

The Sheku Bayoh Public Inquiry

Witness Statement

Dr Nathaniel Cary

Taken by 

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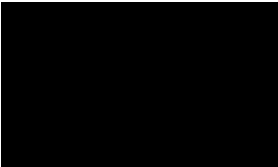
on 21 April 2023

Witness Details

1. My name is Nathaniel Cary. My contact details are known to the Inquiry.
2. I am a consultant forensic pathologist.

Professional Background and Qualifications

3. I have given two previous statements to the Inquiry (SBPI-00268 and SBPI-00269).

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4. My professional experience and qualifications are set out in paragraphs four to six of my first statement to the Inquiry (SBPI-000268).

5. I have been asked to outline in greater detail my experience of restraint cases. My experience in this area spans my whole career, 30 years or more. I was involved in the Hillsborough Inquests. Although this incident concerned positional asphyxia, and crushing, I think parallels can be drawn with restraint, as both situations involve the trunk being squeezed, resulting in an inability to breathe. Most of my experience comes from my case work. I have been involved in a large number of restraint related deaths.

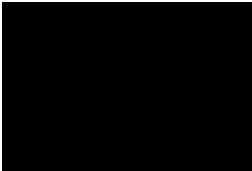
6. I have been asked to outline my respiratory experience. My original degree was in Physiological Sciences, and I have kept up an interest in this area since. In collaboration with others, I have designed and carried out studies relating to respiration and restraint. I have provided the Inquiry with two of the papers I have published on the subject¹. Forensic pathology looks at the interface of what happens in life, and in death. As such, it is necessary to have knowledge of respiratory function in these sorts of case.

Restraint related research

7. I was involved in the design of a study looking into moderate exercise and breath-holding. The title of this paper was *The effect of breath holding on arterial oxygen saturation following exercise in man*². We had to stop the experiment because we felt it was too dangerous to continue. The ECG results were concerning. We were surprised at just how quickly an individual, who has engaged in moderate exercise and then held their breath having breathed out first, can become hypoxic. It's a matter of 10-15 seconds or so. I think this is something a lot of people, including medics, fail to appreciate. We intended to carry out the experiment on more participants but were unable to due to this. There are limits to which you can take experiments for ethical reasons. Now it is possible to do

¹ WIT-00036

² WIT-00036, at page 5 and 6.

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computer modelling where you program in human physiology and show the effect of breath holding at low lung volumes after exercise. In actual experiments, you can't push people to the point that they become ill.

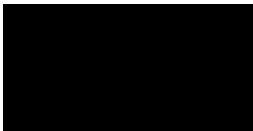
8. A second study is documented in the following article: *The effect of simulated restraint in the prone position on cardiorespiratory function following exercise in humans*³. I have been asked to provide a summary of this study. I was involved this study. We wanted to test whether exercise plus restraint would reduce breathing. We lay the participants in the prone position and monitored their blood oxygen. We put sandbags on their backs and abdomens. The findings of this study were that exercise, in combination with restraint, reduced the maximum voluntary ventilation ("MVV"). We obviously could not continue restraint to the point of cardiac arrest. From this study we learned that the MVV could be markedly reduced during restraint. You have a lot of built in reserves and so you don't usually require MVV but if other things are happening at the same time, this would be relevant.

9. I understand that Dr Karch has commented on this study in his statement to the Inquiry⁴ at paragraph 105. He states "*Dr Cary [...] found that, even in obese people, there was de minimis increase in deoxygenation during intense exercise. I would want to know why Dr Cary is disavowing his own research. The article to which I refer is The effect of simulated restraint in the prone position on cardiorespiratory function following exercise in humans.*"

10. My view is that Dr Karch doesn't understand MVV or exercise physiology. There are limits to which you can take experiments for ethical reasons. Now it is possible to do computer modelling where you program in human physiology and show the effect of breath holding at low lung volumes after exercise. In actual experiments, you can't push people to the point that they become ill. In any case, this is simply not Dr Karch's area of specialism. From what I understand Dr Karch

³ WIT-00036, pages 4 to 5.

⁴ SBPI-00319

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does not have any involvement in the surgical aspects of cardiac-pathology and I believe that he doesn't carry out autopsies either. In North America there is a completely different system of evaluation for forensic pathologists. In the UK there is a strict system of re-evaluation and he would not meet the criteria. You have to be appraised yearly and every five years have your credentials revalidated by the GMC.

11. I completely disagree with Dr Karch's view that restraint is irrelevant to the cause of death. The two papers cited by me demonstrate that potentially dangerous physiological mechanisms could operate when an exhausted person is restrained.

The respiratory system

12. I have been asked if I can provide a simple explanation of how the respiratory system functions. The respiratory system is designed to get oxygen into the blood, and to let carbon dioxide out. You achieve this through breathing. Two key components of breathing are the diaphragm and the intercostal muscles between the ribs. The diaphragm is a sheet of internal skeletal muscle separating the thoracic cavity (containing the heart and lungs) from the abdominal cavity. The intercostal muscles comprise a number of muscles that run between the ribs, and help to move the chest wall during breathing

13. Put simply, breathing in involves expansion of the chest volume, via the contraction of the intercostal muscles and the contraction of the diaphragm. This increases the internal size of the chest and decreases the air pressure inside it drawing air into the lungs. Conversely, exhaling involves relaxing of the diaphragm and the intercostal muscles, resulting in a decrease in the internal size of the chest and increases the air pressure in the chest so air is forced out of the lungs.

14. The human body is designed to take in oxygen and to remove carbon dioxide. Too much carbon dioxide can cause the body to become acidic. If there is a rise in acidity in the blood, there may be an increase the ventilation rate in an attempt

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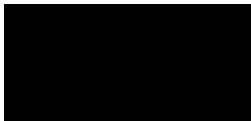
to expel more carbon dioxide. The respiratory system, in combination with the cardiovascular system, is responsible for providing this function.

Effect of restraint on breathing

15. I have been asked to describe the physiological effects of restraint on breathing. Restraint will of course effect breathing. When considering the physiological effects, you have to consider compression of the trunk, which may effectively enforce breath-holding potentially at low lung volumes. Enforced breath-holding paired with even moderate exercise can cause a person to rapidly develop hypoxia. When you think about it, if you exercise and breathe in prior to holding your breath, your lungs contain a store of oxygen. If you can't breathe in and your trunk is squeezed then you don't develop this store of oxygen and this can be very dangerous, ultimately leading to hypoxia.

16. If you have a high demand for oxygen, for example due to isometric exercise, then if something restricts your breath, you might not be able to replenish oxygen effectively. I am asked to explain what isometric exercise is. This is the type of exercise where there is little or no movement but lots of oxygen consumption e.g. weightlifting. If too much carbon dioxide builds up, then this will create too acid in the blood. This is known as acidosis. In restraint situations, you also have the issue of lactic acidosis, this is the main type of acidosis that we see in restraint. There is a lot of literature on this topic related to restraint deaths. Lactic acidosis is where the muscles work inefficiently. It's what makes you feel awful when exercising so much so that you have to stop. I have also referred to metabolic acidosis in my report⁵. This is a type of lactic acidosis. In cases where an individual was intoxicated by stimulant drugs, such as the present case, you also have the issue that they have lost the driver that stops them going too far. For example, you wouldn't run a marathon without training, but you might attempt this if you are intoxicated by drugs.

⁵ COPFS-00196

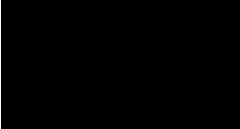
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17. A fundamental factor in this case is what position Mr Bayoh was in when he got into difficulty. I understand that the position of Mr Bayoh whilst being restrained is ultimately a finding for the Chair to make. I have been referred to page six of a document called Cause of Death Expert Instruction – Appendix A (Summary of Events)⁶ in which it is stated that:

“The majority of police and civilian eyewitnesses gave evidence that Mr Bayoh was in the prone (full prone or partial prone) position until the point that he was turned on his side, at which time the officers noted he was unconscious and PC Smith sought an ambulance (07:25:17). PC Walker states that Mr Bayoh was supine (on his back) throughout.”

18. I am asked whether an individual being in the prone or supine position has any bearing on respiration in restraint. I think the prone position is more dangerous because the trunk can be squeezed more effectively in this position. Most restraint related deaths are in the prone position. It’s so easy to overdo it and inadvertently press the abdomen onto the ground, diminishing breathing. This is potentially why its use is widespread in restraint situations, it’s a means of getting rapid control over someone. I note that in this case, the restraint lasted around four minutes in total. I also understand that the Inquiry has heard evidence to the effect that PC Walker was, at one point, lying across the deceased’s upper back. I understand that this is disputed. I have been advised that PC Walker weighed 25 stone. I have been asked, if the Chair were to accept this evidence, what effect this would have on a person who is being restrained. My comment is that this is a lot of pressure on the back. I’ve come across similar situations where nightclub bouncers have restrained people in a similar way. With regard to the supine position, I think there are dangers, however, the prone position is significantly worse.

⁶ SPBI-00306

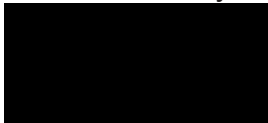
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19. I have been asked what difference the application of weight on the upper torso makes to respiratory function. My answer to this is that the placement of weight is relevant as it is what stops you being able to breathe adequately. Pressure on the chest could push the abdomen to the ground. This is particularly true of people who are obese, however, even in an individual, such as Mr Bayoh, who had a muscular stomach, such a large mass could make a person more susceptible to being unable to breathe adequately in this situation. If forced onto the ground, you don't require to have a large abdomen to be affected. As described, there are type types of breathing, intercostal breathing and diaphragmatic breathing which is when you breathe in. Something which compresses the abdomen diminishes the ability to breathe diaphragmatically. When this type of breathing is diminished and the chest is compressed as well, diminishing intercostal breathing, a potentially dangerous situation arises.

20. I am asked whether the length of restraint would have an impact on respiration. My response to this is, yes it would. The whole episode in this case is relatively short, under five minutes. However, the described application of force is substantial (subject to the Chair's appraisal of this evidence). As I mention previously, from the breath holding study, we know that hypoxia can develop very quickly – within 15 seconds. Many people don't think you can make yourself hypoxic in such a short timeframe, but you can.

21. I am asked whether the application of leg restraints during the restraint could have had an impact on breathing. I think it would have been hard to get leg restraints on Mr Bayoh, who is described as struggling against the restraint, without exerting significant pressure. If you hold the arms and legs, it will have an indirect effect on trunk. I liken it to a guy rope on a tent. Pulling on the guy ropes of a tent exerts indirect pressure on the tent, and help it to remain upright

22. I have been asked what impact intoxication with MDMA and Alpha-PVP would have on a person in a restraint situation. The heart would be susceptible to a lack of oxygen. The individual would also be mentally driven, that is to say, their

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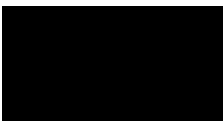
anxiety and fear level would be high. They are also likely to act irrationally. All of this will make cardiac rhythm disturbance more likely.

23. I have been asked what impact exposure to CS/Pava spray might have on an individual in a restraint situation. It could increase anxiety and fear, but this is all that I think it could contribute. In my opinion, it couldn't contribute to death.

24. I am also asked what effect I consider hay fever and sleep apnoea might have in a restraint scenario. I don't think either of these are relevant in the present case.

25. I am further asked to consider the impact that sickle cell trait might have on an individual under restraint. I recall that Professor Lucas placed a lot of emphasis on this in his report. My view is that if you have sickle cell trait, it will only cause difficulty in restraint if you become hypoxic. If, for example, someone is having an operation, and will undergo anaesthesia, a sickle test is done. This is because you have to be very careful about causing the patient to become hypoxic under anaesthesia. In short, having sickle cell trait, makes you potentially more vulnerable to the effects of hypoxia, which may ultimately culminate in cardiac arrest. It becomes a very important marker of hypoxia in the period leading up to Mr Bayoh's arrest. There is also a condition called exertional rhabdomyolysis, which can cause sickling of red blood cells in the muscles. It is often seen in military recruits who are not very fit. We know that Mr Bayoh was a carrier of sickle cell trait. So it is worthy of consideration. Breakdown of muscles releases potassium into the blood. This is a 'heart poison' that could have contributed to cardiac arrest. I think it impinges on what is likely to have happened.

26. I am asked whether catecholamine hyperstimulation might have played a role in Mr Bayoh's death. Yes, I think that's what went on here. Catecholamine hyperstimulation essentially means that the release of adrenaline, noradrenaline (and dopamine), whether due to the drugs and / or a fight or flight response, affecting the heart. I don't think this takes us any further, the cause of immediate death was simply cardiac arrest.

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27. I have been asked about whether I consider that commotio cordis could have played a role in Mr Bayoh's death, specifically in relation to the point in time that PC Walker tackled Mr Bayoh to the ground. Commotio cordis is a rather quaint term to describe something that rarely happens, occasionally to hockey players, or players of other sports with a small hard ball. When the puck or ball hits the chest with force, it may put you into a heart rhythm disturbance. You sometimes find it with rugby players too. However, it is unusual, and I would expect the individual to go into immediate cardiac arrest upon impact in these circumstances. I don't think on the evidence it could be shown that he was in cardiac arrest the moment it happened, if he was conscious or struggling to any extent.

28. 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.

May 9, 2023 | 10:17 AM BST

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