

## **TRAINING CASES FOR THE INTERNATIONAL SPINAL CORD INJURY MUSCULOSKELETAL BASIC DATA SET**

The 5 cases included were prepared by Fin Biering-Sørensen, Anthony S. Burns, Lisa A. Harvey, and M.J. Mulcahey. The cases were reviewed and adjusted for inconsistencies by the whole working group for the International Spinal Cord Injury Musculoskeletal Basic Data Set, i.e. apart from the above Armin Curt, Patricia W. Nance, Arthur M. Sherwood, and Sue Ann Sisto.

If the readers find specific issues which should be clarified or anything else with respect to the International Spinal Cord Injury Musculoskeletal Basic Data Set, which may be improved, please inform the working group for the International Spinal Cord Injury Musculoskeletal Basic Data Set.

Contact: Fin Biering-Sørensen, e-mail: [finbs@rh.dk](mailto:finbs@rh.dk)

---

### **Training case number 1 for the INTERNATIONAL SPINAL CORD INJURY MUSCULOSKELETAL BASIC DATA SET**

This 60 year old man had his spinal cord injury (SCI) 19 years ago when he fell 3 meters from a roof. He had an L1 burst fracture with a spinal cord compression, which was surgically decompressed and stabilized. This injury left him with an L2 American Spinal Injury Association Impairment Scale grade D SCI.

Before the SCI he only suffered from slight hypertension, but has otherwise never been hospitalized or otherwise ill apart from minor problems like everyday small accidents, flue etc.

After his initial rehabilitation he was able to walk with two elbow crutches. For emptying of his flaccid bladder he used intermittent self-catheterization, and he used transanal colonic irrigation for bowel management. He never experienced spasticity, but once (April 19, 2007) he fell and fractured his left forearm, which was treated successfully at previous visit to the clinic.

He lived independently in his own house, but because his bathroom was on the second floor he had to climb the stairs several times every day, which over the years has given him increasing knee pain. This in particular has become a significant problem, and he may have to move to another home. For this reason he has asked for a consultation at the SCI-centre on March 22, 2012.

**INTERNATIONAL SPINAL CORD INJURY MUSCULOSKELETAL BASIC DATA SET  
FORM for Case number 1 (Version 1.0)**

**Date performed:** 2012/03/22

**Neuro-Musculoskeletal history before spinal cord lesion (collected once):**

Pre-existing congenital deformities of the spine and spinal cord

If yes, specify Diagnosis and Location \_\_\_\_\_

If previous surgery due to this, description \_\_\_\_\_

Date of surgery YYYYMMDD  Unknown

Pre-existing degenerative spine disorders

If yes, specify Diagnosis and Location \_\_\_\_\_

If previous surgery due to this, description \_\_\_\_\_

Date of surgery YYYYMMDD  Unknown

Pre-existing systemic neuro-degenerative disorders

If yes, specify Diagnosis and Location \_\_\_\_\_

If previous surgery due to this, description \_\_\_\_\_

Date of surgery YYYYMMDD  Unknown

Presence of spasticity / spasms

No  Yes

Treatment for spasticity / spasms within the last four weeks?

No  Yes

Fractures, heterotopic ossifications, contractures, or degenerative changes/overuse:

	Fractures since spinal cord lesion (only those not documented previously)				Heterotopic ossification		Contracture		Degenerative changes / Overuse	
	Right	Left	Date of fracture YYYY/ MM/DD	Fragility fracture	Right	Left	Right	Left	Right	Left
Neck / Cervical spine										
Shoulder/ Humerus										
Elbow										
Forearm										
Wrist										
Hand										
Upper back / Thoracic spine										
Lower back / Lumbar spine										
Pelvis										
Hip / Femur										
Knee									X	X
Tibia / fibula										
Ankle										
Foot										

Method used to document heterotopic ossification, if present:

- X-ray    CT-scan    Triple phase bone scan    Other method, specify \_\_\_\_\_

Scoliosis

No    Yes

If scoliosis is present, method of assessment (check all that apply)

- Observation in sitting    Observation in standing  
 Plain radiographs in sitting    Plain radiographs in standing

If scoliosis is present,

Surgically treated?  If Yes: Date of surgery YYYYMMDD    Unknown

Other musculoskeletal problems; specify \_\_\_\_\_

**Do any of the above musculoskeletal challenges interfere with your activities of daily living (transfers, walking, dressing, showers, etc.)?**

No – not at all    Yes, a little    Yes, a lot

## **Training case number 2 for the INTERNATIONAL SPINAL CORD INJURY MUSCULOSKELETAL BASIC DATA SET**

Date: 10<sup>th</sup> November, 2011

Mr. Herbert is a 68 year old gentleman who sustained a motor incomplete C4 injury 3 years ago from a trivial fall at home. He has a central cord syndrome with C4 motor and sensory levels on the right and C5 motor and sensory levels on the left. His upper limb total motor score is 6/50 and his lower limb total motor score is 40/50 according to the International Standards for the Neurological Classification of Spinal Cord Injury (ISNCSCI). He can walk in a limited way around the home with a forearm support frame and moderate amount of assistance from one person; however, his primary means of mobility is a power wheelchair with a joystick control and he has very little upper extremity function. He requires maximal assistance to complete all self-care and activities of daily living. He has presented at an outpatient clinic for a general review accompanied by his wife.

Mr. Herbert is cheerful but appears older than his chronological age. He has major problems with spasticity and has obvious contractures in his hands and ankles. After reading Mr Herbert's medical notes and speaking to him and his wife, you learn that Mr. Herbert has no history of congenital malformation of the spine or prior neuro-degenerative disorders although after his injury he was found to have severe cervical canal stenosis secondary to spondylosis of the spine. You also notice that he has an obvious kyphosis but it is not clear whether he also has scoliosis. Mr. Herbert has been reasonably healthy since his SCI with no history of fractures or other SCI-related degenerative neuromuscular conditions. He has clearly not been sufficiently active to suffer from overuse injuries. He is currently taking a number of different medications including Baclofen to manage his spasticity. Mr. Herbert tells you that his spasticity is a major problem and if this could be better controlled, he might be able to walk more about the home and perform standing transfers on and off the toilet.

On physical examination you note that he has clear loss of passive range of motion in his shoulders, elbows, wrists, hands, hips, ankles and feet including flexion contractures of the interphalangeal joints of the fingers. The contractures of his fingers are preventing an effective tenodesis grip. The only joints that appear to have near full range of motion are his knees. His spasticity is very severe making it difficult to clearly distinguish between contracture and spasticity. The loss of range in his left elbow is particularly pronounced and makes you wonder about the possibility of past heterotopic ossification. Mr Herbert knows nothing about this and there is no indication of heterotopic ossification in his notes. There is no palpable ossification around the left elbow or in the biceps. Instead his left elbow contracture appears to be primarily due to soft tissue changes in his biceps consistent with sitting and lying for prolonged periods of time with his elbow flexed. This is also consistent with his pattern of tetraparesis.

You examine Mr. Herbert's back for scoliosis while he is seated but decide that while there might be a very mild scoliosis this is probably age related. While examining his back you notice a marked pelvic anterior tilt interfering with his seated posture. You decide that this is probably related to the bilateral hip flexion contractures you previously noted.

**INTERNATIONAL SPINAL CORD INJURY MUSCULOSKELETAL BASIC DATA SET  
FORM for Case number 2 (Version 1.0)**

**Date performed:** 2011/11/10

**Neuro-Musculoskeletal history before spinal cord lesion (collected once):**

Pre-existing congenital deformities of the spine and spinal cord

If yes, specify Diagnosis and Location\_\_\_\_\_

If previous surgery due to this, description\_\_\_\_\_

Date of surgery YYYYMMDD  Unknown

Pre-existing degenerative spine disorders

If yes, specify Diagnosis and Location\_\_ canal stenosis in the cervical spine

If previous surgery due to this, description\_\_\_\_\_

Date of surgery YYYYMMDD  Unknown

Pre-existing systemic neuro-degenerative disorders

If yes, specify Diagnosis and Location\_\_\_\_\_

If previous surgery due to this, description\_\_\_\_\_

Date of surgery YYYYMMDD  Unknown

**Presence of spasticity / spasms**

No  Yes

Treatment for spasticity / spasms within the last four weeks?

No  Yes

**Fractures, heterotopic ossifications, contractures, or degenerative changes/overuse:**

	Fractures since spinal cord lesion (only those not documented previously)				Heterotopic ossification		Contracture		Degenerative changes / Overuse	
	Right	Left	Date of fracture YYYY/ MM/DD	Fragility fracture	Right	Left	Right	Left	Right	Left
Neck / Cervical spine									X	X
Shoulder/ Humerus							X	X		
Elbow							X	X		
Forearm										
Wrist							X	X		
Hand							X	X		
Upper back / Thoracic spine										
Lower back / Lumbar spine										
Pelvis										
Hip / Femur							X	X		
Knee										
Tibia / fibula										
Ankle							X	X		
Foot										

Method used to document heterotopic ossification, if present:

- X-ray    CT-scan    Triple phase bone scan    Other method, specify \_\_\_\_\_

**Scoliosis**

No    Yes

If scoliosis is present, method of assessment (check all that apply)

- Observation in sitting    Observation in standing  
 Plain radiographs in sitting    Plain radiographs in standing

If scoliosis is present,

Surgically treated?    If Yes: Date of surgery YYYYMMDD    Unknown

**Other musculoskeletal problems; specify** \_\_\_\_\_

**Do any of the above musculoskeletal challenges interfere with your activities of daily living (transfers, walking, dressing, showers, etc.)?**

- No – not at all    Yes, a little    Yes, a lot

**Training case number 3 for the  
INTERNATIONAL SPINAL CORD INJURY MUSCULOSKELETAL BASIC DATA SET**

January 15, 2012

Gerry is a 28 year old young man who has a C5 level spinal cord injury that he sustained 18 years ago when he was 10 years old in a motor vehicle crash. Using the International Standards for the Neurological Classification of Spinal Cord Injury (ISNCSCI), his upper limb total motor score is a 10; his lower limb total motor score is a 0 and; his total sensory score is a 32. He is classified as having a complete (A) injury, based on the American Spinal Injury Association Impairment Scale (AIS). Gerry's pre-injury history indicates a typically developing youth without any significant medical problems with the exception of episodic ear infections as an infant and one wrist fracture as a result of playing a game of back-yard football. His post-injury musculoskeletal medical history is significant for progressive neuromuscular scoliosis that was surgically treated via a posterior spinal fusion and instrumentation at the age of 17 (June 28, 2001) and, hip flexion and adduction contractures that were surgically released at 12 years of age but have since reoccurred. He denies having any neck and upper extremity pain despite well-documented shoulder abduction and forward flexion range limitations and elbow-forearm flexion-supination contractures. His spasticity has been well-managed pharmacologically, with a combination of Baclofen and Tizanidine which he continues to date. He has a history of three fragility fractures, one each at 14, 20 and 22 years of age. He denies any active problems with his skin. He presents today in his power chair with his mother, who is his primary caregiver, for complaints associated with left lower extremity swelling and increase spasticity of the lower extremities starting five days ago. The associated increase in spasticity is making it difficult for his carers to dress him in the mornings.

Upon examination of his lower extremities, there appears to be slight dependent edema on the right and significant swelling on the left; the skin on the left also appears slightly red and shiny. Gerry denies any pain but reports an increase in spasticity in his legs over the last five days and a low grade fever. He does not recall any trauma to his lower extremities. Because of his history of fragility fractures, a plain radiograph was ordered and confirmed a fracture of the left distal tibia. The leg was immobilized in a well-padded posterior splint and a prescription for valium was written to address the increased spasticity. The plan of care was follow-up in four weeks.

**INTERNATIONAL SPINAL CORD INJURY MUSCULOSKELETAL BASIC DATA SET  
FORM for Case number 3 (Version 1.0)**

**Date performed:** 2012/01/15

**Neuro-Musculoskeletal history before spinal cord lesion (collected once):**

Pre-existing congenital deformities of the spine and spinal cord

If yes, specify Diagnosis and Location \_\_\_\_\_

If previous surgery due to this, description \_\_\_\_\_

Date of surgery YYYYMMDD  Unknown

Pre-existing degenerative spine disorders

If yes, specify Diagnosis and Location \_\_\_\_\_

If previous surgery due to this, description \_\_\_\_\_

Date of surgery YYYYMMDD  Unknown

Pre-existing systemic neuro-degenerative disorders

If yes, specify Diagnosis and Location \_\_\_\_\_

If previous surgery due to this, description \_\_\_\_\_

Date of surgery YYYYMMDD  Unknown

Presence of spasticity / spasms

No  Yes

Treatment for spasticity / spasms within the last four weeks?

No  Yes

Fractures, heterotopic ossifications, contractures, or degenerative changes/overuse:

	Fractures since spinal cord lesion (only those not documented previously)				Heterotopic ossification		Contracture		Degenerative changes / Overuse	
	Right	Left	Date of fracture YYYY/ MM/DD	Fragility fracture	Right	Left	Right	Left	Right	Left
Neck / Cervical spine										
Shoulder/ Humerus							X	X		
Elbow							X	X		
Forearm										
Wrist										
Hand										
Upper back / Thoracic spine										
Lower back / Lumbar spine										
Pelvis										
Hip / Femur							X	X		
Knee										
Tibia / fibula		X	2012/01/10	X						
Ankle										
Foot										

Method used to document heterotopic ossification, if present:

X-ray    CT-scan    Triple phase bone scan    Other method, specify\_\_\_\_\_

Scoliosis

No    Yes

If scoliosis is present, method of assessment (check all that apply)

Observation in sitting    Observation in standing

Plain radiographs in sitting    Plain radiographs in standing

If scoliosis is present,

Surgically treated?  If Yes: Date of surgery 2001/06/28    Unknown

Other musculoskeletal problems; specify\_\_\_\_\_

**Do any of the above musculoskeletal challenges interfere with your activities of daily living (transfers, walking, dressing, showers, etc.)?**

No – not at all    Yes, a little    Yes, a lot

**Training case number 4 for the  
INTERNATIONAL SPINAL CORD INJURY MUSCULOSKELETAL BASIC DATA SET**

This 55 years old woman sustained her spinal cord injury (SCI) due to a gunshot wound 25 years ago, during attempted robbery. She has T10 incomplete SCI, American Spinal Injury Association Impairment Scale grade C. Since her primary rehabilitation she has used a manual wheelchair for mobility, intermittent self-catheterization for bladder management, and she can evacuate her bowel using stool softener together with digital stimulation.

Pre-SCI she was healthy apart from slight sequel in the right leg from poliomyelitis during her early childhood, i.e. she did limp a little pre-injury due to a slightly reduced motor strength around her right hip.

During the initial rehabilitation period she developed heterotopic ossification around her left hip, verified by CT-scan as well as triple phase bone scan. Even after surgery it left her with decreased mobility and some difficulty with transferring, in particular into her car. She has some spasticity and spasms when moving around and crossing curbs, but she does not need to take spasmolytics. In addition, she has had a couple of fragility fractures in the past, including of the right femur (March 8, 1999) and the left tibia (August 23, 2005).

She has not been to the clinic for 15 years when she came for a follow-up visit January 25, 2012. She came in particular because of bilateral shoulder pain, which was related to her wheelchair use and transferring activities. The examination revealed a painful arch on shoulder abduction bilaterally from 80-100 degrees which was associated with restricted range of motion. A program was set up to try to minimize her exposure to repetitive and strenuous activities of the upper limbs. The examination also showed increasing development of ankle contractures.

**INTERNATIONAL SPINAL CORD INJURY MUSCULOSKELETAL BASIC DATA SET  
FORM for Case number 4 (Version 1.0)**

**Date performed:** 2012/01/25

**Neuro-Musculoskeletal history before spinal cord lesion (collected once):**

Pre-existing congenital deformities of the spine and spinal cord

If yes, specify Diagnosis and Location\_\_\_\_\_

If previous surgery due to this, description\_\_\_\_\_

Date of surgery YYYYMMDD  Unknown

Pre-existing degenerative spine disorders

If yes, specify Diagnosis and Location\_\_\_\_\_

If previous surgery due to this, description\_\_\_\_\_

Date of surgery YYYYMMDD  Unknown

Pre-existing systemic neuro-degenerative disorders

If yes, specify Diagnosis and Location\_ Poliomyelitis sequel around right hip\_\_\_\_\_

If previous surgery due to this, description\_\_\_\_\_

Date of surgery YYYYMMDD  Unknown

Presence of spasticity / spasms

No  Yes

Treatment for spasticity / spasms within the last four weeks?

No  Yes

Fractures, heterotopic ossifications, contractures, or degenerative changes/overuse:

	Fractures since spinal cord lesion (only those not documented previously)				Heterotopic ossification		Contracture		Degenerative changes / Overuse	
	Right	Left	Date of fracture YYYY/ MM/DD	Fragility fracture	Right	Left	Right	Left	Right	Left
Neck / Cervical spine										
Shoulder/ Humerus									X	X
Elbow										
Forearm										
Wrist										
Hand										
Upper back / Thoracic spine										
Lower back / Lumbar spine										
Pelvis										
Hip / Femur	X		1999/03/08	X		X				
Knee										
Tibia / fibula		X	2005/08/23	X						
Ankle							X	X		
Foot										

Method used to document heterotopic ossification, if present:

X-ray  CT-scan  Triple phase bone scan  Other method, specify \_\_\_\_\_

Scoliosis

No  Yes

If scoliosis is present, method of assessment (check all that apply)

Observation in sitting  Observation in standing

Plain radiographs in sitting  Plain radiographs in standing

If scoliosis is present,

Surgically treated?  If Yes: Date of surgery YYYYMMDD  Unknown

Other musculoskeletal problems; specify \_\_\_\_\_

**Do any of the above musculoskeletal challenges interfere with your activities of daily living (transfers, walking, dressing, showers, etc.)?**

No – not at all  Yes, a little  Yes, a lot

**Training case number 5**  
**INTERNATIONAL SPINAL CORD INJURY MUSCULOSKELETAL BASIC DATA SET**

David Franklin is a 51 year old male who sustained a cervical spinal cord injury (SCI) 16 years ago while skiing. Imaging studies following the injury revealed Klippel-Feil Type II syndrome characterized by congenital fusion of the C4 and C5 vertebrae. Prior to his SCI, he was asymptomatic and unaware of this condition. His injury level according to the International Standards for the Neurological Classification of Spinal Cord Injury is C5 sensory C7 motor, with an American Spinal Injury Association Impairment Scale (AIS) grade C.

In the past, David had severe spasticity of the lower limbs which complicated positioning in his wheelchair and transferring. His spasticity has been well controlled since surgical implantation of an intrathecal baclofen pump 10 year ago. With this therapy, he no longer considers spasticity to be a significant issue. David has good strength in the triceps and can transfer independently using a sliding board. He propels a manual wheelchair in the home and utilizes a motorized wheelchair, with a right joystick control, for community mobility. Prior bone density studies have revealed secondary sublesional osteoporosis and approximately 11 years ago he sustained a left distal femur fracture due to a fall precipitated by a severe truncal spasm while transferring. This required open reduction and internal fixation. He is currently on oral biphosphonate therapy with alendronate 70mg weekly.

David has recently developed progressive left shoulder pain aggravated by transfers and wheelchair propulsion. He has maintained his independence for these activities, although it has become more difficult and painful. On exam, he had normal motor strength of the rotator cuff muscles bilaterally. Active and passive range of motion was normal bilaterally at the shoulders. There was significant tenderness with palpation of the left subacromial space and there was significant pain when he actively abducted his left arm over his head; which was exacerbated with resistance. There were no significant contractures noted in the upper or lower limbs. Inspection of his spine did not reveal scoliosis. Ultrasound on April 17, 2012 confirmed the presence of a left rotator cuff tendonopathy and prominent subacromial spur. He returns today, April 20, 2012, for a steroid injection of the left subacromial bursa and initiation of physiotherapy.

**INTERNATIONAL SPINAL CORD INJURY MUSCULOSKELETAL BASIC DATA SET  
FORM for Case number 5 (Version 1.0)**

**Date performed:** 2012/04/20

**Neuro-Musculoskeletal history before spinal cord lesion (collected once):**

**X** Pre-existing congenital deformities of the spine and spinal cord

If yes, specify Diagnosis and Location: Klippel-Feil Type II syndrome with congenital fusion of C4 and C5

If previous surgery due to this, description \_\_\_\_\_

Date of surgery YYYYMMDD  Unknown

Pre-existing degenerative spine disorders

If yes, specify Diagnosis and Location \_\_\_\_\_

If previous surgery due to this, description \_\_\_\_\_

Date of surgery YYYYMMDD  Unknown

Pre-existing systemic neuro-degenerative disorders

If yes, specify Diagnosis and Location \_\_\_\_\_

If previous surgery due to this, description \_\_\_\_\_

Date of surgery YYYYMMDD  Unknown

**Presence of spasticity / spasms**

**X** No  Yes

Treatment for spasticity / spasms within the last four weeks?

**X** No  Yes

**Fractures, heterotopic ossifications, contractures, or degenerative changes/overuse:**

	Fractures since spinal cord lesion (only those not documented previously)				Heterotopic ossification		Contracture		Degenerative changes / Overuse	
	Right	Left	Date of fracture YYYY/ MM/DD	Fragility fracture	Right	Left	Right	Left	Right	Left
Neck / Cervical spine										
Shoulder/ Humerus										X
Elbow										
Forearm										
Wrist										
Hand										
Upper back / Thoracic spine										
Lower back / Lumbar spine										
Pelvis										
Hip / Femur										
Knee										
Tibia / fibula										
Ankle										
Foot										

Method used to document heterotopic ossification, if present:

- X-ray    CT-scan    Triple phase bone scan    Other method, specify\_\_\_\_\_

**Scoliosis**

No    Yes

If scoliosis is present, method of assessment (check all that apply)

- Observation in sitting    Observation in standing  
 Plain radiographs in sitting    Plain radiographs in standing

If scoliosis is present,

Surgically treated?    If Yes: Date of surgery YYYYMMDD    Unknown

**Other musculoskeletal problems; specify\_\_\_\_\_**

**Do any of the above musculoskeletal challenges interfere with your activities of daily living (transfers, walking, dressing, showers, etc.)?**

- No – not at all    Yes, a little    Yes, a lot