

THE INITIAL MANAGEMENT OF ADULTS WITH SPINAL CORD INJURIES

Advice for Major Trauma Networks

Approved by the CRG for Spinal Cord Injury

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THE INITIAL MANAGEMENT OF PATIENTS WITH SPINAL CORD INJURIES

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Background

Few disabilities produce the devastation of a spinal cord injury. The effects extend beyond the individual patient and include the impact on the immediate family and society in general. The financial cost is considerable. It is estimated that the annual incidence of traumatic spinal cord injury is 15 per million in the UK. Approximately half of these are cervical injuries, and the majority now have incomplete injuries, with significant potential for neurological improvement.

People who sustain a spinal cord injury require specialised care and rehabilitation. The initial management of a patient with a suspected spinal cord injury can have major implications for the patient's long-term management^{1,2}. Patients with spinal cord injuries (SCI) are extremely vulnerable to avoidable complications, particularly pressure ulcers, urinary tract complications, autonomic problems and joint stiffness / contractures. The avoidance of these complications requires a high level of input from a dedicated multi-disciplinary team.

Introduction

The document “**Management of People with Spinal Cord Injury - NHS Clinical Advisory Groups Report August 2011**” indicates that all Major Trauma Networks should have a defined link to a named specialised SCI Centre³. This document also mandates the development of joint protocols for management of acute spinal cord injury between the Major Trauma Network and the SCI Centre.

The purpose of this document is to provide a check-list of topics for adults with SCI, where protocols are required and suggested wording which

- Is consistent with **Management of People with Spinal Cord Injury - NHS Clinical Advisory Groups Report August 2011**, and with the **National SCI standards and Pathways and Spinal injury: assessment and initial management, NICE guideline NG41 February 2016**.
- Can form the basis of locally agreed bespoke protocols

The following is a check-list of the topics where Management of People with Spinal Cord Injury - NHS Clinical Advisory Groups Report August 2011 indicates clinical protocols should be agreed. (Clickable links)

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Location of initial care and protocols for transfer

This is illustrated in the three algorithms overleaf.

Algorithm One: Adult Patient with SCI taken to Trauma Unit

Algorithm Two: Adult Patient with SCI taken to taken to Major Trauma Centre

Algorithm Three: Adult Patient with SCI taken to Major Trauma Centre with Low Velocity Cervical Injury

Local protocols will vary depending on the facilities and services available both in the linked SCI Centre and in the MTC with its network of Trauma Units. They should prescribe the time frame for referral to the SCI Centre (The default is 4 hours in the absence of local protocols). Registration of patient on the SCI referral Database is required within 4 hours. Where the mechanism of injury rules out the possibility of other major trauma local protocols may mandate the transfer of a patient with isolated SCI from the receiving Emergency Department directly to the SCI Centre if fit for transfer. In some SCI Centres specialised spinal surgery may not be available. Local protocols will recognise these variations and mandate transfer to the MTC. Some patients will not be fit for transfer or the Specialised SCI Centre may not be able immediately to accept referral. Under these circumstances admission to the receiving hospital ward or ITU may be required. If this is the case then the closest collaboration on treatment strategy and day to day management should be part of a formalised network which should be subject to the normal governance arrangements. All SCI Centres provide 24/7 advice and must also provide face to face outreach advice and assistance.

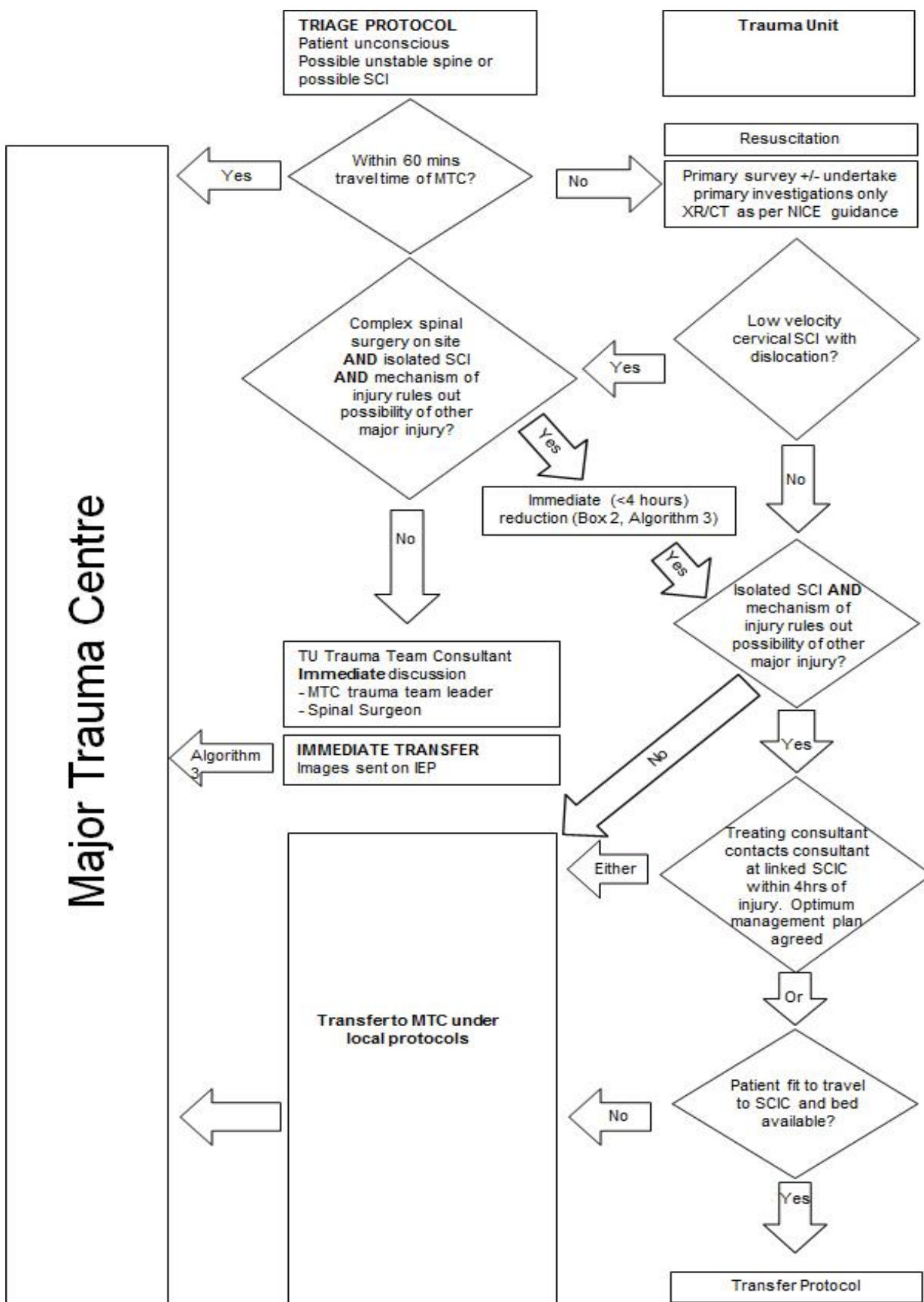
It is the intention of this document to assist health care professionals in Emergency and in Orthopaedic and Neurosurgical departments in the initial assessment and management of adult patients prior to transfer to the Spinal Cord Injury Centre.

Algorithm One: Adult Patient with SCI taken to Trauma Unit

Pro-forma Algorithm for Joint Major Trauma Network and SCI Centre Protocols

Algorithm One: Adult Patient with SCI taken to Trauma Unit

Name of Trauma Network..... Name of Spinal Cord Injury Centre.....
 Date agreed..... Review Date.....



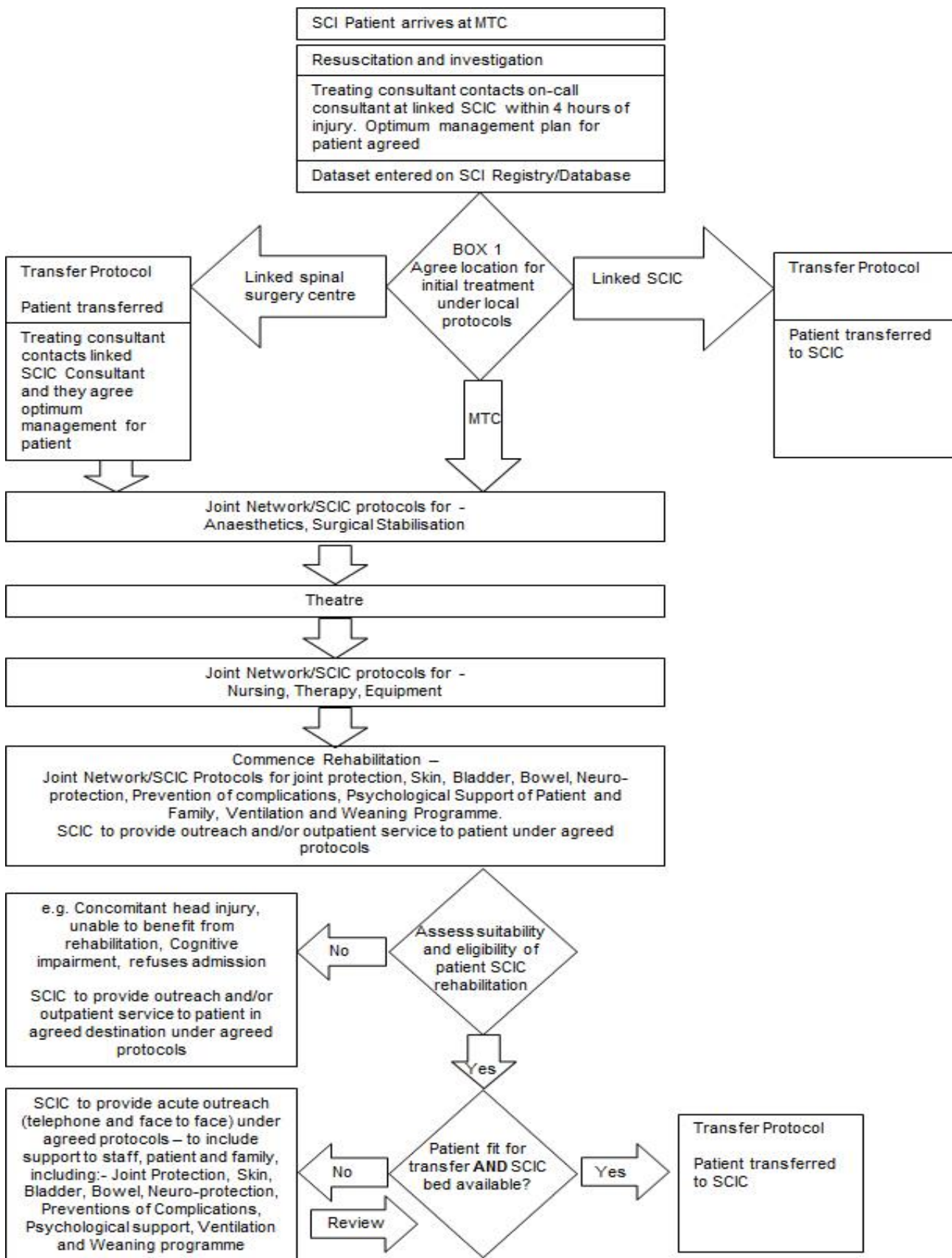
Algorithm Two: Adult Patient with SCI taken to taken to Major Trauma Centre

Pro-forma Algorithm for Joint Major Trauma Network and SCI Centre Protocols

Algorithm Two: Adult Patient with SCI taken to taken to Major Trauma Centre

Name of Trauma Network..... Name of Spinal Cord Injury Centre.....

Date agreed..... Review Date.....

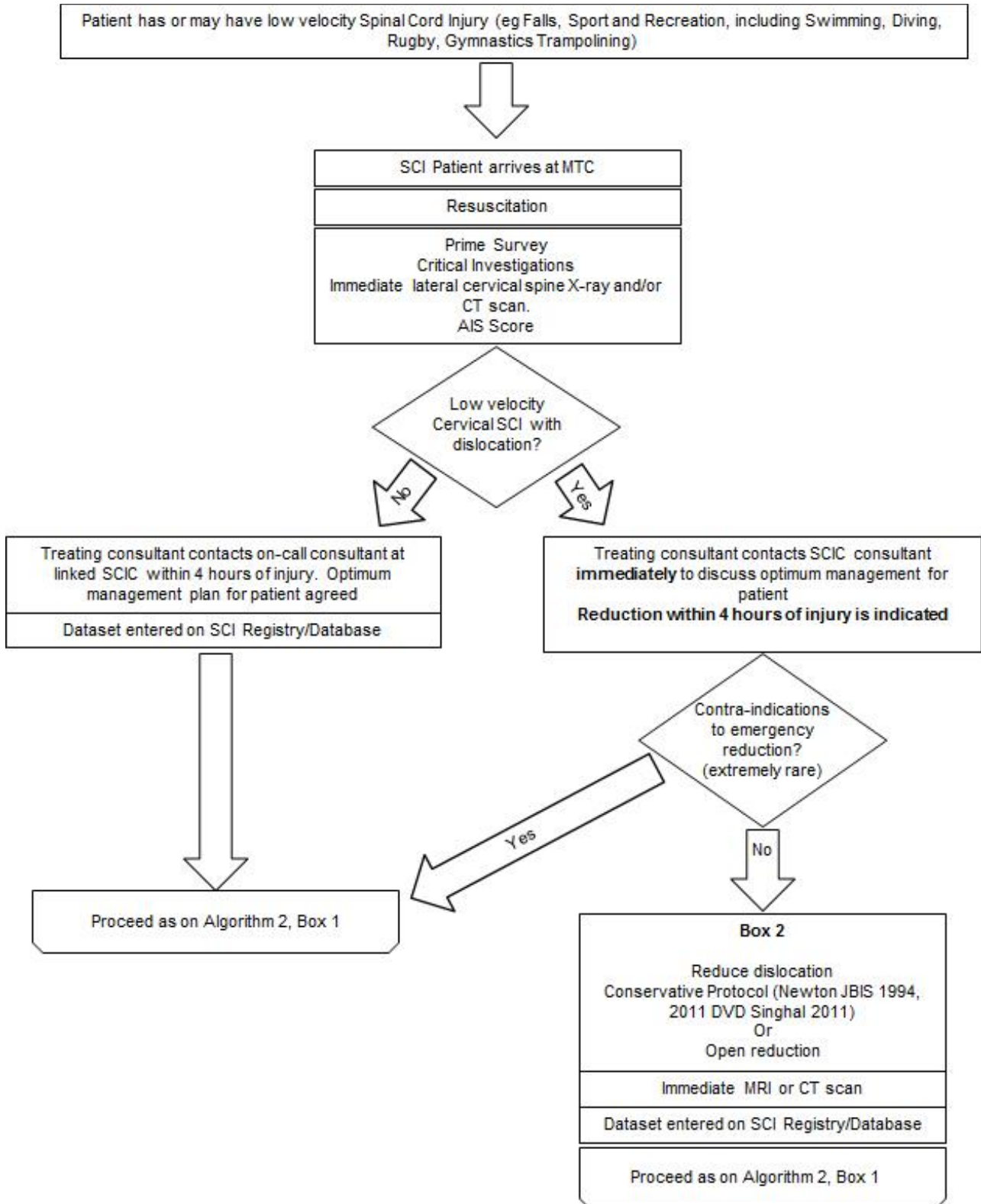


Algorithm Three: Adult Patient with SCI taken to Major Trauma Centre with Low Velocity Cervical Injury

Pro-forma Algorithm for Joint Major Trauma Network and SCI Centre Protocols

Algorithm Three: Adult Patient with SCI taken to Major Trauma Centre with Low Velocity Cervical Injury

Name of Trauma Network..... Name of Spinal Cord Injury Centre.....
 Date agreed..... Review Date.....



Advice and Liaison

Advice on the medical, surgical, nursing and therapy aspects of patients with spinal cord injuries may be obtained at any time from the linked Specialised Spinal Cord Injury Centre. All Specialised Centres have an outreach service including Spinal Nurse Specialists or other liaison workers who are available to visit any hospital in the Region and give advice on the management of any patient with spinal cord deficit, usually within 5 days of referral.

For people in a major trauma centre who have a spinal cord injury, the trauma team leader should immediately contact the specialist neurosurgical or spinal surgeon on call.

For people who have a spinal cord injury, the specialist neurosurgical or spinal surgeon at the major trauma centre or trauma unit should contact the linked spinal cord injury centre consultant within 4 hours of diagnosis and referrals made online at www.spinalreferrals.nhs.uk to establish a partnership of care and a named link for communication.

NHS Spinal Cord Injury Centres in England:

Specialised health care services for the management of spinal cord injury are provided in eight specialist centres in England, offering support for patients sustaining spinal cord injury through the initial period of treatment and rehabilitation and on-going lifelong support.

Duke of Cornwall Spinal Treatment Centre, Salisbury District Hospital, Odstock, Salisbury
Tel: 01722 336262

Golden Jubilee Regional Spinal Cord Injuries Centre, James Cook University Hospital, Middlesbrough.
Tel: 01642 282470

London Spinal Cord Injuries Centre, Royal National Orthopaedic Hospital NHS Trust, Stanmore
Tel: 020 8954 2300

Midlands Centre for Spinal Injuries, Robert Jones & Agnes Hunt Orthopaedic Hospital, Oswestry
Tel: 01691 404655

National Spinal Injuries Centre, Stoke Mandeville Hospital, Aylesbury
Tel: 01296 315000

Princess Royal Spinal Injuries Centre, Northern General Hospital, Sheffield
Tel: 0114 2715644

North West Regional Spinal Injuries Centre, Southport & Formby Hospital, Southport
Tel: 01704 547471

Yorkshire Regional Spinal Injuries Centre, Pinderfields General Hospital, Wakefield
Tel: 0844 8118110

The Spinal Injuries Association (SIA)

The SIA has published two books dealing with the essential features of nursing a patient with acute traumatic spinal injury: These are available from the SIA at the web site below.

Managing Spinal Cord Injury: The First 48 hours
Managing Spinal Cord Injury - Continuing Care

The SIA also have a peer support service and can arrange for someone to visit patients within major trauma centres. More information available at <http://www.spinal.co.uk/>

There is also a Web based resource with guidance and standards, linked to the referral system. More information can be found at <http://www.spinalcordinjury.nhs.uk/>

Training, education, audit and governance

All MTCs and Trauma Units must have agreed written protocols for audit and governance of the referral and management pathway. These should cover both process and outcomes.

The training needs of nursing, therapy and medical staff in the acute centres must be considered.

Pathway for children with SCI

| Local protocols should be agreed for the management of children with SCI.
See <http://www.spinalcordinjury.nhs.uk/> for national standards.

Patient Assessment

Think Spinal Injury

Following an injury the potential for a spinal cord injury to exist must be considered. People may present with full movement and sensation of all four limbs; however, they may have a vertebral fracture and, if handled incorrectly, the spinal cord may be damaged and the results could be devastating.

Of 569 patients admitted to a Spinal Cord Injuries Centre, 52 injuries (9%) were missed at presentation and of these 26 had experienced further avoidable deterioration. Only 5 of these missed injuries were at C1/2 or the cervico-thoracic junction. One-third of patients with missed injuries had a significant head injury, 13 required early ventilation, 9 were intoxicated and 7 were thought to be hysterical. X-rays were of poor quality in 18, failed to demonstrate the whole region in 11, 4 were of an uninjured region, there were 10 with unrecognised soft tissue swelling and 6 had no vertebral injury⁴. Whole body CT is now recommended (see page 17)

Details on risk assessment are included in the section “Handling the Patient with a spinal cord injury” below.

Initial assessment under ATLS protocols is essential. **Airway, breathing & circulation** are the priority, with protection of any potential unstable fracture. The secondary survey is of even greater importance in a patient with impaired sensation.

Spinal Shock

At the acute stage there is total, flaccid paralysis of all skeletal muscle and loss of all spinal reflexes below the level of the lesion. This is referred to as spinal shock. It may last from several hours to several weeks depending on the severity. The return of the bulbo-spongiosus (previously referred to as the bulbo-cavernosus) reflex denotes the end of the spinal shock period.

Airway and Cervical Spine Control

As soon as it is feasible the patient should be placed into the neutral supine position. Remember that in ankylosing spondylitis this may be in a flexed position. *If the patient is wearing a helmet, two people are needed for its removal.* The helmet is held by the first rescuer who maintains the neck in the neutral position to the rest of the body. The second rescuer undoes the chin strap then places one hand behind the neck and the other hand is placed around the jaw to support and maintain alignment. The first rescuer then uses lateral force to spread the helmet and gently removes it.

In any injury the airway can become compromised. With a suspected spinal cord injury the patient cannot be placed in the normal first aid recovery position which does not maintain cervical alignment. The spine should be kept in alignment at all times.

Observation

- Look for evidence of breathing difficulties, obstruction or aspiration
- Listen for noisy breathing, stridor or gurgling – evidence of airway compromise
- Feel for air exchange, deformity or foreign bodies in the mouth or throat

Action

- Clear airway of any obstruction
- Remove any foreign bodies from the mouth or throat
- Oral suctioning may be necessary
- To protect a threatened airway **do not hyperextend the neck**; use instead the chin lift technique
- Minimise movement of the cervical spine
- Remember opiate analgesics may cause nausea with the risk of aspiration
- Consider naso-pharyngeal or oro-pharyngeal airway
- Anaesthetic / ICU review.
- Use appropriate intubation techniques with immobilisation of the spine
- NB *In cervical or high thoracic injuries, during intubation severe bradycardia can occur, leading to cardiac arrest. To minimise this risk consider: pre-oxygenation, hyperventilation with ambubag, (unless also have head injury), use of topical anaesthetic spray. Administration of Atropine 0.3mg/0.6mg may be required.*

Breathing, Ventilation and Weaning

In cervical and high thoracic injuries the nerves to the intercostals are paralysed, reducing the ability to breathe effectively. In high cervical lesions the diaphragms may also be affected (C3,4,5). In these high lesions the most affected function is coughing. Patients with very high lesions are breathing with the diaphragm only and have no effective cough at all. The risk of deteriorating respiratory function is extremely high due to:-

- Fatigue of innervated muscles
- Chest trauma
- Relative bronchoconstriction and high volume secretions due to unopposed parasympathetic activity in individuals with tetraplegia
- Retained secretions
- Developing V/Q mismatches from immobility
- Abdominal distension splinting diaphragm (see paralytic ileus, p. 20)
- Effects of opiate analgesics
- Upward extension of the spinal lesion

Observation

Look for:-

- Presence, rate & depth of respirations, shallow or abdominal breathing
- Asymmetry of the chest
- Paradoxical breathing in cervical injuries
- The development of respiratory fatigue, i.e. shallow grunting breathing, dropping in SaO₂ despite O₂ supplements
- Initial and serial measurements of vital capacity – a gradual drop in vital capacity is a sign of respiratory deterioration
- Signs of aspiration or consolidation

Action

- Continuously monitor oxygen saturation levels and check respiratory rate regularly
- Maintain SpO₂ at 95% or above
- If longer term O₂ is required, it should be humidified
- Monitor blood gases regularly
- Monitor the vital capacity - contact ICU if VC falling
- Regular turning to optimise V/Q match (two hourly, mechanical bed may be utilised)
- **Early, regular and frequent physiotherapy is the mainstay of treatment**, including assisted cough techniques and incentive spirometry
- Chest x-ray as indicated
- Elective ventilation may be needed. Ideally, patients should be managed with NIV
- Tracheal suctioning may be needed
- Information on weaning is available from RISCI ⁵

Weaning

Weaning should be undertaken on the ventilator free principle, preserving the ventilator tidal volume. Further advice is available from RISCI5

Circulation

Neurogenic (spinal) shock is the body's response to the sudden loss of sympathetic control. It occurs in cervical and high thoracic lesions (above T6). Incomplete injuries may not display these signs. Due to lack of vasomotor control significant hypotension results. Bradycardia occurs as a result of unopposed effects of the vagus nerve. A systolic blood pressure of 90 may be normal in these patients. Monitoring of fluid balance in patients with spinal cord injury is essential. Remember, however, that hypovolaemic shock may be present and other injuries may escape detection in the cord injured patient with sensory deprivation. In the acute phase, if other significant injuries are present, a CVP line may be of assistance.

Observation

- Hypotension
- Note: Hospital Early Warning Scores will need values adjusted for patients with a lesion above T6

Action

- Nurse patient supine
- Monitor BP
- Maintain a mean arterial pressure >85mmHg (systolic BP >90mmHg) and a urinary output of 30mls or above per hour
- Administer IV fluids
- NB *Do not over-infuse. This may precipitate cardiac failure and pulmonary oedema.*
- In rare instances Inotropes may be necessary to maintain a stable BP. Ephedrine or Midodrine may also be required.
- A CVP line may be indicated

Observation

- Bradycardia

Action

- ECG monitoring
- Extreme bradycardia can result in cardiac syncope. If heart rate drops below, and remains below, 40 beats per minute Atropine 0.3-0.6mg may be given as IV bolus if the patient is cardio-vascularly unwell or unstable.
- NB An abnormal vaso-vagal response can occur through stimulation such as rapid changes in body positioning, i.e. log rolling too quickly, tracheal suctioning, passing an N.G. tube etc.
- In patients with tracheostomy, during suctioning, stimulation of vagal afferents can result in a marked vagal response, bradycardia and consequent hypoxia. Bagging with 100% O₂ pre and post tracheal suction is a useful manoeuvre to minimise these effects
- Problematic bradycardia usually resolves over a few days. Pacemakers can cause management complications in the long term (e.g. MRI scanning, electrical stimulation treatments) and should be avoided where possible
- There is a high incidence of cardiac contusion in patients with thoracic injuries with a potential for arrhythmias

Neurological Assessment

Careful neurological assessment is absolutely essential for patient with spinal cord injury. In the first hours and days following injury the neurological level may change. An extension of the lesion by one or even two levels may be observed and it is critical that any change is monitored, to prevent any avoidable deterioration of neurological deficit. Neurological observations should be performed at two hourly intervals. At the site of cord injury there will be a zone of critical ischaemia. This zone may expand with poor oxygen saturation or poor perfusion. Patients with high lesions have poor autonomic vascular control and postural hypotension may be severe and significant. In the acute phase of the injury such postural hypotension may expand the zone of critical ischaemia. **Patients with acute spinal cord injury must be nursed flat.**

Neurological examination should be undertaken by an experienced member of the medical team using the standardised examination recording chart published by the American Spinal Injuries Association (ASIA Chart, ref www.asialearningcenter.org appendix 1). Performing this can be challenging for the patient and it is better to make one good assessment. The acutely injured patient often finds it easier to report alteration of pin prick than alteration of light touch. Sharp pin prick also has a high prognostic significance. Test pin prick on the anterior surface of the body and the perineum. Mark the sensory level on the patient as this is very useful in subsequent review. A change from an accurately recorded level may allow diagnosis of potential complications, e.g., epidural haematoma, over distraction when using skull traction.

Sacral segments have great prognostic significance for predicting neurological outcome and for informing bowel and bladder management. Careful examination of perianal sensation, deep anal pressure and voluntary anal contraction is essential.

Spinal surgery may be contemplated (see p. 23). If spinal surgery is undertaken the ASIA Chart must be carefully completed both prior to surgery and post-operatively.

Pain

Offer medications to control pain in the acute phase after spinal injury. For people with spinal injury use intravenous morphine as the first-line analgesic and adjust the dose as needed to achieve adequate pain relief.

Do not use medications in the acute stage after traumatic spinal cord injury to try and prevent neuropathic pain from developing in the chronic stage.

Neuroprotection (including Steroids)

There is a lot of ongoing research aimed at reducing the consequences of SCI, however there is no evidence to support the use of any medication in the acute stage that is aimed at providing neuroprotection and preventing secondary deterioration therefore do not use Methylprednisolone⁶, Nimodipine or Naloxone for this purpose.

Handling the Patient with a Spinal Cord Injury⁷

Assess whether the person is at high, low or no risk for **cervical spine injury** using the Canadian C-spine rule as follows:

The person is at high risk if they have at least one of the following high-risk factors:

- age 65 years or older
- dangerous mechanism of injury (fall from a height of greater than 1 metre or 5 steps, axial load to the head – for example diving, high-speed motor vehicle collision, rollover motor accident, ejection from a motor vehicle, accident involving motorised recreational vehicles, bicycle collision, horse riding accidents)
- Paraesthesia in the upper or lower limbs

The person is at low risk if they have at least one of the following low-risk factors:

- involved in a minor rear-end motor vehicle collision
- comfortable in a sitting position
- ambulatory at any time since the injury
- no midline cervical spine tenderness
- delayed onset of neck pain

The person remains at low risk if they are:

- unable to actively rotate their neck 45 degrees to the left and right (the range of the neck can only be assessed safely if the person is at low risk and there are no high-risk factors).

The person has no risk if they:

- have one of the above low-risk factors and
- are able to actively rotate their neck 45 degrees to the left and right.

Carry out or maintain full in-line spinal immobilisation and request imaging if:

- A high-risk factor for cervical spine injury is identified and indicated by the Canadian C-spine rule
- A low-risk factor for cervical spine injury is identified and indicated by the Canadian C-spine rule and the person is unable to actively rotate their neck 45 degrees left and right or indicated by one or more of the factors

Assess the person with **suspected thoracic or lumbosacral spine injury** using these factors:

- Age 65 years or older and reported pain in the thoracic or lumbosacral spine
- Dangerous mechanism of injury (fall from a height of greater than 3 metres, axial load to the head or base of the spine – for example falls landing on feet or buttocks, high-speed motor vehicle collision, rollover motor accident, lap belt restraint only, ejection from a motor vehicle, accident involving motorised recreational vehicles, bicycle collision, horse riding accidents)
- Pre-existing spinal pathology, or known or at risk of osteoporosis – for example steroid use
- Suspected spinal fracture in another region of the spine
- Abnormal neurological symptoms (paraesthesia or weakness or numbness)
- Abnormal neurological signs (motor or sensory deficit)
- New deformity or bony midline tenderness (on palpation)
- Bony midline tenderness (on percussion)
- Midline or spinal pain (on coughing) on mobilisation (sit, stand, step, assess walking):

- Pain or abnormal neurological symptoms (stop if this occurs).

If thoracolumbar injury is suspected, do not flex hip more than 45 degrees during any neurological assessment.

Patients are frequently transferred into Emergency departments on a spinal board. Transfer onto an appropriate trolley MUST be undertaken at the earliest possible opportunity to ensure skin and pressure areas are protected. Ensure sufficient personnel are available for continued maintenance of spinal alignment. Ensure all head huggers and straps are removed before transfer.

When immobilising the spine tailor the approach to the person's specific circumstances

The use of spinal immobilisation devices may be difficult (for example in people with short or wide necks, or people with a pre-existing deformity) and could be counterproductive (for example increasing pain, worsening neurological signs and symptoms). In uncooperative, agitated or distressed people, including children, think about letting them find a position where they are comfortable with manual in-line spinal immobilisation.

When carrying out full in-line spinal immobilisation in adults, manually stabilise the head with the spine in-line using the following stepwise approach:

- Fit an appropriately sized semi-rigid collar unless contraindicated by:
 - a compromised airway
 - known spinal deformities, such as ankylosing spondylitis (in these cases keep the spine in the person's current position).
- Reassess the airway after applying the collar.
- Place and secure the person on a scoop stretcher.
- Secure the person with head blocks and tape, ideally in a vacuum mattress.

To ensure that total protection and alignment of the spine is maintained, to allow the patient to be moved, there are two techniques which can be applied.

1. Logroll
2. Multi Hand Lift ^{8,9}

Log rolling is the method normally employed in the acute phase of the spinal cord injury management when the spine has not been stabilised. This requires sufficient nurses to control the head, shoulder girdle, pelvis and legs. The senior nurse should control the head and give the directions. MASCIP have produced an illustrated guide which may be consulted ¹⁰.

Imaging

Imaging for spinal injury should be performed urgently, and the images should be interpreted immediately by a healthcare professional with training and skills in this area⁷.

Suspected Cervical Spine Injury

- Perform CT in adults (16 or over) if:
 - Imaging for cervical spine injury is indicated by the Canadian C-spine rule or
 - there is a strong suspicion of thoracic or lumbosacral spine injury associated with abnormal neurological signs or symptoms.
- If, after CT, there is a neurological abnormality which could be attributable to spinal cord injury, perform MRI.

- For imaging in adults (16 or over) with head injury and suspected cervical spine injury, follow the recommendations in section 1.5 of the NICE guideline on head injury.

Suspected thoracic or lumbosacral column injury

- Perform an X-ray as the first-line investigation for people with suspected spinal column injury without abnormal neurological signs or symptoms in the thoracic or lumbosacral regions (T1–L3).
- Perform CT if the X-ray is abnormal or there are clinical signs or symptoms of a spinal column injury.
- If a new spinal column fracture is confirmed, image the rest of the spinal column.

Blunt major trauma and suspected multiple injuries

- Use whole-body CT (consisting of a vertex-to-toes scanogram followed by CT from vertex to mid-thigh) in adults (16 or over) with blunt major trauma and suspected multiple injuries. Patients should not be repositioned during whole-body CT.
- Use clinical findings and the scanogram to direct CT of the limbs in adults (16 or over) with limb trauma.
- If a person with suspected spinal column injury has whole-body CT carry out multiplanar reformatting to show all of the thoracic and lumbosacral regions with sagittal and coronal reformats.

An MRI scan will help with prognosis, and can identify prolapsed disc, haematoma and other soft tissue lesions. Access to the patient is poor in scanners and careful assessment of clinical condition particularly breathing is essential.

Deep Venous Thrombosis

Patients with acute spinal cord injury are at very high risk of deep venous thrombosis. Prophylaxis is mandatory with physical plus Low molecular weight Heparin (LMWH) which should start as soon as possible and before day 3 post injury unless the patient has other injuries that make it contraindicated. LMWH should be omitted prior to spinal surgery. The preferred regime of the Linked Spinal Cord Injuries Centre should be followed if possible and this can be obtained from the Centre.

Skin

The risk of developing pressure ulcers following spinal cord injury is extremely high ^{2,11} due to:-

- Lack of sensation – the patient is unaware that there may be a problem
- Lack of muscle activity below the level of injury
- Impaired circulation, reducing the amount of oxygen to the skin

A pressure ulcer, taking an hour or so to develop, may delay the patient's treatment by weeks and produce a permanently vulnerable scar. A pressure ulcer is a sign of neglect.

The patient must be turned regularly, initially every 2 hours. Regular and routine turning not only relieves pressure but also moves static fluid within the paralysed body therefore reducing the risk of other systemic complications such as pneumonia, UTI, VTE and gastric ulceration. Thirty degrees side to side is with appropriate pillow supports is sufficient. Dynamic mattresses and other pressure relieving devices are often insufficient for the prevention of skin problems in this vulnerable population. A dynamic mattress is ineffective in the prevention of heel sores and the heels should be supported clear of the bed with pillows.

It is **absolutely contra-indicated** to allow a patient to sit or lie on a pressure ulcer.

The liaison staff from the linked Specialised Spinal Cord Injuries Centre would be pleased to visit any ward to provide advice and demonstrations of correct skin care.

Observation

- Check all pressure areas for signs of skin breakdown
- Red Marks are significant and must be protected from pressure

Action

- Heels are vulnerable when lying supine - they should be supported clear of the bed with pillows. Dynamic and thermal contouring mattresses are inadequate for prevention of heel sores
- Subsequent pressure relief must be carried out 2-hourly, with side-to-side turning of minimum 30°.

Paralytic Ileus

Paralytic ileus is common in spinal shock. There is a risk of vomiting/aspiration. Ileus usually occurs immediately in thoraco-lumbar injuries but can be delayed for anything up to 48 hours in cervical injuries. Abdominal distension may impede breathing by splinting the diaphragms. Gastric dilatation may occur even if bowel sounds are present.

Observation

- Listen to abdomen for presence of bowel sounds
- Observe for abdominal distension

Action

- Nil-by-mouth
- Pass naso-gastric tube – free drainage (beware possible bradycardia)
- If abdomen is distending due to the build-up of gas, undertake digital rectal examination and decompression to avoid over-distension of the bowel.
- Re-commence nutrition when ileus resolves, which can be as early as day1-2.

Stress Ulceration

Stress ulceration and gastric haemorrhage is common in acute spinal cord injury. Prophylactic use of Proton Pump Inhibitors or Ranitidine or other similar preparation is indicated. Continue use of gastric protection initially upon commencement of feeding.

Bladder

The bladder is flaccid during spinal shock and therefore it is important to avoid over-distension as this can have an adverse effect on the patient's longer term management.

Over-distension damages the myo-neuronic plexus in the bladder wall and this damage can be permanent. All patients should be managed with a urethral catheter on *free drainage initially*. Urinary output should be monitored hourly until the patient is stable. If there is a prolonged delay before admission to the Specialised Spinal Cord Injuries Centre can be arranged, further advice on bladder management may be obtained from the Centre as the patient may require anticholinergic medication and procedures to prevent further secondary complication

In the acute situation urethral catheterisation should not be attempted in the presence of priapism. Under these circumstances suprapubic catheterisation should be undertaken in the Emergency Department. A number of devices are available for this purpose. Ultrasound control can be helpful.

Bowel

The spinal cord injury may create two types of problems with bowel control, usually depending on the level of damage to the spinal cord.

- Upper Motor Neurone Damage (Thoracic Level 12 and above) (spastic/reflexic bowel). Reflex activity is maintained; the bowel will contract and empty when stimulated. Anal sphincter tone is maintained
- Lower Motor Neurone Damage (Usually Lumbar Level 1 or below) (flaccid/areflexic bowel). Although peristalsis will return, these movements are quite ineffective without the support of the spinal reflex. Faecal retention and overflow of faecal fluid may occur and the anal sphincter will be flaccid.

Action

- Daily insertion of glycerine suppositories 15 – 30 minutes prior to rectal examination and evacuation if the rectum is full.
- When bowel sounds return, passage of flatus occurs or bowels move then aperients may be started:
 - a. Senna Tablets 7.5mg or Syrup 7.5mg in 5mls (usually 15 mgs on alternate evenings) and
 - b. Docusate 100-200 mg b.d.

If the above regime is not successful consider:

Movicol 1 sachet b.d.

Bisacodyl Tablets 10mg

Upper motor neurone (reflex) bowel

- Continue rectal examination and digital evacuation daily
- Commence suppositories on mornings after evening aperient
- Anal digital stimulation to trigger reflex and ensure rectal emptying. CHECK digitally that emptying is complete

Lower motor neurone (flaccid) bowel

- Continue daily rectal examination
- Digital removal of faeces is essential in these patients

Guidance from the National Patient Safety Agency mandates all NHS trusts to develop a policy on digital removal of faeces. It states that failure to meet this aspect of care is neglectful and in breach of the Nursing and Midwifery Council Code of Conduct ^{12,13}.

Do not use the Flexi-seal system for managing 'diarrhoea' except in the case of actual C.difficile. Its prolonged use in neurogenic bowel conditions is contraindicated by the manufacturer and can severely affect sphincter competence and reflex activity. Most 'diarrhoea' in SCI is usually the result of impaction with overflow or overstimulation of the gut with aperients or high-fibre feeds.

Joint Mobility

Following a spinal cord injury (SCI), disruption to the descending neural system and control leads to muscle weakness and paralysis. Immobility of the joints follows and where there is some preserved muscle innervation around a joint, muscle imbalance occurs. Further compounding factors, secondary to SCI such as imposed immobility, altered tone and spasticity, pain, injury and disuse along with weakness and muscle imbalance can cause structural muscular, ligamentous, capsular and muscle stiffness changes which can affect the range of motion of a joint and can quite rapidly result in joint contracture. Even a small loss of range / joint contracture can significantly limit functional outcomes and can be very disabling if they prevent proper seating in a wheelchair or hygiene or may limit use of a joint if partial neurological recovery occurs.

The outcome of rehabilitation depends very much on maintaining adequate range of movement and muscle length and passive movements and positioning are very important in managing joint range and movement. Baseline assessments and regular monitoring are essential. Patients will require daily input from the physiotherapy and occupational therapy teams in the acute stage, Splinting to maintain a prolonged stretch and 24 hour positioning regimes maybe advocated.

The shoulders are particularly affected in cervical lesions. The development of frozen shoulder can be a complication and can be prevented by correct passive mobilisation techniques and positioning which must start from the day of admission. Abduction, flexion and external rotation are particularly prone to limitation of movement. Shoulder pain is often a feature of cervical cord injury and can be reduced by appropriate stretching and mobilisation techniques.

-**The elbows** are at risk of fixed flexion deformity. Elbow extension with full wrist extension and supination or pronation is needed.

-In **the hand** flexion deformity of the interphalangeal joints can occur and requires regular passive stretching. On occasion reflex sympathetic dystrophy is seen and this is best addressed early with passive stretching.

-In **the lower limbs** flexion contracture and adduction with internal rotation of the hip can occur. When respiratory function is satisfactory, periods of prone lying can assist.

-Fixed flexion deformity of **the knee** is also seen but equinus deformity of **the ankle** is very common and requires early and regular stretching, and “blocking” with pillows. Appropriate splints may be recommended by the physiotherapy team.

Passive stretching can, and should, be undertaken by all health care professionals involved with the patient. Nursing staff have a significant role to play in positioning of the arms and shoulders and can also undertake some passive stretching exercises, which should be an integral part of turning regimes, and whilst undertaking other routine nursing care. Stability of the fracture site must be considered, especially when carrying out lower limb movements on a person with a fracture below T10

Spinal Surgery

The great majority of the injuries of the spinal cord can be treated surgically or non-surgically with good outcomes when the treatment is provided in Centres dedicated to the management of patients with spinal cord injuries. All patients should be given informed choice between Surgical Stabilisation and non-surgical management.

Spinal surgery comprises two components; decompression of the neural tissues and reduction and stabilisation of the spine. Conservative management is also appropriate in some injuries and should also be considered if the requisite skills are available.

The role of decompression in the management of patients with spinal cord injury has yet to be fully determined. There is no conclusive evidence that decompression of the injured spinal cord improves either the rate or completeness of any neurological recovery^{14,15}. Most incomplete lesions demonstrate significant improvement with time whether treated operatively or conservatively. Preliminary results of the Surgical Treatment of Spinal Cord Injury Study (STASCIS) showed 24% of patients who received decompressive surgery within 24 hours of their injury experienced a 2-grade or greater improvement on the American Spinal Injury Association (ASIA) scale, compared with 4% of those in the delayed-treatment group¹⁶. A systematic review and a meta-analysis indicate that surgery at less than 24 hours is safe, that urgent reduction (4 hours) is mandated in bifacetal dislocation (e.g. rugby injuries) and that many surgeons believe that early (<24 hours) decompression is an option for the patient with an incomplete injury^{17,18,19}. The evacuation of a compressive haematoma or large central disc prolapse requires urgent management. If traction is used for stabilisation or the reduction of dislocation **regular neurological assessment** is vital as the injured cord is particularly vulnerable to distraction.

Patients with acute spinal cord injury have autonomic dysfunction and surgery does carry a risk of neurological deterioration if oxygenation and blood pressure are not precisely controlled or if post-operative oedema and swelling creates any further anoxic insult to the injured tissues. This is of particular importance in the cervical spine where the difference between a C5 lesion and a C6 lesion is very substantial in terms of independent living.

Benefits of stabilisation surgery are the protection of the neural tissues, reduction of pain, easier patient handling, earlier mobilisation within physiological restrictions (p.24), reduction of respiratory complications and reduction in late deformity with better posture and balance. There is evidence to suggest that unreduced fracture dislocations or gross kyphotic deformities may be associated with an increased incidence of post traumatic syringomyelia. Meta-analysis of stabilisation indicates that it reduces complications, length of stay and hospital costs¹⁴.

Other than the potential for neurological deterioration complications of surgery include infection, poor wound healing, and the complications of misplaced or inadequate instrumentation. As most of the achievable objectives of spinal surgery are those of stabilisation then the aim of surgery should be to provide sufficient stabilisation to allow a patient to mobilise without external support. Spinal stabilisation techniques employed need to result in the optimum short-term and long-term outcomes and independence for SCI patients. These may differ from those employed in vertebral column fracture without spinal cord injury. These patients represent the most vulnerable patients and only experienced spinal surgeons and anaesthetists should undertake stabilisation surgery.

Anaesthesia

Anaesthesia in this group of patients is extremely demanding. Autonomic dysfunction produces significant lability of blood pressure and it is preferable that an anaesthetist experienced in the management of spinal cord injured patients should undertake anaesthesia. The treatment of correct fluid balance is difficult and CVP measurements are indicated. Care should be taken when turning the patient from prone to supine (e.g. when coming off the table) as the external pressure on the capacitance vessels is removed and these vessels may have no tone. This can result in a sudden catastrophic fall in the venous return to the heart.

Mobilisation

In patients with spinal cord injury the most important consideration is the provision of optimal conditions for neurological improvement and the prevention of further deterioration. Any spinal cord injury will have an area of cord tissue at critical levels of ischaemia which surrounds an area of necrosis. Any factor increasing this ischaemia has the potential to cause a deterioration of neurological function and, on occasion, this can be permanent. Patients with high lesions (above T6) will have very significant postural hypotension and this can exacerbate poor perfusion in the critical zone.

Mobilisation requires a graduated and carefully monitored approach. Simply allowing a patient with an acute cord injury to sit without such a programme is unacceptable. Safely mobilising patients and engaging muscle activity requires a collaborative, multidisciplinary effort. Mobilisation should initially be undertaken using TEDS and abdominal binder in the presence of an appropriately qualified practitioner. Medication with ephedrine or midodrine may be necessary. During gradual tilting, measurements of blood pressure are required together with monitoring of neurological function particularly at the levels adjacent to the injury itself. Significant hypotension or appearance of increasing deficit indicates return to the recumbent position. The ideal time to begin mobilisation should be evaluated on an individual basis according to the patient's haemodynamics, underlying comorbidities, and the expertise of the healthcare team.

Patients vary significantly in the degree of postural hypotension and in any influence on neurological function. In some cases it can be some weeks before elevation to vertical sitting position may be safely achieved.

Provision of the appropriate wheelchair and cushion must meet mobility, postural, pressure relieving and comfort needs

Autonomic Dysreflexia

Patients with a lesion at or above T6 are prone to autonomic hyper-reflexia (dysreflexia). Common precipitants include blocked catheters or rectal examination, instrumentation and operation – thus a general anaesthetic is still necessary for spinal patients even if they have no apparent sensation.

A stimulus causes reflex sympathetic over-activity below level of cord lesion, leading to vasoconstriction and systemic hypertension. The hypertension stimulates the carotid and aortic baroreceptors leading to increased vagal tone and bradycardia. Peripheral

vasodilatation, which would normally relieve the hypertension, cannot occur because of the injured cord.

Blood Pressure continues to rise until cause removed. Danger – can result in intracranial haemorrhage

General causes:

- Bladder distension
- Bowel distension
- Pressure ulcers
- Ingrown toenails
- Childbirth
- Anal fissure

Symptoms:

- Pounding headache/fullness in head
- Profuse sweating
- Tightness in chest

Signs:

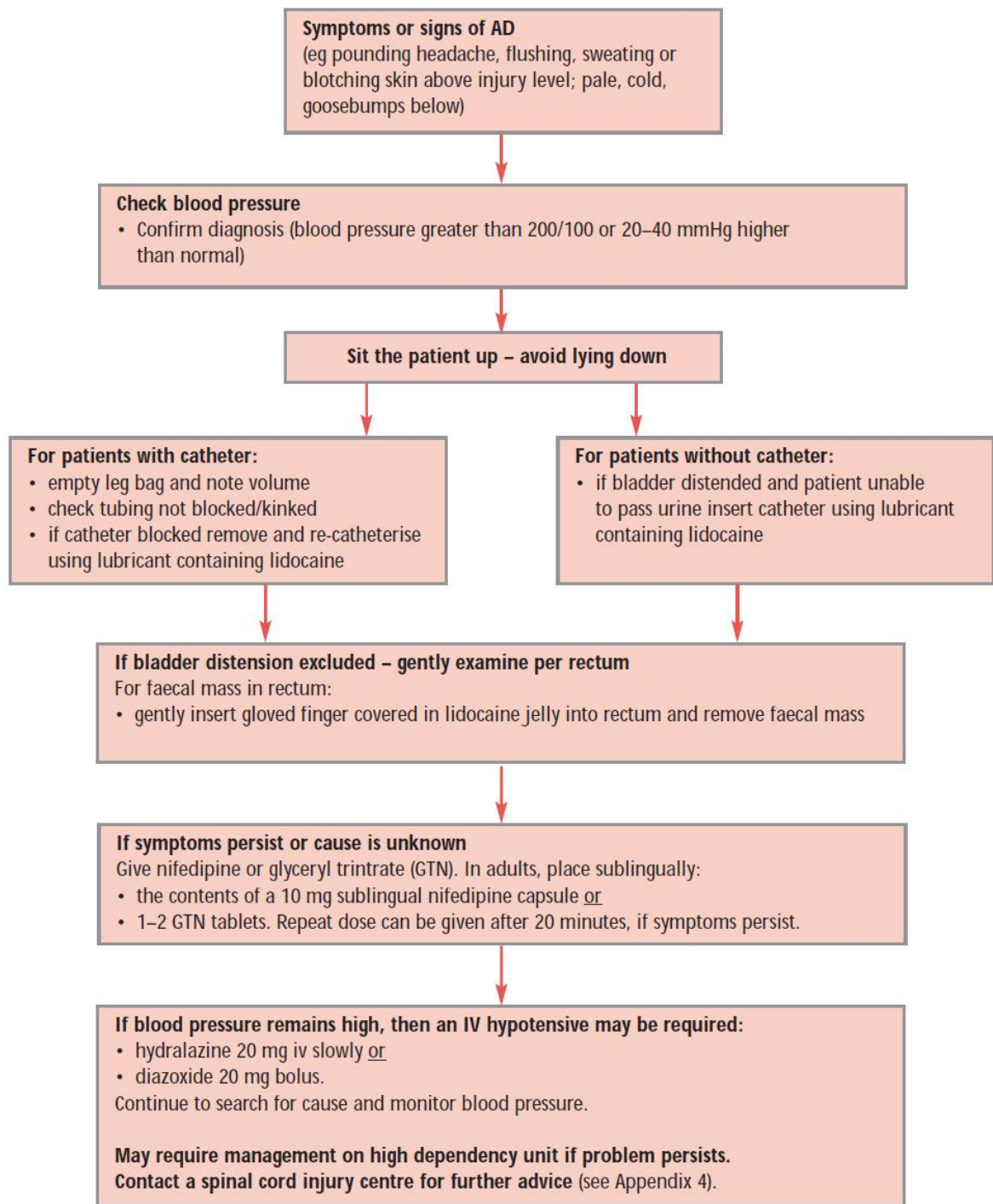
Hypertension and bradycardia. (Occasionally cardiac dysrhythmia)

- Above lesion - Pallor initially, then flushing and/or blotching
 - Sweating in area above and around the lesion
 - Pupillary dilatation
- Below lesion - Cold peripheries
 - Pilo erection
 - Contraction of bladder and large bowel
 - Penile erection and seminal fluid emission

Treatment (see fig 1):

1. Tilt bed head up (if spine is stable)
2. Remove cause
3. Sublingual Nifedipine 10 mg bitten or GTN sublingual
4. DO NOT USE ASPIRIN OR NSAID for analgesia afterwards. Use Paracetamol/Cocodamol.

Fig 1. Management of patients with autonomic dysreflexia (AD).



Reproduced from: Royal College of Physicians, British Society of Rehabilitation Medicine, Multidisciplinary Association of Spinal Cord Injury Professionals, British Association of Spinal Cord Injury Specialists, and Spinal Injuries Association. Chronic spinal cord injury: management of patients in acute hospital settings: national guidelines. Concise guidance to Good Practice series, No 9. London: RCP, 2008.

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Information and support for patients, family members and carers

Experiencing a spinal cord injury is very frightening for the patient and their families, and, as patients are usually fully cognitively aware and maintain capacity, frequently produces extreme emotional reactions. Understanding this, and ensuring the provision of meaningful emotional support is important. What the patient most wants is certainty, but of course this can rarely be immediately provided. Spinal shock in the first days will make neurological assessment difficult and many practitioners in the acute setting will have little or no experience of the long-term outlook following modern spinal cord injury rehabilitation.

Although certainty over the neurological prognosis is not possible, the provision of a definite plan of treatment to the patient is of enormous benefit, allowing them to have better understanding and a feeling of control. Early discussion with the linked spinal cord injury Centre will provide information on the proposed treatment after transfer, and will also provide advice on patterns of recovery in generic terms. SCI Centres normally have in-house psychology / psychiatry services, which can also provide advice and support for acute emotional management of newly injured patients.

Information in support of the care for those people identified with pre-existing psychiatric conditions can usually be obtained through local liaison psychiatry teams and the patient's General Practitioner.

The SIA have a peer support service and can arrange to visit patients within major trauma centres.

The NICE guidelines on major trauma: service delivery and Spinal Injury contain recommendations on information and support for patients, family members and carers, who should be given contact details for a named person at the SCIC.

Trauma in People with Pre-existing cord injury

Patients with existing spinal cord deficits may present with subsequent injury. The management of the cord deficit will need to continue. These patients remain extremely vulnerable and strict attention to management of skin, bladder and bowel is essential. These are "expert patients" in the true sense of the word and will be very knowledgeable on the management of their condition. All staff should listen to these patients when they give advice on their own management. The SCI Centre which routinely follows up the patient should be contacted. Where this is not possible, the linked SCI Centre will be pleased to offer advice and will be able to arrange a visit from an outreach worker.

Valuable Guidance is available in the publication by the Royal College of Physicians ²⁰. In brief, specific areas to consider are:

- Medication - established spinal cord injured patients frequently are on significant numbers of medications including aperients, anti-spasmodics, bladder agents, pain management drugs etc. In some of these, for example Baclofen and Gabapentin, sudden cessation can lead to dangerous side effects. Interference with normal established bowel regime and associated digital and pharmaceutical prescriptions can give rise to major problems with bowel management.

- Intrathecal Baclofen Pumps, anterior root stimulators and other intra-canal devices. Care will need to be taken when considering MRI scanning and during surgery, when Baclofen pumps need to be checked post MRI scanning.
- Patients with lesions above T6 will be at risk of autonomic dysreflexia (Page 24)
- Pressure ulcers are the most frequent and the most disabling of all the avoidable complications. Regular turning is essential at all times. It is never acceptable to allow the patient to rest weight on a pressure ulcer.
- When using plaster cast immobilisation for fractures in insensate limbs, there is a high risk of skin break-down. Any external splintage must be extremely well padded and removable. The skin must be inspected daily.
- The skeleton in the paralysed area will usually be osteoporotic and this should inform any plans for internal or external fixation in orthopaedic management.
- Spasm may be a major obstacle and management may need to be addressed. This may be done on a local basis for example with Botox or by manipulation of systemic anti-spasmodics.
- **Pre-operative action plan.**
 - Bladder and bowel care. Distension must be prevented to avoid autonomic dysreflexia. Ensure free urinary drainage by catheterisation if necessary. Check bowel programme and confirm empty rectum prior to theatre.
 - Respiratory care. Measure vital capacity and blood gases.
 - Thermoregulation is impaired: monitor rectal temperature.
 - Avoid over-transfusion

Transfer to the SCIC

Decisions to transfer, and planning for it, should take place between senior staff in the transferring and receiving units.

Travel time should be estimated; battery reserve of monitors and infusion pumps and capacity of oxygen cylinders driving pneumatic ventilators should be calculated and skin care be planned for the duration of the journey.

A properly immobilised spinal injured patient can be transferred by road ambulance at normal road speeds. Sudden acceleration and deceleration should be avoided.

Please liaise with the linked SCIC as some will have specific transfer checklists.

References

1. Spinal Injuries Association. 1997. A Charter for Support: The Spinal Injuries Association Recommendations regarding NHS treatment of people confirmed, suspected or potentially experiencing spinal cord injury. Spinal Injuries Association. London.
2. Barr F. Preserving and Developing the National Spinal Cord Injury Service. Phase 2 – Seeking the Evidence. Spinal Injuries Association, May 2009
3. <http://www.excellence.eastmidlands.nhs.uk/welcome/improving-care/emergency-urgent-care/major-trauma/nhs-clinical-advisory-group/>
4. Poonnoose PM, Ravichandran G, McClelland MR. Missed and mismanaged injuries of the spinal cord. *J. Trauma* 2002;53:314-20.
5. <http://www.spinalinjurycentre.org.uk/information/022.asp?UType=2&CType=4>
Weaning RISC1
6. Short DJ, El Masry WS and Jones PW. High dose methylprednisolone in the management of acute spinal cord injury – a systemic review from a clinical perspective. *Spinal Cord* 2000;38:273-286.
7. <http://www.nice.org.uk/NG41>
8. American College of Surgeons. 1997. Advanced Trauma Life Support Manual. Chicago.
9. Tippeff J. 1993. Spinal immobilisation of the multiply injured patient. *Accident & Emergency Nursing*. Longman UK Ltd.
10. www.mascip.co.uk/Core/DownloadDoc.aspx?documentID=4725
11. <http://www.nice.org.uk/CG029> (pressure ulcers)
12. Bowel Care For People With Established Spinal Cord Lesions. National Patient Safety Agency, 15 Sept 2004. (www.npsa.nhs.uk/advice)
13. Digital Rectal Examination and Manual Removal of Faeces. Guidance for Nurses. Royal College of Nursing, London 2004 (publication code 000934)
14. Kishan S, Vives MJ and Reiter MF. Timing of surgery following spinal cord injury. *J. Spinal Cord Med.* 2005;28:11-9.
15. Bagnall A-M et al. Effectiveness and cost-effectiveness of acute hospital-based spinal cord injuries services: systematic review. *Health Technology Assessment* 2003; Vol. 7: No. 19
16. Fehlings MG et al. A Prospective, Multicenter Trial to Evaluate the Role and Timing of Decompression in Patients with Cervical spinal Cord Injury: Initial one year results of the STASCIS Study. Presented at: American Association of Neurologic Surgeons Annual Meeting; April 28, 2008; Chicago, Illinois.

17. Newton DA (2011) Cervical spinal cord injury in rugby is an absolute emergency. Journal of Bone and Joint Surgery - British Volume, Vol. 90-B, Issue SUPP_III, 460.
18. La Rosa G, et al. Does early decompression improve neurological outcome of spinal cord injured patients? Appraisal of the literature using a meta-analytical approach. Spinal Cord. 2004;42:503-512.
19. Fehlings MG, Perrin RG. The timing of surgical intervention in the treatment of spinal cord injury: a systematic review of recent clinical evidence. Spine (Phila Pa 1976). 2006;31(suppl 11):S28-S36.
20. Royal College of Physicians. Spinal cord injury: management of patients in acute hospital settings. Concise guidance to good practice series, No 9. London: RCP, 2008.

Bibliography

1. Good Practice Guide: BASCIS website: <http://www.bascis.pwp.blueyonder.co.uk/>
2. Grundy D, Swain A. 1992. ABC of Spinal Cord Injury 2nd. edition. British Medical Journal Publishing Group. London.
3. Zedjdlik Cynthia Perry. 1992. Management of Spinal Cord Injury. 2nd edition. Jones and Bartleff. Boston.

Change Control

April 22nd 2016 – Added change control
Corrected errors with Table on Contents
Corrected several pages with missing heading style
Algorithms 1, 2 and 3 changed to JPEG format, (originals are available)
Changed Fig 1 on p.26 to improve quality
Added clickable hyperlinks to page 4 and removed old TOC