

**SHEKU
BAYOH
INQUIRY**

The Sheku Bayoh Public Inquiry

Witness Statement

Prof Jack Crane

Taken by [REDACTED]

Via MS Teams

on Wednesday, 8 March 2023

Witness Details

1. My name is Jack Crane. My contact details are known to the inquiry.
2. I am a consultant forensic pathologist.

Professional Background and Qualifications

3. I hold the degrees of Bachelor of Medicine and Bachelor of Surgery. I am a Fellow of the Royal College of Pathologists and a Fellow of the Faculty of Pathology of the Royal College of Physicians of Ireland. I am also a Fellow of the Faculty of Forensic Legal Medicine. I hold the Diploma in Medical Jurisprudence in Clinical Forensic Medicine and in Forensic Pathology.
4. I have been a consultant forensic pathologist since 1985. In 1990 I was appointed State Pathologist for Northern Ireland. The State Pathologist is

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responsible for running the forensic pathology service in Northern Ireland and I held that post until I retired in 2014. From 2015 until 2016 I returned as Acting State Pathologist. In 1992, I was appointed Professor of Forensic Medicine at The Queen's University of Belfast, and I still hold that academic appointment with the university. I currently work as a locum consultant forensic pathologist doing cases just from time to time and also carting out 'defence' post mortem examinations

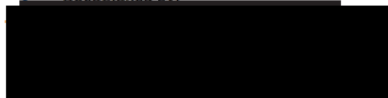
5. I also have been involved in reviewing a variety of cases including a number of restraint-related deaths. I was the lead pathologist reviewing the deaths in the Hillsborough Stadium disaster and I also was the lead pathologist reviewing the deaths in the Manchester Arena bombing. These review-type cases involve reviewing the documentation including autopsy reports, witness statements, CCTV footage, photographs etc. I have conducted a number of such reviews on restraint-related deaths
6. I have had an interest in restraint-related deaths for some time and have given evidence in court in a number of such cases. Currently I am a member of a group appointed by the Attorney General of Maryland, US, looking at restraint-related deaths in Maryland.

Report

7. I have been referred to the report that I prepared for this case (COPFS-00134) and I have been asked since there isn't an Appendix attached to the report if I have any recollection of what documentation I was provided with at the time. I know I was given the post-mortem report, and a number of other reports from experts including a cardiac pathologist and a neuropathologist. I was also provided with the histology slides in the case. I apologise for not providing an appendix with my report.

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Histology Slides

8. I have been referred to an email (PIRC-03413) sent by William Little the Deputy Senior Investigator at PIRC to Zelda Hearst. It is dated 23 November 2015 discussing arrangements to provide the histology slides, together with a list of the paperwork as follows:

- 1. Copy of Redacted Civilian Witnesses Statements*
- 2. Copy of Redacted Police Statements*
- 3. Copy of A & E Notes*
- 4. Expert Witness Package*
 - 4.1 Briefing Paper*
 - 4.2 Post Mortem Examination Report dated 18/06/2015*
 - 4.2.1 Drug Control Independent Analysis Report*
 - 4.2.2 Neuropathy Report- Brain Examination*
 - 4.3 Certified Disc of CCTV and Video Footage*
 - 4.4 Certified Disc of Post Mortem and other photographs of Deceased*
- 5. Drug Control Centre Independent Analysis Report*
- 6. Copy of GP Medical Notes*
- 7. Use of Force Police Scotland Standard Operating Procedure.*
- 8. Disc of all the paper work supplied above.”*

9. Yes, that looks like the list of materials that I was provided with. I do remember Mr Little from PIRC coming over to see me in Belfast. The main reason he came over was to bring over the histology slides for me to look at.

10. I have been asked if when William Little came with the histology slides his instructions where he had to stay with the slides while the slide were with me. Yes, that was his instruction.

11. I have been asked about the histology material to begin with and if I can remember what tissues I examined. There were slides of heart, liver, kidney, and brain, from recollection. There may have been some others, but I think those were the main ones.

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12. I have been asked in lay terms to describe what the review of histology slides entails for me as a pathologist. The purpose of looking at the histology slides is to see if there are any microscopic abnormalities that you may not be able to detect on naked-eye or gross examination of the organ or tissue. So, if you look at a person's heart, naked eye, you may not see any abnormality but, if you look at the heart cells under the microscope, you may see abnormalities. One of the particular things one looks for in some cases of sudden deaths is the possibility of detecting an abnormality in the conducting system of the heart, and that may only be seen by looking at the conducting system under the microscope. You cannot always detect such abnormalities, but a cardiac pathologist would be looking for subtle changes which could explain an individual's sudden collapse and/or death. Examination of the heart both by naked eye examination and microscopically would be standard practice in all cases of sudden death.

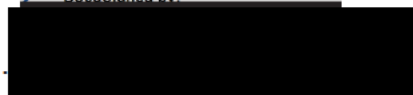
13. When I am reviewing the histology slides that it is in conjunction with the original post-mortem report in which the pathologist who carried out the examination describes what was seen macroscopically i.e. on naked-eye examination. The standard procedure, when one carries out a post mortem examination, is to look at the organs grossly, then to dissect them and then, as part of the examination, to take small samples of tissue, which you would look at microscopically. Now, in some cases, it might be appropriate to keep a whole organ and then take the sections from the whole organ after further examination. So it might not be uncommon to keep the whole heart or to keep the whole brain, and then to take sections from it afterwards.

Excited Delirium

14. It's my understanding that the Royal College of Pathologists has recommended that the term excited delirium should not be used as a cause of death. Similarly, I understand that the main concerns around the use of the term, particularly in the United States, was that it, i.e. excited delirium, was

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being used as a cause of death. It seems that the term originated in the US where individuals, who were being restrained or in police custody, were dying suddenly and unexpectedly and that this was caused by the excited delirium syndrome. It is now recognised that this is not a definitive diagnosis. Individuals suffering from so-called excited delirium exhibit a number of symptoms because of various factors including mental illness and the use of stimulant drugs.

15. One of the things I would say is that I mentioned in my initial report that drugs can cause this excited delirium condition. I think that the view now is that excited delirium is not an entity or a particular condition as such. The view now is that it is a manifestation in individuals, usually because they've taken stimulant drugs, to start to exhibit bizarre, erratic and sometimes violent behaviour. They become agitated and can become aggressive. They may sweat and there is often an association with a rise in their body temperature. So, it is not a defined condition as such. It is a combination of the effects of drugs and other physiological factors that are affecting them. So, that's what I would say in relation to the use of the term "excited delirium." I, and other pathologists would not use it now as a definitive diagnosis.

16. I have been asked whether you call it excited delirium or acute behavioural disturbance or some kind of stimulant psychosis, have I much experience of people dying suddenly when they have exhibited those kinds of behaviours? The evidence suggests that people suffering from an acute behavioural disturbance don't normally die. It seems that there has to be some other factor or factors which may precipitate sudden death. I think individuals in this state are vulnerable and that vulnerability often is exacerbated by some form of restraint. That's how I look at it.

17. One of the difficulties with these cases is determining the precise mechanism or mechanisms of death. We're not completely clear about what the mechanism of death is. Now, quite clearly, if you stop or prevent someone from breathing, you will induce a degree of asphyxia which, if prolonged, will

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result in death. So, a good example would be the case of George Floyd where a police officer put his knee on Floyd's neck such that he couldn't breathe. In many of these restraint deaths it would appear that there is probably some degree of respiratory embarrassment. Now, it's not simply that you stop them breathing and that's what causes their death. In many of these cases, it's not as simple as that and we think probably one other possible mechanism is the development of a metabolic acidosis. This is where the pH of the blood becomes deranged. We know that stimulant drugs themselves can cause metabolic acidosis, and if the individual is thrashing about, running around or becoming aggressive, that will exacerbate the acidosis. If you then interfere with their breathing to some way, that too exacerbates the acidosis. It is thought that this may explain the mechanism of death in some individuals who die suddenly and quite rapidly during restraint.

18. I have been asked what term I would apply to Sheku Bayoh's behaviour on the morning of 3 May 2015, if any. I don't know what the psychiatrists call it, but it seemed to me, that he was demonstrating an acute behavioural disturbance. This in itself is not a specific diagnosis. It is an individual exhibiting a range of symptoms characterised by behavioural disturbance. So that's the term I like, and I think that the evidence would suggest that he was showing acute behavioural disturbance, and if you have an individual who's showing acute behavioural disturbance, then the next thing you consider is, what are the reasons for this individual demonstrating this type of behaviour? The commonest one seems to be stimulant drugs, but it's probably not the only underlying cause.

Drug Use and its Effects

19. I have been asked how an increase in dopamine and noradrenaline from the MDMA that Mr Bayoh had ingested would affect his heart, particularly in the circumstances of a restraint. MDMA is a stimulant drug, and its stimulant effects seem to be because it increases levels of dopamine and noradrenaline and serotonin in the blood and brain. So particularly noradrenaline affects the

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heart. For example, say you are anxious or get a fright, your heart beats faster. That's the effect of noradrenaline. If you're running, it's adrenaline that keeps your heart pumping faster. So that's the effect of noradrenaline and that's the effect of MDMA. In general terms, dopamine also will affect your heart and will also increase the contractibility of the heart. Whether the fatalities due to MDMA are due to its effect on the heart or due to its effect on and the brain is difficult to determine. Probably the drug affects both the central nervous system and the cardiovascular system. In some deaths which I have investigated associated with the use of MDMA, the drug has been associated with a disturbance of the body's the body's temperature regulating mechanism. The individual develops a condition known as hyperpyrexia where their temperature goes up and they start sweating. These drugs have various effects but on its own MDMA is not usually associated with aggression and/or violent behaviour. So having taken MDMA, it doesn't usually cause severe or serious acute behavioural disturbance in my experience. It used to be quite common to be taken by young people, and they get lots of energy and they can dance all night and so forth, but they tend not to show signs of acute behavioural disturbance.

20. I have been referred to my report (COPFS-00134) and the seven questions I had been asked to address. The first of those was the physiological effect of the drugs detected in the toxicology sample, individually or in combination, on the deceased in the circumstances of his arrest. I outline my opinion in relation to the effect of the drugs on Mr Bayoh at page 5. I have been asked if there have been any developments in the research related to those drugs that I am aware of that would change my opinion here. No, I don't think so. Prior to providing this statement, I looked to see whether we were seeing much alpha-PVP in particular. We have had no deaths in Northern Ireland, associated with its use, so I don't know whether it's peculiar to Scotland or not, but there's very little written about it and it's certainly not a drug that's widely abused, certainly not here. I can't comment on the situation in Scotland.

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21. Alpha-PVP has been linked to paranoid ideation, hallucination, violence and aggressive behaviour and has also been associated with cardiac arrhythmia, hypothermia and renal failure.
22. I have been asked if the Alpha-PVP had caused a cardiac arrhythmia would you expect to see evidence of that at post-mortem. No. An arrhythmia means that there is an upset in the heart rhythm and that is not detectable at post-mortem examination. So, if someone has a cardiac arrhythmia, you'll not be able to detect it.
23. I have been asked if I have any idea whether Alpha-PVP has a fatal dose level. I don't know because I have very little experience of it. So, you might need to ask another expert, perhaps a toxicologist. As I say, we have had no deaths associated with alpha-PVP. So, as I say whether it's just something that people in Scotland are using as opposed to here in Northern Ireland. We had a lot of 'Ecstasy' being used and we had a significant number of deaths associated with its use, particularly amongst young people.
24. I have been referred to Dr Soilleux's Report (COPFS-0031) at paragraph 56 where she says *"Alpha-PVP is also reported to have effects on the heart, notably an increase in heart rate and an increase in blood pressure. Abnormal fast heart rhythms are reported to occur following the taking of alpha-PVP. Therefore, these two drugs both act on the heart in very similar ways, namely, to increase heart rate, to increase blood pressure, and to increase the risk of rhythm abnormality. The risk of rhythm abnormality will be greatest when there are additional stresses to the cardiorespiratory system."* I have been asked whether I agree with this. Yes, I broadly agree with that. I think these drugs can potentially predispose to a cardiac arrhythmia. The difficulty is that the mechanism of death in all these cases is probably an arrhythmia. The difficulty lies in determining what precisely caused the arrhythmia. Is it due to the effect of the drugs or is it due to the effects of the drugs and/or something else such as restraint? The other point I would now make (which wasn't included in my initial report) relates to the development of

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metabolic acidosis. We know that these drugs themselves can cause a metabolic acidosis as do some stimulant drugs. So it may be that it is the metabolic acidosis which causes the cardiac arrhythmia. So that is probably the mechanism of death. The drugs on their own potentially could do it because they have the potential for causing an arrhythmia. A helpful article in relation to this is *Metabolic Acidosis in Restraint-associated Cardiac Arrest: A Case Series* (WIT-00044).¹

25. I have been asked to explain what bronchospasm is. Bronchospasm is typically seen in people who have asthma and is caused by narrowing of the air passages within the lungs resulting in wheeze and shortness of breath. There was no evidence that the deceased had any underlying lung condition.

26. I suppose the other thing that's worth perhaps mentioning is that in individuals who are showing signs of acute behavioural disturbance, certainly some evidence from the States would suggest that agents such as sensory irritants i.e. pepper spray and CS sprays don't seem to have much effect on these individuals. The idea of using these sprays is to try and reduce their aggression and their violent behaviour but it seems that they don't tend to work in individuals exhibiting signs of acute behavioural disturbance. So you can spray them as much as you want, it doesn't seem to have any effect.

27. I have been asked if hay fever would be something which would predispose you to the development of bronchospasm or wheeze? I am not a clinician, but I would not think so.

28. I have been asked if sleep apnoea would be something which would predispose you to the development of bronchospasm or wheeze? Again, I am not a clinician, but I do not think so.

¹ Hick *et al*, *Acad Emerg Med*. 1999 Mar;6(3):239-43

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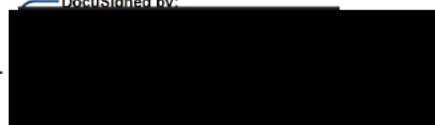


29. I have been asked if any medical doctor can determine cause of death. If you don't carry out a post-mortem examination, you may, from the background information and from their medical history, be able to provide a likely cause of death. So, it's not unreasonable, in some circumstances, to say the most likely cause of death is a heart attack, and that's what GPs do. So, if one of their patients dies, they look at their records and they say, "Yes, he's had heart disease, and he was found dead." However, we do know that the cause of death as stated on a medical certificate of cause of death is, in many cases, incorrect. I'll just give you a good example of that. Scotland has one of the highest instances of coronary artery disease in the world. It's the highest in the UK. More people seem to die from heart disease in Scotland than elsewhere. Is that due to diet or lifestyle? Possibly, but it's also due to the fact that if someone dies suddenly and you don't want the death referred to the Fiscal, you give the cause of death as coronary artery disease. Also, in Scotland there is the 'view and grant' system which does not exist in other parts of the UK.

30. In Scotland a doctor just needs to look at a body and can state that the cause of death is coronary artery disease. So, the very high instance of heart disease in Scotland is probably not completely true. So, in effect, any medical practitioner can give a cause of death, but without a post-mortem examination what they're doing is they're giving their opinion as to what they think the most likely cause of death is. Now, whenever you do a post-mortem examination, then the likelihood is that you will get a more accurate cause of death. So hopefully when you do a post-mortem, you'll see evidence of the heart attack and you can say, "Yes," or you will see that the belly's full of blood and say this is due to that. That's the advantage of doing a post-mortem, is that it'll give you a more definitive cause of death.

31. However, in some circumstances, you may have a number of competing things going wrong, and then what you have to do is to decide what is the most significant, what is the most relevant, or what may have contributed to the death. So, just to take a simple example, you do a post-mortem

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examination on someone who has had a heart attack. So, the cause of death seems very simple, but that person has got diabetes. So, the diabetes has probably made their coronary disease worse, so you might put that in the cause of death as well. Similarly, they may have high blood pressure, so you might want to put that in the cause of death also. Now, in these circumstances, it's the pathologist giving what he thinks is his best shot, if you like, or his opinion as to how these different factors have contributed to the death. The problem with restraint-related deaths – and I'm just saying "related deaths" – is that there are a number of competing factors involved. There has perhaps been a tendency, because there's a number of competing factors, to take the easy way out and say, "Yes, it's the drugs. He's had an arrhythmia because of the drugs," and so forth. So, these cases are very difficult to untangle and to determine what particular factor has been the most important or what other factors may have contributed to the fatal outcome.

32. I have been asked if you've got a death in which there has been restraint and you determine whether that restraint was a factor in the death. Is it only a forensic pathologist who can speak to that and make that determination? Well, I think the best person to do it is the pathologist because he will have been able to examine the body but that examination in itself may not be helpful in deciding whether restraint was a factor. Information from others may be crucial. For example, an eyewitness may say, "Well, yes, somebody was sitting on his back," and so forth. The difficulty for a pathologist is that a death due to restraint per se may not leave any evidence at all in the body. So, the pathologist is faced with a body and there's nothing to find but the person is dead. Another example would be, for example, you have a child who's suffocated with a pillow over its face. If that pillow is removed, there may be nothing to find at autopsy. So, how does a pathologist come up with the cause of death? He's probably relying on information that's been provided by others saying, "Well, I saw the person put the pillow over his face and keep it there." So, often it's an inference based on information that is provided. There may be some tell-tale signs, but in the majority of restraint deaths that I have been involved in in reviewing, there has often been very little to find. So,

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one of the things that I think is crucial in these cases is the temporal relationship, i.e., when did the person die? Did they die after taking the drug? Did they die when they were agitated and running around, or did they die when they were being restrained? Then you have to consider the type of restraint. What position were they in when they were being restrained that would make them more vulnerable to the restraint?" such as lying face down on their belly and so forth, having your arms tied behind your back and so forth. These cases are not easy, and often the pathologist coming to a conclusion as to the cause of death is not necessarily making the conclusion based on definite physical findings but on the circumstances surrounding the death.

33. I have been asked whether a medical doctor other than a forensic pathologist is entitled to provide a opinion as to whether restraint may or may not have been relevant to cause of death. I would have concerns. I would ask what experience that individual has in these types of deaths? It's very easy to say, "These drugs can cause an arrhythmia, therefore that's the cause of death," due to the drugs. Well, that's possible but, as I say, then you have to come back to look at all the circumstances. So, a cardiac pathologist has a rather narrow field, rather, a tunnel vision. They're just looking at, "Yes, these drugs can cause an arrhythmia, therefore that's what the cause of death is." I am currently reviewing another restraint death, and we have the exact same problem. The cardiac pathologist has stated, "This is an arrhythmia caused by the cocaine." But without knowledge or consideration of the circumstances

34. I have been asked what would make a person particularly vulnerable to being restrained or dying during a restraint? Probably one of the most important factors in these cases is the effects of stimulant drugs, so that goes top of list, I think that an individual demonstrating acute behavioural disturbance is also at risk from restraint.

35. So, one has to consider positioning, if you have someone lying on their back and you restrain them by holding their arms, theoretically you should not,

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under those circumstances, restrict their ability to breathe. Anything that will impede their breathing is a risk factor in restraint. Thus, the face-down position could potentially be a risk because the chest wall is pinned against the ground. Now, for most of us, just lying on the ground face downwards should not impede our breathing. However, if any pressure is applied to the individual's back, then the ability of the chest to move adequately is reduced. If the person is obese, i.e., too fat, then the pressure on the abdomen from being in a face down position results in the contents of the abdomen pushing upwards and splinting the diaphragm. It's the diaphragm which separates the chest from the abdomen. So, obese people who are face down are at an increased risk.

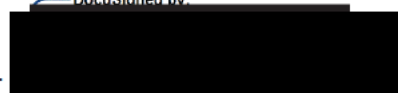
36. If you are lying on your back and you're handcuffed to the front, your breathing is not impeded. If you're lying face downwards, however, and you're handcuffed to the back, the motion of bringing your arms back and handcuffing you to the back of the body puts tension on your chest wall muscles and, again, can cause some degree of respiratory embarrassment. So, what you often have is this incremental situation developing: somebody who's agitated, aggressive, has already got an acidosis because of their activity, and then what you do is you make them hypoxic (oxygen lack) because you interfere with their breathing. So, you have this accumulation of factors which can cause sudden collapse and death,

37. I have been asked would the fact that Mr Bayoh was described as very muscly, if that would be a risk factor for restraint. Not really, no. He was muscular but he wasn't obese. So, it's people who have a huge belly that are at increased risk. I don't think just being muscular is a risk factor. In fact, if anything, being muscular protects you a little bit because you're fit and healthy and you've got good muscle tone.

38. I have been referred to my report at pages 5 and 6 where I say, *"if respiration is not impeded, and the person is able to breathe normally, the blood oxygen levels are unlikely to fall. [...]* Such physical effects would not, in a healthy

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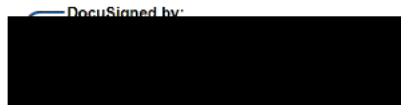


individual, be expected to produce any significant untoward effects and, under normal circumstances, would not have caused or contributed to death. In individuals who have taken 'stimulant-type' drugs which in themselves may affect cardiac function including pulse and blood pressure, then anything which further increases the strain on the heart may potentially predispose to the development of a fatal upset in the heart rhythm. It must be understood however that it is not the 'restraint' per se which may predispose to the cardiac arrest but its association with the effects of the stimulant drugs along with aggressive and/or violent behaviour, excitability and physical/emotional stress. It is the combination of factors which may be considered albeit that the effects of the drugs must be regarded as the principal contributory factor in the fatal outcome." I have been asked if there is any significance if Mr Bayoh was in respiratory arrest, does that make restraint being a factor in death more likely. I don't believe so.

39. I have been asked whether I consider the effects of struggling against restraint as part of the restraint as a whole. I would agree with this. If we have him lying on his back, first of all, and being restrained say by his arms and his legs his breathing under those circumstances is not going to be impeded, but he still might be acidotic because of other factors. Even if he is struggling, trying to get up, I don't think that the restraint can be implicated, really, in the fatal outcome. In general terms, if a person is struggling and resisting and fighting, they are potentially increasing the risk of metabolic acidosis. So, I think that's fair to say, and clearly the risks of that are exacerbated if they are in a position whereby their breathing might be restricted in some way.

40. I have been referred to page 5 of my report where I state "*A general increase in muscular activity may result in elevation of blood lactate levels, leading to acidosis.*" I have been asked would that be even more so in someone like Sheku Bayoh, who was a particularly muscly person. No. I don't think that the fact that he's got a lot of muscles is going to exacerbate the development of acidosis. So, it's not the muscle bulk, it's the activity and the strenuous activity that does it.

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41. I have been referred to my report where I say *“Restraint on the other hand, which restricts or impedes respiration, is potentially life threatening and, if not alleviated, may cause sudden death. Also restraint in situations where the position or posture of the individual may also pose a risk to life, so-called postural/positional asphyxia. Such situations include an individual lying face-downwards on a hard unyielding surface such as the ground, application of handcuffs to the rear of the body whilst the individual is lying face-downwards, or severe forward flexion of the trunk in an individual in a sitting position.”* I have been asked if lying face-down on a hard surface is enough to impede your breathing. No, it's not. It's not enough. We can lie on a hard surface, and you still are able to breathe.

42. I have been asked if there is a possibility that the pressure that the police would exert to try and keep Sheku Bayoh on the ground could impede his breathing. Yes, particularly if the pressure is applied to the back of his trunk.

43. I have been asked that if the Chair holds that PC Walker, weighing 25 stone, was lying at some point across Mr Bayoh's upper back, would I consider that this would impede Mr Bayoh's breathing? Yes. So, if you consider yourself breathing, your chest expands. That's how you breathe in, and you breathe out. Your chest has to expand. If you're lying face-down, you are still capable of breathing. Your chest can still expand. You still are able to move. However, if weight is applied to the back of your trunk, you can see that the capacity for the chest to expand, by common sense, has to be reduced, and therefore if you are reducing the capacity of the chest to expand, then you are impeding respiration to some extent.

44. The things you have to then consider are, how much weight is being applied? So, for example, if it's only light pressure it probably isn't going to have a lot of effect, but if it's somebody who's 25 stone and lying on you then it is likely that it will have a greater effect. The other consideration is the duration of the application of weight to his back. So, it's the amount of weight or force that's applied to the back and the duration. If significant force is applied to the back

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of the trunk when a person is lying prone, then you will, to some extent, interfere with breathing.

45. I have been asked if I can comment on what that duration of the weight on a person's back would be required before it would impact on their breathing. It'll impact on your breathing right away. If you put pressure on the chest, then your breathing is impeded right away. Now, what is the effect of impeding breathing on your body? Well, it's the development of hypoxia. In other words, if you're not breathing properly, the amount of oxygen in your bloodstream is going to go down, and you're going to exacerbate the development of acidosis.
46. Now, the reason why I think this is important in restraint deaths is that if the restraint is for a prolonged period of time, ie if you can't breathe for a prolonged period of time like George Floyd, you die from asphyxia. I don't think however that in some of these restraint related deaths the mechanism of death is a simple asphyxial one. In some of these deaths it seems that the duration of the restraint is quite short, before the individual goes limp or lifeless. This may very well be due to the development of a metabolic acidosis which can cause rapid death.
47. So, it's not simply that you are interfering with breathing to such an extent that they are dying from asphyxia. It's because you're causing some degree of respiratory embarrassment, some degree of hypoxia, some degree of acidosis, combined with the acidosis that they've already got because of everything else that's going on: the drugs, the aggression, the violent behaviour, the agitation etc. So, it's this combination; you have a degree of restraint in a vulnerable person.
48. I have been told that at one stage testing was done to see whether Sheku Bayoh had sickle cell disease or sickle cell trait, and it came back positive to say that he had sickle cell trait. I have been asked if this impacts my opinion in any way. Well, individuals who have sickle cell disease, if they become

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hypoxic for any reason, their blood can start to sickle, but I don't think in my view it's played any part in the fatal outcome.

49. I have been referred to Professor Sebastian Lucas's report (COPFS 00084 [REDACTED]) at page 2 and 3:

"From my review of the gross and histology features of the deceased's tissues, and based on my previous experience of such deaths in HbAS, and knowing the literature as it presented by Dr Soilleux, I believe that the HbAS trait did contribute to the death of BAYOH. There is no doubt that HbAS persons who have died in custody are under stress, heat, dehydration, exercise, where the main pathogenesis is a sickle cell crisis affecting the lungs, particularly the kidneys, skeletal muscle and the heart, and this has led to death. There is no doubt that the vast majority of persons with HbAS who undergo life's daily stresses do not suffer from any such syndrome. The critical aspects are therefore the level of stress and accompanying elements such as dehydration, drugs, alcohol intake, muscle activity and body temperature.

In the Bayoh case, I'm impressed by the quantity of cycling in the organs such as the heart, kidney, liver, thyroid and adrenal, much more than I expected to see in the organs of those with HbAS who died of unrelated causes. The lung tissues show more variable amounts of sickling, but where it is present, it is again more pronounced, i.e., the blood vessels are more distended than one would normally see in HbAS persons dying of other causes."

50. Dr Lucas then outlines his view on the cause of death: "1a. Sudden cardiopulmonary failure, 1b. sickle cell trait, recreational drug use and struggle against restraint. The last feature, struggle against restraint can also include positional asphyxia, but as a non-forensic pathologist I don't wish to be drawn into a more detailed discussion in that area. Importantly, I do not think we can quantify the contribution of the three factors present in 1B and state with rigor that one is more or less important than the others. It is multifactorial."

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51. I have been asked for my comments on this. First of all, the fact that he had sickle cell trait, and he's had it for a long time and it hasn't caused him any problems. Struggling can make it worse, and hypoxia can make it worse. So, I think that it is highly unlikely that the sickle cell trait has played any significant part in this man's death at all, and I think it's a bit of a red herring. You do see sickling of cells after death, so it does occur. I'm not impressed it is of significance, I'm afraid. If I were to concede on this point or if the Inquiry feels that it has played a part, then we would require to consider how significant a part has it played. And to me it has played a very insignificant part in the fatal outcome.

52. I have been asked to explain the mechanisms of death in an asphyxia case. This case is perhaps complicated to some extent by the fact that the deceased had petechial hemorrhages.

53. In asphyxia-type deaths, there are no specific diagnostic features to say a person died from asphyxia. I was involved in reviewing all the Hillsborough cases where asphyxia was a feature of death. Many people who die from asphyxia may not exhibit the presence of petechial hemorrhages, but if they are found then they may have significance in that they may indicate some degree of asphyxia. Now, there's lots of caveats with that because you can get them in other conditions. Some people say you get them with resuscitation – not very often – but I think it does perhaps raise the possibility that there was some asphyxial element to the death, albeit that, as I have already explained, I don't think that is necessarily the mechanism. As explained, often the rapidity of death, we tend to say that it's not simply purely asphyxial in nature, it's more metabolic as such, but having five petechial hemorrhages, that might be an indicator that the degree of interference with his breathing was sufficient to induce some asphyxial changes and, might indicate it but again, it's not a diagnostic finding. The difficulty with a lot of these pathologies is that things are not black and white.

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54. I have been asked if I would expect to find signs of asphyxia at autopsy. No, you wouldn't and that's the difficulty with these cases.
55. I have been asked if asphyxia causes respiratory arrest. It can do, yes.
56. I have been asked if asphyxia caused respiratory arrest, would I expect the respiratory arrest to happen and then cardiac arrest to follow afterwards. Yes, I would.
57. I have been referred to the second paragraph of page 6 of my report where it says "Such situations include an individual lying face downwards," I have been asked if I mean in the prone position as opposed to the face pressed to the ground. Yes, the important thing is the trunk on the ground being on a hard unyielding surface. So it's the prone position.
58. I have been asked if a person is lying on their front, what effect would be caused by the application of pressure to the back. If the person is lying in the prone position, then if you apply pressure to the back of the trunk, then you are impeding to some extent that person's ability to breathe because their chest cannot expand in the normal way. The issue of the person who is overweight is that the pressure on their abdomen causes the abdominal contents to push up towards their diaphragm and that may also to some extent impede breathing.
59. I have been asked to clarify if in my report when I talk about individuals sitting or kneeling on a person who's lying on a hard unyielding surface if that would include a person who would be lying across a person on the ground. Yes. Any weight applied to the back of the trunk in whatever way. Sometimes in a lot of these cases it's a person kneeling on the back but you can imagine if someone's lying on the back, the effect is the same. It's pressure from whatever source or whatever cause on the back of the trunk, thereby reducing the ability of the chest to fully expand.
60. I have been referred to Paragraph 59 of Dr Soilleux Report (COPFS-00031) where she says "*However, an alternative scenario is that there was a degree*

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of positional or mechanical asphyxia, meaning that less oxygen was able to get into the blood. While the oxygen requirements were probably increasing due to the struggling against restraint and possibly the effects of stimulant drugs, this could have led to cerebral ischemia, insufficient oxygen reaching the brain, and thus a loss of consciousness. It could possibly also have led to myocardial ischemia, insufficient oxygen reaching the heart, which may have predisposed to subsequent rhythm abnormalities and heart pump failure.” I have been asked if this paragraph is something I agree with. If a person is struggling or being aggressive, their oxygen requirement for their bodies is increased. If the individual is being restrained in such a way that their breathing is impeded then less oxygen is getting into their bloodstream.

61. The body needs more oxygen during strenuous activity such as running or violent activity of any sort. However if you do something to the body to interfere with breathing then less oxygen will be available. I'm just not quite so sure that this is likely to cause cerebral ischemia and loss of consciousness. So that type of scenario is less likely, in my view.
62. It's not impossible, it's simply less likely. Say if we reduce the amount of oxygenated blood getting to the brain, that's cerebral ischemia, that can lead to unconsciousness. I don't disagree with that. I don't think that that mechanism then leads to myocardial ischemia. I don't think that's what she's saying. I think she's saying simply that if you don't have enough oxygenated blood getting to the heart as well, it may predispose to a rhythm upset. That's true, that the heart needs oxygenated blood, so lack of oxygenated blood to the heart is important.
63. I have been asked if myocardial ischemia is likely in this scenario. Yes. What you probably have in this situation is an individual who may very well not have enough oxygenated blood per se. If you don't give your heart enough oxygenated blood, it can predispose to an arrhythmia. So that might be a mechanism, but I don't think it is the mechanism in this case. I think the mechanism is more likely to be acidosis causing an upset in the heart rhythm.

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However, it is possibly in a heart that's already compromised by not getting enough oxygen. So it's not getting enough oxygen and you've got an acidotic situation that then leads to the cardiac arrest.

64. I am asked if your oxygen requirements increase because of the MDMA or the alpha-PVP. These drugs tend to increase your requirement for oxygen by causing you to be agitated and engaging in strenuous activity. Many years ago when MDMA was first used in the United States people would be at home with friends and would take some MDMA. they were not aggressive, they sat, and they were in good form, and they liked touching each other. So it didn't cause much in the way of increased heart rate. It was only when we saw MDMA come to the rave scene where people started dancing, getting hot and sweaty and dehydrated. It might not be the drug itself that's causing the increase in oxygen requirements. It's the effect of the drug and what it does to you.

65. So, it's the fact that you have all this energy and you're running around That is when you need to get more oxygen.

66. I think the other thing I would say with her report is I don't think she has sufficiently considered (and I maybe accept too that I haven't) is the effects of acidosis. The more I look at these cases the more I think there's increasing evidence that acidosis may play a part in the sudden collapse and death which we see in these cases.

67. I have been asked would that fatal dysrhythmia caused by the drugs, would that predispose to respiratory arrest – or the effects of the drugs. Well, if he has a cardiac dysrhythmia, that will in turn cause a respiratory arrest. So, it's the rhythm irregularity first before he gets the respiratory arrest.

68. I have been asked if due to this you would have an irregular heartbeat, essentially, and that would cause you to stop breathing: Before the heart then goes into full arrest. Well, yes. If you go into ventricular fibrillation, your heart is just like a jelly. It's not beating properly. So, if it's not beating properly,

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ventricular fibrillation effectively is that you're in cardiac arrest. There are two types of cardiac arrest: ventricular fibrillation and asystole, where there's no movement at all, but in ventricular fibrillation, if you do not do something, the patient will then go into respiratory arrest.

69. I have been asked if you have a pulse during that time or a detectable pulse. Not usually in ventricular fibrillation, no because there's no proper cardiac output in ventricular fibrillation. The heart is just sort of quivering.

70. I have been referred to my report, at page 6, where it says *"The role, if any, of restraint is more problematical and cannot be determined solely from the autopsy findings. If the deceased was being restrained at the time, he suffered the cardiac arrest and if that restraint was such to have impeded respiration, then it would be reasonable to conclude that such restraint played a part in the fatal outcome."* I have been asked in that scenario, where someone is continuing to resist to the point of exhaustion, what difference would that make in this scenario if there was no effect on his ability to breathe? Now, if he continues to struggle and resist, then theoretically he could be increasing the degree of metabolic acidosis and that could be to such an extent that he could have a cardiac arrest. I don't think that you could completely exclude that possibility. You have to look at these cases in the round and try and put everything together. There probably is not one single one factor that you can say, "Yes, well, it's obviously this. It's obviously these drugs, or it's obviously struggling, or it's obviously the restraint." That's the difficulty. You cannot tease everything out individually. As I say, that's what makes these cases so problematical and so difficult. The simple answer is yes, theoretically, if you're struggling for a long period of time, you could develop such severe metabolic acidosis, but I think it's unlikely.

71. Unlikely that he could develop such a severe metabolic that would cause sudden death. Maybe simply just struggling but his breathing is fine, because what happens is if you get a metabolic acidosis, your body compensates with what we call a respiratory alkalosis. So how does that happen? Well, you

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breathe more rapidly and so forth. So rapid breathing allows you then to decrease the degree of acidosis that you have.

72. I have been referred to the report of Dr Nat Cary (COPFS-00196) where in his conclusion he agrees with the original pathologists that there's no underlying evidence of natural disease process that caused or contributed to death. He then says,

"In terms of the possible role for restraint, I support the opinions expressed that petechial haemorrhages in the eyes may indicate a degree of asphyxia, in this case, most likely originating from compression of the trunk in a face down position rather than any compression of the neck, for which there is no evidence.

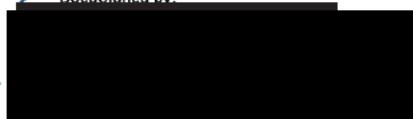
In terms of any role for restraint, this cannot be separately considered from struggling. As is commonly the case in acute behavioural disturbances, the deceased displayed remarkable strength and stamina. Ongoing restraint and struggling in these circumstances is very likely to lead to significant metabolic disturbances, with early breakdown of muscle releasing potassium, which can precipitate cardiac dysrhythmias and the development of metabolic acidosis.

Indeed, in my opinion, given the background of potent stimulant drugs, this case cannot be viewed simply as an example as a case of sudden death during restraint. I therefore entirely support the cause of death proposed, namely, 'Sudden death in a man intoxicated by MDMA and alpha-PVP whilst being restrained.' The only suggestion I would make would be to substitute the phrase 'whilst being restrained' with 'in association with struggling and restraint.'"

73. I have been asked if I have any comments on this. I think, in general terms, I agree with what Dr Cary is saying, and I think that's essentially what I have said. I agree with the fact that there may very well have been a degree of asphyxia, as demonstrated by the petechial haemorrhages, and I say they're

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not pathognomonic of asphyxia, but what I would say and, again, ongoing restraint is likely to lead to significant metabolic disturbances. Again, I agree with that.

74. I think where I perhaps disagree is essentially in the cause of death, and I think giving the cause of death in these cases is difficult. He uses the term "while being restrained" or "in association with struggling and restraint." To me, these deaths, it is the restraint that is the most important factor to consider. If I was giving the cause of death, I might say, "Restraint in an individual intoxicated by MDMA and alpha-PVP." To me, it's the restraint's the most important thing, and I suppose it's just perhaps slightly different interpretation, and you get six pathologists they'll all give you six different opinions, but he's showing all this aggressive behaviour, and he doesn't collapse and die. However, he collapses and dies suddenly when he's being restrained. So, there is that important temporal association. Is there evidence that the restraint has impeded his breathing? I think there is in the form of the development of petechial haemorrhages. So I think the restraint has been significant, so significant that I think that it's been the most important factor in a vulnerable individual. So that's slightly where I'm coming from as opposed to where Dr Cary's coming from, but I think we are in agreement, essentially, with the mechanism, if you like, of what's happened though.

75. I have been referred to my report, at page 6, where I say "*There is no evidence of underlying heart disease. I have examined the microscopic sections taken of heart tissue, including the sections of the conducting system. There is no evidence of inflammation, recent necrosis or fibrosis. I am satisfied that there was no cardiac abnormality that would have caused or contributed to death.*" I have been asked if I actually examined the heart histology myself. Yes, I did.

76. I have been asked if I have any particular expertise in cardiac pathology. No, just that we look at thousands of hearts in forensic pathology. That's all.

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77. I have been referred to the report of Dr Steven Karch (PIRC-02526(a)), at page 1. He states: *"My review disclosed histological abnormalities that were apparently overlooked at the original autopsy. Because of their presence, I conclude that the decedent suffered from pre-existing heart disease that could have been fatal in its own right. In addition, the three drugs found in Mr Bayoh's body were at minimum contributory causes of death and quite possibly the actual cause of death. While the microscopic alterations I observed and cardiac structure were mostly of a chronic nature – known consequences of both long-term stimulant and steroid abuse – they could have caused death at any time, even in the absence of all the drugs. At the same time, acute microscopic alterations, also potentially fatal and a result of the alpha-PVP usage, were also observed."*

78. I have been asked whether I saw anything in my examination that supports Dr Karch's opinion. No, I didn't.

79. I am then referred to his report, at page 2, where he reports sees the following changes: *"... uneven staining pattern of the myocardium, fragmentation and waviness of fibres, perivascular connective tissue growth, intermuscular fibrosis and scarring, disintegration of the cardiomyocytes, nuclear disintegration, loss of cross-striations and thickening of blood vessel walls."* I looked at the microscopic sections. I found no evidence of any underlying heart disease. I understand that Professor Sheppard, an expert in cardiac pathology found no evidence. In the past we would have sent material to Professor Sheppard for examination. Dr Cary, who I know, also has done some work in cardiac pathology. I think the position is everyone who's looked at the heart, apart from Dr Karch, has found no abnormality, so it's entirely up to the Chair to see whether he agrees with us or whether he agrees with Dr Karch.

80. I have been asked if saw any evidence of about the cardiac remodelling of both ventricles. No, there was no abnormality. Now, some of the changes that Dr Karch may be talking about are changes as a result of post-mortem change. Like uneven staining, that can be simply the way the tissues have

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been taken. Also, the fact that resuscitation was carried out may also affect the tissue. So, if you give people cardiac massage, you get changes, but there was no abnormality of the heart; it's nonsense, I'm afraid.

81. I have been referred to my conclusion on page six and seven of my report about the significance of the handcuffs and leg restraints where it says "*The application of handcuffs to the front and the use of leg restraints would not in themselves have contributed to or caused positional asphyxia as neither mechanism would have interfered with breathing or chest movements.*" I have been asked if this is still my opinion or if I am aware of anything now that would cause you to revise that conclusion at all. No. As explained, handcuffing an individual to the rear when they are lying prone does have some effects, but handcuffing to the front wouldn't.

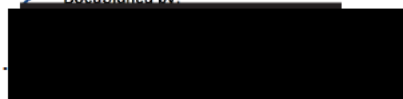
82. I have been asked if my opinion changes in relation to the handcuffs or the leg restraints if it was in combinations with prone restraint. No, because there would still be, theoretically, no interference with breathing if his hands are to the front or if his legs are tied, so no.

83. I have been asked that if the Chair held that the police officer was lying across Mr Bayoh's back, that there was weight applied to his trunk, again, would it make any difference then if you had leg restraints or handcuffs? Not really, no, because in my view, restraining the legs shouldn't affect breathing. I suppose the only thing is that if you put leg restraints on, he's going to try and struggle more but it's the restraint that's the important-- It's not the fact that the legs are being held. It's restraint that may interfere with breathing is the crucial thing, in my opinion.

84. I have been asked about ongoing effects once Mr Bayoh had stopped breathing and CPR starts. I am told that the handcuffs remained on Mr Bayoh until he arrived at the hospital. I have been asked whether as a pathologist I would have any comment on what effect the handcuffs might have on attempted CPR. I think it's very difficult to say. I suppose ideally you might

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want to have them taken off so that the chest is more exposed but, no, I have no comment to make.

85. I have been referred to my report at page 7 where I say. *"It would be my view that the rib fracture was caused by localised pressure having been applied to the upper back of the deceased while he was being restrained, such as by a person kneeling on the deceased's upper back whilst he was lying face downwards on the ground. It would not, in my view, be as a result of the deceased falling or being knocked to the ground."* I have been asked what situations might cause this type of injury. A fracture is simply a break in the bone. It's an unusual position and it's caused by pressure having been applied, and this is usually localised pressure. Any mechanism whereby there could be localised pressure applied to the upper back could, in theory, fracture the rib. So, if somebody landed on top of him, for example, or, say, he fell and put an arm out, or if he was on the ground and somebody was kneeling on him or applying pressure on his upper back, that could explain the rib fracture. But I'm not saying that's the only mechanism, but certainly it has to be fairly localised pressure, just to crack the first rib and nothing else.

86. I have been asked if I have seen a fractured first rib or an isolated fracture of the first rib in practice? No. Not on its own, no.

87. I have been referred to a line in my report where I say, at page 7, *"The application of pressure sufficient to fracture a rib is also likely to have been sufficient, if sustained, to impede breathing."* Yes. If the pressure was such to fracture the rib, then it's likely that it's going to affect breathing. I think that speaks for itself, yes.

88. I am referred to my report where I discuss the role and effects of the drugs and on page 7 where I say *"If, on the other hand, the deceased was lying on the ground, either on his back or face downwards, and pressure was applied to his trunk, e.g. by a person or persons kneeling or sitting on him then a serious and potentially life-threatening degree of asphyxia could have been induced. In an individual where cardiac instability had already been induced*

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by drugs, then any form of respiratory embarrassment causing hypoxia would have rendered an unstable myocardium more prone to the development of a fatal arrhythmia, upset in the heart rhythm. Thus, asphyxia could have been a contributory factor in the death if at the time of his cardiorespiratory arrest restraint of the type described above was taking place.”

89. I have been asked if it is right to conclude that the heavier that officer was the greater the effect on Mr Bayoh’s ability to breathe. Yes. The more pressure that’s applied and the duration of the pressure are the two things that are important. The heavier the person is, then the more likely they are to affect the movement of the chest wall if you’re lying across the back of the trunk.

90. I have been asked to comment on Dr Steven Karch’s statement (SBPI-00319) at paragraph 100 where he states, *“I refer to a large body of literature that suggest that maximal prone restraint positioning “has very little clinical effect.” I am asked to explain what I mean by “very little clinical effect?”. In the experiments I referred to, a volunteer would be hog-tied, and then every exhaled breath collected on an inhalation, an exhalation –and the amount of oxygen and carbon dioxide measured in each breath. In other studies volunteers were also hogtied following violent struggling (from memory I think this of continuous beating a boxing bag prior to being hogtied). When that, protocol was followed, volunteers they did show measurable decreases in oxygen, but only on the order of 10 per cent which is interesting, expected and not dangerous. To put it in perspective, to qualify for a lung transplant, at least in US transplant centers, one needs to lose 80 per cent of their lung capacity before being considered a candidate for lung replacement. Yet studies on so called positional asphyxia demonstrate loss of less than 10 per cent.”*

91. It’s absolute nonsense and it’s completely irrelevant. If you’ve got chronic lung disease, then your body compensates for that. For example, if you only have one lung, you compensate, and your other lung works more and works better and so forth. An episode of restraint which effects breathing is not some sort of long-term, chronic respiratory thing. It is a sudden, acute

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reduction in normal breathing which causes some degree – and this is important – some degree of hypoxia in an individual who was already at severe risk of a cardiac event. So that's the important thing. It's nothing to do with lung reserve and so forth. There's no comparison between an acute situation in an individual who's taken drugs and who is in an agitated state and somebody who's got chronic lung disease and needs a transplant.

92. I am referred to a letter dated 21 March 2017 (COPFS-02362) that was sent to me regarding my report. The letter states *“Unfortunately, during investigations by the Crown, it's been discovered that the redacted statement of Witness S. provided to you by PIRC was incomplete. This has occurred as a result of an administrative error by PIRC, and I should make it clear that the information was not redacted out. An amended redacted statement has been prepared and is attached. The redacted statement that was disclosed to you has omitted the following information: ‘There was at least six police officers lying on top of him’ [Sheku Bayoh] ‘They were crossing over him from both sides. They pretty much covered his whole body. It was only when they moved that I could see his arm and definitely knew that it was a black man. It looked like one officer was using a baton to hold the man down. It was on his upper chest towards his throat.*

93. I have been told within the letter it stated *“If you could confirm whether or not you considered the information provided by Witness S referred to in the briefing paper in reaching your conclusions, and if this is not the case, I'd be grateful if you would now consider this additional information and advise if it has any bearing on your conclusions.”*

94. I have been asked if this effects my opinion in any way. No. It doesn't matter whether it's one officer or six officers. What is important is what they were doing to the deceased when he was on the ground. As I've said before, it's the pressure on his back is the important thing. So, I'm not sure these additional lines of evidence take us any further in relation to that. Like Dr Cary, I don't think that there was any evidence of compression of his neck. So, I see the baton towards his throat, so I don't think there's any evidence to

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suggest that there was any neck compression. So, I don't think it alters my views.

95. I am asked if I have any recollection of seeing that letter. I don't. I came back as acting state pathologist in 2015 and stayed on for a year, so was there until the end of 2016; by 2017 I'd left. Normally mail was forwarded onto me, but it may not have been, so I apologise if I haven't responded to that.

96. I believe the facts stated in this witness statement are true. I understand that this statement may form part of the evidence before the Inquiry and be published on the Inquiry's website.

Date May 9, 2023 | 9:24 AM BST

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