Acute Management and Early Rehabilitation of Spinal Cord Injuries

2nd October 2018
Major Trauma Rehabilitation Conference

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Steve Brown
Countryfile presenter

Chris Ryan
GB wheelchair rugby captain

Henry Fraser
Mouth artist

www.sophiemorgan.com www.stevebrowngb.com www.whtimes.co.uk www.thetelegraph.co.uk

UK Spinal Cord Injury Infographic
Tetraplegia & Paraplegia

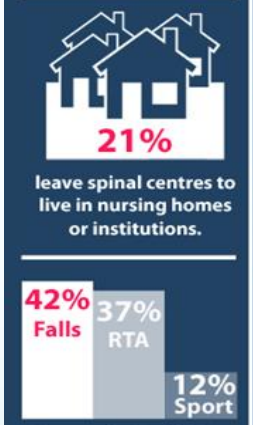
Prepared and designed by
www.apparelyzed.com
spinal cord injury peer support

55%

55% of people suffering a spinal cord injury are between 16 - 30 years of age.

21%

leave spinal centres to live in nursing homes or institutions.



Causes of spinal injury

80%
of spinal injuries affect males

X 1000

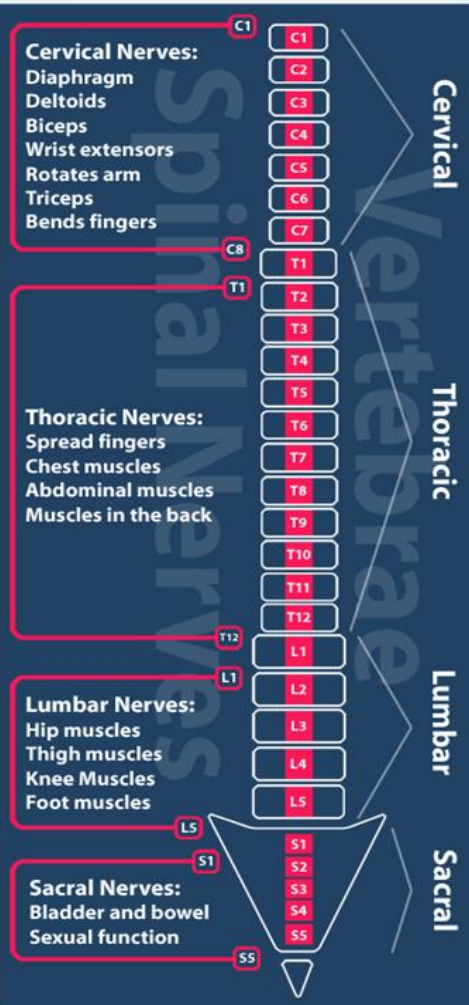
40,000 People in the UK are living with a spinal cord injury

X 100

1200 people are paralysed in the UK every year

£1 Billion
Annual cost to the nation

Highest levels of paralysis for paraplegia and tetraplegia. Damage to the spinal cord results in paralysis from the level of injury downwards.



Sources: www.aspire.org.uk, www.apparelyzed.com, www.basics.org.uk, www.everyeighthours.com, www.spinal.co.uk, www.spinal-research.org

Apparelyzed
spinal cord injury peer support

Patient Journey

Admission to A&E

Diagnostic investigations i.e. CT/MRI/ASIA Referral to neurosurgical team/orthopaedic spinal team +/- ICU team	Commence SCI pathway and referral to SCIC

Transfer to Ward/ICU at Major Trauma Centre

Management plan for spine – conservative vs surgical	Management plan for respiratory function and other injuries

Repatriate to local hospital / Spinal Centre

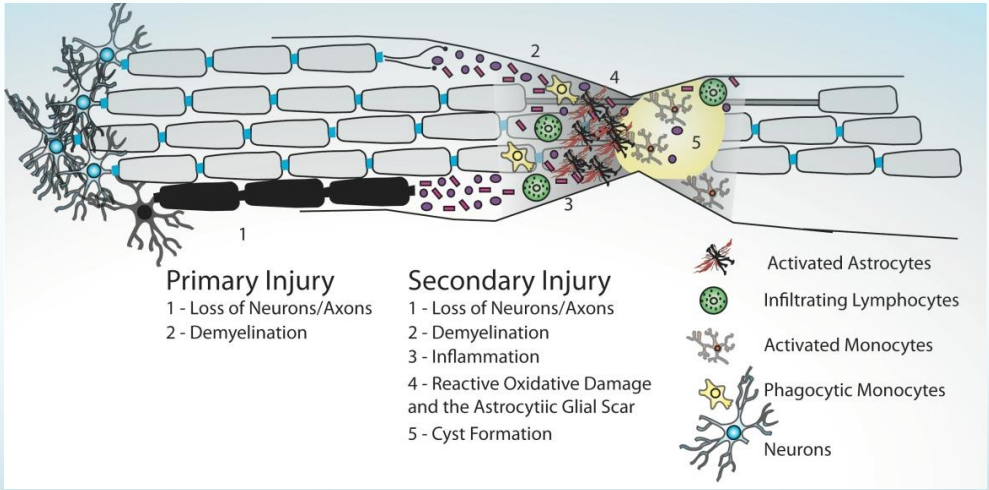
SCIC outreach	Therapy management: MDT approach & SCIC advice

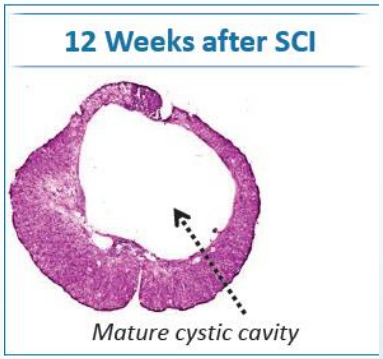
Neuropathology of SCI

Primary (immediate)
Concussion, contusion, laceration, transection

Secondary (minutes – weeks)
Cascade of systemic and cellular events

Chronic (up to 12 months)

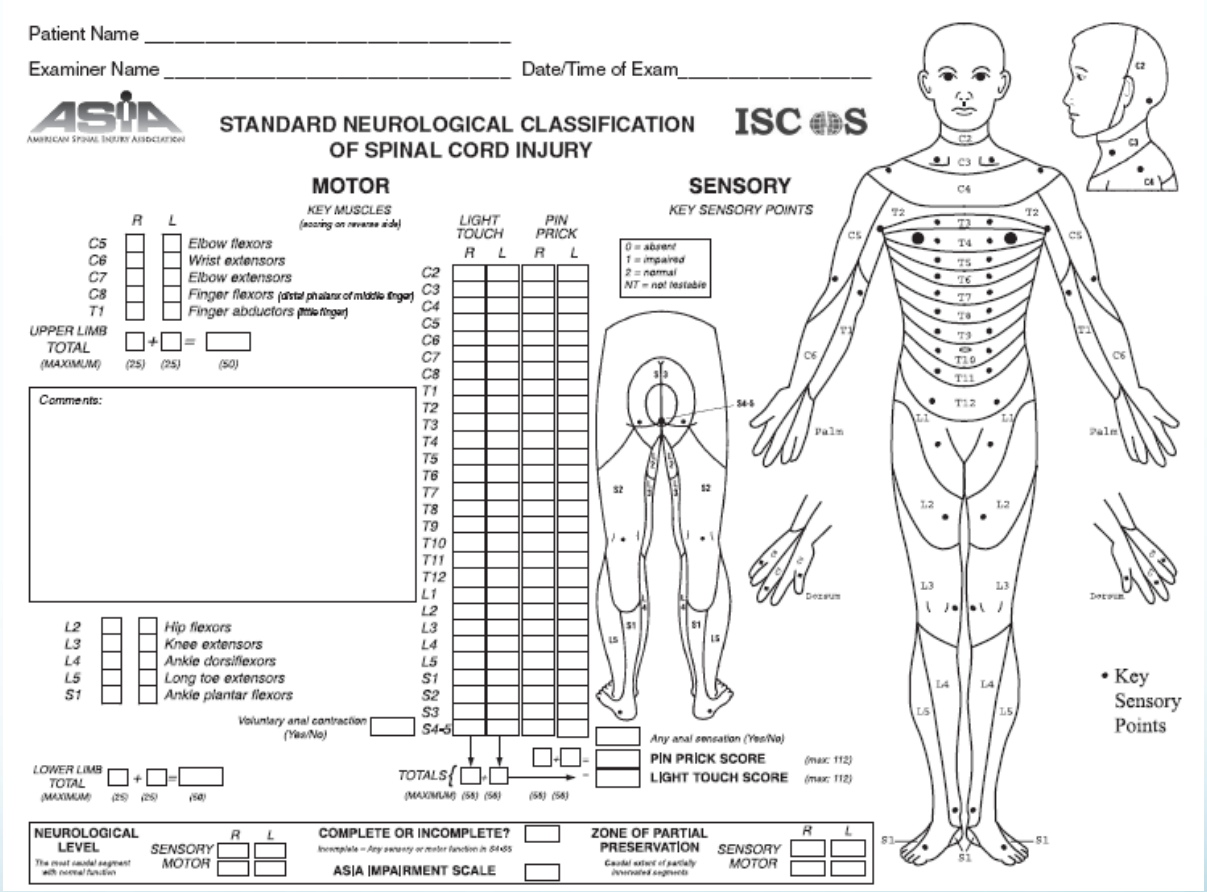




Somers, 2010; Lindsay and Bone, 2010; James et al, 2011

ASIA assessment

- 4 hours
- 24 hours
- 72 hours



http://asia-spinalinjury.org/learning/

Spinal Shock

- Present in 50% of SCI patients
- Transient phenomenon
- Loss of all sensorimotor function below level of injury
- Flaccid paralysis including bladder and bowel

Somers, 2010; Lindsay and Bone, 2010.

Physiological Consequences of SCI

- Impairment of:
  - Autonomic nervous system
  - Cardiovascular
  - Respiratory
  - Neuromuscular

Harvey, 2008;Somers, 2010; Field-Fote, 2009

Autonomic Nervous System

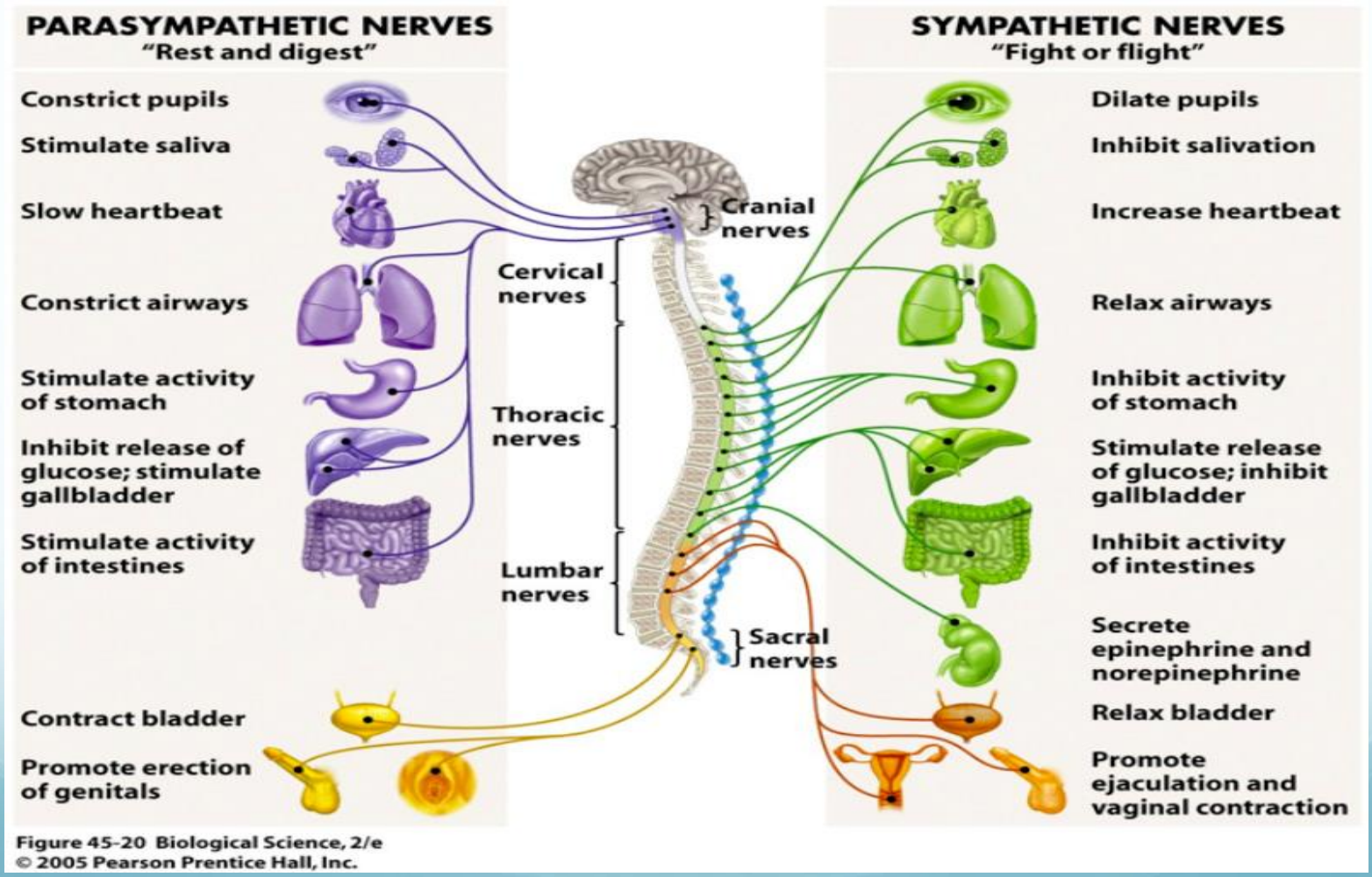
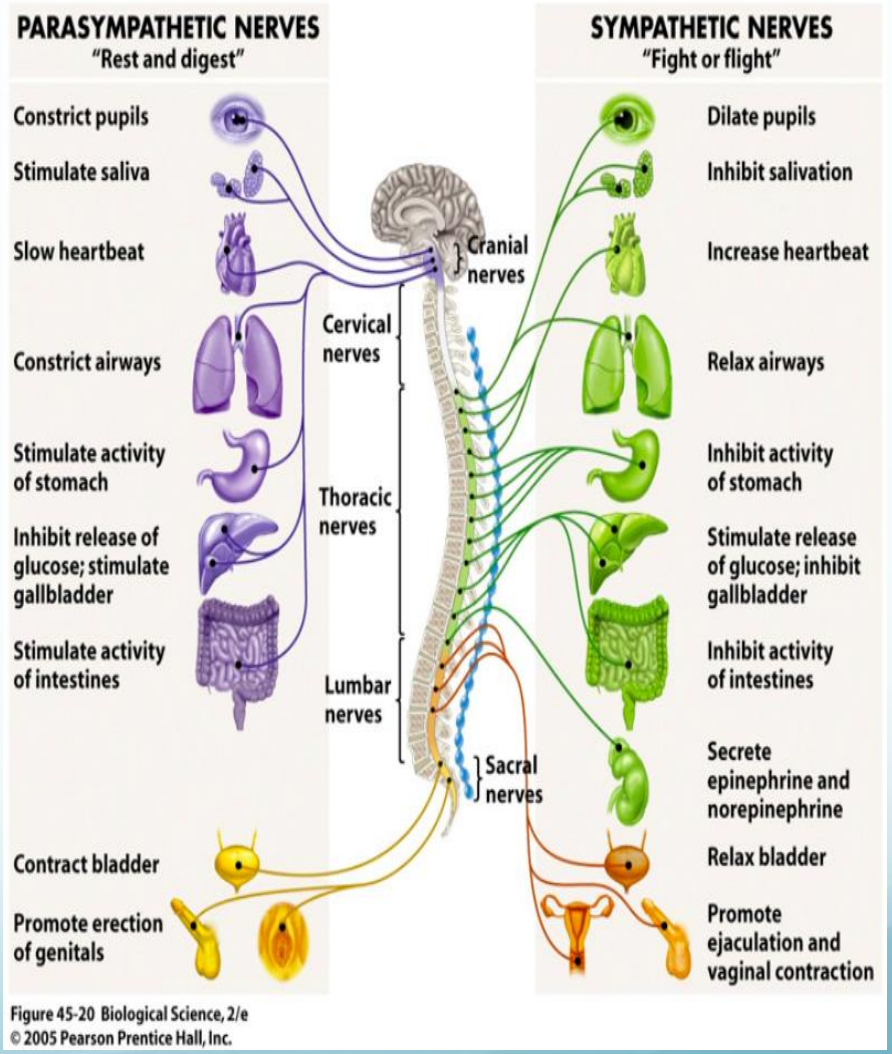


Figure 45-20 Biological Science, 2/e

Autonomic Dysfunction

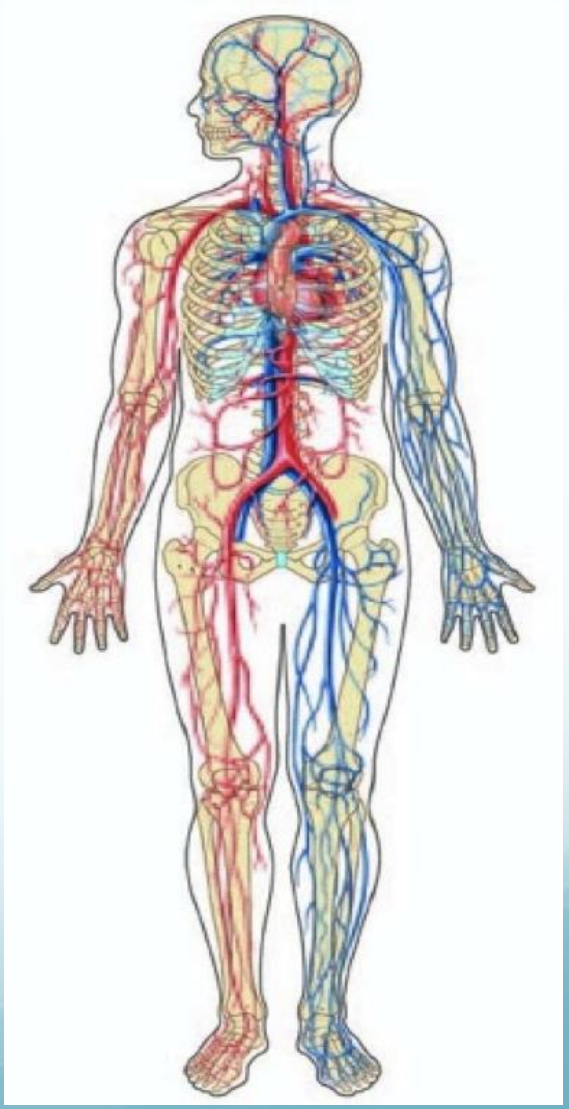
- Mucus hypersecretion
- Decreased mucocillary activity
- Bronchospasm
- Vascular congestion
- Bladder, bowel & sexual dysfunction



Harvey, 2008: Somers, 2010; Field-Fote, 2009

Cardiovascular

- Unopposed parasympathetic activity
  - Bradycardia
  - Peripheral vasodilation
  - Hypotension
  - Reduced venous return



Autonomic Dysreflexia

- Acute and life-threatening
- T6 and above
- A response to noxious stimuli below level of SCI
- Signs and symptoms:
  - Hypertension
  - Bradycardia
  - Headache
  - Flushed skin and sweating above the level of injury
  - Cold clammy skin below the level of injury

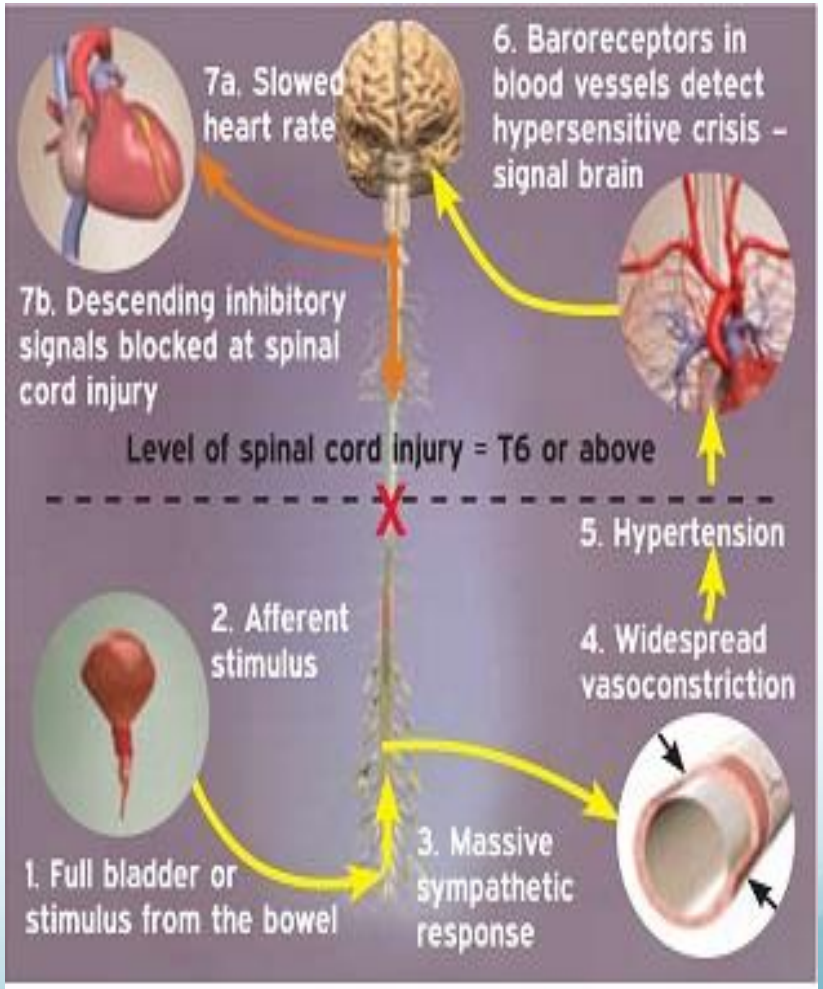
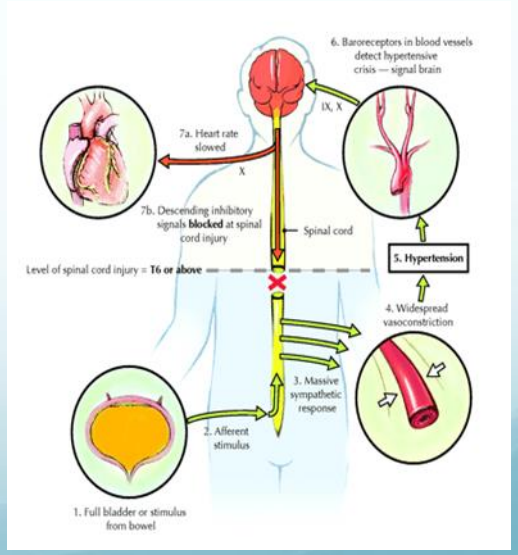


Figure 1: Disruption of autonomic reflexes following spinal injury

Harvey, 2008;Somers, 2010; Field-Fote, 2009

Autonomic Dysreflexia Management

- Sit up, avoid lying down
- Locate stimuli and rectify (e.g. catheter, bowels, pressure)
- If symptoms persist medical management = nifedipine or GTN
- Liaise with SCIC if required



Harvey, 2008; Somers, 2010; Field-Fote, 2009

Respiratory Impairment

Respiratory Complications

- *"Respiratory complications continue to be one of the leading causes of morbidity and mortality in people with spinal cord injury, especially among cervical and high thoracic injuries"* (Mullen, et al, 2015).
- High risk during the first few weeks
- Common respiratory complications include:
  - Hypoventilation
  - Atelectasis
  - Secretion retention
  - Pneumonia
  - Resulting in hypoxaemia and respiratory failure

Harvey, 2008

Respiratory Impairment

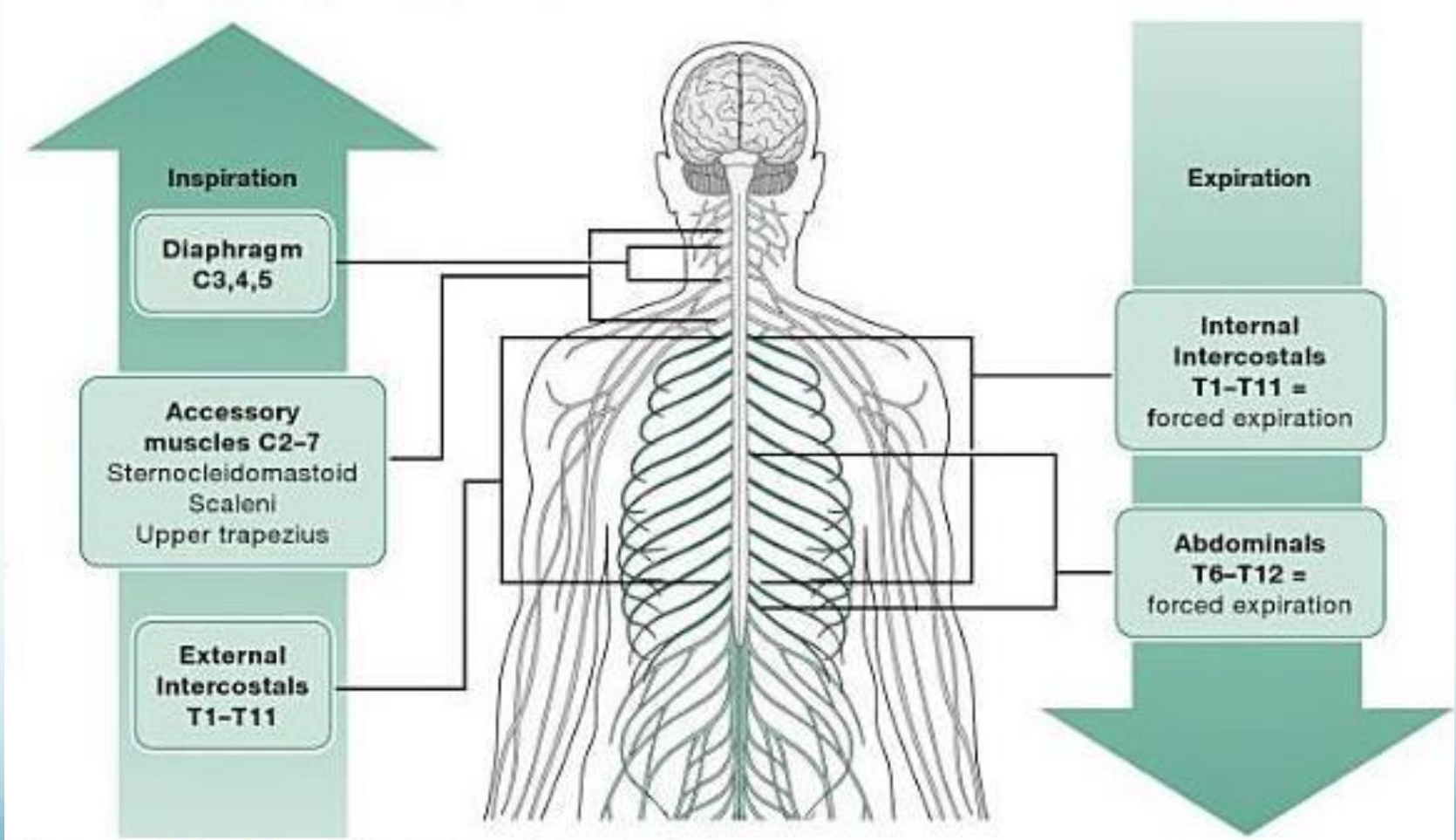
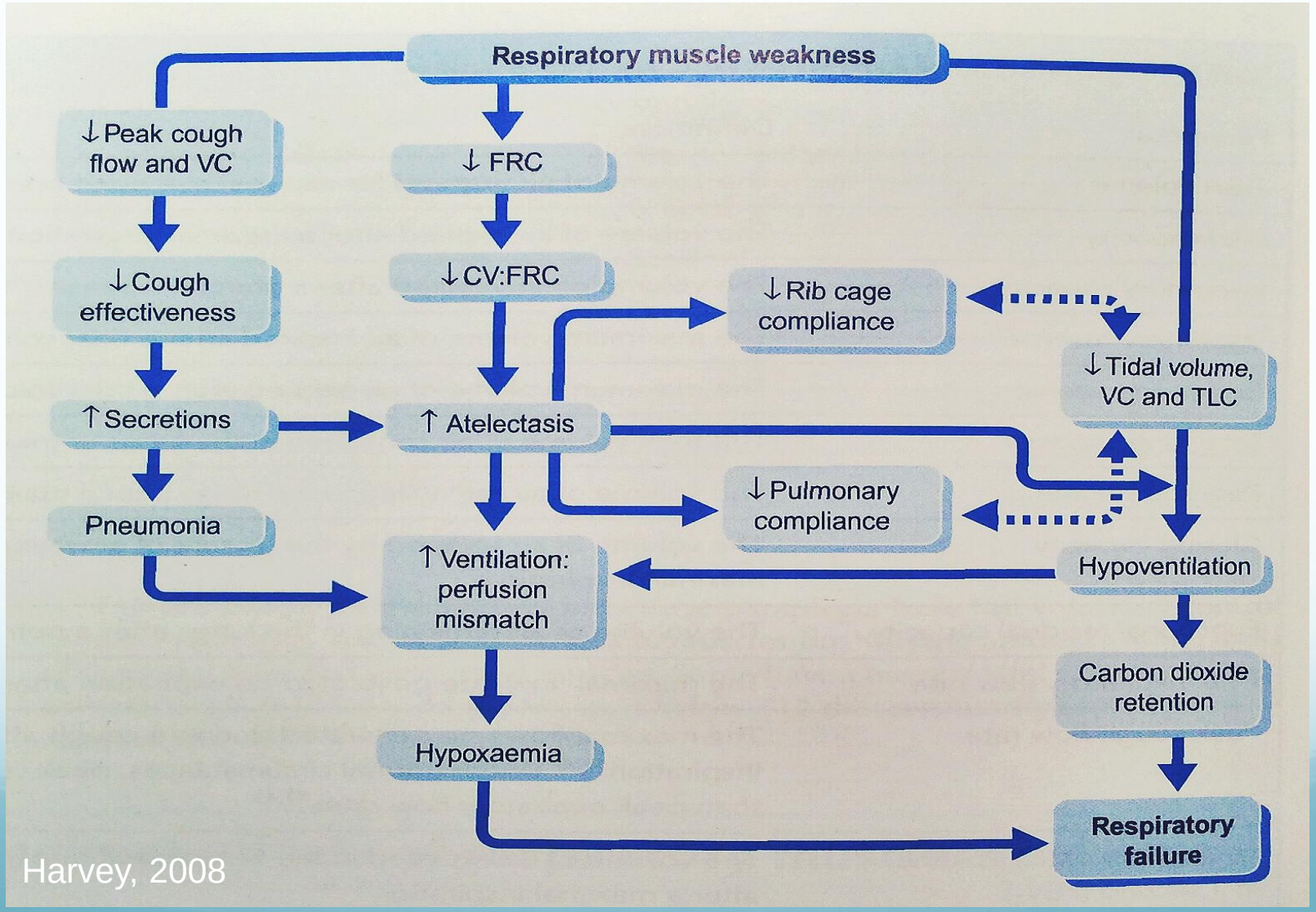


Figure 16.1 Spinal innervation of the respiratory muscles.

Pryor and Prasad, 2008

Effects of Respiratory Muscle Weakness



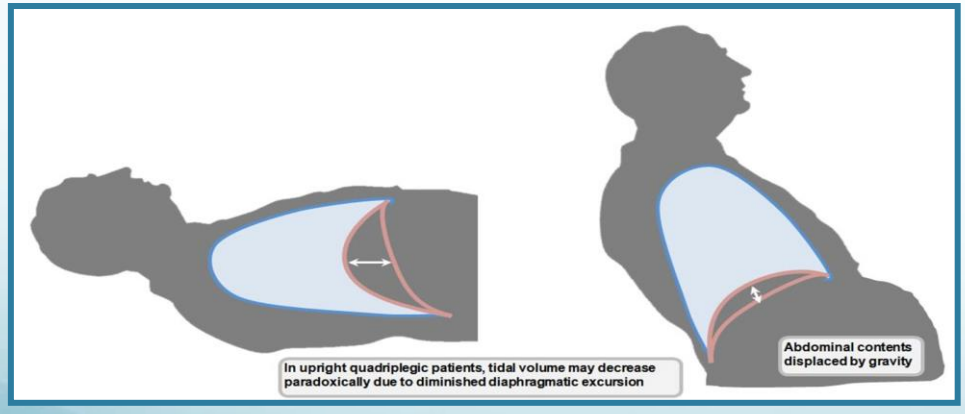
Harvey, 2008

Other Respiratory Considerations

- Autonomic involvement
- Paralytic ileus
- Pre-existing co-morbidities
- Associated chest wall/lung injury

Importance of Supine

- In erect postures, abdominal contents fall unopposed and diaphragm flattens.
- In supine, reduced residual volume results in elevation of diaphragm and more efficient use.



	FVC	FEV1
Supine	3.32	3.17
Sitting in chair	2.15	2.11

Estenne & De Troyer, 1987; Chen et al, 1990; Baydur et al, 2001; Berly & Shem, 2007; Nawarski, 2014

Long Term Physiological Changes

- Pulmonary function will improve over time
- Due to:
  - Functional descent of the neurologic injury level as inflammation resolves
  - Enhanced recruitment of accessory respiratory muscles
  - Retraining of deconditioned muscles
  - Evolution from flaccid to spastic paralysis

Winkler, 2016

Neuromusculoskeletal Impairment

Classification of Impairment

- Diagnostic investigations
- Neuro assessment including ASIA (see appendix a)
- Classification (complete/incomplete)
- Incomplete syndromes:
  - Brown-Sequard
  - Central cord
  - Anterior cord
  - Posterior cord
  - Cauda Equina
  - Conus Medullaris

Neuromusculoskeletal Complications

- Flaccidity
- Spasticity
- Loss of joint range
- Loss of muscle length
- Pain
- Skin integrity

Phases of Spinal Rehabilitation

- Phase One: Acute
- Phase Two: Mobilisation
- Phase Three: Rehabilitation
- Phase Four: Two weeks prior to discharge

Therapy Involvement in the Acute Phase

Physiotherapy

Psychology

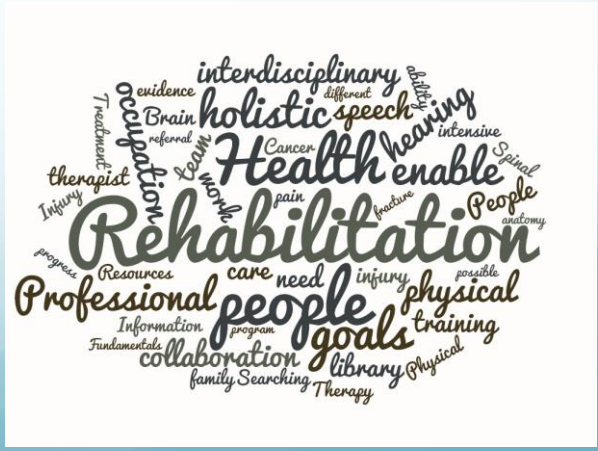
Occupational Therapy

Dietetics

Speech and Language therapy

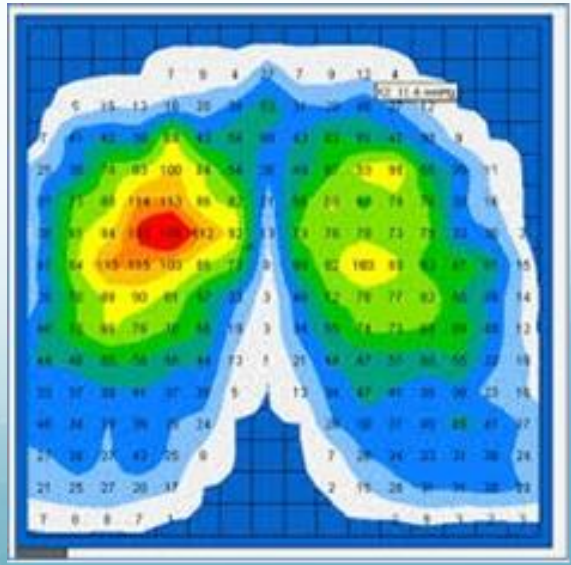
Early Rehabilitation

- Aims of therapy:
  - Early referrals, education and managing expectations
  - Maintain lung function
  - Maintain joint range & soft tissue length
  - Prevent oedema
  - Maintain/improve muscle strength
  - Manage spasticity
  - Upper limb/hand assessment
  - Address sensory deprivation



Early Rehabilitation

- Commence mobilisation
- Aims of therapy:
  - Co-ordinated MDT approach
  - Establish neurological function (i.e. ASIA)
  - Prepare for getting up
  - Establish seating regime
  - Improve muscle strength
  - Progress sitting balance
  - Progress transfers
  - Progress to standing as appropriate



Ongoing Rehabilitation

- Carried out at SCIC
- Aims of therapy:
  - Promote independence and return to community environment
- Therapy may include:
  - Pressure care
  - Postural management
  - Exercise programme (maintenance/strengthening)
  - Functional upper limb (e.g. trick movements/tenodesis grip)
  - Wheelchair skills
  - Assistive technology
  - Driving
  - Housing
  - Work

Later Stages

- Community based
- Aims & ongoing needs:
  - Discharge planning
  - Community follow-up
  - Self management
  - Completion of longer term goals
  - Link into other services

Functional Expectations

Level of Injury	Function
C3 and above	Totally dependent. Needs ventilation. Head, chin or suck and puff control wheelchair.
C4	Totally dependent. Has diaphragm to breathe. Shrug shoulders. Chin control powered wheelchair.
C5	Moves shoulders, flex elbows, no wrist control. Propel manual wheelchair short distances on level. Hand control powered wheelchair. Transfer with assistance.
C6	Wrist extension. Tenodesis grip. Propel wheelchair up gentle slopes. Independent transfers. Drive car with hand controls.
C7	Elbow extension. Possible to be totally independent. Reduced hand function. Transfers. Manual wheelchair.
C8	All hand muscles except intrinsics. Wheelchair independent. Kerbs difficult.

Transfers for Patients with Tetraplegia

Functional Expectations

Level of Injury	Function
T1	Arms intact. Totally wheelchair independent. Kerbs. Back wheel balance. 
Mid para (e.g. T6)	Unassisted ventilation. Full UL function. Rolling. Lie-sit. Fully independent with all transfers. Advanced wheelchair skills. Limited ability to walk with orthoses/aid. Driving.
Low para (e.g. L2)	May walk with orthoses and aids.

Conclusion

- SCI can have significant physiological consequences.
- Early management is aimed at rehabilitation and prevention of secondary injury and complications.
- SCI patients have complex needs and therapies play a significant role in the holistic management of this patient group.
- Emphasis on:
  - Early MDT involvement
  - Early referrals and ongoing communication with SCIC
  - Early rehabilitation when appropriate

A Patient's Perspective

Any Questions?

Resources

- American Spinal Injuries Association http://www.asia-spinalinjury.org/
- Aspire http://www.aspire.org.uk/
- Multidisciplinary Association of Spinal Cord Injury Professionals http://www.mascip.co.uk/
- Respiratory Information for Spinal Cord Injury http://risci.org.uk/
- RFU Injured Players Foundation http://www.rfuipf.org.uk/
- Spinal Injuries Association https://www.spinal.co.uk/
- Elearn SCI http://www.elearnsci.org/

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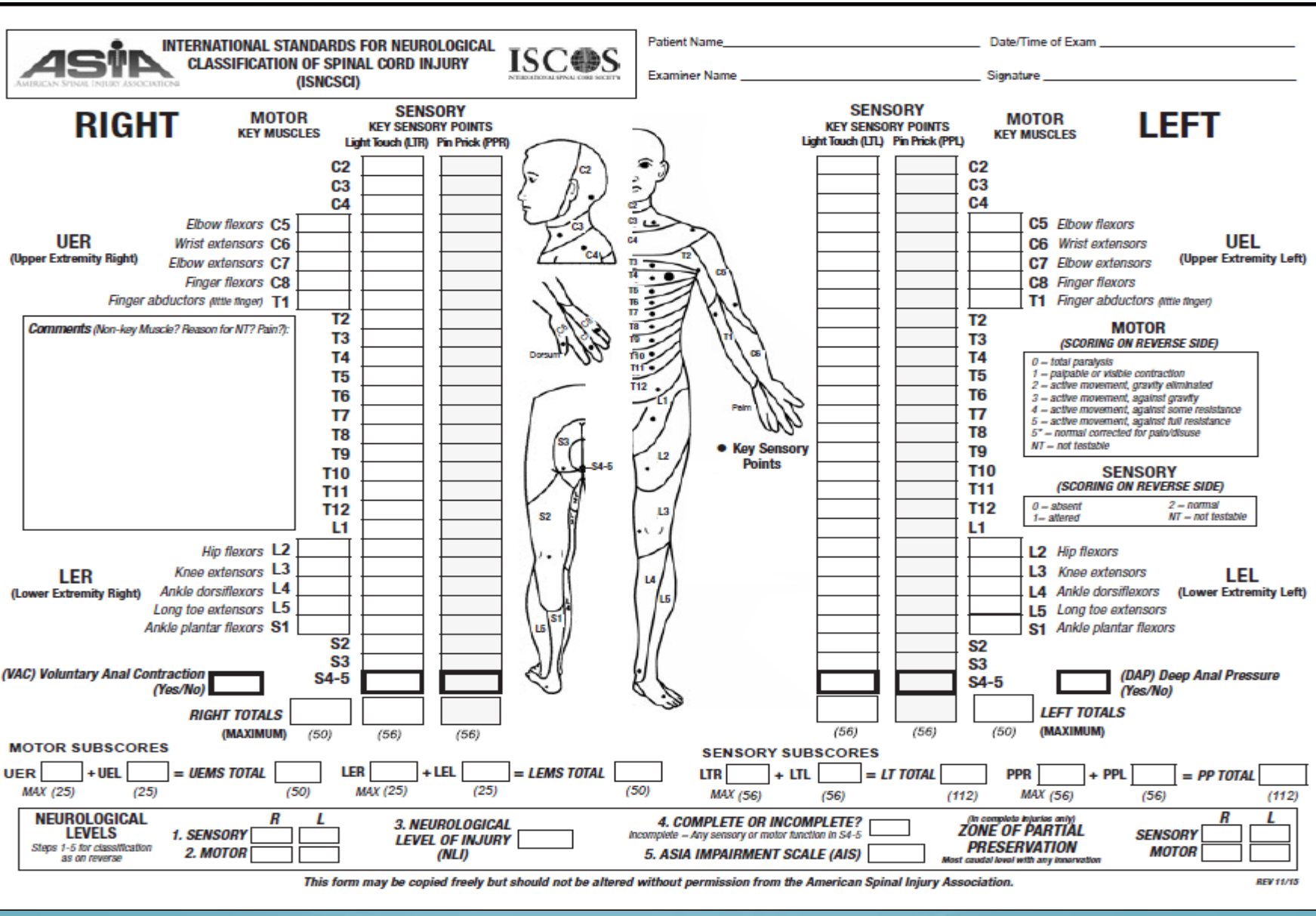
Appendix

Appendix a



INTERNATIONAL STANDARDS FOR NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY (ISNCSCI)

ASIA American Spinal Injury Association — ISCOS International Spinal Cord Society

Patient Name _____ Date/Time of Exam _____

Examiner Name _____ Signature _____

RIGHT

MOTOR KEY MUSCLES		SENSORY KEY SENSORY POINTS Light Touch (LTR)	Pin Prick (PPR)
	C2		
	C3		
	C4		
Elbow flexors	C5		
Wrist extensors	C6		
Elbow extensors	C7		
Finger flexors	C8		
Finger abductors (little finger)	T1		
	T2		
	T3		
	T4		
	T5		
	T6		
	T7		
	T8		
	T9		
	T10		
	T11		
	T12		
	L1		
Hip flexors	L2		
Knee extensors	L3		
Ankle dorsiflexors	L4		
Long toe extensors	L5		
Ankle plantar flexors	S1		
	S2		
	S3		
	S4-5		
RIGHT TOTALS (MAXIMUM)		(50)	(56) (56)

UER (Upper Extremity Right)

LER (Lower Extremity Right)

Comments (Non-key Muscle? Reason for NT? Pain?):

(VAC) Voluntary Anal Contraction (Yes/No) ☐

● Key Sensory Points

LEFT

SENSORY KEY SENSORY POINTS Light Touch (LTL)	Pin Prick (PPL)	MOTOR KEY MUSCLES	
		C2	
		C3	
		C4	
		C5	Elbow flexors
		C6	Wrist extensors
		C7	Elbow extensors
		C8	Finger flexors
		T1	Finger abductors (little finger)
		T2	
		T3	
		T4	
		T5	
		T6	
		T7	
		T8	
		T9	
		T10	
		T11	
		T12	
		L1	
		L2	Hip flexors
		L3	Knee extensors
		L4	Ankle dorsiflexors
		L5	Long toe extensors
		S1	Ankle plantar flexors
		S2	
		S3	
		S4-5	
(56)	(56)	(50)	LEFT TOTALS (MAXIMUM)

UEL (Upper Extremity Left)

LEL (Lower Extremity Left)

MOTOR (SCORING ON REVERSE SIDE)

0 – total paralysis
1 – palpable or visible contraction
2 – active movement, gravity eliminated
3 – active movement, against gravity
4 – active movement, against some resistance
5 – active movement, against full resistance
5* – normal corrected for pain/disuse
NT – not testable

SENSORY (SCORING ON REVERSE SIDE)

0 – absent
1 – altered
2 – normal
NT – not testable

☐ (DAP) Deep Anal Pressure (Yes/No)

MOTOR SUBSCORES

UER ☐ + UEL ☐ = UEMS TOTAL ☐ (MAX (25) (25) (50))

LER ☐ + LEL ☐ = LEMS TOTAL ☐ (MAX (25) (25) (50))

SENSORY SUBSCORES

LTR ☐ + LTL ☐ = LT TOTAL ☐ (MAX (56) (56) (112))

PPR ☐ + PPL ☐ = PP TOTAL ☐ (MAX (56) (56) (112))

NEUROLOGICAL LEVELS (Steps 1-5 for classification as on reverse)

	R	L
1. SENSORY		
2. MOTOR		

3. NEUROLOGICAL LEVEL OF INJURY (NLI) ☐

4. COMPLETE OR INCOMPLETE? ☐ (Incomplete – Any sensory or motor function in S4-5)

5. ASIA IMPAIRMENT SCALE (AIS) ☐

(In complete injuries only) **ZONE OF PARTIAL PRESERVATION** (Most caudal level with any innervation)

	R	L
SENSORY		
MOTOR		

REV 11/15

Appendix b

Severn Major Trauma Network

North Bristol NHS Trust

Spinal Cord Injury Care Pathway

(In collaboration with Duke of Cornwall Spinal Treatment Centre, Salisbury District Hospital)

Patient name:…… DOB:……Hospital Number:…… Address:…… …… (or Addressograph)	**Consultant Neurosurgeon/ Orthopaedic Surgeon/ Other responsible for SCI care:** …… *(Please complete the individual speciality clerking proforma for clinical details and attached this document on diagnosis of spinal cord injury, either traumatic or non-traumatic)*

Admission details:

Date of Injury: ……Time of Injury……

Mechanism of Injury: : Traumatic SCI: / Non-traumatic SCI :

Date:	Provisional/ Actual Spinal Injury Diagnosis

Spinal Injury Neurological Assessment Record :*complete ASIA Score using attached charts*

1st	Within 4hrs of admission by assessing Dr.	ASIA completed YES No	Reason not completed	Date	sign
2nd	Within 24hrs of admission	ASIA completed YES No	Reason not completed	Date	sign
3rd	Within 72hrs of admission	ASIA completed YES No	Reason not completed	Date	sign
4th	Further neurological changes	ASIA completed YES No	Reason not completed	Date	sign
5th	Further neurological changes	ASIA completed YES No	Reason not completed	Date	sign

(ASIA Score to be completed once diagnosis within 24 hours, 72 hours by competent Dr, physio, ANP plus following any clinical changes. If spinal surgery is undertaken the ASIA Chart must be carefully completed both pre and post-operatively. NB: this is however less reliable in the presence of spinal shock)

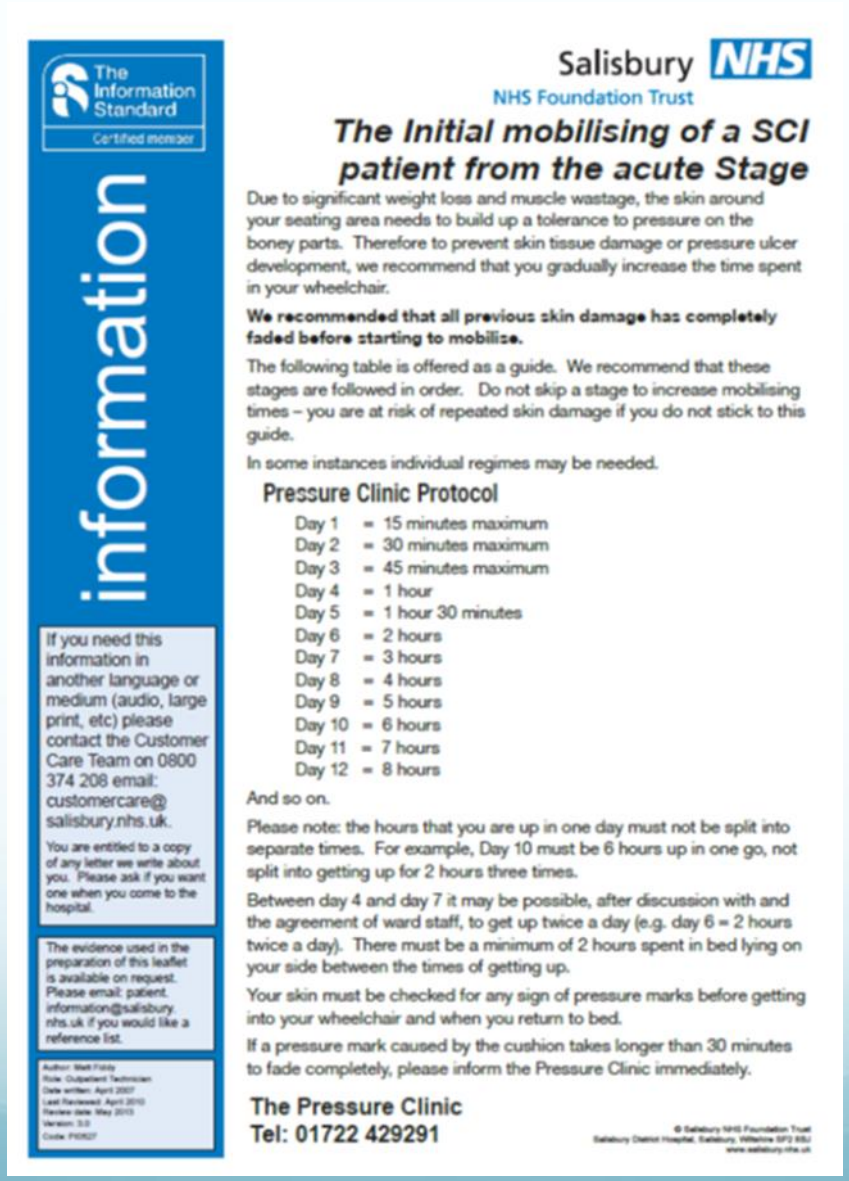
Current Management of Injury: *spine precautions/ orthotics/ patient handling*

1.Date	Logroll Y N Sit up Y N Full mobilisation Y N TLSO Y N JTO Y N Traction Y N Halo Y N Hard collar Y N	SPR/Dr SIGN	**2.**Date	Logroll Y N Sit up Y N Full mobilisation Y N TLSO Y N JTO Y N Traction Y N Halo Y N Hard collar Y N	SPR/Dr SIGN
3.Date	Logroll Y N Sit up Y N Full mobilisation Y N TLSO Y N JTO Y N Traction Y N Halo Y N Hard collar Y N	SPR/Dr SIGN	**4.** Date	Logroll Y N Sit up Y N Full mobilisation Y N TLSO Y N JTO Y N Traction Y N Halo Y N Hard collar Y N	SPR/Dr SIGN

Section 2. SCIC Outreach visits – visits by specialist spine practitioners

Date	Advice given	Sign

Appendix c



The Information Standard
Certified member

information

If you need this information in another language or medium (audio, large print, etc) please contact the Customer Care Team on 0800 374 208 email: customercare@salisbury.nhs.uk.

You are entitled to a copy of any letter we write about you. Please ask if you want one when you come to the hospital.

The evidence used in the preparation of this leaflet is available on request. Please email: patient.information@salisbury.nhs.uk if you would like a reference list.

Author: Matt Fiddy
Role: Outpatient Technician
Date written: April 2007
Last Reviewed: April 2010
Review date: May 2013
Version: 3.0
Code: PI0827

Salisbury NHS
NHS Foundation Trust

The Initial mobilising of a SCI patient from the acute Stage

Due to significant weight loss and muscle wastage, the skin around your seating area needs to build up a tolerance to pressure on the boney parts. Therefore to prevent skin tissue damage or pressure ulcer development, we recommend that you gradually increase the time spent in your wheelchair.

We recommended that all previous skin damage has completely faded before starting to mobilize.

The following table is offered as a guide. We recommend that these stages are followed in order. Do not skip a stage to increase mobilising times – you are at risk of repeated skin damage if you do not stick to this guide.

In some instances individual regimes may be needed.

Pressure Clinic Protocol

Day 1 = 15 minutes maximum
Day 2 = 30 minutes maximum
Day 3 = 45 minutes maximum
Day 4 = 1 hour
Day 5 = 1 hour 30 minutes
Day 6 = 2 hours
Day 7 = 3 hours
Day 8 = 4 hours
Day 9 = 5 hours
Day 10 = 6 hours
Day 11 = 7 hours
Day 12 = 8 hours

And so on.

Please note: the hours that you are up in one day must not be split into separate times. For example, Day 10 must be 6 hours up in one go, not split into getting up for 2 hours three times.

Between day 4 and day 7 it may be possible, after discussion with and the agreement of ward staff, to get up twice a day (e.g. day 6 = 2 hours twice a day). There must be a minimum of 2 hours spent in bed lying on your side between the times of getting up.

Your skin must be checked for any sign of pressure marks before getting into your wheelchair and when you return to bed.

If a pressure mark caused by the cushion takes longer than 30 minutes to fade completely, please inform the Pressure Clinic immediately.

The Pressure Clinic
Tel: 01722 429291