CITATION:	*Inquest into the death of* ***Nikita Anderson*** [2004] NTMC 089
TITLE OF COURT:	Coroner's Court
JURISDICTION:	Darwin
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HEARING DATE(s):	
FINDING OF:	Ms Lyn McDade

CATCHWORDS:

Resuscitation, administration of carbon dioxide

REPRESENTATION:

Counsel:

Assisting:	Mr Michael Grant
Dr Drum:	Mr John Reeves QC
Dept. of Health & Comm. Services:	Mr David Farquhar

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IN THE CORONERS COURT
AT DARWIN
IN THE NORTHERN TERRITORY
OF AUSTRALIA

IN THE MATTER OF AN INQUEST INTO THE DEATH OF

NIKITA ANDERSON ON 13 OCTOBER 2003 AT ROYAL DARWIN HOSPITAL IN THE NORTHERN TERRITORY

FINDINGS

Ms McDade Deputy Coroner:

THE NATURE AND SCOPE OF THE INQUEST

[1] Nikita Anderson ("the deceased") was a 9 month old Aboriginal infant who died at Royal Darwin Hospital at about 0400 hours on 13 October 2003.

[2] The deceased's death was reported to the Coroner pursuant to section 12 of the *Coroner's Act* ("the Act"). A Public Inquest into her death was held in Darwin from 18 October to 22 October 2004 pursuant to section 15 of the Act. A number of witnesses were called to give evidence, namely:

Sergeant Anne Lade

Sister Maloney

Sister Young

Sister Mortimer

Professor South

Dr Fitzpatrick

Sister Wilson

Dr Kilburn

Dr Drum

Dr Fasher

Dr Buxton

Dr Cupitt

Dr To

A number of witness statements, medical reports, documents and items were tendered and admitted as evidence.

Exhibit list:

(a) Coronial brief;

(b) Birth certificate;

(c) Borroloola medical files;

(d) Darwin medical files

(e) CO2 manifold;

(f) Tubing and mask;

(g) South report;

(h) Fasher report;

(i) Dr Drum curriculum vitae;

(j) Action plan.

[3] Counsel assisting me was Mr Grant. Mr Reeves QC sought leave to appear on behalf of Dr Drum and Mr Farquhar for the Department of Health and Community Services. I granted leave pursuant to section 40 of the Act.

FORMAL FINDINGS

[4] Pursuant to section 34 of the Act I find, as a result of the evidence adduced at the Inquest the following:

[5] The deceased was Nikita Virginia Anderson.

[6] The deceased died at Royal Darwin Hospital at 0200 hours on 13 October 2003. The cause of death was broncho pneumonia caused by hypoxic brain damage which was caused or contributed to by:

(i) meningitis.

(ii) seizures.

(iii) aspiration of vomit.

(iv) cardio respiratory arrest; and

(v) the administration of carbon dioxide during resuscitation causing the deceased to be deprived of oxygen for an indeterminate period.

[7] Particulars required to register the death under the *Birth, Deaths and Marriages Registration Act* are as follows:

(1) The child was female.

(2) The child was an Aboriginal Australian.

(3) A post-mortem examination was carried out.

(4) The pathologist viewed the body of the child.

(5) The pathologist was Dr Nigel Buxton. A locum pathologist of the Forensic Pathology Unit of Royal Darwin Hospital.

(6) The father of the child is Edwin David Anderson.

(7) The mother of the child is Kim Eileen Rory.

(8) At the time of her admission to Royal Darwin Hospital the child resided with her parents at Borroloola, Northern Territory.

RELEVANT CIRCUMSTANCES CONCERNING THE DEATH

[8] It is apparent that "the deceased" presented at the Borroloola Health Clinic on 29 September 2003 very unwell. She was subsequently seen at the GP Clinic by a qualified and capable medical practitioner, namely Dr Drum. He with the assistance of nursing sisters, Young, Mortimer and Maloney attempted to revive and stabilise the deceased. I accept the evidence that the deceased had been unwell for some hours before her presentation at the GP Clinic. She had been experiencing seizures and probably suffering from a meningitic infection. At the Clinic the deceased vomited and convulsed and went into cardio respiratory arrest.

[9] Dr Drum and Sister Mortimer immediately commenced mouth to mouth and cardiac compression. The evidence of the resuscitation procedure showed it to be well conducted. There was no panic, and Dr Drum to his credit, (given the circumstances of the clinic at the time) – performed and directed the procedure in a professional and competent manner.

[10] As best I can ascertain from the evidence the following was the sequence of the events leading up to the resuscitation of the deceased.

[11] Dr Drum had only recently arrived in the Community. The previous resident doctor, Dr Fitzpatrick, had left the Community before the arrival of Dr Drum. Dr Drum did not have the benefit of a "hand over/take over". He arrived in a Community that, unusually as I understand it, had two medical facilities.

[12] The Borroloola Health Clinic was staffed and operated by the Department of Health and Community Services. It was called "The Top Clinic" during the Inquest. The second clinic was called the "GP Clinic" and was so referred to during the Inquest. The facilities performed different functions, however, there was only one resident general practitioner and he worked from the GP Clinic.

[13] The deceased was initially taken to the Top Clinic and then taken to the GP Clinic, a short distance away, to be seen by Dr Drum. The GP Clinic has now been closed and the Community is serviced by the Top Clinic. I make no comment about that decision, save this, had the Department not acted to rationalise health services at Borroloola before the Inquest, I would have recommended that it do so.

[14] The existence of the two clinics clearly could not continue. Dr Fitzpatrick in his evidence, painted a picture of the GP Clinic that was in stark contrast to the evidence given at the Inquest. I accept the evidence of Dr Drum and the nursing sisters concerning the condition of the GP Clinic. The necessity to have it cleaned and items moved from room to room more than likely contributed to the

unfortunate error which occurred during the resuscitation, namely the administration of the CO^2 rather than oxygen.

[15] At the time the deceased was brought to the GP Clinic it was in disarray. Dr Drum had not had the opportunity to ascertain where equipment was, in particular resuscitation equipment. Ironically, at the meeting held at the Top Clinic earlier in the morning of 29 September 2003, the lack of such equipment at the GP Clinic had been identified.

[16] Dr Drum and the nurses at Borroloola were placed in an unenviable situation by having to conduct a critical paediatric resuscitation in the GP Clinic given the state it was in.

[17] The process of the resuscitation procedure bears out the extreme situation. I find it occurred as follows:

The deceased arrived at the GP Clinic about 0910 hours on 29 September 2003. At the time she was extremely unwell however, she was still conscious and aware. After her arrival she convulsed and vomited. The deceased than progressed from cardiac to cardiac respiratory arrest very quickly. Dr Drum and Sister Mortimer commenced mouth to mouth and external cardiac massage. Spontaneous circulation was restored about 3 minutes after the arrest. The resuscitation continued with the intention of administering oxygen to the deceased. A cylinder was located under the table and was presumed to be oxygen. That cylinder was then used to administer CO^2 to the deceased for about 30 seconds or perhaps longer.

[18] Sister Young arrived at the GP Clinic at about 0930 hours. At this stage the deceased was intubated and re-intubated. The deceased was then administered carbon dioxide by the endotracheal tube. This administration was considerably longer than the first. It could have been as long as 20 minutes or as little as 5 minutes. I am unable to say with certainty how long the administration of carbon dioxide continued.

[19] Sister Maloney arrived sometime between 9:40 and 9:45am. She noticed the cylinder and checked it. She informed Dr Drum and the others that the cylinder was carbon dioxide and not oxygen. The administration of carbon dioxide was ceased. The deceased was administered 2 millilitres of adrenaline by the endotracheal tube at about 0945 hours or shortly thereafter. A further 2 millilitres of adrenaline was administered at about 0955 hours. The deceased was also given an intraosseus injection at about this time.

[20] Throughout the resuscitation procedure it was necessary to bring resuscitation equipment and medications from the Top Clinic to the GP Clinic. Oxygen was obtained from the ambulance.

[21] The deceased was eventually stabilised and prepared for evacuation to Darwin. At this time I find on the evidence available that she had suffered hypoxic brain damage. Any prospect of survival, albeit with impairment, had been extinguished. In my opinion the hypoxic brain damage was caused by the

deceased's cardio respiratory arrest and the administration of carbon dioxide during the resuscitation procedure.

[22] The administration of the carbon dioxide to the deceased was accidental. The CO^2 cylinder was thought to be an oxygen cylinder because it was located in the room where the resuscitation was performed and apparently had tubing and a face mask already attached to it. Dr Fitzpatrick usually kept this cylinder in another room of the clinic. The cylinder was probably moved without the knowledge of Dr Drum and the nursing sisters when the clinic had been cleaned a few days earlier. No one checked the gas cylinder before it was used on the deceased. It was presumed because of its location and configuration to be an oxygen cylinder. Tragically it was not.

[23] Medical gas cylinders are as I understand it are identified by colour. The evidence given at the Inquest by a number of medical professionals, doctors and nurses alike, indicated a general lack of knowledge as to the colour of CO^2 cylinders. Even so, if the cylinder had been checked prior to being used, I would expect that a medical professional would have realised that it was not an oxygen cylinder.

[24] Having said that, I can understand how, given the circumstances that existed in the GP Clinic at the time and the acute condition of the deceased, the cylinder was not checked.

[25] At the Inquest, I heard from Dr Fasher and received his reports into evidence. He proffered the opinion that the cause of the deceased's hypoxic brain damage was her cardio respiratory arrest and not the administration of carbon dioxide. I refer to his report dated 17 October 2004. In paragraph 8 thereof, under the heading "Carbon Dioxide Administration in lieu of Oxygen" he says and I quote:

> "A Medline review of 744 papers with a search of "carbon dioxide administration and dosage, complications, therapeutic use, drug effects, toxicity" revealed no paper discussing a similar situation to Nikita's at Borroloola. Not one medical officer or nurse in our department today could tell me the colour of a carbon dioxide cylinder.
>
> Basic principles would suggest that the administration of the carbon dioxide (CO2) would have contributed to Nikita's hypoxia and encephalopathy. If given by a bag and mask the concentration may have been minimally diluted because of difficulties with mask to mouth and nose seals etc. Given via endotracheal tube it is more likely to be 100%k inspired carbon dioxide.
>
> This means there is no oxygen being delivered to the blood and thence the brain. Increasing acidosis and inability to remove waste products would ensure, vasodilation of the cerebral blood vessels, raised intracranial pressure and further vascular embarrassment.
>
> Logic would suggest the extent of the contribution of the inhaled CO2 to hypoxia would be linked directly, at least, to the duration of time it was administered. I note inter alia that nurse Debra Young heard a hissing sound

from the cylinder, possibly early in the peace. It is this sort of sound one often hears when oxygen tubing pops off the supply nipple when high flow rates are being employed.

Thus it is difficult for me to estimate for how long Nikita received carbon dioxide, and how much hypoxic damage it caused. Whatever, I take the view that this matter is less important in the overall outcome, which, I recognise, rails against all intuition, and diverts attention from what has actually already occurred and is the far more significant factor ordaining ultimate outcome.

In Summary

I would take the view that the event which far outweighed all others and which predicted Nikita's final outcome in its own right, was the cardiorespiratory arrest. This was probably asystolic, occurred in a pre-hospital setting and in an infant <12 months old. The aspiration pneumonia would have been an ongoing contributor to hypoxia as would the meningoencephalitic process. I believe there is good evidence that for 12 hours at least Nikita was in status epilepticus. That Nikita was possibly recovering from the aspiration pneumonia and the meningoencephalitic process I believe is immaterial to the ultimate outcome predicted by the *cardiorespiratory arrest*, which was itself, at least in part precipitated by the aspiration pneumonia and the meningoencephalitic process when at their most florid. Clearly the status epilepticus become of less concern once anticonvulsant therapy had been instituted and sadly once the hypoxic

encephalopathy took hold with no electrical activity on the electroencephalogram at all.

The expired air resuscitation I believe is minimal in the enormity of the other events.

The carbon dioxide administration would clearly not have helped matters. However I would take the view that the administration of carbon dioxide occurred after the defining event of an asystolic cardiorespiratory arrest in a pre-hospital setting in an infant under 12 months, whose outcome and prognosis, by that stage, is reasonably confidently predictable.

Had Nikita survived to discharge from hospital there is a highly significant chance that she would have done so with significant neurological deficit."

[26] He also presented statistics about the survival chances of infants after cardiorespiratory arrest in hospital and out of hospital settings. Those statistics were all predicated, as I understand it, on uncompromised resuscitation efforts, not involving the inadvertent administration of carbon dioxide.

[27] I can accept that an out of hospital resuscitation of a child in cardiorespiratory arrest could be considered compromised, however, this was a resuscitation in an in-hospital situation where a qualified medical practitioner was available and the requisite equipment was also available, (albeit not instantaneously).

[28] Accordingly I cannot accept Dr Fasher's opinion that the administration of the carbon dioxide did not contribute to the hypoxic brain damage suffered by the deceased. In this respect I prefer the evidence and reports of Professor South. In particular his additional comments in his supplementary report which I set out hereunder are compelling:

> "From my reading of the case material, and the expert opinion provided by Dr Fasher, it appears that there would probably be consensus on the following points:
>
> 1. Carbon dioxide was used instead of oxygen during the resuscitation.
> 2. This was an error, and clearly far below an acceptable standard of care.
> 3. The duration of use of carbon dioxide is difficult to ascertain accurately in retrospect.
> 4. For several good theoretical reasons, the use of carbon dioxide instead of oxygen during resuscitation could have serious adverse consequences, particularly in a child who is already very ill, and in whom the oxygen supply to the brain is already compromised.
> 5. Nikita Anderson was indeed very ill at the time of her assessment at the xx clinic. The oxygen supply to her brain was likely to be already compromised.
> 6. Nikita Anderson suffered a cardiorespiratory arrest – hence the need for resuscitation.
> 7. Death, or survival with severe neurological impairment, are likely outcomes for children who have cardiorespiratory arrest.
>
> I would make some further observations in regard to point to 7.

The bad outcome figures provided by Dr Fasher are largely from studies in which cardiorespiratory arrest has occurred away from medical facilities and the immediate availability of equipment and expertise in resuscitation. Most of these studies are of children who are in a confirmed state of cardiac arrest at the time of arrival of paramedical staff, or on arrival at a hospital emergency department. They therefore are studies of a group of children who will have had a fairly prolonged cardiorespiratory arrest (due to the delay in arrival of paramedical staff) and henceforth a worse prognosis. They also exclude subjects who have responded well to bystander administered CPR.

Children who suffer a cardiorespiratory arrest in a medical facility overall have a somewhat better outcome, but death or survival with severe neurological impairment certainly can still occur. Two studies of cardiopulmonary arrest in a medical facility are cited by Dr Fasher. The first (Wark et al) had a survival to hospital discharge rate of 42%, and the second (Innes et al) showed that overall 70% of cardiopulmonary resuscitation attempts were initially successful, 37% of the children were still alive 12 months later. The 11 children who had been neurologically normal before the arrest showed no evidence of neurological damage after successful cardiopulmonary resuscitation.

The term "cardiorespiratory arrest" is used to describe a spectrum of physiological states. At one end of this spectrum are subjects who have

severely reduced, but still present, respiratory and cardiac function. At the other end are subjects in whom all cardiac and respiratory function has ceased. Eventually even the automatic electrical activity of heart disappears and this is termed asystole. At the former end of the spectrum, patients may respond well to resuscitation efforts. Good examples of this are seen in childhood near-drowning. A fairly common scenario being the young child who, after a relatively short period of immersion, is pulled from a swimming pool pale, floppy and not breathing, but who responds will to the efforts of an adult trained in CPR and goes on to have a complete recovery. At the other end of the spectrum are children who reach the point of asystole, following a hypoxic event, who have an almost universally terrible prognosis.

Current teaching does not attempt to train resuscitators to recognise where a subject is on the spectrum of severity, but rather recommends commencement of full resuscitation efforts in any person who appears to have inadequate respiration, or is unresponsive to stimuli. It is recognised that during emergency situations, feeling for a pulse can be unreliable, hence both artificial respiration and cardiac compressions should be commenced. Resuscitation was appropriately instituted for Nikita.

Cardiac ECG monitoring was not available at the Gulf Clinic, Borroloola, so it is difficult to ascertain where Nikita was on the spectrum of severity of cardiorespiratory arrest. This lack of ECG equipment does not in itself

represent an unacceptable standard of care. The same would be true of many general practice clinics.

From my reading of the evidence made by Dr Fasher, I think the main issue likely to be discussed may be summarised as follows:

Could it be that Nikita's fatal outcome was already determined by her state of cardiorespiratory arrest at the clinic? While it was clearly a terrible error, that the inadvertent administration of carbon dioxide instead of oxygen did little or nothing to add to her bad prognosis.

Put bluntly – was her fate already sealed?

From my knowledge and reading of the evidence provided, I believe she did have a chance of a better outcome, but that this was by no means certain. From his statements, Dr Fasher appears to believe that the fatal outcome was already determined, and that the use of carbon dioxide would have made no difference.

It is an issue that could be debated at length, but I believe will always remain uncertain. There are too may variables that cannot be accurately ascertained in retrospect.

Just what went on before Nikita arrived at the clinic? How bad and how prolonged were her seizures?

Where was she on the spectrum of severity of cardiorespiratory arrest when the carbon dioxide was used?

For how long was carbon dioxide inadvertently administered?

Whatever you might conclude from the evidence and expert opinion provided, I suggest respectfully that the issue will always be tinged with uncertainty."

[29] The child was eventually evacuated from Borroloola to Royal Darwin Hospital. The communication of the administration of the carbon dioxide to the child during resuscitation was, in my view on the available evidence, inadequate. I accept that Dr Drum did speak with Dr To and I also accept that he made a cryptic reference to the administration of the carbon dioxide in his notes that were handed over with the child. Dr To has a vague recollection of being told about the administration of the carbon dioxide but he did not tell Dr Cupitt or any other practitioner at Royal Darwin Hospital when the child arrived of the error. Dr Kilburn clearly had no idea that the child had been administered carbon dioxide during resuscitation attempts until after her death. I accept that the care given at Royal Darwin Hospital would not have changed and that it was appropriate care.

[30] The care given to the child during her evacuation flight, if I accept Dr Cupitt's evidence was clearly not of the highest standard. She apparently convulsed during flight. I would make further comment about the in-flight care had I not formed the view that the damage had been done at the Clinic and that whatever occurred in-flight did not contribute to the death of the deceased. Having said that however, it is clear that her in-flight care was not in accordance with best practice. The convulsions could have and should have been stopped by the administration of medication during flight.

[31] The withdrawal of life support and the administration of morphine to the deceased prior to her death was, in my view, appropriate.

RECOMMENDATIONS

[32] I agree with Professor South that "there are some very important lessons to be learned from this sad case. It would be a second tragedy if the opportunity to learn from this case was missed and that no attempt was made to address the obvious system deficiencies that could lead to future morbidity or mortality in other people". I agree with his thoughts as set out in his supplementary report and recommend the following:

1. The Department of Health and Community Services conduct an audit of all medical clinics and other facilities to ensure:
   (a) the availability, maintenance and organisation of resuscitation equipment meet minimal acceptable standards;
   (b) That cylinders of medical gases which are inappropriate to be used in resuscitation eg. carbon dioxide, nitrogen and helium are stored away from designated resuscitation areas.

2. The issue of labelling medical gas cylinders be reviewed.

3. That the configuration of medical gas cylinders be reviewed to ensure that inappropriate gases such as carbon dioxide cannot be connected to equipment used for resuscitation such as face masks.

4. These findings and a transcript of the evidence and exhibits be referred to the Therapeutic Goods Administration for its consideration and action as appropriate.

Lyn McDade
Deputy Coroner
14 December 2004