ADAM STRAIN
BRIEF FOR EXPERT ON PAEDIATRIC PATHOLOGY

INTRODUCTION

1. Adam Strain is one of 4 children who are the subject of a public inquiry being conducted by John O'Hara QC.

2. Adam was born on 4th August 1991. He died on 28th November 1995 in the Royal Belfast Hospital for Sick Children ("the Royal") following kidney transplant surgery. The Inquest into his death was conducted on 18th and 21st June 1996 by John Leckey the Coroner for Greater Belfast, who engaged as experts: (i) Dr. Edward Sumner then Consultant Paediatric Anaesthetist at Great Ormond Street Hospital for Sick Children ("Great Ormond Street"); (ii) Dr. John Alexander Consultant Anaesthetist at Belfast City Hospital; and (iii) Professor Peter Berry of the Department of Paediatric Pathology in St. Michael's Hospital, Bristol. The Inquest Verdict identified Cerebral Oedema as the cause of his death with Dilutional Hyponatraemia as a contributory factor.

3. Adam is one of 5 children who died in hospital and whose treatment, or certain aspects of treatment, and/or the aftermath of their death is being investigated.

4. The impetus for this Inquiry was a UTV Live 'Insight' documentary 'When Hospitals Kill' shown on 21st October 2004. The documentary primarily focused on the death of a toddler called Lucy Crawford (who died in hospital in 2000 and whose death was subsequently found to have been as a result of hyponatraemia). The programme makers identified what they considered to have been significant shortcomings of personnel at the Erne Hospital where Lucy had been initially treated before being transferred to the RBHSC. In effect, the programme alleged a cover-up and it criticised the hospital, the Trust and the Chief Medical Officer. The programme also referred to the deaths of Adam and Raychel in which hyponatraemia had similarly played a part. At that time, no connection had been made with the deaths of Claire and Conor.

TERMS OF REFERENCE

5. The Inquiry was established under the Health and Personal Social Services (Northern Ireland) Order 1972, by virtue of the powers conferred on the Department by Article 54 and Schedule 8 and it continues pursuant to the Inquiries Act 2005.

6. The Inquiry's revised Terms of Reference[1] are :

"To hold an Inquiry into the events surrounding and following the deaths of Adam Strain and Raychel Ferguson, with particular reference to:

i. The care and treatment of Adam Strain and Raychel Ferguson, especially in relation to the management of fluid balance and the choice and administration of intravenous fluids in each case.

ii. The actions of the statutory authorities, other organisations and responsible individuals concerned in the procedures, investigations and events which followed the deaths of Adam Strain and Raychel Ferguson.

iii. The communications with, and explanations given to, the respective families and others by the relevant authorities.

(a) Report by 1 June 2005 or such other date as may be agreed with the Department, on the areas specifically identified above and, at his discretion, examine and report on any other relevant matters which arise in connection with the Inquiry.

(b) Make such recommendations to the Department of Health, Social Services and Public Safety as he considers necessary and appropriate."

7. Claire Roberts and Conor Mitchell were included into the Inquiry's work by the Chairman pursuant to his discretion. Claire Roberts' case is being investigated in accordance with precisely the same terms as those of Adam Strain and Raychel Ferguson. The investigation of Conor will address more limited issues in view of the fact that hyponatraemia was not thought to be a cause of his death.

ROLE OF THE EXPERTS

8. The Role of the Experts to the Inquiry is set out in 'Protocol No.4: Experts', a copy of which is attached. There are 4 categories of expert assistance:

(a) Expert Advisors to assist the Inquiry in identifying, obtaining, interpreting and evaluating the evidence within their particular area of

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1 The reference in the original Terms of Reference to a child named Lucy Crawford was removed following a request by Lucy's family. The Chairman has interpreted the Revised Terms of Reference as follows:
"… the terms still permit and indeed require an investigation into the events which followed Lucy's death such as the failure to identify the correct cause of death and the alleged Sperrin Lakeland cover-up because they contributed, arguably, to the death of Raychel in Altnagelvin. This reflects the contention that had the circumstances of Lucy's death been identified correctly and had lessons been learned from the way in which fluids were administered to her, defective fluid management would not have occurred so soon afterwards (only 14 months later) in Altnagelvin, a hospital within the same Western Health and Social Services Board area."

expertise, currently: (a) Paediatrician; (b) Paediatric Anaesthetist; (c) Nurse in Paediatric Intensive Care; and (d) National Health Service Hospital Management

(b) Experts appointed to 'peer review' the work of the Expert Advisers, currently: (a) Internal Medicine/Nephrology; (b) Paediatric Anaesthetist; and (c) Paediatric Intensive and Critical Care Nursing

(c) Experts on a case by case basis as Expert Witnesses

(d) Experts to provide commissioned 'Background Papers'

9. You have been identified as an expert whose role falls within category (c) above. You are asked to consider Protocol No. 4 from this perspective.

BACKGROUND TO ADAM

10. Adam Strain was born with cystic, dysplastic kidneys with associated problems with the drainage of his kidneys related to obstruction and vesico-ureteric reflux. He was referred to the Royal from the Ulster Hospital in Dundonald and came under the care of Dr. Maurice Savage (Consultant Paediatric Nephrologist)[2] and Mr. Stephen Brown (Consultant Paediatric Surgeon).

11. Adam had multiple operations to his urinary tract, during which he was largely under the care of Mr. Stephen Brown. He had re-implantation of his ureters on 2 occasions and had nephrostomies performed during the early months of his life. On several occasions, he was critically ill and required care in PICU and a brief period of dialysis due to acute renal failure. In addition a fundoplication procedure was carried out in 1992 when Adam was less than a year old, to help prevent gastro-oesophageal reflux. Eventually he required all his nutrition through a gastrostomy tube and, in 1993, he had a cystoscopy and PEG gastrostomy. In October 1995, he had his PEG changed.

12. Adam was subject to recurrent urinary tract infections and his renal function deteriorated to the point where he required dialysis for uraemia. His mother was trained in the home peritoneal dialysis technique so that he could be dialysed at home. His urine output was quite large but of poor quality and he was described as being polyuric. Biochemistry tests carried out when he was a few months old showed the sodium content of his urine to be 29 – 52 mmol/l.

13. A graph of all Adam's recorded urine sodium results is shown below:

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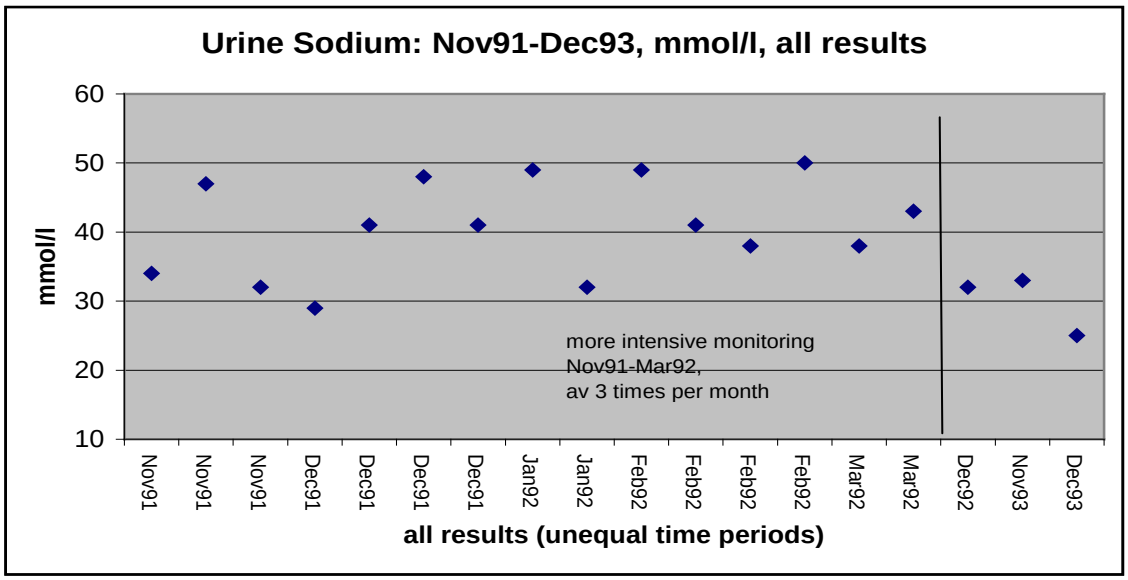
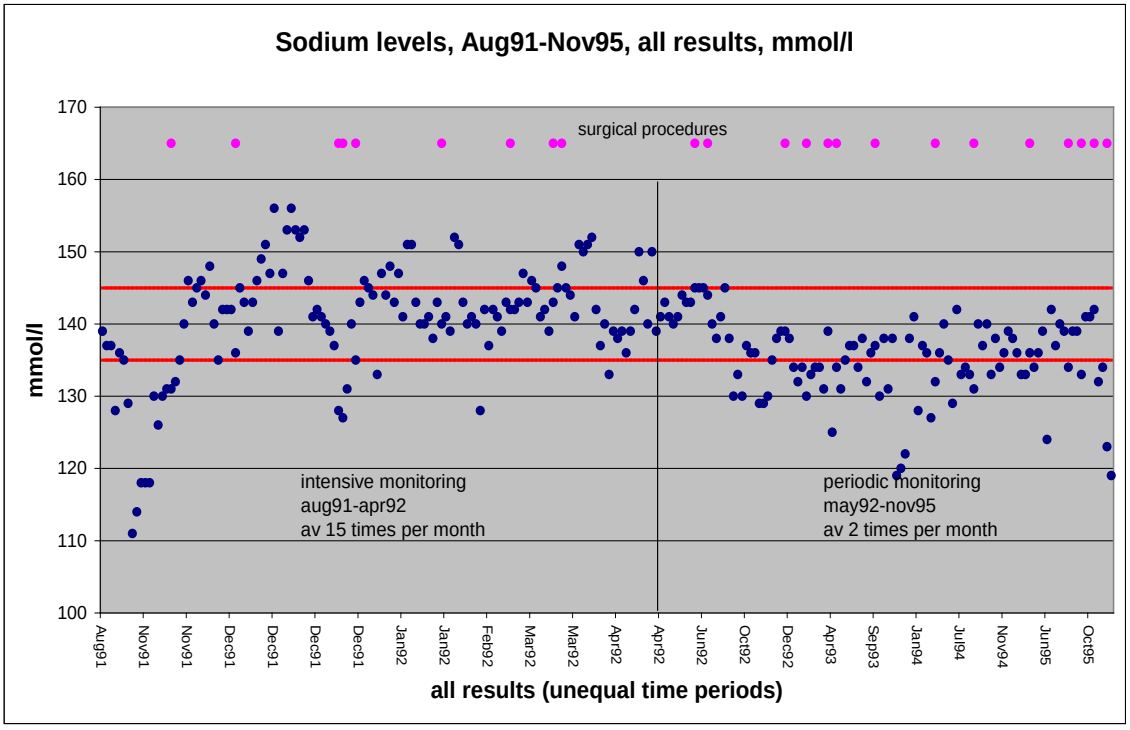
[2] Now Professor Maurice Savage



14. According to his nephrologist, Dr. Maurice Savage, Adam had a potential for hyponatraemia and he received sodium supplements in his feeds.

15. A graph of all of his recorded blood sodium levels is shown below with 135-145mmol/l being the normal range:



16. The management of his serum sodium levels appears to have been largely carried out under the care of Messrs. Victor Boston and Stephen Brown, both Consultant Paediatric Surgeons. Despite that, his recorded sodium levels for

1995, the year of his transplant surgery, show one very low result of 124 mmol/l and a number below the normal range of 135-145 mmol/l. Furthermore, in Adam's first year of life his recorded sodium levels fell as low as 111 mmol/l, 114 mmol/l and 118 mmol/l. Thereafter there were numerous occasions when his recorded serum sodium levels fell below the normal range.

17. Adam was put on call for a kidney transplant once he was placed on dialysis. His tube feeds in the months prior to the transplantation surgery were slightly over 2 litres per day and he passed in excess of 1 litre of urine each day.

18. Adam received the offer of a reasonably matched kidney on 26th November 1995. The donor kidney had been removed from a heart-beating 16-year-old donor with normal renal function at 1.42am on 26th November 1995. Transplant surgery was scheduled for 6.00am on 27th November 1995.

19. Adam was admitted to the ward in the Royal Belfast Hospital for Sick Children (RBHSC) at approximately 21.00 on 26th November 1995. A blood sample was taken from Adam at approximately 21.30 by Dr. Jacqueline Cartmill[3]. At 23:00 on 26th November 1995, Adam's serum sodium was recorded as 139 mmol/l and Hb 10.5 gm/dl. A second serum sample was taken from Adam on 26th November 1995. There is a second electrolytes laboratory report, recording a sample taken on 26th November 1995 but reporting thereon on 27th November 1995, showing a serum sodium concentration of 133mmol/L.[4] On the evening of 26th November 1995 a cannula was inserted and an IV fluid infusion commenced at about 23.00.[5] It may be that a second blood sample was taken from Adam at the time the cannula was being inserted at approximately 23.00, and this would account for the laboratory report being available on the following day, rather than on 26th November.

20. As part of the preparation for his surgery, his feeds were changed although there remains an issue as to exactly what they were changed to. According to his charts, he was given 952 ml of 'clear fluid' to stop 2 hours before going into theatre. The nursing records do not state the nature of the 'clear fluids' given. Some witnesses have claimed that fluid was Dioralyte (containing 60 mmol of sodium chloride/L). However, Dr. Maurice Savage's Inquest Deposition was amended to delete '*Dioralyte*' and substitute '*N/5 Saline Dextrose*' (containing 30mmol of sodium chloride/L).[6] In any event, it is thought that he received almost a litre of fluids.[7] Apparently it was planned between Dr. Maurice Savage and Dr. Robert Taylor (Consultant Paediatric Anaesthetist) that Adam

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3 WS 003/1 p.2 Q1.
4 Ref: 301-081-547
5 Ref: 057-010-013
6 Ref: 200-002-052
7 Ref: 057-010-013

should receive intravenous fluid (75 ml/h) after the tube feeds were discontinued and have his blood chemistry checked before going to theatre. Those checks did not take place. Once again, there are different views as to why they did not. Adam did not receive 75ml/hr intravenously as originally planned. From 23.00 he received "*5/N*" at 20ml/hr.[8] At approximately 01.30 on 27th November 1995 the cannula tissued and it appears that further intravenous access was not achieved until Adam was in theatre. At approximately 02.00 the rate of administration of Adam's feed was increased from 180ml/hr to 200ml/hr and this continued until 05.00.

21. Adam normally received peritoneal dialysis 6 nights a week with 750ml volume cycles and 15 cycles given over 13 hours on a normal evening.[9] On the 26th and 27th November 1995 Adam had a shorter period of dialysis with 8 cycles for a period of approximately 7-8 hours with 750 ml fluid volume cycles of 1.36% Dextrose solution.[10]

22. The main events surrounding Adam's pre-operative, peri-operative and post-operative care and treatment are summarised in the following table:

Date	**Event**	
26.11.95	20:00	Adam brought to RBHSC
	21.30	Blood taken resulting in the serum sodium level subsequently reported as 139mmol/L
	22:00	Evaluation Nursing Report taken by SN Murphy
	23:00	i.v. fluids commenced prescribed by Dr. Cartmill (SHO); Results of investigations recorded by Dr. O'Neill (SHO) as haemoglobin 10.5g/dl, sodium 139mmol/l and urea 16.8 mmol/l; Dioralyte instead of Nutrison gastrostomy feeds on Dr. Taylor's (Consultant Paediatric Anaesthetist) advice Blood possibly taken resulting in the serum sodium level of 133mmol/L subsequently reported
	23:30	Medical history and clinical examination taken by Dr. O'Neill (Senior House Officer): (i) temp. 36.4; (ii) pulse 97; (iii) blood pressure 108/56; (iv) weight 20.2kg
27.11.95	01:30	SN Murphy recorded i.v. fluids tissued and informed Dr. O'Neill
	05:00	i.v. cannula reinserted (although this is recorded, it seems that the

8 Ref: 057-010-013, WS 005/2. P.5 Q2(c)
9 WS001/2, p.4 Q12, WS002/3, P. 8 Q2(n)
10 WS002/3, p.8, Q2(n), Ref: 011-001-001, 011-015-109 to 011-015-110

Date	Event	
		cannula was not actually reinserted) Between 23:00 and 0500 952ml of 'Dioralyte' given internally. Peritoneal Dialysis cycles as normal (750 ml fluid volume 1.36% Dextrose solution – 8 cycles (as opposed to the usual 15 cycles) given before theatre). Dialysis stopped at approximately 05:00
	06:55	Adam arrival in theatre. Anaesthesia induced.
	07:00	Dextrose saline fluids (0.18% NaCl in 4%glucose) started i.v. by Dr. Taylor – 500 ml given up to 07:30. Epidural inserted by Dr Montague. Arterial line inserted by Dr Taylor.
	08:00	Central Venous Line inserted via right subclavian vein initial reading of 17 mmHg (considered by Dr. Taylor to be unreliable due to the incorrect position of the CV line catheter tip. Transplant surgery started by Mr. Keane (Consultant Urologist); further 500 ml of Dextrose saline fluids given up to 08:45
	08:30	Donor kidney removed from ice; 400 ml HPPF given
	08:45	Rate of Dextrose saline fluids slowed (500 ml given up to 1100) and 500 ml Hartmann's solution commenced
	09.15	400 colloid fluids (HPPF) given
	09:32	Results of pH Blood Gases and Electrolytes received, showing sodium at 123 mmol/l ('normal' shown on the report as 135-145) and haematocrit at 18% (Adam's normal being 30%3) and haemoglobin 6.1g; 250 ml packed red blood cells given
	10:45	200 ml colloid fluids (HPPF) and 250 ml packed red blood cells given
	11:00	Skin closure by Mr. Brown (Mr. Keane having apparently left due to an emergency); neostigmine and glycopyrolate administered by Dr. Taylor to reverse the neuromuscular blockade; blood loss recorded from swabs (328 ml), suction (500 ml) and other (300 ml)
	circa 11:55	Adam failed to wake, did not breathe and pupils fixed and dilated
	12:05	Adam transferred to PICU for ventilation of his lungs and assessment; puffy appearance with central venous pressure (CVP) approx. 30 mm Hg dropping to 11 mmHg; Mannitol 50 ml prescribed and reduction in fluids
	12:15	Adam's appearance is 'bloated'
	19:35	First brain stem test carried out by Dr. Webb (Consultant

Date	Event	
		Paediatric Neurologist)
28.11.95	09:10	Second brain stem test carried out by Dr. Webb (Consultant Paediatric Neurologist)
	circa 11:30	Ventilatory support withdrawn and lines removed
29.11.95	14:40	Autopsy commenced by Dr. Alison Armour (Senior Registrar Forensic Medicine, State Pathologist's Department) at the Mortuary for the Royal Group of Hospitals
08.12.95		The Coroner notes that Dr. Armour showed slides to Dr. Denis O'Hara (Consultant Paediatric Pathologist) and Dr. Chitra Bharucha (Consultant Haematologist) and he records that they both stated there was *"clear evidence of hypoxia/anoxia/anaphylactic reaction"*
22.12.95		Histological slides sent to Professor Jeremy Berry (Professor of Paediatric Pathology, University of Bristol) for a second opinion by Dr. Armour
12.01.96		Brain was cut after fixation. Dr. Armour claims that the brain, spinal cord and histological slides were seen by Dr. Meenakshi Mirakhur (Consultant Neuropathologist, Royal Group of Hospitals)

23. A post-mortem was carried out on 29th November 1995 in the Mortuary, Royal Victoria Hospital, Belfast by Dr. Armour who reported the cause of Adam's death as: 1(a) cerebral oedema due to (b) dilutional hyponatraemia and impaired cerebral perfusion during renal transplant. The Royal Victoria Hospital (RVH) and the RBHSC are located on the same site in Belfast. The latter is the children's hospital and the former provides services principally to adults and also to paediatric patients when RBHSC does not have that particular service e.g. in 1995 paediatric CT scans were carried out in RVH.

24. We attach Dr. Armour's notes from the autopsy. Those notes provide information which has not been included in her final autopsy report, such as:

    (a) The fresh unfixed brain weight is recorded as *"1,302gms"*, but this figure is partially struck out and reads *"1,320gms"*. The reason for the amendment of the weight in unknown nor the time of amendment. …

    (b) Information on lungs regarding their weight and the degree of oedema therein.

(c) Further information on the pleural cavities and the trachea & main bronchi.

25. For the purposes of her Report, Dr. Armour sought a second opinion on the histological slides from Professor Jeremy Berry (Professor of Paediatric Pathology). He was sent slides of: (i) the native kidneys and the donor kidney; (ii) spleen; (iii) lungs; (iv) liver; (v) lymphnode. He noted that there was unexplained cellular change in the hepatocytes scattered throughout his liver but he did not know the significance of it. He concluded that the transplanted kidney was infarcted (dead) at or before the time of transplantation.[11]

26. Dr. Armour claims to have sought a second opinion on the brain and related material from Dr. Meenakshi Mirakhur (Consultant Neuropathologist) and sent her the brain, spinal cord and histological slides. Blocks were taken from: (i) right frontal white matter; (ii) left cingulated gyrus; (iii) left basal ganglia; (iv) right and left hippocampus; (v) left occipital lobe; (vi) cerebellum; (vii) pons in toto; (viii) thalamus and the brain was photographed sequentially. Blocks were also taken from: (i) cervical; (ii) thoracic; (iii) lumbar. Dr. Armour also claims that Dr. Mirakhur's views were consistent with Dr. Armour's description of and comments on the brain in her Report on Autopsy.[12] However, no formal neuropathological report was requested by Dr. Armour nor was any such report provided by Dr. Mirakhur. Furthermore Dr. Mirakhur denies any knowledge of her opinion being sought or of seeing any slides and she claims not to have seen the Report on Autopsy until the Inquiry referred her to it in seeking a Witness Statement from her. We have attached the witness Statements of both Dr. Armour and Dr. Mirakhur.

27. The Coroner made a note dated 8th December 1995 that,

"...Today Dr. Armour showed slides etc to Dr. O'Hara and Dr. Bharucha. Both stated that there was clear evidence of hypoxia/anoxia/anaphylactic reaction. Those are virtually all the same thing."[13]

Dr. Armour states that the slides would have been shown to these doctors for their opinion [14] Dr. Bharucha (Consultant Haematologist) has stated that she has no knowledge of Adam[15]. Dr. Denis O'Hara (Consultant Paediatric Pathologist) is now deceased. Dr. Armour states there was no evidence of "*hypoxia/anoxia/anaphylactic reaction*"[16].

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11 Ref: 011-007-020 (Report) – attached; Ref: 011-029-151 (letter of instruction) - attached
12 Ref: 011-010-034 - attached
13 Ref:011-025-125
14 WS012/2 p.12, Q24
15 WS229/1 p.1
16 WS012/2, p.13 Q24(d)(ii)

Dr. Armour also states in the autopsy report:

"*MICROSCOPY: ...*

(The above slides were seen by Professor J. Berry, Consultant Paediatric Pathologist)

Brain: There was massive cerebral oedema of the cortex and white matter. There was no evidence of terminal hypoxia. .." [17]

"Generalised cerebral oedema in children has many causes including hypoxia. In this case this has been excluded." [18]

28. Dr. Armour wrote to Professor Jack Crane, State Pathologist, on 8th December 1995 stating that she had been dealing with the case of Adam Strain and further,

"*I am willing to attend any meeting about this case, including a meeting with clinicians, administrative staff, H.M. Coroner and whoever else wishes to attend. As I was the pathologist who carried out the autopsy I feel my opinion on the case is relevant to such a meeting and as such the case could be discussed in full."*

This letter was prior to the provision of the autopsy report, and was copied to the Medical Protection Society, Mr. Calvin Spence of the British Medical Association, Mr. George Murnaghan, Hospital Administration and the Coroner.[19]

29. Dr. Armour's autopsy report is undated. The Coroner sent copies of that report to Mrs. Slavin, Dr. E. Sumner, Dr. J. Alexander and Dr. George Murnaghan by letter dated 22 April 1996.[20]

30. The Report on Autopsy records the fluids given to Adam. Dr. Armour also reports and comments that the fixed weight of the brain at post-mortem was 1,680gms, the average weight for a boy of this age being 1,300gms and the average weight of a man's brain being 1,450gms and that it was the *"effects of this massive swelling of the brain which caused his death"*.[21]

31. The Inquest that was subsequently conducted into Adam's death on 18th and 21st June 1996 recorded the Verdict that the cause of his death was:

"1(A) Cerebral Oedema

17 Ref: 011-010-040
18 Ref: 011-010-041
19 Ref: 011-023-123.
20 Ref: 011-059-194, 011-060-195, 011-061-196 and 100-062-197.
21 Ref: 011-010-040 - attached

due to

(B) Dilutional Hyponatraemia and impaired cerebral perfusion during renal transplant operation for chronic renal failure (congenital obstructive uropathy)

Findings:

The onset of cerebral oedema was caused by the acute onset of hyponatraemia from the excess administration of fluids containing only very small amounts of sodium and this was exacerbated by blood loss and possibly the overnight dialysis and the obstruction of the venous drainage to the head".

32. The Coroner, Mr. John Leckey, was assisted in reaching that Verdict by Dr. Edward Sumner (Consultant Paediatric Anaesthetist) who was retained to prepare a Report on the circumstances of Adam's death. Dr. Sumner concluded in his Report dated 22nd January 1996:

"I believe that on a balance of probabilities Adam's gross cerebral oedema was caused by the acute onset of hyponatraemia (see reference) from the excess administration of fluids containing only very small amounts of sodium (dextrose-saline and plasma). This state was exacerbated by the blood loss and possibly by the overnight dialysis.

A further exacerbating cause may have been the obstruction to the venous drainage of the head. If drugs such as antibiotics were administered through a venous line in a partially obstructed neck vein then it is possible that they could cause some cerebral damage as well."

33. Dr. Sumner also gave evidence at Adam's Inquest and his Deposition of 18th June 1996 records him as having expressed the following views:

"All the fluids given after dialysis may have been given to increase central venous pressure. It may have had the effect of causing the dilution of the sodium in the body. Fluid balance in paediatrics is a more controversial area with a variety of views. With kidney transplants one gives more fluids than in other operations ["it is usual to be generous with fluids to maintain a CVP of 10-12 to optimise perfusion of the new kidney and to establish its urine-producing function"[22]]. When the new kidney is perfused it is vital that sufficient fluids are available. I got the impression that Dr. Taylor was not believing the CVP readings he was getting. I believe they were probably correct but high. I think I would have believed them. A high CVP can mean too much fluid has been administered[23] … The low sodium was indicative of the hyponatraemia. Below 128 is a hyponatraemic state."

[22] See Dr. Sumner's Report of 22nd January 1996 at ref:011-011-059 – attached

[23] Dr. Sumner prepared his Report on the basis that Adam received 900mls of Dioralyte. See at ref: 011-011-055 – attached. That figure was corrected in correspondence between the Coroner and Dr. Armour but it is not

34. Dr. Robert Taylor (Consultant Paediatric Anaesthetist) gave evidence at the Inquest. His Deposition of 21st June 1996 shows that he disagreed with Dr. Sumner's principal finding:

"I cannot understand why a fluid regime employed successfully with Adam previously, led on this occasion to dilutional hyponatraemia … I believe that the underlying cause of the cerebral oedema was hyponatraemia (not dilutional) during renal transplant operation.

[…]

Adam was the only child with polyuric renal failure I have anaesthetised for renal transplant. He needed a greater amount of fluid because of the nature of the operation ["All the more important in this case is the need to avoid dehydration that will deprive the donor kidney of sufficient fluid to produce urine"[24]]. I believe the fluids given were neither restrictive or excessive. The new kidney did not work leading to a re-assessment of the fluids given. This made us think we have underestimated fluid and we gave a fluid bolus at 9.32."

35. Dr. Taylor set out his objections to Dr. Sumner's report and Dr. Armour's autopsy report in correspondence dated 2nd February 1996 and 8th May 1996 respectively.[25]

36. The circumstances of the calculation of the fluids given to Adam and the actual amounts involved (bearing in mind his 'polyuric condition'[26]) are important issues for the Inquiry as they go to whether Adam's hyponatraemia might have been avoided by appropriate fluid management.

37. Dr. Armour reports that a chest x-ray revealed pulmonary oedema.[27] It is unclear whether Dr. Armour examined the x-rays herself or relied upon the description thereof in Adam's medical notes and records. Similarly it is unknown whether Dr. Armour examined the CT scan of Adam herself or relied upon the description thereof in Adam's medical notes and records.

38. Dr. Armour was a trainee forensic pathologist at Senior Registrar grade employed within the State Pathologist's Department in 1995. Dr. Armour

clear that the correspondence from Adam's mother referring to the lower figure was passed to Dr. Sumner. Dr. Armour thought that the difference between the two figures made no difference to her opinion on the cause of Adam's death: *"It is not just the volume of fluid he received but the type."* See at ref: 011-079-214 – attached

24 See Deposition at ref:011-014-100 - attached

25 Ref: 059-053-108, 059-036-071.

26 See letter dated 2nd March 1995 from Mr. Maurice Savage (Consultant Paediatric Nephrologist) to Dr. Scott (Adam's GP) explaining: *"The problem is he still needs about 2 litres a day because of his polyuric renal failure"* (Ref: 057-072-133) - attached.

27 Ref:011-010-036

worked under the supervision of the consultant pathologist(s) within the State Pathologist's Department. The consultant grade pathologists took "clinical" responsibility for the autopsies they performed but the State Pathologist, Professor Jack Crane, had overall responsibility for ensuring that all cases were carried out appropriately and to a high standard.[28]

REQUIREMENTS

39. The Inquiry team requires your assistance with the following matters, arising out of the material received to date and the guidance of the Inquiry's Expert Advisors.

A. <u>Protocols, Procedures, Guidelines or Guidance in 1995</u>

40. Identify any protocols, procedures, guidelines, guidance and established and/or good practice in 1995 relating to and/or governing:

    (a) the conduct of an autopsy

    (b) compilation of an autopsy report

    (c) the level of training, experience and expertise appropriate or required to carry out an autopsy generally and also in relation to a case similar to Adam's.

    (d) a pathologist requesting and seeking specialist assistance, advice, opinion or second opinion for an autopsy.

    (e) both formal and informal neuropathological referrals by pathologists on paediatric autopsies, and tracking samples and tissues.

B. <u>Conduct of the Autopsy</u>

41. Please explain how, as a matter of appropriate practice in 1995, a pathologist should have carried out a full autopsy on a young child that had died during, or as a result of, surgery and who had developed cerebral oedema, including:

    (a) Specify what grade of clinician should have performed it i.e. Senior Registrar (Forensic Medicine) or Consultant

[28] Ref: INQ-0782-12

(b) State what level of training, experience and expertise would have been appropriate or required for a pathologist to have been competent to carry out Adam's autopsy.

(c) State whether, if a Consultant was not performing the autopsy, a Consultant should nonetheless have been involved in some capacity and if so, how and in what circumstances

(d) State whether it would have been appropriate to have taken photographs of the external appearance of Adam's body in addition to those of the brain, and state the reasons why. Also state whether:

- Photographs were usually taken at autopsy in 1995, and if so, of what.

- Photographs are normally taken now, and if so, of what.

(e) State whether the Mortuary, Royal Victoria Hospital, Belfast was an appropriate location for Adam's autopsy, particularly where there may have been an issue over the conduct of the clinicians and their involvement in the child's death. Please state the reasons for your answer.

(f) Explain how the clinical history should have been obtained, especially where there was to be an Inquest and the conduct of the treating clinicians may have been under question.

(g) Specify what input there should have been from other disciplines or specialisms and how that should be sought

(h) Identify who should have been present (including whether the clinicians whose conduct may have been under question) and for what purpose.

C. <u>Specialist assistance in Adam's autopsy</u>

Dr. Armour stated:

At the Inquest: "*This was massive cerebral oedema and I have never come across anything of a similar degree. The cause of it in this case is extremely rare and never encountered by me previously. On a worldwide basis it would be equally rare. It was a complex case because of Adam's underlying condition, his previous surgery and the technical difficulty of the operation.*"[29]

In the autopsy report: "*COMMENTARY:...*

[29] Ref: 011-010-030

The autopsy revealed gross cerebral oedema. ...This is a highly complex and difficult case..." [30]

In her witness statement: "*...as far as my memory serves me I am unaware of a case where dilutional hyponatraemia had caused the death of a child or contributed to it to any great extent. This was the first case I had undertaken of a child dying after renal transplant surgery. To date I have not carried out any such other case."*[31].

42. In the circumstances, state whether it would have been appropriate in 1995 for Dr. Armour to have requested specialist assistance or additional advice to carry out Adam's autopsy and produce the autopsy report, and if so:

    (a) Identify from which disciplines/persons Dr. Armour should have requested specialist assistance/advice, and explain the reasons for your answer.

    (b) State how Dr. Armour should have sought and obtained this specialist assistance/advice, and how that request and advice should have been recorded.

D. <u>Consultant pathologist's supervision of Dr. Armour in relation to Adam's autopsy and report</u>

43. Describe the responsibilities and duties of the consultant supervisor in the supervision of Dr. Armour in relation to Adam's autopsy and report.

44. Describe the nature and degree of the supervision which would have been appropriate in Adam's case.

45. State how, when and where you would have expected that supervision to take place and in particular in relation to:

    (a) the autopsy examination

    (b) provision and countersigning of the autopsy report

    and explain the reasons why.

46. State whether Dr. Armour should have sought the advice of her consultant supervisor in relation to Adam's autopsy and report, and explain the reasons why.

30 Ref: 011-010-040 to 011-010-041
31 WS012/1 p. 15 Q8(d)

47. If so, state what would you have expected the consultant supervisor to have done?

48. In Adam's case, where Dr. Armour was under the supervision of a consultant pathologist(s), state whether the conclusions of Adam's autopsy report were the responsibility of:

    (a) Dr. Armour

    (b) her consultant supervisor

    (c) or both persons,

    and explain the reasons for your answer.

E. <u>Oedema</u>

49. If Adam had suffered from dilutional hyponatraemia, state:

    (a) Whether you would have expected the cerebral oedema to have affected all, or only some parts, of the brain, and explain the reasons why. If only some parts of the brain would have been affected, identify those parts.

    (b) Whether you would have expected the degree of cerebral oedema to have been uniform or varied, and explain the reasons why.

    (c) Whether you would have expected any swelling to have been evident in any other parts of his body, and explain the reasons why. If so, identify those parts.

50. The anaesthetist first noticed that Adam's face, hands and feet were swollen when the sterile towels were removed at the end of the operation in theatre on 27th November 1995.[32] If that degree of swelling was evident on 27th November 1995, in so far as is possible, state:

    (a) What degree of swelling, if any, you would have expected to have seen at the autopsy on 29th November 1995

    (b) How you would have expected it to have been described

    (c) Whether you would have expected photographs to have been taken thereof.

[32] Dr. Taylor WS-008/2, p.45 Q122

Please explain the reasons for your answers.

51. Adam's weight on admission to RBHSC on 26th November 1995 is recorded as 20.2kg.[33] Adam's weight is recorded in the anaesthetic record on 27th November 1995 as 20kg.[34] Adam's autopsy took place on 29th November 1995 at 14.40, and the autopsy report records Adam's weight as *"20 kilograms"*.[35] Dr Armour has stated that "*[a]s far as I can recall the body was duly weighed"* and "[*i*]*t is routine for the mortuary technician to weigh the body prior to the commencement of the autopsy examination...It is not the job of the pathologist to weigh the body."*[36] Details of Adam's fluid balance are recorded on the Fluid Balance Sheets[37] and Anaesthetic Record.[38] Please comment on Adam's weight at autopsy in the light of his fluid balance and his weight on admission.

F. Examination of the Abdomen

52. State whether it would have been appropriate for Dr. Armour to have described in more detail her findings on internal examination of the organs involved in the transplant surgery and previous procedures e.g. the anastomosis of the donor kidney, and the attachment of one ureter to the other, and then the single lower part of the ureter draining into the bladder.[39] Please explain the reasons for your answer.

G. Autopsy Report

53. Please explain how, as a matter of appropriate practice in 1995, a pathologist should have compiled a Report of Autopsy in Adam's case, and in particular:

    (a) State whether Dr. Armour's grade of Senior Registrar should have been shown on the Report

    (b) State whether the autopsy report by Dr. Armour should have been reviewed by a Consultant Pathologist and if so, how any such 'involvement' of a Consultant should have been shown in the report (i.e. whether by a counter signature)

[33] Ref: 057-010-013, 058-035-131
[34] Ref: 058-003-005, 058-003-007
[35] Ref: 011-010-037
[36] Ref: WS 012/2, p. 2, Q2.
[37] Ref: 057-010-013, 057-018-026, 057-018-027, 057-017-024
[38] 058-003-003 to 058-003-007
[39] Ref: 016-085-127

(c) State whether the source of the clinical history and background information should have been disclosed in the report

(d) State whether the fact that advice/input from Consultants in other disciplines was sought should have been identified (i.e. Drs. O'Hara and Bharucha)

(e) Comment on the acceptability of the "procedures" to seek a second or specialist opinion in Adam's case in light of the acceptable standards in November 1995.

(f) State whether and how the input from Consultants in other disciplines should have been identified, cited and used (i.e. Dr. Mirakhur and Professor Berry).

(g) In particular, state whether it would have been appropriate for Dr. Armour to have shown a copy of her report to those Consultants before it was produced to the Coroner, and explain the reasons why.

(h) State whether it would have been appropriate for Dr. Armour to have requested an expert opinion on Adam's CT scans (i.e. those of 27th November 1995 and 7th July 1995), and explain the reasons why. Also, please comment on the implications of the autopsy having been compiled without the benefit of such an opinion.

(i) State whether the Report should have been dated for both the pre-brain fixation part of the Report and the post-fixation part.

H. <u>Tests and investigations</u>

54. Identify any other tests or investigations should Dr. Armour have carried out and explain the reasons for your answer.

55. State what, if anything, would it have been appropriate in 1995 for Dr. Armour to have done in relation to:

(a) the inspection of the anaesthetic equipment in RBHSC

(b) the in-house report provided by Mr. Wilson & Mr. McLaughlin[40] which queried whether they had inspected the relevant theatre equipment. And explain the reasons for your answer.

[40] Ref: 011-004-012

56. State whether it would have been appropriate for Dr. Armour to have taken any further steps or investigations in relation to Adam's liver, in light of Professor Berry's findings in his report.[41]

I. Information

57. Identify what information should Dr. Armour have had in order to conduct a competent autopsy and produce an autopsy report, and if she did not have that information to hand, what steps would it have been appropriate to take in order to obtain it?

    (a) In particular, state whether it have been appropriate for Dr. Armour to have examined and read all of Adam's medical notes and records, or only some of them e.g. only those relating to the transplant surgery. Please explain the reasons for your answer.

58. Dr. Armour stated at the Inquest,

    "*At the autopsy I had 10 sets of notes relating to Adam and the clinicians' statements.*"[42]

    If it would have been appropriate for Dr. Armour to have read all of Adam's medical notes and records, please identify what information it would have been appropriate for Dr. Armour to have been looking for in them.

59. State whether it would have been appropriate for Dr. Armour to have requested and examined the CT scan and the x-rays images and reports herself if she was going to refer to their findings in her Report, and explain the reasons why.

J. Discrepancies between Autopsy Notes and Autopsy Report

60. Please comment on whether the omission of the following information, which was recorded in Dr. Armour's contemporaneous autopsy notes, from the final autopsy report is either significant or relevant, and explain the reasons why:

    (a) Fresh/unfixed brain weight

    The fresh unfixed brain weight is recorded in Dr. Armour's autopsy notes as 1320gms.[43] The weight was originally recorded as 1302gms in the

41 Ref: 011-007-022
42 Ref: 011-010-033
43 WS 012/2 p. 25

notes, but was then corrected to 1320gms. Dr. Armour does not recall why the fresh weight of the brain was not included in the autopsy report.[44]

(b) Information on lungs

Dr. Armour's autopsy notes recorded,

"*Lungs: The left weighed 190gms and the right lungs weighed 290gms. Both were moderately oedematous throughout*".[45]

Dr. Armour cannot explain why this comment was not included in the final autopsy report other than the non-inclusion of the weights of the lungs was a typographical error.[46]

(c) Pleural cavities

The notes recorded "*Pleural Cavities: The left contained 35mls of straw-coloured fluid. The right cavity contained 5mls of straw-coloured fluid."*[47]

(d) Trachea & main bronchi

The notes recorded "*Contained a little frothy fluid*".[48]

K. <u>Discussion between the pathologist and other clinicians</u>

61. In relation to discussions prior to the provision of the autopsy report between Dr. Armour and other persons in relation to Adam Strain and the autopsy report:

(a) If Drs. Savage and Taylor were going to be present during the autopsy, please specify for what purpose they should have been there, and how it would have been appropriate for Dr. Armour to conduct and record discussions with them.

(b) Dr. Armour had other discussions relating to Adam and the autopsy with other persons including the Coroner and clinicians[49] e.g. Dr. Robert Taylor (consultant anaesthetist during Adam's surgery), Dr. Denis O'Hara (now deceased) and Dr. Bharucha (consultant haematologist). Please state whether it was appropriate for those discussions to have taken place, in

44 WS 012/2 p. 11 Q21(d)
45 WS 012/2 p.24
46 WS 012/2 p. 11 Q20(a) & (b)
47 WS 012/2 p. 24
48 WS 012/2 p./24
49 Ref: 011-025-125

that way, and if so specify what was the purpose of them (in terms of the autopsy and the report) and how should they have been conducted and recorded etc by Dr. Armour.

L. Meetings and/or discussions between the pathologist and any other person(s)

62. In relation to Dr. Armour's letter dated 8th December 1995 to Professor Crane[50]:

(a) State whether it would have been appropriate in 1995 for Dr. Armour to have offered to "*attend any meeting about this case, including a meeting with clinicians, administrative staff, H.M. Coroner and whoever else wishes to attend*" prior to her examination of the brain after fixation and the provision of Adam's autopsy report, and explain the reasons why.

(b) Identify what would have been the purpose of such a meeting.

(c) Identify who would have been the appropriate persons to have attended such a meeting, and state the reasons why.

(d) State whether the rationale of "*As I was the pathologist who carried out the autopsy I feel my opinion on the case is relevant to such a meeting and as such the case could be discussed in full*" would have been an appropriate basis upon which to offer to attend any such meeting.

(e) Explain whether it would have been appropriate for Dr Armour to have attended a meeting "*with clinicians, administrative staff, H.M. Coroner and whoever else wishes to attend*" so that Adam's "*case could be discussed in full*" prior to her examination of the brain after fixation and her provision of the autopsy report, and explain the reasons for your answer.

(f) If Dr. Armour did attend such a meeting, explain Dr. Armour's responsibilities during such a meeting and whether it would have been appropriate to have kept a minute of the meeting.

M. Siting of Samples of the brain and the quality of those samples

The Autopsy report states:

"*Description of Organs after Fixation:*

Brain...

[50] Ref: 011-023-123

Blocks were taken from:...

4. Right and left hippocampus..."[51]

Thereafter in the report there are no positive or negative findings recorded relating to the hippocampus.

63. Please explain the significance and relevance of examining the hippocampus:

    (a) in order to explain Adam's cerebral oedema.

    (b) in relation to diagnosing hypoxic damage.

64. Given the absence of any findings in the hippocampus being mentioned in the report, state whether it is possible to exclude cerebral tissue hypoxia as an additional cause of brain damage and subsequent additional brain oedema, and explain the reasons why.

65. Please comment on the adequacy and quality of the sites of samples and the sampling of the brain in Adam's case.

66. State whether it would have been appropriate for Dr. Armour to have examined and sampled:

    (a) The dura

    (b) The sinuses

    If so, state for what purpose. Please explain the reasons for your answer.

N. Samples from Donor Kidney

67. Please comment on the adequacy and quality of:

    (a) The sites of samples

    (b) The samples

    of the donor kidney in Adam's case.

O. Accuracy of fresh (unfixed) and fixed Brain weights

The Autopsy report states,

[51] Ref: 011-010-039

"*DESCRIPTION OF ORGANS AFTER FIXATION*

Brain...

External Examination: Fixed weight of brain 1.680gm, cerebellum and brain stem 176gm; cerebellum only 154gm. The brain was grossly swollen with loss of sulci and uncal swelling. This was symmetrical. There was no uncal necrosis. There was swelling of the cerebellar tonsils but no necrosis. There was no cortical venous thrombosis. ...

On cut section there was massive brain swelling and constriction of the ventricles...."[52]

The fresh unfixed brain weight is recorded in Dr. Armour's autopsy notes as 1320gms.[53] The weight was originally recorded as 1302gms, but was then corrected to 1320gms. Dr. Armour does not recall why the fresh weight of the brain was not included[54] . She states that the fresh unfixed brain weight "*is probably an error"* and that "*During fixation the brain increases in weight from between 5 and 10% with the fixed weight being 1680g. As I described massive cerebral oedema it is my view that the fresh weight of the brain was more likely to be 1520g."*[55] Dr. Armour states that the uncalibrated scales were accurate.

68. State whether Dr. Armour's notes are adequate, and explain the reasons why.

69. Please comment on Dr. Armour's conduct and approach in relation to establishing the brain weight in the light of the fact that an Inquest was to be held at which her Report was likely to be a significant document.

70. State whether a child with chronic renal failure and on dialysis would have been expected to have the same brain weight of a same sized "normal" child, and explain the reasons for your answer and any expected discrepancies in the brain weight of Adam and a "normal" child.

71. State whether a fresh brain weight of 1320gms would have been consistent with gross cerebral oedema in Adam and explain the reasons why.

72. Explain the likely effect on Adam's brain of:

    (a) the fixing procedure and

    (b) the care and treatment administered to Adam in PICU after his surgery on 27th November 2012

[52] Ref: 011-010-039
[53] WS 012/2 p. 25
[54] WS 012/2 p. 11 Q21(d)
[55] WS 012/2 p. 11 Q21(e)

and whether it would have been appropriate to take those factors into consideration in Adam's autopsy, and if so, state how and the reasons why.

P. Cerebral perfusion/cerebral venous drainage

The autopsy report states:

"*There was impaired cerebral perfusion as there was a suture on the left side and a catheter tip in the right...The suture impaired the blood flow to the brain and the catheter tip on the right may have had a role to play. The suture had been there for some time.*"[56]

"*Another factor to be considered in this case is cerebral perfusion. The autopsy revealed ligation of the left internal jugular vein. The catheter tip of the CVP was situated on the right side. This would mean that cerebral perfusion would be less than that in a normal child. This would exacerbate the effects of the cerebral oedema and should also be considered as a factor in the cause of death. Therefore the most likely explanation is that the cerebral oedema followed a period of hyponatraemia and was compounded by impaired cerebral perfusion.*""[57]

Dr. Armour also stated:

"*...The brain showed massive oedema mainly as a result of the dilutional hyponatraemia. It is my opinion that in this case there was an additional factor responsible. That was clearly addressed in the cause of death. This opinion was based on reading of the literature where other cases did show some cerebral oedema but not as excessive as this.*"[58]

Dr. Armour understood that the ligation of the left internal jugular vein was carried out "*after the removal of a long line.*"[59] She cannot recall the anatomical dissection of the neck but has stated that "*the examination was a routine examination of the neck structures.*"[60]

There is a note of an operation performed on Adam on 29th May 1992[61] which involved "*insertion central line, cystoscopy and retrograde pyelogram*". The typed notes state "*Insertion Broviac Line into left common facial vein. Transverse cervical incision. Left common vein identified, entering left internal jugular. Left common facial vein ligated with 5 x 0 PDS. Broviac line tunnelled from anterior chest wall using Westminster and inserted into common facial vein and then internal jugular. Check x-*

56 Ref: 011-010-031
57 Ref: 011-010-041
58 WS 012/2 p. 9 Q18(c)
59 WS012/1 p.12, Q5(b)
60 WS 012/2, p3, Q3(a)
61 Ref: 053-015-052

ray confirmed tip of broviac line in proximal SBC. Neck wound closed in layers 5 x 0 PDS and wound anterior chest wall closed 5 x 0 PDS".

Dr. Armour states that the suture she observed is inconsistent with the note ie. ligation of the left common facial vein. She explains that the common facial vein lies high in the neck at the level of the hyoid bone, and that the site of the ligature identified at autopsy is low in the neck. Dr. Armour states that her finding of the ligated vein would have accounted for the difficulty in gaining intravenous access at the start of the procedure.[62]

It is unknown if Dr. Armour examined the inside of vein to see if it was patent.

Dr. Armour concluded in her Report that the combined effect of the ligation of the left internal jugular vein (identified by a suture in situ) and the catheter tip of the CVP being on the right side would have reduced cerebral perfusion and exacerbated the effects of cerebral oedema. She also states in her Inquiry Witness Statement that the *"degree of impaired blood flow was insuffice[sic] to cause hypoxic change".*[63]

Dr Armour also stated "*There was no evidence of congestion of obstruction of the major blood vessels or the carotid arteries and jugular veins. There was no evidence of superior vena caval obstruction. The carotid arteries were normal. There was a suture in situ on the left side of the neck at the junction of the internal jugular vein and the subclavian vein."*[64]

73. Please comment generally on the above statements.

74. Please comment on the totality of Dr. Armour's description of her examination and her statements on the impact of the suture.

75. State whether it would have been appropriate for Dr. Armour to identify by age and type the suture, and if so, state what else Dr. Armour ought to have done. Please explain the reasons for your answer.

76. State whether it would have been appropriate for Dr. Armour to have carried out any other investigations or tests in relation to the said suture and/or the surrounding tissue, and if so describe any investigations or tests which should have been carried out. Please explain the reasons for your answer.

77. State whether a suture which ligates the left internal jugular vein would likely have caused:

62 WS 012/2 p.3 Q3(b)(ii); p.6 Q12(f)(i)
63 Ref: WS 012/2, p.9
64 Ref: 011-010-039

(a) impaired cerebral perfusion

(b) impaired cerebral venous drainage

(c) an increase in intracranial pressure

in Adam's case and explain the reasons for your answer.

78. Please comment on the extent to which the effects of cerebral oedema were likely to be exacerbated by an impaired blood flow that was insufficient to cause hypoxic change.

79. State whether you would expect to find any evidence of previous cannulations causing vein damage such as fibrosis:

(a) Generally in a paediatric autopsy

(b) Specifically in Adam's autopsy

80. State whether in 1995 it would have been appropriate to examine the paravertebral plexus in autopsy :

(a) Generally

(b) Specifically in Adam's case.

Please explain the reasons for your answer. If so, identify the nature and extent of the examination which would have been appropriate in respect of (i) and (ii).

81. State what, if any, other consideration should have been given by Dr Armour to impaired cerebral perfusion and/or reduced venous drainage, and explain the reasons for your answer.

82. Please comment on the contents of the letter from Dr. Robert Taylor (Paediatric Anaesthetist during surgery) to Dr. George Murnaghan (Director of Medical Administration) dated 8th May 1996[65] and in particular:

"*There is no evidence that "Impaired cerebral perfusion" occurred in this case. Cerebral Perfusion is defined as Mean Arterial pressure (MAP) minus Intracranial pressure (ICP). Intracranial pressure was not monitored in this case, and is never monitored except in head injuries etc as it involves an invasive monitor in the brain. Since MAP was maintained throughout the procedure it is unlikely that there was cerebral hypoperfusion. Perhaps a better logical explanation would be "Impaired Cerebral*

[65] Ref: 059-036-072

Drainage". However this is against known research especially in this case where a recent article suggests that complete jugular ligation does not cause an increase in ICP.

This is contradicted by the description of the post-mortem findings. In the PM under Examination of the Neck it states "There was no evidence of congestion or obstruction of the major blood vessels..." This contradicts the conclusion that cerebral perfusion (or cerebral drainage) could have been impaired..."

Q. Involvement of Drs. O'Hara and Bharucha

The Coroner made a note dated 8th December 1995 that,

"*...Today Dr. Armour showed slides etc to Dr. O'Hara and Dr. Bharucha. Both stated that there was clear evidence of hypoxia/anoxia/anaphylactic reaction. Those are virtually all the same thing.*"[66]

Dr. Armour states that the slides would have been shown to these doctors for their opinion.[67] Dr. Bharucha has stated that she has no knowledge of Adam.[68] Dr. Denis O'Hara is deceased.

However, Dr. Armour states in the autopsy report :

"*MICROSCOPY:...*

(The above slides were seen by Professor J. Berry, Consultant Paediatric Pathologist)

Brain: There was massive cerebral oedema of the cortex and white matter. There was no evidence of terminal hypoxia."[69]

"*Generalised cerebral oedema in children has many causes including hypoxia. In this case this has been excluded.*"[70]

"*[...there was no sign of terminal hypoxia despite 'the impaired blood flow to the brain']...because the degree of impaired blood flow was insuffice to cause hypoxic change.*"[71]

The basis upon which Dr. Armour excluded hypoxia is not known. She maintains that there was no evidence of hypoxia.[72]

66 Ref:011-025-125
67 WS 012/2 p.12, Q24
68 WS 229/1 p.1
69 Ref: 011-010-040
70 Ref: 011-010-041
71 Ref: WS 012/2 p.9, Q18(d) Ref: WS 012/2 p.9, Q18(d)
72 WS 012/2 p.13 Q24(d)

83. State whether there should have been a formal referral to and opinion sought from Dr. O'Hara and Dr. Bharucha. If not, state how and where the slides should have been shown to Drs. O'Hara and Bharucha and the response thereto received by Dr. Armour should have been recorded.

84. In light of the differing views between Drs. O'Hara/Bharucha and Dr. Armour on whether there was evidence of hypoxia, state whether Dr. Armour ought to have done anything else in relation to that issue e.g. held further discussions with those doctors or reverted to them on that issue in order to explain the basis for the difference in views, and explain the reasons for your answer.

85. State whether it was appropriate to involve Dr. O'Hara at all given that he was an employee of the Trust/Hospital group in which Adam had died?

R. <u>No formal or written Neuropathological Report</u>

In a letter to Prof. J. Berry, Paediatric Pathologist, dated 22nd December 1995, Dr. Armour states "*The brain and spinal cord are fixing and a neuropathological opinion will be requested...*"[73] There does not appear to have been a formal written request for a second opinion. Dr Armour states, "*Dr. Mirakhur worked in the Royal Victoria Hospital and I would have communicated with her verbally*".[74]

Dr. Armour showed the brain, spinal cord and histological slides to Dr. M. Mirakur for a second opinion. The autopsy report states, "*MICROSCOPY:...(The brain, spinal cord and histological slides were seen by Dr. M. Mirakhur, Consultant Neuropathologist).*"[75]

Dr. Armour has no notes of any conversation with Dr. Mirakhur about those slides.[76] No written neuropathological report or note from Dr. Mirakhur has been furnished by Dr. Armour. The autopsy report was not signed by Dr. Mirakhur.

Dr. Mirakhur states that[77]:

- She does not recall seeing the brain or spinal cord or any material.
- Adam's case was not formally referred to her or to the Neuropathology Department and she did not provide any formal report as she was not asked to do so.

73 Ref: 011-029-152
74 WS 012/2 p.13
75 Ref: 011-010-040
76 WS 012/2 p.4 Q8(c)
77 Ref: WS 223/1

- There is no record of any material, information, document, medical notes or records, or photographs being provided to her

- It is possible that Dr. Armour asked her informal opinion on histological slides. She cannot recall what she might have said. She did not make any notes relating to examining the slides.

- She did not make any records of what opinion she might have given as the case was not formally referred to her.

- She did not prepare the slides

- She was not involved in carrying out Adam's autopsy nor was she present at the autopsy.

- She was involved in conducting autopsies on children who were 5 years old or younger jointly with paediatric pathologists prior to Adam's death

Dr. Armour has stated,

"*...As far as I am aware what is written in my autopsy report was concurred by her.*"[78]

86. State whether it would have been appropriate in 1995 for Dr. Armour to have required a formal neuropathological opinion in relation to Adam's autopsy, and explain the reasons why.

87. If it would have been appropriate for Dr. Armour to have sought an opinion/advice/assistance from an neuropathologist, explain how Dr. Armour ought to have gone about this, and in particular:

    (a) State what issues should Dr. Armour have asked the neuropathologist to address.

    (b) State whether it was appropriate to have involved Dr. Mirakhur, an employee of the Trust/Hospital Group, and explain the reasons for your answer.

    (c) State whether it was appropriate to have informally sought the opinion of a neuropathologist without formal referral at any time in Adam's case

[78] WS 012/1, p.12 Q2(b)

(d) State whether it was appropriate to have referred in the autopsy report to Dr. Mirakhur when Dr. Mirakhur had not countersigned the report and may not have seen or approved the report.

(e) State whether it would have been appropriate for Dr. Armour to have requested Dr. Mirakhur to have countersigned the autopsy report and explain the reasons why.

88. Please comment on the implications of the autopsy report not having been provided to Dr. Mirakhur for her comment and having been compiled without the benefit of a formal and complete brain examination by a neuropathologist.

89. Dr. Armour made a formal written request dated 22nd December 1995 to Professor Berry to provide an expert Opinion to the Coroner.[79] Histological slides of the transplanted kidney were sent to Professor P.J. Berry, Consultant Paediatric Pathologist, for a second opinion. Dr. Armour states that she, *"...cannot recall the exact site where [she] took the histological samples/samples. However it would have included a section of cortex and medulla".*[80]

Dr. Berry provided a report dated 23rd March 1996. Dr. Armour also states, *"...As far as I am aware his opinion concurred with mine."*[81] Dr. Armour's undated autopsy report states, *"MICROSCOPY... Lungs...Liver...Kidney... Transplanted Kidney...Spleen...Lymph Node... (The above slides were seen by Professor J. Berry, Consultant Paediatric Pathologist).*

(a) State whether it would have been appropriate at that time for Dr. Armour to have provided Dr. Berry with the Autopsy Report for him to concur in the way in which she had incorporated his views, and explain the reasons why.

(b) Dr. Sumner requested that he be sent copies of "*all the notes" – everything you have"* to allow him to prepare a report for Coroner [82] Dr. Armour did not do so on 20th December 1995 when briefing Dr. Sumner.[83] When the Coroner inquired whether all 10 files of Adam's medical notes had been sent to Dr. Sumner, Dr. Armour stated she had not done so "*due to the huge number of records involved".*[84] State whether Dr. Armour should have provided Dr. Sumner with all of Adam's files as she was asked to by the Coroner. Please explain the reasons for your answer.

79 Ref: 011-029-151
80 Ref: WS 012/2 p.5 Q9(b)
81 Ref: WS 012/1, p.13. Q3(a)
82 Ref: 011-027-129
83 Ref: 011-028130
84 Ref: 011033-165

S. Dopamine

90. State whether the use of dopamine can contribute to cerebral oedema and explain the reasons for your answer. If so, explain how and to what extent.

91. Given the amount of dopamine prescribed for Adam and when it was administered to him, is it possible that it could have affected the extent of his cerebral oedema? If so, can you estimate the likely extent of its contribution to cerebral oedema in Adam's case?

T. Histological slides in Adam's autopsy

92. Histological slides from the kidney, transplanted kidney, liver, lungs, spleen, larynx and lymph node were examined for the autopsy. Please indicate whether you require to see any of these slides for the purposes of your report.

CONCLUSION

93. It is of fundamental importance that the Inquiry receives a clear reasoned opinion on these issues. Furthermore, if there are any other issues which have not been raised with you but which you regard as relevant and of importance in Adam's case, please include those in your report.

94. To assist you we have attached an index of 'key documents' together with a file of the documents that would appear to be of especial significance. Please request any other documents that you consider relevant for the preparation of your Report.

95. Your assistance on the Inquiry's requirements should be provided in the form of a fully referenced Expert's Report.

INDEX OF KEY ACCOMPANYING DOCUMENTS

Tab.1 Brief

Tab.2 Selected Inquest Documents:

1. Letter from Subdivisional Commander of the Royal Ulster Constabulary to the Coroner dated 6th December 1995 with Form 19 (Ref: 011-022-121)

2. Memo from Dr. Armour to the Coroner received by Coroner on 8th December 1995 (Ref: 011-024-124)

3. Memo of the Coroner dated 8th December 1995 (Ref: 011-025-125)

4. Report on Post-mortem by Dr. Armour carried out on 29th November 1995 (Ref: 011-010-034 to 011-01-041.)

5. Dr. Armour's contemporaneous autopsy notes

6. Autopsy Photographs.

7. Letter from Dr. Armour to Professor Crane dated 8th December 1995 (Ref: 011-023-123)

8. Letter from Dr. Armour to the Coroner dated 3rd June 1996 (Ref: 011-079-214)

9. Letters from Dr. Robert Taylor (Ref: 059-053-108, 059-036-071 and 059-036-072)

10. Letter from the Coroner to Dr. Armour dated 13th December 1995 (Ref: 011-027-129)

11. Letter from Dr. Armour to Dr. Sumner dated 20th December 1995 (Ref:011-028-130)

12. Memo from the Coroner dated 4th January 1996 (Ref: 011-033-165)

13. Letter from the Coroner to Dr. Sumner dated 26th January 1996 (Ref: 011-044-177)

14. Inquest Verdict (Ref: 011-016-114)

15. Statements:

    (a) Debra Slavin (Ref:011-041-173;011-049-182; 011-076-211)

(b) Dr. Maurice Savage (Ref: 011-001-001)

(c) Dr. Robert Taylor (Ref:011-002-003)

(d) Mr. Patrick Keane (Ref: 011-003-010)

16. Depositions:

(a) Debra Slavin (Ref: 011-009-025)

(b) Dr. Maurice Savage (Ref: 011-015-109)

(c) Dr. Alison Armour (Ref: 011-010-030)

(d) Dr. Robert Taylor (Ref: 011-014-096)

(e) Dr. Edward Sumner (Ref: 011-011-042)

(f) Dr. John Alexander (Ref:011-012-079)

17. Reports:

(a) Professor Peter Berry (Ref: 011-007-020; 011-053-187)

(b) Dr. Edward Sumner (Ref: 011-011-053)

(c) Messrs. Wilson & McLaughlin on inspection of equipment on 2 December 1995 (Ref:011-004-012)

Tab.3 Selected PSNI Documents:

18. Correspondence from Detective Sergeant W. Cross (PSNI) to Detective Inspector Nicholl dated 16th December 2006 with attachments in relation to theatre equipment (Ref: 094-210-996; 094-210-997 to 094-210-998; 094-210-999; 094-210-1000 and 094-210-1001).

19. Reports:

(a) PSNI Statement of Dr. Armour

(b) Professor Peter Berry (Ref: 093-030)

(c) Professor Risdon (Ref: 093-031)

(d) Medical opinion of Dr. Edward Sumner, including PSNI brief (Ref: 094-001-001 and Ref: 094-002-002)

(e) Photographs of Adam provided by Debra Slavin

Tab.4 Selected Inquiry Documents:

20. Witness Statements of:

    (a) Ms. Debra Slavin

    (b) Dr. Armour

    (c) Dr. Mirakhur

    (d) Dr. Bharucha

    (e) Prof. Berry

    (f) Prof. Risdon

    (g) Dr. Maurice Savage

    (h) Mr. Patrick Keane

    (i) Dr. Robert Taylor

    (j) Dr. Mary O'Connor

    (k) Dr. Edward Sumner

21. Other Inquiry documents:

    (a) Chest X-rays and reports

    (b) CT scans and report

    (c) Article of Dr. Armour

    (d) Autopsy Request Form

    (e) Letter dated 10th May 2011 from State Pathologist's Office to the Inquiry attaching the contemporaneous notes of Dr. Alison Armour

    (f) Adam's medical notes and records for 26th November 1995 – 29th November 1995 (including Ref: 057-010-013, 016-085-127, 058-035-131, 057-018-026, 057-018-027, 057-017-024 and 058-003-003 to 058-003-007).

    (g) Ref: 301-081-547

    (h) Ref:306-008-044 (INQ-0782-12)