Retrieval of the Trauma Patient: *A Users Guide*

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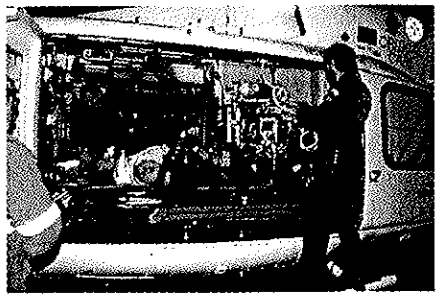
Retrieval is an Australian term used to describe critical care transport by a team that travels out from, or on behalf of, a major hospital to stabilise and transport a patient from a smaller facility. In the "ideal trauma system" interhospital transfers should not be required as all trauma patients would be admitted directly to a trauma centre. While something close to this occurs in parts of Europe and the USA, it is unlikely ever to be a reality in Australia. With long distances, sparse population, and relatively more small hospitals, admission to the nearest hospital may be the only alternative for some trauma victims. Many of these patients are likely to need subsequent transfer – and ironically the more urgent the transfer, the less stable the patient usually is. This is where the retrieval system can be of value – as the integrator of the trauma system. Transfer of trauma patients without a proper retrieval system has been shown to be associated with poor outcome.[1]

The essential components of a retrieval system have been outlined in the ANZCA/ACEM policy document on minimum standards for critical care transport.[2] They include:

1. Clinical Teams. These should be based around experienced & procedurally capable critical care medical practitioners. Other team members may include nurses, paramedics or both. Additional personnel such as a surgeon can be carried as required.
2. Modes of Transport. This can be road, fixed wing, or helicopter, depending on distance, urgency and weather. Vehicles may be dedicated mobile ICU type, or provided by addition of a mobile ICU module to an ambulance or general purpose vehicle.
3. Equipment. This should include mobile intensive care hardware such as ventilator, infusions pumps, and monitors, often modular form, such as the CareFlight stretcher bridge.[3] A full range of resuscitation equipment and drugs should also be carried.
4. Communications. This has been one of the areas of major advancement, in the last ten years. Thanks to the advent of mobile telephone technology, constant communication between retrieval team and both referring and receiving hospitals is possible.
5. Bed Finding. This has become an increasingly accepted role of the retrieval system. It is not appropriate that the referring clinical team be asked to locate a receiving hospital with a bed. Rather they should be free to devote all their, often limited, resources to managing the patient.



Many hospitals are "consumers" of retrieval services. For staff in this situation, principles of preparing the trauma patient for transport include:

- **Preparation.** Get to know how your local system works or should work before you need it. The more you know about what your local retrieval team can and perhaps more importantly cannot do the less nasty surprises you and your patient will get.
- **Communication.** Activate the system early, with as much information as possible. Continue to communicate as much as possible.
- **Realism.** Work within your capabilities – don't expect to do be able to do everything the patient needs, otherwise retrieval wouldn't be required. Communicate your capabilities and limitations to those advising you – as this enables their advice to be tailored to the situation.
- **Continuation.** Avoid the "retrieval hole", which occurs when referring staff mentally categorise a (usually stable) patient as no longer their problem. Once you have done what you can you need to keep reassessing the patient until the retrieval team arrives and not just park him or her in a corner.
- **Flexibility.** Above all, be flexible and alert. Blunt trauma in particular can be a series of nasty ambushes, and frequent changes in management may be needed.

Specific preparation for transport may need to encompass the following:

- ABC – Do the basics well. The sicker the patient the more you should concentrate on this. Remember that the Early Management of Severe Trauma (EMST) guidelines emphasise:
  Airway with **Cervical spine precautions**
  Breathing and **Ventilation**
  Circulation and **Haemorrhage control**
  not just ABC. This may be summed up as: "Is air going in and out and is blood going round and round (and not out onto the floor)?"
- Cervical spine control with a hard collar should be used when indicated. In blunt trauma it should be used unless contra-indicated.
- 2x large IV cannulae preferably in upper limbs. This does not necessarily imply that a lot of fluid should be given. Current thinking is that many trauma patients may do better if full circulatory refilling is delayed until haemostasis has been obtained. This probably excludes head injuries and possibly pregnant and elderly patients also. Suggestions on appropriate fluids may be sought from the retrieval or receiving teams.
- An intragastric tube is needed in anybody who is intubated. Beware using a nasogastric tube in patients with facio-maxillary injury. "If in doubt, go oral".
- An indwelling urinary catheter should be inserted in hypovolaemic and intubated patients, unless there is a contraindication (such as suspected ruptured urethra).
- Radiology – there are three essential films: Chest; Pelvis; and Cervical Spine. These should be done in all trauma patients if at all possible. The cervical spine film needs to include T1.
- All fractures should be immobilised , they do not necessarily need to be reduced.

Munford's law of transport states that the length of tape employed on the patient should not exceed the distance between the referring and receiving hospitals – but up to this length is OK. This is only semi-flippant. All lines, tubes, drains, etc. should be well secured.

- Documentation is communication too. The important points of documentation can be summed up under M*I*S*T: Mechanism of injury; Injuries sustained; vital Signs; and Treatment given. In addition, originals or copies of X-rays and blood test should be available "to go". Such personal details and next of kin details as are available must also accompany the patient.

Sometimes, sadly, friction may occur between the referring and retrieval staff. Avoidance of this is based on mutual respect. Remember, in the end, everybody should be on the same side – the patient's. The retrieval team should understand and respect the capabilities and limitations of the referring facility. Conversely, the referring staff should also respect the capabilities of the transport team and understand that the transport environment imposes its own limitations and priorities. During the hand over process and preparation for transport a number of aspects of treatment may be changed by the retrieval team. This does not mean that the initial treatment was wrong but is often just to optimise everything for the transport phase.

Remember that a retrieval system is by nature an imperfect solution to a non ideal situation. Difficulties will inevitably arise occasionally, and sometimes in spite of everything you do, the outcome is bad. Efficient and timely use of retrieval services however, will help significant numbers of patients that would otherwise suffer further morbidity and mortality.

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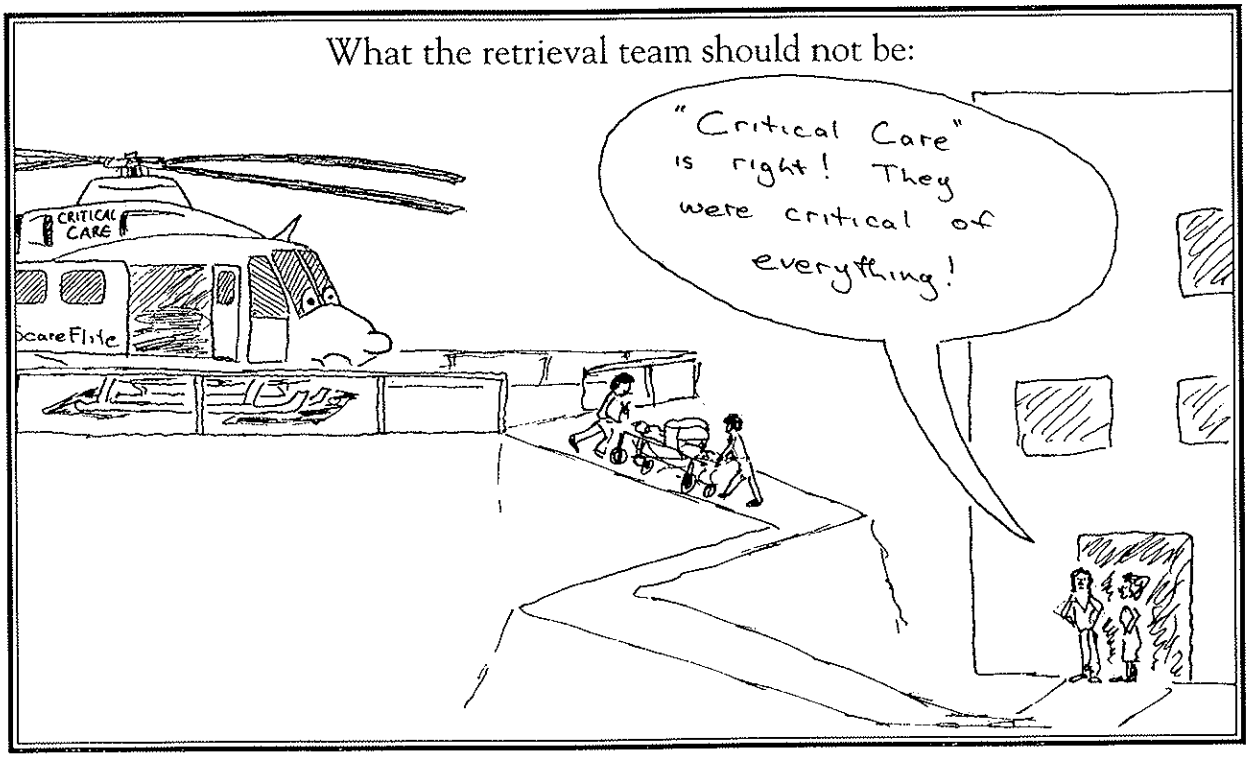

New South Wales Newborn and Paediatric Emergency Transport Service (NETS)

In October 1995 retrieval teams based at Prince of Wales Children's Hospital and Royal Alexandra Hospital for Children, combined to form what is now known as the New South Wales Newborn and Paediatric Emergency Transport Service or more frequently called "NETS".

NETS is located between the New Children's Hospital and Westmead Hospital at Westmead, in the Chesalon Building. NETS is a unique service, in that it is a statewide service funded directly by the Department of Health. Administratively, NETS comes under Western Sydney Area Health Service and clinically under the Perinatal Services Network. NETS does not belong to any one hospital, but services them all.

NETS is a specific neonatal and paediatric emergency transport service and is the only service of this kind in NSW. There are adult retrieval teams who undertake some paediatric retrieval, however no neonates. NETS covers all of NSW, the ACT, Lord Howe and Norfolk Island. International retrievals from Noumea, Japan and Taiwan have all occurred this year. The NETS team may find themselves in many different units and areas, ranging from delivery suite to the hyperbaric chamber. Most commonly frequented are nurseries, paediatric wards, emergency departments and intensive care units

The team is composed of twenty-six nurses and eight registrars. All the nurses are permanent employees and include a Nurse Unit Manager, Senior Nurse Manager and part-time educators. The registrars are part of the paediatric rotation and spend between three and six months with NETS. Dr. Andrew Berry is the State Medical Director of NETS and along with two other consultants provide twenty-four hour medical support. There are three teams available at all times, with the possibility of more using the consultants and educators. Nurses work ten hour shifts on a rotating roster.

As with most emergency services, there are busy and quiet periods. The winter months are busy with the increased cases of bronchiolitis and asthma requiring retrieval. The busiest week so far this winter had 79 infants and children transferred by NETS.

The transfer of a child is a team process with referring staff doing the immediate resuscitation and stabilisation. NETS continue to stabilise and may initiate further treatment, then transport the child to the receiving hospital. Early communication is essential as time, distance, vehicle and staff availability all play major roles in how soon NETS will arrive and transfer the patient.

Nurses work as a team member both within the service and with the doctor on retrieval. As the nurse is the continuous member of the team, much of the work on retrieval is the nurses' reponsibility and they provide support and guidance for new registrars. The diversity of ages and conditions provides a stimulating and challenging field to work in, thus nursing in NETS provides an exciting area of critical care nursing, which differs from all other intensive care environments.

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The NSW Air Ambulance: an option for patient transfer

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One of the options when transferring patients in New South Wales (NSW) is the NSW Air Ambulance. The NSW Air Ambulance is part of the NSW Ambulance service. The following article will provide on overview of the service provide by the NSW Air Ambulance. It will also briefly discuss some of the issues, both clinical and organisational that need to be considered when transferring patients by Air Ambulance. The role of the flight nurse will also be discussed, as it is integral to both the role and function of the Air Ambulance.

The NSW Air Ambulance was established in response to community needs highlighted in a survey in 1956-57. The first flight was to Canberra in March 1967 and since this date has been providing a service to NSW.[1] Originally the service started with one Beechcraft Queenair aircraft and now it operates four Beechcraft Super Kingair aircraft, which are pressurised. The service flies regularly to Victoria and Queensland (Brisbane) as well as the transfer of patients from all of NSW, Lord Howe Island and occasionally Adelaide. The number of patients transferred by the air ambulance has consistently increased[2](Table 1).

Coordination officers make the decision as to the mode of patient transport in consultation with the referring medical officer. This decision is based on a number of factors. The options available are road, helicopter or fixed wing. The factors considered when deciding on the mode of transport are the distance, weather conditions, availability of staff and chosen means of transport, urgency of case, clinical requirements (i.e. need for pressurised cabin), and the distance from the airport to the hospital.

The ambulance service and flight nurses utilise a process of triage to assess the priority of transfer, especially as the demands on the service are ever increasing. The system uses three categories (Table 2), and on most occasions the ambulance officers in the coordination room in consultation with the requesting physician make this decision. They will utilise the resources of the medical retrieval services and nursing staff at times to ensure that the appropriate priority is given.

This triage system however, is not based on only patient acuity; geographical factors, bed availability and the reason for transfer are considered. Many non-urgent patients can be very ill. A good example of this is the palliative care patient returning to the local hospital for care or the patient with unstable angina for transfer to Sydney for angiography. As with emergency departments, triage decisions can and do change with reevaluation of the patient.

The NSW Air Ambulance service charter is interhospital transfer; therefore, nurses were initially chosen to staff the fixed wing aircraft, as they were able to maintain the level of care of nursing received in the hospital. The prerequisite requirements of the flight nurse are a registered nurse with a minimum of five years experience, registered midwife, extensive critical care experience and it is an advantage to have experience working in an isolated area. These qualification requirements were based on the anticipated diverse patient groups that would be transferred and is demonstrated in Table 3.

Flight nurses alone do 94% of the entire patient transfers, only 6% of transfers have a doctor accompany the flight nurse for patient retrieval. Doctors become part of the team where the medical care required by the patient is outside the scope of practice of the registered nurse. In these situations the doctor and the flight nurse form the medical team. The only time another nurse is involved in the transfer is neonatal and paediatric retrievals when Newborn Emergency Transport Service (NETS) are called. In this situation a doctor and nurse from NETS are both taken and the flight nurse supports the team, and provides care for the mother of the neonate. If a team is not available for a paediatric retrieval, a flight nurse will do this transfer with a doctor.

At orientation, new staff participates in an education program that covers aviation physiology and safety. Both these are imperative for the safe care of the patient and staff in flight and on the ground. An understanding of alterations that occur at increased altitude to human physiology is essential when assessing every patient for flight.

The "Stresses of Flight" are: the decrease in the partial pressure of oxygen with increasing altitude predisposing the patient to hypoxia; the expansion of gas at increasing altitude, which can increase the pressure in any cavity containing air for example the gastrointestinal system; changes in barometric pressure; noise; vibration; gravitational forces which can cause significant changes to blood pressure; temperature changes; a decrease in the humidity of the air resulting in drying of airway secretions; turbulence; and third spacing.[3,4] These all impact clinically on the patient and have implications for patient care.

There are other stresses associated with flying but not as a direct result of the aircraft and these are known by the acronym of DEATH: drugs, exhaustion, alcohol, tobacco and hypoglycaemia. Altitude increases the negative effects of these factors. The flight nurse has to consider these factors as they impair perception, judgment, and motor skills.[3] An example of this is the effects of alcohol at 3,000 meters are two to three times greater than the effects at sea level which has implications for the trauma patient with a high blood alcohol level.[5] The patient who has been given sedation just prior to flight may require supplemental oxygen due to increased respiratory depression caused by the effects of increased altitude.

The flight nurse may contact the referring hospital to request treatment or interventions to be instigated pre-flight to reduce potential complications in the air. The decision to call the hospital is

Table 1 Patients flown by air ambulance

PATIENTS	1994/95	1995/96	1996/97	1997/98
Urgent	2267	2435	2550	2388
Routine	2971	2831	2771	3100
Total	5238	5266	5271	5488

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Table 2 – Triage Codes

Priority	Response time
1	Within 1hr
2	Within 6hrs
3	Within 24hrs

NSW Air Ambulance

dependent on the patient diagnosis and the information already available.

Communication skills are very important to ensure that all necessary information is obtained prior to flight to facilitate both maintenance of the level of care and the safe and appropriate transfer of the patient. Incomplete information or an unreported change to the patients condition can sometimes mean that the clinical condition is too unstable for nurse only transfer and a medical retrieval team has to be sent after the patient is assessed by the flight nurse at the airport. This can mean a critical time delay for patients thus we strive through a number of communication channels to minimize this happening.

Common considerations are sedation, analgesia, anti-emetics, intravenous access, intragastric tubes, sustenance for diabetics, and adequate fluid orders. Another frequent consideration is the patient that requires specific drugs or therapies (i.e. feeds for babies) to be administered during flight. These must be sent with the patient from the transferring hospital as the aircraft is limited in the drugs and equipment routinely carried. The confined working space in the aircraft and conditions such as turbulence make some procedures difficult to achieve in flight. This is why stablisation is very important before transferring a patient.

The initial phone call by flight nurse may reveal that the patient is beyond the scope of practice of a nurse alone, and referral of the patient on to the medical retrieval services for assessment will be necessary. This is done in conjunction with discussions with the referring doctor. If the patients condition deteriorates in flight whilst being transferred by a nurse alone, the medical consultant is the doctor at the referring hospital, and they are contacted for further medical orders. If they are unable to be contacted the receiving doctor or a retrieval doctor can provide advice.

Safety on the aircraft is paramount. There are serious implications of having a patient on board that could possibly become violent and/ or agitated inflight. Not only can the patient become a threat to the safety of himself or herself and the flight nurse but also the pilot and other patients. This patient group can be clinically diverse. Patients with a history of mental health problems, dementia, claustrophobia, or an abnormal biochemistry profile causing abnormal behavior all need to be assessed prior to flight. Hypoxia associated with flight can also precipitate abnormal behavior.[4] Chemical sedation may only provide part of the solution. These patients may require re evaluation to decide what means of transport is going to be both safe and appropriate.

The similarities to emergency practice do not end with triage; your day may hold an ever-altering array of patients and locations. The initial flight plan may begin with leaving Sydney with a premature neonate returning to Coffs Harbour or an elderly gentleman for palliative care to Taree. On assessment it is found that the palliative care patient has multiple resistant staphlococcus aureus and can not be transferred with the neonate. The flight leaves Sydney with the neonate and is to pick up a post laminectomy patient from Newcastle to be transferred to Taree.

The plan goes astray when an urgent medical retrieval needs to be done from Coffs Harbour, so a retrieval doctor and more equipment is picked up at Williamtown (Newcastle) instead of a patient. On arrival at Coffs Harbour the neonate is handed over to the midwife requested prior to leaving Sydney. The medical team is taken by road ambulance into the hospital to assist with stablisation and preparation of the patient for transfer.

Once stabilised the patient and the team is taken via ambulance to the aircraft and flown to Newcastle. A nurse from Newcastle meets the aircraft at the airport and continues to care for the patient with the doctor to John Hunter Hospital. If a nurse escort from John Hunter could not be arranged, the flight nurse would continue to escort the patient to the hospital. The other three patients on the flight plan that day have been reallocated. The shift was to finish at four pm, instead the aircraft is just landing in Williamtown (Newcastle).

Most patients are transferred via ambulance to the airport where the nurse takes over their care, highlighting the necessity for accurate and concise patient transfer documentation from the transferring hospital. Predominately the written transfer information is the only information we have to plan in flight patient care. It is imperative that vital information such as significant past history, allergies, presenting problem, any treatment required inflight, current vital signs and medication charts are complete and accompany the patient.

On occasions the flight nurse will need to go into the transferring hospital to collect the patient and/or continue with the patient to the receiving hospital. This occurs when nursing care is required to maintain the optimal level of care. Clinical examples of this are when a detailed history of an unstable patient may be required, or the patient is a spinal patient and it is preferable to stabilise the patient at the hospital prior to moving them. Another option that is sometimes requested is that a nurse escort from the referring or receiving hospital either accompanies the patient to the airport or meets the aircraft, for example the patient in preterm labor receiving intravenous salbutamol. Staffing levels at the hospital will determine whether this is possible.

At times the flight nurse will request a specific level of ambulance officer to care for an unstable patient. These patients may require more advanced drug protocols, thus a level four or five ambulance officer will transfer the patient into the receiving hospital. If they are not available the flight nurse will accompany the patient into the receiving hospital.

The air ambulance is a unique nursing environment to work in and in many ways isolated. It provides the nurse with daily clinical challenges and an opportunity for the use of all the diverse skills learnt over many years. The working environment requires the nurse to have a good understanding of the implications of aviation physiology and extensive clinical experience. Other essential criteria are good communication skills, the ability to prioritise care, a sense of humor and an ability to problem solve and improvise.

Table 3 – Categories of patients flown by Air Ambulance

Category of patient	Number of patients 1/7/97-30/6/98	Percentage
Cardiac	1266	22.61%
Medical	2009	35.88%
Neonatal	319	5.70%
Obstetric	379	6.77%
Respiratory	264	4.72%
Surgical	708	12.65%
Trauma	537	9.59%
Other	117	2.09%
Total	5599	

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