

SHERIFFDOM OF GLASGOW AND STRATHKELVIN AT GLASGOW

2014 FAI 7

DETERMINATION

by

SHERIFF DANIEL SCULLION

**Following a FATAL ACCIDENT INQUIRY under
FATAL ACCIDENTS AND SUDDEN DEATHS
INQUIRY (SCOTLAND) ACT 1976, into the DEATH OF
of
CAROLINE McCALL**

GLASGOW, March 2014.

The Sheriff, having resumed consideration of the cause, **DETERMINES:**

1. In terms of section **6(1)(a)** of the Act, that Caroline McCall, born 19 July 1970, died at 0737 hours on 26 November 2008 at the Princess Royal Maternity Unit, “the hospital”, Glasgow;
2. In terms of section **6(1)(b)** of the Act, that the cause of death was: 1a: Cardiac tamponade, due to 1b: Aortic dissection; 2: Pregnancy, bicuspid aortic valve.
3. In terms of section **6(1)(c)** of the Act, that reasonable precautions whereby the death might have been avoided, would have been:

(i) for Caroline to have been seen by a consultant obstetrician at any of the following points: (a) on 24 November 2008, after her admission to the

hospital; (b) during the morning ward round on 25 November 2008 or as soon as possible thereafter, before the end of the day shift; (c) upon her admission to the High Dependency Unit on the evening of 25 November 2008 or shortly thereafter;

(ii) for her to have been seen by a senior physician, either on 24 November 2008, after her admission to the hospital, or on 25 November 2008;

(iii) for a cardiac cause or causes to have been included in the differential diagnosis.

4. Section 6(1)(d): No Finding

5. In terms of section 6(1) (e) of the Act, that the lack of a system which ensured that an outstanding request for medical review of an obstetric patient was noted and prioritised as part of the change of shift handover, was a defect in the system of working at the hospital as at 25 November 2008, and is a fact which is relevant to the circumstances of the death.

Sheriff

Note

Introduction

[1] This inquiry took place in consequence of the sudden death of the late Caroline McCall while she was an in-patient at the Princess Royal Maternity Hospital, Glasgow, the Lord Advocate having considered it expedient in the public interest, that an inquiry should be held into the circumstances of the death.

[2] I heard evidence and submissions over a total of ten days. Miss K O’Sullivan, Procurator Fiscal Depute appeared on behalf of the Procurator Fiscal, in the public interest. Mr Douglas Ross, Advocate, appeared on behalf of Greater Glasgow and Clyde Health Board, “the Health Board”. The following witnesses gave evidence to the inquiry:

Mr Alan Muir; Mr Steven McKenna; Dr Elizabeth Blair; Dr Lilantha Wedisinghe; Joanna Climie; Dr Fiona Irwin; Dr THJ Mudzamiri; Michelle Mitchell; Dr David Blane; Dr Robert Docking; Donna McLaren; Margaret Young; Dr Louise Santangeli; Dr Kirstyn Brogan; Muriel Faulds; Sandra

Frame; Dr Derek Baxter; Dr Kenneth Fraser; Dr Ros Jamieson; Dr Rupert Fawdry; Dr Alan Mathers; Dr Dina McLellan; Mr William Martin; Mr Robert R Jeffrey; Professor G. McKay.

Mr Muir was Caroline’s partner and Mr McKenna, her brother in law. Dr McLellan, Mr Martin and Mr Jeffrey were called as expert witnesses. The remaining witnesses were members of the midwifery staff or doctors, either at the hospital or at Glasgow Royal Infirmary as at November 2008, many of whom had contact with Caroline during her period as an inpatient. Some additional material was introduced in evidence by way of a Minute of Uncontroversial Evidence. This included the content of the post-mortem report (Crown

production 2) prepared by Dr Linda Isles, the Forensic Pathologist, who did not give evidence in person.

Other reports into the circumstances of Caroline's death

[3] The circumstances surrounding Caroline's death were previously the subject of an internal review by the Health Board, which resulted in the production, in January 2009, of an Adverse Incident Analysis Report (Crown production 3). The Health Board also commissioned an external review by Dr McClellan, Consultant Obstetrician. Her report is Crown production 4. The Crown instructed expert reports from Mr W L Martin, Consultant in Fetal Maternal Medicine and from Mr R R Jeffery, Consultant Cardiothoracic Surgeon. Their reports are Crown productions 5 and 6 respectively. All references to "the 2007 report" are references to the triennial report produced in 2007 by the Confidential Enquiries into Maternal Deaths in the United Kingdom, which aim to make motherhood safer (Crown production 12).

The statutory scheme

[4] Section 6(1) of the Act provides that the Sheriff shall make a Determination setting out the following circumstances of the death, so far as they have been established to his/her satisfaction :

(a) where and when the death and any accident resulting in the death took place;

(b) the cause or causes of such death and any accident resulting in the death;

(c) the reasonable precautions, if any, whereby the death and any accident resulting in the death might have been avoided;

(d) the defects, if any, in any system of working which contributed to the death or any accident resulting in the death; and

(e) any other facts, which are relevant to the circumstances of the death.

[5] Section 6(3) provides that the Sheriff's Determination is not admissible in evidence and cannot be founded upon in any judicial proceedings arising from the death. The standard of proof is the balance of probability. It is well established that a Fatal Accident Inquiry is not a forum for determining questions of civil fault or liability (*Black v Scott Lithgow Limited* 1990 SLT 612).

Statutory Interpretation

[6] I respectfully agree with the views of Sheriff Kearney regarding interpretation of section 6(1)(c), (d) and (e) of the Act, as expressed in his Determination, issued on 17 January 1986, following the Fatal Accident Inquiry held into the death of the late James McAlpine, in which he said:

"In deciding whether to make any determination under section 6(1)(d) as to the defects, if any, in any system of working which contributed to the death or any accident resulting in the death the court must, as a pre-condition to making any such recommendation, be satisfied that the defect in question did in fact cause or contribute to the death.....In relation to making a finding as to the reasonable precautions, if any, whereby the death or any accident resulting in the death might have been avoided (s.6(1)(c)) it is clearly not necessary for the court to be satisfied that the proposed precaution would in fact have avoided the accident or the death, only that it might have done, but the court must, as well as being satisfied that the precaution might have prevented the accident or death, be satisfied that the precaution was a reasonable one.....the phrase 'might have been avoided' is a wide one which has not, so far as I am aware, been made the subject of judicial interpretation. It means less than 'would on the balance of probabilities have been avoided' and rather directs one's mind in the direction of lively possibilities.....The provisions of section 6(1)(e) are very

widely stated and, in my view, entitle and indeed oblige the court to comment on and, where appropriate, make recommendations in relation to any matter which has been legitimately examined in the course of the Inquiry as to a circumstance surrounding the death, if it appears to be in the public interest to make such comment or recommendation”.

[7] I also respectfully agree with the views expressed by Sheriff Lockhart,(now Sheriff Principal), in his Determination, issued on 20 July 1993, following the Fatal Accident Inquiry held into the railway accident at Newton, in which he said:

“In my opinion a Fatal Accident Inquiry is very much an exercise in applying the wisdom of hindsight. It is for the sheriff to identify the reasonable precautions, if any, whereby the death and any accident resulting in the death might have been avoided and the defects, if any, in any system of working which contributed to the death or any accident resulting in the death. The sheriff is required to proceed on the basis of the evidence adduced without regard to any question of the state of knowledge at the time of the accident. The statutory provisions are concerned with the existence of reasonable precautions or defects in the system at the time of the accident or death and are not concerned with whether they could or should have been recognised. They do not relate to the question of foreseeability of risk at the time of the accident. The statutory provisions are widely drawn and are intended to permit retrospective consideration of matters with the benefit of hindsight and on the basis of the information and evidence available at the time of the Inquiry. There is no question of the reasonableness of any precaution depending on the foreseeability of risk. The reference to reasonableness relates to the question of availability and suitability or practicality of the precautions at the time of the accident resulting in death”.

The factual background

[8] Although the passage of time since Caroline died in 2008 inevitably had some impact upon the recollection of some witnesses, no issues arose as to the credibility of the witnesses who gave evidence, I was satisfied that the undernoted factual background was established in evidence.

[9] Caroline was born on 19 July 1970. At the time of her death, she and Mr Muir were expecting a baby. The expected date of delivery was 26 December 2008. Caroline had suffered from heartburn throughout her pregnancy.

Events of 24 November 2008

[10] On 24 November 2008, Caroline, having had an unsettled night, rose from bed around 0600 hours and went downstairs to the living room of her house. Mr Muir came downstairs shortly thereafter to keep her company. As the couple sat downstairs together, Caroline lunged forward suddenly onto her knees, clutching her chest. She said she felt as if she was having a heart attack.

[11] Caroline telephoned the hospital and was advised to attend there. She insisted upon taking a shower before going to hospital. As Mr Muir helped her upstairs to the shower, she was in intense pain, clutching her chest. She required Mr Muir's assistance to shower.

[12] In the interests of speed, Mr Muir drove to the hospital. Caroline was in severe pain during the journey. She received immediate attention upon her arrival at hospital. She reported that she had a stabbing pain in her chest and said the pain was such that she had felt as if she was having a heart attack.

[13] She was examined by Dr Blair, an FY2 doctor in her first obstetrics rotation. Initial assessment by a junior member of medical staff was in keeping with standard practice in hospitals throughout the United Kingdom. Caroline gave a history of having experienced intermittent chest pain for about a week. She complained of central stabbing chest pain, radiating slightly to either side and to her throat. The pain was worse when lying flat but

was not pleuritic in nature and was different from the pain she had previously experienced from heartburn, which she had suffered throughout her pregnancy. Her pulse rate was 52 beats per minute, blood pressure was 121/54, respiratory rate was 14 per minute and her oxygen saturation in air was 98%. Examination of her calves was normal. An electrocardiogram "ECG" confirmed a sinus bradycardia. Dr Blair considered a diagnosis of acid reflux. Because of her concerns arising from Caroline's presentation and pulse rate, and from the apparent change in the nature of her pain, she sought advice from the obstetrics registrar, Dr Wedisinghe.

[14] Dr Wedisinghe, then a first year registrar, was working his first ever shift at the hospital on 24 November. He had responsibilities that day to several wards and was the only mid - grade doctor covering these duties. When contacted by Dr Blair, Dr Wedisinghe was about to perform an urgent caesarean section. Having discussed Caroline's case with Dr Blair, he considered the problem might be medical rather than obstetric and advised Dr Blair to admit the patient and discuss her case with a physician.

[15] Dr Blair admitted Caroline to ward 68 at around 11.30 hours. The consultant ward round had already taken place. Dr Blair spoke with a Senior House Officer in the medical department, who advised intravenous Ranitidine, a repeat ECG and to re-refer if Caroline did not settle.

[16] Examination by a midwife at around 1130 hours revealed Caroline's abdomen was soft and non-tender upon palpation. The midwife administered intravenous Ranitidine at around 1155 hours. At 1230 hours, Caroline's platelet count was noted to be down.

[17] At around 1410 hours Dr Irwin, then an FY2 doctor in her first obstetrics rotation, considered Caroline's blood results, which revealed, *inter alia*, proteinuria+, thrombocytopenia and moderate renal impairment. Dr Irwin instructed a repeat full blood count and a troponin estimation be performed. She saw Caroline briefly later that afternoon at which point Caroline told her she had received antacid and was feeling much better. A repeat ECG, performed at 15.50 hours showed a sinus bradycardia of 63 beats per minute. The repeat blood tests showed no change in the platelet count and borderline elevation of troponin. At 2100 hours, she is noted as having no chest pain. Caroline took Co-codamol from the drug trolley rounds at 1410 hours, 1810 hours and 2230 hours.

25 November 2008

[18] Caroline sought pain relief outwith the normal drug trolley round and received Co-codamol at 0635 hours. A midwife recorded her observations at 10:30 hours and noted her epigastric pain had been relieved by ranitidine. Her pulse had risen to 82 beats per minute. She made no complaint of abdominal pain during palpation of her abdomen.

[19] Dr Rupert Fawdry, Consultant obstetrician, conducted the morning ward round in ward 68 on 25 November, accompanied by Dr Mudzamiri, a senior registrar. Dr Fawdry was paged during the ward round, resulting in him leaving the ward round before it concluded to attend to an emergency. He asked Dr Mudzamiri to see the last few patients on the ward, one of whom was Caroline. Dr Fawdry did not meet Caroline and was given no information about her prior to her death.

[20] Dr Mudzamiri concluded the ward round in Dr Fawdry's absence. Upon examination, Caroline said she was feeling better, compared to her initial presentation. She complained of

on-going epigastric and retrosternal chest pain, which was worse when lying down. Examination of her abdomen revealed tenderness in the epigastric area, but was otherwise normal. Dr Mudzamiri reviewed the blood results, which revealed a thrombocytopenia. Troponin levels were still awaited. As he was about to discuss this result with Caroline, Dr Mudzamiri was called away from the ward to attend to an emergency. He requested a diagnostic work up of Caroline, with consideration of a possible pulmonary embolism. No note of this consultation was made in Caroline's medical records but Dr Mudzamiri's recollection of the consultation is set out in a statement he prepared subsequently (Crown production 13). Caroline asked for additional heartburn relief at 1235 hours.

[21] Dr Blane, then a GPST2 doctor, reviewed Caroline at around 15:10 hours and retook a history. He noted Caroline was *"currently pain free. Feels chest discomfort improved since yesterday. Yesterday pain was sudden onset, central, stabbing, about 8 o'clock. No radiation; worse on lying flat/certain movements; different to normal heartburn. Patient initially felt was having panic attacks but yesterday pain was more severe- 'felt like having heart attack' "*. Dr Blane thought the chest pain atypical. The differential diagnosis was of pulmonary thromboembolism, musculoskeletal in nature or heartburn related. A thrombophilia screen was arranged and Dr Blane requested a ventilation perfusion scan (VQ) and bilateral Doppler ultrasound of the legs, to exclude thromboembolism. He spoke with the on call physician and requested Caroline be reviewed by the on call medical team. Low molecular weight Heparin was commenced.

[22] Caroline took additional heartburn relief at around 1630 hours. Dr Mudzamiri returned to ward 68 at around 1630 hours and saw Caroline. She appeared to be in some discomfort

and when he asked her about that, she said she was coping. The presumed diagnosis was of pregnancy-induced thrombocytopenia and he requested contact be made with the anaesthetic and haematology teams. Caroline had sought pain relief out with the normal drug trolley round and took Co-codamol at around 1635 hours.

[23] Dr Docking, then an ST3 doctor and the on call anaesthetist in the labour ward, saw Caroline at around 1720 hours, primarily because of her low platelet count. He considered her ECG and blood results, took a history and examined her. She described central chest pain behind the breastbone, not radiating to her arms, jaw or belly. She said the analgesia had taken the edge of the pain but pain was still present. Dr Docking noted the thrombocytopenia, atypical chest pain and borderline troponin level. He noted the two main problems as low platelet count and atypical chest pain. The outcome of the V/Q scan was awaited.

[24] Caroline's condition deteriorated in the early evening of 25 November. At around 1825 hours, a member of her family sought assistance for her. Midwifery staff attended upon her and recorded her observations. She was noted to be feeling very uncomfortable and to have chest pain similar to her admission episode. She appeared breathless. Midwifery staff requested review by an obstetrician but the obstetric team was busy in theatre and unable to review. Midwifery staff again contacted the obstetrics team at 1920 hours, but the team was still busy in theatre and unable to review. At 1945, Caroline was noted to be very upset, complaining of extremely sore chest pain and struggling to breath and talk. She was commenced on two litres of oxygen per minute and medical staff was informed.

[25] Dr Brogan, then a specialist registrar in the final year of her training, was the senior obstetrician in the hospital on the night shift on 25 November. Dr Jamieson, Consultant obstetrician, was on call from home for that shift. Caroline's case was one of the first topics discussed during the shift handover. Dr Santangeli, then an ST1 in obstetrics, was asked to see Caroline and did so immediately, while Dr Brogan went into theatre.

[26] Dr Santangeli saw Caroline at 2000 hours and spent around 50 minutes with her. She examined Caroline and considered the notes and previous blood results, which were interpreted as normal liver and renal function. Caroline had an increased respiratory rate of 24 per minute and a pulse of 76 beats per minute. Upon palpation of her chest, she complained of tenderness in the epigastric region. She appeared distressed. Dr Santangeli thought Caroline was in considerable pain and was concerned about her. She discussed matters with Dr Brogan, who saw the patient immediately.

[27] On examination by Dr Brogan at around 2100 hours, Caroline was tender in the epigastrium. She said her pain had improved slightly. Dr Brogan considered she was suffering severe chest pain and was concerned about her. She arranged immediate transfer to the High Dependency Unit and further blood investigations with a view to discussing matters with the on call physician or surgeon once the results of these investigations were available. The High Dependency Unit is adjacent to theatre, has a higher medical presence than ward 68 and patients there receive one to one care from midwifery staff. Dr Brogan was not aware that a medical review had previously been requested and remained outstanding.

[28] Dr Brogan discussed Caroline's case with Dr Fraser, the night shift on call anaesthetist, who saw Caroline and reviewed her pain relief. At around 22.40 hours, he administered 5mg of morphine intravenously and stayed with Caroline to observe her. Dr Brogan reviewed Caroline at around 2245 hours. Moderate renal impairment was noted, as well as mildly elevated C Reactive Protein, blood pressure of 155/52 and a pulse of 81 beats per minute. Caroline exhibited mild epigastric and right upper quadrant tenderness. The differential diagnosis was noted as pulmonary thromboembolism, pneumonia or gastric/gallbladder cause. Dr Brogan instructed a repeat ECG, a chest x ray and a discussion with a medical registrar if possible. At around 2255 hours, Dr Fraser administered a further 2mg dose of morphine intravenously. At 2330 hours midwifery staff noted that Caroline "remains quite sore despite IV morphine. Has to remain upright. ". At around 2350 hours, she received a further 10mgs of morphine intramuscularly from midwifery staff. The most recent blood results were, at that time, still outstanding.

[29] Dr Derek Baxter, then a specialist registrar in year 3 of a 5 year training programme in medicine and rheumatology, was the night shift team leader covering general medical admissions for the Glasgow Royal Infirmary site on 25 November 2008. He was not made aware at the start of his shift, that Dr Blane's earlier request for physician review remained outstanding.

26 November 2008

[30] At 0035 hours, when the latest blood tests became available, Dr Santangeli spoke to Dr Baxter by telephone and requested physician review for Caroline. Dr Baxter examined Caroline at 0110 hours. She had low chest discomfort and pain in her upper abdomen,

which Dr Baxter considered had some oesophageal qualities. He considered that if Caroline's results and observations did not herald pre-eclampsia, the underlying diagnosis was unclear. He thought pulmonary embolism unlikely. Although he did not instruct imaging, he suggested a V/Q scan might rule out embolism and suggested ultrasound or a CT scan might help to exclude other causes including basal chest infection, biliary disease or sub-diaphragmatic problems. Dr Baxter planned to discuss Caroline's case with the consultant physician, Dr (now Professor) McKay, the following morning.

[31] Throughout her period in the High Dependency Unit Caroline was observed constantly by midwifery staff. Dr Brogan made repeated checks upon her progress. Caroline appeared settled on and off. At 0310 hours, she was given betamethasone to promote fetal lung maturation. At 0400 hours, midwifery staff advised Dr Brogan, that she was more settled. At 0420 hours Caroline seemed to be settled and managing to sleep. Her observations were noted as stable. At 0500 hours, she was noted as being settled and asleep and her observations were noted as stable. At 0600 hours, her observations were normal.

[32] At 0620 hours, Caroline is noted as tolerating oral fluids. Midwifery staff was to repeat a full range of bloods. At around 0625 hours, Caroline woke from a sleep and was sitting up in bed. A midwife attempted, unsuccessfully, to obtain blood. At around 0630 hours, Caroline suffered sudden-onset chest pain. She clutched her chest and her head fell back onto the pillow. The midwife called her name but she did not respond. The midwife activated the emergency buzzer and a crash team attended the unit immediately. Cardiopulmonary resuscitation commenced at 0634 hours and continued throughout the ensuing transfer to theatre. Dr Brogan performed an emergency caesarean section and baby

X was delivered at 0647 hours. Dr Ross Jamieson, on call obstetrics consultant arrived at 0655 hours. She was unaware, prior to Caroline's collapse, that she had been admitted to the High Dependency Unit. Extensive attempts by the crash team to resuscitate Caroline were unsuccessful. Death was confirmed at 0737 hours on 26 November 2008.

[33] Aortic dissection is a rare condition in pregnancy. The 2007 report quotes a figure of 0.4/100,000 maternal deaths from the condition. Pulmonary venous thromboembolism is a potentially fatal condition and is the leading cause of direct maternal mortality. The 2007 report quotes a figure of 1.94/100,000 maternal deaths from this condition. Caroline's only prospect of survival lay in surgery, which she would have undergone at the Golden Jubilee Hospital in Clydebank. She would have been required to transfer to that hospital for that purpose.

The Confidential Enquiries into Maternal Deaths

[34] The 2007 report was the subject of some discussion in the evidence. Of the doctors who were asked about it, those who had chosen obstetrics as a career, and some others, were at the time aware of the Report. There was particular emphasis upon four learning points relevant to aortic dissection, which are listed in chapter 9 of the report (page 125), in the following terms (*my numbers*):-

1. *"Maternity professionals must remember that aortic dissection is a cause of chest or interscapular pain in pregnancy, particularly in the presence of systolic hypertension."*

2. *“Women with Marfan syndrome are at high risk of aortic dissection, but previously apparently normal pregnant women may also suffer this complication, most commonly at or near term, or post-natally.”*

3. *“Marfan syndrome diagnosed at autopsy has implications for the family as it is possible to screen relatives for mutations in the fibrillin gene”.*

4. *“Women with severe chest pain requiring opiate analgesia must be investigated. Appropriate imaging includes a CT chest scan or MRI, or transoesophageal echocardiogram”*

[35] As Caroline did not have Marfan syndrome, learning points 2 and 3 were of limited application to the present case. Learning points 1 and 4 were the subject of some discussion. Counsel for the health board emphasised that Caroline’s pain level had varied during her stay in hospital, that there was no evidence that she suffered systolic hypertension and that she had not required opiate analgesia until late in the evening of 25 November. He pointed also to the fact that learning point 4 is silent on the question of any timeframe within which the investigation and imaging therein mentioned should be undertaken.

[36] There was some evidence that the Confidential Enquiries Report issued subsequent to the 2007 report, described an increase in the number of maternal deaths from aortic dissection over the period discussed in that report, compared to the period discussed in the 2007 report. I refer to this issue in more detail when discussing Dr McLellan’s evidence.

The Internal Review

[37] The internal review group reported In January 2009. At page 11 of the report it is noted that:

“The group believed that the most appropriate place for Caroline at the time was the maternity unit, due to her advanced gestation. It is unlikely that she could have had a different diagnosis made on the Monday, given her history and the good effect of the treatment given. However, they need to look at their referral pathways to a consultant physician. She was a medical patient who was pregnant and we need to ensure that a physician sees all medical admissions in the future within 12 hours, as is the standard for medical wards. Every consultant ward round in ward 68 needs to review all new admissions. It may well have altered treatment in this case.”

[38] The report also identified a number of action points for implementation. These included the introduction of a trigger chart to alert staff to the possible differential diagnosis and diagnostic tests to consider in patients with atypical symptoms; the introduction of an obstetric early warning chart; education around critical illness and development of the intranet site for medical disorders in pregnancy.

The day shift on call consultant on 25 November

[39] Dr Fawdry has been a consultant obstetrician for more than thirty years. He did not meet Caroline. He remembered being paged during the ward round on 25 November before the last two patients had been seen. He explained that his practice during ward rounds was to allow registrars who have experienced four or five years training to lead during the ward round, while he observes closely. Upon being paged, he left the ward to attend to another matter and asked the registrar to see the last two patients. While he had no information about these patients, he assumed, from their position in the ward, that they were comparatively low risk. He considered the registrar very competent and had no qualms about allowing him to complete the ward round. He did not return to see the last two

patients but was confident the registrar would let him know if he had any concerns about these patients. He could not recall anyone bringing any concerns about Caroline to his attention.

[40] Having considered the medical records, he was adamant that even if he had seen Caroline, he would not have suspected aortic dissection. Although he said initially he thought no consultant in Britain would have suspected dissection, his ultimate position was that an exceptional doctor might have suspected it. On the hypothesis that the registrar had spoken to him about Caroline, he said he would have done nothing different and would not have considered asking for a medical review at that stage nor would he have considered referral to a cardiologist or obtaining other imaging. When on call, he would expect to be informed if morphine was administered to a patient, in order that he could ascertain whether anything else should be considered. If he had been on call on the evening of 25 November, he would have wanted to be informed of Caroline's admission to the High Dependency Unit, although he would not have altered the treatment plan.

[41] He rejected the suggestion in the internal review that he should have returned to the ward later on 25 November to see Caroline and said there are numerous occasions where a consultant would not return to see a patient who is not perceived to be high risk. He disagreed with Dr McClellan's opinion that early consultant obstetric involvement may have ensured early senior medical review, leading to an urgent request for imaging facilitating a diagnosis and a window of opportunity for treatment. He said he would be staggered if the path proposed would have led to a diagnosis of aortic dissection in any of the hospitals in the United Kingdom in which he has worked.

The night shift on call consultant on 25 November

[42] Dr Jamieson has been a consultant obstetrician and gynaecologist for 10 years and was the night shift on call consultant obstetrician on 25 November. She has never observed an aortic dissection. She was involved in the resuscitation attempts made on Caroline. She thought the decision to move Caroline to the High Dependency Unit was appropriate and thought it within Dr Brogan's capability to make that decision independently of contact with the on call consultant. She considered Dr Brogan a very capable senior trainee who knew the limits of her capabilities and would have contacted the on call consultant if the situation appeared to require it.

[43] When asked if she would have wanted to be contacted when a decision was made to administer morphine, she referred to the fact a chest x ray and further blood tests were also planned and said that if she had been contacted, she would have wanted to know the outcome of those tests. She pointed also to the fact that discussion with a physician was part of the treatment plan. She trusted Dr Brogan to use her judgement in the situation, and considered the tests arranged were appropriate and would have determined what further steps should be taken.

[44] She thought referral to a cardiologist would be appropriate if there was an obvious abnormality of the ECG or a high suspicion of cardiac problems but where, as in this case, the cause of the symptoms was unclear, referral to a physician or a cardiologist was reasonable. She thought it would be unusual now for an obstetric patient to be admitted to the high dependency unit without a consultant being aware of it.

[45] Dr Jamieson considered the investigations undertaken to exclude pulmonary embolism were appropriate. Although chest pain is a common complaint in pregnant women, the cause of such pain in the vast majority of cases is acid reflux. Obstetricians do not regularly see women with serious causes of chest pain. On the hypothesis that she had become involved in Caroline's treatment when she was relatively settled after morphine had been administered, she would not have arranged imaging during the night. From a review of the case papers, she did not think she would have done anything different but she acknowledged it was difficult to be definite about what she would have done, had she seen the patient.

The Liason Physician for the Princess Royal Maternity hospital

[46] Professor McKay has been a consultant physician for nine years and specialises in clinical pharmacology and the provision of acute medical services. He is the liason physician for the Princess Royal Maternity Hospital and has a weekly input into a medical obstetric clinic. He provided consultant physician input to the Internal Review into Caroline's death.

[47] He has been involved in several cases where investigations were undertaken because of suspicion of aortic dissection. In two of these cases, the investigations led to a diagnosis being made. He acknowledged the difficulty of considering matters retrospectively and said that, without having the opportunity to interrogate the symptoms, he could not say what he would have done differently in this case.

[48] Professor McKay explained that the consultant sometimes asks the patient the same questions as those asked earlier by more junior doctors. Much of the interpretation of

symptoms is influenced by experience. Professor McKay tends to concentrate on the presenting complaint, as it is the start of the diagnostic process. He tries to tease the symptoms out. In medicine, many things, looked at in isolation, may not be particularly concerning but everything has to be used to go back to the presenting complaint and the individual's interpretation of the presenting complaint, in terms of working through the diagnostic process. He said it is often the case that less experienced doctors are not quite sure what is going on and he thought some of the notes in this case were suggestive of uncertainty as to the cause of Caroline's problem. He did not know whether he would have suspected a dissection in this case. On the hypothesis that Dr Baxter had contacted him in the early hours of 26 November, he thought it possible that any cardiologist he might then himself have contacted would have advised continued monitoring of the patient with a view to cardiology review later in the morning. He agreed with the proposition advanced by counsel, that the level of experience and expertise of a senior registrar who is near the end of training may not be so different from that of a consultant.

Acute Medicine-changes since 2008

[49] Professor McKay explained that since 2008 there have been major changes in the provision of acute medical care at Glasgow Royal Infirmary. There is now a consultant led acute medicine team as opposed to a service where consultants simply contribute to acute medicine. In essence, people who have been trained in acute medicine now provide acute medical care. Steps have been taken to increase the seniority of front door review. All referrals now go through one page number and the page holder is a doctor of at least four years experience. The page holder has sufficient experience to be able to advise

appropriately, if the acute physician is the best person to see the patient. The page holder redirects some problems to the appropriate speciality. It is the responsibility of the page holder, supported by the consultant, to ensure that outstanding work is prioritised. After 1700 hours, if the page holder is concerned or feels the need to discuss a patient's care, a call is made to the on call consultant to discuss the issue. The current handover process is more robust and any outstanding requests for medical review are now a formal part of that process. While acknowledging that someone might still forget to mention something at handover, Professor McKay emphasised that the fundamental importance of the handover process and the desire to ensure that nothing is omitted, and to avoid delays in treatment, are now very much part of the induction process of those involved in acute medicine.

The Clinical Director of Women's and Children's Services

[50] Dr Mathers has been a consultant obstetrician and gynaecologist since 1991 and is the Clinical Director of Women and Children Services in obstetrics and gynaecology for the Health Board. He occupied that role in 2008. The Princess Royal deals with 6500 births per year. Dr Mathers could recollect only one or two maternal deaths occurring for obstetric reasons during his period as a consultant there, although he emphasised that Caroline's death was due to a cardiac cause. He was not involved in Caroline's treatment but had attended the hospital immediately upon learning of her collapse on the morning of 26 November 2008. He was responsible for arranging the internal review into the circumstances surrounding the death and instructed the independent review by Dr McClellan. He was responsible also for implementing the action point raised by the internal review.

[51] Dr Mathers has previously observed one aortic dissection, in a medical patient, who did not survive. He considered atypical chest pain a medical problem and thought it obvious Caroline had a medical problem. As a minimum, he would expect an obstetric patient with chest pain to have an ECG, a chest x ray and a troponin test. He considered bradycardia an unusual event in pregnancy. Interpretation of renal impairment posed some difficulty. He would expect the potential cause of renal impairment to be considered, although it had to be borne in mind that abnormal renal function would generally trigger consideration of obstetric pathologies as opposed to medical pathologies. He was conscious of the fact he had not seen the patient.

[52] While he accepted other consultants might not share his view, he would expect a consultant to see an obstetric patient with chest pain, as it is a very unusual presentation and is not a typical obstetric problem. When on call, he would expect to be contacted if an obstetric patient was admitted with chest pain. He thought senior obstetric review was warranted upon Caroline's admission. He thought the consultant should have been made aware of her admission and thought Caroline should have been seen as part of the consultant ward round. In an ideal world, best practice would have been for the consultant to return to the ward to see the patient.

Obstetrics-changes since 2008

[53] Dr Mathers spoke of changes, which have been introduced since 2008. In response to the action points raised by the internal review, a trigger chart was produced in February 2009 (production 10) and has been made available to all maternity units in the greater Glasgow and Clyde Health Board area. It is available through the hospital intranet system to

all medical staff. A maternity early warning system (MEWS) chart has been reviewed and is now in use. This system is not a diagnostic aid but is a warning system designed to give an early indication that a patient's physiology is deteriorating, in order to ensure appropriate and timeous additional review of patients. Depending on the trigger, the assumption is that the patient will be seen within 15 or 30 minutes. If a patient is admitted to Day Care or Outpatient Assessment, her recordings are noted on the MEWS chart. Dr Mathers expressed the view that the introduction of these charts has improved the safety of the hospital.

Caroline would have been red flagged on that system as someone who was not fitting into normal parameters. Efforts have been made to embed learning from other sources into the culture of the hospital. Approximately 100 clinical guidelines, including obstetric guidelines, together with multidisciplinary contributions and protocols are available on the hospital intranet, to clinicians with appropriate security clearance. Systems are in place to ensure review and updating of these guidelines. Dedicated weekly tutorials are available to first on-call doctors and are embedded in practice. A module based training programme and regional training sessions, encompassing medical disorders in pregnancy, are available to specialist trainees. Guidelines that inform practice are available to all medical staff.

[54] A daily afternoon ward round has been introduced, in addition to the morning ward round. There is now a guideline that a consultant should see a new patient within twelve hours of admission. Dr Mathers pointed out that in November 2008 there was no automatic referral to the on call consultant when a patient was admitted to the High Dependency Unit. While he appeared unsure if it is now a requirement that such a referral is made in those circumstances, the thrust of his evidence was to the effect that, as a result of changes which have been made to working arrangements, it is very unlikely that the consultant would not

now be advised of such an occurrence. There is now a consultant in the hospital 100 hours per week and consultants are in hospital at night more often than was formerly the case. The handover is an integral part of an evolving patient safety culture and it is now a formal part of the handover that, wherever possible, everyone who has been on the floor in obstetrics, meets to discuss outstanding reviews. An additional meeting also now takes place at 1130 hours every day at which current cases are considered. This provides a further opportunity for discussion of outstanding reviews.

The expert evidence

[55] Parties were agreed, and I was satisfied, that each of the three skilled witnesses was eminently qualified to give expert evidence, subject to the caveat that Dr McClellan and Mr Martin accepted they could not give expert evidence on cardiology and Mr Jeffery, likewise, accepted he could not give expert evidence on obstetrics. I shall outline in turn, some key aspects of the expert reports before discussing the thrust of the parole evidence given by each of the expert witnesses.

Dr McClellan

[56] Dr McClellan has been a consultant obstetrician since January 1998 and currently works at Wishaw General Hospital, Lanarkshire. She established the Lanarkshire Disciplinary Medical Obstetric Antenatal Clinic in 1998. She was the lead clinician for intra-partum care from 1998 until 2008. She co-founded a maternity risk management group in 1998 and served as a Medical Case Reviewer until 2004. She has been the lead local collaborator to the Scottish Stillbirth and Neo-Natal Death Inquiry since 1998 and is a committee member of the Scottish Perinatal Mortality and Morbidity Review Advisory Group.

Report

[57] In her report, Dr McLellan noted that by 1410 hours on the day of admission, it was apparent there were several abnormal findings, namely thrombocytopenia, moderate renal impairment and sinus bradycardia. These findings, together with significant symptomatology, indicated that senior obstetric review was warranted on the day of admission. The consultant was not informed of the admission and should have been. While throughout the rest of the day, the junior obstetric team was attentive, regularly reviewed Caroline and took steps designed to exclude myocardial ischaemia/infarct, a chest x ray should have been considered as part of a standard investigative approach for potential ischaemic heart disease. Again, the junior team should have sought senior support. Dr McLellan noted there was no recorded explanation for the sinus bradycardia, which is an unusual finding in a 38-year-old woman with a BMI of 32 in the third trimester of pregnancy. She considered the bradycardia was likely to be due to the dissection itself, as it can precipitate either a bradycardic or a tachycardic response. The mild rise in Troponin 1 was not commented on. As Troponin 1 levels are not significantly altered in pregnancy, any elevation should be considered relevant and suggestive of myocardial damage from whatever cause. Accordingly, further investigation was warranted. Caroline had become increasingly unwell by 1945 hours on 25 November, with significant deterioration of her vital signs, and there was a further missed opportunity to inform the consultant obstetrician thereafter. While imaging should have been undertaken as an emergency after the medical review in the early hours of 26 November, she considered the window of opportunity for diagnosis and treatment had already been missed, as Caroline arrested approximately 5 hours later.

[58] Dr McLellan noted that aortic dissection is a rare event in pregnancy and the majority of obstetric units including large teaching institutions have little clinical experience of this condition. A diagnosis is often not made until a post-mortem examination has been performed. The frequency of the condition is increasing, due to the higher prevalence of women of advanced maternal age and obesity. Pulmonary venous thromboembolism remains the leading cause of direct maternal mortality in the United Kingdom and thus must always be considered within the differential diagnosis of women presenting with chest pain at any stage in pregnancy. While she considered it unsurprising that this was the presumed diagnosis and thought many obstetric units would have reached a similar conclusion, she pointed to the fact that Caroline had several atypical features that were highlighted by the initial attending FY2 doctor and the medical registrar. She considered that early blood investigations suggested the presence of a significant disease process that warranted consultant referral. Early consultant obstetric involvement may have mitigated the difficulties and ensured review by a senior member of the medical team. This may have led to an urgent request for a CT scan of the chest and abdomen, facilitating diagnosis and a window of opportunity for treatment. She acknowledged that the fatality rate for surgical management in such cases remains high and thought it highly feasible that the diagnosis may not have been made even with early consultant involvement, due to the rarity of this condition.

[59] While the lack of consultant obstetric involvement was indicative of substandard care, this may have had no direct bearing on the outcome, as even with consultant involvement, the diagnosis would not have been made in the majority of units in the United Kingdom.

Oral evidence

[60] Dr McLellan has seen one dissection in her career. The patient did not survive. She explained that if all the findings had been appreciated, the appropriate review would have been at consultant level, at least to the extent of being discussed with a consultant. She thought any consultant contacted about a patient in Caroline's position would try to see the patient personally. The consultant should have been notified on the afternoon of 24 November at the point the blood results were available. The fact a Troponin test was done indicates someone was thinking there might be a cardiac cause. No one had put all the circumstances together. While Dr McLellan recognised the need for junior doctors to be given scope in training to take on a degree of responsibility, she thought a doctor of the level of seniority of the registrar who carried out the obstetric review in place of the consultant on 25 November, was still less than ideal. If called away during a ward round, Dr McLellan would expect an update on patients she had not seen and would usually meet up later with the junior doctor to discuss what else had been seen on the ward round. When medical review was sought at 1510 on 25 November, if the significance of everything that was going on had been appreciated, senior medical review was warranted with an appropriate work up of the most appropriate tests at that stage. Dr McClellan would have considered a chest CT scan, which she considered would have likely led to a diagnosis, but she probably would have discussed the most appropriate test with a senior physician.

[61] If a consultant obstetrician had reviewed Caroline personally, the usual practice would have been to seek a consultant medical opinion and it is much more likely that a consultant physician would then have seen her. Consultants are more likely to be taken seriously when

making a referral and it is much easier to make a consultant-to-consultant referral. As a matter of professional courtesy, consultants often deal personally with a review requested by a consultant from another discipline. Dr McLellan thought many on call consultant obstetricians, if informed a patient has been admitted to the High Dependency Unit, is unwell and has an increased respiratory rate, would consider coming in to see the patient, failing which they would ensure a senior physician reviewed the patient. Caroline required senior medical review at this point and if the consultant obstetrician had been told about her admission to the High Dependency Unit, it is more likely senior medical review would have followed. A CT scan should have been pursued immediately after the medical review that took place, as it is very unusual for a pregnant woman to present with chest pain requiring large doses of opiate analgesia. This presentation is so unusual it would give rise to concerns about the underlying diagnosis, meaning the investigative pathway should be followed through as quickly as possible. Dr McLellan thought that imaging could have been undertaken within an hour or two and reported upon promptly. However, while acknowledging she did not know what available resources there were at the hospital at that time, she considered it unlikely that the required cardiothoracic team could have been put together, offsite, in the remaining time available prior to Caroline having arrested.

[62] She did not consider the initial presenting features typical of pulmonary embolism. However, as the pain at one point was pleuritic, if the treating doctors were sure or fairly convinced that they were dealing with a pulmonary embolism, the investigation and treatment that was put in place was appropriate. She believed senior medical review would have led to appropriate imaging and a diagnosis. Caroline's symptoms were significant and she should have received senior medical review on the day of her admission. The abnormal

laboratory reports had not been fully appreciated. The fact that no senior clinician was involved in picking up on all the other results together was a concern. Despite the variations to Caroline's presenting features and observations, it would have been substandard for a consultant obstetrician to have reviewed her history and not noted the unusual features and thereafter, to have tried to work out a diagnosis and the appropriate method of investigation. Dr McLellan considered most consultants would have thought Caroline's overall presentation and results quite atypical and would have fast tracked further investigations that may have led to a diagnosis. An alternative to pulmonary embolism should be considered when features are atypical and appropriate imaging would have to be considered, as the treating doctor would be looking for other cardiac causes. An alternative diagnosis to pulmonary embolism may have been considered, if a consultant obstetrician had spoken to Caroline and considered her results. Counsel asked her whether there may be an element of hindsight in her opinion but she did not accept she was being wise after the event and said she was not impressed from the outset, based on the very elaborate description of the pain, that this was a pulmonary embolism. She was adamant that based upon her experience at consultant level, the atypical features jumped out at her when she considered the papers and would have jumped out at her had she reviewed the patient on a ward round. She would have considered aortic dissection because of her previous experience of the condition.

[63] Dr McLellan pointed out that while obstetricians will have read about aortic dissection, most clinicians will not see the condition during their career. The most recent Confidential Enquiries Report had highlighted the lack of improvement in the outcomes regarding aortic dissection over the period covered by the previous three reports. There appeared to be a

difficulty recognising the condition. Dr McLellan considered it would be difficult to develop an educational programme that puts the condition at the forefront of the clinician's mind and thought there may be some way to go in terms of education. She observed that a different educational approach might be required regarding this issue. However, she also considered that where dissection is suspected every clinician would appreciate the urgency of the required investigations.

Mr W L Martin

[64] Mr Martin has been a Consultant at the Birmingham Women's Hospital since 2001. He is a specialist in obstetrics, gynaecology and fetal maternal medicine. He continues to work two sessions per week directly in the delivery suite at Birmingham Women's Hospital, which delivers over 7,000 babies each year. The Unit is a referral centre for the West Midlands for complex fetal and maternal obstetrics cases and deals with high and low risk obstetric problems.

Report

[65] In his report, Mr Martin indicated that a pregnant woman presenting with atypical chest pain merited review by a cardiologist and an echocardiogram, particularly where there is a sinus bradycardia, which is an unusual finding, especially towards the end of pregnancy. In view of the mortality rate associated with dissection, he accepted death might not have been avoided even if a diagnosis had been made. He considered a consultant obstetrician should have reviewed Caroline and he would have expected senior review by a physician and involvement of a cardiologist. He thought the obstetricians involved in Caroline's care should have been aware of the 2007 report and considered cardiac causes had not been fully

appreciated, or ruled out. He was of the view that the lack of consideration of aortic dissection as a possible cause for the atypical chest pain amounted to substandard care. A chest x ray should have been done earlier, an echocardiogram should have been carried out and consideration should have been given to additional imaging.

Oral evidence

[66] Mr Martin has encountered one aortic dissection. He described it as a phenomenally rare diagnosis. While he considered Caroline's history was not suggestive of pulmonary embolism, he accepted that condition is potentially fatal and, where suspected it must be treated until confirmed or excluded. He considered the initial heart rate of 52 beats per minute unusual in a pregnant woman and thought the fact that there was significant pain, which would normally elicit a tachycardic response, rendered the bradycardia even more unusual. He thought it would have been very reasonable to seek an opinion from a cardiologist either once the blood results, ECG results and, possibly, the chest x ray results were available or at some other point on the day of admission. A cardiologist would have been able to organise an urgent echocardiogram.

[67] He would have expected a consultant obstetrician to see Caroline, failing which, on the ward round of 25 November, a doctor of greater seniority than the registrar who saw her in place of the consultant. He considered a junior physician would not appreciate the physiological changes that pregnancy brings about and suggested a senior physician would have been more likely to appreciate the abnormal renal results, taking account of the pregnancy. When asked to expand upon his criticism of the failure to consider aortic dissection, he appeared to change emphasis and said it was the failure to consider cardiac

causes that concerned him. He thought consideration of cardiac causes would have generated discussion with the relevant doctor, who could be a physician, leading on to a cardiologist. He questioned the validity of the conclusions drawn from the tests done in Caroline's case. While gestational thrombocytopenia is a recognised phenomenon in pregnancy, it is not a normal occurrence in the third trimester, at which point the majority of expectant mothers should have a normal platelet count. He thought a more senior obstetrician would have considered cardiac causes. He agreed with counsel's suggestion that in view of Caroline's fluctuating symptoms, pulmonary embolism was not a diagnosis that could confidently be excluded and agreed that in many obstetric units even a consultant obstetrician might not have put it all together and thought of aortic dissection.

[68] He would have spoken first to a cardiologist but he accepted that referral patterns differ in different hospitals. Some of the tests undertaken, such as the ECG and the troponin test, would not ordinarily be considered for an obstetric patient and indicated that some of the treating doctors had thought something was going on and that a possible cardiac cause was being considered. Accordingly, there should have been direct consultation with a cardiologist as opposed to a physician.

Mr RR Jeffery

Report

[69] Mr Jeffery is a consultant cardiothoracic surgeon of 24 years standing and currently holds that role at Aberdeen Royal Infirmary. He undertakes surgery on the heart and great vessels, both electively and as an emergency. In addition, he covers thoracic emergencies associated with chest injuries. He performs, on average, more than one hundred cardiac procedures per year. In his report, he explained that the diagnosis of aortic dissection can be very difficult and requires a high index of suspicion on the part of the clinician. Caroline had a bicuspid aortic valve, which predisposes to aortic dissection, which can occur in pregnancy. While recognising that aortic dissection is an uncommon cause of maternal mortality, he thought the condition should have been included in a differential diagnosis, particularly in a patient who had presented with chest pain, which she described as different from the heartburn she had been treated for previously, and similar to what a heart attack must feel like. He thought Caroline had had significant symptoms, which had not received the attention they deserved. He acknowledged that even if she had undergone surgery, the outcome may not have been different due to the significant mortality rate associated with the required surgery, but considered that if a diagnosis had been made, as a young person, she would have been offered every reasonable procedure to save her life. He considered that if Caroline been seen by a senior clinician, there was a chance that the correct diagnosis may have been made with a possibility of a successful outcome.

Oral evidence

[70] Mr Jeffrey said he would expect an obstetrician to be aware of the fact that women in the third trimester of pregnancy are at increased risk of aortic dissection. He thought the episode of pain Caroline had experienced leading to her admission on 24 November may have been an intramural haematoma which, over the next 24 to 48 hours, extended to a full-blown aortic dissection. While it is not possible to identify the precise point at which the aortic dissection developed, it is likely to have been ongoing. When Caroline collapsed, clutching her chest, at around 0630 hours on 26 November, she had probably ruptured at that point into the pericardial cavity, becoming fatal.

[71] Mr Jeffrey spoke of three different classes of surgery namely, elective, urgent and salvage. The operative risk of an acute aortic dissection is between 20% and 40%. For urgent operations, the risk is 20%. The Society of Cardiothoracic Surgeons quotes a risk of 38.5% mortality for salvage operations on the aortic root for the three years preceding 2008. If emergency and salvage are grouped together, he thought a better way of expressing it was to put the mortality rate in excess of 30%. He thought it reasonable to assume a 20% operative risk if the dissection been picked up on the day of admission and 20%-40% if picked up on 25 November. Had Caroline been referred to a Cardiac Surgeon and operated on within 24 hours, this would have been classed emergency surgery. He thought the pain and the site of the pain were the most important pointers to practitioners in suspecting dissection. He thought a scenario of severe pain at onset, which apparently settles, then returns with a vengeance, should alarm clinicians and alert them to the necessity of further investigations. He thought further investigations appropriate at the point of Caroline's transfer to the High Dependency Unit, including an ECG, a chest x ray and a CT scan with contrast. A transthoracic echo or a transthoracic ultrasound would also have been

reasonable but the diagnostic test would have been a CT scan with contrast. The CT scan spoken of by Dr Baxter would have picked it up. Mr Jeffrey considered imaging should have been done out of hours and, had that been done, there would still have been a window for treatment in the early hours of the morning of 26 November, at which point Caroline would have been in the emergency surgery category, with a mortality rate of around 30%. He thought the severity of pain at admission and her comment that it was like a heart attack would have warranted investigation by a cardiologist at admission. When the severe pain returned on 25 November and at her admission to the High Dependency Unit, a cardiology opinion would have been an entirely appropriate referral, although a general physician would have been a reasonable place to start.

[72] He thought the potential diagnosis of pulmonary embolism reasonable and thought the decision to seek medical review reasonable, as if every patient with atypical chest pain was referred to cardiology, the cardiologists would be inundated. Broadly speaking, aortic dissection is fatal without surgical intervention. He has never operated on a pregnant woman with a dissection and, from a surgical perspective, he described the prospect of dealing with a mother delivering her child and then facing surgery herself for dissection as “quite awesome”.

[73] He knew of cases reported anecdotally, of pregnant mothers sustaining a dissection and surviving, but no information regarding risk was available. He thought that if a CT scan been done either when Caroline’s pain recurred on the evening of 25 November or prior to admission to the High Dependency Unit, the outcome would have been known by midnight and appropriate transfer and surgery could have been considered. Had the dissection been

picked up earlier, her chances of survival would have been better. He would expect a consultant obstetrician or a trainee registrar who has chosen a career in obstetrics to have the index of suspicion required to suspect aortic dissection and would expect an obstetrician or a general physician to consider aortic dissection at the point of transfer to the High Dependency Unit, standing the worsening pain and its severity.

[74] He agreed that a CT scan taken on 24 November would not necessarily have shown the same image as a scan taken after the worsening of symptoms on 25 November. An experienced vascular radiologist would probably have identified the intramural haematoma at that point. When the symptoms worsened on 25 November, he would be confident that the dissection would have shown on imaging and would have been evident to any radiologist. He agreed that by the time of Caroline's collapse at 0630 on 25 November there was no realistic prospect of saving her.

[75] Mr Jeffrey agreed with counsel's contention that when considering the window of opportunity available on the evening of 25 November, a number of imponderables had to be taken into account. These included the required index of suspicion; imaging requiring to be done as an emergency; a radiologist attending from off site to supervise the scan; interpretation of the scan; discussion with a cardiologist; decision to proceed to surgery and transfer to Clydebank followed by the surgery itself, with attendant risk. While he accepted that assessing the likelihood of these things coming together involved considerable speculation, he pointed out that, without surgery, the patient's chances of survival were zero, whereas with surgery there was a chance of survival and as a young person, Caroline would have been given every opportunity to survive. He thought that had a diagnosis been

made, even up to one hour before her arrest, there would still have been an opportunity to intervene as, although surgery would not have been immediate, there would have been aggressive intervention to lower blood pressure and to prevent any further deterioration.

Crown submissions

[76] The Crown contended there were three reasonable precautions whereby Caroline's death might have been avoided. The first such precaution was for a consultant obstetrician to have reviewed Caroline at three distinct trigger points: firstly, upon her admission to Ward 68; secondly, in the course of the ward round on 25 November 2008, failing which, at some point later that day and, thirdly, upon her admission to the High Dependency Unit. The second reasonable precaution was for Caroline to have been reviewed by a physician on 24 or 25 November. The third such precaution was for those treating Caroline to have considered cardiac causes for her condition.

Submissions for Health Board

[77] While accepting Caroline should have been seen by a consultant, counsel for the health board submitted that it had not been established in evidence that if a consultant had seen her, there would have been a different outcome. Counsel pointed to the evidence of a number of the consultants who gave evidence. Dr Fawdry was adamant he would not have suspected Aortic Dissection or changed the course of treatment. Dr Jamieson did not think she would have done anything different had she been contacted at home. Nor was she critical of the fact that, as on-call consultant, she was not contacted on the evening of 25 November. Dr McClellan had opined that even with consultant involvement, the diagnosis would not have been made in the majority of units in the United Kingdom. Mr Martin had

agreed that even if a consultant had been involved in Caroline's care, he/she might not have "put it all together". Accordingly, counsel submitted, it would be entirely speculative to suggest that a hypothetical consultant reviewing Caroline at some point during her admission would have altered the management of the patient in a way which would have altered the outcome.

[78] Counsel suggested that while a substantial difference in the level of experience and knowledge is to be expected between a junior doctor and a consultant, the difference will be much less as between a consultant and senior registrar. Professor McKay had given evidence that the level of experience and expertise might not be so different and that a review by a senior registrar would be more like that of a consultant. Whilst a consultant had not seen Caroline, it could not be said that she had only been seen by junior doctors. Doctors Mudzamiri, Brogan and Baxter had been senior registrars at the time and became consultants shortly thereafter.

[79] Counsel submitted that while the picture was unclear as to why a medical review had not taken place sooner, there had been no evidence to suggest that earlier medical review would have altered the outcome. Dr Baxter, the physician who reviewed Caroline, did not alter the treatment plan by, for example, ordering urgent imaging or requesting cardiology input. Having regard to the fact that Dr Baxter saw Caroline after her condition had deteriorated, it was speculative to suggest that a hypothetical physician reviewing Caroline prior to the deterioration in her condition would have instigated such action. Furthermore, Dr Baxter had said that he would probably have sought the view of Professor McKay the following morning. Professor McKay gave evidence that, having reviewed the notes, he did

not know what he would have done. Had he thought Caroline was experiencing aortic dissection, he would have had to take that to a conclusion but he did not know if he would have considered dissection had he been contacted at the time.

[80] Professor McKay also said that had a referral to cardiology been made out of hours, it is likely the advice would have been to continue monitoring and Caroline would have been seen in the morning. Mr Jeffery had said that if all cases of atypical chest pain were referred to a cardiologist, the Cardiology Department would be inundated. He had pointed also to the fact that cardiac disease is uncommon in pregnant women. For all of these reasons, counsel contended, there was no evidential basis for suggesting that any of the doctors who had treated Caroline should have referred her to a cardiologist. Furthermore, the evidence did not suggest that the outcome would have been different if a referral to cardiology had been made. Accordingly, no findings should be made under section 6(1)(c) of the Act.

[81] The Crown and the Health Board were in agreement that the evidence did not meet the test required for a finding under section 6(1)(d) of the Act to be made. Counsel submitted that in the event the court proposed to make any findings, section 6(1)(e) was the appropriate statutory provision under which such findings should be made.

Discussion

[82] Caroline was admitted to a major maternity hospital because she was unwell. She died some 41 hours later, without a consultant obstetrician having seen her and without a consultant having been involved in any aspect of her treatment before the fatal collapse that immediately preceded her death. Indeed, no evidence was led to suggest that prior to that collapse at 0630 hours on 26 November 2008, any consultant was aware that she was an

inpatient. The lack of consultant obstetric involvement in her treatment clearly amounted to substandard care.

[83] The thrust of the submission advanced for the Health Board was to the effect that the evidence did not establish that any of the reasonable precautions contended for by the Crown would have led to a different outcome. I reject this submission and reject the contention that any findings under section 6(1)(c) in this case are reliant upon speculation. While I have made three findings in terms of section 6(1)(c) of the Act, I am of the opinion, for the reasons hereafter discussed, that the key to Caroline's prospects of survival lay with consultant obstetric review. In assessing the issues to which section 6(1)(c) of the Act is directed, it must be recognised that there is no requirement that the evidence should establish that the outcome *would* have been different had the proposed reasonable precaution been taken. Findings made under that section do not require to be underpinned by proof that death *would* have been avoided had the precaution been taken, only that it *might* have been avoided. Furthermore, the reasonableness of a precaution is not dependent upon the foreseeability of risk. While the evidence of the consultant obstetricians who were on call on 25 November is relevant to consideration of the impact which consultant involvement might have had upon treatment, it is not determinative of the questions addressed by section 6(1)(c) of the Act.

[84] It has to be borne in mind that neither Dr Fawdry nor Dr Jamieson had the opportunity to observe Caroline and listen to her. It was clear on the evidence of a number of consultants, that time spent with the patient, listening and observing, sometimes retracing the history taken by the junior doctor, is a vital part of the diagnostic process. Several

witnesses spoke also to the benefits which consultant involvement brings to the patient, having regard to the depth and breadth of the consultant's experience compared to that of the more junior doctor. There is an expectation that the consultant will be in a position to appreciate the wider picture suggested by the patient's symptoms. Dr McLellan spoke of the beneficial effect consultant involvement tends to have upon patient access to review by other disciplines. A request made by a consultant for review by another discipline, is likely to lead to senior review by that other discipline, often at consultant level.

[85] Caroline was an obstetric patient who had a medical problem. Every doctor in the obstetrics department who dealt with her suspected this was the case. A number of the consultants who gave evidence said this was obviously so. The difficulty lay in determining what that problem was. Caroline was able to articulate clearly her appreciation of the pain she had experienced prior to and upon admission. There was a clear body of evidence to the effect that chest pain of the type and degree suffered and described by her, is unusual in an apparently otherwise healthy obstetric patient. Dr McLellan and Mr Martin thought senior obstetric review and senior medical review were warranted on the day of admission. I accepted this was so.

[86] Against that whole background, it is in my opinion highly probable that a consultant obstetrician reviewing Caroline, at any of the three points mentioned in paragraph 3(i) of the Determination would have sought at least a medical review. Clearly, that would have been a reasonable step to take. The potential for a beneficial effect is likely to have been greater, the earlier the occurrence of the consultant review. I accepted, and have taken account of, the evidence that there are many obstetric units in the United Kingdom where Caroline's

aortic dissection would not have been diagnosed. However, care must be taken to avoid placing excessive weight on that fact. It does not follow automatically from the fact there are many obstetric units where Caroline's dissection would not have been diagnosed, that there were no reasonable precautions whereby her death might have been avoided. In assessing the facts of this case, it must be borne in mind that a successful diagnosis was not dependent upon a consultant obstetrician suspecting dissection or diagnosing the condition. Mr Jeffrey, in any event, made it clear that a diagnosis can only be confirmed through imaging. Many of the consultants who gave evidence acknowledged that the fact they had not seen Caroline made it difficult to say with certainty what steps they would have taken if they had seen her. What is clear is that among the various benefits a consultant obstetrician would have introduced to Caroline's treatment, is the opportunity it would have afforded of improved access to review by other disciplines.

[87] Every consultant questioned on this issue said they had no problem obtaining patient review by other disciplines. Had a consultant obstetrician sought a medical review of Caroline, there is every reason to envisage that review by a senior physician, possibly a consultant, would have taken place within a reasonable timeframe. If medical review had been sought either on the day of admission or during the day shift on 25 November, I conclude with little difficulty on the evidence that the review would have taken place prior to 0110 hours on 26 November. Even if medical review had not been requested until the point of Caroline's admission to the high dependency unit, or shortly thereafter, the evidence suggested it is highly probable that such a review would have occurred prior to 0110 hours on 26 November. The consultant obstetrician requesting the review at that last

mentioned stage would have observed Caroline prior to the administration of morphine and would have had the opportunity of appreciating that her current pain was a recurrence of the type of pain experienced at admission. The three expert witnesses placed weight upon Caroline's description and characterisation of her pain. Mr Jeffrey suggested that the return of severe pain at 1830 on 25 November would or should have alarmed clinicians. In these circumstances, it is difficult to envisage a consultant obstetrician reviewing Caroline shortly after 2100 hours on 25 November would not have considered further investigations including medical review and would not have ensured the medical review was carried out forthwith. Clearly, it would have been reasonable to do so.

[88] I reject the contention that there was no evidence to suggest that earlier medical involvement would have altered the outcome. I agree with the Crown's observation that it is striking that Dr Baxter, then a mid-grade doctor and the only physician who saw Caroline some five and a half hours before her fatal collapse, thought it unlikely she was suffering a pulmonary thromboembolism and, albeit for different reasons, suggested a CT scan, which would have revealed the dissection. The weight of evidence suggested that had senior medical review occurred at any of the points discussed in paragraph 3(ii) of the Determination, it is likely to have led to causes other than pulmonary embolism being suspected and investigated. I accepted Dr McLellan's opinion that early review by a senior member of the medical staff may have led to an urgent request for imaging, facilitating a diagnosis and a window of opportunity for treatment.

[89] The Crown submitted that consultant obstetric review might have led to the perceived need for a medical review being leapfrogged in favour of a review by cardiology which, if

sought, would have been more likely to result in appropriate imaging being instructed, leading to a diagnosis and an opportunity for surgical intervention. Counsel for the health board emphasised the fact that Caroline's symptoms varied at a number of points and, at times, the treatment appeared to settle her and have a beneficial effect upon her pain. Some of her symptoms were consistent with symptoms of pulmonary embolism. In these circumstances, the working diagnosis of pulmonary embolism was reasonable and the treatment appropriate.

[90] I am unable to hold, on the evidence, that a consultant obstetrician would have instructed cardiology review directly. Furthermore, having regard to the actual circumstances, the initial referral to the medical department was a reasonable course for Dr Blane to have taken. The evidence suggested this was the normal pathway in the hospital and that the physician would, if appropriate, secure the involvement of cardiology. Mr Jeffrey himself said that if every case of atypical chest pain were referred straight to cardiology, the cardiologists would be inundated.

[91] I do, however agree with the Crown contention that earlier physician review would have been more likely to lead to a referral to a cardiologist. The expert evidence suggested that in light of the laboratory results and Caroline's presentation and explanation of her pain, a senior physician is likely to have instructed imaging and as matters progressed, if unable to get to the root of the difficulty, is likely to have sought cardiology review. These would have been reasonable steps for a senior physician to take. It was also clear on the expert evidence that a cardiologist would reasonably be expected to have investigated the complaint appropriately, leading to a diagnosis being made. Had appropriate imaging been

done on the day of admission, or on 25 November prior to Caroline's deterioration at 1830 hours, the dissection may well have been diagnosed prior to her deterioration. Even if no diagnosis had been made before that point, I consider it highly probable that the fact of the earlier consultant obstetric involvement and the likely senior physician involvement would have altered the course of events after her deterioration. Midwifery staff were unable to arrange for Caroline to be seen by an obstetrician between 1830 hours and the start of the night shift, as the team was busy in theatre. While midwifery staff did what they could to comfort Caroline, essentially, she languished in agony over this period. It is improbable, in the knowledge there had been prior consultant obstetric and/or senior physician involvement in Caroline's treatment, that the mere fact of the obstetric team being engaged in theatre, would have resulted in no steps being taken between 18.30 hours and 20.00 hours to inform, either the on call consultant obstetrician or the medical department, of Caroline's dramatic deterioration.

[92] Had the consultant obstetrician been informed of the deterioration either before, or upon Caroline's admission to the High Dependency Unit, investigations may well have been carried out on an emergency basis, including imaging, facilitating a diagnosis with a resultant opportunity for surgery. There was some discussion as to whether imaging was available during night hours but the weight of evidence suggested that imaging, including a CT scan, would have been available if sought at that stage.

[93] While I do not find it established that aortic dissection should have been considered as part of the differential diagnosis, I am satisfied the evidence established that a reasonable precaution whereby death might have been avoided would have been for a cardiac cause or

causes to have been considered as part of the differential diagnosis. It was clear that at certain points after admission, the possibility of a cardiac cause was to some extent contemplated. Caroline underwent more than one ECG. A troponin test was done. Neither test is performed routinely on obstetrics patients. I accepted the expert evidence that the wider picture suggested by the range of symptoms was not appreciated. Having regard to Caroline's symptoms and to her repeated assertions as to the extent and type of pain she was suffering, I am satisfied that with the benefit of consultant obstetric and/or senior medical involvement, a cardiac cause or causes would, or reasonably should have been considered as part of the differential diagnosis. I agree with the Crown submission, that had a cardiac cause been considered, either appropriate imaging would then have been considered, or a referral to cardiology would have been made which in turn would have led to appropriate imaging and a diagnosis with an opportunity for potentially lifesaving surgery.

[94] In making findings under section 6(1)(c) of the Act, I have had regard to the rarity of aortic dissection in pregnancy, to the evidence of the mortality rates associated with the necessary surgery and to the arrangements which would have been necessary, both for a diagnosis to have been made and for surgery to have been effected. In my assessment of the evidence, none of these factors, either individually or in combination, excludes there having been a lively possibility that Caroline might have survived had any of the reasonable precautions discussed been taken. Mr Jeffrey recognised the immense challenges which surgery would have presented in this case. He spoke also of cases, reported anecdotally, in which expectant mothers had survived such surgery and considered survival in this case possible. I proceed also upon the assumption that those responsible for the production and

publication of the Confidential Enquiries Reports, consider that dissemination of the learning points on aortic dissection might result in saving the lives of expectant mothers who suffer this condition.

[95] There was some discussion as to whether death might have been avoided if imaging had been instructed on an emergency basis, after the medical review at 0110 hours on 26 November. Mr Jeffrey thought surgery and survival still possible, whereas Dr McClellan thought that by that stage the window of opportunity had closed. I concluded on the evidence that emergency imaging would have been a reasonable and practical precaution to take at that stage. However, having regard to the numerous imponderable factors earlier referred to (paragraph 76 *supra*), and to the absence of evidence on the timeframe within which all of the necessary arrangements could have been made I am unable to conclude that there was a lively possibility that death might have been avoided had emergency imaging been undertaken at that point. Accordingly, I have not made a finding under section 6(1)(c) on this discrete matter.

Section 6(1)(e)

[96] Counsel suggested the picture was unclear as to why a medical review had not taken place sooner. The clear inference to be drawn from the available evidence is that there was no system in place to ensure that the review took place within a particular timeframe, if at all. Dr Baxter was not aware of an outstanding review when he started nightshift duty on 25 November 2008. He did not consider the telephone call he received from Dr Santangeli was a follow up call regarding an earlier request. He described himself as “hands on” and said he would have known if the call he received about Caroline had been a follow up call. I

accepted his evidence. It was consistent with the picture painted, both by Dr Santangeli, who said she did not seek the medical review as a follow up call, and with Dr Brogan's evidence that she was unaware an earlier request for medical review remained outstanding. Had Dr Santangeli not, on Dr Brogan's instructions, sought a medical review upon receipt of the up to date test results in the early hours of 26 November, there was nothing in the evidence to suggest when, or even if, the review requested by Dr Blane would have taken place. This apparent lack of a system to ensure that an outstanding request for medical review of an obstetric patient was noted and prioritised as part of the change of shift handover, was clearly a defect in the working arrangements then in place between the Princess Royal and Glasgow Royal Infirmary. While I was not persuaded that the test required for a finding in terms of section 6(1)(d) was met in respect of this issue, the existence of that defect is nonetheless a fact of relevance to the circumstances of Caroline's death which it is appropriate to mention.

Death of expectant mothers

[97] Death of an expectant mother is a rare occurrence in a maternity hospital. Despite Caroline having being attended by a number of doctors of varying grades below consultant level, aortic dissection was not considered or suspected in her case. The evidence suggested that since Caroline's death, there has been no improvement in the rate of maternal death from this condition in the United Kingdom as a whole, despite discussion of the subject in successive reports of the Confidential Enquiries into Maternal Deaths. Furthermore, the incidence of the condition in expectant mothers, apparently, has increased. It was clear on the evidence that a diagnosis requires appropriate imaging and that there is a window of

opportunity for potentially lifesaving treatment, likely to be surgery. The condition is often only diagnosed post mortem. It seems to me that the mere fact that the incidence of a life threatening condition known to affect some expectant mothers is rare, should not, of itself, determine the patient's chances of being diagnosed. Nor should it be the case that only those clinicians who have previously observed a dissection, are likely to have the index of suspicion required to consider or suspect the condition.

Recommendations

[98] The evidence in this case suggests that something needs to be done to improve the rate of detection of aortic dissection in expectant mothers. If it has not already done so it respectfully seems to me, that the Greater Glasgow and Clyde Health Board should initiate discussions with the appropriate Medical Authorities, designed to ensure that the issue of improving detection in expectant mothers of this life threatening condition receives appropriate attention.

[99] I draw attention also to the fact that there appeared to be some dubiety as to whether there is now in place a requirement that the on call consultant obstetrician is notified when an obstetric patient is admitted to the High Dependency Unit (see paragraph 54 *supra*). If no such requirement is in place, it seems to me that the Health Board, if has not already done so, should consider whether such a requirement is necessary.

Concluding remarks

[100] I wish to record that it appeared to me, having had the benefit of hearing and observing the witnesses give evidence, that the midwifery staff and medical practitioners who had contact with Caroline were attentive, caring professionals who did their best to care for her in the circumstances as they perceived them. The doctors who dealt with Caroline encountered a rare, life threatening condition at a relatively early stage in their respective careers. A picture emerged in evidence of young or relatively young medical practitioners dealing with heavy workloads which carry considerable responsibility. It was obvious that Caroline's death had, and continues to have, an effect upon some of those involved in her treatment. The openness and frankness displayed by a number of them in giving evidence was striking.

[101] I am grateful to the Procurator Fiscal Depute, Ms O'Sullivan and to Mr Ross, Counsel for the Health Board, for the sensitive and focussed way in which they dealt with the evidence in this particularly sad case.

[102] Finally, I express my condolences to Mr Muir and to Caroline's wider family. That her sudden and untimely death devastated her loved ones is obvious. Mr Muir and other family members attended each day of the inquiry. I recognise that for them to have heard the events of Caroline's last hours recounted and analysed in the forensic environment of the courtroom must have been enormously difficult. They conducted themselves with dignity throughout the hearing.