BRIEF FOR EXPERT ON NURSING
ADAM STRAIN

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 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. The other 3 children are :

   (1) Claire Roberts was born on 10th January 1987. She was admitted to the Royal on 21st October 1996 with a history of malaise, vomiting and drowsiness and she died on 23rd October 1996. Her medical certificate recorded the cause of her death as Cerebral Oedema and Status Epilepticus. That certification was subsequently challenged after a television documentary into the deaths of Adam and 2 other children (Lucy Crawford and Raychel Ferguson).

   The Inquest into Claire's death was carried out by John Leckey on 4th May 2006 who engaged as experts Dr. Robert Bingham (Consultant Paediatric Anaesthetist at Great Ormond Street) and Dr. Ian Maconochie (Consultant in Paediatric A&E Medicine at St Mary's, London). The Inquest Verdict found the cause of Claire's death to be Cerebral Oedema with Hyponatraemia as a contributory factor.

   (2) Raychel Ferguson was born on 4th February 1992. She was admitted to the Altnagelvin Area Hospital on 7th June 2001 with suspected appendicitis. An appendectomy was performed on 8th June 2001. She was transferred to the Royal on 9th June 2001 where brain stem tests were shown to be negative and she was pronounced dead on 10th June 2001. The Autopsy Report dated 11th June 2001 concluded that the cause of her death was Cerebral Oedema caused by Hyponatraemia.

The Inquest into Raychel's death was conducted on 5th February 2003 by John Leckey who once more engaged Dr. Edward Sumner as an expert. The Inquest Verdict found the cause of Raychel's death to be Cerebral Oedema with Acute Dilutional Hyponatraemia as a contributory factor. It also made findings that the Hyponatraemia was caused by a combination of inadequate electrolyte replacement following severe post-operative vomiting and water retention resulting from the secretion of anti-diuretic hormone (ADH).

(3) Conor Mitchell was born on 12th October 1987 with cerebral palsy. He was admitted to A&E Craigavon Hospital on 8th May 2003 with signs of dehydration and for observation. He was transferred to the Royal on 9th May 2003 where brain stem tests were shown to be negative and he was pronounced dead on 12th May 2003.

The Inquest into Conor's death was conducted on 9th June 2004 by John Leckey, Coroner who again engaged Dr. Edward Sumner as an expert. Despite the Inquest, the precise cause of Conor's death remains unclear.

The clinical diagnosis of Dr. Janice Bothwell (Paediatric Consultant) at the Royal was brainstem dysfunction with Cerebral Oedema related to viral illness, over-rehydration/inappropriate fluid management and status epilepticus causing hypoxia. Dr. Brian Herron from the Department of Neuropathy, Institute of Pathology, Belfast performed the autopsy. He was unsure what 'sparked off' the seizure activity and the extent to which it contributed to the swelling of Conor's brain but he considered that the major hypernatraemia occurred after brainstem death and therefore probably played no part in the cause of the brain swelling. He concluded that the ultimate cause of death was Cerebral Oedema. Dr. Edward Sumner commented in his Report of November 2003 that Conor died of the acute effects of cerebral swelling which caused coning and brainstem death but he remained uncertain why. He noted that the volume of intravenous fluids was not excessive and the type appropriate but queried the initial rate of administration. That query was raised in his correspondence shortly after the Inquest Verdict. In that correspondence Dr. Sumner described the fluid management regime as 'sub-optimal'.

The Inquest Verdict stated the cause of death to be Brainstem Failure with Cerebral Oedema, Hypoxia, Ischemia, Seizures and Infarction and Cerebral Palsy as contributing factors.

4. The impetus for this Inquiry was a UTV Live Insight documentary 'When Hospitals Kill' shown on 21st October 2004.[1] The documentary primarily focused on the death of a toddler called Lucy Crawford (who was subsequently

[1] See DVD of the programme with the accompanying Core Files

also found to have died in hospital in 2000 as a result of hyponatraemia) and what was presented as significant shortcomings of personnel at the Erne Hospital. In effect the programme alleged a cover-up and it criticized 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.

Original 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 original Terms of Reference for the Inquiry as published by Angela Smith (then Minister with responsibility for the Department of Health, Social Services and Public Safety) on 1st November 2004 were to:

> To hold an Inquiry into the **events surrounding and following the deaths of Adam Strain**, Lucy Crawford and Raychel Ferguson, with particular reference to:
>
> i. The **care and treatment of Adam Strain**, Lucy Crawford 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**, Lucy Crawford and Raychel Ferguson.
> iii. The **communications with, and explanations given to, the respective families and others by the relevant authorities**.
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> In addition, Mr O'Hara will:
>
> (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.
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> (Emphasis added)

Changes

7. There have been a number of significant changes in the Inquiry since 2005. Firstly there was the receipt of Revised Terms of Reference from the Minister following the wish of the Crawford family to have Lucy excluded from the Inquiry's work:

1. 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.

2. 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.

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

In addition, Mr O'Hara will:

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

8. Secondly Claire Roberts and Conor Mitchell were included into the Inquiry's work by the Chairman due to the cause of Claire's death and the apparent fluid mismanagement in Conor's case so soon after the implementation of Guidelines on Hyponatraemia which stressed the importance of fluid management.

9. The effect of the Revised Terms of Reference has been to exclude all explicit references to Lucy Crawford. The Chairman has interpreted the Revised Terms of Reference insofar as Lucy is concerned in the following way:

> ... 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.

10. The case of Claire Roberts is being investigated according to 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 (if anything he developed hypernatraemia). Similarly the fluid mismanagement referred to by Dr. Sumner was not considered to have been a cause of his death. The Chairman has stated:

> It is obviously a matter of concern if guidelines which have been introduced as a result of a previous death or deaths and which are aimed at avoiding similar events in the future, are not properly communicated to hospital staff and followed. It is relevant to the investigation to be conducted by the Inquiry whether and to what extent the guidelines had been disseminated and followed in the period since they were published. Another matter of interest is whether the fact that Connor was being treated on an adult ward rather than a children's ward made any difference to the way in which it appears that the guidelines may not have been followed.

Accordingly, the Inquiry will investigate the way in which the guidelines had been circulated by the Department, the way in which they had been made known to hospital staff and the steps, if any, which had been taken to ensure that they were being followed. While this is an issue of general importance, it will be informed by an examination of the way in which the guidelines had been introduced and followed in Craigavon Area Hospital by May 2003.

Role of the Experts

11. The Role of the Experts to the Inquiry is set out in 'Protocol No.4: Experts', a copy of which is attached.[2] There are 4 categories of expert assistance:

    (i) Panel of Expert Advisors to assist the Inquiry in identifying, obtaining, interpreting and evaluating the evidence within their particular area of expertise, which Panel currently comprises the following:
        (a) Consultant Paediatrician
        (b) Consultant Paediatric Anaesthetist
        (c) Paediatric Nurse, previously Consultant Nurse in Paediatric Intensive Care
        (d) National Health Service Hospital Management
    (ii) Experts on a case by case basis as Expert Witnesses. In addition to Nursing, such expertise is currently being sought on Paediatric Nephrology, Hyponatraemia and Medical Statistics. Such Experts will be required to provide their Expert opinion in the form of a Report(s) attached to a Witness Statement. Their Reports will be made public and they may be required to attend the oral hearings and present their views.
    (iii) Experts to provide commissioned 'Background Papers'
    (iv) Experts appointed as Peer Reviewers

Background to Adam

12. 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)[3] and Mr. Stephen Brown (Consultant Paediatric Surgeon).

13. Adam had multiple operations to his urinary tract, during which he was largely under the care of Mr. Stephen Brown. To optimise drainage of the urinary tract he had a suprapubic catheter inserted. He had re-implantation of his ureters on 2 occasions and had nephrostomies performed during the early months of his

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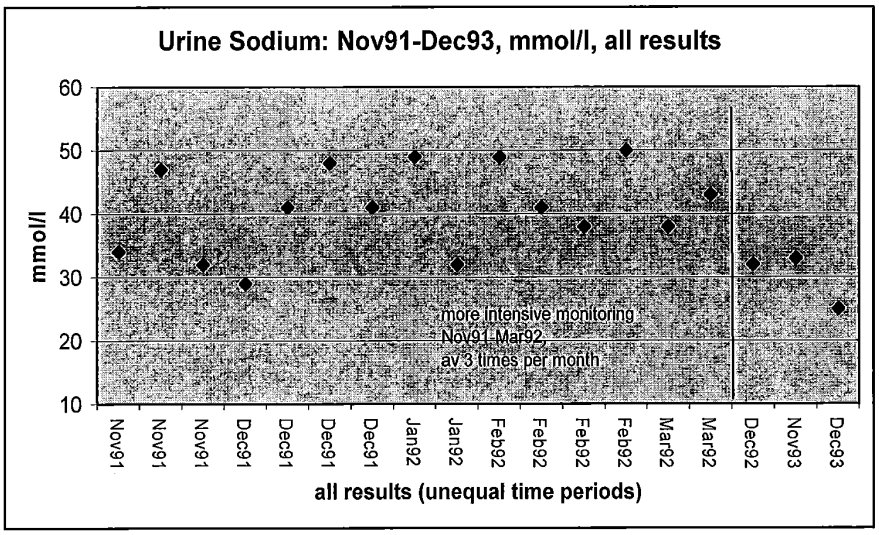
2 See Tab 2a... of the accompanying Core Files

3 Now Professor Maurice Savage

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 stop gastro-oesophageal reflux. Eventually he required all his nutrition through a gastronomy tube and in 1993 he had cystoscopy and PEG gastronomy. In October 1995 there was a change of his gastrostomy.[4]

14. 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 has been described as polyuric. The biochemistry tests carried out when he was a few months old show the sodium content of his urine to be 29 - 52mmol/l.[5]

15. A graph of all Adam's recorded urine sodium results is shown below:[6]



16. According to his Nephrologist, Dr. Maurice Savage,[7] Adam had a potential for low sodium and he received sodium supplements in his feeds. A graph of all of his recorded blood sodium levels is shown below with 135-145mmol/l being the normal range:

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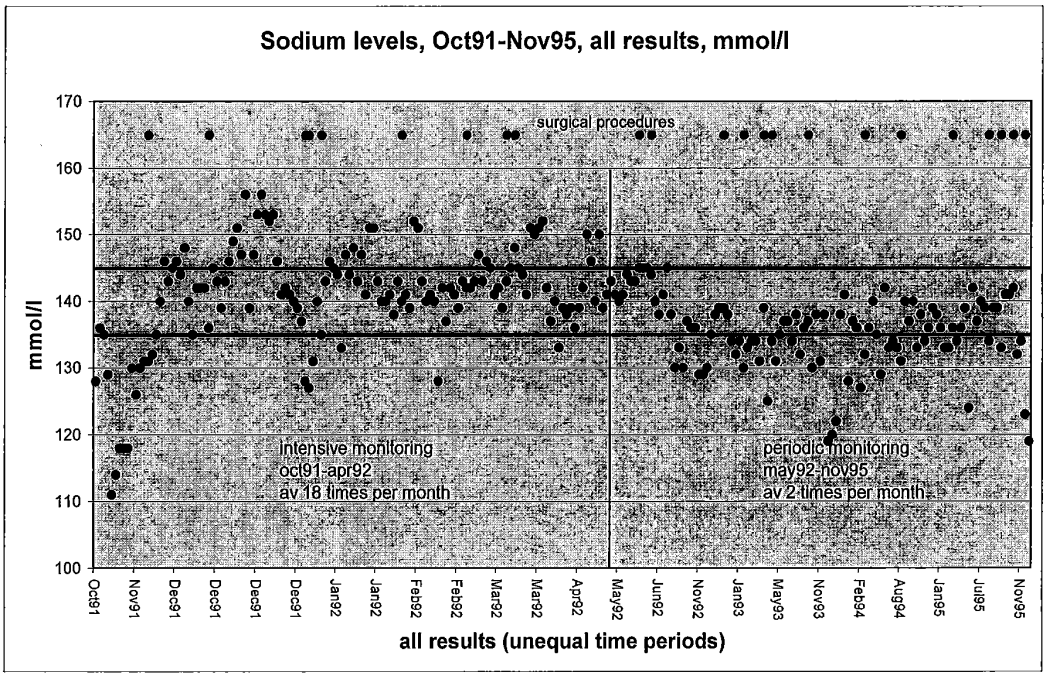
4 A Schedule is attached showing all Adam's surgical procedures and their dates together with the surgeons and anaesthetists involved see Tab 6a of accompanying core file

5 See Witness Statement to the Inquiry of Robert Taylor. See also biochemistry results in 1995 at: ref: 058-041-187-224 and 050-018-055

6 The 2 graphs are taken from tables compiled from Adam's medical notes and records included in the accompanying Core Files at Tab 6b and Tab 6c For ease of reference the parallel red lines indicate the normal range of 135-145mmol/l

7 See ref. 011-015-113. See also letter dated 17th January 1996 from Adam's Mother to the Coroner referring to the fact that it was commonly known that Adam had an ongoing problem with his sodium for which he had been treated the previous 4 years - ref: 011-041-174



17. According to his Nephrologist, Dr. Maurice Savage,[8] Adam had a potential for low sodium and he received sodium supplements in his feeds. The management of his 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 124mmol/l and a number below the normal range of 135-145mmol/l. Furthermore, in Adam's first year his recorded sodium levels fell as low as 111mmol/l, 114mmol/l and 118mmol/l. Thereafter there were numerous occasions when his recorded sodium levels fell below the normal range.

18. 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.[9]

19. 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 1995.[10] Transplant surgery was scheduled for 6.00am on 27th November 1995.

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8 See ref. 011-015-113. See also letter dated 17th January 1996 from Adam's Mother to the Coroner referring to the fact that it was commonly known that Adam had an ongoing problem with his sodium for which he had been treated the previous 4 years - ref: 011-041-174

9 See ref: 059-006-121

10 See Report of Mr. Geoff Koffman Consultant Surgeon for the PSNI dated 5th July 2006, ref: 094-007-027

20. At 11.00pm on 26th November 1995 Adam's serum sodium was recorded as 134mmol/l[11] and Hb 10.5. 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.[12] The nursing records do not state the nature of the 'clear fluids' given. Some witnesses have claimed that fluid was Dioralyte (containing 60mmol of sodium chloride/L). However, Dr. Maurice Savage corrected his Deposition to delete 'Dioralyte' and substitute 'N/S Saline Dextrose'.[13] In any event it is thought that he received just over 1 litre of fluids. It was planned between Dr. Maurice Savage and Dr. Robert Taylor (Consultant Paediatric Anaesthetist) that Adam should receive intravenous fluid (75ml/hr)[14] 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 not. One basis it was because it proved difficult to achieve venous access.[15] Whilst another it was because of the potential delay in receiving results back from the laboratory.[16]

21. The main events surrounding Adam's transplant surgery are summarised in the following table:

Date	Event		Reference
26.11.1995	1.42am	Donor kidney removed by Mr. Casey at Southern General Hospital, Glasgow	058-009-025 (Kidney Donor Information Form)
	9.00pm	Adam admitted to Musgrave Ward at the RBHSC for possible renal transplant	011-009-001 (Deposition of Ms. Strain 18th June 1996)
	9.30pm	Pre-op investigations for possible renal transplant carried out by Dr. Cartmill (Surgical SHO); Nursing admission details taken by SN Murphy	058-035-144 (Extract from Medical Notes and Records) 049-036-245 (Royal's Chronology of Care)
	10.00pm	Evaluation Nursing Report taken by SN Murphy	049-036-245 (Royal's Chronology of Care)
	11.00pm	i.v. fluids commenced prescribed by Dr. Larkin (Community SHO); Results of investigations recorded by Dr. O'Neill (SHO) as haemoglobin 10.5g/dl, **sodium 134mmol/l** and urea 16.8; Dioralyte instead	• 049-036-245 (Royal's Chronology of Care) • 058-035-144 (Extract from Medical Notes and Records) • 011-014 & 015 (Depositions of Drs. Savage and Taylor 21st June 1996)

[11] Reference 057-007-008. No print out is available but some confusion arose as a result of an entry in the clinical notes of 'query' 139 – see reference 058-035-144.

[12] See ref: 057-010-013

[13] See ref: 011-015-109

[14] See ref: 059-006-022

[15] See ref: 011-014-099 and ref: 093-006-017 for the explanation of the difficulty in achieving venous access. See also: 093-035-105 for the other basis as to the time taken to receive results back from the laboratory

[16] See ref: 093-035-105 for the other basis as to the time taken to achieve results back from the laboratory

		of Nutrazon gastronomy feeds on Dr. Taylor's (Consultant Paediatric Anaesthetist) advice	
	11.30pm	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	059-006-009 (Extract from Medical Notes and Records)
27.11.1995	1.30am	SN Murphy recorded i.v. fluids tissued and informed Dr. O'Neill	049-036-245 (Royal's Chronology of Care)
	5.00am	i.v. cannula reinserted;[17] between 11.00pm and 5.00am 952mls of 'clear fluids' given, peritoneal dialysis as normal (750ml fluid volume 1.36% Dextrose solution – 8 cycles given before theatre)	• 049-036-246 (Royal's Chronology of Care) • 011-015 (Deposition of Dr. Savage 21st June 1996)
	6.30am	Epidural administered by Dr. Taylor	058-005-013 (Extract from Medical Notes and Records recorded by Dr. O'Connor)
	6.45am	Adam transferred to theatre with right subclavian and right radial lines inserted; general anaesthesia induced in the presence of his Mother	• 011-014 (Deposition of Dr. Taylor 21st June 1996) • 049-036-246 (Royal's Chronology of Care)
	6.55am	Adam arrival in theatre	• 094-006-022 (theatre log)
	7.00am	Dextrose saline fluids (0.18% NaCl in 4% glucose) started i.v. by Dr. Taylor – 500ml given up to 7.30am	• 058-003-005 (Anaesthetic Record) • 011-014 (Deposition of Dr. Taylor 21st June 1996
	7.30am	Central Venous Line inserted in right subclavian vein initial reading of 17mm.Hg (normal 10-12mm.Hg); transplant surgery started by Mr. Keane (Consultant Urologist); further 500ml of Dextrose saline fluids given up to 8.45am	• 011-014 (Transcript of Dr. Taylor 21st June 1996) • 058-003-005 (Anaesthetic Record)
	8.30am	Donor kidney removed from ice; 400 colloid fluids (HPPF) given	• 058-009-027 (Kidney Donor Information Form) • 058-003-005 (Anaesthetic Record)
	8.45am	Rate of Dextrose saline fluids drastically slowed (500ml of given up to 11.00am) and 500ml Hartmann's solution commenced	• 058-003-005 (Anaesthetic Record) • 059-004-007 (Dr. Taylor's note to Mr. Brangam, Solicitor)
	9.15am	400 colloid fluids (HPPF) given	• 058-003-005 (Anaesthetic Record)
	9.32am	Results of pH Blood Gases and	• 058-003-003 (BGE Report)

[17] Despite the record in the Nursing Notes, there is an issue over whether that actually happened

		Electrolytes received, showing **sodium at 123 mmol/l** (normal being 135-145) and haematocrit at 18% (normal being 35-40%); 250ml packed red blood cells given	• 058-003-005 (Anaesthetic Record)
	10.45am	200 colloid fluids (HPPF) and 250ml packed red blood cells given	058-003-005 (Anaesthetic Record)
	11.00am	Skin closure; neostigmine and glycopyrolate administered by Dr. Taylor to reverse the neuromuscular blockade; blood loss recorded from swabs (328ml), suction (500ml) and other (300ml)	• Ref:011-014 (Transcript of Dr. Taylor 21st June 1996); • 058-003-005 (Anaesthetic Record)
	11.55 noon	Adam failed to wake, did not breathe and pupils fixed and dilated	011-014 (Deposition of Dr. Taylor 21st June 1996)
	12.05pm	Adam transferred to PICU for ventilation of his lungs and assessment; puffy appearance with Central Venous Pressure reading of approx. 30 dropping to 11; Mannitol 50ml prescribed and reduction in fluids	• 058-005-013 (Drug record sheet) • 058-005-014 (Extract from Medical Notes and Records recorded by Dr. O'Connor) • 094-006-022 (Theatre log)
	12.15pm	Adam's appearance bloated	011- 009 (Deposition of Ms. Strain 18th June 1996) 093-003 & 093-005 (PSNI witness statements of Adam's mother)
	7.35pm	First brain stem test carried out by Dr. Webb (Consultant Paediatric Neurologist)	058-004-009 (Brain Death Form)
28.11. 1995	9.10am	Second brain stem test carried out by Dr. Webb (Consultant Paediatric Neurologist)	058-004-009 (Brain Death Form)
	9.15am	Life pronounced extinct	011-010-011 (Report of Autopsy 29th November 1995)

Issues

22. A post-mortem was carried out on 29th November 1995 by Dr. Armour (Senior Registrar State Pathologist's Department) 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.[18]

[18] See ref: 011-010-034

23. The Inquest that was subsequently conducted into Adam's death on 18th and 21st June 1996 recorded the Verdict[19] that the cause of his death was:

> 1(A) Cerebral Oedema
> 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

24. 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:[20]

> 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.
>
> (emphasis added)

25. Dr. Sumner also gave evidence at Adam's Inquest and his Deposition of 18th June 1996[21] 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 CVO can mean too much fluid has been administered[23] ... The **low sodium was indicative of the hyponatraemia. Below 128 is a hyponatraemic state**.

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19 See ref: 011-011-063

20 See ref: 011-011-053

21 See ref: 011-011-042

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

23 Dr. Sumner prepared his Report on the basis that Adam received 900mls of Dioralyte. See at ref011-011-055. That figure was corrected in correspondence between the Coroner and Dr. Armour but it is not 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 2 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

(emphasis and parenthesis added)

26. Dr. Robert Taylor (Consultant Paediatric Anaesthetist) gave evidence at the Inquest. His Deposition of 21st June 1996[24] 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"[25]]*. 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.
>
> (emphasis added)

27. 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. Mr. Geoff Koffman (Consultant Surgeon at Guy's & St. Thomas Hospital and Great Ormond Street), was retained by the Police Service of Northern Ireland (PSNI)[27] to assist with their investigation into the circumstances of all of the children's deaths. He states in his Report of 5th July 2006 that: *"The sodium and potassium should have been repeated prior to start of surgery. The polyuric patient with poor renal function would pass large quantities of dilute urine and may have difficulty controlling the concentration of sodium and potassium in the blood".*[28]

28. However, the fundamental difference between Dr. Edward Sumner and Dr. Robert Taylor is over whether Adam's condition permitted him to suffer from 'dilutional hyponatraemia'. Dr. Taylor's underlying thesis was that Adam's condition and his performance under anaesthesia were known to him (but not to Dr. Sumner) and he was therefore able to state with confidence that Dr. Sumner was wrong in concluding that Adam developed 'dilutional hyponatraemia' as opposed to 'hyponatraemia'.

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24 See ref: 011-014-108

25 See Deposition at ref:011-014-100

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:057-072-134

27 The PSNI conducted an investigation into the deaths of all of the children over a period of about 2 years before deciding not to prosecute anyone in connection with their deaths

28 See ref: 094-007-032

29. In addition the papers received by the Inquiry disclose a difference between the medical personnel over the condition and performance of the kidney transplanted into Adam. Mr. Geoff Koffman makes the point in his PSNI Report dated 5th July 2006 that by the time the kidney was implanted into Adam it had had a total storage time of approximately 34 hours, which he states is considerably longer than the average storage time of approximately 20 hours.[29] He considers the possibility in his Report that the donated kidney was severely injured referring to *"acute tubular necrosis"* and noting that *"with a storage time in excess of 30 hours acute tubular necrosis and delayed graft function would be expected"*.[30]

30. Those matters are being taken up by Dr. Malcolm Coulthard (Consultant Paediatric Nephrologist) and Dr. Peter Gross (Professor of Medicine and Nephrology) who the Inquiry has appointed as Experts.

31. However, there are also significant nursing issues in relation to Adam's care.

Requirements

32. The most pressing matter is to receive your advice on the nursing aspects of Adam's care including:

    (1) The adequacy of the record-keeping of Adam's fluid and nutritional management and his dialysis
    (2) The nursing elements of the transplant surgery and the adequacy of the records maintained
    (3) The quality of the information given to Adam's family
    (4) The specific matters identified by the Inquiry's Expert Advisors

33. The Inquiry's Expert Advisors have specifically identified 3 issues:

    (i) The recording of the peritoneal dialysis/fluid balance in relation to Adam's stay on the ward prior to theatre. Consideration of that issue should include taking into consideration and commenting on the following:

        - There was no record of measurements of the dialysis cycles carried out overnight either on the fluid chart[31] or on a separate dialysis record sheet. The relative accuracy of weighing children on ward scales at different times by different nurses can be questionable. However, weights recorded both pre- and post- dialysis, alongside fluid balance

[29] See ref: 094-007-029
[30] See ref: 094-007-034
[31] See ref: 057-010-013

monitoring of all fluid intake and output, can provide important information about trends in fluid balance.

- It is unclear who had the responsibility for monitoring and documenting Adam's dialysis, especially in regard to record keeping of fluid intake and output and serial weighing and that should be made clear. The only reference to Adam's dialysis is in the nursing notes[32] which refer to him being on the Pac X (dialyser) until 0600. Dr. Taylor has stated that there was 'no reason to believe there had been a change in electrolytes between 11 pm and 6.45 am'[33]. However, this opinion does not take into account the reduced period of time that Adam was on dialysis.

- The role of a nurse (if any) to check and clarify with medical staff about whether Adam should have been prescribed any of his routine medications as noted on his admission, such as sodium bicarbonate and calcium carbonate.[34]

(ii) The information that the nurses should have been exchanging with Adam's family about the transplant and on Adam's condition: immediately prior to the transplant, during it, after he left theatre and was transferred to PICU, during his time in PICU and up until he was pronounced brain-stem dead. Again, consideration of that issue should include taking into consideration and commenting on the following:

- The local policy on the provision of information to parents about their children and relating to recording the information provided

- What was and is acceptable practice in giving and recording information provided to children and their parents pre-operatively

(iii) Whether at the time of Adam's transplant (November 1995) nurses could be asked to operate a blood gas machine, in the case of:

- A Theatre or PICU nurse, alternatively

- A Ward nurse

34. You will need to consider all the Adam documents so as to carry out a thorough review of the evidence and form an opinion on the issues. However, to assist you we have attached an index of 'key documents' together with a 'core bundle'

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32 See ref: 057-014-019
33 See ref: 011-014-108
34 See ref: 057-013-017

identifying and providing the documents that would appear to be of especial significance.

Conclusion

35. It is of fundamental importance that the Inquiry receives a clear and fully reasoned opinion on these nursing issues.

36. Your assistance on the Inquiry's requirements should be provided in the form of a fully referenced Expert's Report. In accordance with the Protocol on Experts your Report will be peer reviewed.

INDEX OF KEY ACCOMPANYING DOCUMENTS

CORE BUNDLE
Tab 1-Original and revised Terms of Reference
Tab 2- Protocol on Experts
Tab.3 (from Inquest documents):

Depositions:
- Dr. Maurice Savage (011-015, Tab 3a)
- Mr. Patrick Keane (011-013, Tab 3b)
- Dr. Alison Armour (011-010, Tab 3c)
- Dr. John Alexander (011-012, Tab 3d)
- Dr. Robert Taylor (011-014, Tab 3e)

Reports:
- Professor Peter Berry (011-007, Tab 3f)
- Dr. Edward Sumner (011-011, Tab 3g)

Tab.4 (from Inquiry documents):
Witness Statements of:
- Dr. Maurice Savage (Tab 4a)
- Mr. Patrick Keane (Tab 4b)
- Mr. Stephen Brown (Tab 4c)
- Dr. Robert Taylor (Tab 4d)
- Mr. Victor Boston (Tab 4e)
- Dr. Joe Gaston (Tab 4f)
- Dr. Mary O'Connor (Tab 4g)
- Dr. Edward Sumner (Tab 4h)

Tab.5 (from PSNI papers)
Statements:
- Dr. Maurice Savage (093-006, Tab 5a)
- Nurse Catherine Murphy (093-007, Tab 5b)
- Mr. Patrick Keane (093-010, Tab 5c)
- Mr. Stephen Brown (093-011, Tab 5d)
- Ms. Eleanor Donaghy (093-015-048 and 093-016-049, Tab 5e)
- Joanne Sherratt (now Clingham) (093-017-051, Tab 5f)
- Dr. Mary O'Connor (093-020, Tab 5g)
- Dr. Joe Gaston (093-023, Tab 5h)
- Professor Peter Berry (093-030, Tab 5i)
- Professor Risdon (093-031, Tab 5j)

- Transcript of Dr. Robert Taylor's interview under caution (included in the statement of DS William Cross (093-035, Tab 5k)

Reports:

- Dr. Edward Sumner (094-002, Tab 5L)
- Mr. Geoff Koffman (094-007, Tab 5m).
- Medical opinion of Dr. Edward Sumner (094-001, Tab 5n)

Other documents:

- Dr. John Burton's folder of documents (094-013, Tab 5o)
- Schedule of Adam's surgical procedures (Tab 6a)
- Table showing Adam sodium levels and surgical procedures(Tab 6b)
- Urine sodium table(6c)

CORONER'S PAPERS (File 11)

PSNI PAPERS (Files 93 & 94)

ADAM'S MEDICAL NOTES AND RECORDS (Files16, 49-60 inclusive)