

## PART 7

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# THE CAUSE OF MR. DZIEKANSKI'S DEATH

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A.	INTRODUCTION .....	275
B.	FORENSIC PATHOLOGISTS.....	276
	1. Dr. Charles Lee.....	276
	2. Dr. Vincent J.M. Di Maio .....	281
	3. Dr. Michael S. Pollanen.....	282
	4. Dr. John Butt .....	285
C.	CARDIOLOGISTS .....	288
	1. Dr. Charles Swerdlow .....	288
	2. Dr. Charles Kerr.....	293
	3. Dr. Zian Tseng.....	296
D.	EMERGENCY DEPARTMENT PHYSICIANS .....	301
	1. Dr. Christian Sloane .....	301
	2. Dr. Jeffrey Ho .....	302
	3. Dr. William Bozeman.....	306
E.	PSYCHIATRISTS .....	307
	1. Dr. Shao-Hua Lu.....	307
	2. Dr. Paul Janke.....	310
F.	EPIDEMIOLOGIST .....	313
	Dr. Keith Chambers .....	313
G.	ELECTRICAL ENGINEER .....	318
	Dr. Dorin Panescu .....	318
H.	FINDINGS OF FACT AND CONCLUSIONS .....	320
	1. Introduction.....	320
	2. Determining the time of Mr. Dziekanski's death.....	320
	3. Determining the cause of Mr. Dziekanski's death .....	326
	a. Pre-existing heart disease plus accumulated stress .....	326

PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

b.	Weapon-induced direct capture of Mr. Dziekanski's heart .....	328
c.	"Sudden death during restraint" and/or "excited delirium" .....	330
d.	The hyperadrenergic state arising from the weapon deployment and physical altercation .....	331
4.	Concluding comment .....	337

## A. INTRODUCTION

In this part, I will summarize the opinions of 14 medical experts from various disciplines. I will then draw conclusions about the factors that in my view most likely contributed to Mr. Dziekanski's death. Please refer to the Glossary at the end of this report for definitions of medical terms.

Several points should be kept in mind when considering these medical opinions. Some experts had not had an opportunity to review the opinions of other experts before they prepared their written reports and/or testified at our evidentiary hearings, and consequently, they were not able to comment on those opinions during their testimony. Because of that, Commission Counsel provided them with those other experts' reports and with transcripts of their testimony, and invited them to file supplementary written reports. I have included summaries of these supplementary reports at the end of my summaries of those experts' initial reports and testimony. In addition, some experts have commented on the medical opinions of other experts, when their respective areas of expertise differ.

Finally, the opinions of three other medical experts were filed as exhibits, although they did not testify at our evidentiary hearings. Two of those experts (Drs. Pollanen and Sloane) had prepared reports for the RCMP's Integrated Homicide Investigation Team, and the third (Dr. Di Maio) prepared a report for the Criminal Justice Branch during its charge assessment process. If this were litigation, there would be several problems in considering the opinions of such experts who did not testify:

- They reviewed documents that were provided to them by the RCMP or the Criminal Justice Branch, but that are not part of the evidentiary record in these proceedings.
- They did not have access to the complete evidentiary record in our proceedings, some of which differs significantly from the material they had.
- They were not subjected to cross-examination in our proceedings.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

I will take those matters into account in assessing their evidence, and in determining how much weight I will attach to it. I emphasize that these are not court proceedings, and I consider it important to have these reports filed, to ensure as complete a record as possible. The problems identified above were, to some extent, addressed by providing these three experts with the reports of, and transcripts relating to, experts who did testify, whose opinions they might take issue with, and by giving them an opportunity to file supplementary opinions. Those supplementary opinions are summarized at the end of my summary of each such expert's original opinion.<sup>217</sup>

### **B. FORENSIC PATHOLOGISTS**

#### **1. Dr. Charles Lee**

Dr. Charles Lee is a forensic pathologist. After obtaining a medical degree from the University of Alberta in 1994, he completed a residency in anatomic pathology in Vancouver and a forensic pathology fellowship in Albuquerque, New Mexico. He has been a member of the Forensic Pathology Department of Vancouver General Hospital since 2002, where he has completed 2,500-3,000 autopsies, most of them forensic. A forensic pathologist performs autopsies on people who have died suddenly or in suspicious circumstances, in order to determine the cause of death. I qualified Dr. Lee as an expert in forensic pathology.

Dr. Lee performed an autopsy on Mr. Dziekanski on October 16, 2007. His external examination revealed a puncture mark in the centre of the chest at the lower end of the sternum, consistent with a barb from a TASER conducted energy weapon. There was also a puncture-type scratch on the lower right abdomen at the belt level that could have been from a conducted energy weapon, although it did look different than the one on the chest. He found scratches, bruises, or abrasions consistent with an altercation or struggle and the application of handcuffs; broken ribs and breastbone; and pinpoint hemorrhages of very small capillaries (petechiae) in the lower left eyelid,

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<sup>217</sup> With respect to the procedures I adopted, as outlined in this section, no objection was taken by counsel for any participant, and I was not asked to call or re-call any witness.

all consistent with resuscitation efforts by CPR. He found no evidence of a contusion or abrasion on the neck area.

His internal examination revealed no internal injuries, and most of the organs were relatively normal. He did a layer-wise dissection of the front of the neck, but found no evidence of any internal hemorrhaging or bleeding of any sort, saw no internal neck injuries to suggest any force being applied to the neck, and saw no signs of asphyxiation. When he was asked about the significance of one of the officer's knees being placed on the back of Mr. Dziekanski's neck, he said:

I don't think that played a significant role since he was still struggling, he was still moving around, and he was still somewhat vocalizing, which indicates that he was still able to breathe.<sup>218</sup>

Overall, Mr. Dziekanski was in reasonable health. Three organs were consistent with alcohol use:

- He had a very fatty liver, which suggested recent alcohol ingestion (i.e., within a few days).
- The cerebrum and cerebellum parts of his brain were atrophied or shrunken, which was fairly specific to chronic alcohol use. The rest of the brain was relatively normal.
- There was evidence of cardiomyopathy,<sup>219</sup> based on the gross visual examination, although the microscopic findings were minimal and did not confirm cardiomyopathy. The lower chambers of his heart (ventricles) were markedly enlarged (dilated), and the wall of the heart was somewhat thinned. There was an absence of atherosclerosis in the coronary arteries. It was Dr. Lee's experience that many chronic alcoholics have dilated hearts and very clean coronary arteries. Overall, the heart was in reasonably good health, and the dilation was more in the nature of a "finding" than a significant potential cause of death by itself.

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218 Transcript, April 28, 2009, p. 11.

219 Dr. Lee defined cardiomyopathy as diseases of the heart muscle that are not associated with diseases of the coronary arteries or of the valves.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

Dr. Lee told me that his microscopic examination of these organs, and the toxicology results,<sup>220</sup> confirmed his findings respecting the liver and brain. The autopsy and toxicology yielded a negative autopsy – there was no anatomic or toxicological cause of death. His findings respecting the three organs pointed to alcohol use, but those findings by themselves would not have killed Mr. Dziekanski. His cardiomyopathy may have increased his likelihood of having a sudden death, but it was not something that Dr. Lee considered imminent. Mr. Dziekanski was reasonably healthy.

Dr. Lee distinguished between the mechanism of death and the cause of death. In this case, Mr. Dziekanski likely developed a lethal arrhythmia, which was the mechanism of death (i.e., the physiological process by which the cause of death exerts its effect). However, in cases like this, it is very difficult to come up with an accurate and appropriate cause of death (i.e., what caused the lethal arrhythmia). In his report, he stated:

### PART 1. PRINCIPAL CAUSE OF DEATH:

- Sudden Death During Restraint
  - due to or as a consequence of ...

### PART 2. CONTRIBUTORY FACTORS:

- Chronic Alcoholism

Dr. Lee told me that alcohol did not play a role in Mr. Dziekanski's death, because he did not have any alcohol in his body at that time. However, the changes to his organs due to chronic alcoholism could have made him more susceptible to the development of a lethal arrhythmia.

Dr. Lee emphasized that the principal cause of death was sudden death during restraint, adding:

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<sup>220</sup> I qualified Dr. Walter Martz, a toxicologist presently working as a senior scientist and the scientific director at the Provincial Toxicology Centre, as an expert in the area of toxicology. He testified that he analyzed blood, liver, and vitreous fluid samples taken from Mr. Dziekanski, and no alcohol, prescribed medication, or illicit drugs were detected: Transcript, April 30, 2009, p. 40ff, and Exhibit 116.

There were at least two forms of restraint that I saw. Number 1 was a TASER, number 2 was the — I guess the tackling of the individual by the RCMP officers. Both of those forms of restraint contributed eventually to his death.<sup>221</sup>

He told me that there was no single cause of death. There were a number of factors that all contributed to finally causing the death. The physical interaction with the police and the conducted energy weapon both contributed to Mr. Dziekanski's death, but he could not really differentiate what proportion each played. Dr. Lee added that although the Pritchard video shows that Mr. Dziekanski was agitated, nothing in the autopsy showed a reason for him to have been delirious (e.g., drugs, alcohol, or altered mental state). He concluded his written report with the following:

His dilated cardiomyopathy would have put him at an increased risk for development of an arrhythmia and sudden death, but probably would not have caused death by itself. The added stress of the physical restraint along with the decreased ability to breathe as a result of being pinned in the prone position may have been enough to elicit a fatal arrhythmia. The presence of signs of chronic alcohol abuse does raise a possibility that he was suffering from alcohol withdrawal, which may partly explain his agitation. It is likely a combination of these and other contributory factors that led to his death. Therefore, the cause of death is best described as sudden death following restraint.<sup>222</sup>

Dr. Lee agreed that "sudden death during restraint" is well-documented in the medical literature, in trying to put a name to a phenomenon that is difficult to describe, when there is no obvious anatomical cause of death. However, there are known behaviours and demographic patterns associated with this phenomenon, including: subjects who are males between 20 and 50 years of age, agitated behaviour, collapse shortly after restraint, sweating, wide eyes, irrational behaviour, and barricading.

Dr. Lee said that it would have been nice to know that the conducted energy weapon had been deployed against Mr. Dziekanski five times (not once, as he understood), although that new information would not have changed his final opinion on the cause

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221 Transcript, April 27, 2009, p. 25.

222 Exhibit 76, p. 6.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

of death. All the research he had read said that the weapon's electrical current does not affect the heart. A number of deaths have occurred in similar situations, in which a conducted energy weapon was not involved, thus it is difficult to say, had he not been hit with a TASER, whether or not Mr. Dziekanski would have lived or died. In these types of cases, the adrenergic response is believed to be the mechanism of death – i.e., the adrenaline that flows through the body whenever the body is in a stressful or dangerous situation – and pain can increase the adrenergic response. This outflowing of adrenaline increases blood pressure and heart rate, which can potentially lead to an arrhythmia.

Dr. Lee said that the evidence of Mr. Dziekanski making snoring sounds likely may have been agonal breathing, which refers to chest movements or breathing movements made by a person who is on the verge of dying, even though the heart has stopped; these chest movements could have been misinterpreted by witnesses as normal breathing. Agonal breathing can continue for a few minutes after the person has probably died. However, if the person had a pulse and the chest was seen to rise and fall five minutes after the snoring sound, it would probably indicate that it was not agonal breathing. Turning blue would probably indicate that he was not getting sufficient oxygen. It would be an indication that the person is in cardiac arrest or is close to going into cardiac arrest, and one should be prepared to do further resuscitative efforts on short notice.

Dr. Lee said that while Mr. Dziekanski's cardiomyopathy was not severe enough to cause sudden death, it may have increased his susceptibility to other stressors, such as lack of food, water, or sleep; recent cessation of smoking or alcohol consumption; and being alone at the Airport for eight or more hours.

If it was established that Mr. Dziekanski had a pulse and respiration several minutes after being handcuffed, it is unlikely that the discharge of the conducted energy weapon's electrical current directly caused an arrhythmia, since such an electrical charge should have an immediate effect on the heart, and there should be no detectable pulse within seconds.

Dr. Lee was not prepared to conclude that Mr. Dziekanski was going through alcohol withdrawal; it is difficult to make such a diagnosis in a non-hospital setting. In other respects, Dr. Lee generally agreed with those parts of the reports of Dr. Vincent Di Maio and Dr. Swerdlow that he was asked about. However, he added that it would be speculative to say that Mr. Dziekanski stopped breathing before his heart stopped beating. Dr. Lee said that acidosis cannot be detected post-mortem, especially when the autopsy is performed (as in this case) two days after the death.

## 2. Dr. Vincent J.M. Di Maio

Dr. Di Maio is a consultant in forensic pathology in San Antonio, Texas. He is the co-author of a book entitled *Excited Delirium Syndrome*. He was retained by the Criminal Justice Branch of the Ministry of Attorney General to prepare a report on Mr. Dziekanski's death, as part of its charge assessment process. His September 16, 2008, report was filed as an exhibit in our proceedings (Exhibit 79), although Dr. Di Maio did not testify.

After summarizing the facts based on the materials he had reviewed, Dr. Di Maio stated:

... it is my opinion that death was due to a cardiac arrhythmia secondary to the effects of chronic alcohol abuse; alcohol withdrawal; stress from both the emotional and physical results of the withdrawal; the struggle with law enforcement personnel and alcoholic cardiomyopathy. The mechanism precipitating the fatal arrhythmia was, in all medical probability, a hyperadrenergic state due to elevated levels of catecholamines produced by autonomic hyperactivity, psychomotor agitation, anxiety, and the struggle, superimposed on increased catecholamine levels observed in cardiomyopathies and chronic alcohol abuse.<sup>223</sup>

In Dr. Di Maio's view, there was no evidence that use of the conducted energy weapon caused the death. The only way the weapon could theoretically cause death directly would be by producing a fatal cardiac arrhythmia (i.e., by electrocution), and the arrhythmia produced would have to be ventricular fibrillation. But ventricular

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<sup>223</sup> Exhibit 79, p. 6.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

fibrillation results in unconsciousness within 5-15 seconds and cessation of respiration within a minute, neither of which occurred in this case.

Dr. Di Maio provided a second report on May 27, 2009 (Exhibit 190), in which he commented on the reports of several other experts:

- *Dr. Butt* – Dr. Di Maio said that although there were no specific cardiac lesions diagnostic of chronic alcohol abuse, Mr. Dziekanski did have atrophy of the vermis which, in his age group, is virtually the same. While Dr. Butt made mention of a respiratory component contributing to death, he did not specify what it was.
- *Dr. Kerr* – Dr. Di Maio said that cyanosis is secondary to inadequate oxygenation of blood, and is not specific to respiratory problems. Further, research disproves the suggestion that a conducted energy weapon causes significant acidosis or metabolic derangement.
- *Dr. Tseng* – Dr. Di Maio said that Dr. Tseng's opinions rely on pig experiments, but differences between pigs and humans (e.g., greater sensitivity to electricity, anesthesia can sensitize the heart, etc.) make extrapolation risky. In addition, Dr. Tseng cited no evidence for his opinion that the weapon caused ventricular tachycardia that evolved into ventricular fibrillation.

### 3. Dr. Michael S. Pollanen

Dr. Pollanen received his Ph.D. (1995) and his medical degree (1999) from the University of Toronto. He became a Fellow of the Royal College of Pathologists of the United Kingdom (2001) and a Fellow of the Royal College of Physicians and Surgeons of Canada in Anatomical Pathology (2003). He was appointed as the Chief Forensic Pathologist for Ontario in 2006, is an associate professor of laboratory medicine and pathobiology at the University of Toronto, and was the Founding Chair of the Forensic Pathology Section of the Canadian Association of Pathologists. He has published more than 50 papers in the peer-reviewed medical literature, including in the area of custodial death.

At the request of the Integrated Homicide Investigation Team, Dr. Pollanen prepared an independent review of the autopsy of Mr. Dziekanski, and provided an opinion on the medico-legal issues in this case. He did not testify at our evidentiary hearings.

With respect to the autopsy, Dr. Pollanen noted:

- Although Dr. Lee performed a special forensic dissection of the front of the neck, there was no indication of a dissection of the back of the neck.
- Some ancillary tests, such as histology of the "TASER mark" and vitreous electrolytes, appear not to have been performed.
- There was no discussion of the putative role of the TASER deployment.
- His review of the histology revealed a fatty liver, pulmonary hemorrhage, rare pulmonary fat emboli, and degeneration of the cerebellar vermis, but he could not confirm the presence of dilated cardiomyopathy. Thus, he did not believe that heart disease contributed to death.
- While chronic alcoholism might have contributed to Mr. Dziekanski's agitated state, perhaps by alcohol withdrawal, there is little objective evidence to support or refute that proposition.

With respect to Mr. Dziekanski's agitated state and the prone-position restraint, Dr. Pollanen stated that Mr. Dziekanski was markedly agitated and could qualify for a diagnosis of excited delirium, although two features of so-called restraint deaths associated with excited delirium were absent — a documented major psychiatric illness (e.g., schizophrenia or bipolar disorder) and acute intoxication with cocaine or a similar stimulant drug. The video evidence clearly demonstrates prone-position restraint, but Dr. Pollanen added:

However, there is no reliable evidence of major chest compression that could cause direct interference with breathing. On this basis, it seems clear that a direct "asphyxia" death from restricted breathing can be excluded. But, I am unable to exclude that the prone-positioning contributed to a relative reduction in ventilation to meet the increased oxygen requirements of an agitated state (e.g., increased oxygen demands due to physical exertion).<sup>224</sup>

With respect to the effects of the conducted energy weapon, Dr. Pollanen concluded that the video evidence of Mr. Dziekanski's activities after deployment of the weapon clearly excluded a direct weapon-related acute arrhythmic death. He then turned to

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<sup>224</sup> Exhibit 80, p. 11.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

whether the weapon could have been a co-factor in the death, which had two dimensions:

- The death could be explained entirely by the excited delirium/prone-position restraint concept, without referring to additional causes. It is a fact that most people who die in this situation are not subject to a conducted energy weapon deployment, so it is possible to conclude that the weapon need not be a factor in the death.
- If the excited delirium/prone-position restraint concept is accepted as an explanation for the death, then any co-factor that increases agitation or induces additional stress should exacerbate the mechanisms leading to death. Thus, the weapon could have contributed to the death through a non-arrhythmogenic mechanism. He stated:

Although the data is conflicting, I have an open mind to the possibility that the TASER discharge may have indirectly contributed to death through a non-arrhythmogenic mechanism. A simple line of reasoning supports this conclusion. If a theory is developed to explain death based on excited delirium or an agitated state, it seems difficult to argue (based on the video) that Robert Dziekanski was not more (dis)stressed or agitated after the deployment of the TASER. However, to be entirely balanced on this point, knowledge is evolving, both in the area of excited delirium and the physiologic effects of the TASER (e.g., dose-dependency of metabolic effects, species differences in TASER responses, lack of a suitable animal model of excited delirium that can be studied using TASER discharges).<sup>225</sup>

Dr. Pollanen concluded that Mr. Dziekanski did not die of a conducted energy weapon-induced cardiac arrhythmia, or from a physical injury, the toxic effects of a drug, or an acutely fatal natural disease or condition. He added that if Mr. Dziekanski's death was caused, in part, by the adverse effects of an agitated state, then we need to keep an open mind about the putative role that the conducted energy weapon may have played in indirectly contributing to death, since he appeared more stressed or distressed and agitated after the deployment of the weapon.

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225 Exhibit 80, pp. 11-12.

#### 4. Dr. John Butt

Dr. Butt has a medical degree from the University of Alberta (1960), a Licentiate of the Medical Council of Canada (1962), a Diploma of Medical Jurisprudence (London, England, 1969), and is a Fellow of the Royal College of Pathologists (Great Britain, 1985). He was the Chief Coroner of Alberta, following which he developed the Medical Examiner System in Alberta and became that province's first Chief Medical Examiner (1993). He became the Chief Medical Examiner for Nova Scotia (1996), and served as clinical professor of pathology at Dalhousie University in 1999. He now has a consulting practice in forensic pathology. I qualified him as an expert in the field of forensic pathology and cause of death.

The Commission asked Dr. Butt to review Dr. Lee's autopsy report, and to comment on the expert reports of Drs. Pollanen and Di Maio. In his April 17, 2009, report he did so as follows:

- *Dr. Lee* – Mr. Dziekanski's principal cause of death (sudden death during restraint) relates to circumstances alone, and is not a medical diagnosis. However, Dr. Lee's comments on circumstances were not complete, in that there was no mention of the deployment of the conducted energy weapon. In Dr. Butt's experience, it would be uncommon for the pathologist who performed the autopsy not to discuss the role of the weapon, given the circumstances of Mr. Dziekanski's death. In addition, Dr. Butt stated that after finding the microscopic slides of sections of Mr. Dziekanski's heart to be essentially normal, he was unable to conclude that the features that he saw represented alcoholic cardiomyopathy.
- *Dr. Pollanen* – Dr. Butt was generally in accord with Dr. Pollanen's opinions, although he added that caution is advisable about use of the term "excited delirium," which is questioned by those practising psychiatry.
- *Dr. Di Maio* – his opinion that Mr. Dziekanski was in a state of excited delirium just before the conducted energy weapon was deployed led Dr. Butt to respond that pathologists do not commonly have the experience to make clinical diagnoses about aberrant behaviour, such as delirium. Further, Dr. Di Maio appears to have reiterated Dr. Lee's conclusions about the heart (without having reviewed the microscopic slides himself) but nevertheless offered his opinion about the

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

pathophysiology of alcoholic cardiomyopathy, including fatal arrhythmia of the heart related to cardiomyopathy and chronic alcohol abuse.

Dr. Butt stated that he did not find evidence, in examining microscopic sections of the heart, to conclude that Mr. Dziekanski had alcoholic cardiomyopathy. From his review of the videos showing Mr. Dziekanski walking around in the Customs Hall, he saw nothing to indicate that he was unsteady on his feet (i.e., that he was ataxic), which is usually the case with cerebellar degeneration. He concluded:

Robert Dziekanski's cause of death was *likely* related to his heart, and somehow to nerve conduction pathways in his heart and an arrhythmia. Given this, I believe that increasing exertion and stress seen following the discharge of the CEW (TASER) likely contributed to the death of Robert Dziekanski. As well the death may have had a respiratory component through restriction of air into the air passages/lungs. I do not believe that there was enough pathological evidence in the autopsy of Robert Dziekanski to be sure of the medical cause of death.<sup>226</sup>

In his testimony, Dr. Butt said that, based on the weight of Mr. Dziekanski's heart and the thickness of the walls of the two ventricles, he did not think that the chambers were dilated. He examined eight microscopic slides of the heart and found no significant myocardial or interstitial change, from which he concluded that Mr. Dziekanski did not have cardiomyopathy. There was nothing about his heart that put him at increased risk of a sudden cardiac event without any other contributing factors. He agreed with the suggestion that Mr. Dziekanski's state of agitation, the fact that the conducted energy weapon had been deployed against him, being wrestled with and struggling on the ground were all triggering causes of death in the sense that they increased his heart and respiration rates, adding to his stress and causing the release of adrenaline. Left to his own devices (i.e., if the weapon had not been used and he had not been restrained on the floor), Mr. Dziekanski would have survived.

Dr. Butt said that one of the officers placing his knee on Mr. Dziekanski's upper back, as shown in the video evidence, might have reduced air entry into his lungs. Evidence

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<sup>226</sup> Exhibit 111, p. 5.

that he turned blue indicated that there was a problem with Mr. Dziekanski's circulating oxygen, because either the respiratory or cardiovascular system was compromised. He was not prepared to say that Mr. Dziekanski's snoring-like sounds were agonal breathing.

Dr. Butt agreed that increased blood pressure would put a person at risk of a lethal arrhythmia if they were subjected to enough physical and emotional stress, although his understanding from Mr. Dziekanski's Polish medical records was that he had borderline high blood pressure.

Dr. Butt said that after he delivered his report to the Commission on April 14, 2009, he received a phone call from Commission Counsel noting that he had commented in his report on Dr. Lee's failure to discuss whether the conducted energy weapon had played any role in the death, but that he (Dr. Butt) had not reached any conclusion respecting the conducted energy weapon in his report either. Commission Counsel also sent to him a copy of a 12-page document entitled "Robert Dziekanski – Circumstances."<sup>227</sup> Dr. Butt reviewed that document and then submitted a revised report dated April 17, 2009, which included a new statement: "Given this, I believe that increasing exertion and stress seen following the discharge of the CEW (TASER) likely contributed to the death of Robert Dziekanski." He testified that he continued to be of the view that it is likely that the conducted energy weapon contributed to Mr. Dziekanski's death, directly or indirectly.

He also testified that it is generally agreed that there is no support in any peer-reviewed medical literature for the concept of delayed ventricular fibrillation from an electrical cause.

Dr. Butt said that he had no issue with Dr. Lee about Mr. Dziekanski's chronic alcoholism. The question was whether it was actually a contributing factor to the death.

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<sup>227</sup> See Exhibit 105. This document, prepared by the Commission and provided to persons who would be giving expert evidence, was a summary of Mr. Dziekanski's movements on October 13 and 14, 2007, drawn from the evidentiary record.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

Dr. Butt was referred to his conclusion that death may have had a respiratory component through restriction of air into the air passages/lungs. He agreed that this opinion is inconsistent with the evidence of Mr. Enchelmaier. He also agreed that there was no objective evidence to back up the position that the officers caused the death as a result of the struggle.

### C. CARDIOLOGISTS

#### 1. Dr. Charles Swerdlow

Dr. Swerdlow received his M.D. from the Harvard-MIT Program in Health Sciences and Technology, completed his internship and residency in medicine at the Los Angeles County-UCLA Harbor General Hospital and completed a fellowship in cardiology at the Stanford University Medical Center. He is board certified in internal medicine, cardiology, and clinical cardiac electrophysiology. He is currently a clinical professor of medicine at UCLA and attending physician in the Cardiac Electrophysiology Laboratory at Los Angeles' Cedars-Sinai Medical Center. I accepted him as an expert in cardiology and electrophysiology.

In his written report,<sup>228</sup> Dr. Swerdlow stated that the mechanism of cardiac arrest caused by cardiac electrical stimulation lasting less than 15 seconds is almost always ventricular fibrillation, which results in abrupt failure of the heart to pump blood and characteristically causes loss of consciousness within about 10 seconds. Much less frequently, the rhythm is ventricular tachycardia. Two other classes of cardiac rhythms that may be recorded during cardiac arrests, due to causes other than ventricular fibrillation, are:

- Pulseless electrical activity (a regular cardiac rhythm is present, but the heart is not pumping blood); and
- Extreme bradycardia (the heart generates impulses at a rate too low to sustain life), or asystole (the heart stops generating electrical impulses). Asystole, which was recorded in Mr. Dziekanski's case, may

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<sup>228</sup> See Exhibit 104.

occur in cardiac arrests caused by heart disease or those secondary to respiratory arrests, neurological events, delirium, metabolic effects, or drug effects (including cocaine).

If collapse is delayed, or the initial post-arrest rhythm is not ventricular fibrillation, then the mechanism of death is not electrically induced ventricular fibrillation. In the case of Mr. Dziekanski, the detailed report of a normal pulse for minutes after the conducted energy weapon discharge and the initial cardiac arrest rhythm of asystole excludes electrically induced cardiac arrest related to weapon discharge.

With respect to sudden in-custody deaths, Dr. Swerdlow's research confirms that subjects who die of non-traumatic sudden deaths after the discharge of a conducted energy weapon have demographic and drug-use profiles similar to those in prior reports of sudden deaths during law enforcement interactions that were unassociated with the use of conducted energy weapons. His research also shows that the initial cardiac rhythm in sudden death temporally proximate to the use of a conducted energy weapon is pulseless electrical activity or asystole in over 90 percent of cases in which it can be determined. This excludes the diagnosis of electrically induced cardiac arrest in these cases.

Small studies have reported fatal asystole caused by metabolic acidosis after struggles that did not involve conducted energy weapons, although the precise mechanisms by which acidosis causes cardiac arrest are not understood with certainty. It is known that conducted energy weapon discharges cause nerve-mediated muscular contractions that produce lactic acid, but studies of human volunteers found that discharges of 5-20 seconds result in a minor, transient reduction in pH that is not clinically significant. Several studies concluded that probe-mode discharges cause less acidosis than vigorous exercise, and the effect peaks within one minute of discharge and dissipates rapidly.

Dr. Swerdlow agreed that his analysis relies on a statement of assumed facts prepared by the Commission and his review of the testimony of Mr. Enchelmaier. He concluded that, because Mr. Enchelmaier identified a pulse about two minutes before the arrival of the firefighters, the best evidence is that Mr. Dziekanski did not develop cardiac

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

arrest until 9-11 minutes after the last discharge of the conducted energy weapon. This excludes electrically induced ventricular fibrillation. Further, the two defibrillators used by the paramedics showed that the initial cardiac rhythm was asystole, excluding the diagnosis of ventricular tachycardia or ventricular fibrillation.

Dr. Swerdlow concluded that several factors probably contributed to Mr. Dziekanski's cardiac arrest: respiratory acidosis and possibly respiratory arrest, possible metabolic acidosis, and underlying alcoholic cardiomyopathy.

Mr. Dziekanski had several characteristics typical of subjects who experienced sudden in-custody deaths — male gender, aged 20-50, agitated behaviour, collapse shortly after restraint, asystole. However, he was atypical in that he did not have a history of stimulant drug use or mental illness.

He concluded that in most cases the pathophysiological mechanism responsible for sudden in-custody deaths is unknown, and no known electrophysiological effect of conducted energy weapon stimulation can cause death as it occurred in Mr. Dziekanski's case.

In his testimony, Dr. Swerdlow explained that it was exceedingly unlikely that Mr. Dziekanski went into ventricular fibrillation prior to the asystole that was found by the firefighters and paramedics. Based on Mr. Enchelmaier's testimony that Mr. Dziekanski had a pulse two minutes before the arrival of the firefighters, it is highly unlikely that he went into ventricular fibrillation after Mr. Enchelmaier's last pulse check, and that the ventricular fibrillation changed into asystole before the firefighters found Mr. Dziekanski to be pulseless two to three minutes later. In any event, if ventricular fibrillation occurred about nine minutes after the last conducted energy weapon deployment, the weapon's electrical current could not have caused it, because when such electrical stimulation causes rhythm disturbance, it happens immediately.

Dr. Swerdlow discounted the significance of the evidence that Mr. Dziekanski became cyanotic within a minute of being handcuffed:

But whether or not he was turning cyanotic because he wasn't breathing, we still have good evidence that he had a strong and, for practical purposes, relatively close to normal pulse for a number of minutes.<sup>229</sup>

Dr. Swerdlow doubted that the evidence of Mr. Dziekanski making snoring sounds was agonal breathing, given the other evidence of his continued shallow breathing up until shortly before the arrival of the firefighters.

With respect to indirect effects of a conducted energy weapon, Dr. Swerdlow said that both sympathetic nervous stimulation and stress-related hormones (catecholamines) could directly affect the heart. They can make the heart beat faster, and in vulnerable individuals they can cause ventricular tachycardia and fibrillation, which typically occurs within a few seconds or a minute. However, in Mr. Dziekanski's case, he had a normal rhythm for minutes later. Dr. Swerdlow added:

And so while I think it's nearly certain Mr. Dziekanski was stressed, there's no evidence that stress, whether it was the stress of the confrontation, stress of fighting with the police officers, or any other kinds of stress he was under or stress from the TASER – whatever the stress he was under, it didn't cause the cardiac arrhythmia that led to his death.

Dr. Swerdlow said that there are two types of acidosis that might be applicable in this case. The first is respiratory acidosis. If a person stops breathing, the body is unable to exhale built-up carbon dioxide that has resulted from metabolic activity. The carbon dioxide builds up in the blood as carbonic acid, and cellular mechanisms, including cardiac contraction, work less well, and the subject can die. The second is metabolic acidosis. Lactic acid is generated when muscles work very hard and do not get sufficient oxygen transported to them. Normally a body gets rid of lactic acid by transporting it to the liver, where it is converted into carbonic acid, which is the acid that the lungs can then breathe out as carbon dioxide. However, if the person has liver disease, it will take longer for the liver to convert the lactic acid to carbonic acid. In addition, if the person is not breathing well, the potential for being acidotic is greater.

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<sup>229</sup> Transcript, April 28, 2009, p. 36.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

On May 26, 2009, Dr. Swerdlow provided a second written opinion, responding to the reports of Drs. Tseng and Kerr, in which he discussed two issues. First, with respect to the likelihood of weapon-induced ventricular tachycardia, he said that Dr. Tseng's hypothesis that the weapon induced hemodynamically stable ventricular tachycardia, which degenerated into ventricular fibrillation and then asystole, is dependent on the existence of five conditions:

- Both of the weapon's probe electrodes had to be located on the anterior chest, but the evidence is that the lower probe was attached to Mr. Dziekanski's shirt, adjacent to his abdomen.
- Mr. Enchelmaier's report of Mr. Dziekanski's pulse must be disregarded, but in Dr. Swerdlow's opinion, Mr. Enchelmaier's account was highly credible. In his experience, significant pulsus alternans is uncommon during ventricular tachycardia.
- The weapon discharge must have induced a ventricular tachycardia that was sustained and remained hemodynamically stable for over seven minutes. This was not recorded in Mr. Dziekanski's case, and has never been recorded after any conducted energy weapon discharge in animals or humans.
- The postulated ventricular fibrillation, which was never recorded, had to degenerate into asystole within the remaining portion of the three to four minutes. However, there is no evidence of either ventricular tachycardia or ventricular fibrillation, and the hypothesized degeneration into asystole over an atypically short interval is contrary to animal studies.
- Mr. Dziekanski would be the first person who collapsed more than a minute after weapon discharge to have ventricular tachycardia as an initial rhythm. However, in this case all the evidence points to an asystolic cardiac arrest. No evidence points to undetected ventricular tachycardia or fibrillation, and Dr. Swerdlow's own study of unexplained sudden deaths found no instance of ventricular tachycardia as the initial cardiac arrest rhythm.

Dr. Swerdlow also disagreed with Dr. Tseng's hypothesis that a conducted energy weapon discharge delivered over the abdomen can induce ventricular tachycardia and cardiac arrest. They have never been reported to induce any sustained cardiac rhythm disturbance in animals or humans, and in his view Dr. Tseng's recent study of in-

custody deaths in 50 California cities found no significant statistical association between sudden death and weapon deployment.

Second, with respect to the likelihood that indirect effects of weapon discharge contributed significantly to death, Dr. Swerdlow agreed with Dr. Kerr that Mr. Dziekanski likely had respiratory acidosis from reduced ventilation and lactic acidosis from exertion during the struggle, possibly combined with limited ability of his abnormal liver to metabolize lactate. However, recent studies of exhausted human volunteers who then received a 15-second weapon discharge found no increase in acidosis and only a modest increase in lactate. Other studies have shown that conducted energy weapons do not impair respiration. With respect to a hyperadrenergic state, Dr. Swerdlow agreed that any stressful situation can increase sympathetic nervous system activity, and it is reasonable to assume that a physical confrontation with law enforcement may produce a hyperadrenergic state. He added:

Thus, it is reasonable to postulate that Mr. Dziekanski had a hyperadrenergic state during his confrontation with the RCMP and that he may have had a hyperadrenergic state before this confrontation. But neither postulate can be proved. It is not possible to determine the relative contributions of the CEW discharge and other factors to the postulated hyperadrenergic state; it is not possible to determine the relationship between the postulated hyperadrenergic state and mechanism of death.<sup>230</sup>

## 2. Dr. Charles Kerr

Dr. Kerr received his medical degree from the University of British Columbia (1973), followed by a residency in cardiology and a fellowship in electrophysiology. He is a staff cardiologist and electrophysiologist at St. Paul's Hospital in Vancouver and a professor at the University of British Columbia. I accepted him as an expert in cardiology and electrophysiology.

Dr. Kerr explained that electrophysiology is the study and practice of treating patients who have abnormalities of the electrical system of the heart. The electrical system has a built-in pacemaker (the sinus node), which triggers very uniform and sequential

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<sup>230</sup> Exhibit 185, p. 11.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

electrical flows through the heart, providing a rhythmic and fluid contraction pattern. Superimposed on that is the autonomic (i.e., subconscious) nervous system of the heart, which consists of the sympathetic nervous system and the parasympathetic nervous system. The former tries to speed up the heart, while the latter tries to slow it down.

In situations of stress (or even physical activity), there is a sudden surge of the sympathetic nervous system, which is activated in two ways:

- There is a direct connection from the brain through the sympathetic nerve fibres that go right into the heart muscle and stimulate the various parts of the electrical system of the heart.
- In a fight-or-flight situation, the brain stimulation results in adrenaline surging directly down the sympathetic nervous system. In addition, hormones in the bloodstream (i.e., catecholamines) act on those nerve fibres in the heart and directly on the cells of the heart. In a situation where you get very intense stimulation, the adrenergic state gets progressively higher and starts to push the heart to tremendous degrees.

Dr. Kerr said that when the person has high adrenaline levels, the heart is much more prone to developing various types of abnormal rhythms. Cells that do not normally drive the heart can start firing off extra beats. This can actually change the electrical system of the heart, creating the possibility of abnormal rhythms developing where electricity will chase itself around in circles around structures in the heart and cause, potentially, more sustained arrhythmias. Although this kind of rhythm is most commonly benign, it becomes worrisome if the person has a susceptibility to other factors, such as metabolic derangements. The heart can become so irritable that it can develop a more sustained abnormal rhythm, which, if it comes from the lower chamber of the heart, can be a very serious and life-threatening arrhythmia — ventricular tachycardia or ventricular fibrillation. Adrenaline surges brought on by physical exertion or stress are very unlikely to bring on ventricular arrhythmia unless there is also an underlying heart disease.

Dr. Kerr said that based on the material he had reviewed, Mr. Dziekanski's heart weight was normal, and his blood pressure was normal or possibly borderline. He may

have had a slightly dilated heart, but that could have been from the physical exertion at the Airport. He may have had a very mild cardiomyopathy, but certainly not advanced cardiomyopathy. It would have been highly abnormal for someone without quite significant structural heart disease to have an unprovoked episode of ventricular arrhythmia. He was asked about the statement in his written report that the intense pain resulting from multiple TASER applications would have sent surges of catecholamines into his circulation and stimulated the nerve fibres, exacerbating the pre-existing hyperadrenergic state. He responded:

I've read quite a bit about TASER applications and ... they're obviously intensely painful. So one is getting an intensely painful stimulation, which we know, again, causes an intense outpouring of the sympathetic nervous system, both the releasing of more adrenaline and the stimulation of the nerve fibres that go to the heart. So it's taking — an individual must have had a high — high sympathetic adrenergic state to begin with, and then applying repeated painful stimuli I think can't help but having further increased that catecholamine state.<sup>231</sup>

In his report, Dr. Kerr expressed the belief that it is hard to escape the conclusion that the conducted energy weapon applications contributed as a major cause of Mr. Dziekanski's death, certainly through metabolic effects and development of a hyperadrenergic state, but not excluding a direct induction of a ventricular arrhythmia by the weapon application. In his testimony he added:

There would be no question that the level of sympathetic stimulation in this circumstance would have been astronomically high. You know, I can't think of too many situations where there would be higher sort of stimulation than in this type of a situation. Not only with respect to heart rhythms, but the high sympathetic tone stimulates all parts of the body. It will also stimulate the heart to beat excessively rapidly.<sup>232</sup>

Dr. Kerr said that in addition, Mr. Dziekanski became hypoxic (i.e., low oxygen levels in the blood), which would make the heart more prone to electrical development by weakening the heart muscle, further decreasing the circulation, further enhancing the release of lactic acid, leading to a downward spiral in how the heart would be

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<sup>231</sup> Transcript, May 7, 2009, pp. 83-84.

<sup>232</sup> Transcript, May 7, 2009, p. 86.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

functioning. It is theoretically possible that the heart could get so tired that it just stops working, if you had a very high sympathetic level.

In his written report, Dr. Kerr stated that it is logical and highly probable that Mr. Dziekanski developed a fast, abnormal rhythm from his ventricle sometime after the conducted energy weapon application and before the time he was noted to be cyanotic and not breathing. He added:

With respect to the role of TASER discharge in Mr. Dziekanski's death, there are two principal possibilities. First, it is possible that the TASER profoundly exacerbated his hyperadrenergic state, led to acidosis and general severe metabolic derangement, and thereby, created a milieu where spontaneous malignant arrhythmias could arise. Secondly, there remains a possibility that the TASER discharge could have directly induced ventricular arrhythmias, given that a TASER barb appeared to be on the anterior chest, quite close to the heart. It is unlikely that TASER discharges directly induced ventricular fibrillation, as this would have caused much more rapid loss of consciousness. However, they could have induced ventricular tachycardia that subsequently contributed to loss of adequate circulation, transition to ventricular fibrillation, then asystole and death. Therefore, I believe that there is a very high probability that the multiple TASER applications were instrumental in the development of malignant ventricular arrhythmias and death.<sup>233</sup>

Dr. Kerr agreed that if Mr. Enchelmaier's monitoring of Mr. Dziekanski's pulse and breathing were accurate, that would rule out that Mr. Dziekanski was in a state of ventricular tachycardia during the period up to and including his last monitoring.

### 3. Dr. Zian Tseng

Dr. Tseng has a bachelor's degree in biochemistry and molecular biology from the University of California at Berkeley, followed by a combined medical degree and Ph.D. from the University of California at San Francisco. He completed a residency in internal medicine, a fellowship in cardiology, a fellowship in electrophysiology, and a master's degree in clinical research and epidemiology, all from the University of California at San Francisco. He is an assistant professor of medicine in the Cardiac

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<sup>233</sup> Exhibit 129, p. 3.

Electrophysiology Section of that institution. I qualified him as an expert in cardiology and electrophysiology.

In his written report (Exhibit 135), Dr. Tseng noted that Dr. Lee had found a dark punctuate abrasion on the central chest that was consistent with a conducted energy weapon electrode. He found several other punctuate abrasions, one on the chest and the other on the abdomen. If the one on the chest represents the second barb mark, then the probe-mode discharges were delivered over the cardiac axis with probe penetration, which resulted in direct cardiac capture and induction of sustained ventricular tachycardia.

Alternatively, if the second barb attached to the abdomen, then the vector was not over the cardiac axis and the weapon's discharges did not directly induce ventricular tachycardia by cardiac capture. However, the adverse physiological effects, including stress, pain, and adrenaline surge, resulting from the weapon discharges, triggered a sustained ventricular tachycardia. Due to alcoholic cardiomyopathy, Mr. Dziekanski's cardiac function was already compromised, and ventricular tachycardia eventually resulted in hemodynamic instability and collapse, followed by degeneration to ventricular fibrillation and asystole.

According to Dr. Tseng, this sequence of events is consistent with the evidence that Mr. Dziekanski struggled for about 90 seconds after the first weapon discharge:

In situations of stress and high levels of circulating adrenaline, subjects are able to maintain an adequate blood pressure for several minutes, even in the setting of ventricular tachycardia and alcoholic cardiomyopathy. However, the low cardiac output due to ventricular tachycardia eventually results in a blood pressure too low to maintain consciousness or blood flow to the brain or vital organs. Thus, at this point Mr. Dziekanski became unconscious and unresponsive and was handcuffed.<sup>234</sup>

Dr. Tseng questioned the accuracy of Mr. Enchelmaier's testimony for several reasons:

- Although his first assessment of pulse was "strong and fast," he had not felt Mr. Dziekanski's pulse before the incident and consequently could

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<sup>234</sup> Exhibit 135, p. 3.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

not compare what he felt with his normal pulse. Dr. Tseng concluded that the pulse was very likely weaker than during normal rhythm — this would correlate with a low cardiac output, and would be consistent with his being unconscious, unresponsive, and cyanotic. The fast rate would correlate with it being in ventricular tachycardia.

- A British study found that an anesthesiologist assessed the presence of a carotid pulse in patients who were in shock and had very low systolic blood pressures (between 35 and 55 mmHg). Thus, Mr. Enchelmaier's observations are consistent with the low cardiac output resulting from a rapid ventricular tachycardia.
- Mr. Enchelmaier described a slower pulse during his second and third assessments. However, heart failure and ventricular tachycardia are two important causes of pulsus alternans, a condition Dr. Tseng had observed on many occasions where electrical rhythm results in alternating strong and weak pulses. Consequently, Mr. Enchelmaier described a slower pulse because he felt only every second pulse (i.e., only half of what the actual tachycardia rate was). Alternatively, Mr. Enchelmaier may have been feeling his own pulse — Dr. Tseng had made that mistake himself several times in Code situations.

Dr. Tseng wrote that low cardiac output due to ventricular tachycardia in the setting of alcoholic cardiomyopathy continues to the point where the heart itself receives too little blood flow, and ventricular tachycardia degenerates into ventricular fibrillation which, when untreated, almost universally results in asystole and death. In the three-and-a-half minutes between Mr. Enchelmaier's last assessment and the paramedics' reading of "no shock advised" (i.e., asystole) on the automated external defibrillator, Mr. Dziekanski's rhythm had degenerated from ventricular tachycardia to ventricular fibrillation to asystole.

Dr. Tseng also expressed the opinion that without exposure to the conducted energy weapon discharges, Mr. Dziekanski would very likely not have experienced sudden death. Without a trigger of intense pain and adrenaline release, he would not have had this ventricular arrhythmia leading to sudden death. He acknowledged that Mr. Dziekanski had experienced numerous stressors before, during, and after his flights, and was asked whether he was, as a result, at significant risk of having a heart problem even before the police arrived at the Airport:

- A No, I wouldn't say significant risk. I'd say he was at some risk, but I wouldn't quantify it as a significant risk.
- Q Well, is he at the point where he's at a risk where just about anything more added to that was going to put him into the significant risk category?
- A Yes.<sup>235</sup>

In cross-examination, Dr. Tseng agreed that sudden death during restraint is a known and documented phenomenon in the medical literature, and it overlaps with the phenomenon of excited delirium. It typically involves collapse shortly after restraint, agitated behaviour, sweating, pacing, barricading oneself, and minimal findings on autopsy. Commonly the first reported cardiac rhythm is either asystole or pulseless electrical activity, although such documentation is typically many minutes after the initial event. He agreed with Dr. Lee that the term sudden death during restraint is principally descriptive – trying to put a name to a phenomenon that is difficult to describe.

Dr. Tseng agreed that the mechanism of the fatal collapse of TASER-related deaths is an unanswered question and that, without the mechanism of death being known, it is only speculation to give an opinion on what caused or contributed to death in a TASER-related case. He cited several studies (by Dr. Ho, Dr. Kim, and Dr. Swerdlow) suggesting that TASER deployment has a physiological effect that causes or contributes to death. He said that his own recent research supports his view that in the case of subjects in delirium and an agitated state who then die, the risk of death is increased when a conducted energy weapon was involved. His study found that in 50 California cities, there was a six-fold increase in arrest-related deaths in the first year following introduction of conducted energy weapons. He acknowledged that thereafter the death rate returned to a statistically comparable rate.

Dr. Tseng said that the location of the punctate abrasion on Mr. Dziekanski's central chest, as shown in the photograph (Exhibit 87), is very consistent with where a cardiologist would perform a pericardiocentesis tap of the heart. If this was in fact

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<sup>235</sup> Transcript, May 8, 2009, p. 30.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

the location of one of the weapon's barbed probes, then any other location for the other barbed probe would constitute a cardiac axis that could result in capture of the heart. His interpretation of the evidence was that the barbed probe did penetrate to sufficient depth to cause a direct cardiac capture and ventricular arrhythmia. He was referred to the statement in his report that the vector of TASER electrodes over the cardiac axis was critical for cardiac capture and induction of sustained (i.e., over 30 seconds) ventricular tachycardia in animal studies, but he acknowledged that the studies he had cited for this proposition did not show *sustained* ventricular tachycardia.

Dr. Tseng agreed that there is no support in any peer-reviewed medical literature with respect to humans for the concept of delayed ventricular fibrillation caused from an external electrical source. He agreed that there are several theories of how sudden death during restraint arises, including the following:

- Stress has a physiological effect on the brain, which causes the person to stop breathing, causing the heart to stop.
- Stress from a heightened adrenergic state causes an arrhythmia of the heart.

Dr. Tseng was asked what effect pain from the weapon might have, and he responded:

Q ... Are you saying that any pain from the TASER would cause adrenaline, acid, heart, leading to death?

A It would be contributory. Certainly it's speculation whether or not every single TASER deployment would cause an arrhythmia, but I think it's a fair statement to say that any deployment of the TASER, whether in stun or in probe-mode, would create intense pain, and that intense pain itself would lead to an increased adrenaline state.

Q And tell me something, would any other type of intense pain cause the same problems?

A I'm not aware of any other modes of restraint that would cause such an intense response as a TASER discharge.<sup>236</sup>

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236 Transcript, May 8, 2009, p. 117.

## D. EMERGENCY DEPARTMENT PHYSICIANS

### 1. Dr. Christian Sloane

Dr. Sloane is a medical doctor, and certified by the American Board of Emergency Physicians. He is employed full time as an academic attending and assistant clinical professor at the University of California at San Diego Medical Center. He has cared for numerous patients in various states related to alcohol, including alcohol intoxication, as well as the complete range of alcohol withdrawal – from mild tremors to fully developed major alcohol withdrawal, as well as delirium tremens.

In August 2008 Dr. Sloane wrote an opinion (Exhibit 78) for the Integrated Homicide Investigation Team respecting the possible role of alcohol withdrawal as it may pertain to contributing to the death of Mr. Dziekanski. He did not testify at our evidentiary hearings. Based on his review of materials provided to him, he reached several opinions, including the following:

- The findings on autopsy (fatty liver, enlargement of the heart, cerebellar atrophy) are all well-known to occur in the setting of alcohol abuse, and it appears that Mr. Dziekanski had sustained systemic effects to his organs as a result of chronic alcohol use.
- On the Pritchard video Mr. Dziekanski is alert, but confused and sweaty. He appears to be a man in a state of agitated delirium, which could be consistent with, or exacerbated by, a state of alcohol withdrawal, though clearly not delirium tremens. In this state, one would expect him to be in a state of adrenergic excess, which could increase the likelihood of him suffering from the sudden in-custody death syndrome.
- Minor alcohol withdrawal occurs as early as six hours and usually peaks at 24 to 36 hours after cessation of or significant decrease in alcohol intake. It is characterized by mild autonomic hyperactivity: nausea, anorexia, coarse tremors, tachycardia, hypertension, hyperreflexia, sleep disturbance, and anxiety. Mr. Dziekanski's condition on that evening could certainly be consistent with some degree of alcohol withdrawal. Whether the condition of alcohol withdrawal should be added to the milieu of agitated delirium that is witnessed on the video and described by those involved, or if it is solely due to alcohol withdrawal, is difficult to definitively determine, but placed him at risk for sudden death.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

- While the circumstances of Mr. Dziekanski's death are unfortunate, they are not that unique or surprising when one looks at cases of sudden in-custody death. It is often the matter that in these cases, no definitive cause of death is ever determined.

### 2. Dr. Jeffrey Ho<sup>237</sup>

Dr. Ho graduated from the Loma Linda University School of Medicine, California, in 1992. He completed his residency in emergency medicine (1995) and his fellowship in emergency medical services/prehospital care (1996) at the Hennepin County Medical Center in Minneapolis, Minnesota. He is currently Attending Faculty, Emergency Medicine, at the Hennepin County Medical Center (Level 1 Trauma Center) and an associate professor of emergency medicine at the University of Minnesota School of Medicine. He is also a deputy sheriff in the Meeker County Sheriff's Office. His area of expertise includes research into sudden and unexpected death in law enforcement custody and the physiologic effects of conducted energy weapons, and he is the author of numerous peer-reviewed papers on these subjects. I qualified him as an expert in emergency medicine and TASER research.

In his written report, Dr. Ho stated, "[I]n general, there is nothing that exists to date scientifically to support a causal connection between ECD (electronic control device) application in humans and sudden, unexpected death."<sup>238</sup> There are, however, general conditions that are strongly associated as risk factors in sudden death, such as underlying cardiac disease issues (e.g., dilated cardiomyopathy, as in this case) and volitional resistance during attempts at control and restraint.

Dr. Ho cautioned against using inappropriate logic when examining allegations of a possible association between conducted energy weapons and sudden deaths, such as:

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<sup>237</sup> Dr. Ho disclosed that he is an independent, expert medical consultant to TASER International, Inc. He owns shares in TASER, provides consultative advice to TASER upon request for which he received, in 2008, compensation totaling \$61,000. He has also received remuneration from TASER for his testimony or his giving of depositions in six court cases (plus this Commission of Inquiry) on behalf of TASER.

<sup>238</sup> Exhibit 141A, p. 9.

- *post hoc, ergo propter hoc* – just because Mr. Dziekanski's death was proximate in time to deployment of the conducted energy weapon does not establish a causal relationship, and
- **causal oversimplification** – assigning causal blame to the conducted energy weapon while disregarding Mr. Dziekanski's underlying physical condition and his decision to resist, fight with, and attempt to flee from law enforcement officers.

Dr. Ho said that from a scientific standpoint, higher voltage with very low amperage is not known to be dangerous to humans, and the average delivered current of a TASER X26 is only 0.0021 amperes, compared to 16 amperes of sustained current in a typical residential wall outlet. Similarly, emergency external cardiac defibrillators typically deliver electrical energy in the range of 150-360 joules, while a TASER X26 delivers about 0.1 joule. He added that there is now a plethora of human data showing that human exposures to conducted energy weapons do not yield findings of cardiac abnormality, as measured by serum biomarkers, electrocardiograms, and echocardiography.

He stated that several recent human studies have shown that from a human physiology standpoint, no harm has been found to be associated with a conducted energy weapon exposure when used in probe or push-stun mode, and even when the application was directly over the heart. He cautioned against extrapolating the results from swine studies to humans. Further, the manufacturer has documented no complaints of death after more than 680,000 voluntary human exposures, which is a vastly larger number of study subjects than required before approval of a medical device or therapeutic drug.

Dr. Ho said that Mr. Dziekanski's underlying condition of metabolic acidosis should not be underestimated. This condition is known to be an associated risk for a sudden death event that is independent of the application of a conducted energy weapon. At the same time, there is no evidence that the weapon caused ventricular fibrillation, which is generally known to be relatively instantaneous. However, Mr. Dziekanski's changing pulse rates as described are quite consistent with those that are due to extreme acidosis states induced by agitated and continued resistive behaviour, and

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

this mechanism of death is independent of the application of a conducted energy weapon. He agreed with Dr. Lee that Mr. Dziekanski's sudden death during restraint

... was likely due to a variety of factors including his underlying disease processes secondary to alcohol abuse and his volitionally elevated state of metabolic demand. It is my opinion that [Mr. Dziekanski's] death was most likely due to a terminal arrhythmic event brought about by the stress of his elective physical resistance and from his underlying cardiomyopathic condition that was brought about by his alcohol abuse. [Mr. Dziekanski] represents a person with multiple factors associated with [sudden death] (gender, [body mass index], underlying cardiac disease, exertional and resistive behaviour) and all of these are independent of the application of an [electronic control device].<sup>239</sup>

Dr. Ho concluded, "[I]t is my opinion, to a reasonable degree of medical certainty or probability, that the use of the TASER ECD did not cause or contribute to [Mr. Dziekanski's] death."<sup>240</sup>

In his testimony, Dr. Ho said that the phenomenon of sudden death during restraint typically involves agitated males with an average age of about 40, who are acting bizarrely (e.g., running out in traffic naked, attacking bystanders or the side of a house); showing elevated vital signs, elevated temperature, apparent hallucinatory or psychotic activity where the person appears to be responding to external stimuli (e.g., hearing voices); resistant to help; attracted to things that reflect or are bright and shiny; and who may have altered perception of pain, an underlying health problem, and ingestion of medications or illicit toxins or drugs. The first recorded cardiac rhythm is frequently pulseless electrical activity or asystole.

He said that the evidence of Mr. Dziekanski being agitated and showing signs of exertion is consistent with his own recent research that found 45 seconds of vigorous exertion is enough to make a person really ill from a metabolic acidosis standpoint. He disagreed with Dr. Tseng's opinion that Mr. Dziekanski experienced sustained

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239 Exhibit 141A, p. 20. Dr. Ho's repeated characterizations of Mr. Dziekanski's "volitionally elevated state of metabolic demand," "elective physical resistance," "resistive behaviour," and "voluntary fighting" imply that Mr. Dziekanski was consciously and deliberately resisting the police officers. The evidence does not support that implication. In my view, such imputations of blameworthiness have no place in what should be a neutral medical opinion.

240 Exhibit 141A, p. 20.

ventricular tachycardia for seven or eight minutes, and then devolved into ventricular fibrillation, and then asystole. He was not aware of any human research showing this, and it has not arisen in his clinical practice nor in any of the 600-700 subjects he has tested.

He was referred to several of his recent studies, which he said produced the following results:

- 15-second TASER applications with pre-placed thoracic electrodes over the cardiac axis of 44 subjects did not demonstrate any evidence of a dangerous arrhythmia.<sup>241</sup>
- Prolonged 15-second conducted energy weapon application in 25 exhausted human male volunteers did not cause a detectable change in their 12-lead electrocardiograms.<sup>242</sup>
- In a resting adult population of 66 human volunteers, the TASER X26 did not affect the recordable cardiac electrical activity within a 24-hour period following a standard five-second application. Additionally, no evidence of dangerous hyperkalemia or induced acidosis was found.<sup>243</sup>
- Preliminary data from a study to compare the human stress response to conducted electrical weapons, pepper spray, cold-water tank immersion, and a defensive tactics drill suggest that physical exertion during custodial arrest may be most activating of the human stress response, particularly the sympathetic-adrenal-medulla axis. Conducted electrical weapons were not more activating of the human stress response than other uses of force.<sup>244</sup>
- 15-second conducted energy weapon applications to 38 exhausted human volunteers were not associated with a worsening change in pH or troponin. Decreases in pCO<sub>2</sub> and potassium and a small increase in lactate were found.<sup>245</sup>
- 15-second conducted energy weapon applications to 52 human volunteers did not impair respiratory parameters.<sup>246</sup>

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241 Exhibit 141D.

242 Exhibit 141E.

243 Exhibit 141F.

244 Exhibit 141G.

245 Exhibit 141I.

246 Exhibit 141J.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

Dr. Ho said that Mr. Enchelmaier's observations of Mr. Dziekanski's pulse and breathing were

... very consistent with many of the resuscitations that I've been involved in, where the person is extremely acidotic after some type of a huge exertional event and they subsequently go on to die. And what ends up happening is their pulse, which starts out very fast to compensate for their acidosis, eventually, because they become so acidotic their body can no longer operate correctly under that and they can't compensate for it any more, their heart begins to slow down, and we call that — they have a Brady arrhythmia, to the point where eventually their heart function stops and they are either found in a presenting rhythm of asystole or something called pulseless electrical activity, which is basically you may see electrical spikes on the cardiac monitor, but their heart is refusing to make any squeezing action. So I think it's very consistent with that. It's consistent with my research. It's also consistent with other literature in the area of known metabolic acidosis.<sup>247</sup>

He generally agreed with Dr. Di Maio's, Dr. Pollanen's, and Dr. Swerdlow's opinions about Mr. Dziekanski's cause of death. With respect to Dr. Butt's opinion that increasing exertion and stress seen following the discharge of the weapon likely contributed to death, Dr. Ho said this was an oversimplification:

So to be able to list that, you know, simply the TASER increases the amount of stress, I don't believe that that is the case. And again, if you look at the catecholamine paper that we talked about, the TASER is the least likely to give a physiologic rise in any of the stress parameters when you compare it to all of the other things that are going on, such as, you know, continued resistance, voluntary fighting, you know, those types of things.<sup>248</sup>

### 3. Dr. William Bozeman

Dr. Bozeman is an emergency physician in North Carolina and associate professor, director of prehospital research at Wake Forest University's Department of Emergency Medicine. He specializes in prehospital care and resuscitation, and is a researcher into TASER-related medical effects. Although he did not testify at our evidentiary hearings, he reviewed audiovisual and written materials respecting the Dziekanski case and provided a written opinion that stated in part:

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<sup>247</sup> Transcript, May 11, 2009, p. 23.

<sup>248</sup> Transcript, May 11, 2009, p. 37.

Though it is impossible to conclusively determine without concurrent ECG monitoring, I feel that it is very unlikely that the TASER caused or significantly contributed to the unfortunate death of Mr. Dziekanski beyond the general stress of the physical subdual process.

That said, I do note that Mr. Dziekanski's physical collapse and cessation of purposeful resistance did occur within a short period (roughly 90 seconds) after two discharges of a TASER in probe deployment mode with an anterior thoracic, likely transcardiac, discharge vector. Though not conclusively demonstrating a TASER-related effect, this clinical course is consistent with, among other things, the TASER's electrical discharge contributing to a cardiac dysrhythmia and thus to Mr. Dziekanski's demise. Acknowledging that our current knowledge is incomplete and that significant disagreement exists among experts regarding the potential for the TASER to affect the human cardiac cycle, I cannot completely discount the animal data and human case report that suggest that this may be a rare possibility. Therefore I cannot fully rule out that the TASER weapon may have contributed to Mr. Dziekanski's death.<sup>249</sup>

## E. PSYCHIATRISTS

### 1. Dr. Shao-Hua Lu

Dr. Lu has a medical degree from Dalhousie University. He completed a residency in psychiatry at the University of Ottawa and a clinical fellowship in addiction psychiatry at Harvard University. He is currently a clinical assistant professor in the Department of Psychiatry at the University of British Columbia and is on staff in the Consultation-Liaison Psychiatric Service at Vancouver General Hospital, providing consultation, liaison, and psychiatry care to medical and surgically ill patients. For 10 years he has treated patients with delirium, alcohol withdrawal, and other types of medically related psychiatric conditions. I qualified him as an expert in psychiatry and addiction medicine.

In April 2008, after reviewing the Pritchard video and an extensive volume of documentary material, Dr. Lu provided the Integrated Homicide Investigation Team with a written medical-psychiatric opinion regarding Mr. Dziekanski's mental state

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<sup>249</sup> Exhibit 124, p. 1.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

prior to the incident with the RCMP. In a subsequent July 2008 report, written after his review of additional witness statements, he confirmed his opinion.

In his report, Dr. Lu stated that there is a high degree of certainty that Mr. Dziekanski was in a state of agitated delirium prior to the police incident and his death, and that there were no other potential medical-psychiatric conditions that could better account for his behaviours and mental status. He said that delirium is a complex neuropsychiatric disorder primarily characterized by generalized impairment of cognition and general brain functions. Disorientation, poor attention, and poor concentration are almost universal. Delirium has a wide range of non-cognitive symptoms, including changes in psychomotor behaviours with agitation, excitation, and defensive aggression. An individual's thinking, language, perception, and emotional tone are disturbed. Visual and auditory hallucinations are common, often unpleasant, frightening, or threatening. Delirium typically has an acute onset, and often worsens at night and is exacerbated by sleeplessness. He stated:

Mr. Dziekanski demonstrated classic features of delirium especially based on the Pritchard video footage. He demonstrated psychomotor agitation, disorganized behaviours. He appeared both frightened and defensively threatening. His aggressive behaviours did not appear to aim at any individual in particular or to achieve a specific purpose. Mr. Dziekanski demonstrated a decreased awareness of his surroundings. Mr. Dziekanski's behaviours are not typical of [an] individual in an unfamiliar environment or individual coping with language barriers. He did not respond to bystanders' attempt to communicate with him. Although based on limited information, it is clear that Mr. Dziekanski had disturbances in cognition. His actions were not predictable. He appeared to have difficulty organizing and coordinating his actions and behaviours.<sup>250</sup>

Dr. Lu said that it was impossible to retrospectively give a precise cause for Mr. Dziekanski's delirium. However, he had numerous risk factors, including lack of restful sleep, anxiety, vomiting, fatigue, autonomic disturbances (e.g., thirsty, sweating, laborious breathing), electrolyte imbalance, and possible alcohol withdrawal.

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<sup>250</sup> Exhibit 77, pp. 13-14.

In his testimony, Dr. Lu stated that laborious breathing is often a sign either of dehydration or autonomic instability, the latter of which refers to physiological changes in the body where there is increased heart rate, increased respiratory rate, and increased or changed blood pressure. Some people in a delirious state can exhibit greater than normal strength. When a delirious person exhibits defensive aggressiveness, sometimes de-escalation techniques work, but sometimes they do not work. It would not be unusual for a delirious person exhibiting defensive aggressiveness to grab whatever is present as a defensive measure.

Dr. Lu said that he did not consider Mr. Dziekanski to be in a really mean, angry state. Rather, he was more frightened and scared, leading to behaviours of defensive aggression.

In May 2009 Dr. Lu provided a third report (Exhibit 155), responding to reports provided by Drs. Chambers, Kerr, Tseng, and Janke, in which he stated:

- *Dr. Chambers* – he agreed that Mr. Dziekanski did not have delirium tremens. However, he was hyperventilating (an involuntary activity), which is commonly observed in delirium. Dr. Chambers also identified an increased heart rate and blood pressure, which are almost always encountered in individuals with delirium.
- *Dr. Kerr* – the hyperadrenergic state described by Dr. Kerr is consistent with the medical opinion that Mr. Dziekanski was experiencing delirium.
- *Dr. Tseng* – he agreed that without exposure to the conducted energy weapon, it is unlikely that Mr. Dziekanski would have experienced sudden death.
- *Dr. Janke* – he disagreed with Dr. Janke's dismissal of the significance of Mr. Dziekanski hyperventilating, stating that it is almost always a sign of some kind of physiological distress. He added that Dr. Janke's understanding of dehydration was incomplete – individuals with potential alcohol withdrawal, dehydration, and delirium can have significant fluid imbalance that oral fluid and a few glasses of water will

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

not replace. He added:

Mr. Dziekanski's delirium resulted in a physiological vulnerable state that increased his susceptibility to the cardiac impacts of TASER as outlined by Drs. Chambers, Kerr, and Tseng.<sup>251</sup>

### 2. Dr. Paul Janke

Dr. Janke received his medical degree from the University of British Columbia in 1982. He completed a year of internal medicine at St. Paul's Hospital in Vancouver, and then a residency in psychiatry at UBC (1987), including a rotation in forensic psychiatry at Youth Forensic Psychiatric Services. He is a Fellow of the Royal College of Physicians of Canada in Psychiatry. He currently maintains a private practice in forensic psychiatry and also has a sessional appointment as the regional clinical director of the South Burnaby Region of Youth Forensic Psychiatric Services. I qualified him as an expert in forensic psychiatry.

Dr. Janke reviewed the Pritchard video and numerous documents provided by Commission Counsel. In his written report, Dr. Janke noted that Mr. Dziekanski was responsive to direction from the RCMP officers. The translation of his statements recorded on the video indicates that he had awareness of his surroundings and he was making comments that were consistent with the circumstances he found himself in. There is no indication that he was disoriented or was experiencing delusional thinking or hallucinations. The pathologist (Dr. Lee) noted no medical condition that may cause delirium, which corresponds with the video showing Mr. Dziekanski to be agitated but not delirious.

Dr. Janke disagreed with several aspects of Dr. Lu's opinion:

- It was unclear how Dr. Lu could come to the conclusion that Mr. Dziekanski appeared to be in a state of moderate to severe psychomotor agitation. Throughout much of the video, Mr. Dziekanski appeared relatively calm, was interacting with others, and was attempting to engage in conversation with others.

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<sup>251</sup> Exhibit 155, p. 3.

- Mr. Dziekanski was quite aware that his actions caused the automatic door to open and close. On other occasions, he appeared to deliberately move things in order to prevent the door from automatically opening and closing.
- It was unclear how Dr. Lu concluded that Mr. Dziekanski was noted to move chairs around in an unclear fashion. To the contrary, his actions appeared to be deliberate and purposeful – he moved the chairs in front of the doorway to fashion a sort of barrier.
- It was unclear how Dr. Lu could come to the conclusion that Mr. Dziekanski did not respond to efforts by bystanders to calm him. There were several times when Mr. Dziekanski appeared to interact with bystanders, appearing to calm down somewhat and attempting to communicate with them. At one point he raised the computer monitor, and then put it down after several people shouted, "No."

Dr. Janke disagreed with Dr. Lu's opinion that Mr. Dziekanski was in a state of agitated delirium. The Pritchard video shows an individual who was at times agitated and angry, which would be consistent with an individual who had been in transit for 30 hours, had in all likelihood little in the way of restorative sleep, had likely consumed only water during the final 10 hours, and was experiencing a severe language barrier. He added:

Furthermore, it would be my considered opinion that observing a short amateur video of an individual interacting in an environment cannot provide sufficient information to reach a medical opinion with respect to an individual's mental state. The diagnosis of delirium requires direct physical assessment of an individual including direct attempts at interviewing of the individual. Review of documentation showing an altered mental state over a period of time would also be an essential feature in making a diagnosis of delirium.... Dr. Lu uses the minimal information available through the Pritchard video to speculate on Mr. Dziekanski's internal thought processes.... It is my opinion that the Pritchard video provides insufficient information to reach the conclusion that Mr. Dziekanski was in a delirious state.<sup>252</sup>

Dr. Janke added that Dr. Lu's comments with respect to possible physical factors that could contribute to the development of delirium represented speculation. With respect to his comments respecting autonomic disturbance, Dr. Janke stated that it is well-recognized that anxiety can cause individuals to sweat and breathe heavily –

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<sup>252</sup> Exhibit 154, pp. 6-7.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

certainly Mr. Dziekanski's circumstances could lead to the assumption that he was experiencing quite significant anxiety. In his view, attributing Mr. Dziekanski's delirium in part to electrolyte imbalance was purely speculation. He concluded:

It would be my forensic psychiatric opinion that the information available to us with respect to Mr. Dziekanski's mental status does not allow a diagnosis of delirium to be made. Given the material available to us, in my opinion diagnosis should be restricted to observations that he was agitated, distressed, and anxious and no further conclusions can be drawn from a medical forensic psychiatric perspective.<sup>253</sup>

In his testimony, Dr. Janke acknowledged that in a clinical setting he might diagnose delirium about once a year while Dr. Lu, when working in consultation-liaison psychiatry, might do so on a daily basis. He said that patients in alcohol withdrawal have a tendency to go into delirium, which can be fatal. They are treated with intravenous fluids and vitamins, and with medications to treat their agitation and delirium.

Dr. Janke said that from his review of the Pritchard video and the translation of Mr. Dziekanski's statements recorded on it, it appears that he was happy to see the police initially, based on his tone of voice. However, he then becomes what appears to be puzzled or upset by their actions, which is when he made the comment, "Leave me alone. Did you become stupid? *Or*, Have you lost your minds?"

In response to Dr. Lu's statement (in his third report) about the significance of hyperventilation, Dr. Janke said he agreed that hyperventilating is almost always a sign of some kind of physiological distress, but that it is not relevant to a diagnosis of delirium. He disagreed with Dr. Lu's comments about dehydration, because they assumed delirium.

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<sup>253</sup> Exhibit 154, p. 7.

## F. EPIDEMIOLOGIST

### Dr. Keith Chambers

Dr. Chambers has a medical degree (1973) and a master's degree in clinical epidemiology (1990) from the University of British Columbia. He has clinical experience in internal medicine and emergency medicine, and practised as a family physician between 1975 and 1996. He practised as a consultant epidemiologist at BC Children's Hospital between 1990 and 1995, and then became assistant director of the Epidemiology Evaluation Unit at Vancouver General Hospital. Since 2003 he has been an associate clinical professor in the Health Care and Epidemiology Department of the UBC Faculty of Medicine, and he also maintains a consulting practice in clinical epidemiology. I qualified him as an expert in clinical epidemiology, emergency medicine, and family practice.

In his written report (Exhibit 148), Dr. Chambers reviewed the sequence of events at the Airport before and after the conducted energy weapon was deployed. He calculated that Mr. Dziekanski was handcuffed approximately 90 seconds after the start of the struggle, and 15-20 seconds later Cst. Bentley observed him turn blue, indicating a loss of circulation and cyanosis. Since cyanosis takes time to develop, one can infer that he was developing cyanosis for a period of time prior to this observation. The possibility exists that the fatal arrhythmia could have developed within a minute of the third deployment of the conducted energy weapon. He added:

The logical sequence of first developing an arrhythmia, then going unconscious and later developing cyanosis makes intuitive sense. This is as opposed to the alternative order of going unconscious then developing an arrhythmia. It is difficult to understand, in the absence of a blow to the head or a seizure, why a prone person, with a good carotid pulse, would go unconscious.

However, against this logical sequence of events is the testimony that Mr. Dziekanski's breathing and pulse were monitored during this period. If it is true that he did, in fact, have a pulse and was breathing up until close to the time when cyanosis [was] noted, then the arrhythmia must have developed minutes after the third TASERing and direct capture of the heart by the TASER can be ruled out. However, if the assessments that were done were

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

inadequate to correctly monitor the pulse and breathing, then direct capture of the heart and the possibility of an arrhythmia such as ventricular tachycardia remains a possibility.<sup>254</sup>

Dr. Chambers reported that, based on the negative autopsy, one can assume that Mr. Dziekanski suffered an electrical death — his heart developed a fatal arrhythmia, although we will never know for sure the actual arrhythmia that led to his death. The next step in determining probable causation is to assess those risk factors that might have caused the fatal arrhythmia. In Mr. Dziekanski's case, heart attack, coronary ischemia due to atherosclerosis, and death due to drugs can be ruled out. We can also rule out delirium tremens (given the time frame and the absence of delusions, hallucinations, tremors, and other typical manifestations) and "excited delirium" (the syndrome's main common presenting features were not present; he was not immune to pain, nor was there evidence of cocaine use or psychosis). Turning to other potential risk factors, Dr. Chambers said that Mr. Dziekanski was undoubtedly stressed out and exhausted, both of which can cause physiological changes in the body:

A term "hyperadrenergic state", as adrenaline is involved, is used here to describe this physiological response to acute stress. It is known that it can be associated with hyperventilation such as was seen on the video. It is my opinion, that Mr. Dziekanski's heart would have been somewhat stressed during this period leading up to the restraint period. He was probably hyperventilating, his blood pressure was probably elevated and his heart rate would have been raised from normal. This would have increased the stress on his heart and in particular on the electrical part or conduction system of the heart.<sup>255</sup>

However, Dr. Chambers added that it is significant that any susceptibility to an arrhythmia (e.g., mild cardiomyopathy, if it existed at all) had to have been there for years, without causing a fatal arrhythmia. Even the added stress and fatigue since leaving Poland did not trigger one. However, within a minute or two from the start of the restraint effort and the use of the TASER, Mr. Dziekanski had died. This relatively short period of time, as well as the strong temporal relationship to his death, forces us

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254 Exhibit 148, pp. 7-8.

255 Exhibit 148, p. 13.

to consider these two remaining risk factors and possible mechanisms by which one or the other, or both, could be causally related to his death.

The mechanisms by which the stress of physical restraint can trigger sudden death involve activation of our primitive "fight or flight" response. Adrenaline, cortisol, noradrenaline, and many other neurohormones are released, causing increases in blood pressure, the heart rate, the metabolic rate, and blood sugar. Glycolysis occurs in the liver and muscle stores of energy. Byproducts can include lactic acid and a more acid environment in the blood. The heart becomes more vulnerable to fatal cardiac arrhythmias.

This mechanism would also apply to the response to stress caused by deployment of a conducted energy weapon, driven by the extreme pain and muscle feedback to the brain via spinal cord pathways due to the effects of repeated discharges. This, plus the associated anxiety of being hit with a TASER and the effects of immobility would certainly have caused a severe "fight or flight" response. It is also possible that metabolic acidosis, triggered by the release of lactic acid from the sudden capture and tetany of nearly all the large skeletal muscles in the body, rendered the heart more susceptible to a fatal arrhythmia.

Dr. Chambers said that the Pritchard video assists in assessing the relative impact of physical restraint and the conducted energy weapon in contributing to the electrical death of Mr. Dziekanski. It appears that the weapon had a far more violent effect. He cried out in pain several times, dropped to the ground, and writhed. His outward response to physical restraint appears to be significantly less violent and reactive. He concluded:

In my opinion, the two most significant contributing causes of the death of Mr. Dziekanski were the act of TASERing and the act of physical restraint. Further, the mechanism of death was most likely the creation of a hyperadrenergic state that caused or brought on a fatal arrhythmia, although the possibility of direct capture of the heart and the development of ventricular tachycardia cannot entirely be ruled out.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

The extended period of TASERing appears on the tape by Pritchard to have been a great deal more stressful to Mr. Dziekanski than the act of physical restraint. So while both most likely contributed to the death of Mr. Dziekanski, in my opinion, the act of TASERing Mr. Dziekanski for 31 seconds over a period of 49 seconds, contributed more to his stress response and subsequent demise than physical restraint.<sup>256</sup>

In his testimony, Dr. Chambers said that it was highly unlikely that there could have been any pulse or breathing after the cyanotic evidence was noted:

The cyanosis is a lack of oxygenation; it takes time to develop. So you'd have to have significant pump failure for a period of time prior to cyanosis developing. And therefore that would argue that the arrhythmia had started sometime prior to the cyanosis developing.<sup>257</sup>

When asked about Mr. Enchelmaier's testimony about taking three pulses, Dr. Chambers said that the video shows that Mr. Enchelmaier spent only about seven seconds taking the pulse. He said that in non-stressful situations, you would want to take the pulse for at least 30-60 seconds. In stressful environments like this, he said that he was not sure how even a trained physician could in seven seconds be assured that it was the patient's (and not the physician's) pulse that was being recorded, that it was a regular pulse and get some idea of the rate.

Dr. Chambers said that volunteer studies involving 40-50 subjects, often done under ideal circumstances, are not designed to test real-world situations, and it is very difficult to draw conclusions from them.

Dr. Chambers said that based on his review of the medical literature respecting sudden death following restraint, if you eliminate cases involving illicit drug use, heart disease, severe psychiatric mental illness, and wildly agitated purposeless movement, "you're getting into a pretty rarefied air there."<sup>258</sup>

Dr. Chambers was asked to comment on excerpts from several medical reference books, and he indicated that he agreed with some excerpts and disagreed with others.

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<sup>256</sup> Exhibit 148, p. 20.

<sup>257</sup> Transcript, May 13, 2009, p. 80.

<sup>258</sup> Transcript, May 13, 2009, p. 128.

He was asked whether he agreed with the statement by one author that when some sudden deaths during restraint “cannot be adequately explained by injuries produced by lethal pathophysiology of the procedures themselves, it is clear that the deaths are coincident with but not caused by the restraint procedure.”<sup>259</sup> He responded:

I couldn't disagree more. I think that's the whole problem here is, you know, if the way out of this problem is to — is to stick our heads in the sand and say, you know, it's coincident, then I think we're doing society a disservice. I think it is incumbent upon us to give our best opinion as to the pathophysiological mechanism and get on with it, and I think that's being done in a lot of areas of literature, and I think even in this chapter later on when she describes the response. But to say it's coincident, I — it just, it's wrong. Mr. Dziekanski died for a reason. It wasn't coincidence.<sup>260</sup>

Dr. Chambers was also asked to comment on several studies reported in medical journals on conducted energy weapons. He agreed with some findings and disagreed with others, and stated that it would be unsafe to extrapolate findings from studies using a small number of volunteer subjects. When looking at rare events, such as the death of Mr. Dziekanski, one needs large sample sizes in order to figure out what is going on. “If your sample size is below your event rate, you're not going to see it.”<sup>261</sup> He added that a Ph.D. statistician with whom he works has calculated that a sample size of between 20,000 and 30,000 would be sufficient to produce reliable results.

Dr. Chambers disagreed with Dr. Di Maio's opinion of chronic alcohol abuse and alcohol withdrawal. Severe alcoholics typically have a long history, which is absent in this case. In addition, it is remarkable that Dr. Di Maio excluded the conducted energy weapon as a risk factor.

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259 Transcript, May 14, 2009, p. 23.

260 Transcript, May 14, 2009, pp. 23-24.

261 Transcript, May 14, 2009, p. 64.

## G. ELECTRICAL ENGINEER

### Dr. Dorin Panescu<sup>262</sup>

Dr. Panescu received a Bachelor of Science degree (1985) in Romania, and Master of Science (1991) and doctorate degrees (1993) in electrical and computer engineering from the University of Wisconsin-Madison. He served as principal staff scientist, Cardiac Rhythm Management, at St. Jude Medical in Sunnyvale, California, and is currently chief technical officer at NewCardio, Inc., in Santa Clara, California. He is a senior member of the Institute of Electrical and Electronics Engineers and a Fellow of the American Institute of Medical and Biological Engineering. I accepted him as an expert in conducted energy weapons and their electrical effect on the heart from an electrical and bioelectrical perspective.

In his written report (Exhibit 108), Dr. Panescu offered opinions on 14 matters, including the following:

- The voltage, current, and charge delivered by a TASER X26 device are, by a very wide margin, significantly below thresholds known to be capable of inducing ventricular fibrillation. Electricity, including currents from a TASER X26, cannot directly trigger asystole or pulseless electrical activity.
- If any fraction of the TASER X26's voltage, current, or charge reached Mr. Dziekanski's heart, the residual level was significantly below, by a very wide margin, scientifically accepted thresholds required for induction of ventricular fibrillation. Similarly, they would have been insufficient to capture or pace Mr. Dziekanski's heart.
- With a high degree of scientific and electrical engineering probability, the first deployment of the weapon did not induce ventricular fibrillation in Mr. Dziekanski, nor did it capture his heart.
- Based on the video evidence of Mr. Dziekanski rolling on the floor and the testimony of Cst. Millington that he heard a loud noise from the weapon during the third deployment, it is highly likely, with a high probability of scientific and engineering confidence, that the second

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<sup>262</sup> Dr. Panescu acknowledged that he is an independent medical consultant to TASER International, Inc. In 2008 he invoiced TASER more than \$92,000 for expert consulting work, including preparing reports and depositions, and speaking engagements.

and third weapon deployments did not induce ventricular fibrillation in, nor could they capture, Mr. Dziekanski's heart.

- The weapon's pulses delivered on Mr. Dziekanski's shoulder area in push-stun mode could not have had the strength to induce ventricular fibrillation or to capture his heart.
- Given Mr. Dziekanski's body mass index, and an estimated minimum skin-heart distance of about 31.1 mm, it is highly likely that his body geometry further protected his heart by attenuating the electrical current delivered by all five weapon discharges.
- A significant body of peer-reviewed literature has proved that the concept of delayed ventricular fibrillation does not have scientific merit; Mr. Dziekanski did not experience this.
- With a high degree of scientific certitude, Mr. Dziekanski's death was not caused or contributed to by the use of the conducted energy weapon.

After reviewing the reports and transcripts of Drs. Tseng, Chambers, and Kerr, Dr. Panescu provided a second written report (Exhibit 174). His disagreements with their findings and conclusions included the following:

- *Dr. Tseng* – the autopsy report did not substantiate full penetration of the dart electrodes through Mr. Dziekanski's skin. It was not established that the vector of the probes was along the cardiac axis. Dr. Tseng's entire report is flawed because it was based on the wrong skin-heart distance requirements for direct electrical induction of ventricular arrhythmias. Although Dr. Tseng credited the conducted energy weapon for the adverse physiological effects that triggered a sustained ventricular tachycardia, he failed to mention that if other restraining measures had been employed (e.g., baton or pepper spray), the end result would have been the same or worse. He also ignored the fact that the second through fifth weapon discharges were in open circuit, and were not continuous. While Dr. Tseng cited his own study, he failed to mention other studies that confirm a significant decrease in in-custody sudden deaths after introduction of TASER conducted energy weapons. Finally, he speculated without any evidence that without exposure to conducted energy weapon discharges, Mr. Dziekanski would not have died.
- *Dr. Chambers* – after citing the conducted energy weapon for contributing to the death because of the extreme pain and resulting stress, Dr. Chambers should have discussed the comparative potential effects that batons, pepper spray, or other restraining devices would

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

have had. The actual effective current delivery of the weapon was much shorter than Dr. Chambers' stated 49 seconds,<sup>263</sup> and the third to fifth discharges could not have produced the stress that Dr. Chambers was presuming in constructing his opinion.

- *Dr. Kerr* – he made an unqualified implication that TASER conducted energy weapons may cause ventricular arrhythmias during the vulnerable period of the cardiac electrical cycle, when such an assertion was not applicable, given the specific facts of this case. He failed to compare the alleged TASER X26 exacerbated hyperadrenergic state to the potential effects of other restraining means, such as hog-tying, batons, and pepper spray. Finally, he speculated on the possible direct induction of ventricular arrhythmias by the TASER X26.

## H. FINDINGS OF FACT AND CONCLUSIONS

### 1. Introduction

Before making any findings of fact or reaching any conclusions respecting cause of death, I gave careful consideration to the written and oral closing submissions of counsel for the participants.

There appeared to be general consensus among the medical experts that Mr. Dziekanski suffered an electrical death, which I understand to mean that he experienced a fatal cardiac arrhythmia that caused cardiac arrest. The process by which that fatal arrhythmia developed, and when it developed, was the subject of considerable debate and disagreement among the experts.

### 2. Determining the time of Mr. Dziekanski's death

We know that at approximately 1:45 a.m., when the basic life support paramedics attached the automated external defibrillator to Mr. Dziekanski, they obtained a "no shock advised" reading, which told them that his heart was not shockable. We also know that about two minutes earlier (1:43 a.m.), the Richmond firefighters determined that Mr. Dziekanski was not breathing and did not have a pulse. I

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<sup>263</sup> Dr. Panescu's reference was incorrect. Dr. Chambers did not testify that the effective current delivery was 49 seconds, but only that the weapon was deployed for a total of 31 seconds over a period of 49 seconds.

interpret that to mean that at that time his heart was stopped, and necessarily must have stopped at some earlier time.

It is important to determine, as best we can, when Mr. Dziekanski died, because that will assist in drawing conclusions respecting the most likely cause of his death. During the evidentiary hearings, a great deal of evidence was led about the chronology of events at the Airport after the arrival of the four RCMP officers. This included radio communications among Airport personnel; E-Comm, BC Ambulance Service, and RCMP radio dispatches; Airport closed-circuit videos; and the Pritchard video. All these sources of information recorded the time of specific events or, in the case of the videos, recorded either the clock time or the number of minutes and seconds from when the video equipment began recording images.

I am indebted to counsel for the Vancouver Airport Authority for combining these various sources of information into one chronology and synchronizing the different timing systems. The most significant events in this chronology are set out below (shown as minutes and seconds after 1:00 a.m., on October 4, 2007).

**TABLE 1: Chronology of events (shown as minutes and seconds after 1:00 a.m.)**

Minutes	Seconds	Event
28	33	First contact between RCMP and Mr. Dziekanski. Cst. Bentley says: "How are you, sir? What's going on, bud?"
28	59	Beginning of first conducted energy weapon discharge, which lasted for six seconds (probe mode)
29	07	Beginning of second conducted energy weapon discharge, which lasted for five seconds (probe mode)
29	14	First RCMP officer attempts to restrain Mr. Dziekanski
29	23	Cpl. Robinson says to Cst. Millington: "Hit him again, hit him again."
29	24	Beginning of third conducted energy weapon discharge, which lasted for five seconds (probe mode)
29	34	Beginning of fourth conducted energy weapon discharge, which lasted for nine seconds (push-stun mode)
29	44	Beginning of fifth conducted energy weapon discharge, which lasted for six seconds (push-stun mode)
30	15	The handcuffs have been placed on Mr. Dziekanski

PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

Minutes	Seconds	Event
30	39	Mr. Dziekanski appears to cease struggling or moving
31	05	Cst. Bentley radios for an ambulance – routine response
31	29	Cst. Bentley radios again, requesting that the ambulance be upgraded to Code 3, after seeing that Mr. Dziekanski's face had turned blue
32	53	Mr. Enchelmaier kneels down, takes Mr. Dziekanski's carotid pulse for seven seconds, then stands up and moves away
42	09	Richmond Fire-Rescue arrives in the International Reception Lounge
43	57	Basic life support paramedics arrive curbside

Two contradictory scenarios emerge from the evidence. The “continued breathing” scenario postulates that Mr. Dziekanski was last observed breathing about two minutes before the Richmond firefighters arrived (they arrived at 42:09), which means that he continued to breathe for at least 10 minutes after the time that the handcuffs were applied (30:15).

The “cyanosis” scenario postulates that the evidence of Mr. Dziekanski's face being blue at 31:29 means that this cyanotic condition (i.e., inadequate oxygenation of the blood) must have been developing for some time (either directly or as a result of respiratory failure), most likely because of cardiac failure. This would mean that Mr. Dziekanski's heart stopped pumping during the preceding 50 seconds, after he ceased struggling (30:39) and before his face turned blue (31:29).

From my review of the evidence, I have concluded that the “cyanosis scenario” outlined above is the more likely sequence of events and that, consequently, Mr. Dziekanski most likely died some time between when he ceased moving (at 30:39) and when his face was observed to be blue (at 31:29). That means that he died at most 75 seconds after he was handcuffed, and at most two minutes after the completion of the third probe-mode deployment of the conducted energy weapon. I have reached this conclusion for the following reasons.

First, there is indisputable evidence that Mr. Dziekanski's face had turned blue by 31:29. Cst. Bentley testified that he saw this, recognized that they now were dealing with a medical emergency and, for that reason, called RCMP dispatch with a request

that the ambulance he had asked for 24 seconds earlier be upgraded to Code 3. Although Cst. Bentley did not remember saying anything to any of the other officers about this, Cst. Millington confirmed in his testimony that Cst. Bentley told him that he had upgraded the ambulance to Code 3 because he had seen Mr. Dziekanski turn blue. Cpl. Robinson also testified that he was aware that Mr. Dziekanski had turned blue, although he said it was his ear, not his face. Three civilian witnesses also testified that they saw Mr. Dziekanski turn blue:

- Alison Kula saw his hands go very dark purple and then very blue 30 seconds after he was handcuffed,
- Genevieve Deziel saw his face and hands turn blue within a minute of being handcuffed, and
- Lance Rudek saw his hands look a little reddish or bluish, after he was handcuffed.

Second, turning blue (i.e., cyanosis) is a sign of inadequate circulation of oxygenated blood and is recognized as a medical emergency. Dr. Lee, the pathologist who performed the autopsy, testified that turning blue is an indication that the person is in cardiac arrest or close to it. Dr. Chambers testified that there must have been significant pump failure before the cyanosis was visible.

Third, I accept Dr. Chambers' testimony that the logical sequence of events would be for a person to first develop an arrhythmia, then go unconscious, and then become cyanotic. He added, "This is as opposed to the alternative order of going unconscious then developing an arrhythmia. It is difficult to understand, in the absence of a blow to the head or a seizure, why a prone person, with a good carotid pulse, would go unconscious."<sup>264</sup> Dr. Lee testified to the same effect, that it would be speculative to say that Mr. Dziekanski stopped breathing before his heart stopped.

Fourth, the "cyanosis" scenario means that Mr. Dziekanski died at most 75 seconds after an intense period of weapon discharges and physical struggling with three police officers, whereas the "continued breathing" scenario means that Mr. Dziekanski lay undisturbed (unconscious and breathing well) for at least 10 minutes after the

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<sup>264</sup> Exhibit 148, pp. 7-8.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

handcuffs were applied and then, for no apparent reason, went into cardiac arrest during the ensuing 2-3 minutes. Something must have triggered the cardiac arrest. For the reasons I will discuss in more detail when exploring the most likely cause of death, I am satisfied that cardiac arrest proximate in time to intensely stressful activities is more plausible than cardiac arrest after 10 minutes of undisturbed rest.

Fifth, the “continued breathing” scenario is principally dependent on the testimony of Trevor Enchelmaier, the Securiguard shift manager, whose evidence I summarized in Part 5. He testified that he took Mr. Dziekanski’s carotid pulse three times, that he spent 10-30 seconds taking each pulse, and that the pulses were, in order, very strong and fast, strong but slower, and clear and slow. The Pritchard video shows Mr. Enchelmaier taking Mr. Dziekanski’s carotid pulse once, for seven seconds. Several other witnesses testified that they saw a man in a suit (who I infer to be Mr. Enchelmaier) take Mr. Dziekanski’s pulse once. Several aspects of Mr. Enchelmaier’s testimony cause me to question the accuracy of his recollection – his overestimation of the time he spent taking Mr. Dziekanski’s pulse each time, and the fact that he was not aware that Mr. Dziekanski was cyanotic until after the paramedics arrived. Also, I accept the testimony of several medical experts that it is doubtful that taking a pulse for seven seconds would enable a person with Mr. Enchelmaier’s qualifications to provide the precise descriptions of each pulse that he did.

Sixth, the other evidence of Mr. Dziekanski’s continued breathing is unpersuasive:

- Cst. Rundel testified that Mr. Dziekanski was breathing heavily soon after the handcuffs were applied, but he then left the scene to get hobbles from his car. After he returned, and about two minutes before the Richmond firefighters arrived, he knelt down near Mr. Dziekanski and heard him breathing and snoring.
- Cst. Bentley testified that Mr. Dziekanski’s breathing was laboured around the time he went unconscious and turned blue, and realized that he might need cardiopulmonary resuscitation. He left the scene soon thereafter to retrieve a camera from his vehicle and did not monitor Mr. Dziekanski after that time.

- Cst. Millington testified that he did not check Mr. Dziekanski's pulse or breathing or check for airway obstruction, and he did not observe Cst. Rundel or Cst. Bentley do so. He asked Cpl. Robinson if Mr. Dziekanski was breathing, and Cpl. Robinson said, "Yes." Prior to the arrival of the Richmond firefighters, he did not observe anyone else check Mr. Dziekanski for pulse, breathing, or airway obstruction.
- Cpl. Robinson testified that he constantly monitored Mr. Dziekanski's breathing until the Richmond firefighters arrived. He did this by placing his hand on Mr. Dziekanski's chest, observing his mouth for breathing and placing his head close to Mr. Dziekanski's head so he could hear his breathing. Initially he heard what he thought was snoring, which alerted him to the fact that Mr. Dziekanski was unconscious. He said that he also checked Mr. Dziekanski's carotid pulse a couple of times, after Mr. Enchelmaier did so. The second Pritchard video shows Cpl. Robinson kneeling behind and leaning over Mr. Dziekanski's upper body soon after the handcuffs were applied, until the end of that video. The third Pritchard video shows Cpl. Robinson in a similar position, bending over Mr. Dziekanski in a manner consistent with checking for breathing, until Mr. Enchelmaier moves in and takes Mr. Dziekanski's pulse (at 32:53). After Mr. Enchelmaier moves away, Cpl. Robinson leans over Mr. Dziekanski again, in a similar fashion as before. There is no video record of the ensuing nine minutes, when the Richmond firefighters arrived. All three firefighters testified that when they entered the International Reception Lounge, no one was monitoring Mr. Dziekanski.

It appears that Cpl. Robinson did check Mr. Dziekanski's breathing initially, immediately prior to and shortly after Mr. Enchelmaier's intervention. I accept the evidence of the three firefighters that when they arrived no one was monitoring Mr. Dziekanski. Although Cpl. Robinson testified that he constantly monitored Mr. Dziekanski's breathing until the firefighters arrived, the evidence of the firefighters contradicts that, and in any event, Cpl. Robinson did not offer any detailed description of Mr. Dziekanski's breathing pattern or whether it changed over time. Cpl. Robinson's testimony implies that Mr. Dziekanski was breathing when the firefighters arrived, yet their initial assessment a minute later showed that he was not breathing.

Having regard to all the circumstances, I can place little reliance on the testimony of Cpl. Robinson that he constantly monitored Mr. Dziekanski's breathing until the

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

firefighters arrived. Similarly, I find unpersuasive the testimony of Cst. Rundel that about two minutes before the Richmond firefighters arrived, he knelt down near Mr. Dziekanski and heard him breathing and snoring.

For all these reasons, I am satisfied that Mr. Dziekanski went into cardiac arrest first, then went unconscious, and finally showed signs of cyanosis, all within 75 seconds of being handcuffed.

### 3. Determining the cause of Mr. Dziekanski's death

The autopsy did not disclose an anatomical or toxicological cause of death. That rules out, for example, a chronic potentially immediately fatal medical condition, a blunt trauma, or an internal injury. Dr. Lee, the pathologist who performed the autopsy, described Mr. Dziekanski as reasonably healthy.

Given the autopsy findings, we will never know with absolute certainty what caused Mr. Dziekanski's death. In these circumstances, the best we can do is draw inferences from the known facts and reach conclusions about the most likely cause of death.

As noted earlier, there appeared to be general consensus among the medical experts that Mr. Dziekanski suffered an electrical death, which I understand to mean that he experienced a fatal cardiac arrhythmia that caused cardiac arrest. What I will now explore is the most likely mechanism that led to that tragic result. During our evidentiary hearings, the medical experts offered several different alternatives.

#### *a. Pre-existing heart disease plus accumulated stress*

Earlier in this report, I documented that, notwithstanding Mr. Dziekanski's excitement about immigrating to Canada, he was afraid of flying. He had rescheduled his flight once, and might have cancelled the trip entirely except for his mother's phone conversation with him shortly before his departure. His holding onto a heat radiator in the apartment, and his shaking and dizziness, suggest that at times he was in a panicky state. However, once he left for the airport he settled down, and his behaviour on both flights appears to have been uneventful.

By the time Mr. Dziekanski reached Vancouver, he was fatigued, confused, stressed, sweaty, and disheveled. Not finding his mother waiting for him at the baggage carousels, having no experience with international travel, and speaking neither of Canada's official languages undoubtedly compounded his stress and confusion. His disappearance from the Customs Hall video cameras for more than five hours remains unexplained, yet his subsequent dealings with Canada Border Security Agency officers were adequate for him to be processed for entry as an immigrant. Mr. Pritchard's video of Mr. Dziekanski in the International Reception Lounge shows a confused and distraught man, breaking a folding table and a computer and arranging his luggage in an apparent desire to form a barricade.

It was suggested that Mr. Dziekanski's accumulated stress and agitation could have triggered (before the arrival of the RCMP officers) a hyperadrenergic effect, whereby his system was flooded with adrenaline and catecholamines, and that this reaction, coupled with his pre-existing medical condition, could have overwhelmed his heart, leading to cardiac arrest. While I am satisfied that the hyperadrenergic effect (which I will discuss in more detail later) is crucial to an understanding of his death, I am not persuaded that the scenario I have described above adequately explains his death, for several reasons.

First, I am not convinced that Mr. Dziekanski had alcohol cardiomyopathy. While Dr. Lee observed dilated ventricles during the autopsy, which given his other observations (of cerebellar atrophy and fatty liver) were indicative of chronic alcoholism, his microscopic examination of sections of the heart did not confirm cardiomyopathy. He testified that this was, at most, a "finding," and it did not in his opinion cause or contribute to his death. Neither Dr. Pollanen nor Dr. Butt were prepared to say that Mr. Dziekanski had cardiomyopathy, and Dr. Kerr testified that he had, at most, very mild cardiomyopathy.

Second, I am not persuaded that Mr. Dziekanski was experiencing alcohol withdrawal after his arrival in Vancouver. While Dr. Sloane said that the evidence he reviewed was consistent with such a finding, Drs. Lee, Pollanen, Chambers, and Butt disagreed.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

Third, while none of the medical experts suggested that Mr. Dziekanski was experiencing delirium tremens, one psychiatrist (Dr. Lu) expressed the opinion that he was in a state of agitated delirium, while another psychiatrist (Dr. Janke) disagreed, based on the evidence available. On this issue, having regard to the Pritchard video and the other evidence I heard, I find Dr. Janke's analysis and opinion more persuasive.

Fourth, and most importantly, these accumulated stresses and any pre-existing medical conditions did not cause, on their own, a fatal arrhythmia. When the four RCMP officers arrived, Mr. Dziekanski was unquestionably upset, but he recognized them as police officers, engaged with them, and cooperated with their request for identification.

### *b. Weapon-induced direct capture of Mr. Dziekanski's heart*

It is not in dispute that an externally originating electrical current can capture a person's heart, which can sometimes result in ventricular fibrillation, in which the ventricles beat chaotically at about 300 beats per minute. Blood is not pumped throughout the body, the person inevitably collapses into unconsciousness within 5-15 seconds, and if the heart is not defibrillated within a few minutes, the person will die.

In recent years an intense debate has developed respecting whether the electrical current from a conducted energy weapon can trigger ventricular fibrillation. At our evidentiary hearings, several medical experts testified that no human volunteer studies have documented this phenomenon. To the contrary, other medical experts cited anecdotal cases and extrapolated from animal studies where anesthetized swine went into ventricular fibrillation under certain conditions. It is fair to say that if capture of the heart and ventricular fibrillation can result from a conducted energy weapon's electrical current, three preconditions are likely necessary – deployment in probe-mode, placement of the two probes across the cardiac axis, and a relatively small skin-to-heart distance.

A recent study by Dr. Swerdlow (who testified at our evidentiary hearings) included a significant finding that supports the proposition that the electrical current from a conducted energy weapon is capable of capturing the heart and triggering ventricular fibrillation. He determined that one out of 56 subjects collapsed immediately after a conducted energy weapon was deployed across his chest, and the first cardiac rhythm presented was ventricular fibrillation. The subject had no drugs or cardiac pathology. In relation to this subject, Dr. Swerdlow stated:

The time sequence and electrode location are both consistent with electrically induced VF [ventricular fibrillation] in one subject (subject 1), and neither drug use nor cardiac disease provides alternative explanations. To the best of our knowledge, this is the first reported fatality suggestive of CEW-induced VF.<sup>265</sup>

For the purposes of my analysis, I will assume that the electrical current from a conducted energy weapon is capable of triggering ventricular fibrillation. The question I must address in this case is whether it in fact did so, leading to Mr. Dziekanski's death. From my consideration of all the relevant evidence, I have concluded that it is unlikely to have happened in this case, for the following reasons.

First, the only relevant deployments of the conducted energy weapon were the probe-mode deployments, and the time between the completion of the third and final probe-mode deployment (29:29) and Mr. Dziekanski's collapse into unconsciousness (at about 30:39 or thereafter) is too long a time period. The medical experts consistently told me that collapse into unconsciousness occurs within 5-15 seconds.

Second, it is not clear whether the placement of the two probes was across the cardiac axis. Although Dr. Lee concluded that a punctate abrasion on the midline of the chest, just below the sternum, was likely from one probe, there was no similar punctate abrasion from which one could determine whether they were on a cardiac axis. A mark on the side of the abdomen above the hip bone might have been caused by the probe, but even if it was, the evidence overall suggests that the second probe embedded in Mr. Dziekanski's shirt rather than his skin, which means that the axis

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<sup>265</sup> Swerdlow, Charles, *et al.*, "Presenting Rhythm in Sudden Deaths Temporally Proximate to Discharge of TASER Conducted Electrical Weapons," (2009) 16 *Academic Emergency Medicine*, 1 at p. 8.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

between the two probes would vary each time the untucked shirt flapped against his skin.

Third, even if the placement of the probes was across the cardiac axis, it is not known how deeply the one below the sternum embedded into his chest (if at all) or what the distance was between the tip of this probe and Mr. Dziekanski's heart. Thus, we are not able to calculate whether that distance was small enough for the electrical current to capture the heart.

On a related issue, several medical experts suggested that the weapon's electrical current might have triggered ventricular tachycardia that transitioned into ventricular fibrillation and then asystole. For example, Dr. Kerr said that it is possible that the weapon discharge could have directly induced ventricular arrhythmias, given that one of the probes appeared to be on the anterior chest, quite close to the heart. The discharges could have induced ventricular tachycardia that subsequently contributed to loss of adequate circulation, then transitioned to ventricular fibrillation and then asystole. Dr. Tseng said that even if there was no direct capture of the heart, the adverse physiological effects from the weapon discharges could have triggered a sustained ventricular tachycardia, which, because of Mr. Dziekanski's alcoholic cardiomyopathy, could have resulted in hemodynamic instability and collapse, followed by degeneration into ventricular fibrillation and asystole.

While this is an interesting hypothetical possibility, I think it unlikely to have been the mechanism of death in this case, having regard to the uncertain evidence respecting whether the two weapon probes vectored the heart and respecting whether Mr. Dziekanski had cardiomyopathy.

### *c. "Sudden death during restraint" and/or "excited delirium"*

Several medical experts testified about a phenomenon whereby a person exhibiting bizarre behaviour will sometimes die soon after being restrained, for no apparent reason. Typically, such a person will act irrationally, will be unaware of their surroundings, will not be capable of complying with demands, will be hyperthermic,

will often disrobe in public, will be impervious to pain, and will exhibit superhuman strength. Almost always, they will be intoxicated with an illicit stimulant such as cocaine and will have a history of serious mental illness. The medical experts indicated that the mechanisms of such deaths are not well understood, and that the terms "sudden death during restraint" and "excited delirium" have been coined as a way of clustering such similar deaths for future research purposes.

In my view, neither term is of much assistance in attempting to ascertain how Mr. Dziekanski died. They are at best descriptive of the cluster of physical symptoms and actions that often surround such deaths, but do not provide any insight into the mechanism of such deaths. For example, ascribing a death to "sudden death during restraint" gives no greater insight into the underlying medical cause of death than would "sudden death during a car accident." The same can be said for "excited delirium." It may be a convenient label to cluster frequently recurring physical conditions and activities, but offers no guidance as to the underlying physiological mechanisms that caused the death.

In addition, I do not think that either of these postulated conditions have any application to this case, since Mr. Dziekanski was aware of his surroundings, complied with directions, was neither impervious to pain nor intoxicated with an illicit drug such as cocaine, and had no history of serious mental illness.

*d. The hyperadrenergic state arising from the weapon deployment and physical altercation*

Since the stress and fatigue that accumulated before, during, and after Mr. Dziekanski's trip to Canada, and any pre-existing medical condition, did not collectively trigger his cardiac arrest, the logical question that must be asked is whether his subsequent interaction with the four RCMP officers did. By "interaction," I am referring to the multiple deployments of the conducted energy weapon and the physical wrestling that culminated in Mr. Dziekanski being handcuffed.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

According to the chronology set out earlier, the first weapon deployment commenced at 28:59, he was handcuffed by approximately 30:15, and he stopped struggling by 30:39 (by which time, I have concluded, he went into cardiac arrest). To put it simply, the interaction with the officers took 75 seconds, and he likely went into cardiac arrest within the next 25 seconds.

Many of the medical experts discussed the hyperadrenergic effect, either in their written reports or their testimony, or both. After reviewing their evidence, I concluded that there was a refreshing degree of consensus that the hyperadrenergic effect plays a pivotal role in our understanding of how Mr. Dziekanski died. I will briefly summarize what they told me:

- *Dr. Lee* – said that in these types of cases, the adrenergic response is believed to be the mechanism of death – i.e., the adrenaline that flows through the body whenever the body is in a stressful or dangerous situation, and pain can increase the adrenergic response. This out-flowing of adrenaline increases blood pressure and heart rate, which can potentially lead to an arrhythmia.
- *Dr. Di Maio* – said that the mechanism precipitating the fatal arrhythmia was most likely a hyperadrenergic state due to elevated levels of catecholamines produced by autonomic hyperactivity, psychomotor agitation, anxiety, and the struggle.
- *Dr. Pollanen* – said that if the excited delirium/prone-position restraint concept is accepted as an explanation for the death, then any co-factor that increases agitation or induces additional stress should exacerbate the mechanisms leading to death.
- *Dr. Butt* – agreed with the suggestion that Mr. Dziekanski's state of agitation, the fact that the conducted energy weapon had been deployed against him, and being wrestled with and struggling on the ground were all triggering causes of death in the sense that they increased his heart and respiration rates, adding to his stress and causing the release of adrenaline. Absent the weapon and physical restraint, Mr. Dziekanski would have survived.
- *Dr. Swerdlow* – said that both sympathetic nervous stimulation and stress-related hormones (catecholamines) could directly affect the heart. They can make the heart beat faster, and in vulnerable individuals they can cause ventricular tachycardia and fibrillation. He agreed that any stressful situation can increase sympathetic nervous

system activity, and it is reasonable to assume that a physical confrontation with law enforcement may produce a hyperadrenergic state. In his view, it was reasonable to postulate that Mr. Dziekanski had a hyperadrenergic state during (and prior to) his confrontation with the RCMP. However, neither postulate could be proved, nor was it possible to determine the relative contributions of the conducted energy weapon discharges and the other factors to this hyperadrenergic state.

- *Dr. Kerr* – said that in a “fight or flight” situation, the brain stimulation results in adrenaline surging directly down the sympathetic nervous system. In addition, hormones in the bloodstream (i.e., catecholamines) act on those nerve fibres in the heart and directly on the cells of the heart. In cases of very intense stimulation, the adrenergic state gets progressively higher and starts to push the heart to tremendous degrees. The recipient of a conducted energy weapon discharge is getting an intensely painful stimulation. There would be no question that the level of sympathetic stimulation in this case would have been astronomically high, and it would stimulate the heart to beat excessively rapidly. It is hard to escape the conclusion that the weapon applications contributed as a major cause of Mr. Dziekanski’s death.
- *Dr. Tseng* – agreed that one of the theories of how “sudden death during restraint” occurs is that stress from a heightened adrenergic state causes an arrhythmia of the heart. Any deployment of a conducted energy weapon, whether in probe or push-stun mode, would create intense pain, which itself would lead to an increased adrenaline state.
- *Dr. Sloane* – said that Mr. Dziekanski was alert, but confused and sweaty. He appeared to be in a state of agitated delirium, which could be consistent with or exacerbated by a state of alcohol withdrawal. In such a state, one would expect him to be in a state of adrenergic excess, which could increase the likelihood of him suffering from the sudden in-custody death syndrome.
- *Dr. Ho* – agreed with Dr. Lee that Mr. Dziekanski’s sudden death during restraint was likely due to a variety of factors, including his underlying disease processes secondary to alcohol abuse and his volitionally elevated state of metabolic demand.
- *Dr. Lu* – said that Mr. Dziekanski’s laboured breathing is often a sign either of dehydration or autonomic instability, the latter of which refers to physiological changes in the body where there is increased heart rate, blood pressure, and respiratory rate. He agreed with Dr. Kerr’s opinions respecting a hyperadrenergic state.

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

- *Dr. Chambers* – said that Mr. Dziekanski was, because of stress and exhaustion, in a hyperadrenergic state even before his interaction with the RCMP officers. The mechanisms by which the stress of physical restraint can trigger sudden death involve activation of the “fight or flight” response. Adrenaline, cortisol, noradrenaline, and other neurohormones are released, causing increases in blood pressure, the heart rate, the metabolic rate, and blood sugar. The heart becomes more vulnerable to fatal cardiac arrhythmias. This mechanism would also apply to the response to stress caused by deployment of a conducted energy weapon, driven by the extreme pain and muscle feedback to the brain via spinal cord pathways due to effects of repeated discharges. The associated anxiety from the weapon discharges and the immobility would certainly have caused a severe “fight or flight” response.

There is another dimension to this hyperadrenergic effect – acidosis – that should be considered. In his written report, Dr. Swerdlow concluded that several factors probably contributed to Mr. Dziekanski’s cardiac arrest, including respiratory acidosis and possibly metabolic acidosis. In his testimony, he explained that respiratory acidosis develops when metabolic activity results in a build-up of carbon dioxide, but the body is unable to exhale it because of a cessation of breathing. The carbon dioxide builds up in the blood as carbonic acid, and cellular mechanisms, including cardiac contraction, work less well and the subject can die.

In the case of metabolic acidosis, lactic acid is generated when muscles work very hard and do not get sufficient oxygen transported to them. Normally a body gets rid of lactic acid by transporting it to the liver, where it is converted into carbonic acid, which is the acid that the lungs can then breathe out as carbon dioxide. However, if the person has liver disease, it will take longer for the liver to convert the lactic acid to carbonic acid. In addition, if the person is not breathing well, the potential for being acidotic is greater.

Dr. Ho said that Mr. Dziekanski’s underlying condition of metabolic acidosis should not be underestimated – this condition is known to be an associated risk for a sudden death event. He added that the evidence of Mr. Dziekanski being agitated and showing signs of exertion is consistent with his own recent research that found 45 seconds of vigorous exertion is enough to make a person really ill from a metabolic

acidosis standpoint. The heart, which initially beats very fast to compensate for the acidosis, eventually slows down and then heart function stops, with a presenting rhythm of asystole or pulseless electrical activity.

Having regard to all the evidence, I am satisfied that the hyperadrenergic response, which was significantly exacerbated by Mr. Dziekanski's interaction with the RCMP officers, is the most likely cause of Mr. Dziekanski's death. It may be that acidosis played a part as well.

Mr. Dziekanski's interaction with the RCMP consisted of the multiple deployments of the conducted energy weapon and the physical altercation on the floor that culminated in Mr. Dziekanski being handcuffed. While there was consensus among the medical experts that the physical altercation exacerbated the hyperadrenergic response, several medical experts did not agree that the conducted energy weapon was a contributing factor. For example:

- *Dr. Di Maio* said that there was no evidence that the weapon caused the death, but he appears to have limited his analysis to direct capture of the heart by electrocution.
- *Dr. Swerdlow* was more equivocal. He stated that the postulated hyperadrenergic state could not be proved, and in any event it is not possible to determine the relative contributions of the weapon discharge and other factors (e.g., the physical altercation) to the hyperadrenergic state, or to determine the relationship between that state and the mechanism of death. I accept that this hyperadrenergic state cannot be proved, but I stated earlier that it is not possible in this case to determine the cause of Mr. Dziekanski's death with an absolute certainty. Given the negative autopsy findings, we are left to draw inferences from the evidence we do have and develop a logical rationale for the most likely cause of death.
- *Dr. Ho* said, in his concluding opinion that to a reasonable degree of medical certainty or probability, the conducted energy weapon did not cause or contribute to Mr. Dziekanski's death. However, in the body of his report he repeatedly referred to Mr. Dziekanski's medical conditions and activities that placed him at significant risk for sudden cardiac death, and then added that all of these "were independent of the application of the [conducted energy weapon]." In my view, whether any one of those medical conditions or activities could have, standing alone, caused a fatal cardiac arrhythmia misses the point. The fact is

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

that none of them had, prior to the intervention of the four RCMP officers, triggered a fatal arrhythmia, and yet within 25 seconds of the weapon discharges and physical altercation, he had gone into cardiac arrest. It is singularly unhelpful, in such circumstances, to suggest that the physical altercation could have caused the death independent of the conducted energy weapon, thereby avoiding the obvious question, "Did the conducted energy weapon contribute to the death as well?"

In my view, it would defy common sense to conclude from all the evidence that the physical altercation exacerbated the hyperadrenergic state that led to Mr. Dziekanski's fatal cardiac arrhythmia, but that the multiple deployments of the conducted energy weapon played no part. To the extent that Dr. Ho did so, I do not accept his evidence. It is beyond dispute that a single five-second deployment of the weapon causes intense, extreme pain, as well as emotional trauma. Multiple deployments, even if intermittent, must compound that pain and trauma.

In my view, it would be insulting to the intelligence of any objective and thoughtful person who sat through our evidentiary hearings and viewed the Pritchard video to baldly assert that the physical altercation, but not the multiple deployments of the conducted energy weapon, was responsible for the hyperadrenergic state that led to Mr. Dziekanski's fatal cardiac arrhythmia.

The final issue to address is whether it is possible to articulate how much the weapon and the physical altercation contributed to Mr. Dziekanski's death. My understanding of the medical evidence is that a variety of elements can combine to produce this type of fatal hyperadrenergic state, including physical pain, emotional stress, fear, physical struggling, and exhaustion.

The Pritchard video is a valuable source of information about the effect that the weapon and the physical altercation had on Mr. Dziekanski. Any objective viewer will shudder at his screams of agony when the weapon was first deployed and when, during the second deployment, he "turtled" around in a circle on the floor, clutching his chest and groaning – all this before the officers moved in and initiated physical contact. Mr. Dziekanski's sounds were more muted during the physical altercation,

but there is no question that having his arms brought behind his back and being handcuffed was an enormous exertion for Mr. Dziekanski.

Dr. Chambers said that the Pritchard video assisted him in assessing the relative impact of physical restraint and the conducted energy weapon in contributing to Mr. Dziekanski's electrical death. In his view, the weapon had a far more violent effect. His outward response to physical restraint appears to be significantly less violent and reactive. To a similar effect, Dr. Kerr said that it is hard to escape the conclusion that the conducted energy weapon applications contributed as a major cause of Mr. Dziekanski's death.

The evidence does not allow me to conclude, with mathematical exactitude, how much the weapon and the physical altercation contributed to the hyperadrenergic state that led, ultimately, to Mr. Dziekanski's death. Unquestionably, they both contributed substantially to that tragic result. However, I consider it to be a reasonable inference to be drawn from all the evidence that the multiple deployments of the conducted energy weapon played a more prominent role.

#### **4. Concluding comment**

This part of the report has been, of necessity, a detailed forensic examination of the medical conditions and/or mechanisms that most likely caused Mr. Dziekanski's untimely and unnecessary death. While ascertaining the medical cause of Mr. Dziekanski's death may satisfy the intellect, there is a human dimension to this story that ought not to be ignored.

It is a story of high hopes, new beginnings, dashed dreams, and tragic loss. What did Mr. Dziekanski think and feel during the last minutes of his life? His last recorded words, "Have you lost your minds?" or "Have you gone insane? Why?" spoken as Cst. Millington was deploying what looked like a pistol against him, convey a sense of incredulity, fear, and panic at the prospect of being shot.

When the details of Mr. Dziekanski's last minutes first came to light, many people asked, "Why did this have to happen?" Although we now know much more about what

## PART 7: THE CAUSE OF MR. DZIEKANSKI'S DEATH

happened and about the medical mechanism leading to his death, that haunting pivotal question still remains, "Why?"