Post Mortem Report for the Coroner

Coroner's Officer's Reference: 3343493 (C Lawson)
Coroner's Office: St Pancras
Name: Gaia YOUNG
PM number: 121/21
PM number (Mortuary): -
Mortuary: St Pancras Public Mortuary
Age: 25 (dob 4th March 1996)
Sex: Female
Height: 164cm
Weight: 54kg
BMI: 20
Time and date of death: 20.25 on 21st July 2021
Time and date of PM: 08.30 on 28th July 2021
Body identified by: Senior Mortuary Technician and wristband (right x2)
Pathologist: Professor M Sheaff

Cause of death: Ia. Tonsillar herniation
Ib. Raised intracranial pressure
Ic. Cerebral oedema

History as per Coroner's Officer's report number 3343493.

External examination

The body was that of a well-nourished and slightly built young Caucasian female subject of appearance in keeping with the stated age. A recently sutured central thoracic and abdominal surgical wound was noted, 54cm long. An intravascular access line was noted in the right antecubital fossa with further lines in the right wrist and right groin. A nasogastric tube and airway were correctly positioned. No old surgical scars were identified. There were no tattoos. There were no signs of offensive or defensive injury. There was no jaundice, clubbing or palpable lymphadenopathy.

Internal examination

Cardiovascular system

Pericardium had been opened previously.
Heart was normal on external inspection. The heart weighed 220g.
Myocardium The right ventricle was normal and the myocardium measured 0.3cm thick. The left ventricular myocardium measured up to 1.3cm in thickness. There was no concentric hypertrophy or cavitary dilatation. There was no discrete scarring of the myocardium to indicate a previous regional infarct.
Endocardium normal.
Coronary arteries the three main coronary arteries were all normal calibre vessels with no macroscopic atheroma in any of the vessels. There was no luminal thrombosis in any vessel.
Valves the valves appeared normal and no vegetations were noted.
Pulmonary arteries and veins there were no thromboemboli.

Aorta and main vessels there was no significant atheroma within the proximal aorta or its main branches. There were no aneurysms or other mural abnormalities.

Respiratory system
Mediastinum there was no abnormality.
Pleural cavities there were no pleural plaques. There were no pleural effusions. There were no adhesions or tumour. There was no evidence of a pneumothorax.
Lung parenchyma the left lung weighed 282g. The right lung weighed 224g. Both lungs were normal. There was no evidence of bullous lung disease, consolidation or expressible pus. There was no pulmonary fibrosis. There was no evidence of aspiration into the lungs. No focal lesions were seen on opening the airways.
Larynx, trachea and bronchi the tracheal and laryngeal lumina were unobstructed. The main bronchi were normal.

Gastrointestinal system
Mouth normal. Tongue not bitten.
Oesophagus normal; no ulcers or tumours were identified.
Stomach contained yellow material. There was no mucosal inflammation, but no ulcer or tumour was identified.
Small and large bowel the duodenum was normal. The colon was loaded with firm faeces; there were no features of significant ischaemia or inflammation.
Peritoneum, omentum and mesentery no significant abnormality.
Retroperitoneum no significant abnormality.
Liver the liver was absent.
Gall bladder absent.
Pancreas absent.

Genitourinary system
Kidneys absent.
Bladder normal.
Uterus and adnexa were normal for age. There was no evidence of pregnancy.

Lymphoreticular system
Spleen weighed 162g and appeared normal.
Lymph nodes there was no significant lymphadenopathy.

Endocrine system
Thyroid gland was normal.
Adrenal glands were absent.
Pituitary gland normal.

Neurological system
Scalp no scars, lacerations or signs of recent injury.
Skull no fractures were identified externally or internally when the dura was stripped.
Meninges normal. No clouding or blood and no thrombosis of the venous sinuses.
Brain weighed 1420g. There was no macroscopic abnormality externally except for loss of the normal sulci/gyral undulations suggesting generalised oedema. The brain was kept whole for formal neuropathological examination.

Musculoskeletal system
No fractures were identified.

The brain was retained whole at the end of the post mortem examination together with small pieces of heart, lung parenchyma and spleen for histology. A sample of pre-mortem blood was provided which has been sent for toxicology.

Histology
The myocardium of the left ventricle is normal. There is no evidence of ischaemia, an inflammatory process or a hereditary condition. The right ventricle shows a single focus of lymphocytic inflammation without accompanying myocyte damage. The significance of this is uncertain. The lung parenchyma shows marked vascular congestion with occasional collections of lymphocytes but no thromboemboli, features of diffuse alveolar damage, vasculitis, infective consolidation or aspiration. The spleen shows congestion of the red pulp with an increase in the local neutrophils. The latter is most often seen with systemic infection but is not specific.

Toxicology (report reference 1948/21)
The ante-mortem blood sample contained no ethanol, amphetamines, morphine or other drug in a general screen (for full list of compounds see report).

Neuropathology (see reference A290/21)
Please refer to full report of Professor Al-Sarraj dated 7th October 2021. This concludes that there is evidence of recent ischaemia and axonal disruption within the brain which are considered secondary alterations. No primary neuropathological process is identified.

Comment

Ms Young appears to have become confused after cycling and laying down in the sun. She also had a headache and was nauseous, and she had vomited. She was seen at hospital and found to be hyponatraemic. A CT scan of the brain revealed diffuse brain oedema which, in the absence of an alternative cause, was considered most likely to be due to a toxin or drug. A toxic screen at that time revealed no alcohol or salicylates. She suffered a respiratory arrest around the time of a lumbar puncture, from which she was rapidly resuscitated. An MRI showed no intracranial thrombosis but features in keeping with encephalitis or drug effect. Her condition deteriorated despite intensive management and she developed raised intracranial pressure and tonsillar herniation. Brain stem death testing was performed and death confirmed. Organ harvesting was performed. Although the ultimate cause of death was apparent (raised intracranial pressure) the underlying cause of the brain injury was not clear.

Autopsy revealed no macroscopic pathology to account for death and so formal neuropathology, routine histology and toxicology were pursued. Histology of the heart, lungs and spleen revealed non-specific abnormalities which do not indicate an obvious cause of death. No drugs were identified on a wide screen of the ante-mortem blood sample.

Ultimately, unfortunately the autopsy cannot establish the underlying cause of the brain oedema and raised intracranial pressure in this case. The brain injury was irreversible and catastrophic but it appears to be a secondary event as no primary pathology was identified within the brain on specialist examination. There are several potential possibilities including hyperthermia (such as heatstroke), toxicity (by an agent not identified on the screen available), a metabolic disorder or a pathological process which clears soon after provoking the initial insult such as a thrombosed vessel which resolves. This list of potential differentials is not exhaustive.

Michael Sheaff, Consultant Histopathologist, Royal London Hospital, E1 2ES
19th October 2021

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AUTOPSY REPORT

POST MORTEM REPORT NO:A290/21 **Date of registration**: 12/08/2021

Name: **YOUNG, GAIA**

Age : 25 years **Sex:** female **Date of death:** 22/07/2021 **Date of autopsy:** 28/07/2021

Clinician: Coroner for Greater London, Inner North London, St Pancras Coroners Court

MICROSCOPY

STATEMENT OF WITNESS

(Section 9 Criminal Justice Act 1967 and Rule 1.62 Criminal Procedure Rules)

Statement of witness	Professor Safa Al-Sarraj, MB ChB, MSc, FRCPath
Age of Witness	Over 18
Occupation of Witness	Consultant Neuropathologist
Address	Department of Clinical Neuropathology King's College Hospital NHS Foundation Trust Academic Neuroscience Building Denmark Hill LONDON SE5 9RS

"I am Safa Al-Sarraj, MBChB, MSc, FRCPath Consultant Neuropathologist, Kings College NHS trust and Professor in Neuropathology and Director of the Brain Bank at Kings College London.

This statement is true to the best of my knowledge and belief. And I make it, knowing that if it is tendered in evidence, I shall be liable to prosecution if I have wilfully stated in it, anything, which I know to be false or do not believe to be true.

I carried out a neuropathological examination on the brain of deceased **Gaia YOUNG (A290/21).**

I am regularly consulted by Home Office pathologists to provide forensic and general neuropathology opinions, receive defence instructions and provide related expert witness opinions in Coronial, Crown Family and Court of Appeal Proceedings.

I understand that I owe an overriding duty to the Court to provide independent assistance, to the

Court, by way of unbiased opinion in relation to the matters within my expertise and that such evidence must be uninfluenced by the exigencies of the case. I have complied with, and will continue to comply with, my duty to the Court."

Circumstances of death

At the time of this report I have the following information from HM Coroner for North London (3343493): *On 17th July 2021 Ms Young presented to A&E at University College London Hospital via London Ambulance Service. She present with headaches and vomiting which started around 6pm. She was noted to be acutely confused and behaving oddly. Noted hypotaurine and sodium was 1.28, blood pressure was normal. Prior to coming in at around 6pm she had been out cycling and shopping and did not complain of anything until later that day. Lumber puncture done query encephalitis. CTA Scan done 18/7/21 showed diffuse brain oedema, post hypoxaemia, no blood flow to intra cranial compartment. As a consequence diffuse brain oedema, consequence to hypoxia. On 19/7/21 she was examined by Consultant Neurologist and he said it appears consistent with neuro cerebral oedema caused by toxin/drug. (When Ms Young was brought in, she was asked if she had taken any drugs she said she had not). No evidence of venous thrombosis on first CT scan or radiology to date, there was evidence of cerebral oedema and brain stem herniation. On the 18/7/21 at 3pm they attempted a lumber puncture but Ms Young became restless, the gave her i/v morphine and attempted this again. She was given 5 mls of lidocaine and they entered between the lumbers 3/4 space, no blood was obtain. Ms Young suddenly became unresponsive during the lumber puncture and went into respiratory arrest. They placed a mask on her and applied medication and she came around quickly, she was then intubated. She has not opted into being a donor, her mother wishes for her to be one. Consultant Sara Polhill, said that the cause of death unknown because they do not know what caused the cerebral oedema. She said she can give a proposed death but it would read 1a would read cerebral oedema of unknown ethology. Organs requested heart, lungs, liver, kidney, pancreas, multi vistirals, corneas and other tissues.*

Brain examination

Macroscopy

Specimen received on 12.08.2021 at 12.14 hours.

Dura: One piece of dura is submitted composed of dorsal attached to infratentorial and lateral part of dura. There is no evidence of extra or subdural haematoma. There is uniformly red and loosely attached clot in the superior sagittal and straight sinuses suggestive of post mortem clot but histological sections are taken. There is no evidence of discoloration of the dura or haemorrhage.

Spinal cord: Not submitted.

Brain: Weight of formalin fixed brain is 1417 g.

External examination
The brain is swollen and soft in consistency. There is mild flattening of the gyri over dorsal surface of right and left cerebral hemispheres. The cerebral hemispheres are symmetrical. The cerebellum and brainstem structures are detached from the brain (at time of autopsy examination due to severe softening of brainstem and cerebellum).

The blood vessels at the base of the brain appear unremarkable. There is no evidence of vascular malformation or aneurysm. There is slight haziness of the meninges at the depth of the sulci over dorsal basal surface of the brain but no thickening or discoloration.

There is no evidence of uncal or tonsillar herniation. The optic chiasm is symmetrical. The olfactory bulbs are unremarkable.

Coronal sections
The cerebral hemispheres are asymmetrical. The brain is soft in consistency. There is bilateral compression to the lateral ventricles. The appearances are consistent with oedematous changes. There is slight pallor of the white matter and cortex with dusky discoloration mainly at the depth of the sulci. These appearances suggest hypoxic-ischaemic damage.

There is no evidence of any contusions or lacerations in the cortex. The white matter shows a few congested blood vessels but no evidence of haemorrhage. There are multiple small haemorrhages or congested blood vessels in the anterior part of right and left thalami. The caudate, putamen and globus pallidus are unremarkable. The amygdalae and hippocampi are symmetrical and of normal internal structure. There is slight artefactual disruption to the base of the brain including base of the thalami.

The cerebellum is soft and slightly disintegrated in many parts. Some of this could be due to oedematous changes and hypoxic-ischaemic damage or possibly due to autolysis. There is artefactual fragmentation of the brainstem structures which are soft in consistency and show multiple small pinpoint haemorrhages.

Summary of gross examination of the brain

1. Brain swelling with flattening of the gyri.
2. Pallor of the cortex with dusky discoloration at the depth of the sulci.
3. Softening and pallor of the white matter with multiple congested blood vessels.
4. Congested blood vessels or small pinpoint haemorrhages in the anterior part of right and left thalami and brainstem structures.

Comment
The gross examination of the brain shows features more suggestive of hypoxic-ischaemic damage based on brain swelling and dusky discoloration at the depth of the sulci with pallor of cortical ribbon and white matter. There is no evidence of focal lesion like haemorrhage or infarct.

The meninges are slightly hazy but are within normal limits, considering the diffuse hypoxic-ischaemic damage to the brain.

Further assessment will be done by histological examination and immunohistochemical tests.

Reported on 31.08.2021

Blocks
Superior sagittal sinus (1), straight sinus (2), left cerebellum (3), left frontal lobe (4), left parietal lobe (5), left basal ganglia (6), middle corpus callosum (7), right and left hippocampi (8), pons (9), right frontal lobe (10), right parietal lobe (11), right temporal lobe (12)

Stains
H&E, βAPP, CD68

Microscopy

Superior sagittal sinus post mortem clot

Corpus callosum
One level of corpus callosum is examined. There is no evidence of haemorrhage. βAPP shows multiple patches of faint granular and filamentous deposits.

Hippocampus
The right and left hippocampi are examined. The neurones in the pyramidal cell layer are unremarkable. There is no evidence of neuronal loss, gliosis or recent ischaemia.

Cerebral cortex and white matter
There is vacuolation in the cortex. Many neurones show shrinkage and slight acidophilic changes in the cytoplasm consistent with recent ischaemia. There are a few congested blood vessels in the white matter. The βAPP shows multiple patches of faint and filamentous deposits throughout the white matter. There is mild increase in number of activated microglia cells around capillaries in the white matter.

Left basal ganglia
The thalamus and putamen are unremarkable. βAPP shows multiple patches of faint ill-defined filamentous and granular deposits consistent with recent disruption of axonal transport. There is no increase in number of activated microglia cells.

Left cerebellum
The Purkinje cells show slight shrinkage. There is pallor of granular cell layer. The white matter is unremarkable. βAPP shows similar appearances to those described above as patches of filamentous and faint granular deposits.

Pons
Unremarkable. No evidence of haemorrhage. βAPP shows multiple, relatively well-defined patches of intense granular and filamentous deposits consistent with recent disruption of axonal transport.

Summary of gross and histological examination of the brain

1. Brain swelling with flattening of the gyri.
2. Pallor of the cortex with dusky discoloration at the depth of the sulci. Histological examination shows features of recent ischaemia.
3. Softening and pallor of the white matter with multiple congested blood vessels.
4. Widespread accumulation of βAPP in the white matter and white matter tracts as patches of filamentous and granular deposits consistent with recent axonal disruption and injury.
5. Mild (but not significant) increase in number of activated microglia cells around small capillaries in the white matter.

Opinion

1. The deceased is a 25 year old female who presented with headaches and vomiting, became acutely confused. Lumbar puncture ?encephalitis. CT scan showed diffuse brain ischaemia and post-hypoxaemia and no blood flow to intracranial compartments. Clinical impression was neurocerebral oedema caused by toxin/drug or encephalitis. IV morphine given due to restlessness but she suddenly became unresponsive and went into respiratory arrest and later died.
2. The brain examination confirms presence of brain swelling and oedema. There are features of recent ischaemia in the neurones of the cerebral cortex. The ischaemia could have resulted from final events of reduction of oxygen and blood supply to the brain for various reasons.
3. There is widespread accumulation of βAPP in the brain indicating recent axonal injury. This could be due to hypoxic-ischaemic damage to the brain as well as other causes such as drug use/abuse. I have noted she was given IV morphine during lumbar puncture procedure after which she became unresponsive. It is possible that this dose of morphine had caused some disruption of axonal transport and is responsible for βAPP accumulated deposits. However, it is essential in this case to investigate any drug use/ abuse from pre-mortem blood sample before final collapse and respiratory arrest.

4. There are a few activated microglia cells around capillaries in the cerebral white matter. This is a not entirely specific finding and could be seen in different conditions and reactive changes. More importantly, there is no evidence of any inflammatory cell infiltration to the brain parenchyma in the meninges. There is no evidence of encephalitis or meningitis.
5. In summary, the brain shows changes which are secondary to other factors (including hypoxic-ischaemic damage or effects of drug use/abuse) but there is no evidence of primary brain pathology which could have caused the respiratory arrest or cerebral oedema.
6. I will review my histological examination of the brain and opinion if further information (including toxicology results) become available.

Conclusion
Recent ischaemia and evidence of axonal disruption. Further correlation with autopsy findings and toxicology results is recommended.

Expert Witness Self Certification
I confirm that I have read guidance contained in a booklet known as Disclosure: Expert's evidence and unused material which details my role and documents my responsibilities, in relation to revelation as an expert witness. I have followed the guidance and recognise the continuing nature of my responsibilities of revelation. In accordance with my duties of revelation, as documented in the guidance booklet, I:

a. Confirm that I have complied with my duties to record, retain and reveal material in accordance with the Criminal Procedure and Investigations Act 1996, as amended;
b. Have compiled reports. I will ensure that the reports are updated in the event I am provided with or generate additional material;
c. That in the event my opinion changes on any material issue, I will inform the investigating officer, as soon as reasonably practicable and give reasons.

T-A0100

F-39340

Professor S Al-Sarraj MB ChB MSc FRCPath
Consultant Neuropathologist
07/10/2021
SAlS