CIG Medishield are proud to assist in helping to achieve a reduction in the severity and number of spinal injuries.

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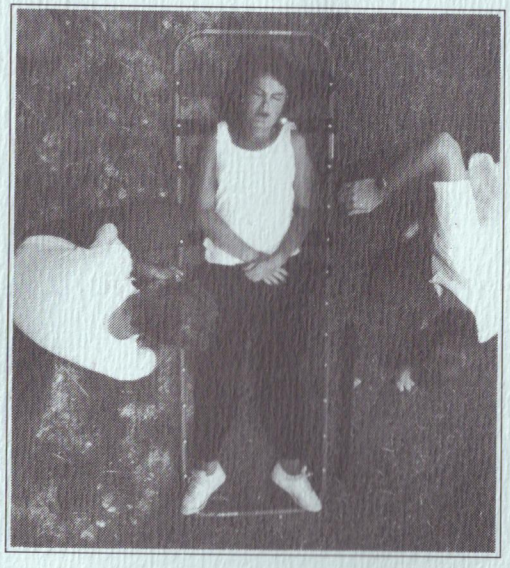


The Acute Management of Spinal Injuries

by
Dr. Adrian Cohen

SLSAA RESCUE HELICOPTER

with forwards by
A/Prof. Richard F Jones
and Dr. John Yeo

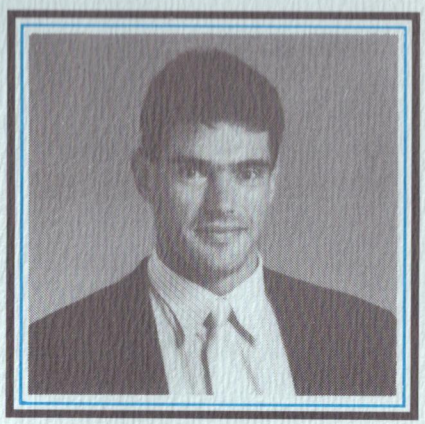
CIG Medishield

PROFILE: ADRIAN COHEN

Adrian Cohen is the Chief Medical Officer for the Surf Life Saving Association of Australia Helicopter Rescue Service in Sydney. He graduated with Honours from the University of NSW in 1983 and worked in Orthopaedic and Traumatic Surgery as well as Accident and Emergency Medicine at the Prince of Wales Hospital before joining the Helicopter Rescue Service in 1986.

In NSW each year over 50 acute spinal cord injuries are transported using the Helicopter Rescue Service, and a large experience and data base has been developed. Dr. Cohen is a regular lecturer on Spinal Injury to local and community groups, sporting bodies, national and international meetings and has published several papers in the field.

He is also a member of the Australasian Society for Emergency Medicine, Royal Australian Air Force Specialist Reserve, NSW Department of Health Medical Retrieval and Aeromedical Operations Sub-Committees, Aviation Medical Society of Australia and New Zealand, American Aeromedical Society and the International Society of Aeromedical Services, amongst others.



Dr. Adrian Cohen

DEDICATED TO:
Janine Shepherd - an outstanding example to the spinally injured.

WITH GRATEFUL ACKNOWLEDGMENT TO:

- Dr John Yeo
- Professor Richard Jones
- Dr John Stephen
- Dr Thomas Havas
- Dr Lawrence Kohan
- Sister Margaret Samuels
- Sister Elizabeth Higgins
- Staff of the Royal North Shore and Prince Henry Spinal Units
- The Medical Board and crew of The Sydney SLSA Helicopter Rescue Service

TABLE OF CONTENTS

SPINAL CORD INJURY CAN BE PREVENTED!

A simple enough statement, but what a world of difference it can make to a patient. Spinal Cord Injury (SCI) is not just para- or quadriplegia; it is loss of bowel and bladder control, a disordered autonomic nervous system, constant pressure area vigilance, psychological devastation, life in a wheelchair and a whole lot more.

And it can be prevented.

Primary Prevention is the ultimate goal; preventing motor vehicle and motor bike accidents, sporting injuries, industrial accidents etc. Here the key is education and perhaps even legislation eg. the requirement in N.S.W. for full-face motor cycle helmets.

Secondary Prevention involves action *after* a potential SCI, to prevent that injury progressing or causing new injury. This is what this booklet is all about. Toscano ("A study to identify risk factors in the aetiology and cause of traumatic spinal cord paralysis") analysed 2 years admissions to the Austin Hospital Spinal Unit and concluded that up to 25 percent of these occurred *after* the initial incident or accident. This lends weight to the concept that a great number of SCI's may well be preventable. The keys to prevention are:

(1) Resuscitation of the patient.

(2) Awareness of the possibility of SCI.

(3) Knowledge of early management.

(4) Immobilization of the unstable spine.

(5) Rapid, controlled transport to an appropriate facility for diagnosis and treatment.

It is my hope that the information contained in this booklet may aid in the prevention of SCI.

Dr. Adrian Cohen

FOREWARDS

A/Prof. Richard F. Jones

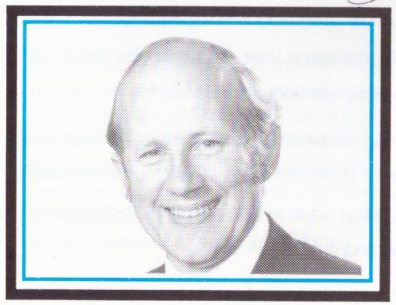
Around the turn of the century patients with spinal cord damage were transported to the Prince Henry Hospital by horse drawn ambulance. Most of those paraplegics and quadriplegics were the result of poliomyelitis and most survived, many with severe paralysis. Those unfortunate enough to have suffered from traumatic spinal cord injury usually succumbed within the first 12 months. I'm sure my colleagues of those days would be staggered to see the advances that have occurred in the management of spinal cord injuries.

However, these improvements in treatment have been overshadowed, to a large extent, by a new community attitude to the prevention of spinal cord injuries and, along with that awareness, has come an era of rapid transport of patients suspected of having sustained spinal cord damage.

Sir Ludwig Guttmann's philosophy of acute care in a comprehensive service is supported and enhanced by a retrieval service such as the Surf Life Saving Association of Australia Helicopter Rescue Service. Our community can be proud of this service and should encourage such facilities and support their maintenance.

It is my pleasure to endorse the approach outlined succinctly in this text and to commend it to those professionals who will be involved in the early care of suspected spinal casualties. We have welcomed the SLSAA Helicopter Rescue Service to The Prince Henry Hospital spinal team.

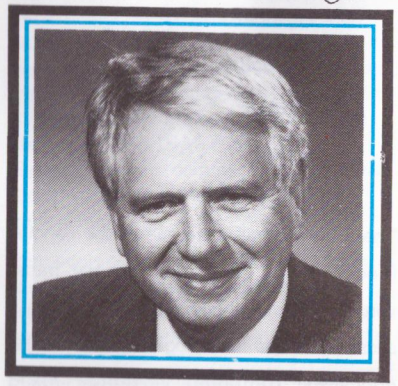
A/PROF Richard F. Jones.
Director
SPINAL INJURIES UNIT
Prince Henry Hospital.



Dr. John Yeo

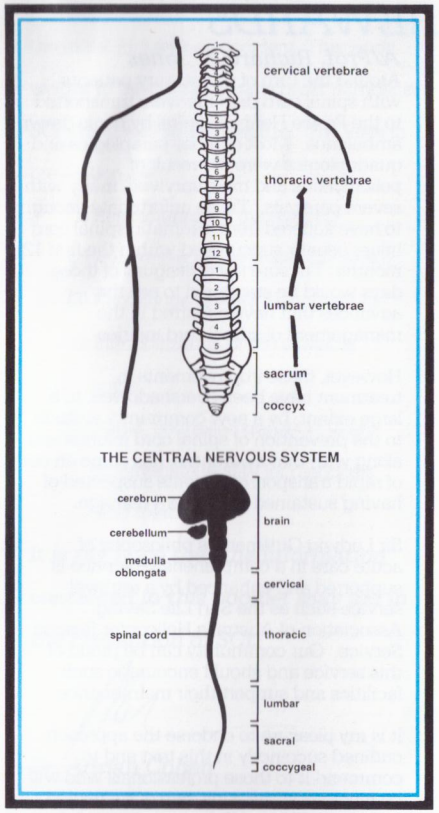
I have read the proposed protocol for the appropriate retrieval and transportation of the suspected spinal cord injured patient. I agree with the principles and details contained in the presentation and fully support the distribution of this protocol to health care providers in this State

John D Yeo
Director
SPINAL INJURIES UNIT
Royal North Shore Hospital



A. INTRODUCTION

1 Anatomy and Physiology of the vertebral column and spinal cord



The spine is central to the skeletal system supporting the head and enclosing the spinal cord. It consists of 33 vertebrae which are classified into five regions:

:cervical

:thoracic

:lumbar

:sacral

:coccygeal

There are 7 small vertebrae in the cervical (neck) region, 12 thoracic (upper back) vertebrae, 5 lumbar (lower back) vertebrae, 5 sacral vertebrae fused together and 4 small coccygeal (tailbone) vertebrae fused together.

Running down the centre of the spine, or vertebral column, is the **spinal cord**. No thicker than your finger, the spinal cord is protected by the vertebrae and the surrounding muscle and ligaments.

The cord, which is extremely delicate and vital to the total functioning of the body, is made up of millions of nerves which are the **communication link** between the brain and all other body parts. This two way cable system picks up the incoming messages from the arms, skin, feet, etc. and transmits them to the brain. At the same time the brain also sends out messages which are transmitted to the different muscle and body functions.

The cervical nerves are responsible for movement and sensation in the upper limbs, neck and upper chest. The thoracic nerves are responsible for movement and sensation in the trunk and abdominal region. Nerves in the lumbar and sacral areas are responsible for movement and sensation in the lower limbs and bladder, bowel and sexual functions.

Damaged nerves may survive and function, but once destroyed will never recover or be replaced.

2 Recognition of spinal injury

The types of trauma most likely to result in spinal fracture and neurologic deficit are: automobile, motorcycle, ATV (all-terrain vehicles) and snowmobile accidents, diving injuries, cave-ins, all codes of football and falls from heights. With a head injury or in any unconscious patient, assume that there may be a spinal injury.

All head injuries should be considered spinal injuries until proven otherwise.

3 When to transport

All patients with recognized spinal injury are candidates for transport to a Spinal Unit. Transport should take place as soon as spinal injury is recognized and immediate life - threatening problems, such as airway compromise and haemorrhage have been stabilized. Definitive care for associated injuries should, in most instances, be deferred until after transport to the Spinal Unit.

B. STABILIZING AND PREPARING THE PATIENT FOR TRANSPORT

1 Resuscitation

Immediately following an acute traumatic spinal cord injury, hypotension and hypoventilation may threaten life and/or increase the extent of neurological impairment. Therefore, cardiorespiratory resuscitation and stabilization of all other life-threatening injuries are the first steps in the treatment of acute spinal cord injured patients. Resuscitation techniques must at times be modified to ensure that any spinal fractures remain as stable as possible, so that further neurological damage does not occur. The aim is to transport the patient in the supine position.

2 Respiratory Insufficiency

(a) Establish airway

(with cervical spine control)

Injuries of the cervical spine are commonly associated with airway obstruction and hypoventilation. If the patient is unconscious, the tongue may passively fall backward occluding the oropharynx. Airway patency can be restored by either the modified jaw thrust manoeuver or by pulling the mandible forward (without inadvertently extending the neck) and then inserting an oropharyngeal airway over the tongue, whilst an assistant maintains the head in the NEUTRAL POSITION. Hypoventilation is common in patients with thoracic injuries and loss of respiratory musculature.

Ventilatory assistance may be required in these patients, usually with tracheal intubation. Measuring and recording the patient's Vital Capacity is very helpful.

A semi-rigid cervical collar such as the "Stifneck" collar should be applied as soon as cervical injury is suspected.

Steps in intubation (oral) are:

(i) Pre-oxygenation: 100% 02 via bag and mask

(ii) Cricoid Pressure: during pre-oxygenation and until intubation is complete (to prevent regurgitation and gastric insufflation).

(iii) Manual Axial Support (NOT TRACTION) by an assistant holding the head in the NEUTRAL POSITION throughout.

(iv) Oro-tracheal intubation in the usual manner.

(v) Blind Nasal Intubation may be performed by a suitably experienced anaesthetist.

(vi) A surgical airway (cricothyroidotomy or tracheotomy)is an emergency alternative when intubation is not possible.

NB. A retropharyngeal haematoma associated with a major injury of the upper cervical spine may also cause upper airway obstruction and necessitate intubation or creation of a surgical airway.

(b) Oxygen Therapy

Determination of arterial blood gases via oximetry or invasive means is an essential part of the initial management of cervical and thoracic spinal cord injuries. Because of local oedema and haemorrhage, spinal cord oxygen tension may quickly fall below normal tissue requirements even without systemic hypoxaemia.

Systemic hypoxaemia may increase the severity of a spinal cord injury and attempts should be made to maintain arterial oxygen tension at or above 80 mmHg.

Oxygen should be delivered by a high concentration mask (50-60% unless contraindiated by chronic respiratory illness) using 100% oxygen at high flows (10-12 litres per minute). In the absence of high concentration masks or a non-rebreathing mask, a Hudson mask will suffice. If oxygen supplementation by face mask is inadequate, careful intubation and ventilatory assistance is indicated.

The use of Hyperbaric Oxygen Therapy is an additional treatment modality aimed at preventing hypoxia at the tissue level, and should ideally be commenced WITHOUT DELAY (preferably within a few hours).

(c) Ventilatory assistance

The most reliable sign of impending ventilatory decompensation is a respiratory rate greater than 35 per minute. Ventilatory assistance should be considered before the patient's respiratory rate gets this rapid. Altered consciousness, apparent drug or alcohol intoxication, systemic hypoxaemia or hypercarbia (CO_2 over 40mmHg) are also indications for assisted ventilation. Endotracheal intubation is recommended for any patient requiring ventilatory assistance.

(d) Chest x-ray

Radiographic evaluation of the chest is essential prior to transport of any patient with cervical or thoracic spinal cord injury, because of the frequency of associated chest injuries, particularly pneumothorax. If a pneumothorax is present, a chest tube must be inserted before transport. A Heimlich valve is *mandatory*.

3 Circulatory Insufficiency

(a) Differentiate Hypovolaemic from Neurogenic Shock

In cervical and thoracic spinal cord injuries, Neurogenic shock with *bradycardia* and *hypotension* are common. In Neurogenic Shock, unlike Hypovolaemic Shock, the pulse rate is slow and of good amplitude and the skin is usually *warm and dry* except if the patient has been exposed to a cold environment (see 5.) Tachycardia and clammy skin are seen in hypovolaemia.

Neurogenic and Hypovolaemic shock may coexist.

When this happens, Neurogenic shock exacerbates the effects of Hypovolaemic shock by disabling the vasoconstrictive reflexes that ordinarily preserve blood flow to vital organs.

(b) Intravenous lifelines

Two intravenous lines, preferably 14 or 16 gauge, should be established for administration of resuscitation fluids and medications.

The maintenance of tissue perfusion cannot be over-emphasized. Spinal cord ischaemia may be due to hypotension (either from spinal shock or hypovolaemia) and can cause increased cord damage and extend the neurological deficit.

In the absence of overt Hypovolaemic shock, Hartmann's solution should be infused at a rate sufficient to maintain a systolic blood pressure of above 80mm Hg, generally 50-100 ml per hour. Pressor agents are *rarely* necessary and should be administered only if the central venous pressure indicates satisfactory

intravascular volume. Neurogenic Shock with associated Hypovolaemic Shock should be treated with Normal saline or Hartmann's solution in order to increase the intravascular volume and blood pressure. Intractable hypotension should raise the possibility of concealed internal haemorrhage. Sinus bradycardia down to 50 associated with cervical spine cord injury *does not* require specific therapy. With rates below 50, nodal or ventricular "escape" rhythms emerge that can be corrected with Atropine (0.5-1.0mg) administered as often as necessary up to 2.0mg per hour.

NB. Normal quadraplegic BP range 80/40 - 100/60

DO NOT FLUID OVERLOAD: Cord oedema and reduced perfusion will result.

4 Spinal Splinting

The key to proper management of spinal trauma is to recognize that an unstable spine may exist. Patients who arrive in the emergency department with the neck already immobilized in the supine position should not be removed from the spinal splint until the extent of the injury is determined. Inadvertent movements of the neck must be prevented during resuscitation. The preferred means of rapidly and safely immobilizing the neck from flexion and extension is to apply a semi-rigid cervical collar, such as "The Stifneck". Lateral cervical immobilization also needs to be maintained. This can be accomplished using blanket rolls, a blanket halo, Russell Extrication Device (R.E.D) or other types of immobilization boards.

5 Impaired temperature regulation

The temperature of patients with cervical spinal cord injuries tends toward that of their immediate environment (Poikilothermia). Body temperature should be determined regularly (orally should suffice), and in most acute cases the patient should be kept covered and warm. "Space blankets" can be of great value in these instances.

6 Internal injuries

Loss of sensation over the thorax, abdomen or limbs is often associated with altered sensation from abdominal viscera or skeletal structures. Thus, injuries to all but the most caudal segments of the spinal cord may abolish the spontaneous pain, tenderness to palpation, local guarding, or generalized rigidity which are often present with other intraabdominal injuries. Spinal cord injury alone can also produce the auscultatory and radiographic signs of ileus, within 30 mins - 48 hours of injury. Patients should be transported supine with a Nasogastric Tube on continuous drainage (with suction if required).

Hypotension combined with tachycardia is seldom, if ever, attributable solely to spinal cord injury.

In the absence of other overt sources of haemorrhage, investigation of potential abdominal sources of haemorrhage by diagnostic peritoneal lavage or CT should be undertaken under these circumstances, as well as a secondary survey of other systems for missed sources.

C. NEUROLOGICAL EVALUATION

The physician that first sees the patient should document the extent of the initial neurological deficit and determine the presence of any associated injury to the vertebral column

1 Diagnosis of spinal cord injury

Signs and symptoms of spinal cord injury are usually readily apparent in the alert patient, but can be obscured by altered consciousness. The following clues should alert the physician to the

possibility of a spinal cord injury in an unconscious patient.

(a) A cervical spinal cord injury should be suspected if an unconscious patient grimaces, vocalizes, or open his eyes in response to pinching the border of his trapezius muscle but does not move his limbs. Similarly, a patient who moves both arms but neither legs in response to noxious local stimuli may have a spinal cord injury below the cervical level. Corroborative findings often include hypo- or areflexia and flaccidity of the paralyzed limbs, a flaccid anal sphincter, or priapism.

(b) "Paradoxical respiration"
In this condition, the thoracic cage, although stable, passively collapses with inspiration (as the diaphragm contracts) and expands with expiration (as the diaphragm relaxes) in a reversal of the normal cycle of thoracic ventilatory movements. This pattern of breathing should be looked for carefully and differentiated from bilateral flail chest, in which there will be *instability* of the chest wall.

(c) Hemiparesis *opposite* pinprick hemianaesthesia suggests cord injury. Both head and spinal injuries can cause hemiplegia, but only spinal injuries routinely produce *contralateral* hemimotor and hemisensory deficits. (Brown-Sequard Syndrome).

(d) In a cervical injury where central fibres only are damaged, the *Central Cord Syndrome* results (upper limbs paralysed, lower limbs less/not affected).

Cord Segment (Root or Myotome)	*Movement*
C5	Abduction at the shoulder; flexion at the elbow
C6	Strong flexion at the elbow; extension of the wrist
C7	Extension of the elbow; extension of the fingers
C8	Grip with fingers
T1	Abduction or spreading of fingers
L2 L3	Flexion of hip; abduction at the hip
L4	Extension of the knee
L5	Extension of the ankle and great toe
S1	Flexion of the ankle and toes

2. Documentation of the extent of the neurological deficit

Management of spinal cord injured patients depends to a large extent upon whether the patient has a *Complete* or *Incomplete* physiological transsection of the spinal cord and, if incomplete, whether the neurological deficit is *progressing* or *resolving* with the passage of time. The first step in determining whether the patient is deteriorating, improving, or stable is to question him/her (and ambulance personnel or members of the rescue squad) about limb movement and sensation *immediately* after the injury.

(a) *Complete v Incomplete*
Complete spinal cord injury is characterized by *no* voluntary movement and *no* sensation of any type below the level of spinal cord trauma. With *any sparing at all* of motor or sensory function below the level of the spinal cord injury (Incomplete lesion) the prognosis of future return of function is much more favourable.

The level of spinal cord injury is designated at the last (or highest) fully intact myotome and dermatome.

(b) *Motor examination*
Examining physicians should identify the highest spinal cord motor segment associated with *normal* voluntary motor function and then determine whether *any* voluntary motor function below this level has been spared. The movements commonly used to test the integrity of spinal cord myotomes and roots are listed below left:

(c) *Sensory examination*
The physician should determine the upper level of sensory deficits as well as any areas of intact or spared sensation below this level. Areas commonly tested include the clavicle (C4), lateral aspect of the arm (C5), forearm and thumb (C6), middle finger (C7), little finger (C8), medial aspect of the arm (T2).

The nipples approximate the T4 level *(but remember that the cervical plexus can supply this area: confirm with motor examination)* and the umbilicus, T10.

The inguinal ligament or groin crease corresponds to L1, the knee to L3, the medial aspect of the dorsum of the foot to L5 and the lateral aspects to S1.

The perineum and perianal areas are innervated by S4 and S5. Anorectal sensation can be evaluated as part of the digital rectal examination. It is of particular importance to determine any areas of intact or spared sensation on the buttocks, perineum, or genitalia as this is often the only sign that a spinal cord injury is less than complete.

(d) *Reflex examination*
Reflexes are usually absent at first. Reflex activity returns from hours to weeks after injury. Reflex perianal muscle contraction usually returns before peripheral deep tendon reflexes. Anal tone is tested by digital rectal examination, anal reflex by stimulating the perianal skin, perineal reflexes by pinching the glans or base of the penis (bulbocavernosus reflex), or by tugging on the urethral catheter. When reflexes are found to be intact, test for preservation of voluntary motor and sensory activity in the same sacral spinal cord segments.

(e) Sphincter examination
Digital rectal examination is an important part of determining the extent of spinal cord injury. If the patient can feel the palpating finger , or if he can voluntarily contract his levator mucles around it, then he has an Incomplete lesion.

D. RADIOGRAPHIC EXAMINATION

Transport should not be delayed unduly awaiting x-rays.

In the initial evaluation of patients with signs of spinal cord injury, a detailed radiographic examination is usually much less important than a detailed neurologic examination. (The converse may be true when osseous or ligamentous spinal injury is suspected in the absence of signs of injury to the nervous system.)
Basic radiographic studies of the spine will include:

1 Cervical spine

The full cervical spine series consist of a cross-table lateral, anterior-posterior and bilateral oblique views , and an open-mouth odontoid view.

(a) In the *cross-table lateral* view , all seven cervical vertibrae MUST be visualised. This may be facilitated by gently putting traction on the wrists to lower the shoulders as much as possible, without causing or increasing pain or producing neurological deterioration (in a conscious patient). If this is still not possible, a "Swimmer's" view, taken through the axilla with the arm abducted may help visualize C7-T1, or a CT scan should be obtained.

(b) The *antero-posterior* view helps evaluate lateral and rotatory dislocations.

(c) The *odontoid* view, which can be obtained only in a conscious patient, visualizes the odontoid process and demonstrates the lateral atlantoaxial (C1-C2) articulations.

(d) *Bilateral oblique* views demonstrate facet disarticulation and locking.

2 Thoracic spine

Lateral and antero-posterior -- All 12 vertabrae should be visualized.

3 Lumbo-sacral spine

Lateral and antero-posterior -- All five lumbar vertebrae and the sacrum should be visualized.

4 Chest

A supine antero-posterior view of the chest is important to rule out associated chest injuries. (The standard PA view obtained with the patient sitting should not be attempted.) Inspiratory and Expiratory views should be taken if pneumothorax is suspected.

Major spinal cord injuries may be present even though there is not radiographic evidence of damage to the vertebral column. Radiographs do not show the extent of bone displacement that may have existed at the moment of injury as the result of ligamentous instability and even CT scan may not visualise the injury.

E. TREATMENT

1 Reduction of vertebral malalignment

A primary goal of early therapy is to decompress the spinal cord by restoring the normal sagittal diameter of the spinal canal. Reduction of a partial or complete dislocation (subluxation) may also reduce pain. Ideally, closed reduction of a cervical dislocation can be accomplished promptly by skeletal traction in experienced hands. Only physicians familiar with techniques of applying skeletal traction should consider carrying this out prior to transport. It may not be desirable or necesary when prompt, early transport to a Spinal Unit is available. The cervical spine should be kept immobilized in a semi-rigid collar such as the "Stifneck" until the patient arrives at the definitive treatment centre where reduction can be accomplished.

Post - traction radiographs must be taken.

2 Steroids

Steroids should not be administered in the hope that they will ameliorate spinal cord injury. Glucocorticosteriods in the treatment of acute spinal cord and/or head injuries have now been shown to have no therapeutic effect on patient outcome, and have undesirable side effects. These findings are based on recent and well documented studies.

3 Visceral paralysis

(a) *Bladder catheterization*
Urinary retention promotes ureterovesical reflux and overdistention of the bladder. Intermittent catheterization is not the urinary drainage method of choice during the early post - injury period, as continuous monitoring of urine output is essential in the initial evaluation of multiple injured patients and is always necessary during transportation. A normal Foley catheter should be inserted under meticulously sterile conditions.

Prior to the introduction of any type of urinary catheter, a rectal examination for occult blood and prostate displacement should be performed on the multiply injured male patient to rule out membranous urethral injury that could be aggrevated by catheter placement.

(b) *Gastric drainage:*
Ileus is common following injuries of the cervical or upper thoracic spinal cord. In order to prevent aspiration of gastric contents and/or gastric dilatation that interferes with breathing, gastric decompression and drainage with a nasogastric tube is recommended. A decompressed upper bowel will also prevent venous back-pressure from further jeopardizing spinal cord perfusion. *It is essential before transport*. Nasogastric tube (NGT) insertion is contraindicated only in patients with severe facial injuries and/or basilar skull fractures, in which case, orogastric insertion is recommended.

4 Other medications

Anti-emetic medication may be given immediately prior to air transport for nausea control. Small amounts of narcotic analgesic medications can be given intravenously for pain management, bearing in mind monitoring of consciousness. Pupillary reaction should be present even when constriction is present, and dilation will still occur with raised intracranial pressure. Medications administered should be documented in the transport record.

5 Hyperbaric Oxygen Therapy

For some cases, the delivery of oxygen under pressure in a Hyperbaric chamber may further alleviate tissue hypoxia. Most Spinal Units now have access to such a facility on-site, and it should be instituted as *soon as possible after the injury*, preferably within 8 hours.

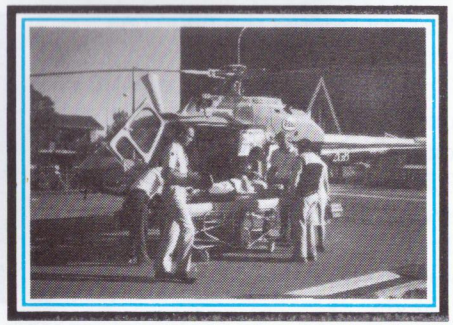
6 Preventing pressure sores

Attention should be paid to pressure relief for the skin over bony prominences, particularly the sacrum and heels. The patient may be lifted briefly, by at least 4 persons, plus one supporting the neck, or a device such as the Jordan Frame, every two hours. A sheepskin or foam pad, or 'Sof-care' mattress (wheelchair size only), can be inserted under the sacrum by carefully lifting the pelvis. Foam or sheepskin heel padding should be used routinely.

Spinal boards should be used for the shortest practicable periods of time, and the slats of the Jordan Frame removed between uses to prevent pressure areas. The neck should be supported for all lifts until cervical injury has been ruled out. Keys and money should be removed from pockets, and ideally all clothes should be removed - cut off if necessary.

F. TRANSPORTING THE "SPINAL PATIENT"

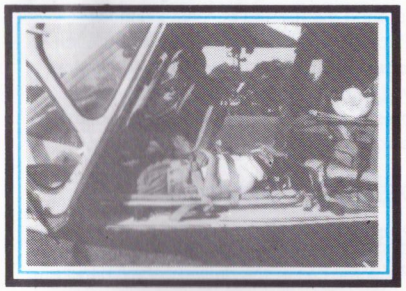
Wherever possible, spinal injured patients should go direct to Spinal Units from the field, as time may be critical. Likewise, a speedy dispatch from the peri¸heral hospital is an essential link in the treatment chain.
For interhospital transfers further than 10km and within 200km of the Spinal Unit, Helicopter Transfer is indicated.
The benefits are:-
(1) High speed 150km/hr direct door-to-door delivery, without "traffic" nor the need to disrupt normal traffic flow with Ambulances travelling at slow speeds.
(2) Minimizing the number of times the patient is handled, lifted or moved.
(3) A doctor trained in Spinal Cord Injury management can accompany each patient. This is particularly important when the SCI is not isolated but part of a multiple-injury scenario.
(4) Low vibration in the helicopter (unlike road vehicles and even fixed wing aircraft) minimizes further tissue trauma.
(5) Time, time, time .... reperfusing the cord is critical.

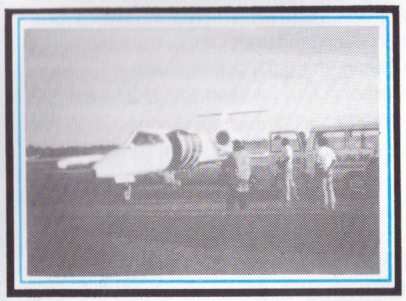


G. FINAL TRANSPORT PREPARATION

Before transport the following important matters should be confirmed:

1. The airway is clear and "guaranteed"
2. Ventilation (either spontaneous or assisted) is satisfactory. Supplemental oxygen is being administered. Endotracheal and other tubes are securely attached to the patient.
3. Neurologic assessment is completed and documented.
4. Chest x-ray is completed, examined and preferably reported by a radiologist.
5. Blood pressure is stable and IV lifelines are established.
6. The stomach has been decompressed with an NGT.
7. Urinary bladder drainage has been established.
8. The entire spine has been immobilized securely for transport in devices such as the R.E.D (Russell Extrication Device) and Stifneck collar.
9. Pressure on the skin over bony prominences has been relieved.
10. Spinal Unit has accepted patient and Retrieval Team notified.





H. CONTACT PHONE NUMBERS

HOSPITALS (ASK FOR SPINAL INJURIES REGISTRAR)

New South Wales
Royal North Shore Hospital
Princes Highway
St. Leonards NSW 2065
(02) 438 7111
Prince Henry Hospital
Anzac Parade
Little Bay NSW 2036
(02) 661 0111

Victoria & Tasmania
Austin Hospital
Studley Road
Heidelberg VIC 3084
(03) 450 5111

Queensland
Princess Alexandra Hospital
Ipswich Road
Woolloongabba QLD 4102
(07) 240 2111

South Australia & Northern territory
Royal Adelaide Hospital
North Terrace
Adelaide SA 5000
(08) 223 0230

Western Australia
Shenton Park Hospital
Selby Street
Shenton Park WA 6008
(09) 382 7171

SLSA HELICOPTER RESCUE SERVICES

Sydney
Cottage 5
Prince Henry Hospital
Little Bay NSW 2035
(02) 311 3499
(02) 311 3122

Hunter Region Helicopter Rescue Service
PO Box 20
Broadmeadow NSW 2292
(049) 52 4144
(049) 52 4019

Northern Region Helicopter Rescue Service
PO Box 822
Lismore NSW 2480
(066) 21 9301

Gold Coast Helicopter Rescue Service
PO Box 118
Nerang QLD 4211
(075) 58 3400

Sunshine Coast Helicopter Rescue Service
Maroocydore Airport
Mail Service 1102
Nambour QLD 4560
(071) 48 7711

Perth Helicopter Rescue Service
PO Box 54
Freemantle WA 6160
(09) 430 4126

National Office
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