



IN THE CORONERS COURT
OF VICTORIA
AT MELBOURNE

Court Reference: COR 2018 003723

FINDING INTO DEATH WITHOUT INQUEST

Form 38 Rule 63(2)

Section 67 of the Coroners Act 2008

Findings of:	Coroner Paresa Antoniadis Spanos
Deceased:	PT
Date of birth:	13 September 1971
Date of death:	28 July 2018
Cause of death:	1(a) Haemopericardium complicating aortic dissection
Place of death:	Sunshine Hospital, 176 Furlong Road, St Albans, Victoria, 3021

INTRODUCTION

1. On 28 July 2018, PT was 46 years old when he died at Sunshine Hospital. At the time of his death, PT lived in Craigieburn.
2. PT had a medical history of untreated hypertension. He had smoked about a packet of cigarettes a day for the past 15 years and used methamphetamine about every second day but had abstained from using that or any other drugs in the two to three weeks immediately preceding his death.

THE CORONIAL INVESTIGATION

3. PT's death was reported to the Coroner as it fell within the definition of a reportable death in the *Coroners Act 2008* (the Act). Reportable deaths include deaths that are unexpected, unnatural or violent or result from accident or injury. In PT's case, his death was unexpected.
4. The role of a coroner is to independently investigate reportable deaths to establish, if possible, identity, medical cause of death, and surrounding circumstances. Surrounding circumstances are limited to events which are sufficiently proximate and causally related to the death. The purpose of a coronial investigation is to establish the facts, not to cast blame or determine criminal or civil liability.
5. Under the Act, coroners also have the important functions of helping to prevent deaths and promoting public health and safety and the administration of justice through the making of comments or recommendations in appropriate cases about any matter connected to the death under investigation.
6. This finding draws on the totality of the coronial investigation into the death of PT including his medical records, the e-medical deposition and statements from Western Health and a review by CPU clinicians. Whilst I have reviewed all the material, I will only refer to that which is directly relevant to my findings or necessary for narrative clarity. In the coronial jurisdiction, facts must be established on the balance of probabilities.¹

¹ Subject to the principles enunciated in *Briginshaw v Briginshaw* (1938) 60 CLR 336. The effect of this and similar authorities is that coroners should not make adverse findings against, or comments about, individuals unless the evidence provides a comfortable level of satisfaction as to those matters taking into account the consequences of such findings or comments.

MATTERS IN RELATION TO WHICH A FINDING MUST, IF POSSIBLE, BE MADE

Identity of the deceased

7. On 28 July 2018, PT, born 13 September 1971, was visually identified by his sister, PK who signed a formal Statement of Identification to this effect before a member of Victoria Police.
8. Identity is not in dispute and requires no further investigation.

Medical cause of death

9. Senior Forensic Pathologist Dr Matthew Lynch from the Victorian Institute of Forensic Medicine (VIFM), conducted a partial autopsy on 1 August 2018 and provided a written report of his findings dated 7 November 2018.
10. The post-mortem examination revealed several significant natural disease processes. There was evidence of 650mL of haemopericardium (blood within the sac encasing the heart) comprising liquid blood and clot. Evidence of aortic dissection with two lacerations was noted within the proximal ascending thoracic aorta. These extended to involve the aortic arch, descending thoracic and abdominal aortae and proximal right common iliac artery. A probe could be passed from the lacerations to communicate with the pericardial sac.
11. The haemopericardium resulted in cardiac tamponade.² There was also significant coronary artery disease with an 80% occlusion of the proximal left anterior descending coronary artery and the heart was markedly enlarged due to concentric left ventricular hypertrophy.
12. Microscopic examination of the heart showed interstitial and perivascular fibrosis, but no evidence of myofibre disarray (to suggest hypertrophic cardiomyopathy) or of abnormal fibrofatty infiltration (to suggest arrhythmogenic cardiomyopathy). Given the known history of hypertension (and changes noted in the kidneys), Dr Lynch considered that the cardiac enlargement was best categorised as hypertensive heart disease as opposed to idiopathic left ventricular hypertrophy.
13. Toxicological analysis of ante-mortem samples taken at about the time of PT's admission to hospital detected morphine. Post-mortem samples detected bisoprolol, lignocaine,

² Tamponade refers to the stoppage of the flow of blood to an organ or a part of the body by pressure, such as by a tampon or a pressure dressing applied to stop a haemorrhage or by the compression of a part by an accumulation of fluid, such as in cardiac tamponade.

ondansetron and paracetamol. The toxicology results were consistent with medical administration.

14. Post-mortem biochemistry revealed a slightly elevated C-reactive protein at 40.5mg/L (<5) and a troponin of 1139ng/L (<26), both of which are elevated. Dr Lynch noted that a troponin taken at 12:05am on 28 July 2018 was only mildly elevated (0.16ug/L)³. Renal function at this time was impaired with a urea of 9.3mmol/L⁴ and creatinine 220 umol/L.⁵
15. A post-mortem computed tomography scan showed haemopericardium, cardiomegaly, renal scarring and no intracranial haemorrhage.
16. Dr Lynch considered the contribution of cardiopulmonary resuscitation (**CPR**) to the autopsy findings, as CPR can result in haemopericardium. In this instance, no such damage was demonstrated. Rupture of the intrapericardial part of the ascending thoracic aorta is also theoretically possible but is rarely seen in Dr Lynch's experience. He commented that in this instance, the presence of intimal defects at the most common site for aortic dissection, with extension of the dissection to involve the aortic bifurcation, suggests a natural rather than iatrogenic process.
17. PT's history of amphetamine use was noted. Relevantly, no amphetamines were detected in antemortem or post-mortem samples. The possibility of more remote amphetamine use contributing to some of the myocardial fibrosis could not be excluded.
18. Dr Lynch explained that when aortic dissection occurs in older patients, it is typically in the setting of hypertension and marked atheroma (hypertension was present in this case). In younger patients, disorders of the connective tissue such as Marfan, Ehlers-Danlos and Loeys-Dietz syndrome warrant consideration. PT was relatively young, but he also had untreated hypertension and showed evidence of hypertensive heart disease and chronic renal disease.
19. Dr Lynch provided an opinion that the medical cause of death was 1 (a) Haemopericardium complicating aortic dissection and was due to natural causes.
20. I accept Dr Lynch's opinion.

³ Reference range <0.05.

⁴ Reference range 2.3 to 7.6).

⁵ Reference range 60-110.

Circumstances in which the death occurred

21. In the evening on 27 July 2018, PT woke from his sleep with chest pain that radiated to his jaw and back. An ambulance transported him to the Sunshine Hospital Emergency Department (**ED**). The ED clinicians were informed that PT's pain radiated to his back.
22. An echocardiogram (**ECG**) detected significant changes that clinicians thought represented a NSTEMI (a type of heart attack).⁶ PT also had a corresponding rise in his troponin levels.⁷ A chest x-ray revealed an enlarged heart and a bedside ECG did not show evidence of pericardial effusion. PT's blood pressure was measured in both arms.⁸
23. PT was admitted to the cardiology unit. In the admission notes, a junior doctor recorded PT had a history of sudden chest pain radiating to the jaw that woke him from sleep, with associated sweating and shortness of breath. This doctor's notes did not record that the pain radiated to the back. A history of three weeks of shortness of breath was also elicited.
24. The next day, cardiology registrar Dr Kunal Verma reviewed PT and recorded their impression as 'Cardiomyopathy⁹ to explain ECG, Not NSTEMI, ?seeking opioids'.
25. The treatment plan¹⁰ was to undertake a formal ECG to check PT's cardiac function and obtain a renal scan to determine the cause of his renal impairment. PT was commenced on diuretic medication, anti-hypertensive medication and an antacid. The opiate analgesia that had been prescribed for his chest pain earlier was ceased.
26. At the time, the working diagnosis was that PT's chest pain and troponin rise were due to an underlying cardiomyopathy. According to Dr Verma, he considered a pulmonary embolism as part of his differential diagnosis. However, he discounted this diagnosis on the basis¹¹ that PT was not hypoxic or tachycardic and had no strong risk factors. In addition, given PT's

⁶ Non-ST elevation myocardial infarction (heart attack). This is a form of myocardial infarction that does not produce the typical ECG changes of ST elevation seen in a full thickness infarction/damage of the heart wall.

⁷ Troponin is a protein found in the heart muscle. Its presence in the blood reflects damage to the heart muscle, with the level being proportionate to the severity.

⁸ A pulse or blood pressure difference is one of the cardinal signs of aortic dissection, however it only occurs in about 20% of patients with the condition.

⁹ This is a disease of the cardiac muscle that reduces the function of the heart. There are several types. It can cause heart failure as well as cause disturbance of the heart rhythm that may result in sudden death. Cardiomyopathy would not typically cause acute, sudden onset prolonged chest pain, but it may cause ECG changes. Methamphetamine and other stimulant use may cause myocardial fibrosis, which is effectively a form of cardiomyopathy.

¹⁰ PT's management plan was discussed with the supervising consultant during the morning round.

¹¹ Dr Verma also considered myocarditis.

poor renal function, Dr Verma felt that a contrast CT should be avoided. Accordingly, a CT pulmonary angiogram was not performed.

27. PT's chest pain did not abate and a cardiology covering resident reviewed him at 2:30pm on 28 July 2018. At this time, he was assessed as stable and prescribed a different antacid.
28. At 6:40pm, the covering cardiology HMO noted an increasing troponin and ongoing pain. This finding was discussed with the on-call cardiology registrar who appeared to indicate that the pain was not due to an acute coronary syndrome (ACS), that the troponin rise could be attributed to the cardiomyopathy and that PT was opiate seeking. The anaesthetics team were consulted and suggested clonidine¹² for pain relief.
29. A nursing note made 40 minutes prior to PT's death noted "*Seen by doctor. Not related to heart, considered to be withdrawal symptoms of ice or drugs that he used before coming to hospital.*" PT's intravenous cannula was removed.
30. A short time later, PT developed severe chest pain and began writhing in bed before going into cardiac arrest. He could not be revived despite resuscitative efforts. An ECG taken during the arrest showed the presence of pericardial fluid/blood.

FURTHER INVESTIGATIONS /CPU REVIEW

31. The Coroners Prevention Unit (CPU) were asked to review the clinical management and care provided to PT at Sunshine Hospital.¹³
32. The CPU noted that the initial ambulance and ED assessments were appropriate, particularly in view of the marked ECG changes in the presence of severe chest pain and risk factors for ischaemic heart disease.¹⁴
33. The cardiology registrar determined that the cause of PT's ECG changes was cardiomyopathy and that his complaints of ongoing pain amounted to drug seeking behaviour. The CPU could not locate any reference in the medical records to indicate PT was an opioid user/abuser. The

¹² This is not typically used for analgesia and is sometimes used in opiate withdrawal regimes.

¹³ The Coroners Prevention Unit (CPU) was established in 2008 to strengthen the prevention role of the coroner. The unit assists the Coroner with research in matters related to public health and safety and in relation to the formulation of prevention recommendations. The CPU also reviews medical care and treatment in cases referred by the coroner. The CPU is comprised of health professionals with training in a range of areas including medicine, nursing, public health and mental health.

¹⁴ Smoking and hypertension.

basis upon which the registrar formed their opinion was not evident and CPU considered it was highly likely that this judgement was made to the detriment of PT.

34. The CPU considered that the assessment of the cardiology registrar was flawed and unsafe on several bases:
 - a) PT was felt to be opiate seeking when there was no other evidence or history taken to establish this. The PBS shopper service could have provided information/confirmation about PT' opiate use (but this service was not consulted).
 - b) Clinicians failed to consider and exclude alternative diagnoses of severe chest pain, including ACS and aortic dissection in a man who was at significant risk of cardiovascular disease.
 - c) In the setting of significant, ongoing chest pain, other causes for the ECG changes were not excluded.
 - d) It was determined that the ECG changes were pre-existing when there was no baseline ECG for comparison.
35. In the view of the CPU, noting that post-mortem examination demonstrated that the dissection involved the full length of the aorta from the heart to beyond its termination at the common iliac arteries in the pelvis, PT's persistent pain probably represented a continuing dissection process.
36. The CPU considered that a more objective assessment of PT's presentation might have resulted in a different diagnostic and management course, particularly in relation to the investigation of his pain. That said, the severity of his ECG changes could have possibly and reasonably lead treating doctors to undertake urgent coronary angiography in the first instance.
37. The ECG changes were not due to the aortic dissection unless it involved the coronary arteries at their origin in the root of the aorta or the dissection/shock placed a strain on the heart and unmasked significant pre-existing coronary artery disease. The incidence of 'ischaemic' ECG changes in acute aortic dissection is about 25%. The incidence of acute coronary syndromes is far greater than acute aortic dissection and the CPU were not surprised that treating doctors

would favour the former. However, PT was not thought to be suffering from acute coronary syndrome.¹⁵

38. Ultimately, the CPU considered that PT's death may have been preventable. Or, at least a timely diagnosis might have been made if management, particularly by the cardiology unit, had taken a different course and had not been coloured by the assumption that PT's drug use was in play.

Sunshine Hospital response

39. Given the CPU's appraisal, Sunshine Hospital/Western Health were invited to respond. Chief Medical Officer Dr Paul Eleftheriou and Dr Kunal Pradip Verma, Cardiology Advanced Trainee, responded in statements provided to the Court.
40. Dr Verma explained the steps that he went through to reach his working diagnosis. Ultimately, Dr Verma considered that PT's chest pain and troponin rise were due to an underlying cardiomyopathy. Although his pain was typical for angina, his ECG and troponin rise were not in keeping with a large myocardial infarct. The abnormalities on the ECG (bearing in mind that a baseline ECG was not available to compare), signified to Dr Verma that further investigation was warranted.
41. He went on to say that the troponin rise was relatively modest, especially in the context of renal impairment. Dr Verma conceded that such changes could be caused by aortic dissection. However, aortic dissection did not form part of a differential diagnosis as, among other reasons, PT was haemodynamically stable, and there were features on history and presentation to suggest other significant cardiac pathology.¹⁶
42. In respect of the suggestion that PT was opiate seeking, Dr Verma stated he reached this conclusion because PT disclosed a history of methamphetamine use regularly up until a few weeks prior to his admission. Additionally, PT's description of his pain on the morning ward round was felt to be out of keeping with his physical presentation as well as the findings of investigations.
43. Dr Eleftheriou advised that PT's case was discussed at the Mortality and Morbidity meeting undertaken by the Cardiology Unit in July 2018. Treatment under the Cardiology Department

¹⁵ He was found to have an 80% occlusion of the left artery at autopsy.

¹⁶ A history of progressive worsening of dyspnoea prior to acute onset chest pain, cardiomegaly and pulmonary congestion on chest x-ray.

was considered appropriate and no recommendations were made to alter practice. The ED held a Mortality and Morbidity meeting in September 2018 and reached the same conclusion. PT's case was felt to highlight the difficulty in diagnosing an atypical presentation of aortic dissection.

44. Having reviewed the statements of both Dr Verma and Dr Eleftheriou, the CPU did not resile from their initial appraisal. They added that while there may have been initial consideration of aortic dissection in PT – the taking of blood pressure in both arms - the documentation suggested that the possibility of aortic dissection was dismissed because uncommon, but widely regarded “classic” signs were absent.
45. According to Dr Eleftheriou, clinical features that are “often present in dissection” were considered and the diagnosis discounted due to their absence.
46. The CPU commented that this stance reflects a lack of understanding of the actual infrequent occurrence of “classic” symptoms and signs of aortic dissection and the unreliability of these in excluding aortic dissection on a clinical basis.

Prevention and recommendations

47. The CPU accepted that the diagnosis of aortic dissection, a relatively rare but life-threatening condition, can be challenging and it is unrealistic to expect perfect diagnostic accuracy on each presentation. However, several common themes continue to arise in cases of aortic dissection which are missed during ED presentations or misdiagnosed and find their way into the coronial jurisdiction, and the following are pertinent to the case of PT:
 - a) The typical (or otherwise) nature of the chest pain. Aortic dissection does not commonly present with the symptoms and signs described as typical or classical for the condition.
 - b) Pain being considered as representing ischaemic heart disease, especially if accompanied by an ECG and biochemical changes.
 - c) The reliance on the absence of what are widely but mistakenly considered to be classical, signs of aortic dissection, to exclude the diagnosis without further investigation.
 - d) Inadequate history taking by clinicians or failure to appreciate the significance of features of the history.

48. The CPU is comprised of several fully qualified and experienced emergency physicians who are regularly asked by coroners to comment on the mis-diagnosis or delayed diagnosis of aortic dissection in ED'.¹⁷
49. The Inquest into the death of Constandia Petzierides was a significant case of the missed opportunity to diagnose aortic dissection in an ED and, indeed, misdiagnosed aortic dissection, in her case as musculoskeletal pain. Following an Inquest into her death, there was a round table discussion with emergency medicine specialists from a number of metropolitan and regional tertiary hospitals¹⁸ to discuss the issue.
50. Some of the consensus views that emerged from the round table bear repeating, in particular:
 - a) The value of focused history taking was considered paramount, especially as to the onset, severity, location and nature of the pain.
 - b) That the absence of a blood pressure difference between arms is not sensitive enough to rule out a diagnosis of aortic dissection.
 - c) Emergency medicine teaching should include the mantra that aortic dissection is to chest pain as subarachnoid haemorrhage is to headache.
51. The CPU commented that as a significant length of time has passed since the inquest into Mrs Petzierides' death, the subject case provides an opportunity to remind the medical community of the findings and recommendations in that case.
52. They identified several prevention opportunities at an individual and a systemic level and proposed that I make prevention focused recommendations directed towards Western Health. At a clinician level, they suggested personal reflection in their response to drug users presenting with clear evidence of significant pathology. At a systems level, they suggested that Western Health might consider reviewing their education around chest pain and aortic dissection with particular regard to clinical history taking and the utility (or otherwise) of absent 'typical' features to safely 'rule out' aortic dissection.

¹⁷ COR 2010 1571, Constandia Petzierides; COR 2015 5847, Fotios Dimos; COR 2017 3945, Denise Wharton; Sununtha Suttha; and 2017 0777, Brendan Morello; to name a few such cases.

¹⁸ I directed the following recommendation to ACEM: *That the...ACEM considers highlighting in training curricula the importance of considering the diagnosis of aortic dissection for patients presenting with chest pain, and nuanced presentations of aortic dissection. This is particularly important with ED patients are treated in accordance with a chest pain pathway, and ischaemic heart disease has been excluded by appropriate testing. A practice of re-visiting the diagnosis at the end of the pathway and/or review by a senior clinician before discharge would improve patient safety.*

53. The CPU also suggested that the Western Health chest pain pathway be amended to alert staff to the ‘classical’ symptoms and signs of aortic dissection when discounting the diagnosis on clinical grounds, that is, based on the history taken and examination.
54. The CPU suggested that this case supports the making of focused comments and recommendations in the interests of improving public health and safety.

WESTERN HEALTH RESPONSE

55. Western Health were invited to comment on the proposed recommendations. They responded by reiterating that PT’s case had been considered at the Western Health Cardiology and the ED Mortality and Morbidity meetings in July and September 2018, respectively and by advising that “Aortic dissection” is included in the emergency medicine curriculum for ED Registrar training at Western Health.
56. Western Health noted the CPU’s comment that clinicians could have consulted the PBS prescription shopper service and advised that they had plans to include education about the service in the organisation’s Grand Round professional development. Western Health otherwise supported recommendations that were proposed to be directed towards other organisations.

FINDINGS AND CONCLUSION

57. Pursuant to section 67(1) of the *Coroners Act 2008* I make the following findings:
 - (a) the identity of the deceased was PT, born 13 September 1971;
 - (b) the death occurred on 28 July 2018 at Sunshine Hospital, 176 Furlong Road, St Albans, Victoria, 3021;
 - (c) the cause of PT’s death was haemopericardium complicating aortic dissection; and
 - (d) It is unedifying that I find the available evidence supports the same findings and conclusions I made in relation to the death of Mrs Petzierides, namely that PT’s presentation to the Sunshine Hospital ED and admission provided a lost opportunity for diagnosis of the aortic dissection to which he succumbed.
 - (e) PT’s death was preventable in the sense that correct diagnosis and the commencement of treatment before catastrophic dissection of the aorta gave him some chance of surviving an otherwise lethal condition, even taking into account the significant mortality associated

with the disease, even when correctly diagnosed and treated in a timely manner, whether medically or surgically or both.¹⁹

COMMENTS

Pursuant to section 67(3) of the Act, I make the following comments connected with the death.

58. Aortic dissection continues to feature regularly in coronial matters and it is disappointing to learn that despite previous recommendations and inquests, flawed reasoning and a lack of awareness of the limitation of clinical criteria used to exclude aortic dissection continues to feature in diagnostic decision making.
59. A more objective assessment of PT's presentation may have resulted in a different diagnostic and management course, particularly if further investigations had occurred to shed light on his drug taking proximate to his death.
60. As in the Petzierides case, the circumstances in which PT died demonstrate that it may not be helpful for clinicians to think in terms of "classic" features of a disease that is a classic mimicker of other condition, and/or because dissection is a dynamic process. A condition precedent to correct diagnosis of PT was management by a clinician who was well informed about aortic dissection as a differential diagnosis for chest pain, cognisant of the signs of symptoms of the disease, including its variability over the course of the disease and depending on the type of dissection, and mindful of the limitations of investigations which can properly confirm or exclude the diagnosis.

RECOMMENDATIONS

Pursuant to section 72(2) of the Act, I make the following recommendations:

1. That Safer Care Victoria promote a wider awareness of the risk factors, presentations and the limitations of clinical signs in ruling out aortic dissection.
2. That the Australasian College of Emergency Medicine promote a wider awareness of the risk factors, presentations and the limitations of clinical signs in ruling out aortic dissection.

¹⁹ Finding into the death of Constandia Petzierides delivered 5 June 2014, court reference COR 2010 1571; Finding into the death of Fotios Dimos delivered 17 March 2020, court reference COR 2015 5847.

Pursuant to section 73(1B) of the Act, I order that this finding be published on the Coroners Court of Victoria website in accordance with the rules.

I direct that a copy of this finding be provided to the following:

QA, Senior Next of Kin

The Proper Officer, Western Health

The Proper Officer, Safer Care Victoria

The Proper Officer, The Australasian College of Emergency Medicine

Signature:



Paresa Antoniadis Spanos

Coroner

Date: 24 June 2021

NOTE: Under section 83 of the *Coroners Act 2008* ('the Act'), a person with sufficient interest in an investigation may appeal to the Trial Division of the Supreme Court against the findings of a coroner in respect of a death after an investigation. An appeal must be made within 6 months after the day on which the determination is made, unless the Supreme Court grants leave to appeal out of time under section 86 of the Act.
