Witness Statement Ref. No. 002/1

NAME OF CHILD: Adam Strain

Name: Maurice Savage

Title: Professor

Present position and institution:

Consultant Paediatric Nephrologist Royal Belfast Hospital for Sick Children/Royal Hospitals Trust & Professor of Paediatrics Queens University, Belfast

Previous position and institution:
[As at the time of the child's death]
Consultant Paediatric Nephrologist, Royal Belfast Hospital for Sick Children and Senior Lecturer in Child Health, Queens University, Belfast

Membership of Advisory Panels and Committees:
[Identify by date and title all of those between January 1995-December 2004]

Member of the Paediatric sub-committee of the Area Medical Advisory Committee, Eastern Health and Social Services Board, N.I.
Member of the Specialty Advisory Committee (Paediatrics) NI DHPSS
President – British Association for Paediatric Nephrology

Previous Statements, Depositions and Reports:
[Identify by date and title all those made in relation to the child's death]

011-003-024,025	Statement of Maurice Savage, Consultant Nephrologist
011-018-122 to 125	Deposition of Maurice Savage c/o RBHSC
016-004-014,015	Letter from M Savage to Dr Scott (GP) 4/12/95

OFFICIAL USE:
List of previous statement, depositions and reports attached:

Ref:	Date:	
011-003-024	28.11.95	Statement
011-018-121	21.06.96	Deposition at the Inquest on Adam Strain
		Transcript of oral evidence at the Inquest on Adam Strain

MSavage 22/7/05

Particular areas of interest
[Please attach additional sheets if more space is required]

1. Describe your role in the general care of Adam prior to his transplant surgery

I was involved in the general medical care of Adam Strain from early infancy when he was referred by Dr Angela Bell from The Ulster Hospital, Dundonald where he had been born with cystic, dyplastic kidneys. There were associated problems with the drainage of his kidneys related to obstruction and vesico ureteric reflux. He required multiple operations to the urinary tract and from that point of view was under the care of the Paediatric Surgeon, Mr Stephen Brown. To optimise drainage of the urinary tract he had a a suprapubic catheter inserted. He had re-implantation of his ureters on two occasions and had nephrostomies performed during the early months of his life. On several occasions he became critically ill and required care in our Intensive Care Unit and a brief period of dialysis because of acute renal failure.

My medical management was aimed at optimising Adam's nutrition and preserving his residual renal function for as long as possible. Maintaining nutrition was a major problem because of persistent vomiting and a fundoplication operation to stop gastro-oesophageal reflux was carried out in 1992. However he continued to have major feeding problems and required supplemental tube feeding and eventually required all his nutrition via a gastrostomy tube. He was subject to recurrent urinary tract infections and his renal function gradually deteriorated until he required dialysis support. Home peritoneal dialysis was chosen. His mother was trained in the home peritoneal dialysis technique by our dialysis nurses.

I co-ordinated Adam's care, prescribed and monitored his dialysis treatment with support from a dietician, psychologist, social worker, the renal nursing team and of course his mother. Although he had many hospital admissions and was seen regularly as an out-patient, a lot of his complicated management, including his medication, tube feeds and home dialysis, was carried out meticulously with great skill by his mother, Debra Strain, with whom we worked closely.

Despite the fact that his kidneys were unable to excrete waste products adequately so that he required dialysis for uraemia his urine output was quite large but of poor quality. His tube feeds in the months prior to transplantation, were slightly over 2 litres per day (059-006-021) and although his night time dialysis removed some fluid he continued to pass in excess of 1 litre of urine each day (059-006-121).

Once he was on dialysis he was put on call for a kidney transplant.

2. Describe in detail your role in the preparation for the transplant surgery on Adam, including:
(i) meetings with other medical personnel; and
(ii) information sought from and provided to other medical personnel

On the 26th November 1995 we had an offer of a kidney from the UK Transplant Service that was a reasonable match for Adam. He was therefore admitted to Musgrave Ward under my care in the Royal Belfast Hospital For Sick Children for pre-operative assessment and so that a tissue crossmatch could be carried out. Standard pre-transplant checks were performed including assessment of hydration, temperature, blood pressure, chest examination, blood crossmatch, biochemistry screen, a full blood picture, coagulation screen and a virological check of his blood. His urine and some peritoneal dialysis

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Particular areas of interest (Cont'd)

fluid were cultured and consent obtained for a transplant. I contacted our operating theatre, the consultant anaesthetist on call and the transplant surgeon on call to alert them to the possibility of a transplant operation and the nature of Adam's medical condition.

Adam's mother had previously been given information about transplantation. In discussion she was apprehensive in relation to such major surgery but of course Adam had experienced quite a long and stormy medical history with many operations so this procedure did seem to offer him the best chance of a more normal life. As it takes approximately six hours for a transplant crossmatch process to be completed it was 1 a.m. before we knew that the transplant crossmatch was favourable. After detailed telephone discussion of the complexity of Adam's case the surgical and anaesthetic team decided that rather than commence major surgery in the middle of the night a planned transplant operation should commence at 7 am, 16 hours after the kidney had been donated.

I was satisfied with his haemoglobin at 10.5 g/dl and with his electrolyte status with a sodium of 139 mmol/L and a potassium of 3.6 mmol/L. His dialysis was performed as normal although the duration of the dialysis was, of necessity, shorter than usual. In consultation with Dr Taylor it was decided that he should have clear fluids overnight by gastrostomy tube rather than his normal Nutrison feeds. The gastrostomy fluids were to stop two hours before going to theatre. Usually Adam was given a high calorie tube feed, Nutrison, and had 1500 ml each night. This contains 43 mmol of sodium/L. On the night of his transplant he instead, had a glucose and electrolyte solution known as Diorlyte which contains 60 mmol of sodium chloride/L so that his stomach would be empty by 7.00 a.m (059-006-011). The total volume he received overnight was just under 1 litre.

I discussed Adam's underlying diagnosis, his past medical history and the current management of his condition in terms of dialysis and fluids with Dr Taylor so that he was aware that Adam normally received 2.1 litres of fluid each day, 1500 ml of which were usually given overnight and that I estimated that his urine output each day was 1200 – 1500 ml. It was planned that Adam should receive intravenous fluid (75 ml/hr) (059-006-022) after the tube feeds were discontinued and have his blood chemistry checked before theatre but it proved impossible to achieve venous access.

I arranged to return to the hospital early the following morning to be available for consultation if required. I noted in the clinical chart the anti-rejection and antibiotic drugs which I recommended for Adam and a request for a double or triple lumen long intravenous central line to be placed for ease of blood sampling, drug administration and monitoring of his CVP (059-006-011).

On the morning of the 27th November I made myself available in theatre for consultation and understood there were no early problems during the transplantation procedure. I reassured Ms Strain of this before undertaking some university duties and my colleague, Dr Mary O'Connor, then made herself available for consultation. Neither of us, of course, take part in the transplant surgery itself but are responsible for the immunosuppressive treatment and usually take over the care of the patient again once they have returned from theatre.

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Other points you wish to make including additions to any previous Statements, Depositions and or Reports
Please attach additional sheets if more space is required]

When Adam Strain returned to the Paediatric Intensive Care Unit my colleague, Dr Mary O'Connor was present and was made aware that Adam was not breathing spontaneously and that he had fixed, dilated pupils (059-066-013). I was contacted and came immediately to the Intensive Care Unit to join her. Post-operative electrolyte analysis indicated a sodium of 119 compared to 139 the previous evening. We were concerned that Adam had developed cerebral oedema. A CT scan was carried out confirming this view.

As soon as this situation was clear I sat down with Adam's mother and the family and told them we were in a grave situation. I explained that Adam had cerebral oedema with a swollen brain causing pressure on his vital centres and indicated that I thought the hope of recovery was remote (059-006-016). Despite this devastating news Ms Strain subsequently wanted to discuss the possibility of organ donation with me (059-066-018).

Over the next twenty-four hours I was in regular contact and kept the family aware of the developing situation and was present when brain stem death was independently confirmed and life support withdrawn with Adam in his mother's arms.

In the succeeding months I kept in contact with Debra Strain and her parents as they struggled to cope with their tragic loss. I tried at all times to be open and honest in talking with them and shared their grief.

Following the events surrounding Adam's death Dr O'Connor and I revised the Renal Transplant Protocol to state that normal saline, plasma or blood should be used in theatre to raise central venous pressure prior to releasing vascular clamps to perfuse the kidney (RGH2.6, copy enclosed).

THIS STATEMENT IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF

Signed: J Maurice Savage **Dated:** 22/7/05

MWSG CMVS WD

RGH·206.

Copy from M. Soos 13/12/04

RBHSC RENAL TRANSPLANT GUIDELINES

CHECK LIST ON ADMISSION

A) HISTORY:-

Function of native kidneys - volume output.
Recent contact with infectious diseases.
When last dialysed.
Vaccination history.
CMV status donor/recipient.
Cytotoxic antibody status.
Tube feeds - what and how much.
What central line sites used previously.
List drugs.

B) EXAMINATION:-

State of nutrition.
State of hydration.
BP
Height and weight, surface area.
Catheter exit site appearance.

C) INVESTIGATIONS (insert peripheral cannula at same time)

Clotted sample - 5 ml by taxi to Ward 11N, BCH for tissue typing X-match (telephone 7-111-2455).
FBP, DWBC, coag screen, U/E, creat, Ca, albumin.
Group and X-match 4 units WBC depleted CMV -ve blood.
Virology for Hep A, B and C, CMV, measles, chickenpox, HIV, EBV.
PD fluid and urine for culture.
Urine for U/E and creatinine.
CXR
ECG if on antihypertensives.

PLAN:-

1. Fast and consent.

2. Shower.

3. Dialysis if K+ > 5.

4. Peritoneal Vancomycin loading dose (500 mg/l)
   Leave x 4 hours and drain pre Theatre.

5. If prolonged fast - maintenance IV fluids (give insensible losses (= 300 ml/m) and output) as 0.18% saline, 4% dextrose. D/W Consultant if Na < 133. Repeat U/E at time of going to Theatre.

6. Acyclovir - if either donor or recipient CMV positive.
   800 mg PO 2-6 hours pre-op.
   800 mg PO 24 hours post-op.

   Thereafter according to GFR

> 25 ml/min/1.73	6 hourly	800 mg PO
10-25 ml/min/1.73	8 hourly	800 mg PO
< 10 ml/min/1.73	daily	800 mg PO
Dialysis dependent	12 hourly	800 mg PO

   (Half dose in < 2 years old)

7. Complete "Check List" for Theatre.

IMMUNOSUPPRESSION

1. CYCLOSPORIN
   Start 3 mg/kg/12 hrs/IV by syringe pump infusion pre-op.
   (Alternative if decided by Consultant =
   3 mg/kg IV slow bolus over 4 hours pre-op or
   10 mg/kg orally 4 hours pre-op)

2. AZATHIOPRINE
   2 mg/kg/IV in 50 ml saline and given over 20 min pre-op.

3. For highly sensitized patients, ie > 70% cytotoxic antibiotics
   - Antithymocyte globulin (see separate protocol).

IN THEATRE

Assess hydration, check electrolytes and ABG x 2 hourly.
IV Augmentin on induction.
S/C Heparin with surgeons consent after induction.

< 15 kg	1000u tds
15-20 kg	1500u tds
20-40 kg	2500u tds
> 40 kg	5000u tds

Triple lumen CVP catheter.
IA line in small children.
If Hb < 10 g/dl give packed cells to bring it up to 10 g/dl.
Start Dopamine 2-3 ~~mg~~ µg/kg/min.
Use N.saline, plasma, or blood (as appropriate) to raise CVP to 8-10 ~~m~~ mmHg prior to removal of vascular clamps. Keep CVP here.

10-15 MINS PRIOR TO RELEASE OF CLAMPS - 0.5 g/kg (2.5 ml/kg) 20% Mannitol
(alternative 4 mg/kg Frusemide)

- 10 mg/kg Methylprednisilone (max 500 mg)

POST-OPERATIVE

1. FLUIDS

Replace urine output and insensible losses (300 ml/m /day) EACH HOUR as 0.45% saline 2.5% dextrose (subtract volume of infusions).

Boluses of N.saline or HPPF (5-10 ml/kg) over 20 mins to maintain CVP and BP.

2. OBSERVATIONS

a. CVP between 5-10 mmHg.
b. BP decided on individual basis.
c. Optimal urine output to be decided on an individual basis. In polyuric patients this will be around 4 ml/kg/hr initially, falling to 2 ml/kg/hr when stable. In previously anuric patients far lower outputs may be acceptable if ATN has occurred. Check transplant troubleshooter for management guidelines on output and BP.

3. DRUGS

Immunosuppression

a. Cyclosporin 6 mg/kg/24 hrs written up as continuous infusion via syringe pump 3 mg/kg/12 hrly (not stable for longer). This will be converted to Cyclosporin 12 mg/kg/day orally given as bd dosage. Stop infusion 12 hours after first oral dose.

b. Methylprednisilone 60 mg/m /day as bd dose for first 5 days and then reduce (see separate sheet).

c. Azathioprine 1 mg/kg/day from D1 post-op - IV or oral, for monitor WCC. Stop after one month if no rejection.

Prophylaxis

d. Dopamine 2-3 mg/kg/hr.

e. Ranitidine 1 mg/kg bd IV, oral 2 mg/kg bd (Until minimum steroid dose achieved)

f. Nifedipine 5-20 mg bd as Cyclosporin toxicity prevention.

g. Septrin 120-480 mg orally bd Mon, Wed, Fri for 3-6 months.

h. Heparin 1000-2500 s/c tds for 5-10 days.

i. Acyclovir if CMV +ve donor or recipient (see above).

Analgesia

j. Epidural
or
k. Morphine 10-20 mcg/kg/hr infusion (half BW (kg) in mg in 50 ml at 1-2 ml/hr).

INVESTIGATIONS

1. U/E, creatinine, glucose, Ca x 6 hourly for 24 hours.
   x 12 hourly next 24 hours.
   x daily thereafter (+ phosphate).

2. Doppler renal USS post-op if possible and repeat PRN (? daily)

3. FBP, DWCC, (and CD3 count if on ATG) daily.

4. CXR daily for 2-3 days.

5. Urine - culture, U/E and creatinine daily.
   - protein/creatinine ratio x twice daily.

6. Cyclosporin levels analysed Tue and Fri (RVH Ext 3334). When on oral drugs send daily for 10 days and thereafter Tue and Fri.

IMMUNOSUPPRESSION POST TRANSPLANT

1. STEROIDS

Day 1-5	Methylprednisolone 60 mg/m /day as bd dosage x 5 days (may be changed to same dose oral Prednisolone as soon as tolerated).
Day 6	Prednisilone 30 mg/m^2/day as 2 divided doses.
Day 14	Prednisilone 20 mg/m^2/day as 2 divided doses.
Day 21	Prednisilone 10 mg/m^2/day as 2 divided doses.
Week 4-8	Prednisilone 10 mg/m^2 DAILY as one daily dose.
Week 8-12	Prednisilone 5 mg/m^2 DAILY.
Week 12+	Prednisilone 10 mg/m^2 alternate days.

2. AZATHIOPRINE

If no severe rejection STOP at 4-6 weeks. Do not give if neutrophils < 1000 or total WCC < 3000.

3. CYCLOSPORIN

Always as NEORAL

Levels -	Weeks 0-4	150-250 ng/ml
	Weeks 4-12	150-200 ng/ml

FOLLOW UP

After discharge	- alternate days x 1 week
Until week 6	- twice weekly
Week 6-10	- weekly
Week 10-12	- fortnightly
> 3 months	- monthly
> 1 year	- 6-8 weekly

NB. See within 1 week of any DOSE CHANGES

REJECTION

ASSESSMENT OF REJECTION

> 10% rise in serum creatinine is a significant change. It could be due to:-

1. Laboratory error.
2. Rejection.
3. Cyclosporin toxicity.
4. Other drug toxicity (especially Acyclovir).
5. Infection (especially UTI).
6. Obstruction - exclude with renal USS.

All such rises in creatinine should be reported to the Consultant and repeated immediately. If a 10% rise is confirmed and rejection suspected then initial treatment would be:

Methylprednisolone 15 mg/kg/IV for 3 days (maximum 500 mg). (100 mls N SALINE over 4 hrs.

This should only be prescribed after discussion with Consultant.

Other causes of a rise in creatinine should be excluded and diagnosis confirmed whenever possible with a renal biopsy.

For patients who have received renal transplant > 1 month previously, oral Prednisolone 3 mg/kg/day is given for 3 days (maximum 150 mg).

ANTI-THYMOCYTE GLOBULIN (MERIEUX-RABBIT)

Given for steroid resistant rejection or as prophylaxis when recipient > 75% cytotoxic antibodies or second transplant when first graft lost early with rejection.

Test dose: 0.1 ml (0.5 mg) in 10 ml N.Saline over 1 hour via central line.

ANAPHYLAXIS treated with:

Hydrocortisone 100 mg IV
Chlorpheniramine 5-10 mg IV
Adrenaline (0.01 ml/kg of 1 in 1000, 1 m)

Prior to theraputic dose give Chlorpheniramine IV and Hydrocortisone IV.

Theraputic Dose:

< 30 kg - 2.5 mg/kg/day

> 30 kg - 1.25-2.5 mg/kg/day

Diluted in 100 ml saline central line over 8 hours.
Chills, fevers and arthralgia common.

ATG Monitoring

Aim absolute lymphocyte count 200-400 (omit if < 200).

CD3 count daily

(Send 0.5 ml EDTA blood to RVH immunology,
arrange with extension 2689,
ask for lymphocyte markers profile 1 which includes CD3).

Aim level 100-300 (omit if < 100).

Updated Sept 96
M Savage/M O'Connor

THEATRE CHECK LIST FOR TRANSPLANT PATIENT

NAME:

Ht: Wt: SA:

CMV status: Donor Recipient

Acyclovir: Yes/No

Pre theatre:

Na	Hb	PT
K	WCC	PTTK
Urea	Plats	
Creat		
Ca		
Albumin		

Drugs:

Drugs in ward pre-transplant:

Azathioprine Dose

Cyclosporin Dose

Drugs in Theatre:

Augmentin (on induction) (30 mg/kg, max 1.2 g) =

Methylprednisolone (10 mg/kg, max 500 mg) =

Mannitol 20% (0.5 g/kg = 2.5 ml/kg) =

Amount of blood to bring Hb up to 10 g/dl =

NURSING CHECK LIST FOR TRANSPLANT

NAME:

Height

Weight

BP

MSU and urine U/E

Shower

PD sample for microscopy and culture

PD Vancomycin 500 mg/l and run in usual fill volume and drain one hour pre theatre.

Pre-op Cyclosporin

Azathioprine

? ATG

Acyclovir if CMV +ve donor or recipient

TRANSPLANT TROUBLESHOOTER

OUTPUT

If urine output falling < 2 ml/kg/hr give volume to correct low BP or CVP.

Volume — 5-10 ml/kg/stat of N.saline or HPPF
(or blood if appropriate)
May need repeated frequently in first 24 hours leading to positive fluid balance > 1-3 litres.

BP

If high - Hydralazine 0.2 - 1.0 mg/kg/IV stat followed by hourly infusion at same rate.

If low - Volume or Dobutamine (0-20 mg/kg/min)

TEMPERATURE

After first 24 hours may signify rejection.
Check creatinine, blood cultures, urine culture, CXR.

SUDDEN ONSET OLIGURIA/ANURIA

Catheter blocked?

Anastomotic leak?

Urine leak?

IF IN DOUBT CALL CONSULTANT NEPHROLOGIST