct, sir.

Q. Are there characteristic signs of submersion drowning found at post mortem?

A. Normally, and please accept I'm not a pathologist, but normally they will find significant post mortem signs of either pulmonary oedema, frothing and evidence that actually water has been taken into the lungs.

Q. You said "normally": what's the significance of "normally" in that context?

A. My understanding on the post mortem of Mr Thomas is that that wasn't the case.

Q. Now, my question is slightly different. You said that when somebody drowns through submersion drowning, so through being unconscious and taking in water, breathing in water in the way that you have described, there will normally be at post mortem, frothy liquid in the air passages, heavy lungs waterlogged with fluid?

A. That is correct, sir.

Q. Is that an invariable finding when there has been submersion drowning?

A. In the case where actually submersion drowning is the primary cause of death, there should be obvious signs at post mortem of that.

Q. So the absence of those signs, where they are absent, indicate that the mechanism of death has not involved simple submersion drowning with water simply being breathed into the lungs?

A. That is correct, sir.

Q. As you've indicated, there weren't signs of that kind at post mortem for Xavier Thomas. We'll hear about his post mortem later, but you have reviewed the report of that post mortem?

A. That is correct, sir.

Q. Therefore, we have to look for a different form of mechanism of death.

Can you now describe what is meant by immersion in your field?

A. Yes. The human being entering cold water undertakes a variety of physiological impacts, and it's often times, especially in UK waters, that patients are killed by the effects of immersion rather than submersion.

The first impact of the human body in immersion in cold water, and I ought to define cold water for you.

So the studies show that cold water starts at 25 degrees C, which is above the UK water temperature at pretty much all times around the coast of the UK.

Q. You have to be interpreted. If you can try to speak up, speak into the microphone and speak a little more slowly, please?

A. No problem, sorry.

THE CHIEF CORONER: The point, I think, was about the temperature. So you were just explaining ...

A. The effects of cold water immersion tend to start at 25 degrees C, the very first effects. They build when they reach 17 degrees C, and the worst effects are seen in water of 10 degrees C or less.

The first physiological impact of the water is a mechanism called cold shock, which has been well documented since the 1990s.

MR HOUGH: Looking at cold shock for a moment, at what temperatures is cold shock a relevant effect?

A. In lab studies, anything from 25 degrees C down. Having said that, the effect builds as you arrive at 17 degrees C, building to its greatest effect at 10 degrees C and lower.

Q. What in physiological terms is cold shock? How does it affect the body?

A. Cold shock is stimulated by receptors in the skin, and

it's caused usually by a whole body immersion, an unplanned whole body immersion. Therefore, if you creep into water slowly, you will never be a victim of cold shock, whereas if your skin is allowed to get wet en masse simultaneously, there is a mass firing of these receptors in your skin that produces a large effect in your body, the cold shock effect. This effect has two distinct sides: one side is a respiratory effect. That respiratory effect is a massive inhalation gasp of anything up to 2 litres of volume, uncontrolled. You cannot control that gasp.

Q. Now, just pause there a second. You said that when all these receptors across the body fire simultaneously, there is a gasp of up to 2 litres?

A. That's correct.

Q. Can that be 2 litres of air?

A. It can be 2 litres of air if you are out of the water at that time, and if you are submersed, it will be 2 litres of water.

Q. What follows that initial involuntary gasp?

A. From the respiratory side of cold shock you then follow about a 2 to 3-minute period of uncontrolled physiology. In that time, you can expect a breathing rate in the region of 60 to 80 breaths a minute, which is the equivalent of human panting, and, most crucially,

an inability to voluntarily breath-hold. Therefore the victim cannot choose to hold their breath.

However, and importantly, the other side to cold shock can be an instantaneous cardiac arrhythmia.

Q. Just before we get to that, if the gasp followed by panting is to have a fatal effect, would that be through the taking in of water as the gasp and panting occur?

A. That is correct.

Q. So if it is the respiratory effect of cold shock that leads directly to death, that too would be marked on post mortem by frothy liquid in the air passages and waterlogged lungs?

A. That is correct.

Q. So is it right that since that was not found in Monsieur Thomas, we can rule out the respiratory effects of cold shock having an immediately and directly fatal effect?

A. My best opinion on that is yes.

Q. You are now going to tell us about a separate set of processes resulting from cold shock, which are cardiovascular in nature?

A. That is correct, sir. So the other side to cold shock is you can suffer an instantaneous cardiac arrhythmia, producing instantaneous death. At that point, your heart is in usually the rhythm of ventricular

fibrillation and you are incapacitated in cardiac arrest.

If that mechanism of cold shock happens, you would not have the respiratory side of cold shock occurring.

Q. So the effect, if I understand it correctly, is that the receptors, firing due to the shock of the cold to the body instantaneously, have an effect on the electrical rhythm of the heart, causing the heart to have an irregular rhythm, and an irregular rhythm of the heart can lead to a cardiac arrest?

A. Yes. The cold shock mechanism produces an irregular rhythm of the heart that is not compatible with life.

Q. Would it be possible at post mortem to detect that that had happened to the heart?

A. No, as electrical activity effectively dies with the patient.

Q. Would there be any sign of it in the tissues or muscles of the heart?

A. Unlikely.

Q. In your report, do you also refer to a process known as autonomic conflict, which has been the subject of recent research and thinking?

A. I do, sir. Autonomic conflict is a new phenomenon that has been undergoing research and is still currently undergoing research so I must stress that it is not

fully understood at this moment in time. A lot of its models are hypothetical, but it is part of significant research being undertaken currently. The first time this concept came to light was in 2012 and was documented in research papers of that year. Autonomic conflict is an interesting phenomenon that our nervous system is split into two halves: we have a voluntary nervous system that is allowing me to talk to you and wave my hands, and we have an involuntary nervous system called the autonomic nervous system, that's what's making us digest our food and breathe in a certain fashion and our eyes open and close to light, et cetera. Those are functions out of our control.

If we look at the two sides of the nervous system, the voluntary and the autonomic, autonomic conflict focuses purely on the autonomic side. The autonomic nervous system itself is bisected in two, something called sympathetic and something called parasympathetic.

Sympathetic most people understand as fight or flight, the fight or flight reflex that human beings have when they are put under duress or fear, with a fast heart rate, a fast breathing rate, big wide eyes, adrenaline-driven.

The other side to the nervous system, the parasympathetic nervous system, is unlike fight or

flight, is known as feed or breed. It is our digestion, it is us in a far more relaxed fashion. Now normally these two sides of the nervous system never meet. They co-exist to drive bodily functions in opposite directions. The work is being done at the moment that when a patient is under the cold shock mechanism and they are being what we call sympathetically-driven, eg their nervous system on the sympathetic side is massively energised, and then they can get a focused stimulation of the parasympathetic nervous system which only comes from a wet face.

So it could be, for example, a patient who is in water with head clear having horrendous cold shock symptoms but not under the surface of the water and therefore not drowning, and then getting a focused wet face. What they have found when you implant the two nervous systems on top of them is absolutely obvious ECG, electrocardiograph heart rhythm changes.

Now, in young, fit subjects they are not fatal, but the hypothesis is that in anybody with predisposing cardiac pathology, or anybody with any weak side to the cardiac system, those arrhythmias could be fatal.

Q. Just to understand how this autonomic conflict works, you've told us that the cold shock response, all these receptors in the body firing as a result of immersion of

the body in cold water, can have an effect on heart rhythm. Can that induce a fast heart rate?

A. Yes.

Q. You have also said that at the same time, a person's face may be cooled rapidly, suddenly. Can that cooling of the facial area on its own, through the autonomic system, lead to a lowered heart rate?

A. Exactly. The cooling of the face in isolation is known as the mammalian dive reflex. It is very rarely seen unless people are in significant protective equipment, for example, a drysuit, crash helmet, gloves, and the only part of their body that gets wet is their face, because it is driven from nerves in and around the mouth and nose. In isolation, that produces a very, very slow heart rate and a very, very slow breathing rate and takes its name from the concept of a deep diving whale, hence the mammalian dive reflex.

Q. So putting it simply, with cooling of the body and the face, one part of the autonomic system may be telling the heart to go faster, while another part is telling it to go slower?

A. That is correct, sir.

Q. And what is the effect of these conflicting impulses?

A. The effect of the conflicting impulses is an obvious, on electrocardiograph, change in the heart rhythm, and in

the presence of any predisposing cardiac pathology, those changes to the heart rhythm are believed to be potentially fatal.

Q. Would that occur or could that occur in somebody who had never displayed known cardiac problems?

A. Because this is at the research phase, it's incredibly difficult -- it would be subjective of me to answer that, but in the research done, the candidates are highly screened to make sure that they have no predisposing cardiac pathology because of the potential risk. As to looking at it from a perspective of how that sliding scale of cardiac pathology leads to fatality, that hasn't been investigated.

Q. May I now ask you briefly about two immersion processes which are unlikely to be relevant in the present case. First of all, can you briefly explain what peripheral cooling is, how it occurs, and how quickly?

A. When a patient or victim is in the water but maintaining their head above water and has potentially survived the first three minutes of immersion, which is the cold shock period, if you've had a cold shock response, at 3 minutes that response has gone. You are now left floating, treading water as you wish, in the absence of any buoyancy, and by that I mean in the absence of a lifejacket or suchlike.

What happens when you are in water below your body temperature is by the method of conduction of heat from yourself to the water, you will start to give away your body temperature to the water. However, it is only the limbs that suffer at this stage and that is because the limbs have a high surface area compared to their mass, and therefore they cool much faster than the core, and therefore you end up with limbs at a significantly different temperature than the core of the patient, which is why we do not talk about core hypothermia in this stage of the problem.

And at this stage of the problem, where we are looking roughly in the 3 to 30-minute window of immersion, your arms slowly cool, and when you reach a temperature in the mid-20s degrees of tissue, the junction between the nerve and the muscle fibre starts to fail and therefore your arms and limbs become relatively useless and you find that people cannot control their limbs and therefore, if they are relying on these for either self-rescue or swimming or buoyancy, then at that stage, they tend to go subsurface, which then leads them to a submersion drowning.

Q. First of all, the temperature of the Thames at the time of Xavier Thomas' drowning was, you understood, about 20 degrees centigrade; is that right?

A. That's correct, sir.

Q. At that temperature, given Xavier's age and likely strength, within what period would this phenomenon have prevented him from treading water?

A. At 20 degrees C with a normal, fit individual, who -- I do believe Mr Thomas could swim, and therefore was used to water, you would expect him to be able to stay at least 30 minutes above the surface, if not longer. At 20 degrees you would be looking into the sort of at least sub one hour period.

Q. Given that Monsieur Thomas was not seen above the surface by vessels which arrived within approximately 6 minutes of him entering the water, and which continued to search for some time thereafter, is it very unlikely that he was treading water for half an hour or more?

A. I think we can say with as much certainty as we can possibly say, and anecdotally from having rescued, unfortunately, too many people from the Thames, anyone who wants rescuing in the Thames, we know about: you can hear them, they call for help. I think we need to look at the fact that on this night, after the terrorist event, the river was closed, and therefore the river was quiet. The London Bridge area is better than other areas in the Thames, which are littered with obstructions, and by that I mean piers and vessels and

moorings, and whilst there are some, there are not many, and therefore anecdotally, the majority of patients that we treat who come off of London Bridge are easy to find on the surface because of the area that it is in.

There are also areas of steps, there are chains to grip hold of, there's a variety of self-rescue methods as well. Whilst I was not there on the night, I do feel strongly that had Mr Thomas been on the surface, he would have identified his presence and he would have been found.

Q. Is a further reason for ruling out peripheral cooling that that leads to death indirectly through submersion drowning, which would show the signs on post mortem of waterlogged lungs and so on which were not found?

A. Exactly, sir.

Q. The final process which I think you concluded similarly is not relevant here, hypothermia. How does that occur and within what time frame?

A. Central core hypothermia, if we start with the idea that we enter the water at 37 degrees in our core, and between 37 and 35 is deemed to be cold, between 35 and downwards is deemed to be hypothermic, with the most interesting or important markers being a 30-degree temperature where you would expect your patient to lose consciousness, and at 27 to 28 degrees C where you would

expect your patient to have an arrhythmia, a bad rhythm of the heart which is not sustainable with life.

Now, in 20 degrees C water in a lightly clad male, we would expect survival times -- I mean, when you look at the survival graphs which are given to the rescue services to promote their search duration, they look at the maximum survivability of a human being in that temperature of water, and in 20 degrees C water, the maximum survival of a lightly clad male is over 40 hours before we have core submersion. That is the sort of search durations that they would keep a coastal search going for. Therefore, hypothermia is something that just isn't relevant in this case at all.

Q. May we now move on to the third part of your report from page 5, some general points about falls from London bridges. Approximately how many falls from London bridges take place each year?

A. Anecdotally, sir, we have in the region, depending on the severity of the year, anything between 50 to 100 people choose to enter the Thames or accidentally into the Thames from bridges. Anecdotally, and there is no formal evidence on this, but anecdotally, very few, if none, suffer any musculoskeletal injury, and by that I mean broken bones and associated injuries with broken bones, unless they hit bridge structures and buttresses.

Therefore, the majority of patients that free-fall from a bridge to the water we do not see significant disabling musculoskeletal injuries in those patients.

Q. May I now ask you about the next section of your report, section 4, which concerns the position of the body in water and particularly how that is relevant to Xavier Thomas' case.

We know that he was wearing jeans, a jacket, boots and a shirt, ordinary clothes, obviously no lifejacket or anything like that. Having regard to those clothes and the natural buoyancy of a body, at what level would you have expected him to rest in water without considering for the moment speed and nature of entry to the water?

A. Anybody floating in water incapacitated, so either unconscious or in arrest, will either be just on the surface or anything up to 1 to 2-foot subsurface during the early stages of immersion in the water.

We teach our crews to look for the equivalent of a pillow case, an inflated pillow case, because often times the only part of the body that you'll spot is, we oftentimes get an air pocket over the top of the shoulders, caught in clothing, acting like an impromptu lifejacket, and sometimes you pick up the back of the person's head and other times you pick up the top of

their clothes because most patients incapacitated in water will have face under, arms out in a cruciform pattern, and their body at about 45 degrees, chest down, face under, and the air pocket behind their shoulders.

If people go in either naked or lightly clad, depending on their body structure, and that is basically fat versus muscle, then you can expect the person to potentially hover anything up to 1 to 2 foot subsurface at that point in time, in the absence of body fat, in the absence of any buoyant clothing.

Q. Is it right that a fall into water can propel somebody a certain distance into the water, a certain depth into the water?

A. Depth becomes crucial when we look at a phenomenon of the body called natural and neutral buoyancy. As a human being, in water of less than 5 metres depth, if we take our body and we take it down to 1 metre or 2 metres and we release it, you would expect that body to return to the surface or to this sort of floating position I've indicated, the sort of 1 to 2 foot subsurface, depending on body structure.

But the crucial depth for this is at 5 metres. When you reach 5 metres depth, the pressure of the water is enough to remove any buoyant air spaces in your body, and a human being will continue to sink from 5 metres

down. So the sort of terminology we use in search and rescue is from 5 metres down you have to actively strike for the surface, and as you swim up to the 5-metre point you almost feel your buoyancy appear and then your swimming effort gets less, but below the 5-metre point you have to strike for the surface and, therefore, if you are below 5 metres, with the inability to strike to the surface, you will continue to sink.

Q. Does the depth to which you penetrate, and in particular whether you go below that 5-metre level, depend to an extent upon the way in which you enter the water?

A. It certainly does, sir. If you come off and flail or fall horizontally and your arrival to water is in any way, shape or form in the sort of horizontal plane, it is highly unlikely that you will penetrate past 5 metres. Unless, unfortunately, some of our victims choose to wear rucksacks full of bricks and they will continue to penetrate because of the extra weight that they were choosing to wear. In this case, if we had a horizontal entry to the water, it is highly unlikely that there will be any penetration past 1 or 2 metres. Whereas if we enter the water vertically, either face-first or feet-first, coming in from a height of 13 metres, which was the fall height on the night, it is highly likely if you are in a vertical plane you will

penetrate past 5 metres.

Q. Presumably there are intermediate positions between vertical and absolutely horizontal. May we take it that the degree to which one enters away from the vertical will reduce the penetration into the water?

A. Yes, and it also depends as well on arm position. So if you are anticipating the entry and you therefore assume, for example, a diving position and put your hands in front of your face as if you are diving into water, then that will give you a further penetration. Whereas, if you are flailing with your arms out from the side of your body, that will slow your penetration.

Q. Now, turning next to factors relevant on the night, we have heard evidence that the tidal flow was relatively slack, so that there was not a heavy flow of tide away from the bridge; you understand that?

A. I do, sir.

Q. We also understand that there was relatively little marine traffic in the area and that a short time into the search, the river area around was closed?

A. That's true, sir.

Q. What other characteristics of the river in the area of London Bridge would be relevant to any search for Xavier and, therefore, any assessment of what happened to him?

A. London Bridge is one of the few bridges that is

routinely lit at night, and that does assist surface searching. We suffer in other places with a very inky-black Thames and very brightly lit embankments, whereas London Bridge is kind in the sense the bridge is already lit in quite a pleasant orange light for working at night. The embankments around are not overly lit, and therefore it gives you a sensible contrast medium to be able to see the water and see the water surface. We also assist that using night vision equipment as required.

Also, ever since the Marchioness disaster they put chains on the bridges at three different tide heights to allow people to self-rescue and therefore victims can grasp these chains and loop themselves into them with their arms, for example, and also in that area, unlike other areas of the Thames, there are steps out, associated around a couple of public houses either side, that people can actually enter the water and effectively self-rescue in that zone as well.

Q. The evidence that we have received is that search vessels arrived around 7 or so minutes after Monsieur Thomas entered the water, that they performed a hasty or immediate search around the area where he fell and saw no sign of him. Also some, such as Ms Holly Jones on the bridge, looked over to see if they

could see anyone in the water and couldn't see anyone, or didn't see anyone, and that there were then searches involving passes up and down the river for some time afterwards; I think you are aware of all of those efforts.

A. Yes, the standard approach for a bridge jumper, the concept of a hasty search is to cover the ground at speed for anyone on the surface. It's very well done, it's very well proven, and it is carried out unfortunately too many times in central London, but it is the arrival of a hasty search normally is guaranteed to pick up the patient on the surface.

If, however, you then detect no patient on the surface, all vessels concerned will form a structured slow search, where normally in this case line abreast, and by line abreast we mean vessels stemming the Thames and we look at the conditions on the night to decide the search width between our vessels, because you have to be able to accurately clear the water.

To give you a concept of what that's like, in a boat search in the River Thames in that sort of reach, you would be looking at no more than myself to the far side of the courtroom as your search duration on either side of the boat to allow you to effectively cover that water distance.

Q. Thank you.

Now, some information from the collision investigation work by PC Andrews, which we heard yesterday, PC Andrews informed us that it would be -- that it's likely that Xavier Thomas was struck on the legs and scooped up over the parapet of the bridge. He also gave evidence that it's likely that Monsieur Thomas entered the water at a speed of approximately 36 miles per hour.

I think you're also aware of the basic conclusions of Dr Lockyer's post mortem examination report, namely as follows: first of all, there were no substantial signs of submersion drowning, such as heavy and waterlogged lungs; no musculoskeletal injury, such as to prevent swimming; no high cervical spine injury, and no evidence of significant head injury.

Bearing in mind all the factors that we have just been through, I'd like to ask you about a series of scenarios. You identified the 11 scenarios to be considered, and you rule out some of them and identify one as most likely.

May I ask you to deal with them one by one. First of all, the scenario you described as "Drowning after a period of surface time". Can you shortly tell us what that scenario would have involved and what your view of

it is?

A. So the first scenario in my report I've called scenario A would be that Mr Thomas would have entered the river, made the surface, continued on the surface to tread water until peripheral swim failure rendered him unable to stay on the surface of the water, at which point in the absence of buoyancy he would have gone subsurface, leading to submersion drowning.

I do believe this can be ruled out by several factors, one of which is the lack of post mortem drowning evidence, and we would be convinced that if Mr Thomas was in a position to support himself above the water, he would have been in a position to seek aid and either self-rescue or make his presence aware to the rescuers to detect him. And the lack of any musculoskeletal injuries on post mortem would indicate that there would be no reason why he couldn't have kept himself above the water and, therefore, all those factors I do believe rule out that he was on the surface of the water for a period of time and then proceeded to drown.

Q. Second, your scenario B you term "Drowning as unable to stay afloat"; can you summarise that scenario and why you have ruled that out too?

A. Again, the concept that Mr Thomas arrived in the water

but then reached the surface but then as some casualties sadly are unable to stay on the surface because they cannot, in the absence of a lifejacket, where they are relying on their limbs to stay buoyant by kicking or treading water or swimming or gripping to a structure, that way they cannot stay on the surface and they proceed to a submersion drowning and I believe again we can rule that out because of the lack of post mortem drowning and the lack of musculoskeletal injuries.

Q. Your third scenario you summarise as "Drowning because unable to surface from a depth in the water". Can you say what that involves or would involve and why that too can be discounted?

A. This is the thought process that had Mr Thomas entered the water near vertical and penetrated past the 5-metre depth and then continued to sink, yet be unable to strike to the surface. Now that would be the case if, again, you had musculoskeletal injuries or any significant head injury, neither of which were present, to strike to the surface, and again, would have let to the post mortem findings of submersion drowning which weren't present.

Q. Your fourth scenario on page 10 you describe as "Drowning face-down on the surface after a brain injury". What would that involve in terms of mechanism

and why do you discount that also?

A. Had the impact of the vehicle or the impact with any part of the bridge caused a catastrophic head injury rendering Mr Thomas unconscious, then he could have arrived in the water, let's -- again, the hypothesis that he arrived in the water near horizontal, surfaced where he would have been face-down. Again, a face-down patient in the water like this would have submersion drowned, and we do not have the evidence of that. And, with the conditions on the river that night, even a face-down surface patient we would have expected to have found.

Q. So those, again, independent and separate reasons why you can discount that process?

A. I believe so, certainly, yes.

Q. Your scenario F next, "Death on the surface due to cold water shock response", and this involves some of the physiological processes you were describing earlier. Once again, can you summarise what this scenario would involve and why you discount it too?

A. So the idea that, again, Mr Thomas might have arrived in the water nearer the horizontal plane, been on the surface and suffered either the respiratory effects or the cardiac effects of the cold shock response. We can rule out the respiratory effects in the absence of the

drowning and I do believe, again, had he been on the surface the high likelihood of detection coupled with the water temperature of 20 degrees is not in the -- it's towards the top end of the responses of cold shock, I said to you earlier that cold shock starts, that it is very minor in 25 degrees C, building to 10 as its real highest effects with the effect curve really starting to peak at 17. So at 20 degrees C we're not expecting catastrophic cold shock effects.

Q. So if Xavier was initially on the surface, it is unlikely that the cold shock response was fatal, is this right, because first of all, it wouldn't have been fatal through the respiratory effects because that would have resulted in the post mortem findings of heavy lungs?

A. Correct.

Q. It's very unlikely that it was fatal through the cardiac effects because it is unlikely that a cold shock response alone at this surface level would have had that effect, given this temperature on somebody of Monsieur Thomas' age and characteristics?

A. I believe that the better term for that would be, sir, unlikely. It is less likely. We can't 100% rule out cold shock at 20 degrees, but it is far less likely than anything else, and the reason why scenario F is removed is because, again, it would render your patient on the

surface, near surface and able to be detected.

Q. So it's physiologically unlikely and it's made very unlikely when one adds to that the fact that he would likely have been visible on the surface of the water?

A. Correct, sir.

Q. Your scenario G, please, you term "Death subsurface due to the cold shock response". Is this a variant of the scenario you were describing earlier for which you have a slightly different view?

A. Yes, so this is why my answer to you a second ago was it's less likely, because this is the situation where Mr Thomas has entered in a more vertical plane, potentially penetrating past the 5-metre point, having a cold shock reaction but that cold shock reaction being purely the cardiac side, not the respiratory side, because we know there is no post mortem evidence of the respiratory side. So that's why we cannot completely rule out the cold shock response. There is a chance, but the water temperature is at the temperature where it would be less likely.

Q. This is the first scenario you have considered a serious possibility. It would have involved Xavier going into the water near vertically, and going some distance below the water, and then would have involved the cold shock response having a fatal cardiac arrhythmic effect that

wouldn't show up on post mortem?
A. Correct, sir, and I think it's probably worth me saying that the higher the fall, the more it gives the person the opportunity to change their position in air, and by that I mean if you are falling just a couple of metres you tend to fall however you fall, whereas if you are falling 13 metres, you do have probably 6 to 7 seconds to change your potential position on arrival to the water.
Q. Thank you.
Your scenario H next involves the phenomenon of autonomic conflict, which you explained to us earlier, the two conflicting impulses of the sympathetic and parasympathetic autonomic systems.
Can you describe first of all this scenario: death on the surface due to autonomic conflict and your view of that?
A. There is a chance, again, autonomic conflict comes down to one of the possibilities of the reason for Mr Thomas' death. However, again, it comes back to the point -- 20 degrees C is less likely to have produced the cold shock response which then the wet face applies the autonomic conflict response on top.
There is the possibility, because autonomic conflict is caused by an aggression in your sympathetic nervous

system, there is the possibility that fear could do that, and therefore there is the possibility that the -- you can imagine during the actual moment of the attack you will have your fight or flight reflex activated. So there is the possibility that, as well as the potential for the cold water, the actual attack itself could be the stimulant for the sympathetic side of that nervous system and then the wet face applying the parasympathetic stimulation to create a cold shock response.
However, if I may take H and I together, again, I rule out H because we do not believe the likelihood of Mr Thomas being on the surface, whereas I, death by autonomic conflict at depth, is one of the possibilities considered, however, again, reduced in its likelihood by the water temperature.
Q. So just to go back over that, and put it, I hope, as simply as we can, autonomic conflict could have been a mechanism of death?
A. Yes.
Q. You think it is unlikely to have occurred following Monsieur Thomas coming to rest on the surface because of the possibility of detection on the surface?
A. Correct.
Q. You consider it is more possible that death occurred by

that process subsurface because there wouldn't have been a chance of detection?
A. Correct.
Q. But there are points against it from a physiological point of view, first of all, that the water temperature is unlikely to have caused a conflict sufficient to be fatal?
A. It's at the upper end of that temperature scale, yes, sir.
Q. And also because this is a phenomenon which poses more of a risk to people with a known cardiac pathology?
A. Correct.
Q. But, once again, as with arrhythmia due to cold water shock below surface, you can't entirely rule this out because there may have been this process which wouldn't have shown up in post mortem findings?
A. That is correct.
Q. The next two scenarios, and the final two scenarios you consider, involve impact brain apnoea. Can you explain what that process is before you take us to the two scenarios?
A. Impact brain apnoea is a condition, like autonomic conflict, which is incredibly new in its discovery. Autonomic conflict we're talking 2012, impact brain apnoea, we're talking about the first research papers

being 2016. So it is a phenomenon again which is not fully understood, and I think that's something we must really outline.
A lot of the studies into impact brain apnoea have been anecdotal from clinicians on the scene and the remaining studies have tended to be animal models, and it is still being actively, currently researched. But impact brain apnoea is where the head receives an insult in such a way that it causes the body to cease respiratory effort. So after a direct blow to the head, the patient stops breathing. This isn't usually self-limiting in that if it isn't treated, the patient maintains their inability to breathe and then goes on to what we call a hypoxic cardiac arrest, which is a stop of the heartbeat, courtesy of lack of oxygen. The same methodology, if you like, as the final end result of any suffocation to the patient.
Impact brain apnoea has been noticed primarily at motorcycle accidents with high impact to the head, and also in some sports fields, and the current research is pointing towards different places where it could occur, and therefore, I do not think we can rule out impact brain apnoea when a person falls 13 metres into water, but for it to happen, they would have to fall head-first into water, not feet-first.

Q. So to summarise there, a person falling from a height such as that from which Xavier Thomas fell, if falling head-first, could strike the water with sufficient force to induce this condition of impact brain apnoea simply through the force to the head?
A. With our current understanding of the situation, that's correct.
Q. And that process resulting from the physical force to the head and to the brain would be sufficient to stop the breathing in the immediate aftermath?
A. Correct, and that cessation of breathing continues unless the patient is actively treated.
Q. Would there be any clinical sign at post mortem examination that this is what had happened?
A. They do believe that the majority of clinical signs of impact brain apnoea are masked with the general degradation of the brain post mortem, and therefore it is incredibly difficult to pull the pre and post mortem findings apart, so there is no definitive sign of it currently understood at post mortem.
Q. Are there any signs which may, while not being definitive, be indicative or supportive of a finding of impact brain apnoea?
A. General hypoxic brain tissue might be an indication of impact brain apnoea, but it's therefore difficult to

prove whether that is pre or post mortem.
Q. Just to be clear about the both immediate and longer term effects, would the effect of the shock, the apnoeic effect, stopping breathing, wear off naturally?
A. Unlikely. At the moment the studies -- there is anecdotal evidence of a few cases, but the bulk of the medical evidence is that it doesn't wear off; it requires active ventilation of the patient. By ventilation I mean artificial respiration with a device to assist it wearing off.
Q. Can this happen -- could this happen to a relatively young and fit person like Mr Thomas?
A. Absolutely.
Q. Are there any physical characteristics of a person that make them more or less vulnerable to this effect?
A. No.
Q. Did you consider it your tenth scenario, scenario J, death on the surface of the water due to this phenomenon of impact brain apnoea?
A. Again, I believe there is a chance, and all of this, as I'm sure you're aware, is supposition and trying to put pieces of evidence together to give you the best opinion that we can, there is a chance that impact brain apnoea was the cause. However, again, we ruled out the surface because we strongly believe had he been on the surface,

he would have been located.
Q. Considering the final scenario, scenario K, "Death subsurface due to impact brain apnoea", how do you consider that as a candidate cause or mechanism of death by comparison to the various other scenarios?
A. If we believe this to be the case, that Mr Thomas, with a 13-metre fall, had the ability to change a body position to potentially enter head-first, from 13 metres entering the near vertical head-first, that impact on the head and brain theoretically has the ability to produce impact brain apnoea, coupled with the near heading towards a vertical entry allows the penetration below 5 metres. You then have a patient sinking below 5 metres, not breathing, apnoeic, in an unrecoverable state that will lead on to, then, a hypoxic cardiac arrest.
With those findings, there being no respiratory effort, there are therefore no signs of submersion drowning, and with the potential for post mortem hypoxic brain injury masking any pre mortem brain injury, makes it virtually undetectable at post mortem.
Q. Drawing the threads together of your evidence, can we say in summary that when death occurs due to immersion in water without the characteristic findings of submersion drowning, there can often be challenges in

determining the mechanism of death?
A. I think that's a very accurate statement. Most of the time post mortems of this nature are inconclusive because the majority of the evidence sadly dies with the patient.
Q. You are prepared to accept as possible mechanisms of death an arrhythmia due to autonomic conflict, an arrhythmia due to cold shock, or a hypoxic cardiac arrest due to impact brain apnoea?
A. Yes, sir.
Q. Is any of those processes physiologically more or less likely than any of the others as mechanism of death?
A. I believe that with the higher water temperature -- we cannot be certain, but my best opinion to you is that with the higher water temperature on the night, the likelihood of the cold shock and the likelihood of autonomic conflict are reduced, leaving the more likely to be the impact brain apnoea, stressing that two of those conditions are still at the research phase of understanding.
Q. As to where death occurred by any of those processes, you formed a view that it was likely subsurface, is this right, that you based that on the assessment that had Monsieur Thomas remained above surface for any significant period, he would have been seen either by

those on the bridge or those coming to search for him?
A. Exactly, sir.
Q. But is this right: you are unable, beyond those conclusions, to say "Here is one cause that I can say is more probable than not"?
A. Exactly as you've described, yes.
MR HOUGH: Thank you very much. Those are all my questions. There will be some more.
A. Thank you.

Questions by MR ADAMSON

MR ADAMSON: Mr Savage, my name is Dominic Adamson and I ask questions on behalf of the parents of Xavier Thomas, and his partner, Christine Delcros.

I'm going to start, if I may, by just dealing with some of your broader themes before turning to your scenarios, and I want to start by looking at submersion drowning and what you might expect to find.

You would accept, would you, that drowning is a diagnosis of exclusion?
A. Yes.
Q. And so the fact that there are no signs of submersion drowning does not mean that it did not happen?
A. I have to answer that within the boundaries of not being a pathologist, being a pre-hospital clinician, that I don't examine dead bodies. With the elements of

submersion/immersion, trying to pick them apart at post mortem, my understanding is it is an incredibly difficult task.
Q. Yes. Let me read to you what Dr Lockyer said in his conclusions to his post mortem report:

"Drowning is a difficult post mortem diagnosis to make with certainty, often considered to be a diagnosis of exclusion."

You agree with that?
A. Yes.
Q. "Probably the most characteristic findings at autopsy in cases of drowning are frothy liquid in the air passages ..."

And you have referred to that, haven't you?

"... sometimes emanating from the nose and mouth, and heavy expanded crepitant oedematous lungs. However, these findings are not always present and are not entirely specific to drowning, sometimes seen in cases of drug overdose and congestive heart failure."

Well neither of those play a part here. But the point that is made by Dr Lockyer is that they're not always present.
A. Yes.
Q. Even in those cases where that is the mechanism of death.

A. And some people would say that the reason is that currently the mechanisms of submersion and immersion are not fully understood by all, which is why I point you towards the current ongoing research, and it's incredibly hard for any professional to put their finger exactly on what has happened to the patient.
Q. If it's difficult, and if it's to make a diagnosis with certainty, and the characteristics described are not always present, it would not be safe, would it, to exclude a particular scenario for that reason?
A. I think, rather than exclude, I think the term "less likely on the balance of opinion" may be a better term.
Q. I see. So where you say in the conclusion to your report "The absence of significant post mortem evidence of drowning allows ..." and then you identify the scenarios to be reasonably discounted, that has to be caveatted, doesn't it, that even in those cases where a person has drowned, there will not always be the signs present?
A. I don't disagree with you, sir. I would be interested to see if there were pathologists who could put stats to that. By that I mean it would be very interesting to know if they believe that, you know, it was absent in 10%, 20%, but I do not know those figures as a pathologist, because I am not.

Q. Second topic. Adequacy of the search on the night of the attack. You say in your conclusion:

"Accepting the certainty of the experienced responding lifeboat crew of the night that had he been on the surface he would have been detected ..."

You then identify various scenarios that can be reasonably discounted, and in other words, I think what you're saying is that had he been there on the surface to be seen, he would have been and he would have been saved; is that right?
A. That's my understanding, sir, yes.
Q. Yes. We heard during your evidence when you were commenting on a number of the scenarios you used the term "we strongly believe that he would have been found." You are a serving member of the RNLI; is that right?
A. I am, sir, yes.
Q. And, in fact, you are based at the station that the operatives on -- who were working on the night are based at too; is that right?
A. Yes, sir, yes.
Q. So you know the people who were involved on the night?
A. Yes.
Q. But you weren't serving on that particular occasion?
A. No.

Q. Now, you're not here in your capacity as a representative of that lifeboat station; you're here as an independent expert. We know that Xavier entered the water at 22.07 and that the first patrol boat, which was a marine patrol boat, arrived about 7 minutes later, and the RNLI boats arrived about 13 minutes later, and we know that a structured search, a line search, to which you've referred, didn't commence until 18 minutes later.

In relation to your scenarios, how long would somebody who fell into the water not in the horizontal, but was in some way rendered unconscious or unable to breathe in those circumstances, but did not penetrate below the surface, be likely to remain on the surface?

A. A human -- I believe what you're asking me is how long, potentially, does a human being stay on the surface prior to waterlogging?

Q. Yes.

A. There is no definitive data, but anecdotally you are looking at several hours in the surface to immediate subsurface zone, and by immediate subsurface it is what I have been talking about, the 1 to 2 feet.

Q. 1 to 2 feet?

A. Yes.

Q. So your understanding is that in the period that we're

talking about for this particular search, we know that the search was called off after 47 minutes. But, on the basis of your answer, it would seem that it's certainly possible for some time after that that a person could still be floating in the water?

A. Yes.

Q. And visible?

A. Yes.

Q. And in terms of what might be capable of being seen, it could be just the back of the head?

A. Yes.

Q. Or it could be what you've described as a pillow-type effect?

A. Yes.

Q. In terms of how easy it is to spot those in the River Thames, is it difficult or is it straightforward?

A. It depends on many factors. It depends on light, it depends on the amount of traffic on the river, it depends on the ambient lighting of the banks, it also depends on the tide state, because the more aggressive the tide state, the bigger your search area is.

My understanding of the night is that we were almost at slack water, by slack water I mean very little tide movement.

Q. The evidence that we've heard is it was about half

a knot.

A. Therefore that is half a mile in an hour, which is not the world's biggest distance when you think about a search pattern, and when you think how, actually, the River Thames is very narrow at that position, you are only looking at a river that's probably three times the width of this courtroom, three to four times the width of this courtroom by London Bridge.

THE CHIEF CORONER: I've probably got a plan somewhere. No, if we work --

A. This is about the span of an arch and we've got four to five arches, so maybe if you wanted to be, not generous, let's say six times the width of this courtroom, and I don't know the intimate details of that night because I've deliberately tried to stay away from the RNLI side of it, however, my understanding is you have at least three, if not four vessels searching that area, with very limited tide, meaning the search area you have to cover is very small and you have a lot of eyes and a lot of vessels to cover that area.

MR ADAMSON: Yes. You don't know the intimate details of the search on that night. We've heard that two marine police units were also engaged in warding people away from what I've described as the danger area, and so it's not really for you to make a decision as to whether or

not the search was adequate or not, or whether it was effective or not; is that fair to say?

A. That's very fair to say.

Q. Yes. And so if there were aspects of the search which were not as effective as they could have been, that would reduce your confidence in discounting scenarios where the certainty of locating Xavier has been applied in your analysis; is that fair?

A. My scenarios come from over 30 years of taking people out of water and searching for people in water and removing them from water, and the understanding of how many times, if the patient is on the surface, they are found, and the ones that aren't found tend to be the ones that aren't on the surface.

So those -- that comes from experience, is the only way I can put that, sir.

Q. But it wouldn't be safe to say that an experienced lifeboat crew would be certain to find it, would it?

A. Not 100 per cent certainty.

Q. Because they may not have done things in the way they ought to, they may not have been as effective as they are on other occasions?

A. I can't say, sir, I wasn't there.

Q. In terms of the -- next topic -- the angle of entry, you can't say one way or another whether he entered in the

vertical or the horizontal; is that right?
A. Correct.
Q. Or somewhere in between?
A. In between.
Q. I think it was in connection with your analysis of impact brain apnoea that you said that that required vertical entry; is that right?
A. Yes, vertical entry to penetrate to depth. It requires a significant strike to the head.
Q. Yes. And you've concluded that of all the scenarios, an impact brain apnoea is the one that you favour?
A. Only based on the elimination courtesy of water temperature. But I think it has to be fair to say we have no certainty of anything that happened to Mr Thomas and all I've tried to do here is look at the evidence that's been presented to me and systemically go through the options and see which ones present a likelihood or not for you, sir.
Q. I mean, you have made the point there was evidence of a blunt force injury to the nose, which you speculated might have been caused at point of entry to the water. We also know that there was bruising to the arms and the left leg. Now, I appreciate that, again, one can't be certain because the evidence indicates that he was probably struck by the vehicle too. But let us take the

arms, for example. Could the arms have been bruised by entry into the water from a fall from that height?
A. I believe they could have been bruised by impact with the vehicle, impact with the bridge parapet or impact with the water. I'm not sure you could eliminate any.
Q. So the physical findings in that respect don't really assist us in determining whether there is horizontal or vertical entry?
A. No.
Q. Just in terms of your analysis of the distance he fell, you've observed that he fell 13 metres, and you thought that that sort of fall would have given Mr Xavier Thomas the opportunity to correct his angle as he was falling, so as to essentially, as I understand it, enter the water in a more convenient dive-like pose; is that right?
A. It has the potential to do so, yes.
Q. Yes. You thought that the fall time might be about 6 or 7 seconds?
A. Based on, we know that fall times from 5 metres are in the region of around about the 2-second point. Just extrapolating that up, it all depends on the speed that Mr Thomas left the bridge and body weight, but you're looking at that sort of neck of the woods.
Q. Yes. We heard some evidence about gravity yesterday and

its effect. An object falls at 9.8 metres per second squared, which means that in the first second, an object would fall 9.8 metres, or half of 9.8 metres, ie 4.9 metres. In the first two seconds, it will fall, as I understand it, 19.6 metres.
A. Okay.
Q. So, in fact, the fall time is rather shorter.
A. I don't disagree with you, sir --
THE CHIEF CORONER: Isn't that its terminal velocity rather than its initial velocity?
MR ADAMSON: Ah, maybe I've got it wrong, then.
A. And also we don't know how high Mr Thomas was ejected above the surface height of the bridge. We have the height of the bridge because it is a geographical structure, but nobody can say how high the van lifted Mr Thomas before he made his descent which might add to the actual fall height as well.
THE CHIEF CORONER: My recollection, Mr Adamson, and do correct me because I don't always get these things right, was the example that was given was about the one which we're all familiar with, the tonne of lead and the feathers. They all reach their terminal velocity, but it's getting there.
MR ADAMSON: Yes, I'll move on.
MR HOUGH: I think, in fairness to Mr Adamson, looking at

appendix 3 of Mr Andrews' report, it was the standard fall speed of a vehicle, 9.81 metres per second squared, which was used in the calculation rather than that being the terminal velocity.
MR ADAMSON: I'm not sure where that leaves us in terms of --
THE CHIEF CORONER: I think Mr Hough is quite rightly saying you were correct in your proposition.
MR ADAMSON: Next topic. So far as the temperature of the water is concerned, 20 degrees Celsius, you're satisfied that that's the sort of temperature of the Thames at this time of year -- at this time of year, because we're almost two years out.
A. The data was supplied to me that the temperature of the Thames that night was -- they had -- the information graph showed the temperature at various locations and there was a degree difference and they met the mean, so they've come to that conclusion of 20 degrees C.
Q. Yes. Now, just turning to the physiological effects on the body of falling and of a few questions on that if I may. Turning to cold shock response first, you said in section 2 of your report that at temperatures of 25 degrees centigrade, it's possible, but there's no significant effect until the water is 17 degrees; is that right?

A. It's a sliding scale that starts at 25 degrees C and reaches a maximum of 10 degrees C. Therefore there are some effects at 20 degrees C but they are not as aggressive as the effects at 17 or 10.
Q. Would clothes reduce the likelihood of cold water shock?
A. It depends very much on the nature of the clothes. We describe clothing as flush clothing or non-flush clothing. Cold shock is stimulated by the ability for your skin to get wet simultaneously, therefore normal civilian clothes are not a guard against cold shock because water can draw into, up your sleeves, in your shirt, et cetera. Whereas if, for example, you are in an immersion or drysuit or a wetsuit they become more cold shock protective.
Q. So on the night Mr Thomas was wearing jeans and a coat; would those be the sort of clothes that would have any impact, in your view?
A. I do not believe they would significantly reduce the likelihood of cold shock.
Q. Now in your report you've put the period 3 to 5 minutes for cold shock. Do I understand that to mean that for a period of 3 to 5 minutes that phenomenon is present?
A. I need to correct that. That's a mistake in my report. It's 0 to 3 minutes, I do beg your pardon. 0 to 3 minutes is the cold shock response. 3 minutes is the

border where it starts to clear.
Q. Right.
THE CHIEF CORONER: I think that was clear from other evidence you gave about the effect wearing off after 3 minutes.
A. Yes. I do apologise; that's a mistake in the report.
MR ADAMSON: So far as the respiratory gasp is concerned, you talked about the inhalation of the water caused by the respiratory gasp and you talked about how the water within the lungs would then either remain or pass through into the bloodstream and, as I understood your evidence, it made a difference whether it was saltwater or non-saltwater --
A. Yes.
Q. -- is that right?
A. That's correct.
Q. This part of the Thames, the water is ...?
A. The general belief is that it's salt up to Blackfriars Bridge and fresh from Blackfriars Bridge north. So here we're talking salt, if you believe the general belief of the Thames.
Q. And so you would expect, then, that water to remain on the lungs, rather than pass into the body?
A. Yes.
Q. You have addressed the cardiovascular elements of it.

I don't have any particular questions in relation to that. I do have some questions in relation to hypothermia and peripheral cooling. Now, you have ruled those both out as potential explanations in this instance but, again, these are phenomenon that take a considerable period of time to occur; is that right?
A. That's correct.
Q. And so far as peripheral cooling is concerned, do I understand your evidence correctly that it would take about 30 minutes for the effects of peripheral cooling to have an effect?
A. Peripheral cooling is directly based on water temperature, so at the colder water temperatures we expect peripheral cooling failure between the 3 to 30-minute mark, but at 20 degrees C, which is a coastal swimming temperature in the summer, you would expect peripheral cooling to not become disabling within the sub one hour. You're still going to have effects from peripheral cooling as it rises past that time period, but peripheral cooling is a sustained period of time in the water.
Q. And hypothermia even longer, and I think you have given a figure of 40 hours.
A. That's the very, very maximum time where, at that point in time, all patients are known to not survive. If you

look at 20 degrees C and you're looking at sort of 50% survival times, you would still be looking in the 4 to 5 hours, but that's what I want to stress: it's hours, not minutes, for hypothermia.
Q. Again, you are describing potential methods of death which take a prolonged period of time --
A. Yes.
Q. -- to occur, and so here a search is called off after 47 minutes and we have two mechanisms of death which would not have taken place within that time frame; is that fair to say?
A. That's a fair comment.
Q. Turning to surface or subsurface, your evidence is that he is likely to have penetrated below 5 metres on entry?
A. There is the potential for a 13-metre fall to do that, yes.
Q. But you can't -- sorry, "likely" is the wrong word: it's "possible", rather than "likely"?
A. Yes.
Q. Any impact with the water which is not horizontal is likely to have left him at some point between 5 metres and at surface level?
A. Yes.
Q. And if he entered in the horizontal, he would have remained roughly at about the surface level for a period

of time?
A. When we say surface level, I think we need to clarify, and by that I mean a human being dead, incapacitated, whichever term you would like to use, in the water, as we went back either based on clothing, body mass, structure, body fat, muscle, et cetera, will float anywhere between the surface and 1 to 2-foot subsurface.
If you, for example, look at the lady ejected off of Westminster Bridge during that attack, she was subsurface throughout that rescue.
So you can't define that people will always be on the surface. By that you mean they might be, you know, just a foot under, 2-foot under, but the immediate body in water doesn't sink off to the deep unless there's a reason to do so.
THE CHIEF CORONER: Mr Adamson, I've got something I need to do in about 2 or 3 minutes' time. I don't want to rush your questions.
MR ADAMSON: I am afraid I'm not going to be finished in 2 or 3 minutes.
THE CHIEF CORONER: That's not a problem at all. I just thought whether that's a convenient moment to break off?
MR ADAMSON: I appreciate that we all thought it might be possible to --
THE CHIEF CORONER: No, there's no problem at all. We will

come back to this topic, as you've got very important issues that you need to explore, but I'm going to suggest we carry on at 2 o'clock with that. I hope that doesn't cause you any inconvenience.
Very well. 2 o'clock.
(12.46 pm)
(The Luncheon Adjournment)
(2.03 pm)
THE CHIEF CORONER: Yes, Mr Adamson.
MR ADAMSON: Mr Savage, I've been asked by the interpreter for my clients if you could keep your voice up and speak slowly. You do speak rather quickly and so it makes the interpretation a challenging effort.
A. Will do.
Q. Thank you very much.
Mr Savage, before lunch we had considered the period of time that somebody might remain on the surface of the water, and I think you said that somebody who was unconscious might remain on the surface of the water or perhaps 1 to 2 feet below it for a period of up to a couple of hours?
A. That's correct, sir.
Q. In section 5 of your report, you consider the factors on the Thames on the night, and I think in essence what you're saying is that, from your experience, the

circumstances on the night were good from the perspective of the prospect of identifying a casualty in the water?
A. That's correct. I think if we look at the area in concern, the river is about 250 metres wide. You described the half a knot tide flow but that was initially half a knot in one direction, with the tide turn in half a knot in another direction, which means if those times were equal, theoretically with physics, your person would remain in the same location with the tide flow in and then out.
Even with a tide flow of half a knot, half a mile in an hour, if you anticipate that a search speed of a boat is around about 5 knots, so you go very slowly so you have optimal search, then you're going to cover that half a mile in six minutes. So in the period of a search duration, and let's say -- and I don't know the exact search duration that night, but I believe you used 40-something minutes, then you can anticipate those legs would have been eight or nine times up and down the patch of water during that period of time.
Q. We certainly heard evidence that there were eight passes as part of the structured search on that night.
A. And I think the night that -- to answer your question in another fashion for you, the river has significant

obstructions in multiple locations. Westminster Bridge is a horrible bridge because you have Westminster Pier and you have the London Eye and its associated structures. London Bridge has clearer water around it, it has less obstructions, and therefore it's a better zone to search in, if that's an understood terminology.
It's also, the banks are not excessively lit, which allows you better vision on the water.
Q. Yes.
THE CHIEF CORONER: And I think the other feature we heard, Mr Adamson, was about the lighting underneath the arches of the bridge which again was mentioned in other evidence as being a factor which would help surface-checking.
MR ADAMSON: Yes, but just in terms of the area, if you had four boats conducting a line search, assuming that they're relatively equally spaced, they're going to be 50 metres apart or so, aren't they?
A. Yes.
Q. And if you've got three boats, it's going to be greater than that, 70 metres apart, or so?
A. Yes.
Q. In terms of your original estimate of the width of the Thames, you were referring to the width of this courtroom --

A. It seems a lot smaller from a boat, I can assure you.
Q. I think we can agree, it's not three to four widths of this courtroom?
A. In the quiet of lunchtime, I quite agree with you.
Q. So in fact, the space between the boats would be rather greater?
A. Yes.
Q. And if you lose a boat from that search, that gap gets even bigger still?
A. That's correct, however, I must add that the luxury of four vessels searching, or even three vessels searching, is an unknown luxury. For the Thames the majority of searches carried out are one police boat and one lifeboat.
Q. We heard from the coastguard that he was unaware that the police vessels were also involved in warning people away from the area during the search for Xavier, and that he -- and I paraphrase -- would have wished to know that and it would have had an influence on his overall attitude to the scale of the search. Is that something with which you agree?
A. I have to refer to the fact I wasn't there on the night. What I will say, and I think it is important to say, is that a search is only ever called off in conjunction with all the people on the search. No searching

authority, from my personal experience on the receiving end of it, just says "We're stopping". It's a consensus agreement and it's a consensus agreement from the people that they have honestly and thoroughly covered the ground. And I can assure you with a boat manned 50% by volunteers who serve no other purpose than altruistically saving of life, we do not go home if we think that person is still on the surface. We search and we search and we search, irrespective of the weather, and it would have been a beautiful night to search then, trust me, some of the minus 3 degree searches in the Thames are a little bit interesting at night when it is horrible and wet and dark, and we don't go home unless we are sure they're not there.
Q. But it's certainly possible, isn't it, that Xavier might have been missed in the course of this search over a period of 47 minutes?
A. I think that's an impossible question for me to answer for you, but with the luxury of three or four vessels over an incredibly small search area, I think that is highly unlikely, and that is one of the reasons why it was majorly discounted from my report.
Q. Have you spoken to those who were involved in the search on the evening?
A. In no detail.

Q. How well do you know them?
A. I know them as colleagues on the station I serve on.
Q. Have you worked with them?
A. Yes. And I know, without sounding romantic, I trust my life in every single one of their hands.
Q. Let us turn to your scenarios. Now, before we go through each scenario, I think we're agreed that you can't say whether Xavier entered the water in the horizontal or the vertical?
A. Correct.
Q. And I think that you have accepted that the findings on post mortem do not rule out submersion drowning?
A. I think they make it more unlikely.
Q. And you have accepted that somebody can remain on the surface, or close to the surface, for a period of a couple of hours?
A. That is correct, but please bear in mind, the minute they are subsurface, eg the 1 to 2-foot scenario we've talked about, they are out of sight. The Thames has horrendous visibility. It's like a cup of tea.
Q. Yes, anyone who looks into the River Thames, and I have done so on many occasions following my involvement in this case, can recognise that it's a dark river in that sense. But nevertheless, it is possible for somebody to remain visible on the surface, isn't it, for a couple of

hours? That's, I think, your evidence?
A. Yes.
Q. So turning to scenario A. Scenario A is "Drowning after a period of surface time", and so in this model, Xavier fell to the water, was conscious and remained at surface level but subsequently effectively sunk, by either peripheral cooling or hypothermia, and you've ruled that out because of the absence of post mortem evidence of drowning, the fact that Xavier would have been able to shout for assistance, and the absence of musculoskeletal injury.
A. Yes.
Q. You've also ruled it out because of the calmness of the tidal conditions, and the water temperature?
A. Yes.
Q. In this model, how long do you think that Xavier would have been able to remain on the surface as a relatively young, healthy male?
A. Prior to submersion?
Q. Prior to submersion?
A. Up to -- impossible to give you an accurate answer. My best guess, and there is no other term for it than my best guess, within the region of an hour.
Q. An hour?
A. Half an hour to an hour, dependent upon anxiety levels,

stress levels, body clothing, et cetera.
Q. Does physical exertion impact upon a person's ability in the water to shout for assistance?
A. Not anecdotally. People can tread water and thrash their arms and still scream quite successfully for assistance.
Q. Does commotion elsewhere or in the vicinity impact upon a vessel or search vessel's ability to hear the cry for help of somebody in the water?
A. Not particularly. Sound is transmitted very easily on the Thames and especially as you have high embankment walls, it tends to reflect off, so actually sound is picked up very, very easily. I was not there on the night, I cannot tell you what the ambient noise conditions were like, but in that area of the river, it is easy to hear people.
Q. Yes. But on this model, assuming that Xavier was capable of remaining on the surface for an hour, the search was called off before that hour had elapsed; do you agree?
A. I imagine the search was called off because the ground had been covered so thoroughly so many times.
Q. Scenario B, this is "Drowning as unable to stay afloat due to injuries". And so on this model, Xavier enters the water, surfaces for a period of time, but is unable

to tread water because of physical injury. And, again, conscious throughout. You ruled this out because of the absence of post mortem drowning evidence, the lack of musculoskeletal injury, and because of tide flow and calmness of the water conditions on the night which would have facilitated a search for somebody in this particular scenario.
A. Yes.
Q. In this scenario, how long do you anticipate Xavier would have remained on the surface?
A. If he was unable to stay afloat because of injuries?
Q. Yes.
A. A very short period of time.
Q. Less than a minute?
A. It's honestly impossible to say, but you're in very small numbers of minutes, you're not in tens of minutes here. It takes a person only 2 to 3 minutes to thrash and go under, so you are in low numbers of minutes.
Q. So we know that the first boat did not arrive until 7 minutes after Xavier had entered the water. So on this scenario, you think that Xavier would probably have been submerged by the time of that boat's arrival?
A. With significant enough injuries, yes.
Q. But that's not supported by the post mortem findings in terms of the absence of musculoskeletal injury?

A. That's my belief, yes.
Q. Yes. Scenario C, this is "Drowning as unable to surface from depth due to injuries", and under this scenario, Xavier enters the water and sinks below 5 metres, and is unable to surface to the top due to limb injuries.
So as I understand it, on this model, Xavier would have had to have entered the water vertically, or almost vertically?
A. Yes.
Q. And we don't know whether that did or did not occur.
A. That's correct.
Q. And he did not return to the surface thereafter?
A. Correct.
Q. And so on this model, as I understand it, no search would have been able to locate him?
A. Correct.
Q. Scenario D, "Drowning floating face-down on surface after brain injury". So on this model, Xavier enters the water and either the impact with the vehicle or the impact with the water renders Xavier unconscious due to head injury, and this rendered him face-down in the water and unable to protect his airway.
On this model I think your two-hour estimate that we've discussed earlier would be the sort of period of time that Xavier might remain at the surface or near to

the surface?
A. Surface or near the surface, correct.
Q. And you discounted this because of lack of post mortem evidence of drowning, the lack of significant evidence of physical head injury, and the adequacy or the tidal conditions and the adequacy of the search on the night.
So coming back to my theme, which you will have identified already, on this model, the search was called off within the time frame that Xavier might have been capable of being seen.
A. Had he been on the surface and not subsurface, yes.
Q. And you've excluded this for three reasons: lack of post mortem evidence of drowning, which I think you've accepted is not always present?
A. I think you have to please realise that I've had the evidence I've had and all I'm trying to do is present you with 13 different scenarios, of which we can't with certainty -- and so it's literally trying to be a process of elimination, to say "That's less likely than this one".
Q. Yes, I appreciate you're doing your best. I am going to work through each scenario. I acknowledge the point that you have made.
The point that I was making was that I think you've accepted that post mortem evidence of drowning is not

always present?
A. Correct.
Q. The second reason that you have ruled this scenario out is lack of post mortem evidence of physical head injury. Now, are you talking about brain injury there or are you talking about a visible external blow?
A. I'm talking about a brain injury.
Q. And, finally, the search conditions on the night. I appreciate you don't agree, but I suggest to you it's possible that he could have been missed on the night.
A. Impossible to say as I was not there, sir.
Q. Yes.
THE CHIEF CORONER: But I think one of the other caveats you've said, again, is this point about "If on the surface; subsurface, things change", and I think, Mr Adamson, you accept that. It's those four words at the end of that third bullet point.
MR ADAMSON: I acknowledge that if Xavier was subsurface, even to the point of a couple of feet, then it's going to be difficult for him to be identified.
THE CHIEF CORONER: Yes, to be seen on the surface.
MR ADAMSON: Yes.
A. Can I please say, not difficult; impossible.
Q. What I'm driving at is the possibility --
THE CHIEF CORONER: Perhaps this: if he is on the surface,

I get that, as I say, it's just the caveat that I think ...
MR ADAMSON: I don't wish to be unfair in the questions I am putting.
THE CHIEF CORONER: No, no.
MR ADAMSON: Scenario E, "Drowning subsurface after brain injury", so that's a similar scenario to the one we have just heard, but on this scenario, Xavier does not return to the surface upon entry; is that right?
A. Yes.
Q. And so on this scenario, in essence, no search is ever going to find him?
A. Correct, sir.
Q. Scenario F, "Death on the surface due to cold water shock response". Now, just to foreshadow the questions on this, in this scenario, Xavier falls, he remains on the surface or slightly subsurface.
A. Yes.
Q. And does your two-hour timeline apply to this scenario as well, ie he might have remained at that sort of level for a period of two hours?
A. For a period of up to two hours.
Q. Up to two hours?
A. Yes.
Q. And so again, subject to the caveats that we have

already fleshed out, on this scenario, the search is called off at a time when it was at least possible that he might have been there to be found?
A. Accepting the questions you have asked me already.
Q. You've ruled out this scenario because of the absence of post mortem evidence of drowning, and I've already made my points in relation to that, I won't put them again, the water temperature, ie, in your experience it's probably not cold enough for this scenario?
A. Less likely, yes.
Q. But it's still possible?
A. It is still physiologically possible, but less likely.
Q. And your observations in relation to the search conditions on the night?
A. Yes.
Q. Scenario G, "Death subsurface due to cold water shock response". Same scenario, but on this model, Xavier goes straight under the water and does not return.
A. Yes.
Q. So, again, this is a scenario which requires horizontal or -- a vertical or near vertical entry.
A. Yes.
Q. Which we don't know.
A. Yes.
Q. So this scenario, no search is going to find him?

A. Correct, sir.
Q. Scenario H, "Death on the surface due to autonomic conflict". This scenario, the impact that Xavier has with the water you have described as "Face-first".
A. To fire autonomic conflict you need an immersion of the face on top of an immersion of the body. So just to recap autonomic conflict, you have to have one side of the autonomic nervous system firing, the sympathetic side, that's either caused by whole body immersion, or we sort of explored, by a fear response.
And then on top of that you have to superimpose a face splash. So this is either, in this case, somebody on the surface receiving a splash to the face from potentially a wave, or this is somebody who has gone, at the same time as firing off a cold shock response by entering the water, their face is immediately impacted as well.
Q. What about if moments before the fall there has been an impact with a vehicle?
A. If that was enough to fire off the sympathetic side of the autonomic nervous system, then it is theoretically, and I have to stress theoretically, because it is still all in the research stages, theoretically possible that combined with wet face can cause autonomic conflict.
Q. And so you've discounted this for two reasons: water

temperature, and that's presumably the impact of the water temperature on the face being not sufficiently -- the water is not sufficiently cold to trigger that reaction --

A. The aggressiveness of that reaction.

Q. And the adequacy of the search conditions, and the likelihood of identification on the night.

On this model, again, do I understand your evidence that a person in this circumstance would be on the surface for perhaps up to two hours?

A. The same conditions, yes, if they are dead on the surface, and I stress again on the surface, and again, there are so many factors, you have a sliding scale there of anything from 5 minutes to 2 hours, but you do have that surface interval, as we call it, yes.

Q. Yes, and so, again on this model, the search was called off at a time when it was theoretically possible that he could have been located?

A. Yes.

Q. Subject to the caveats that you have given?

A. Yes.

Q. Does your evidence that the combination of contact with the vehicle followed by an impact face-first with the water cause you to reflect upon your conclusion that this was a scenario that is unlikely and can be

discounted?

A. I think it's more related to the next scenario, I, because if falling from height the first impact is his face, then he's likely to penetrate to depth, which is why death subsurface due to autonomic conflict was one of the ones that needed serious consideration. Whereas for him to have impacted his face first, unless he was coming down completely horizontally, face-first, which is a possibility, but as a human body falls, it is more likely that the angle will start to pitch up. So that's one of the reasons why H became less likely and I became more likely.

Q. So H -- before we leave H, in terms of the trigger for autonomic conflict, when I think of somebody falling face-first, I think of them falling with their face down rather than the top of the head going into the water; is that a false distinction that I'm drawing, or are you saying that that is an accurate distinction?

A. I'm talking about people ending up in a diving position where, as they enter, it's forehead and nose first as opposed to, you are thinking horizontal face plant.

Q. Yes.

A. Most people, and this is purely anecdotally, I have sat under too many bridges and seen too many people jump, most people do not come down in a sort of belly flop

fashion. They either come down and their feet start to come down, or they come down and their head comes down first.

Q. Scenario I, "Death subsurface due to autonomic conflict", and I think you have touched upon this already, in this model Xavier goes straight under and again, no search is likely to find him.

A. Correct, sir.

Q. Scenario J, "Death on subsurface due to impact brain apnoea". Here, again, am I right to think that on this model he would have potentially remained on the surface for up to a couple of hours?

A. The same conditions we have been discussing, yes.

Q. I'm sorry if I'm doing this in a pedestrian fashion, but it's important that I adduce this so that my clients understand this. On this model, again, search called off at a time when he was potentially capable of being identified?

A. Identified but not saved.

Q. Is this in effect a form of instantaneous death; is that what you are ...?

A. It's an instantaneous cessation of breathing, which means for as long as that breathing doesn't occur, you then go on to hypoxic cardiac arrest. So you will be in hypoxic cardiac arrest theoretically anything from 3 to

5 minutes after that.

So, in effect, search duration in this case becomes irrelevant because death would be really quite fast.

Q. Yes. And just so I'm clear, and I know this may sound like a silly question, in this model, Xavier would not be conscious; is that right?

A. Correct.

Q. Scenario K, "Death subsurface due to impact brain apnoea". This is the same mechanism of death but occurring subsurface and so, again, a search under this model would not have identified Xavier.

A. He would never return to the surface, yes.

Q. And so of your 11 scenarios, six are surface or almost at the surface deaths, five are subsurface. I'm right, I think, in saying that in relation to each of the surface mechanisms of death, the search was called off at a time when it was theoretically possible that Xavier could have been located?

A. Let me look at the exact six so I can give you an answer to that, sir.

THE CHIEF CORONER: One of those, I think, was scenario B, where I think, Mr Adamson --

MR ADAMSON: You're quite right, sir, you're quite right. Five.

A. And I do believe also scenario J, the impact brain

apnoea scenario we discussed on the surface, there wouldn't have been a survival time associated with that either.
MR ADAMSON: But that's survival.
THE CHIEF CORONER: He would have been located within the two hours, but he would not have been alive.
MR ADAMSON: Would not have survived.
THE CHIEF CORONER: So I think that means that you are right, Mr Adamson, there are five in which location would have taken place on the evidence potentially within the two hours.
MR ADAMSON: Yes.
THE CHIEF CORONER: But of those, one would have been instantaneously fatal.
A. To put it in perspective, sir, the only two that have any survivability during that time frame is scenario A, and dependent on the level of injuries, scenario B. Whereas the other surface ones involve either immediate or fairly instantaneous cardiac arrest, which if you are not recovering the patient within the first -- let's be generous -- sub 10 minutes, will prove to be fatal. That is a reason why the Thames lifeboat system exists as it does with a 90-second launch from station, because people don't have the survivability that we have round the coast.

MR ADAMSON: Sorry, at Waterloo you launch within 90 seconds of being notified?
A. If the boat is on station, our operating procedure is to be gone within 90 seconds. We remain on the station fully kitted with the absence of a lifejacket and a crash helmet, the only things we would put on and go. That's the Thames lifeboat operating procedure, is to be lines away in 90 seconds, and it's set up that you can span your patch in a period of time whilst there is still survivability.
MR ADAMSON: Thank you very much, Mr Savage.
Sorry -- sir, may I be given one moment?
THE CHIEF CORONER: Of course, Mr Adamson. (Pause).
MR ADAMSON: Mr Savage, one more topic, please.
We've heard that the thermal cameras that were available to the marine police units, the infrared cameras, the thermal cameras were not being used on the night. In relation to your scenarios, those which involved Xavier being on the surface, would those scenarios have enabled somebody using such technology to locate Xavier?
A. I cannot answer with certainty for you, sir, because we do not use that technology, therefore I don't have in-depth knowledge of that technology, I am afraid.
Q. What technology, if any, do the RNLI have in relation to

that?
A. We use search lights and night vision equipment.
Q. Do you know if night vision equipment was being used on the night?
A. I don't, I am afraid.
MR ADAMSON: Thank you.
Questions by MR HORWELL QC
MR HORWELL: I appear on behalf of the Commissioner for the Metropolitan Police.
Did you know that there was a helicopter that was used that had thermal imaging equipment?
A. I didn't, sir, but I know that in many of the searches that we have on the Thames, the NPAS police helicopter is used and produces immediate effective results for us.
Q. You have said on number of occasions that you bring with you into the witness box 30 years of experience, and it is from your experience that you have been able to say that those who want to be rescued are very able to make their presence aware to rescue craft?
A. In the absence of a disabling condition stopping you speaking or screaming, that is correct, sir.
Q. You've been asked a number of questions as to whether or not Xavier would have been seen if above the surface, alive or dead, and you've discounted a number of these scenarios as being unlikely because he wasn't seen, and

you base that answer, do you, on your 30 years' experience, knowing that a hasty search conducted by two police marine boats that started within about 7 minutes of his entering the water, that if he had been above the surface, he would have been likely to have been seen during the course of that hasty search?
A. I cannot agree more with you, sir. We have, amongst the marine police, London Fire Brigade and RNLI, and the Port of London Authority, and I cannot put a number on it for you, but a ridiculous success rate of recovery of people from the surface, and we do not go home if we think they are still on the surface.
Q. And as you know and as you have been asked about, following that hasty search, there was then the coordinated line abreast search which started with four boats and was then reduced to three.
A. Yes.
Q. And if he had have been above the surface, it's your experience that he would have been seen?
A. I would say to you, sir, that we have found so many people with just one boat that four is an unbelievable luxury for that night. Three is still a highly successful search pattern for a piece of water that is only that diameter.
MR HORWELL: Thank you.

Further questions by MR HOUGH QC

MR HOUGH: Just a couple of final points, Mr Savage. Because of the way that you approached your report, you asked yourself on a number of occasions which was the most probable of various scenarios. What I'm going to ask you to do now is consider a number of propositions and to say whether it is probable, that's to say more likely than not; do you understand?

A. Yes, sir.

Q. First of all, is it probable that Xavier was not visible on the surface at the time of the search?

A. I believe that to be the case, sir.

Q. Based on what you've said to Mr Horwell, would you go so far as to say that it is very probable that Xavier was not visible on the surface during the search?

A. I think with the piece of information I've just received that I did not know before about the police helicopter, if you introduce a police helicopter into that search pattern as well, I would say it's incredibly unlikely that he was on the surface.

Q. Next point. Do you consider it probable, more likely than not, that Xavier did not drown by submersion, by breathing in water?

A. With my best knowledge, and I am not a pathologist, I believe that there would have been far more symptoms

at post mortem had he received that as a route of death.

Q. But for reasons you've given to Mr Adamson, you can't say that with certainty or a very high level of confidence?

A. I can't with 100 per cent certainty say that, sir.

Q. Next, is it therefore probable that Xavier died due to one of the physical processes: cold water shock response and arrhythmia, autonomic conflict or impact brain apnoea?

A. I feel that is the most likely of the three scenarios, sir.

Q. I'm going to ask you the question again: is it more likely than not --

A. Yes.

Q. -- that Xavier died of one of those three processes?

A. That's my belief.

Q. And, thirdly, or fourthly I think now, is it probable, more likely than not, Xavier died before the search was called off, whether above or below the surface?

A. I feel that is far more likely.

MR HOUGH: Thank you very much. Those are all my questions.

A. Thank you.

MR HOUGH: That's all our evidence today, sir, and for this week.

May I just make one matter known to everyone, which

is that next week we are making one change to the published timetable, which is to move DS Ager from Wednesday to Friday, Friday morning.

THE CHIEF CORONER: Thank you. But otherwise we are staying as per the script.

MR HOUGH: Exactly.

THE CHIEF CORONER: Mr Savage, can I thank you very much for coming to give evidence, very clear, if I might say so, the different scenarios. Mr Adamson has very properly explored those differing scenarios with you and one of the things I picked up from quite a bit of what you said is that some of the scenarios which you dealt with are very much based upon material which hasn't been tested over your 30 years of experience. Some of it is very recent thinking, some, I think you said the research is only 2016, but at least you have set out all of those potential scenarios, at least, for me to consider. Thank you very much.

A. Please may I say one thing at the end, sir.

THE CHIEF CORONER: Of course.

A. For the benefit of the family I would just like to say it's my absolute strong belief that Mr Thomas entered the water and died of any of those three conditions we have discussed virtually instantly and in doing so, would have had no suffering.

MR HOUGH: Thank you very much.

THE CHIEF CORONER: Mr Hough, we will meet again on Tuesday, so I hope that everyone has a rest over the bank holiday weekend. Being a bank holiday weekend in this country, one can't predict the weather, one can't predict anything other than chaos on the roads and everywhere else, but I hope at least everyone has a rest at the weekend.

(2.45 pm)

(The court adjourned until 10.00 am on Tuesday, 28 May 2019)

INDEX

J

K

L

M