The International Standards for Neurological Classification of Spinal Cord Injury: Classification Workbook

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INTRODUCTION

The International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) is the most widely accepted system for characterizing sensorimotor impairments after spinal cord injury (SCI). Since its inception in 1982[1], there have been a number of ISNCSCI revisions, with the newest edition published in 2019[2]. The ISNCSCI is maintained by the International Standards Committee of the American Spinal Injury Association (ASIA). Accurate classification is essential as the ISNCSCI is used to monitor changes in sensory and motor function over time, establish realistic rehabilitation goals and effective therapy programs, determine clinical trial eligibility, and predict the probability for neurological recovery.

Inherent challenges and common mistakes in ISNCSCI classification have been described[3,4]. Compared to neurological complete injuries, incomplete lesions tend to be more difficult to classify[5,6], and classification components associated with the highest error rates include motor levels, ASIA Impairment Scale (AIS) grade, and zones of partial preservation (ZPPs)[5,7-10].

In this workbook, we present 26 practice cases, each with explanations for the correct classifications. These cases reinforce important ISNCSCI rules and definitions. Potentially challenging concepts from the 2019 ISNCSCI update, including revised definitions of the ZPPs and documentation of non-SCI conditions, are also reviewed.

Below is a summary of the two major changes made in the 2019 revision[2,11-13].

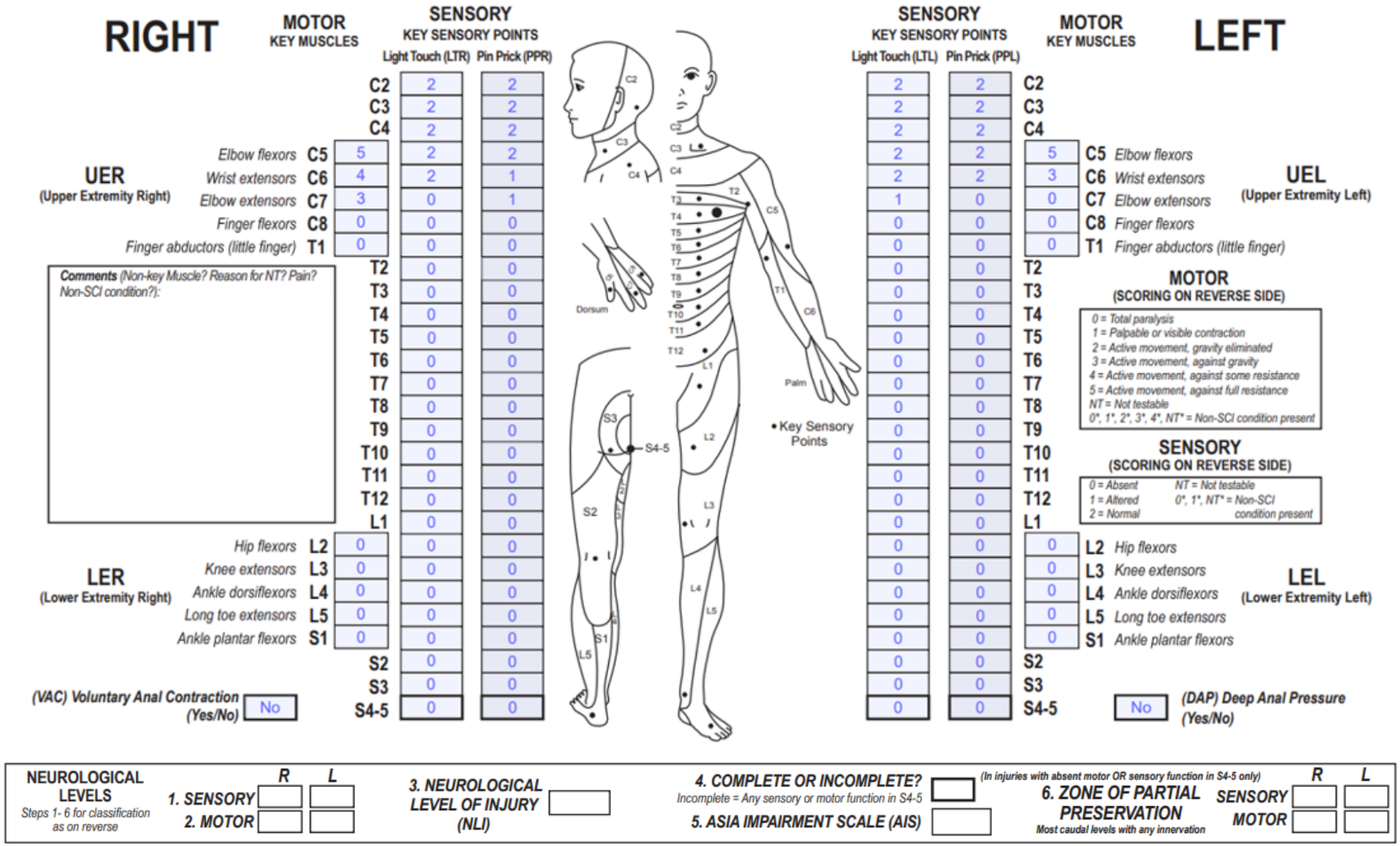
1. *ZPPs:* In injuries without sensory and/or motor sacral sparing, the sensory and/or motor ZPPs represent the most caudal dermatome and/or myotome on each side with partially preserved functions. Prior to 2019, the ZPPs were only applicable in complete (AIS A) injuries, which have absent sensory *and* motor functions in the lowest sacral segments. The new ZPP rule states that a sensory ZPP is applicable in all injuries without sensory function in the lowest sacral segments. A sensory ZPP is not applicable (NA) if there is preservation of deep anal pressure (DAP), pin prick (PP) or light touch (LT) sensation in the S4-5 dermatome. The sensory ZPPs are determined independently for each side, and it is possible to have a sensory ZPP unilaterally (e.g., in an injury with absent DAP sensation, but with preservation of S4-5 PP/LT sensation on only one side). Additionally, bilateral motor ZPPs are applicable in all injuries with absent voluntary anal contraction (VAC)[2,11,12].
2. *Non-SCI conditions:* If sensorimotor functions are thought to be impacted by a non-SCI condition (i.e., pain, fracture, burn, peripheral nerve injury, etc.), the examiner should record the actual examined scores and tag them with an "*". The non-SCI condition is then documented in the comments box with the recommendation for how the "*"-tagged scores should be treated during classification. This includes whether they are considered normal (typically rostral to the neurological level of injury (NLI)) or abnormal (in most cases at or caudal to the NLI) for classification. Note that only impaired sensory and motor scores are "*"-tagged (there is no 2* for the sensory exam or 5* for the motor exam). The presence of "*"-tagged scores may influence the classification of levels, completeness, AIS grade, and ZPPs. If the classification of any of these variables is based on a clinical assumption, the classification component should be tagged with an "*". More detailed explanations of the rules for the documentation of non-SCI related impairments can be found in previous publications[2,11-13].

Many of the cases below were compiled to address specific questions received after ISNCSCI trainings, webinars, "Ask the Expert" calls, etc. All cases were reviewed by the International Standards Committee. If any discrepancies were identified, they were discussed by members of the committee until a consensus was reached. To confirm agreement, cases were also entered into online algorithms[14,15], which are compliant with the 2019 ISNCSCI revision.

This ISNCSCI workbook, along with the International Standards Training E Program (InSTeP)[16], can serve as a valuable training tool to improve classification accuracy. The International Standards Committee recognizes the importance of continued education and open access resources to enhance the consistency for which the 2019 changes are incorporated into everyday practice and to ensure successful utilization of this refined classification system.

CASES

Case 1


RIGHT
MOTOR
KEY MUSCLES
SENSORY
KEY SENSORY POINTS
Light Touch (LTR)
Pin Prick (PPR)
UER
(Upper Extremity Right)
Elbow flexors C5 5
Wrist extensors C6 4
Elbow extensors C7 3
Finger flexors C8 0
Finger abductors (little finger) T1 0
Comments (Non-key Muscle? Reason for NT? Pain? Non-SCI condition?):
LER
(Lower Extremity Right)
Hip flexors L2 0
Knee extensors L3 0
Ankle dorsiflexors L4 0
Long toe extensors L5 0
Ankle plantar flexors S1 0
(VAC) Voluntary Anal Contraction (Yes/No) No
C2 2 2
C3 2 2
C4 2 2
C5 2 2
C6 2 1
C7 0 1
C8 0 0
T1 0 0
T2 0 0
T3 0 0
T4 0 0
T5 0 0
T6 0 0
T7 0 0
T8 0 0
T9 0 0
T10 0 0
T11 0 0
T12 0 0
L1 0 0
L2 0 0
L3 0 0
L4 0 0
L5 0 0
S1 0 0
S2 0 0
S3 0 0
S4-5 0 0
Dorsum
Palm
• Key Sensory Points
SENSORY
KEY SENSORY POINTS
Light Touch (LTL)
Pin Prick (PPL)
MOTOR
KEY MUSCLES
LEFT
2 2 C2
2 2 C3
2 2 C4
2 2 C5 5 Elbow flexors
2 2 C6 3 Wrist extensors
1 0 C7 0 Elbow extensors
0 0 C8 0 Finger flexors
0 0 T1 0 Finger abductors (little finger)
UEL
(Upper Extremity Left)
0 0 T2
0 0 T3
0 0 T4
0 0 T5
0 0 T6
0 0 T7
0 0 T8
0 0 T9
0 0 T10
0 0 T11
0 0 T12
0 0 L1
0 0 L2 Hip flexors
0 0 L3 Knee extensors
0 0 L4 Ankle dorsiflexors
0 0 L5 Long toe extensors
0 0 S1 Ankle plantar flexors
LEL
(Lower Extremity Left)
0 0 S2
0 0 S3
0 0 S4-5
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
NT = Not testable
0*, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present
SENSORY
(SCORING ON REVERSE SIDE)
0 = Absent
1 = Altered
2 = Normal
NT = Not testable
0*, 1*, NT* = Non-SCI condition present
No (DAP) Deep Anal Pressure (Yes/No)
NEUROLOGICAL LEVELS
Steps 1- 6 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 injuries with absent motor OR sensory function in S4-5 only)
6. ZONE OF PARTIAL PRESERVATION
Most caudal levels with any innervation
SENSORY
MOTOR

ANSWER

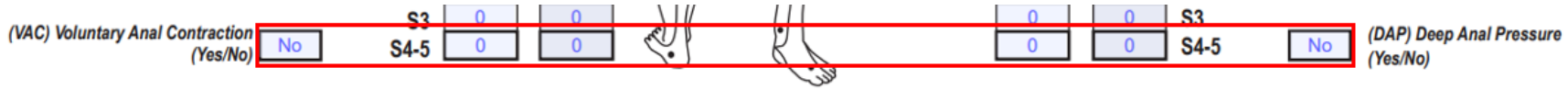
Case 1

Sensory levels: The right sensory level is C5, and the left sensory level is C6 as sensory function is intact from C2 through these dermatomes on the respective sides.

Motor levels: The motor level is C6 bilaterally as this is the most caudal key muscle on each side with a motor score ≥3, and all motor function above this level is presumed to be intact. Even though the right C7 myotome has a motor score of 3, right C6 motor function is impaired (4/5), so C7 does not satisfy the motor level criteria (all motor function rostral to the motor level must be intact).

NLI: The NLI is C5 as this is the most caudal level with intact sensory function and at least antigravity strength (≥3/5), and all sensorimotor function above this level is intact. More simply stated, C5 is the most rostral of the sensory and motor levels.

Completeness: There is no sensory or motor sparing in the lowest sacral segments because DAP sensation, bilateral S4-5 LT/PP sensation, and VAC are absent. This is therefore a complete injury, as indicated by the "N0000N" sign.

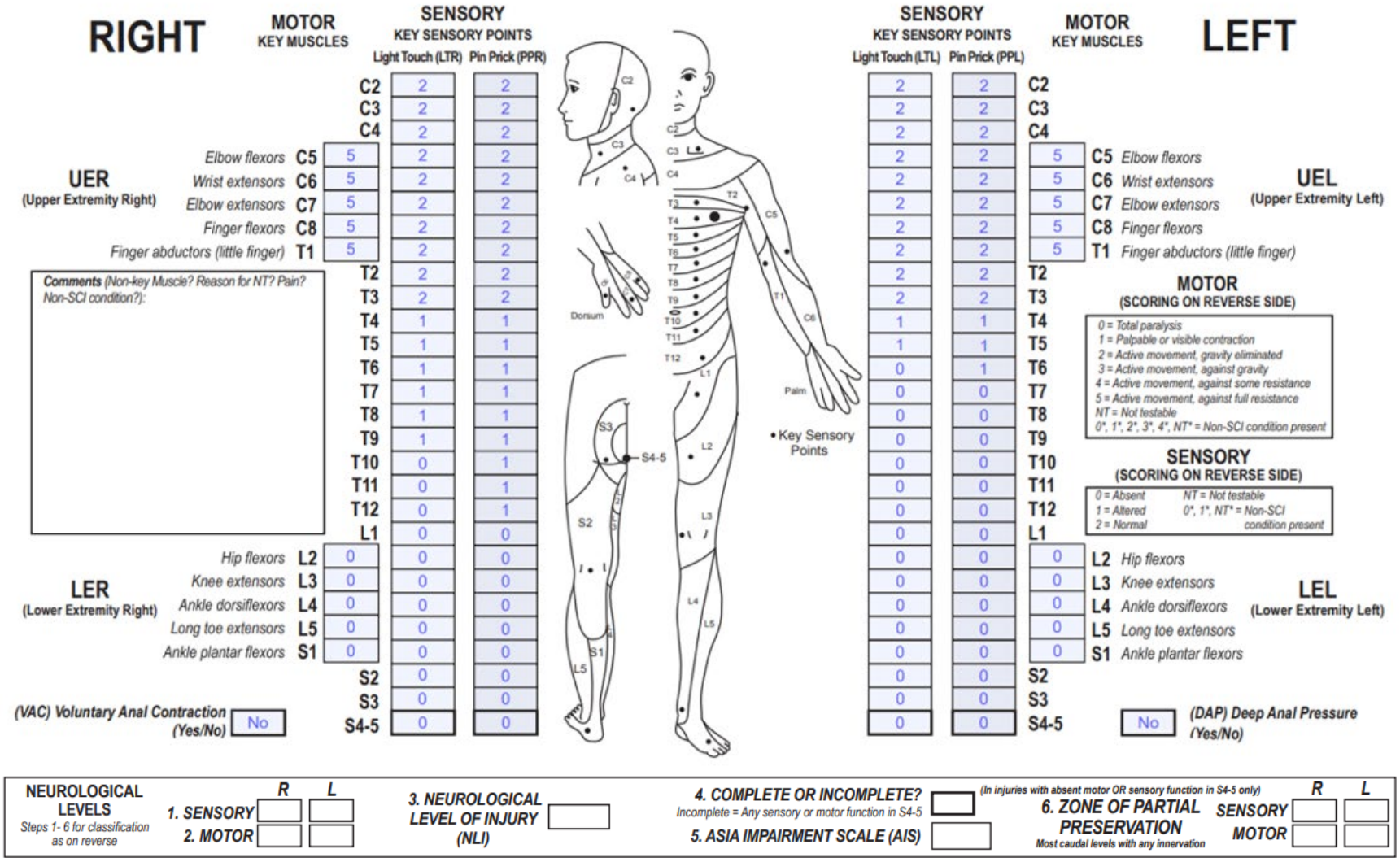


AIS: The AIS grade is A because this is a complete injury.

Sensory ZPPs: There is no sensory function preserved in the S4-5 dermatome on either side and no DAP sensation. Therefore, the sensory ZPPs are applicable and are C7 bilaterally as this is the most caudal segment on each side with any preserved sensory function.

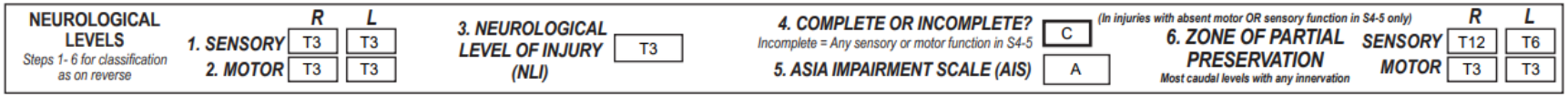
Motor ZPPs: The motor ZPP is applicable bilaterally because VAC is absent. The motor ZPP is C7 on the right and C6 on the left, as these are the most caudal myotomes on the respective sides with any preserved motor function.

Case 2


RIGHT
MOTOR
KEY MUSCLES
SENSORY
KEY SENSORY POINTS
Light Touch (LTR)
Pin Prick (PPR)
UER
(Upper Extremity Right)
Elbow flexors C5 5
Wrist extensors C6 5
Elbow extensors C7 5
Finger flexors C8 5
Finger abductors (little finger) T1 5
Comments (Non-key Muscle? Reason for NT? Pain? Non-SCI condition?):
LER
(Lower Extremity Right)
Hip flexors L2 0
Knee extensors L3 0
Ankle dorsiflexors L4 0
Long toe extensors L5 0
Ankle plantar flexors S1 0
(VAC) Voluntary Anal Contraction (Yes/No) No
C2 2 2
C3 2 2
C4 2 2
T2 2 2
T3 2 2
T4 1 1
T5 1 1
T6 1 1
T7 1 1
T8 1 1
T9 1 1
T10 0 1
T11 0 1
T12 0 1
L1 0 0
S2 0 0
S3 0 0
S4-5 0 0
Dorsum
Palm
• Key Sensory Points
SENSORY
KEY SENSORY POINTS
Light Touch (LTL)
Pin Prick (PPL)
MOTOR
KEY MUSCLES
LEFT
C2 2 2
C3 2 2
C4 2 2
C5 Elbow flexors 5
C6 Wrist extensors 5
C7 Elbow extensors 5
C8 Finger flexors 5
T1 Finger abductors (little finger) 5
UEL
(Upper Extremity Left)
T2 2 2
T3 2 2
T4 1 1
T5 1 1
T6 0 1
T7 0 0
T8 0 0
T9 0 0
T10 0 0
T11 0 0
T12 0 0
L1 0 0
L2 Hip flexors 0
L3 Knee extensors 0
L4 Ankle dorsiflexors 0
L5 Long toe extensors 0
S1 Ankle plantar flexors 0
LEL
(Lower Extremity Left)
S2 0 0
S3 0 0
S4-5 0 0
(DAP) Deep Anal Pressure (Yes/No) No
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
NT = Not testable
0*, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present
SENSORY
(SCORING ON REVERSE SIDE)
0 = Absent
1 = Altered
2 = Normal
NT = Not testable
0*, 1*, NT* = Non-SCI condition present
NEUROLOGICAL LEVELS
Steps 1- 6 for classification as on reverse
1. SENSORY R L
2. MOTOR R L
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 injuries with absent motor OR sensory function in S4-5 only)
6. ZONE OF PARTIAL PRESERVATION
Most caudal levels with any innervation
SENSORY R L
MOTOR R L

ANSWER

Case 2



Sensory levels: The sensory level is T3 bilaterally as sensory function is intact from C2 through this dermatome on both sides.

Motor levels: The motor level is T3 bilaterally. Motor function is intact in the C5-T1 key muscles bilaterally and because myotomes T2-L1 are not clinically testable, the motor level is presumed to be the same as the sensory level (T3).

NLI: The NLI is T3 as each of the motor and sensory levels is T3.

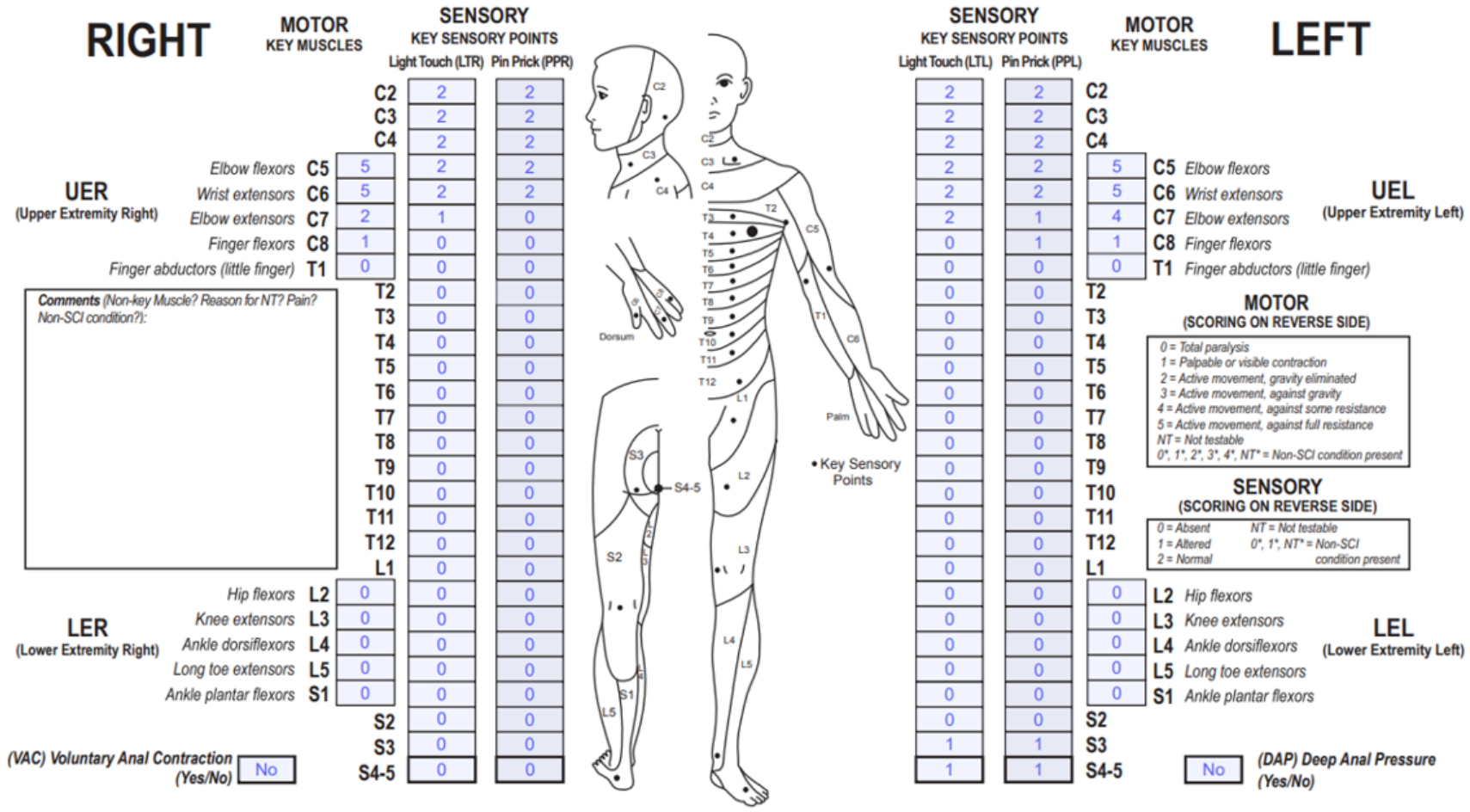
Completeness: There is no sacral sparing (sensorimotor function in the lowest sacral segments is absent), so this is a complete injury.

AIS: The AIS grade is A because this is a complete injury.

Sensory ZPPs: The sensory ZPP is T12 on the right and T6 on the left because these are the most caudal segments on the respective sides with any sensory function.

Motor ZPPs: The motor ZPP is T3 bilaterally because there is no preserved motor function in clinically testable key muscles caudal to the motor level. Even though the sensory ZPP extends to T12 on the right and T6 on the left, it is important to note that motor function does not follow sensory function when determining the motor ZPPs.

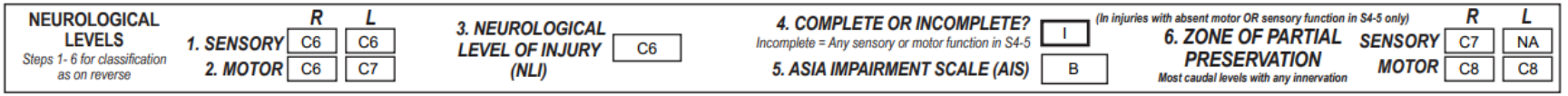
Case 3



NEUROLOGICAL LEVELS Steps 1- 6 for classification as on reverse	R	L	3. NEUROLOGICAL LEVEL OF INJURY (NLI)	4. COMPLETE OR INCOMPLETE? Incomplete = Any sensory or motor function in S4-5	(In injuries with absent motor OR sensory function in S4-5 only)	R	L
1. SENSORY					6. ZONE OF PARTIAL PRESERVATION Most caudal levels with any innervation — SENSORY		
2. MOTOR				5. ASIA IMPAIRMENT SCALE (AIS)	MOTOR		

ANSWER

Case 3



Sensory levels: The sensory level is C6 bilaterally as sensory function is intact from C2 through this dermatome on both sides.

Motor levels: The motor level is C6 on the right and C7 on the left as these myotomes represent the most caudal segments on the respective sides with a motor grade ≥3, with intact motor function rostral to these levels.

NLI: The NLI is C6 as this is the most rostral of the sensory and motor levels.

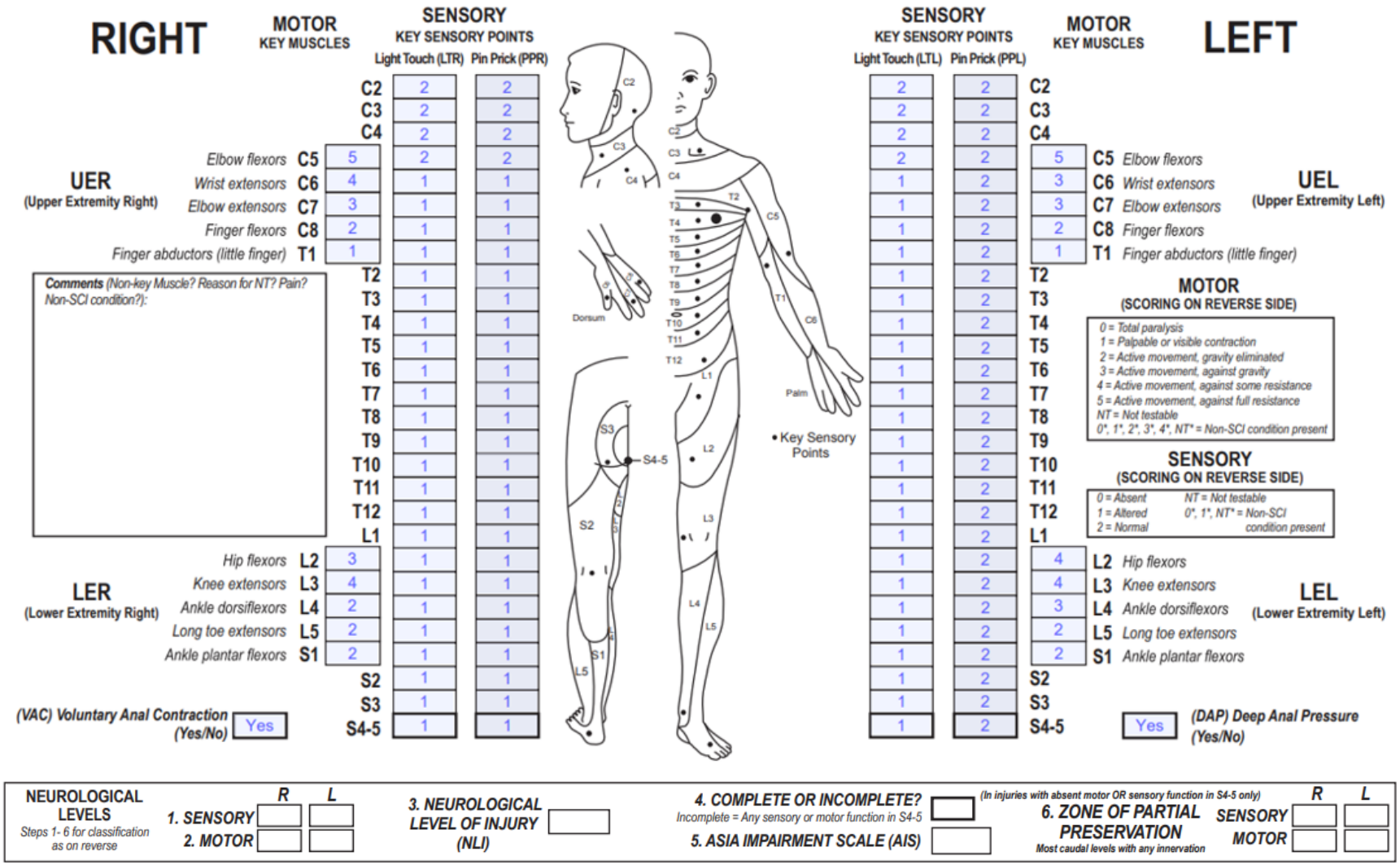
Completeness: There is sensory sacral sparing (preserved S4-5 PP and LT sensation on the left), so this is an incomplete injury.

AIS: The AIS grade is B due to preserved left S4-5 PP and LT sensation. The injury is not motor incomplete because there is no VAC, nor is there any motor function more than 3 segments below the motor level on either side.

Sensory ZPPs: Because DAP sensation is absent and there is no PP or LT sensation at the right S4-5 dermatome, the right sensory ZPP is applicable and is C7 as this is the most caudal segment on the right side with any preserved sensory function. The left sensory ZPP is NA because there is preserved PP and LT sensation in the left S4-5 dermatome. This is a unique case in which there is a unilateral sensory ZPP.

Motor ZPPs: In the absence of VAC, the motor ZPP is applicable and is C8 bilaterally as this is the most caudal segment on each side with any motor function.

Case 4



NEUROLOGICAL LEVELS Steps 1- 6 for classification as on reverse	R	L	3. NEUROLOGICAL LEVEL OF INJURY (NLI)	4. COMPLETE OR INCOMPLETE? Incomplete = Any sensory or motor function in S4-5	(In injuries with absent motor OR sensory function in S4-5 only)	R	L
1. SENSORY					6. ZONE OF PARTIAL PRESERVATION Most caudal levels with any innervation		
2. MOTOR				5. ASIA IMPAIRMENT SCALE (AIS)			

ANSWER

Case 4

NEUROLOGICAL LEVELS *Steps 1- 6 for classification as on reverse*		R	L							R	L
	1. SENSORY	C5	C5	3. NEUROLOGICAL LEVEL OF INJURY (NLI)	C5	4. COMPLETE OR INCOMPLETE? *Incomplete = Any sensory or motor function in S4-5*	I	*(In injuries with absent motor OR sensory function in S4-5 only)* 6. ZONE OF PARTIAL PRESERVATION *Most caudal levels with any innervation*	SENSORY	NA	NA
	2. MOTOR	C6	C6			5. ASIA IMPAIRMENT SCALE (AIS)	D		MOTOR	NA	NA

Sensory levels: The sensory level is C5 bilaterally as sensory function is intact from C2 through this dermatome on both sides.

Motor levels: The motor level is C6 bilaterally as this is the most caudal key muscle with a motor grade ≥3, and all motor function rostral to this level is intact.

NLI: The NLI is C5 as this is the most rostral of the sensory and motor levels.

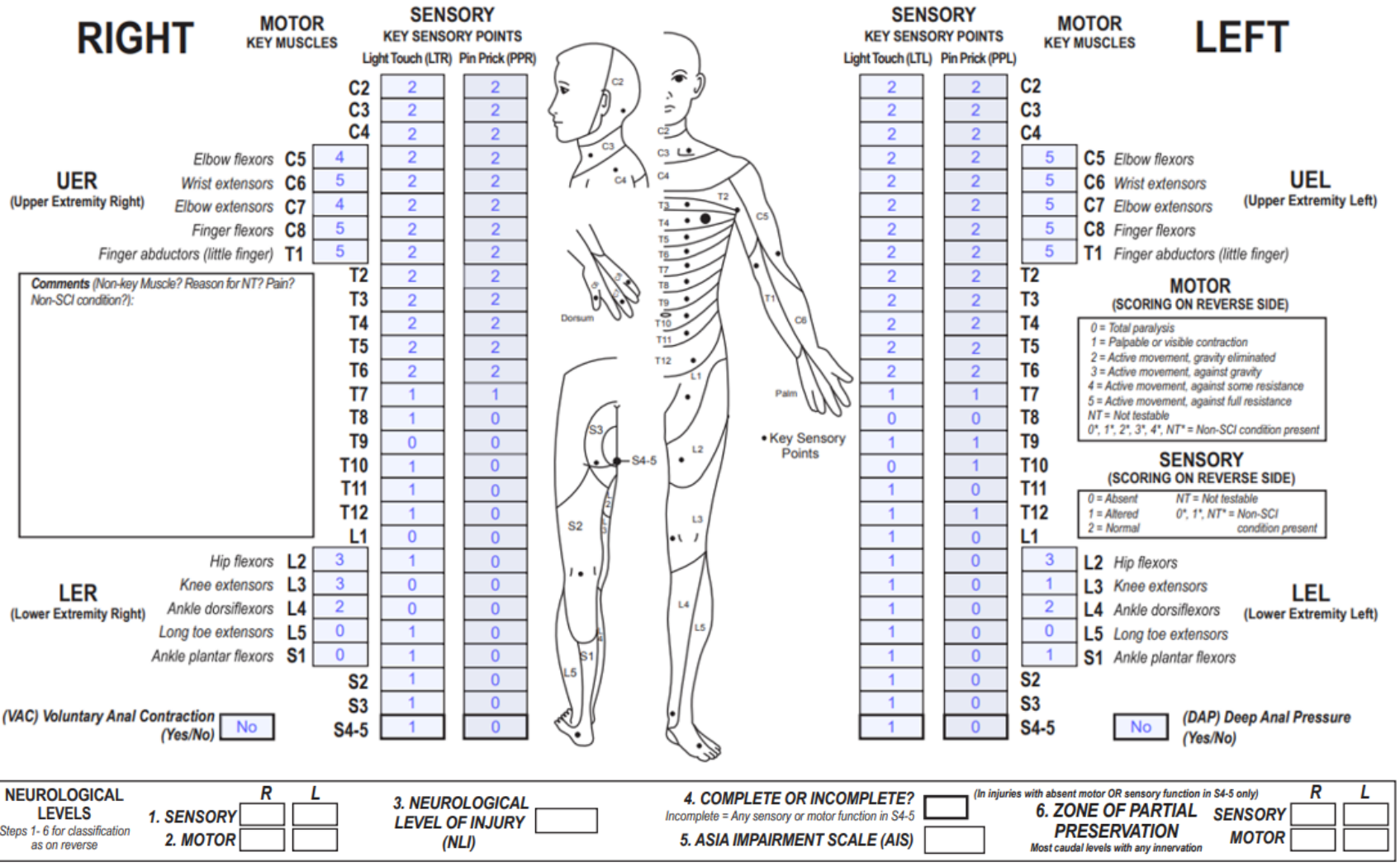
Completeness: There is sparing of sensory and motor function in the lowest sacral segments (DAP is present, S4-5 LT/PP sensation is preserved bilaterally, and VAC is present), so this is an incomplete injury.

AIS: The AIS grade is D. Because VAC is present, this is a motor incomplete injury. Even if VAC had been absent, this would still qualify as a motor incomplete injury because there is sensory sacral sparing and preserved motor function more than 3 segments below the motor level of C6 on both sides. Half (9/18) of the key muscles below the NLI (C5) have a motor grade ≥3, so this injury just barely meets the criteria for AIS D grade.

Sensory ZPPs: The sensory ZPP is NA bilaterally because there is sensory sacral sparing on both sides (DAP is present, and LT/PP sensation is preserved in the S4-5 dermatome bilaterally).

Motor ZPPs: The motor ZPP is NA bilaterally because there is preserved motor function in the lowest sacral segments (i.e., VAC is present).

Case 5


RIGHT
MOTOR
KEY MUSCLES
SENSORY
KEY SENSORY POINTS
Light Touch (LTR)
Pin Prick (PPR)
UER
(Upper Extremity Right)
Elbow flexors C5 4
Wrist extensors C6 5
Elbow extensors C7 4
Finger flexors C8 5
Finger abductors (little finger) T1 5
Comments (Non-key Muscle? Reason for NT? Pain? Non-SCI condition?):
LER
(Lower Extremity Right)
Hip flexors L2 3
Knee extensors L3 3
Ankle dorsiflexors L4 2
Long toe extensors L5 0
Ankle plantar flexors S1 0
(VAC) Voluntary Anal Contraction (Yes/No) No
C2 2 2
C3 2 2
C4 2 2
T2 2 2
T3 2 2
T4 2 2
T5 2 2
T6 2 2
T7 1 1
T8 1 0
T9 0 0
T10 1 0
T11 1 0
T12 1 0
L1 0 0
S2 1 0
S3 1 0
S4-5 1 0
Dorsum
Palm
• Key Sensory Points
SENSORY
KEY SENSORY POINTS
Light Touch (LTL)
Pin Prick (PPL)
MOTOR
KEY MUSCLES
LEFT
C2 2 2
C3 2 2
C4 2 2
T2 2 2
T3 2 2
T4 2 2
T5 2 2
T6 2 2
T7 1 1
T8 0 0
T9 1 1
T10 0 1
T11 1 0
T12 1 1
L1 1 0
S2 1 0
S3 1 0
S4-5 1 0
C5 Elbow flexors 5
C6 Wrist extensors 5
C7 Elbow extensors 5
C8 Finger flexors 5
T1 Finger abductors (little finger) 5
UEL
(Upper Extremity Left)
L2 Hip flexors 3
L3 Knee extensors 1
L4 Ankle dorsiflexors 2
L5 Long toe extensors 0
S1 Ankle plantar flexors 1
LEL
(Lower Extremity Left)
No (DAP) Deep Anal Pressure (Yes/No)
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
NT = Not testable
0*, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present
SENSORY
(SCORING ON REVERSE SIDE)
0 = Absent
1 = Altered
2 = Normal
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0*, 1*, NT* = Non-SCI condition present
NEUROLOGICAL LEVELS
Steps 1- 6 for classification as on reverse
1. SENSORY
2. MOTOR
R
L
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 injuries with absent motor OR sensory function in S4-5 only)
6. ZONE OF PARTIAL PRESERVATION
Most caudal levels with any innervation
SENSORY
MOTOR

ANSWER

Case 5

Sensory levels: The sensory level is T6 bilaterally as sensory function is intact from C2 through this dermatome on both sides.

Motor levels: The right motor level is C5 because this is the most caudal key muscle with a grade ≥3, and motor function above this level is presumed to be intact. Although there is no testable motor function at the C2-C4 myotomes, the motor grade at each of these segments is considered to be 5 as sensory function of all corresponding dermatomes above the sensory level is intact. Of note, because weakness in the right elbow flexors/extensors is much more rostral to the bilateral sensory levels of T6 (and left motor level of T6), it is recommended that the examiner evaluates for a non-SCI condition that may be the cause of the upper extremity motor impairment. The left motor level is T6 (following the sensory level) because all motor function is presumed to be intact through this level.

NLI: The NLI is C5 because this is the most rostral of the sensory and motor levels.

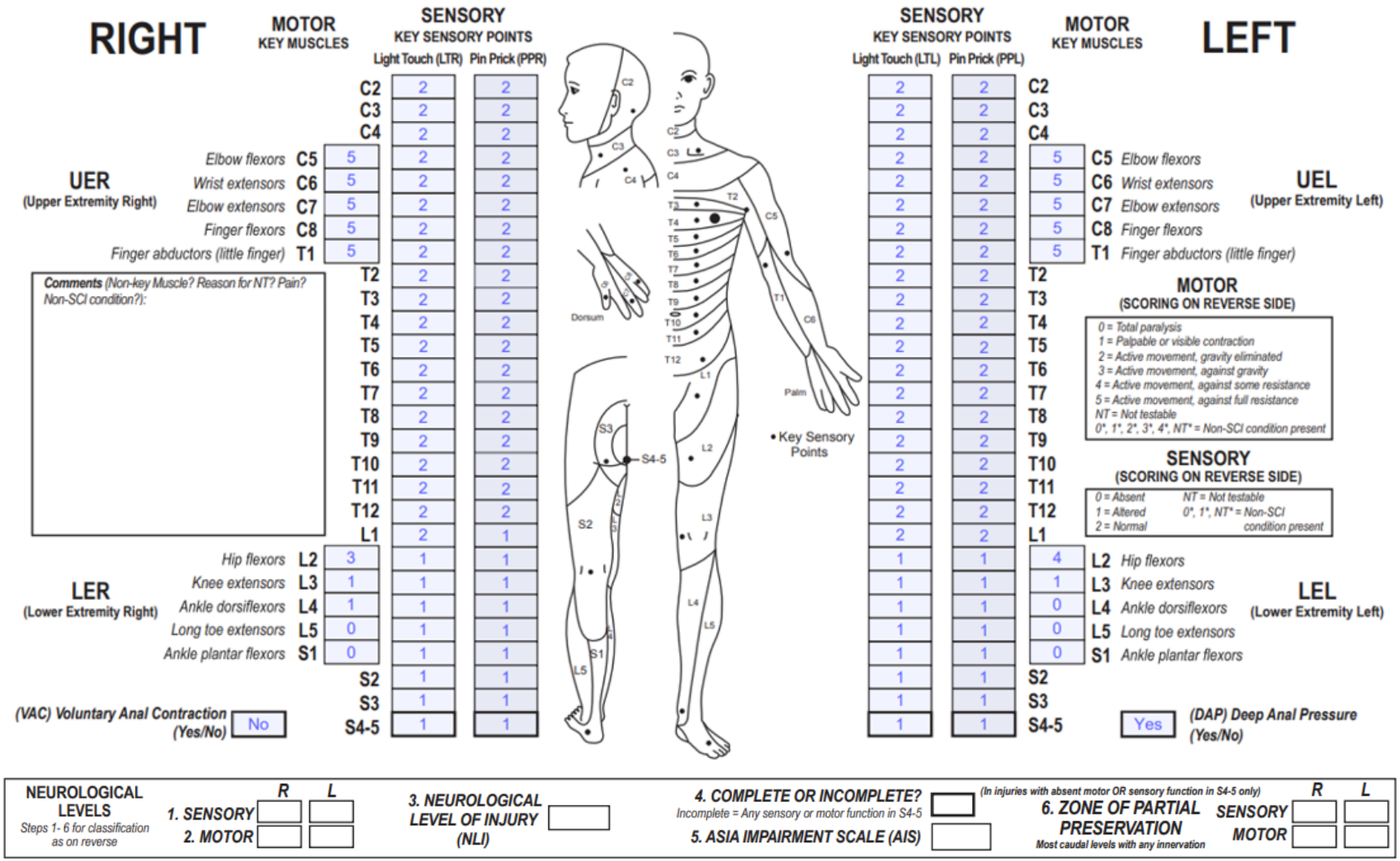
Completeness: There is sparing of sensory function in the lowest sacral segments as S4-5 LT sensation is preserved bilaterally, so this is an incomplete injury.

AIS: The AIS grade is D. This case meets criteria for a motor incomplete lesion. Even though VAC is absent, there is sensory sacral sparing and preserved motor function more than 3 levels below the motor level on both the right and left sides. Because at least half (in this case 11/18) of the key muscles below the NLI (C5) have a motor grade ≥3, this injury is classified as AIS D.

Sensory ZPPs: The sensory ZPP is NA bilaterally because there is sensory sacral sparing on both sides (LT sensation is preserved in the left and right S4-5 dermatome).

Motor ZPPs: The motor ZPP, which is applicable bilaterally in the absence of VAC, is L4 on the right and S1 on the left because these are the most caudal segments on the respective sides with preserved motor function.

Case 6


RIGHT
MOTOR
KEY MUSCLES
SENSORY
KEY SENSORY POINTS
Light Touch (LTR)
Pin Prick (PPR)
UER
(Upper Extremity Right)
Elbow flexors C5 5
Wrist extensors C6 5
Elbow extensors C7 5
Finger flexors C8 5
Finger abductors (little finger) T1 5
Comments (Non-key Muscle? Reason for NT? Pain? Non-SCI condition?):
LER
(Lower Extremity Right)
Hip flexors L2 3
Knee extensors L3 1
Ankle dorsiflexors L4 1
Long toe extensors L5 0
Ankle plantar flexors S1 0
(VAC) Voluntary Anal Contraction (Yes/No) No
C2 2 2
C3 2 2
C4 2 2
T2 2 2
T3 2 2
T4 2 2
T5 2 2
T6 2 2
T7 2 2
T8 2 2
T9 2 2
T10 2 2
T11 2 2
T12 2 2
L1 2 1
S2 1 1
S3 1 1
S4-5 1 1
Dorsum
Palm
• Key Sensory Points
SENSORY
KEY SENSORY POINTS
Light Touch (LTL)
Pin Prick (PPL)
MOTOR
KEY MUSCLES
LEFT
C5 Elbow flexors 5
C6 Wrist extensors 5
C7 Elbow extensors 5
C8 Finger flexors 5
T1 Finger abductors (little finger) 5
UEL
(Upper 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
NT = Not testable
0*, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present
SENSORY
(SCORING ON REVERSE SIDE)
0 = Absent
1 = Altered
2 = Normal
NT = Not testable
0*, 1*, NT* = Non-SCI condition present
L2 Hip flexors 4
L3 Knee extensors 1
L4 Ankle dorsiflexors 0
L5 Long toe extensors 0
S1 Ankle plantar flexors 0
LEL
(Lower Extremity Left)
Yes (DAP) Deep Anal Pressure (Yes/No)
NEUROLOGICAL LEVELS
Steps 1- 6 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 injuries with absent motor OR sensory function in S4-5 only)
6. ZONE OF PARTIAL PRESERVATION
Most caudal levels with any innervation
SENSORY
MOTOR

ANSWER

Case 6

Sensory levels: The sensory level is T12 on the right and L1 on the left because sensory function is intact from C2 through these dermatomes on the respective sides.

Motor levels: The right motor level is T12 and defers to the sensory level as it is presumed that motor function is intact through this segment. The left motor level is L2 because this is the most caudal key muscle with a grade ≥3, and all motor function above this level is presumed to be intact.

NLI: The NLI is T12 as this is the most rostral of the sensory and motor levels.

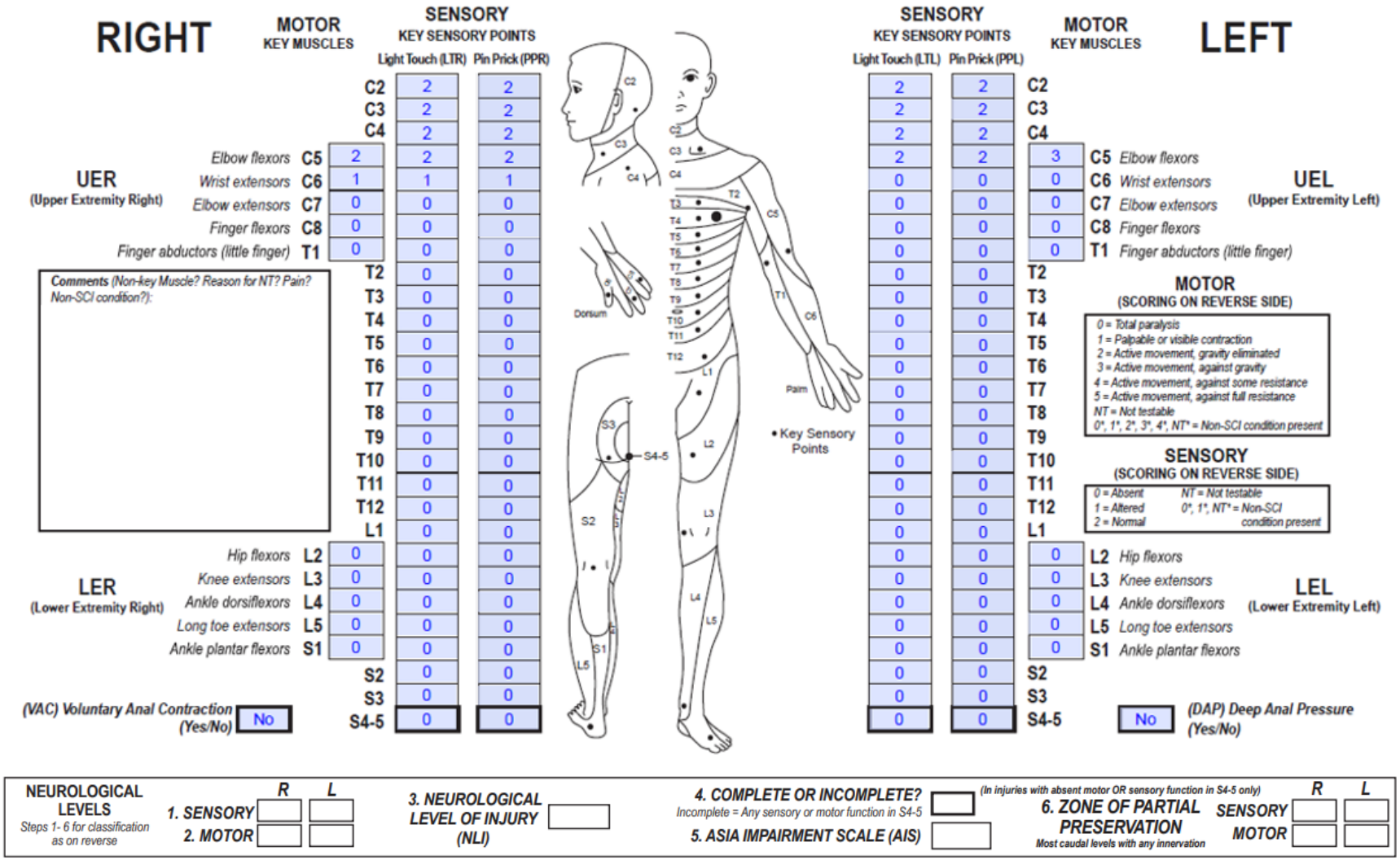
Completeness: There is sparing of sensory function in the most caudal sacral segments (DAP is present and S4-5 LT/PP sensation is preserved bilaterally), so this is an incomplete injury.

AIS: The AIS grade is C. Although VAC is absent, this injury is considered motor incomplete because there is sensory sacral sparing and motor sparing at right L4, which is more than 3 segments below the right motor level of T12. This injury is AIS C grade (and not AIS D) because less than half (2/10) of the key muscles below the NLI (T12) have a motor grade ≥3.

Sensory ZPPs: The sensory ZPP is NA bilaterally because there is sensory sacral sparing on both sides (DAP is present, and LT/PP sensation is preserved in the S4-5 dermatome bilaterally).

Motor ZPPs: The motor ZPP is applicable bilaterally because VAC is absent. The motor ZPP is L4 on the right and L3 on the left as these are the most caudal segments on the respective sides with preserved motor function.

Case 7

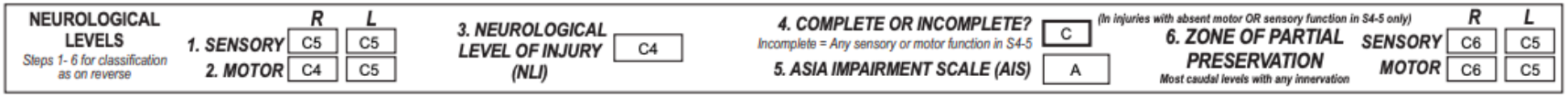


NEUROLOGICAL LEVELS Steps 1- 6 for classification as on reverse	R	L			
1. SENSORY			3. NEUROLOGICAL LEVEL OF INJURY (NLI)		4. COMPLETE OR INCOMPLETE? (In injuries with absent motor OR sensory function in S4-5 only) Incomplete = Any sensory or motor function in S4-5
2. MOTOR					5. ASIA IMPAIRMENT SCALE (AIS)

6. ZONE OF PARTIAL PRESERVATION Most caudal levels with any innervation	R	L
SENSORY		
MOTOR		

ANSWER

Case 7



Sensory levels: The sensory level is C5 bilaterally because sensory function is intact from C2 through this dermatome on each side.

Motor levels: The right motor level is C4 because motor function is presumed to be intact from C2 through this level as sensory function is intact in these dermatomes (C2-C4) without a testable myotome. Because the motor grade is <3 at the right elbow flexors, the right motor level cannot be C5. The left motor level is C5 because this is the most caudal key muscle with a grade ≥3, and all motor function above this level is presumed to be intact.

NLI: The NLI is C4 as this is the most rostral of the sensory and motor levels.

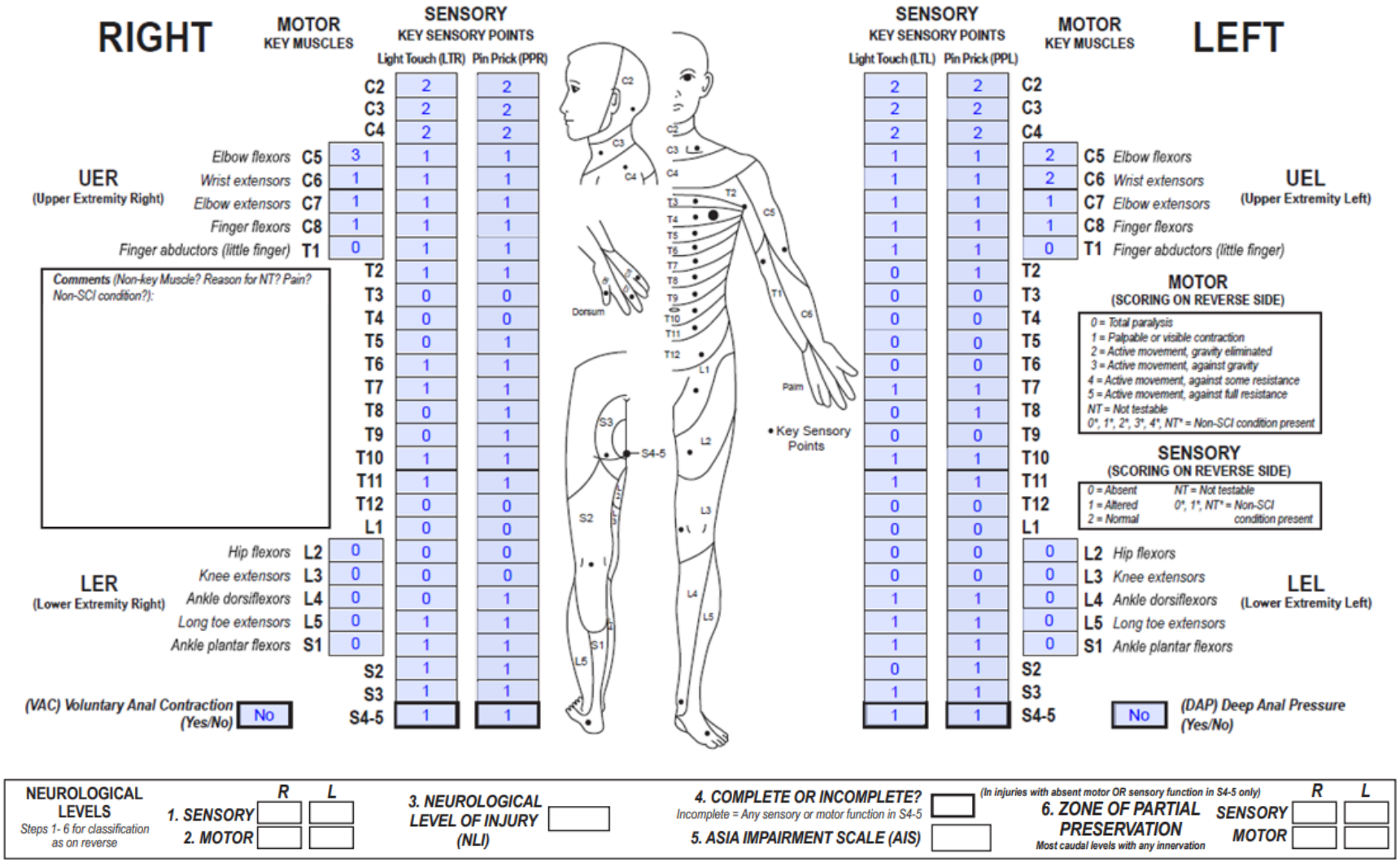
Completeness: There is no sacral sparing, so this is a complete injury.

AIS: The AIS grade is A because this is a complete injury.

Sensory ZPPs: The sensory ZPP is C6 on the right and C5 on the left, as these are the most caudal segments on the respective sides with preserved sensory function.

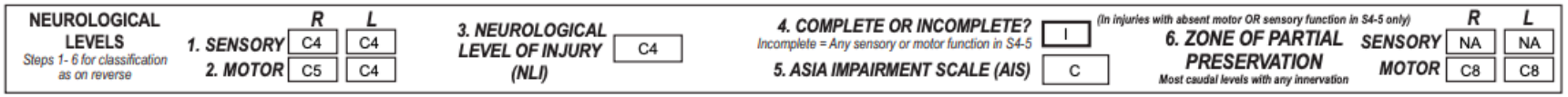
Motor ZPPs: The motor ZPP is C6 on the right and C5 on the left, as these are the most caudal myotomes on the respective sides with any motor function. If there are no segments with partially preserved function below the motor level, as in this case on the left, the motor level is entered in the box for ZPP.

Case 8


RIGHT
MOTOR
KEY MUSCLES
SENSORY
KEY SENSORY POINTS
Light Touch (LTR)
Pin Prick (PPR)
UER
(Upper Extremity Right)
Elbow flexors C5 3
Wrist extensors C6 1
Elbow extensors C7 1
Finger flexors C8 1
Finger abductors (little finger) T1 0
Comments (Non-key Muscle? Reason for NT? Pain? Non-SCI condition?):
LER
(Lower Extremity Right)
Hip flexors L2 0
Knee extensors L3 0
Ankle dorsiflexors L4 0
Long toe extensors L5 0
Ankle plantar flexors S1 0
(VAC) Voluntary Anal Contraction (Yes/No) No
C2 2 2
C3 2 2
C4 2 2
T2 1 1
T3 0 0
T4 0 0
T5 0 1
T6 1 1
T7 1 1
T8 0 1
T9 0 1
T10 1 1
T11 1 1
T12 0 0
L1 0 0
S2 1 1
S3 1 1
S4-5 1 1
Dorsum
Palm
• Key Sensory Points
SENSORY
KEY SENSORY POINTS
Light Touch (LTL)
Pin Prick (PPL)
MOTOR
KEY MUSCLES
LEFT
2 2 C2
2 2 C3
2 2 C4
1 1 2 C5 Elbow flexors
1 1 2 C6 Wrist extensors
1 1 1 C7 Elbow extensors
1 1 1 C8 Finger flexors
1 1 0 T1 Finger abductors (little finger)
0 1 T2
0 0 T3
0 0 T4
0 0 T5
0 0 T6
1 1 T7
0 1 T8
0 0 T9
1 1 T10
1 1 T11
0 0 T12
0 0 L1
0 0 0 L2 Hip flexors
0 0 0 L3 Knee extensors
1 1 0 L4 Ankle dorsiflexors
1 1 0 L5 Long toe extensors
1 1 0 S1 Ankle plantar flexors
0 1 S2
1 1 S3
1 1 S4-5
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
NT = Not testable
0*, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present
SENSORY
(SCORING ON REVERSE SIDE)
0 = Absent
1 = Altered
2 = Normal
NT = Not testable
0*, 1*, NT* = Non-SCI condition present
No (DAP) Deep Anal Pressure (Yes/No)
NEUROLOGICAL LEVELS
Steps 1- 6 for classification as on reverse
1. SENSORY
2. MOTOR
R
L
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 injuries with absent motor OR sensory function in S4-5 only)
6. ZONE OF PARTIAL PRESERVATION
Most caudal levels with any innervation
SENSORY
MOTOR

ANSWER

Case 8



Sensory levels: The sensory level is C4 bilaterally because sensory function is intact from C2 through this dermatome on each side.

Motor levels: The right motor level is C5 because this is the most caudal key muscle with a grade ≥3, and all muscle function above this level is presumed to be intact. The left motor level is C4 because strength in the left elbow flexors (C5) is only 2; the motor level defers to the sensory level of C4 as it is presumed that motor function is intact through this level.

NLI: The NLI is C4 as this is the most rostral of the sensory and motor levels.

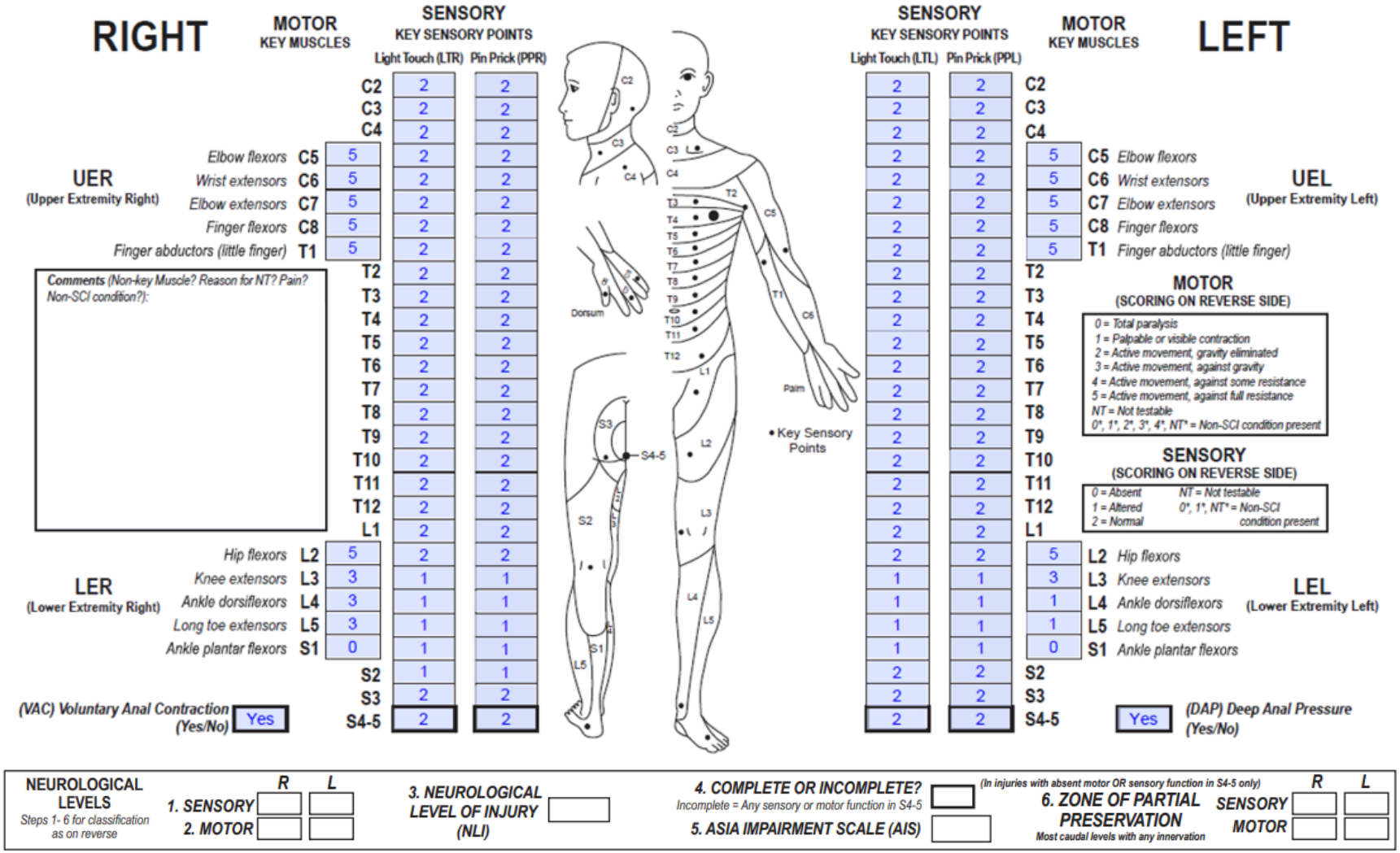
Completeness: There is sparing of sensory function in the most caudal sacral segments (S4-5 LT/PP sensation are preserved bilaterally), so this is an incomplete injury.

AIS: The AIS grade is C. Although VAC is absent, this injury is considered motor incomplete because there is sensory sacral sparing and motor sparing at left C8, which is more than 3 levels below the left motor level of C4. This injury is AIS grade C (and not AIS D) because less than half (in this case only 1/10) of key muscles caudal to the NLI (C4) have a motor grade ≥3.

Sensory ZPPs: The sensory ZPP is NA bilaterally because there is sensory sacral sparing on both sides (preserved LT/PP sensation in the S4-5 dermatome bilaterally).

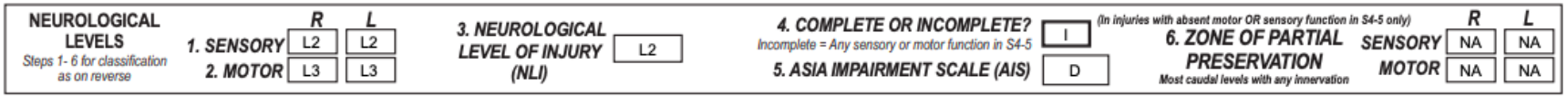
Motor ZPPs: The motor ZPP is applicable because there is no VAC present. The motor ZPP is C8 bilaterally as this is the lowest segment with preserved motor function on each side.

Case 9


RIGHT
MOTOR
KEY MUSCLES
SENSORY
KEY SENSORY POINTS
Light Touch (LTR)
Pin Prick (PPR)
UER
(Upper Extremity Right)
Elbow flexors C5 5
Wrist extensors C6 5
Elbow extensors C7 5
Finger flexors C8 5
Finger abductors (little finger) T1 5
Comments (Non-key Muscle? Reason for NT? Pain? Non-SCI condition?):
LER
(Lower Extremity Right)
Hip flexors L2 5
Knee extensors L3 3
Ankle dorsiflexors L4 3
Long toe extensors L5 3
Ankle plantar flexors S1 0
(VAC) Voluntary Anal Contraction (Yes/No) Yes
C2 2 2
C3 2 2
C4 2 2
T2 2 2
T3 2 2
T4 2 2
T5 2 2
T6 2 2
T7 2 2
T8 2 2
T9 2 2
T10 2 2
T11 2 2
T12 2 2
L1 2 2
S2 1 1
S3 2 2
S4-5 2 2
Dorsum
Palm
• Key Sensory Points
SENSORY
KEY SENSORY POINTS
Light Touch (LTL)
Pin Prick (PPL)
MOTOR
KEY MUSCLES
LEFT
C5 Elbow flexors 5
C6 Wrist extensors 5
C7 Elbow extensors 5
C8 Finger flexors 5
T1 Finger abductors (little finger) 5
UEL
(Upper 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
NT = Not testable
0*, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present
SENSORY
(SCORING ON REVERSE SIDE)
0 = Absent
1 = Altered
2 = Normal
NT = Not testable
0*, 1*, NT* = Non-SCI condition present
L2 Hip flexors 5
L3 Knee extensors 3
L4 Ankle dorsiflexors 1
L5 Long toe extensors 1
S1 Ankle plantar flexors 0
LEL
(Lower Extremity Left)
(DAP) Deep Anal Pressure (Yes/No) Yes
NEUROLOGICAL LEVELS
Steps 1- 6 for classification as on reverse
1. SENSORY R L
2. MOTOR R L
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 injuries with absent motor OR sensory function in S4-5 only)
6. ZONE OF PARTIAL PRESERVATION
Most caudal levels with any innervation
SENSORY R L
MOTOR R L

ANSWER

Case 9



Sensory levels: The sensory level is L2 bilaterally as sensory function is intact from C2 through this dermatome on both sides. Note that even though LT and PP sensation are intact at the S3 and S4-5 dermatomes on the right and S2 through S4-5 dermatomes on the left, there is impaired sensation above these levels; therefore, S4-5 does not satisfy sensory level criteria, even though this is the most caudal dermatome on both sides with intact PP and LT sensation.

Motor levels: The motor level is L3 bilaterally as this is the most caudal key muscle with a motor grade ≥3, and all motor function above this level is presumed to be intact.

NLI: The NLI is L2 as this is the most rostral of the sensory and motor levels.

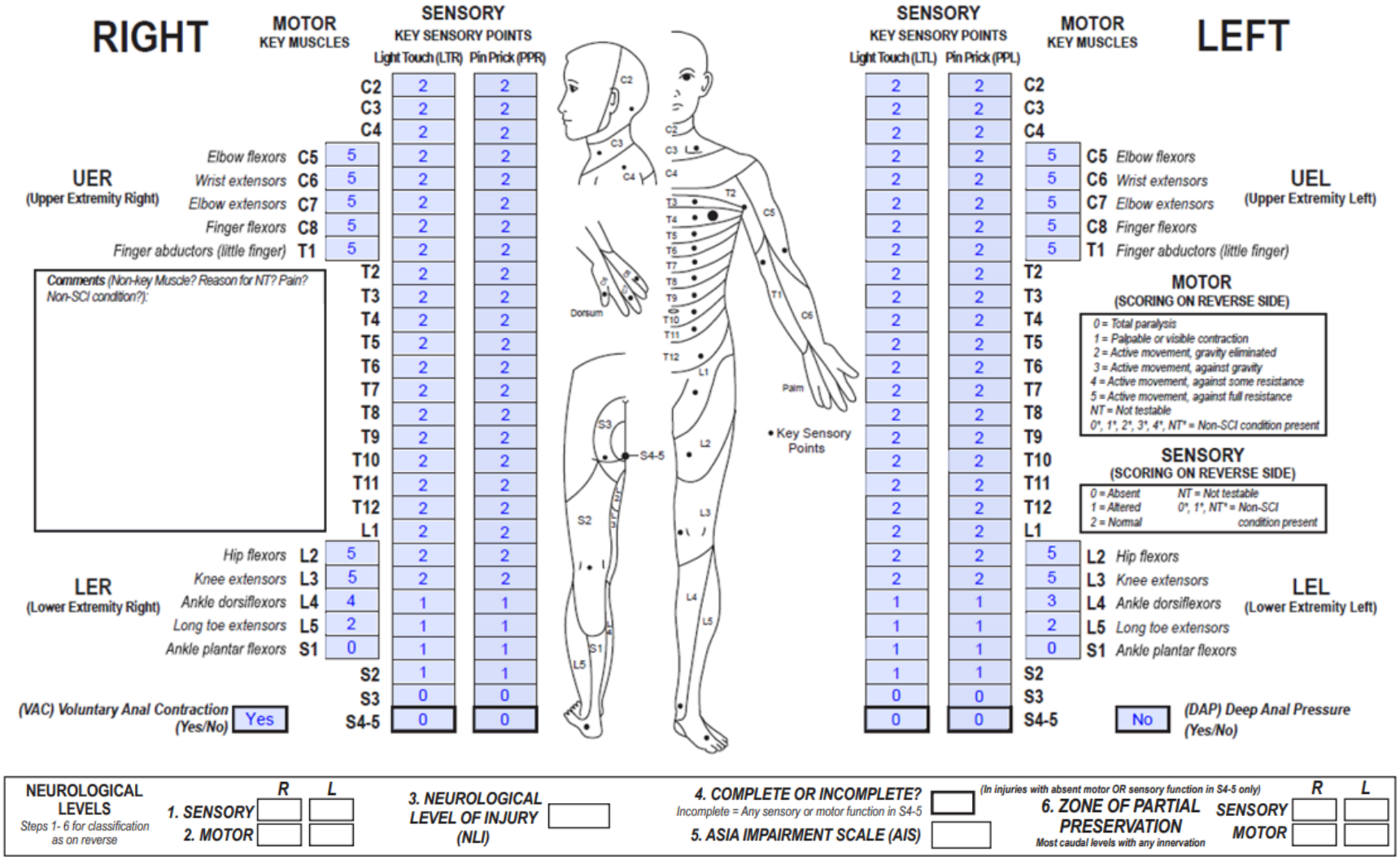
Completeness: There is sparing of sensory and motor function in the most caudal sacral segments (DAP is present, S4-5 LT/PP sensation is preserved bilaterally, and VAC is present), so this is an incomplete injury.

AIS: The AIS grade is D. Because VAC is present, this is a motor incomplete injury. Exactly half (4/8) of the key muscles below the NLI (L2) have a motor grade ≥3, so this injury meets criteria for AIS D grade.

Sensory ZPPs: The sensory ZPP is NA bilaterally because there is sensory sparing in the most caudal sacral segments on both sides (DAP is present, and LT/PP sensation is preserved in the S4-5 dermatome bilaterally).

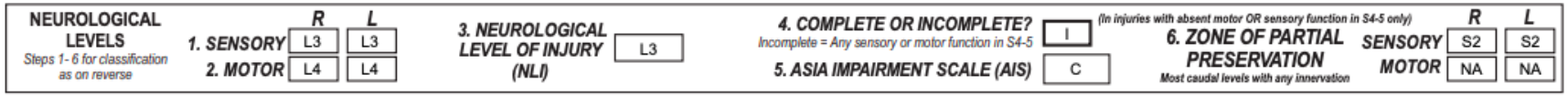
Motor ZPPs: The motor ZPP is NA bilaterally because there is preserved motor function in the most caudal sacral segments (VAC is present).

Case 10


RIGHT
MOTOR
KEY MUSCLES
SENSORY
KEY SENSORY POINTS
Light Touch (LTR)
Pin Prick (PPR)
UER
(Upper Extremity Right)
Elbow flexors C5 5
Wrist extensors C6 5
Elbow extensors C7 5
Finger flexors C8 5
Finger abductors (little finger) T1 5
Comments (Non-key Muscle? Reason for NT? Pain? Non-SCI condition?):
LER
(Lower Extremity Right)
Hip flexors L2 5
Knee extensors L3 5
Ankle dorsiflexors L4 4
Long toe extensors L5 2
Ankle plantar flexors S1 0
(VAC) Voluntary Anal Contraction (Yes/No) Yes
C2 2 2
C3 2 2
C4 2 2
T2 2 2
T3 2 2
T4 2 2
T5 2 2
T6 2 2
T7 2 2
T8 2 2
T9 2 2
T10 2 2
T11 2 2
T12 2 2
L1 2 2
S2 1 1
S3 0 0
S4-5 0 0
Dorsum
Palm
• Key Sensory Points
SENSORY
KEY SENSORY POINTS
Light Touch (LTL)
Pin Prick (PPL)
MOTOR
KEY MUSCLES
LEFT
C2 2 2
C3 2 2
C4 2 2
C5 5 Elbow flexors
C6 5 Wrist extensors
C7 5 Elbow extensors
C8 5 Finger flexors
T1 5 Finger abductors (little finger)
UEL
(Upper Extremity Left)
T2 2 2
T3 2 2
T4 2 2
T5 2 2
T6 2 2
T7 2 2
T8 2 2
T9 2 2
T10 2 2
T11 2 2
T12 2 2
L1 2 2
L2 5 Hip flexors
L3 5 Knee extensors
L4 3 Ankle dorsiflexors
L5 2 Long toe extensors
S1 0 Ankle plantar flexors
LEL
(Lower Extremity Left)
S2 1 1
S3 0 0
S4-5 0 0
No (DAP) Deep Anal Pressure (Yes/No)
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
NT = Not testable
0*, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present
SENSORY
(SCORING ON REVERSE SIDE)
0 = Absent
1 = Altered
2 = Normal
NT = Not testable
0*, 1*, NT* = Non-SCI condition present
NEUROLOGICAL LEVELS
Steps 1- 6 for classification as on reverse
1. SENSORY R L
2. MOTOR R L
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 injuries with absent motor OR sensory function in S4-5 only)
6. ZONE OF PARTIAL PRESERVATION
Most caudal levels with any innervation
SENSORY R L
MOTOR R L

ANSWER

Case 10



Sensory levels: The sensory level is L3 bilaterally as sensory function is intact from C2 through this dermatome on both sides.

Motor levels: The motor level is L4 bilaterally as this is the most caudal key muscle on each side with a grade ≥3, and all motor function above this level is presumed to be intact.

NLI: The NLI is L3 as this is the most rostral of the sensory and motor levels.

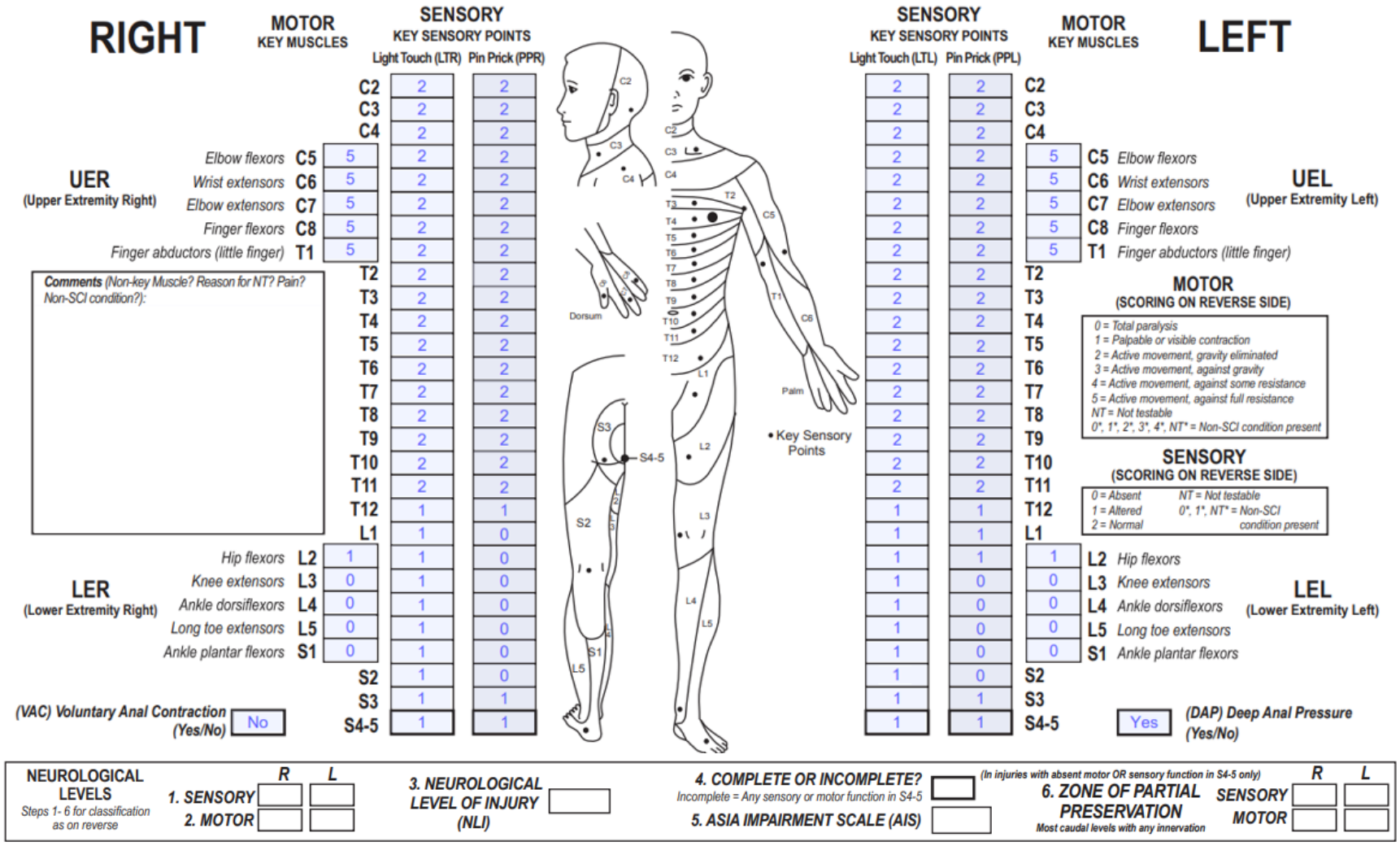
Completeness: Although there is no sparing of sensory function in the lowest sacral segments, there is motor sacral sparing (VAC is preserved), so this is an incomplete injury.

AIS: The injury severity is motor incomplete (at least AIS C) because VAC is present. This injury is classified as AIS C (and not AIS D) because less than half (in this case only 2/6) of key muscles below the NLI (L3) have a motor grade ≥3. This is an example of a rare case in which VAC is present while S4-5 PP/LT and DAP sensation are absent (reported in 1.4% of motor incomplete injuries[17]). If results of the ISNCSCI exam reveal this scenario, it would be worthwhile to carefully evaluate the rectal exam findings to ensure VAC is indeed present and that a reflex contraction of the external anal sphincter was not mistaken for a voluntary contraction.

Sensory ZPPs: The sensory ZPPs are applicable because there is no sensory function in the lowest sacral segments. The sensory ZPP is S2 bilaterally as this is the most caudal segment on both sides with partially preserved sensory function.

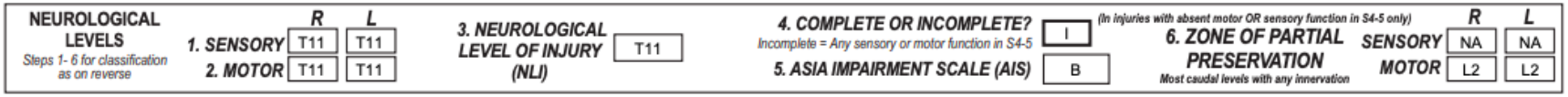
Motor ZPPs: The motor ZPP is NA bilaterally because VAC is present.

Case 11


RIGHT
MOTOR
KEY MUSCLES
SENSORY
KEY SENSORY POINTS
Light Touch (LTR)
Pin Prick (PPR)
UER
(Upper Extremity Right)
Elbow flexors C5
Wrist extensors C6
Elbow extensors C7
Finger flexors C8
Finger abductors (little finger) T1
Comments (Non-key Muscle? Reason for NT? Pain? Non-SCI condition?):
LER
(Lower Extremity Right)
Hip flexors L2
Knee extensors L3
Ankle dorsiflexors L4
Long toe extensors L5
Ankle plantar flexors S1
(VAC) Voluntary Anal Contraction (Yes/No)
No
C2 2 2
C3 2 2
C4 2 2
C5 5 2 2
C6 5 2 2
C7 5 2 2
C8 5 2 2
T1 5 2 2
T2 2 2
T3 2 2
T4 2 2
T5 2 2
T6 2 2
T7 2 2
T8 2 2
T9 2 2
T10 2 2
T11 2 2
T12 1 1
L1 1 0
L2 1 1 0
L3 0 1 0
L4 0 1 0
L5 0 1 0
S1 0 1 0
S2 1 0
S3 1 1
S4-5 1 1
Dorsum
Palm
• Key Sensory Points
SENSORY
KEY SENSORY POINTS
Light Touch (LTL)
Pin Prick (PPL)
MOTOR
KEY MUSCLES
LEFT
2 2 C2
2 2 C3
2 2 C4
2 2 5 C5 Elbow flexors
2 2 5 C6 Wrist extensors
2 2 5 C7 Elbow extensors
2 2 5 C8 Finger flexors
2 2 5 T1 Finger abductors (little finger)
2 2 T2
2 2 T3
2 2 T4
2 2 T5
2 2 T6
2 2 T7
2 2 T8
2 2 T9
2 2 T10
2 2 T11
1 1 T12
1 1 L1
1 1 1 L2 Hip flexors
1 0 0 L3 Knee extensors
1 0 0 L4 Ankle dorsiflexors
1 0 0 L5 Long toe extensors
1 0 0 S1 Ankle plantar flexors
1 0 S2
1 1 S3
1 1 S4-5
UEL
(Upper 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
NT = Not testable
0*, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present
SENSORY
(SCORING ON REVERSE SIDE)
0 = Absent
1 = Altered
2 = Normal
NT = Not testable
0*, 1*, NT* = Non-SCI condition present
LEL
(Lower Extremity Left)
Yes
(DAP) Deep Anal Pressure (Yes/No)
NEUROLOGICAL LEVELS
Steps 1- 6 for classification as on reverse
1. SENSORY
2. MOTOR
R
L
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 injuries with absent motor OR sensory function in S4-5 only)
6. ZONE OF PARTIAL PRESERVATION
Most caudal levels with any innervation
SENSORY
MOTOR

ANSWER

Case 11



Sensory levels: The sensory level is T11 bilaterally as sensory function is intact from C2 through this dermatome on both sides.

Motor levels: Bilateral motor levels follow the sensory levels and are T11 because motor function is presumed to be intact from C2 through T11 on both sides.

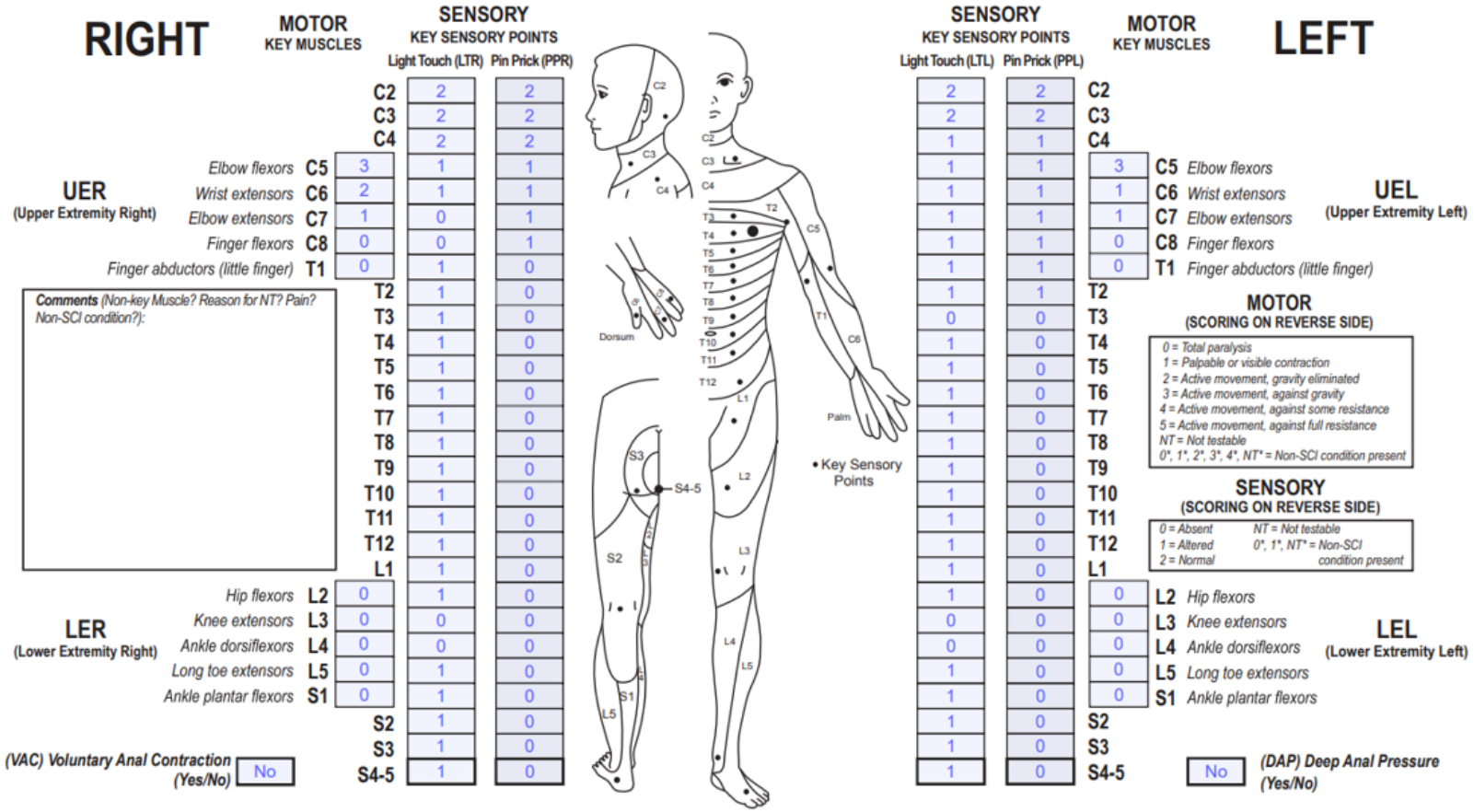
NLI: The NLI is T11 as each of the motor and sensory levels is also T11.

Completeness: There is sensory sacral sparing (preserved S4-5 PP/LT and DAP sensation), so this is an incomplete injury.
AIS: The AIS grade is B because this is a sensory incomplete injury. The injury is not motor incomplete because there is no VAC, nor is there any motor function more than 3 levels below the motor level on either side. Although there is motor function at L2 bilaterally, this is exactly 3 levels below the motor level of T11 and therefore does not satisfy the criteria for motor incomplete status.

Sensory ZPPs: The sensory ZPP is NA bilaterally because there is preserved DAP and S4-5 LT/PP sensation.

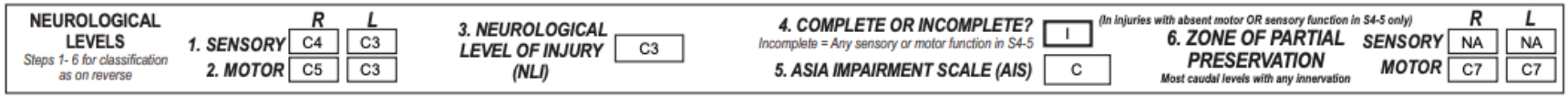
Motor ZPPs: Because there is no preservation of VAC, the motor ZPPs are applicable and are L2 bilaterally, as this is the most caudal segment with any motor function.

Case 12


RIGHT
MOTOR
KEY MUSCLES
SENSORY
KEY SENSORY POINTS
Light Touch (LTR)
Pin Prick (PPR)
UER
(Upper Extremity Right)
Elbow flexors C5 3
Wrist extensors C6 2
Elbow extensors C7 1
Finger flexors C8 0
Finger abductors (little finger) T1 0
Comments (Non-key Muscle? Reason for NT? Pain? Non-SCI condition?):
LER
(Lower Extremity Right)
Hip flexors L2 0
Knee extensors L3 0
Ankle dorsiflexors L4 0
Long toe extensors L5 0
Ankle plantar flexors S1 0
(VAC) Voluntary Anal Contraction (Yes/No) No
C2 2 2
C3 2 2
C4 2 2
T2 1 0
T3 1 0
T4 1 0
T5 1 0
T6 1 0
T7 1 0
T8 1 0
T9 1 0
T10 1 0
T11 1 0
T12 1 0
L1 1 0
S2 1 0
S3 1 0
S4-5 1 0
Dorsum
Palm
• Key Sensory Points
SENSORY
KEY SENSORY POINTS
Light Touch (LTL)
Pin Prick (PPL)
MOTOR
KEY MUSCLES
LEFT
C5 Elbow flexors 3
C6 Wrist extensors 1
C7 Elbow extensors 1
C8 Finger flexors 0
T1 Finger abductors (little finger) 0
UEL
(Upper 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
NT = Not testable
0*, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present
SENSORY
(SCORING ON REVERSE SIDE)
0 = Absent
1 = Altered
2 = Normal
NT = Not testable
0*, 1*, NT* = Non-SCI condition present
L2 Hip flexors 0
L3 Knee extensors 0
L4 Ankle dorsiflexors 0
L5 Long toe extensors 0
S1 Ankle plantar flexors 0
LEL
(Lower Extremity Left)
No
(DAP) Deep Anal Pressure (Yes/No)
NEUROLOGICAL LEVELS
Steps 1- 6 for classification as on reverse
1. SENSORY R L
2. MOTOR R L
3. NEUROLOGICAL LEVEL OF INJURY (NLI)
4. COMPLETE OR INCOMPLETE?
Incomplete = Any sensory or motor function in S4-5
(In injuries with absent motor OR sensory function in S4-5 only)
5. ASIA IMPAIRMENT SCALE (AIS)
6. ZONE OF PARTIAL PRESERVATION
Most caudal levels with any innervation
SENSORY R L
MOTOR R L

ANSWER

Case 12



Sensory levels: The sensory level is C4 on the right and C3 on the left as sensory function is intact from C2 through these dermatomes on the respective sides.

Motor levels: The right motor level is C5 because this is the most caudal key muscle with a grade ≥3, and all muscle function above this level is presumed to be intact. The left motor level is C3 because the motor level defers to the sensory level on this side; while the left elbow flexors (C5) have a motor grade of 3, it cannot be presumed that motor function on the left side is intact at C4 as sensory function is impaired at that segment.

NLI: The NLI is C3 as this is the most rostral of the sensory and motor levels.

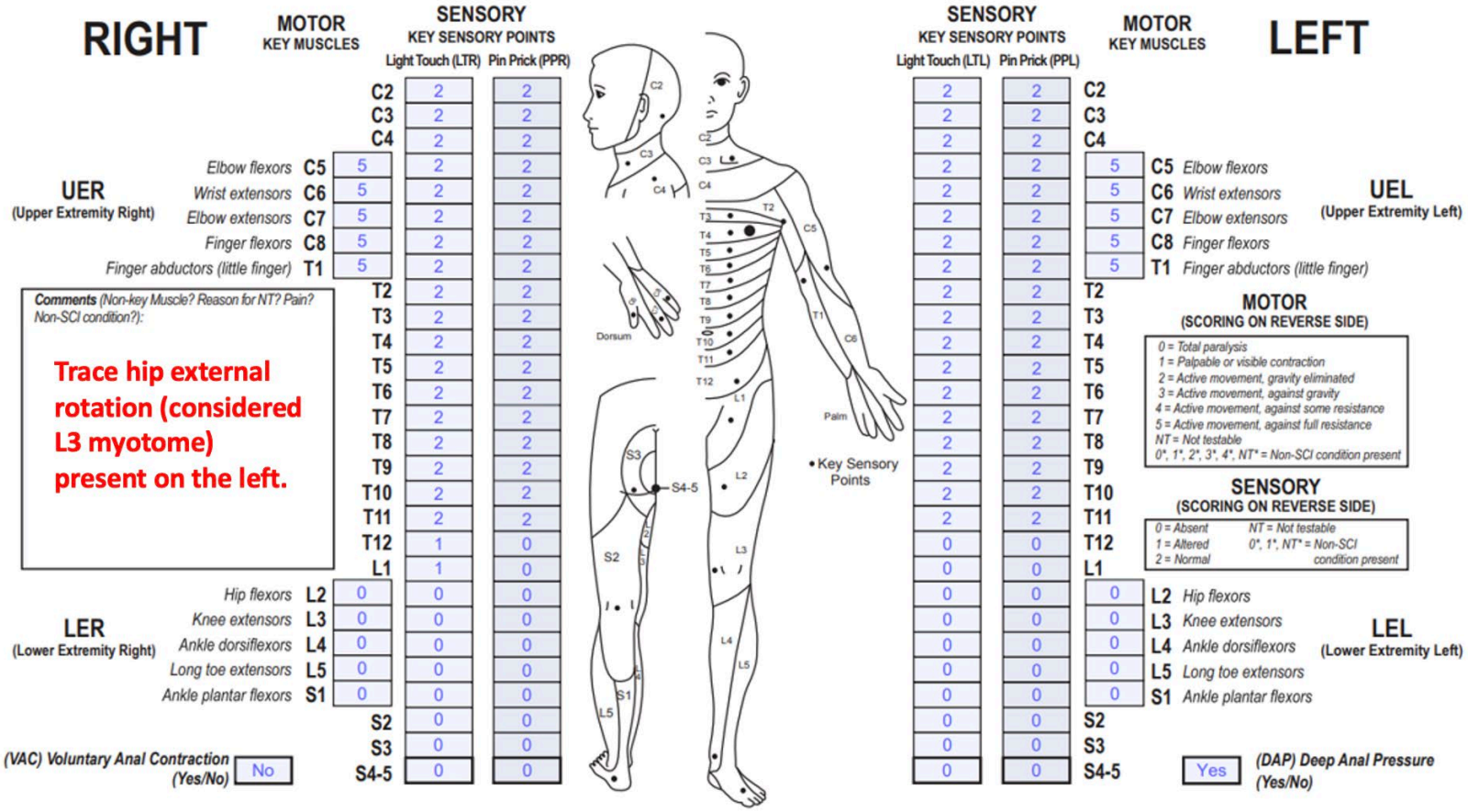
Completeness: There is sparing of sensory function in the most caudal sacral segments (S4-5 LT sensation is preserved bilaterally), so this is an incomplete injury.

AIS: The AIS grade is C. Although VAC is absent, this injury is considered motor incomplete because there is sensory sacral sparing and motor sparing at the left C7 myotome, which is more than 3 segments below the left motor level of C3. This injury is AIS C grade (and not AIS D) because less than half (in this case only 2/20) of key muscles below the NLI (C3) have a motor grade ≥3.

Sensory ZPPs: The sensory ZPP is NA bilaterally because there is sensory sacral sparing on both sides (preserved LT sensation in the S4-5 dermatome bilaterally).

Motor ZPPs: There is no VAC and as such the motor ZPP is C7 bilaterally because this is the lowest segment with preserved motor function on each side.

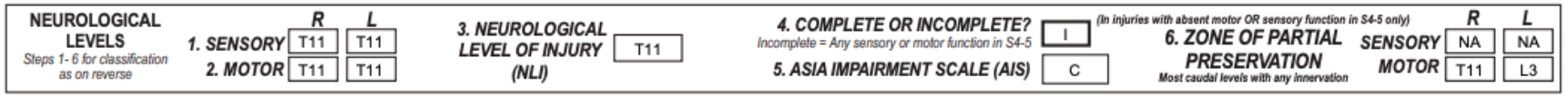
Case 13



NEUROLOGICAL LEVELS Steps 1- 6 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 injuries with absent motor OR sensory function in S4-5 only) 6. ZONE OF PARTIAL PRESERVATION Most caudal levels with any innervation	SENSORY		
	MOTOR		

ANSWER

Case 13



Sensory levels: The sensory level is T11 bilaterally as sensory function is intact from C2 through this dermatome on both sides.

Motor levels: The right and left motor levels are T11 (following the sensory levels) because testable motor function is intact in the C5-T1 myotomes and is presumed to be intact through T11 based on intact sensory scores in all dermatomes rostral to T12.

NLI: The NLI is T11 as each of the motor and sensory levels is T11.

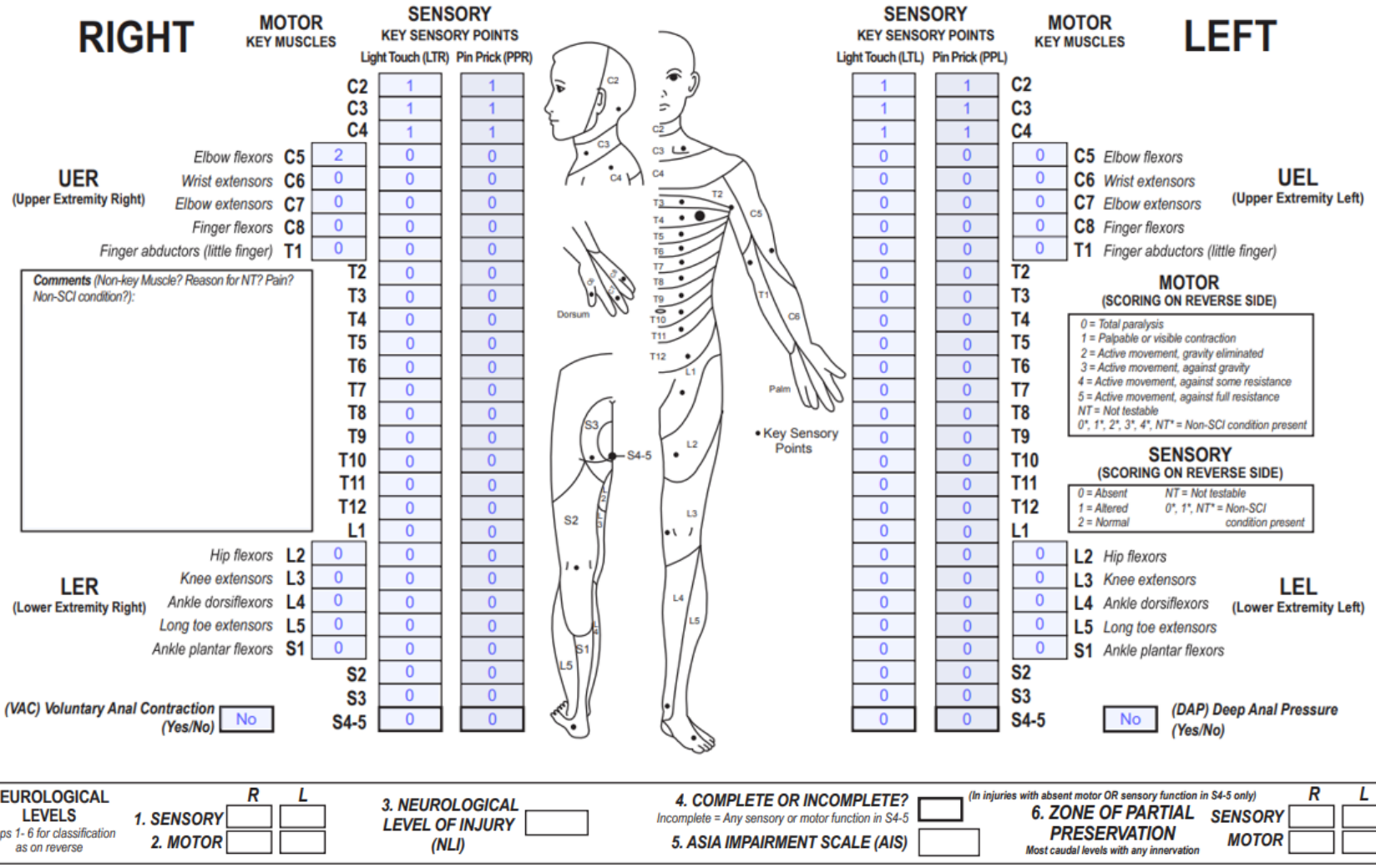
Completeness: This injury is incomplete because there is preserved DAP sensation.

AIS: The AIS grade is C. Because DAP sensation is preserved, the lesion is at least sensory incomplete. VAC is absent, and there is no key muscle function more than 3 segments below the motor level on either side. However, in cases with preserved sensory function in the most caudal sacral segments, non-key muscle function should be evaluated. In this case, non-key muscle function is preserved in left hip external rotation as noted in the comments box. Hip external rotation is assigned to the L3 myotome. (Please note that the most common non-key muscle functions and their associated myotomes can be found on the back of the ISNCSCI worksheet). Therefore, this injury is considered motor incomplete because there is sensory sacral sparing and motor sparing at left L3, which is more than 3 segments below the left motor level (T11). This injury is AIS C (and not AIS D) because less than half (in this case 0/10) of key muscles below the NLI have a motor grade $\geq$3.

Sensory ZPPs: The sensory ZPP is NA bilaterally because there is sensory sacral sparing on both sides (DAP sensation is preserved).

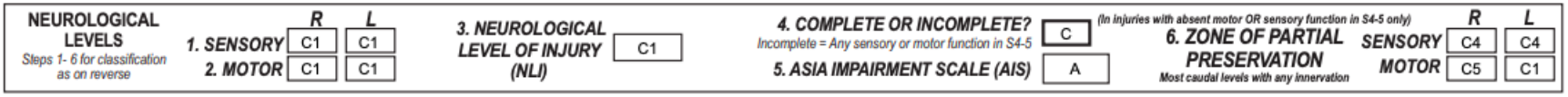
Motor ZPPs: The motor ZPPs are applicable because VAC is absent. On the right, the motor ZPP is T11 because there is no motor function present below the right motor level. The left motor ZPP is L3; while non-key muscle functions are not typically included in the determination process of motor ZPPs, this is a unique situation in which the presence of a non-key muscle function is the only motor finding that defines the case as motor incomplete, so the associated myotome (L3) is recorded as the left motor ZPP.

Case 14


RIGHT
MOTOR
KEY MUSCLES
SENSORY
KEY SENSORY POINTS
Light Touch (LTR)
Pin Prick (PPR)
UER
(Upper Extremity Right)
Elbow flexors C5
Wrist extensors C6
Elbow extensors C7
Finger flexors C8
Finger abductors (little finger) T1
Comments (Non-key Muscle? Reason for NT? Pain? Non-SCI condition?):
LER
(Lower Extremity Right)
Hip flexors L2
Knee extensors L3
Ankle dorsiflexors L4
Long toe extensors L5
Ankle plantar flexors S1
(VAC) Voluntary Anal Contraction (Yes/No)
No
C2 1 1
C3 1 1
C4 1 1
T2 0 0
T3 0 0
T4 0 0
T5 0 0
T6 0 0
T7 0 0
T8 0 0
T9 0 0
T10 0 0
T11 0 0
T12 0 0
L1 0 0
S2 0 0
S3 0 0
S4-5 0 0
Dorsum
Palm
• Key Sensory Points
SENSORY
KEY SENSORY POINTS
Light Touch (LTL)
Pin Prick (PPL)
MOTOR
KEY MUSCLES
LEFT
C2 1 1
C3 1 1
C4 1 1
T2 0 0
T3 0 0
T4 0 0
T5 0 0
T6 0 0
T7 0 0
T8 0 0
T9 0 0
T10 0 0
T11 0 0
T12 0 0
L1 0 0
S2 0 0
S3 0 0
S4-5 0 0
C5 Elbow flexors 0
C6 Wrist extensors 0
C7 Elbow extensors 0
C8 Finger flexors 0
T1 Finger abductors (little finger) 0
UEL
(Upper Extremity Left)
L2 Hip flexors 0
L3 Knee extensors 0
L4 Ankle dorsiflexors 0
L5 Long toe extensors 0
S1 Ankle plantar flexors 0
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
NT = Not testable
0*, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present
SENSORY
(SCORING ON REVERSE SIDE)
0 = Absent
1 = Altered
2 = Normal
NT = Not testable
0*, 1*, NT* = Non-SCI condition present
No
(DAP) Deep Anal Pressure (Yes/No)
NEUROLOGICAL LEVELS
Steps 1- 6 for classification as on reverse
1. SENSORY
2. MOTOR
R
L
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 injuries with absent motor OR sensory function in S4-5 only)
6. ZONE OF PARTIAL PRESERVATION
Most caudal levels with any innervation
SENSORY
MOTOR

ANSWER

Case 14



Sensory levels: The sensory level is C1 bilaterally as sensory function is impaired at C2. The rule states that if sensation is intact on the face but impaired at the C2 dermatome, the sensory level should be documented as C1 (not C0).

Motor levels: The motor level is also C1 bilaterally as it is presumed to be the same as the sensory level.

NLI: The NLI is C1 as each of the motor and sensory levels is also C1.

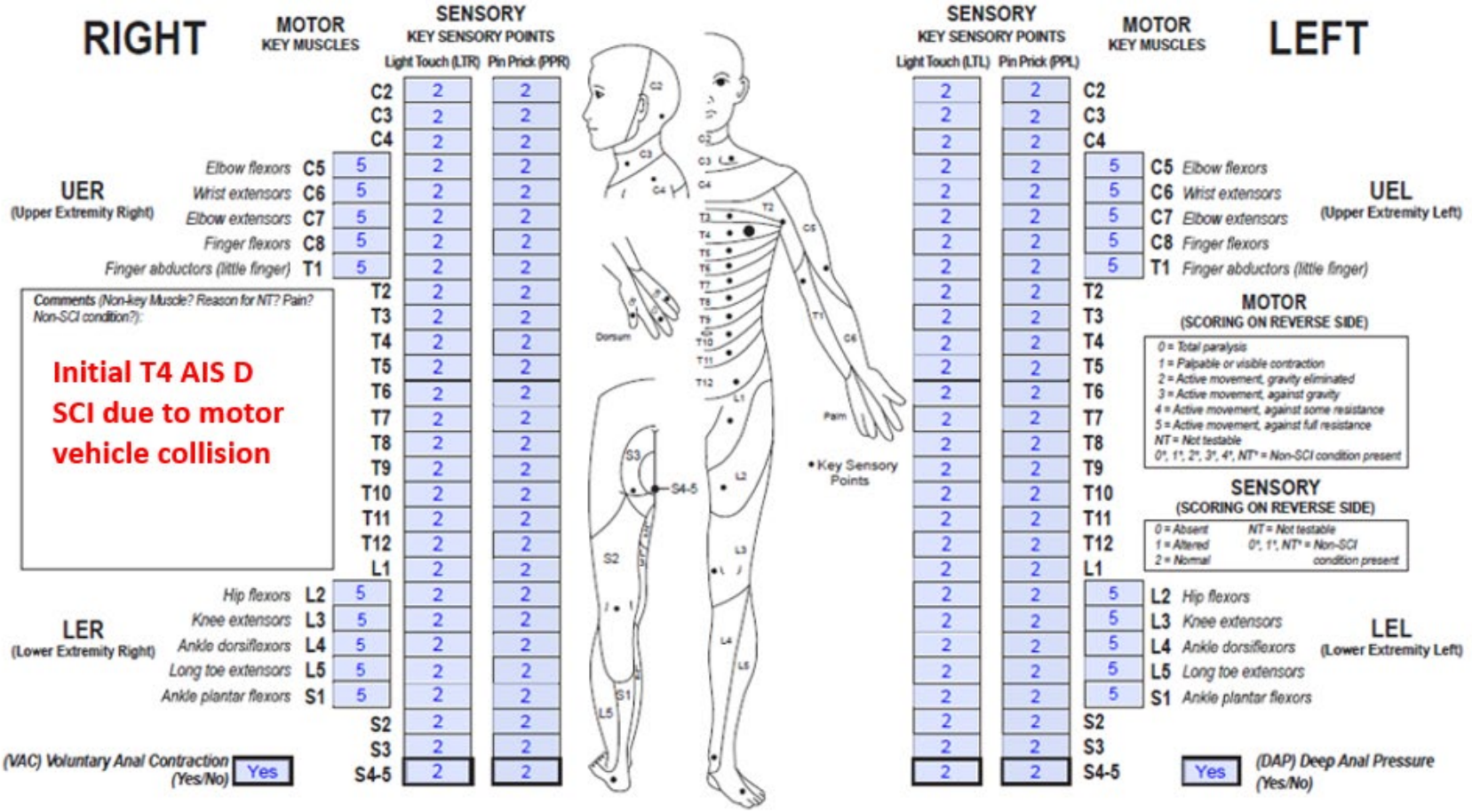
Completeness: There is no sacral sparing (sensorimotor function in the most caudal sacral segments is absent), so this is a complete injury.

AIS: The AIS grade is A because this is a complete injury.

Sensory ZPPs: The sensory ZPP is applicable in the absence of sensory sacral sparing and is C4 bilaterally as this is the most caudal segment on both sides with any sensory function.

Motor ZPPs: There is no VAC and as such the motor ZPP is C5 on the right as this is the most caudal segment with any motor function. The left motor level of C1 is documented as the left motor ZPP as no motor function extends beyond this level. It is important to note that motor function does not follow sensory function below the sensory level when recording the motor ZPP (for example, the left motor ZPP is not C4, even though this is the sensory ZPP).

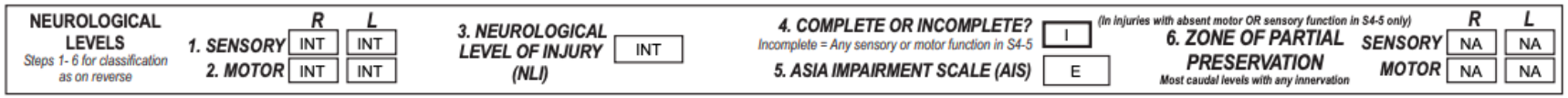
Case 15



NEUROLOGICAL LEVELS Steps 1- 6 for classification as on reverse	R	L	3. NEUROLOGICAL LEVEL OF INJURY (NLI)	4. COMPLETE OR INCOMPLETE? Incomplete = Any sensory or motor function in S4-5	(In injuries with absent motor OR sensory function in S4-5 only)	R	L
1. SENSORY					6. ZONE OF PARTIAL PRESERVATION Most caudal levels with any innervation		
2. MOTOR				5. ASIA IMPAIRMENT SCALE (AIS)	SENSORY		
					MOTOR		

ANSWER

Case 15



Sensory levels: Sensory function is intact throughout all dermatomes (including the most caudal sacral segments), so “INT” should be written for “intact” in both sensory level boxes.

Motor levels: Because motor function is intact in all key muscles and VAC is preserved, “INT” should be recorded in the boxes for motor level.

NLI: “INT” should be recorded in the box for NLI. An initial NLI of T4 is documented in the comments box. It would be best practice in AIS E cases to record the previous NLI (preferably from the initial exam) in the comments box, as this would provide valuable information about the injury and may help to explain and predict ongoing sequelae.

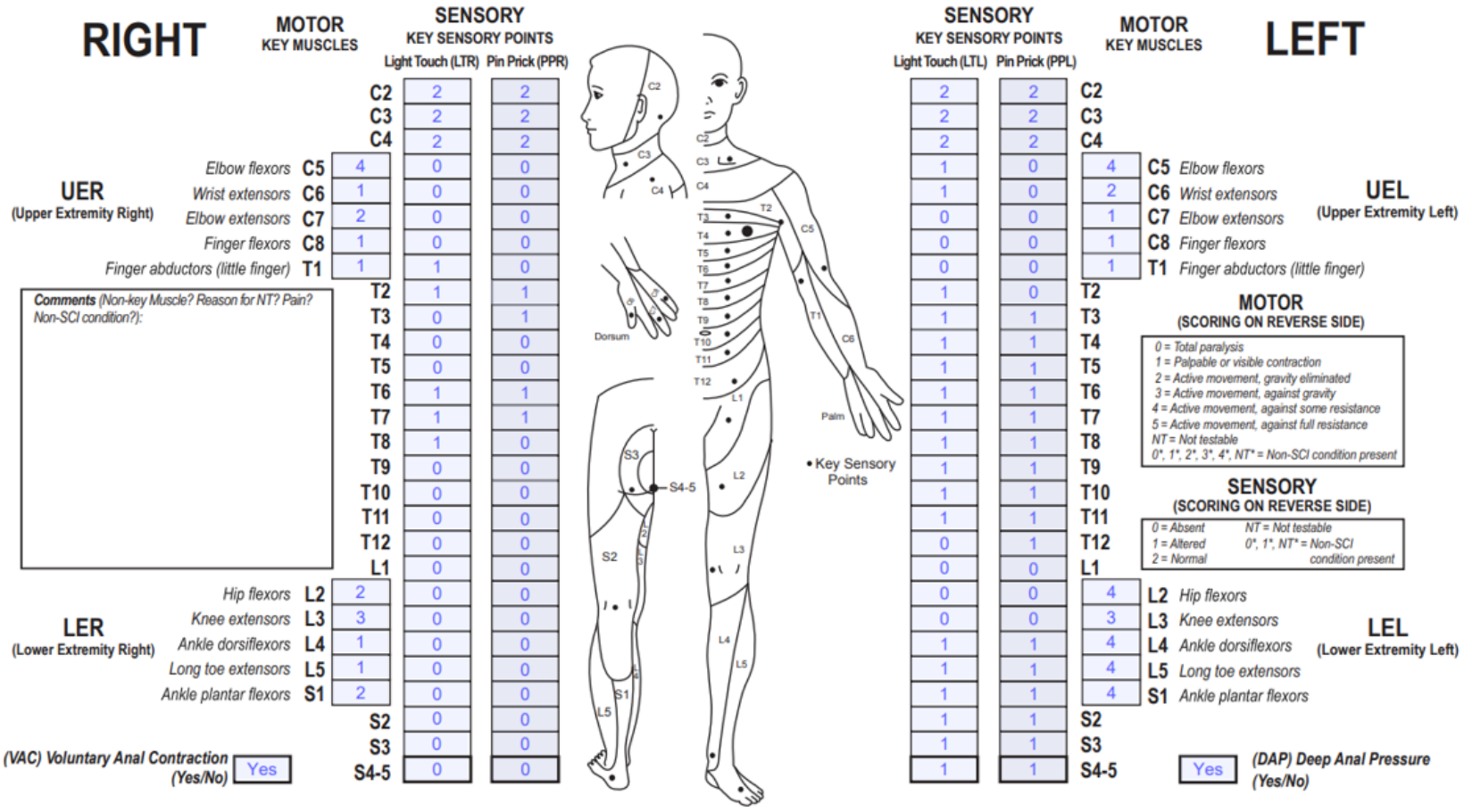
Completeness: This is considered an incomplete injury. Despite a normal ISNCSCI exam, individuals with AIS E injuries may have signs of persistent neurological impairment including brisk reflexes, spasticity, impaired proprioception, and autonomic dysfunction.

AIS: The AIS grade is E because there are no longer any sensorimotor impairments detected with the components of the ISNCSCI exam. Note that the grade is only E if the individual initially had a documented SCI (in most cases based on an earlier ISNCSCI exam indicating some degree of sensory and/or motor impairment). If this was a person’s initial neurological exam (without evidence of an SCI), there would be no AIS grade.

Sensory ZPPs: The sensory ZPP is NA bilaterally because there is sensory sacral sparing on both sides; DAP sensation is present, and both LT and PP sensation are preserved at bilateral S4-5 dermatomes.

Motor ZPPs: The motor ZPP is NA bilaterally because VAC is preserved.

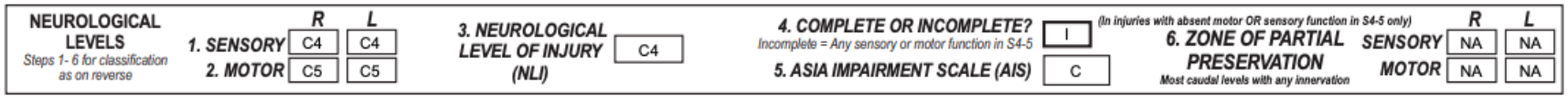
Case 16



NEUROLOGICAL LEVELS	R	L
Steps 1- 6 for classification as on reverse		
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)		
6. ZONE OF PARTIAL PRESERVATION (In injuries with absent motor OR sensory function in S4-5 only) Most caudal levels with any innervation	R	L
SENSORY		
MOTOR		

ANSWER

Case 16



Sensory levels: The sensory level is C4 bilaterally as sensory function is intact from C2 through this dermatome on both sides.

Motor levels: The right and left motor levels are C5 because this is the most caudal key muscle bilaterally with a grade ≥3, and all muscle function above this level is presumed to be intact due to intact sensory scores through C4.

NLI: The NLI is C4 as this is the most rostral of the sensory and motor levels.

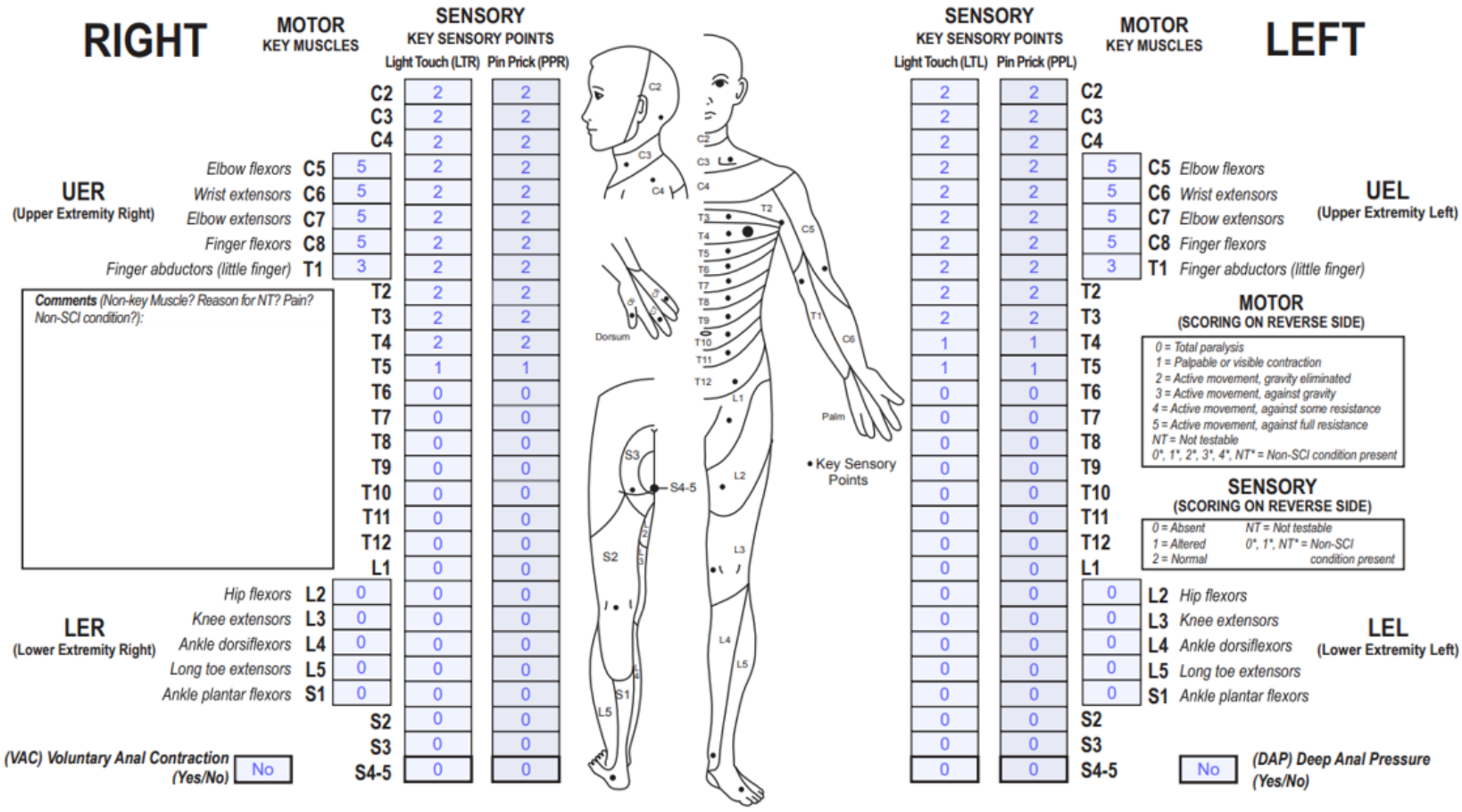
Completeness: This injury is incomplete as there is sacral sparing (DAP sensation, left S4-5 PP and LT sensation, and VAC are preserved).

AIS: The AIS grade is C. Because VAC is present, this injury is considered motor incomplete. This injury is AIS C (and not AIS D) because less than half (8/20) of the key muscles below the NLI (C4) have a motor grade ≥3.

Sensory ZPPs: The sensory ZPP is NA bilaterally because there is sensory sacral sparing on both sides (DAP sensation is preserved). If DAP had been absent in this case, the left sensory ZPP would remain NA due to the preservation of left S4-5 PP and LT sensation, although the right sensory ZPP would then be applicable (and would be T8).

Motor ZPPs: The motor ZPP is NA bilaterally because there is preserved motor function in the most caudal sacral segments (VAC is present).

Case 17



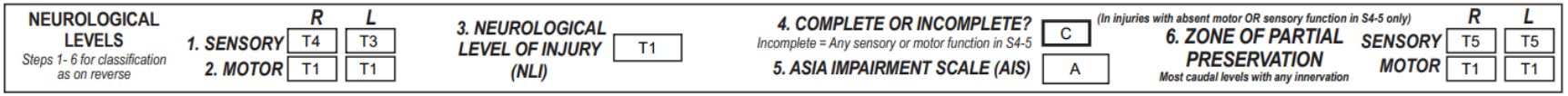
NEUROLOGICAL LEVELS Steps 1- 6 for classification as on reverse		R	L				
	1. SENSORY			3. NEUROLOGICAL LEVEL OF INJURY (NLI)		4. COMPLETE OR INCOMPLETE? Incomplete = Any sensory or motor function in S4-5	
	2. MOTOR					5. ASIA IMPAIRMENT SCALE (AIS)	

(In injuries with absent motor OR sensory function in S4-5 only)

6. ZONE OF PARTIAL PRESERVATION Most caudal levels with any innervation	R	L
SENSORY		
MOTOR		

ANSWER

Case 17



Sensory levels: The sensory level is T4 on the right and T3 on the left as sensory function is intact from C2 through these dermatomes on the respective sides.

Motor levels: The motor level is T1 bilaterally because this is the most caudal key muscle on both sides with a grade ≥3, and motor function above this level is presumed to be intact. Note that even though sensory function is intact through T4 on the right and T3 on the left, the motor level does not defer to the sensory level because the T1 myotome is impaired.

NLI: The NLI is T1 as this is the most rostral of the sensory and motor levels.

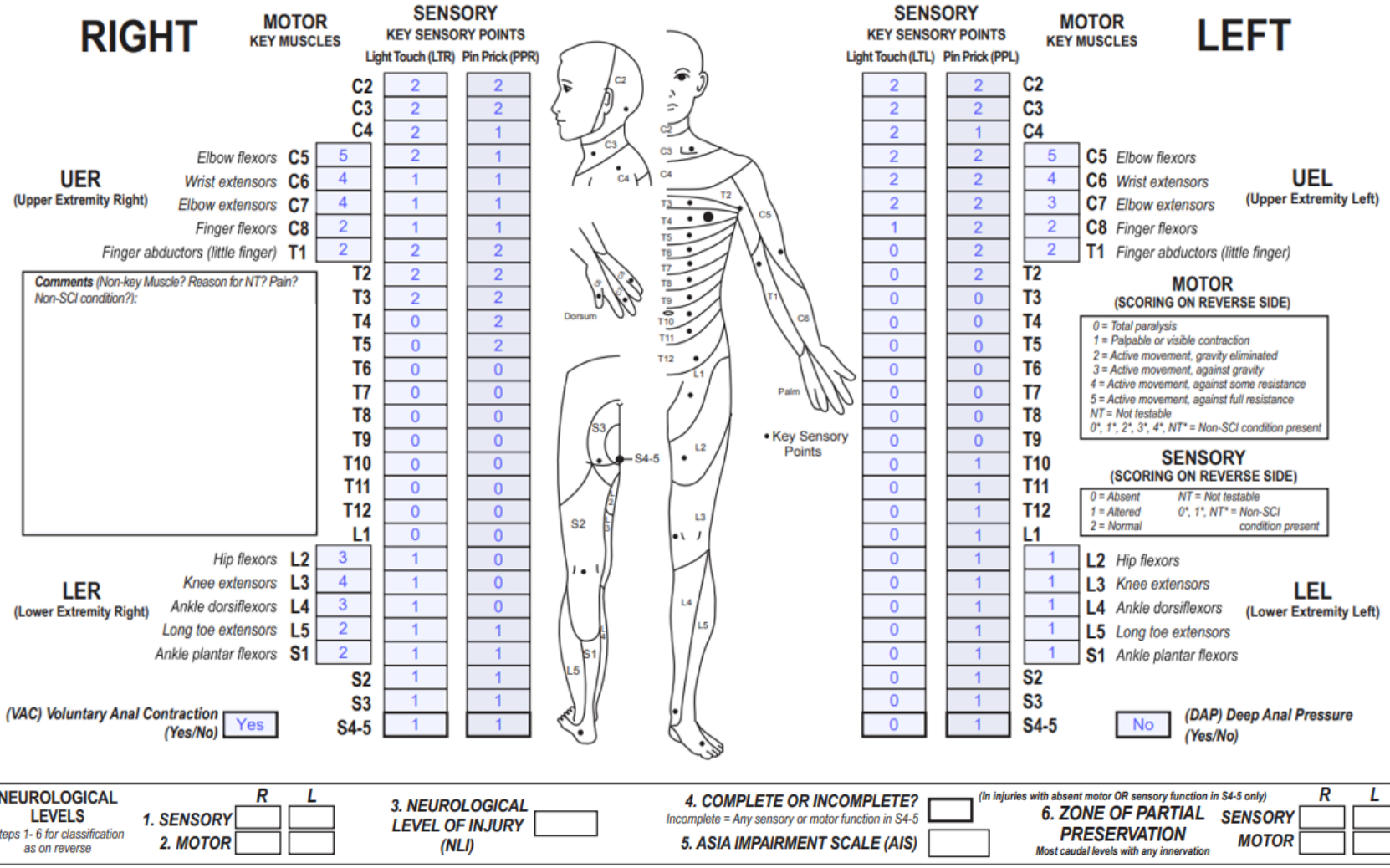
Completeness: There is no sacral sparing, so this is a complete injury.

AIS: The AIS grade is A because this is a complete injury.

Sensory ZPPs: The sensory ZPP is T5 bilaterally as this is the most caudal segment on both sides with preserved sensory function.

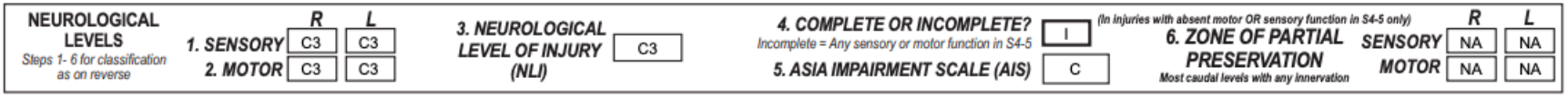
Motor ZPPs: The motor ZPP is T1 bilaterally as this the most caudal myotome on both sides with any motor function. In this case, the motor levels and motor ZPPs are the same because no motor function is preserved below this segment. Even though the sensory ZPP extends to T5 bilaterally, it is important to note that motor function does not follow sensory function when determining the ZPP.

Case 18


RIGHT
MOTOR
KEY MUSCLES
SENSORY
KEY SENSORY POINTS
Light Touch (LTR)
Pin Prick (PPR)
UER
(Upper Extremity Right)
Elbow flexors C5 5
Wrist extensors C6 4
Elbow extensors C7 4
Finger flexors C8 2
Finger abductors (little finger) T1 2
Comments (Non-key Muscle? Reason for NT? Pain? Non-SCI condition?):
LER
(Lower Extremity Right)
Hip flexors L2 3
Knee extensors L3 4
Ankle dorsiflexors L4 3
Long toe extensors L5 2
Ankle plantar flexors S1 2
(VAC) Voluntary Anal Contraction (Yes/No) Yes
C2 2 2
C3 2 2
C4 2 1
T2 2 2
T3 2 2
T4 0 2
T5 0 2
T6 0 0
T7 0 0
T8 0 0
T9 0 0
T10 0 0
T11 0 0
T12 0 0
L1 0 0
S2 1 1
S3 1 1
S4-5 1 1
Dorsum
Palm
• Key Sensory Points
SENSORY
KEY SENSORY POINTS
Light Touch (LTL)
Pin Prick (PPL)
MOTOR
KEY MUSCLES
LEFT
C2 2 2
C3 2 2
C4 2 1
C5 Elbow flexors 5
C6 Wrist extensors 4
C7 Elbow extensors 3
C8 Finger flexors 2
T1 Finger abductors (little finger) 2
UEL
(Upper Extremity Left)
T2 2 2
T3 0 2
T4 0 0
T5 0 0
T6 0 0
T7 0 0
T8 0 0
T9 0 0
T10 0 1
T11 0 1
T12 0 1
L1 0 1
L2 Hip flexors 1
L3 Knee extensors 1
L4 Ankle dorsiflexors 1
L5 Long toe extensors 1
S1 Ankle plantar flexors 1
LEL
(Lower Extremity Left)
S2 0 1
S3 0 1
S4-5 0 1
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
NT = Not testable
0*, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present
SENSORY
(SCORING ON REVERSE SIDE)
0 = Absent
1 = Altered
2 = Normal
NT = Not testable
0*, 1*, NT* = Non-SCI condition present
No
(DAP) Deep Anal Pressure (Yes/No)
NEUROLOGICAL LEVELS
Steps 1- 6 for classification as on reverse
1. SENSORY
2. MOTOR
R
L
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 injuries with absent motor OR sensory function in S4-5 only)
6. ZONE OF PARTIAL PRESERVATION
Most caudal levels with any innervation
SENSORY
MOTOR

ANSWER

Case 18



Sensory levels: The sensory level is C3 bilaterally as sensory function is intact from C2 through this dermatome on both sides.

Motor levels: The right and left motor levels are C3 because the motor levels follow the sensory levels at this segment. While the elbow flexors have a motor grade of 5 and the wrist extensors a grade of 4 bilaterally, neither C5 nor C6 satisfy motor level criteria as it cannot be presumed that motor function is intact at C4. However, if this person were to regain normal PP sensation at the C4 dermatome, the motor levels would then become C6; this illustrates the importance of an accurate PP exam.

NLI: The NLI is C3 as each of the motor and sensory levels is also C3.

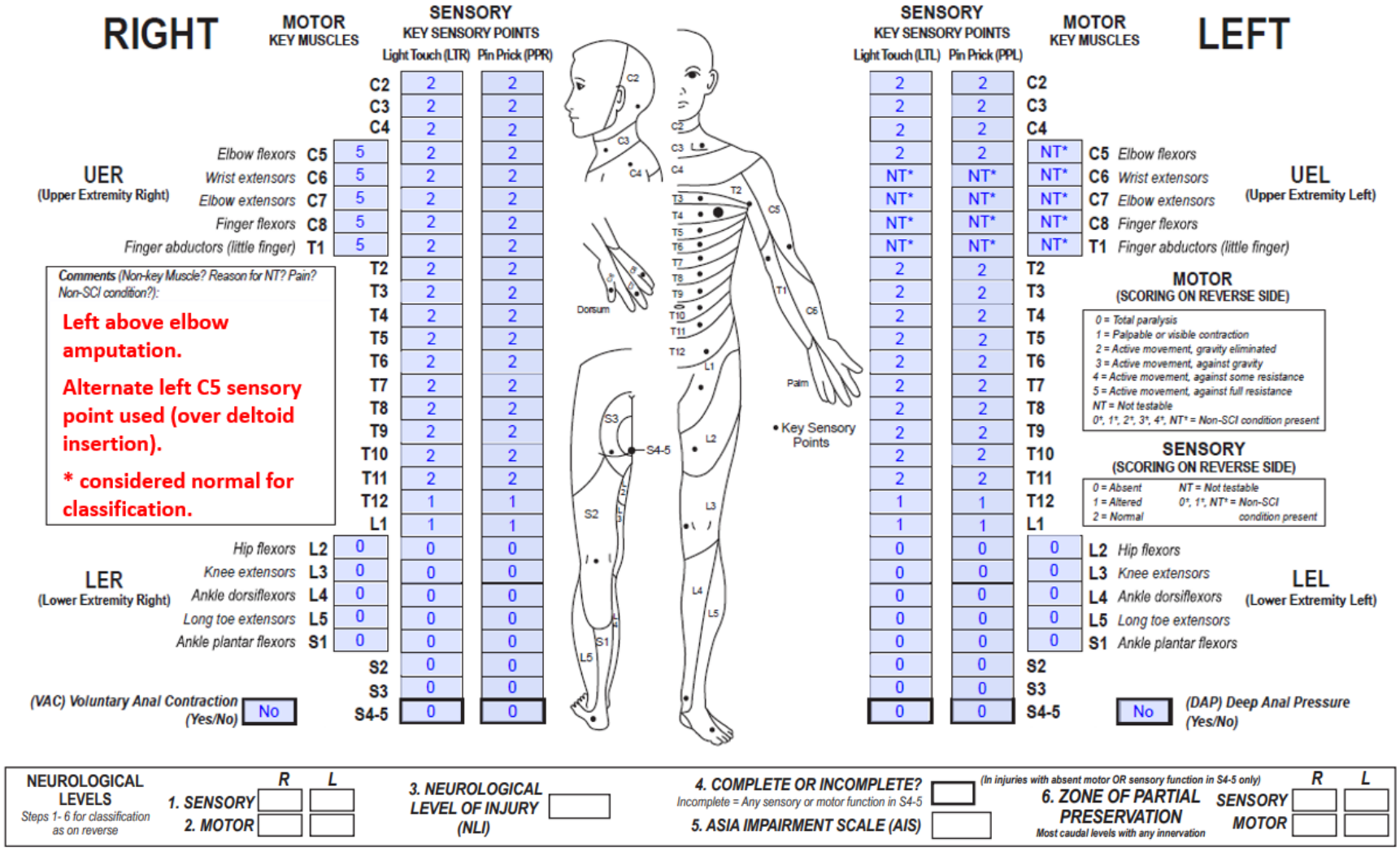
Completeness: This injury is incomplete as there is sacral sparing.

AIS: The AIS grade is C. Because VAC is present, this injury is considered motor incomplete. Even if VAC were absent in this case, the injury would still satisfy criteria for motor incomplete status because there is sensory sacral sparing and preserved motor function more than 3 segments below the motor level. This injury is AIS C grade (and not AIS D) because less than half (9/20) of the key muscles below the NLI (C3) have a motor grade $\geq$3.

Sensory ZPPs: The sensory ZPP is NA bilaterally because there is sensory sacral sparing on both sides. Even though DAP is absent, there is S4-5 PP and LT sensation on the right and S4-5 PP sensation on the left.

Motor ZPPs: The motor ZPP is NA bilaterally because there is preserved motor function in the most caudal sacral segments (VAC is present).

Case 19


RIGHT
MOTOR
KEY MUSCLES
SENSORY
KEY SENSORY POINTS
Light Touch (LTR)
Pin Prick (PPR)
UER
(Upper Extremity Right)
Elbow flexors C5 5
Wrist extensors C6 5
Elbow extensors C7 5
Finger flexors C8 5
Finger abductors (little finger) T1 5
LER
(Lower Extremity Right)
Hip flexors L2 0
Knee extensors L3 0
Ankle dorsiflexors L4 0
Long toe extensors L5 0
Ankle plantar flexors S1 0
(VAC) Voluntary Anal Contraction (Yes/No) No
Comments (Non-key Muscle? Reason for NT? Pain? Non-SCI condition?):
Left above elbow amputation.
Alternate left C5 sensory point used (over deltoid insertion).
* considered normal for classification.
C2 2 2
C3 2 2
C4 2 2
T2 2 2
T3 2 2
T4 2 2
T5 2 2
T6 2 2
T7 2 2
T8 2 2
T9 2 2
T10 2 2
T11 2 2
T12 1 1
L1 1 1
L2 0 0
L3 0 0
L4 0 0
L5 0 0
S1 0 0
S2 0 0
S3 0 0
S4-5 0 0
Dorsum
Palm
• Key Sensory Points
SENSORY
KEY SENSORY POINTS
Light Touch (LTL)
Pin Prick (PPL)
MOTOR
KEY MUSCLES
LEFT
2 2 C2
2 2 C3
2 2 C4
2 2 NT* C5 Elbow flexors
NT* NT* NT* C6 Wrist extensors
NT* NT* NT* C7 Elbow extensors
NT* NT* NT* C8 Finger flexors
NT* NT* NT* T1 Finger abductors (little finger)
UEL
(Upper Extremity Left)
2 2 T2
2 2 T3
2 2 T4
2 2 T5
2 2 T6
2 2 T7
2 2 T8
2 2 T9
2 2 T10
2 2 T11
1 1 T12
1 1 L1
0 0 0 L2 Hip flexors
0 0 0 L3 Knee extensors
0 0 0 L4 Ankle dorsiflexors
0 0 0 L5 Long toe extensors
0 0 0 S1 Ankle plantar flexors
LEL
(Lower Extremity Left)
0 0 S2
0 0 S3
0 0 S4-5
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
NT = Not testable
0*, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present
SENSORY
(SCORING ON REVERSE SIDE)
0 = Absent
1 = Altered
2 = Normal
NT = Not testable
0*, 1*, NT* = Non-SCI condition present
No (DAP) Deep Anal Pressure (Yes/No)
NEUROLOGICAL LEVELS
Steps 1- 6 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 injuries with absent motor OR sensory function in S4-5 only)
6. ZONE OF PARTIAL PRESERVATION
Most caudal levels with any innervation
SENSORY
MOTOR
R L

ANSWER

Case 19

Sensory levels: The right sensory level is T11 because right-sided sensory function is intact from C2 through this dermatome. The left sensory level is T11*. Apart from the levels affected by the amputation, sensory function on the left is also intact from C2 through the T11 dermatome. Sensation is rated NT* at dermatomes C6-T1 on the left due to the amputation. Note that because the left C5 key sensory point was also impacted by the amputation, an alternate point within the C5 dermatome was tested by the examiner as documented in the comments box. It may be good practice to include the location of the alternate testing point so that it can be used for subsequent examinations, if the non-SCI condition is permanent, as it is in this case. If an alternate sensory point is used due to a transient condition that prevents testing at the key sensory point, such as the presence of a cast, the key sensory point should be used whenever possible for follow up exams. Based upon clinical assumptions, "*"-tagged scores are considered normal for classification, and due to this assumption, T11 requires an "*" (T11*). Under different assumptions about the dermatomes that cannot be tested, the left sensory level could be as rostral as C5.

Motor levels: The right motor level defers to the sensory level of T11 because motor function is presumed to be intact through this segment. Similarly, left-sided motor function is also presumed to be intact through T11. Left C5-T1 myotomes are rated NT* due to the amputation, but the clinical assumption is that these scores are normal for classification; under different assumptions about the myotomes that cannot be tested, the motor level could be as rostral as C4. Because of this assumption, the left motor level must be tagged with an "*" (T11*).

NLI: The NLI is T11*. An "*" is required for the same reasons the left sensory and motor levels require one. If the clinical assumption was that the C6-T1 dermatomes and C5-T1 myotomes would not test as intact due to the SCI (even without the amputation), the NLI could be as rostral as C4.

Completeness: There is no sacral sparing, so this is a complete injury.

AIS: The AIS grade is A because this is a complete injury. Note that the AIS grade is not tagged with an "*" because the presence of the non-SCI condition has no impact on the anorectal exam in this case.

Sensory ZPPs: The sensory ZPP is L1 bilaterally as this is the most caudal segment on both sides with any sensory function. It is important to note that the left sensory ZPP should not receive an "*" because this classification component is not impacted by a clinical assumption; in other words, left L1 is the lowest dermatome with any sensory sparing, and this does not depend on the presence or absence of the non-SCI condition.

Motor ZPPs: The motor ZPP is T11 on the right because this is the right motor level, and there is no motor function below this segment. Similarly, the left motor ZPP is T11* as this is also the left motor level, and there is no motor function distal to this myotome. The left motor ZPP requires the "*"-tag because if the assumption was instead that the C5-T1 myotomes were impaired from the SCI, the left motor ZPP could be as rostral as C4.

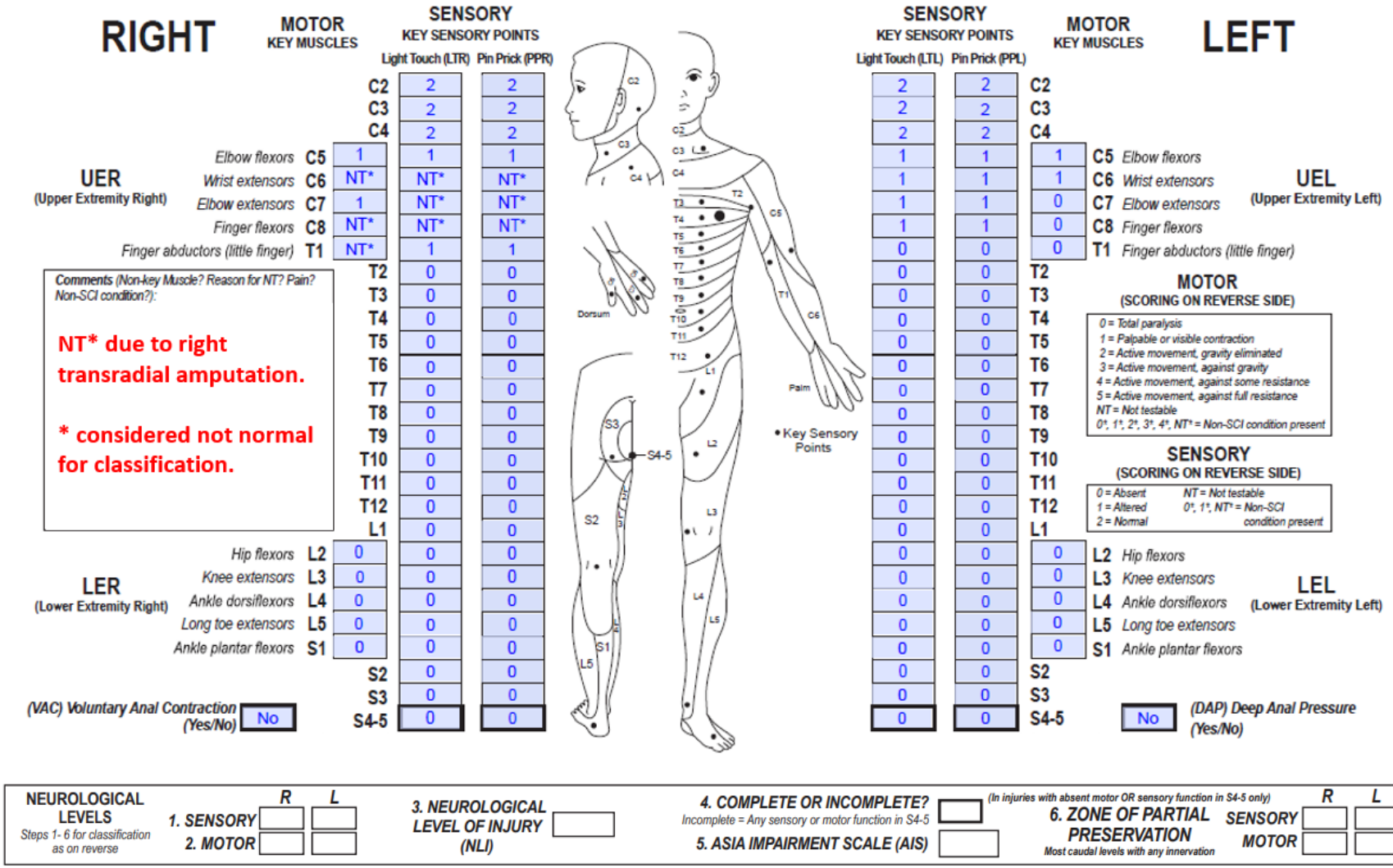
When determining if a classification variable requires an "*", the International Standards Committee recommends the following steps[13]:

1) First perform the classification by replacing the "*"-tagged scores with the assumed ones.
2) Record the classification results in the respective boxes at the bottom of the ISNCSCI worksheet.
3) Next, use the actual examined scores and re-classify.
4) All differing classification variables should receive an "*".

These steps are illustrated below in the classification of Case 19:

1) LT and PP scores in the left C6-T1 dermatomes are assumed to be intact (2/2) for classification, and the motor scores in the left C5-T1 myotomes are also assumed to be intact (5/5).
2) By replacing the "*"-tagged scores with assumed ones, the right and left sensory levels are T11, the right and left motor levels are T11, the NLI is T11, this is a complete injury, the AIS grade is A, the right and left sensory ZPPs are L1, and the right and left motor ZPPs are T11. These results are recorded in the respective boxes at the bottom for the ISNCSCI worksheet.
3) Using the actual examined scores, the right sensory level is T11, the left sensory level is not determinable (ND) as it could be as rostral as C5, the right motor level is T11, the left motor level is ND as it could be as rostral as C4, the NLI is ND as it could be as rostral as C4, this is a complete injury, the AIS grade is A, the right and left sensory ZPPs are L1, the right motor ZPP is T11, and the left motor ZPP is ND as it could be as rostral as C4.
4) All differing classification variables, including the left sensory and motor levels, NLI, and left motor ZPP should receive an "*".

Case 20

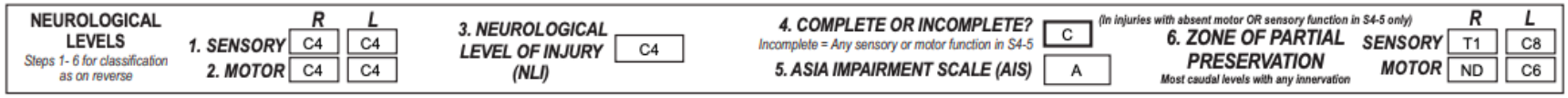


NEUROLOGICAL LEVELS Steps 1- 6 for classification as on reverse	R	L				
1. SENSORY			3. NEUROLOGICAL LEVEL OF INJURY (NLI)		4. COMPLETE OR INCOMPLETE? Incomplete = Any sensory or motor function in S4-5	
2. MOTOR					5. ASIA IMPAIRMENT SCALE (AIS)	

(In injuries with absent motor OR sensory function in S4-5 only)	R	L
6. ZONE OF PARTIAL PRESERVATION Most caudal levels with any innervation		
SENSORY		
MOTOR		

ANSWER

Case 20



Sensory levels: The sensory level is C4 bilaterally because sensory function is intact from C2 through this dermatome on each side.

Motor levels: Both motor levels are also C4 because strength in the left elbow flexors (C5) is graded as only 1 bilaterally; the motor level defers to the sensory level of C4 as it is presumed that motor function is intact from C2 through this level.

NLI: The NLI is C4 as each of the motor and sensory levels is also C4.

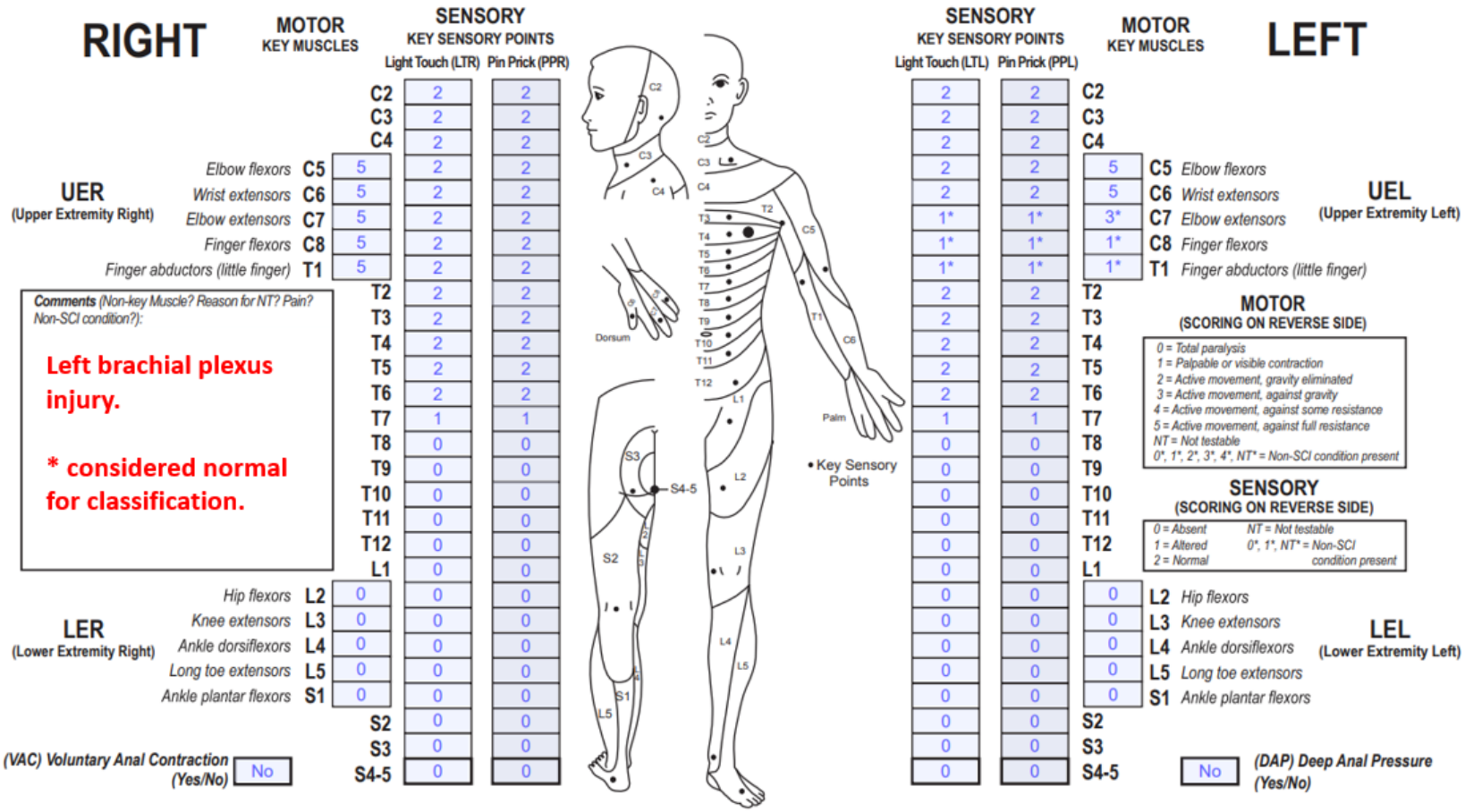
Completeness: There is no sacral sparing, so this is a complete injury.

AIS: The AIS grade is A because this is a complete injury. Note that the AIS grade is not tagged with an "*" because the presence of the non-SCI condition has no impact on the anorectal exam in this case.

Sensory ZPPs: The sensory ZPP is applicable bilaterally in the absence of sensory sacral sparing. The sensory ZPP is T1 on the right and C8 on the left as these are the lowest levels on the respective sides with preserved sensory function. It is important to note that the right sensory ZPP should not receive an "*" because this classification component is not impacted by a clinical assumption; in other words, right T1 is the lowest dermatome with any sensory sparing, and this does not depend on the presence or absence of the non-SCI condition.

Motor ZPPs: The right motor ZPP is ND due to the non-SCI condition. Based on the examination, C7 is the most caudal myotome with any motor function. However, the C8 and T1 myotomes are graded as NT*. In the absence of the amputation, it is possible that motor function would have extended to the T1 segment. Because the most caudal extent of motor preservation remains unknown, ND must be recorded for the right motor ZPP; ND does not require an "*" as this designation is not based on a clinical assumption. The left motor ZPP is C6 as this is the lowest myotome with any motor function on that side.

Case 21



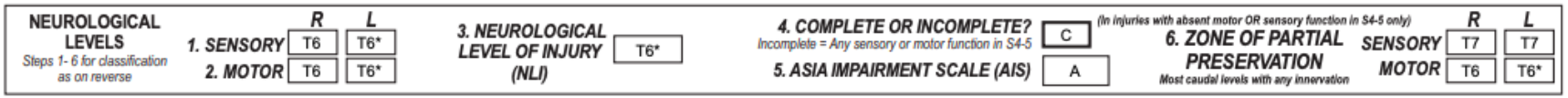
NEUROLOGICAL LEVELS Steps 1- 6 for classification as on reverse	R	L				
1. SENSORY			3. NEUROLOGICAL LEVEL OF INJURY (NLI)		4. COMPLETE OR INCOMPLETE? Incomplete = Any sensory or motor function in S4-5	
2. MOTOR					5. ASIA IMPAIRMENT SCALE (AIS)	

(In injuries with absent motor OR sensory function in S4-5 only)

6. ZONE OF PARTIAL PRESERVATION Most caudal levels with any innervation	R	L
SENSORY		
MOTOR		

ANSWER

Case 21



Sensory levels: The right sensory level is T6 because right-sided sensory function is intact from C2 through this dermatome. The left sensory level is T6*. Apart from the levels affected by the brachial plexopathy, sensory function on the left is also intact from C2 through the T6 dermatome. Sensory scores are "*"-tagged at dermatomes C7-T1 on the left; based upon clinical judgment, these are considered normal for classification, and because of this clinical assumption, T6 requires an "*" (T6*). Note that without the clinical assumption, based on the examined scores, the left sensory level would be C6.

Motor levels: The motor level follows the sensory level bilaterally. The right motor level is T6 because motor function is presumed to be intact from C2 through this segment. Similarly, left-sided motor function is also presumed to be intact from C2 through T6. Left C7-T1 motor scores are tagged with an "*" due to the brachial plexopathy, and the clinical assumption is that these scores are considered normal for classification. Because of this assumption, the left motor level must be tagged with an "*" (T6*). Note that without the clinical assumption, based on the examined scores, the left motor level would be C7.

NLI: The NLI is T6*. An "*" is required for the same reasons the left sensory and motor levels require one. If the clinical assumption was instead that the left C7-T1 dermatomes/myotomes were impaired as the result of the SCI, the NLI would be C6.

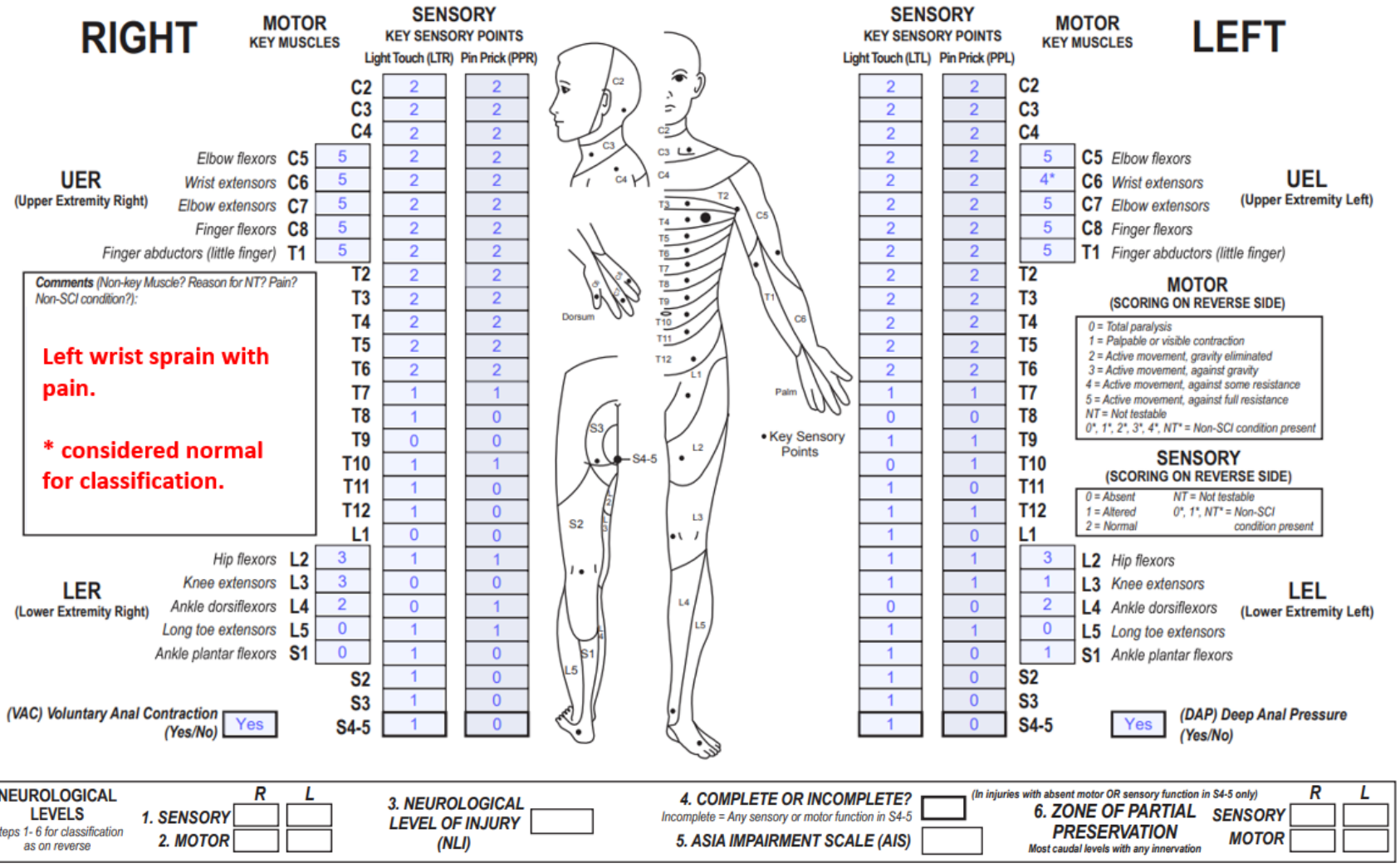
Completeness: There is no sacral sparing, so this is a complete injury.

AIS: The AIS grade is A because this is a complete injury.

Sensory ZPPs: The sensory ZPP is T7 bilaterally as this is the most caudal segment on both sides with any sensory function.

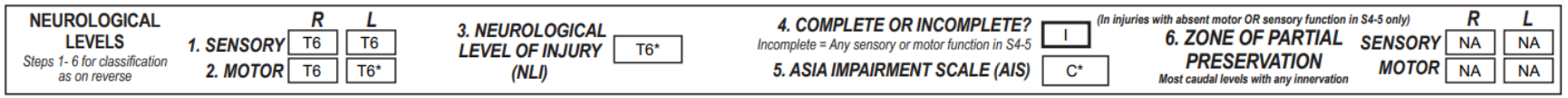
Motor ZPPs: The motor ZPP is T6 on the right because this is the right motor level, and there is no motor function below this segment. Similarly, the left motor ZPP is T6* as this is also the left motor level, and there is no motor function caudal to this myotome. The left motor ZPP requires the "*"-tag because if the "*"-tagged dermatomes/myotomes were impacted by the SCI, the left motor ZPP would be T1.

Case 22


RIGHT
MOTOR
KEY MUSCLES
SENSORY
KEY SENSORY POINTS
Light Touch (LTR)
Pin Prick (PPR)
UER
(Upper Extremity Right)
Elbow flexors C5 5
Wrist extensors C6 5
Elbow extensors C7 5
Finger flexors C8 5
Finger abductors (little finger) T1 5
Comments (Non-key Muscle? Reason for NT? Pain? Non-SCI condition?):
Left wrist sprain with pain.
* considered normal for classification.
LER
(Lower Extremity Right)
Hip flexors L2 3
Knee extensors L3 3
Ankle dorsiflexors L4 2
Long toe extensors L5 0
Ankle plantar flexors S1 0
(VAC) Voluntary Anal Contraction (Yes/No) Yes
C2 2 2
C3 2 2
C4 2 2
T2 2 2
T3 2 2
T4 2 2
T5 2 2
T6 2 2
T7 1 1
T8 1 0
T9 0 0
T10 1 1
T11 1 0
T12 1 0
L1 0 0
S2 1 0
S3 1 0
S4-5 1 0
Dorsum
Palm
• Key Sensory Points
SENSORY
KEY SENSORY POINTS
Light Touch (LTL)
Pin Prick (PPL)
MOTOR
KEY MUSCLES
LEFT
C2 2 2
C3 2 2
C4 2 2
C5 Elbow flexors 5
C6 Wrist extensors 4*
C7 Elbow extensors 5
C8 Finger flexors 5
T1 Finger abductors (little finger) 5
UEL
(Upper Extremity Left)
T2 2 2
T3 2 2
T4 2 2
T5 2 2
T6 2 2
T7 1 1
T8 0 0
T9 1 1
T10 0 1
T11 1 0
T12 1 1
L1 1 0
L2 Hip flexors 3
L3 Knee extensors 1
L4 Ankle dorsiflexors 2
L5 Long toe extensors 0
S1 Ankle plantar flexors 1
LEL
(Lower Extremity Left)
S2 1 0
S3 1 0
S4-5 1 0
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
NT = Not testable
0*, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present
SENSORY
(SCORING ON REVERSE SIDE)
0 = Absent
1 = Altered
2 = Normal
NT = Not testable
0*, 1*, NT* = Non-SCI condition present
Yes
(DAP) Deep Anal Pressure (Yes/No)
NEUROLOGICAL LEVELS
Steps 1- 6 for classification as on reverse
1. SENSORY
2. MOTOR
R
L
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 injuries with absent motor OR sensory function in S4-5 only)
6. ZONE OF PARTIAL PRESERVATION
Most caudal levels with any innervation
SENSORY
MOTOR

ANSWER

Case 22



Sensory levels: The sensory level is T6 bilaterally as sensory function is intact from C2 through this dermatome on both sides. Note that the presence of the non-SCI condition does not affect the sensory scores or sensory levels in this case.

Motor levels: Motor function is presumed to be intact from C2 through T6 bilaterally; both motor levels defer to the sensory levels of T6. Motor function is rated 4* at the left C6 myotome due to the wrist sprain and pain, and it is assumed that motor function at this level is normal for classification. Because of this assumption, the left motor level must be tagged with an "*" (T6*). Otherwise, based on the examined scores, the left motor level would be C6.

NLI: The NLI is T6*. An "*" is required for the same reason that the left motor level requires one. Based on the examined scores (without the clinical assumption), both the left motor level and NLI would be C6.

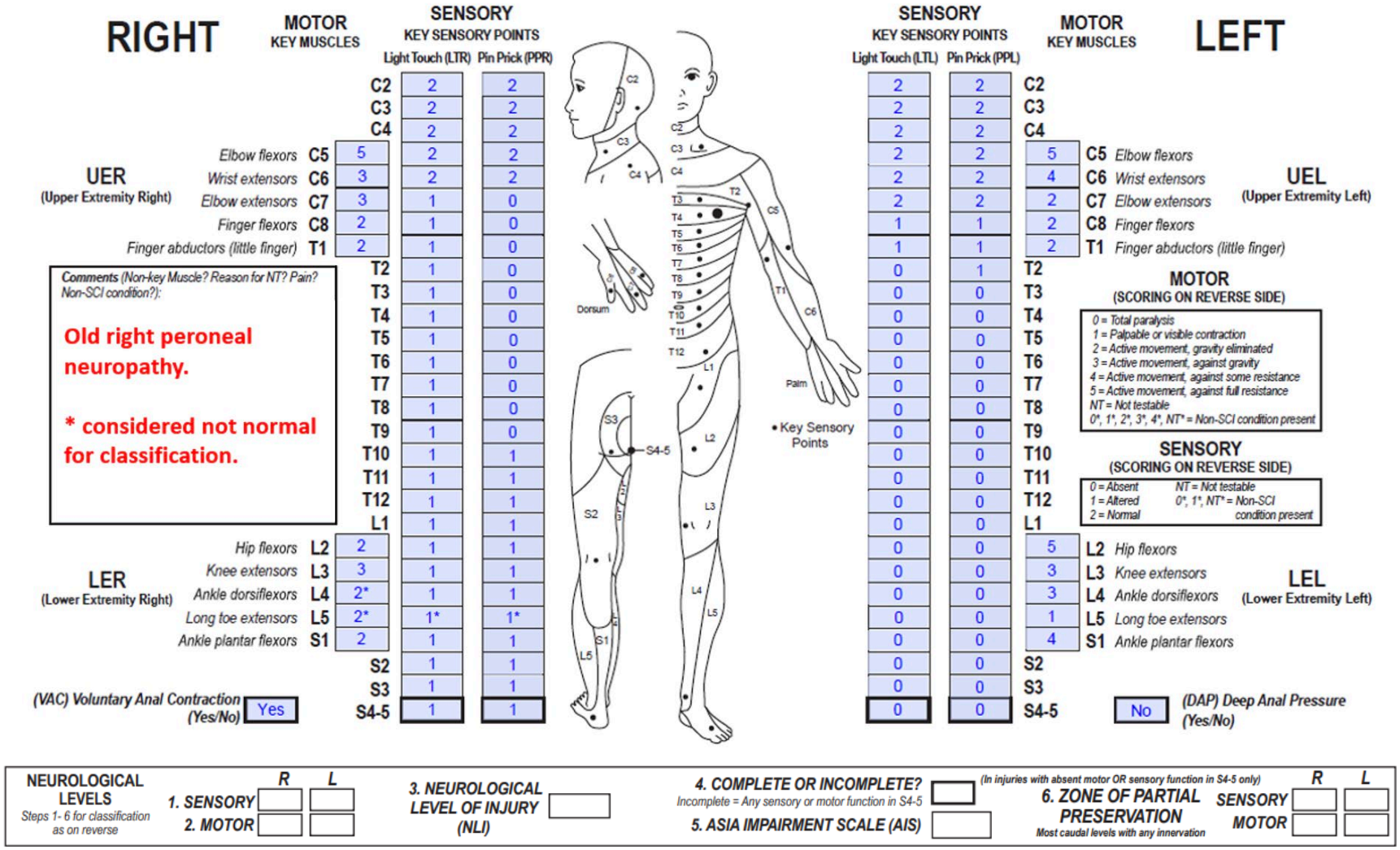
Completeness: This injury is incomplete as there is sacral sparing.

AIS: The AIS grade is C* because VAC is present, and less than half (3/10) of key muscles below the NLI (T6*) have a motor grade $\geq$3. The AIS grade requires the "*"-tag because the classification is based on the clinical assumption that the left C6 myotome would be normal if not for the non-SCI condition. Based on the examined scores alone (without the clinical assumption), the left motor level and NLI would be C6. In this scenario (NLI of C6), the AIS grade would be D because more than half (9/16) of the key muscles below the NLI would have a motor grade $\geq$3. The C* indicates that a clinical assumption has been made and played a role in the classification.

Sensory ZPPs: The sensory ZPP is NA bilaterally because there is sensory sacral sparing on both sides (preservation of DAP and LT sensation at the S4-5 dermatomes bilaterally).

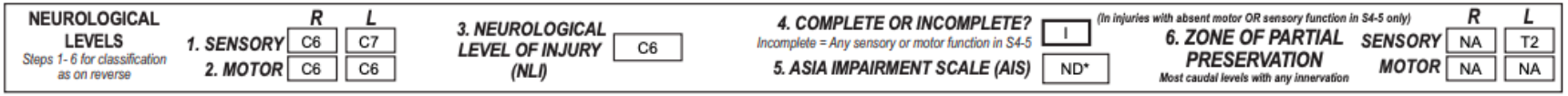
Motor ZPPs: The motor ZPP is NA bilaterally because there is preserved motor function in the most caudal sacral segments (VAC is present).

Case 23


RIGHT
MOTOR
KEY MUSCLES
SENSORY
KEY SENSORY POINTS
Light Touch (LTR)
Pin Prick (PPR)
UER
(Upper Extremity Right)
Elbow flexors C5
Wrist extensors C6
Elbow extensors C7
Finger flexors C8
Finger abductors (little finger) T1
LER
(Lower Extremity Right)
Hip flexors L2
Knee extensors L3
Ankle dorsiflexors L4
Long toe extensors L5
Ankle plantar flexors S1
Comments (Non-key Muscle? Reason for NT? Pain? Non-SCI condition?):
Old right peroneal neuropathy.
* considered not normal for classification.
(VAC) Voluntary Anal Contraction (Yes/No)
Yes
Dorsum
Palm
• Key Sensory Points
SENSORY
KEY SENSORY POINTS
Light Touch (LTL)
Pin Prick (PPL)
MOTOR
KEY MUSCLES
LEFT
UEL
(Upper Extremity Left)
C5 Elbow flexors
C6 Wrist extensors
C7 Elbow extensors
C8 Finger flexors
T1 Finger abductors (little finger)
LEL
(Lower Extremity Left)
L2 Hip flexors
L3 Knee extensors
L4 Ankle dorsiflexors
L5 Long toe extensors
S1 Ankle plantar flexors
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
NT = Not testable
0*, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present
SENSORY
(SCORING ON REVERSE SIDE)
0 = Absent
1 = Altered
2 = Normal
NT = Not testable
0*, 1*, NT* = Non-SCI condition present
No
(DAP) Deep Anal Pressure (Yes/No)
NEUROLOGICAL LEVELS
Steps 1- 6 for classification as on reverse
1. SENSORY
2. MOTOR
R
L
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 injuries with absent motor OR sensory function in S4-5 only)
6. ZONE OF PARTIAL PRESERVATION
Most caudal levels with any innervation
SENSORY
MOTOR

ANSWER

Case 23



Sensory levels: The sensory level is C6 on the right and C7 on the left as sensory function is intact from C2 through these dermatomes on the respective sides.

Motor levels: The motor level is C6 bilaterally as this is the most caudal key muscle on both sides with a motor grade ≥3, and motor function above this segment is presumed to be intact.

NLI: The NLI is C6 as this is the most rostral of the sensory and motor levels.

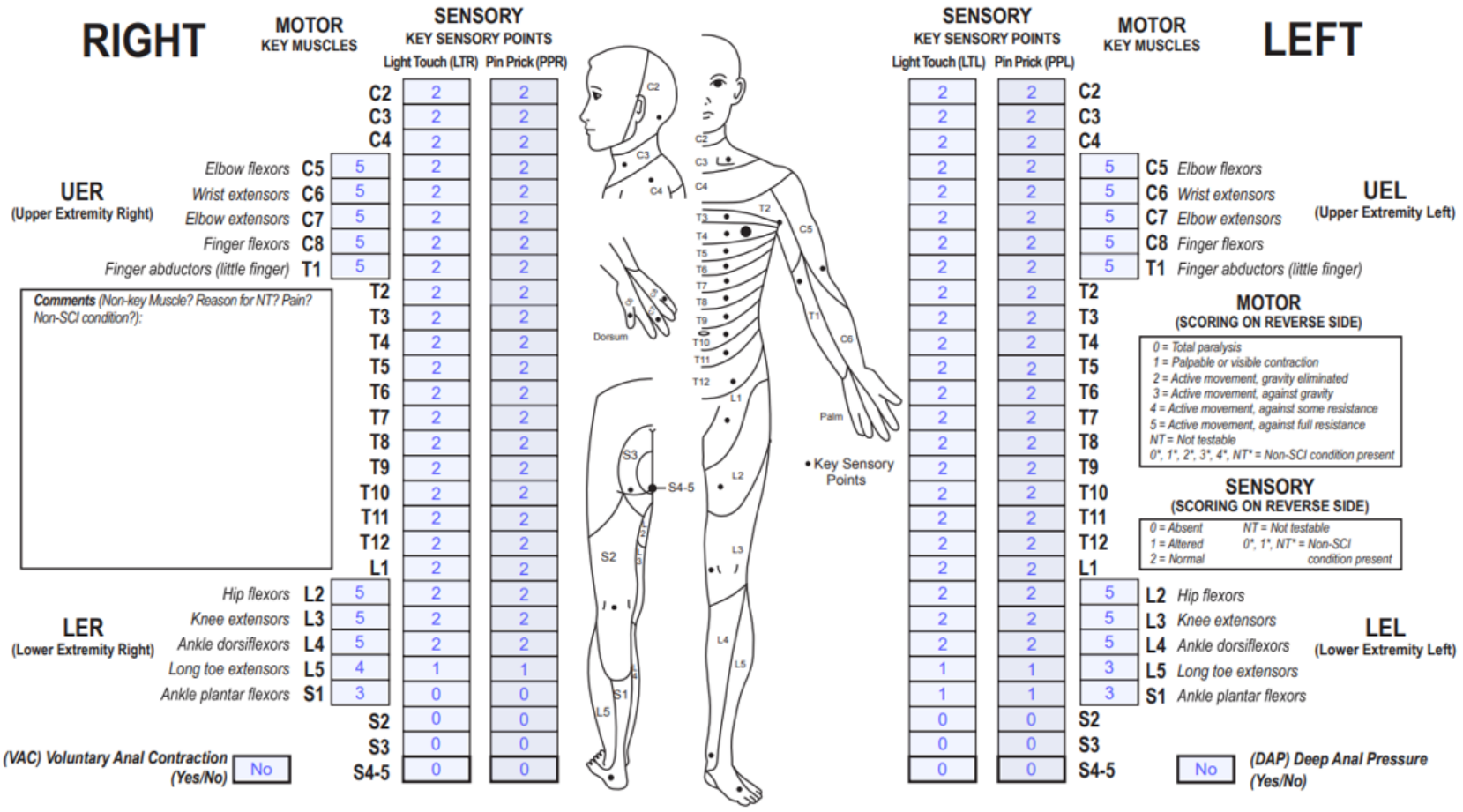
Completeness: This injury is incomplete as there is sacral sparing.

AIS: While this injury is motor incomplete, the AIS grade cannot be defined and should be recorded as ND*. Based on the examined scores, less than half (6/16) of the key muscles below the NLI (C6) have a muscle grade ≥3 (which would result in an AIS grade of C). However, two of these motor scores (right L4 and L5) are graded 2* due to the presence of an old peroneal neuropathy. Although it is assumed that these scores are not normal for classification, the motor scores could be graded as 3 or 4 in the absence of the non-SCI condition. If that were the case, the AIS grade would be D as half (8/16) of the key muscles below the NLI would have a grade ≥3. Because the AIS grade could be either a C or D in the absence of the non-SCI condition, ND* must be documented. Note that the ND requires an "*" because there is an assumption that the clinical impairment is caused by both the SCI and the peroneal neuropathy; if the impairment had been caused by the SCI alone, the AIS grade would be C. Please note that it is good practice to document in the comments box that the injury is motor incomplete and that the AIS grade could be C or D.

Sensory ZPPs: The right sensory ZPP is NA because there is sparing of LT and PP sensation in the right S4-5 dermatome. The left sensory ZPP is applicable in the absence of both DAP and left S4-5 LT/PP sensation, and it is T2 as this is the most caudal segment on that side with any sensory function. This is a unique example of a unilateral sensory ZPP.

Motor ZPPs: The motor ZPP is NA bilaterally because there is preserved motor function in the most caudal sacral segments (VAC is present).

Case 24



NEUROLOGICAL LEVELS Steps 1- 6 for classification as on reverse	R	L	3. NEUROLOGICAL LEVEL OF INJURY (NLI)	4. COMPLETE OR INCOMPLETE? Incomplete = Any sensory or motor function in S4-5	(In injuries with absent motor OR sensory function in S4-5 only)	R	L
1. SENSORY					6. ZONE OF PARTIAL PRESERVATION Most caudal levels with any innervation		
2. MOTOR				5. ASIA IMPAIRMENT SCALE (AIS)	SENSORY		
					MOTOR		

ANSWER

Case 24

Sensory levels: The sensory level is L4 bilaterally as sensory function is intact from C2 through this dermatome on both sides.

Motor levels: The motor level is L5 bilaterally as this is the most caudal key muscle on both sides with a motor grade ≥3, and all motor function rostral to this level is presumed to be intact.

NLI: The NLI is L4 as this is the most rostral of the sensory and motor levels.

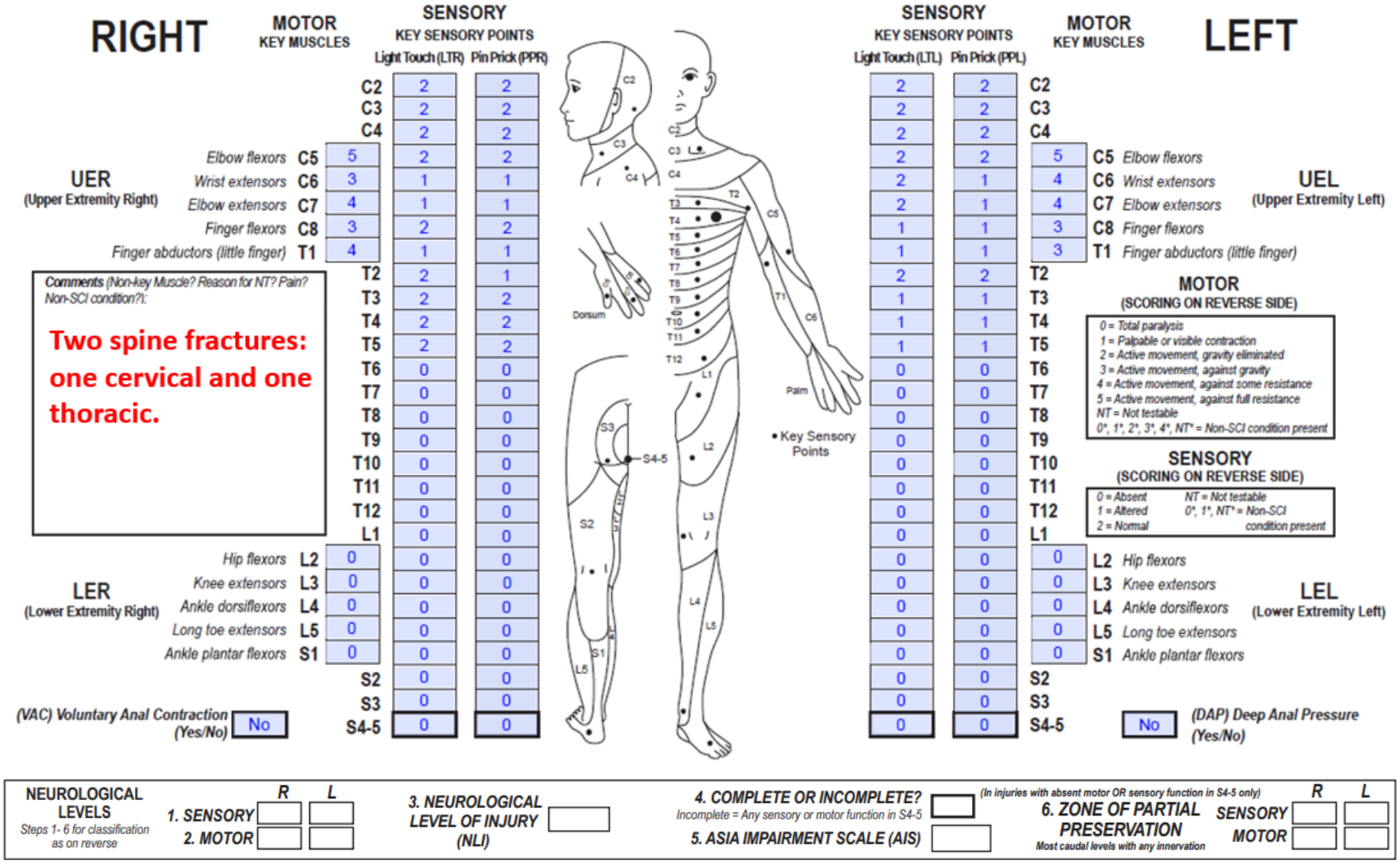
Completeness: There is no sacral sparing (sensorimotor function in the lowest sacral segments is absent), so this is a complete injury.

AIS: The AIS grade is A because this is a complete injury. This is a unique example of a person with an AIS A SCI who is ambulatory.

Sensory ZPPs: The sensory ZPP is applicable bilaterally as there is no sparing of sensory function in the lowest sacral segments. The sensory ZPP is L5 on the right and S1 on the left because these are the most caudal segments on the respective sides with any sensory function.

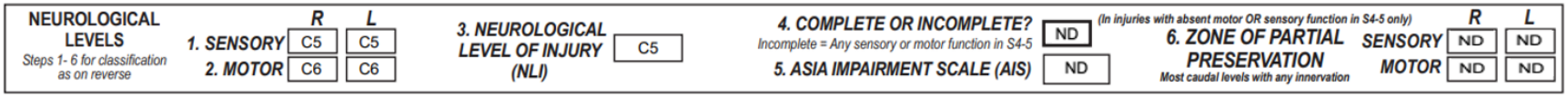
Motor ZPPs: The motor ZPPs are applicable because VAC is absent, and as such are S1 given that this is the most caudal myotome on both sides with partially preserved motor function.

Case 25


RIGHT
MOTOR
KEY MUSCLES
SENSORY
KEY SENSORY POINTS
Light Touch (LTR)
Pin Prick (PPR)
UER
(Upper Extremity Right)
Elbow flexors C5 5
Wrist extensors C6 3
Elbow extensors C7 4
Finger flexors C8 3
Finger abductors (little finger) T1 4
Comments (Non-key Muscle? Reason for NT? Pain? Non-SCI condition?):
Two spine fractures: one cervical and one thoracic.
LER
(Lower Extremity Right)
Hip flexors L2 0
Knee extensors L3 0
Ankle dorsiflexors L4 0
Long toe extensors L5 0
Ankle plantar flexors S1 0
(VAC) Voluntary Anal Contraction (Yes/No) No
C2 2 2
C3 2 2
C4 2 2
T2 2 1
T3 2 2
T4 2 2
T5 2 2
T6 0 0
T7 0 0
T8 0 0
T9 0 0
T10 0 0
T11 0 0
T12 0 0
L1 0 0
S2 0 0
S3 0 0
S4-5 0 0
Dorsum
Palm
• Key Sensory Points
SENSORY
KEY SENSORY POINTS
Light Touch (LTL)
Pin Prick (PPL)
MOTOR
KEY MUSCLES
LEFT
2 2 C2
2 2 C3
2 2 C4
2 2 5 C5 Elbow flexors
2 1 4 C6 Wrist extensors
2 1 4 C7 Elbow extensors
1 1 3 C8 Finger flexors
1 1 3 T1 Finger abductors (little finger)
UEL
(Upper Extremity Left)
2 2 T2
1 1 T3
1 1 T4
1 1 T5
0 0 T6
0 0 T7
0 0 T8
0 0 T9
0 0 T10
0 0 T11
0 0 T12
0 0 L1
0 0 0 L2 Hip flexors
0 0 0 L3 Knee extensors
0 0 0 L4 Ankle dorsiflexors
0 0 0 L5 Long toe extensors
0 0 0 S1 Ankle plantar flexors
LEL
(Lower Extremity Left)
0 0 S2
0 0 S3
0 0 S4-5
No (DAP) Deep Anal Pressure (Yes/No)
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
NT = Not testable
0*, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present
SENSORY
(SCORING ON REVERSE SIDE)
0 = Absent
1 = Altered
2 = Normal
NT = Not testable
0*, 1*, NT* = Non-SCI condition present
NEUROLOGICAL LEVELS
Steps 1- 6 for classification as on reverse
1. SENSORY R L
2. MOTOR R L
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 injuries with absent motor OR sensory function in S4-5 only)
6. ZONE OF PARTIAL PRESERVATION
Most caudal levels with any innervation
SENSORY R L
MOTOR R L

ANSWER

Case 25



Sensory levels: The sensory level is C5 bilaterally as sensory function is intact from C2 through this dermatome on both sides.

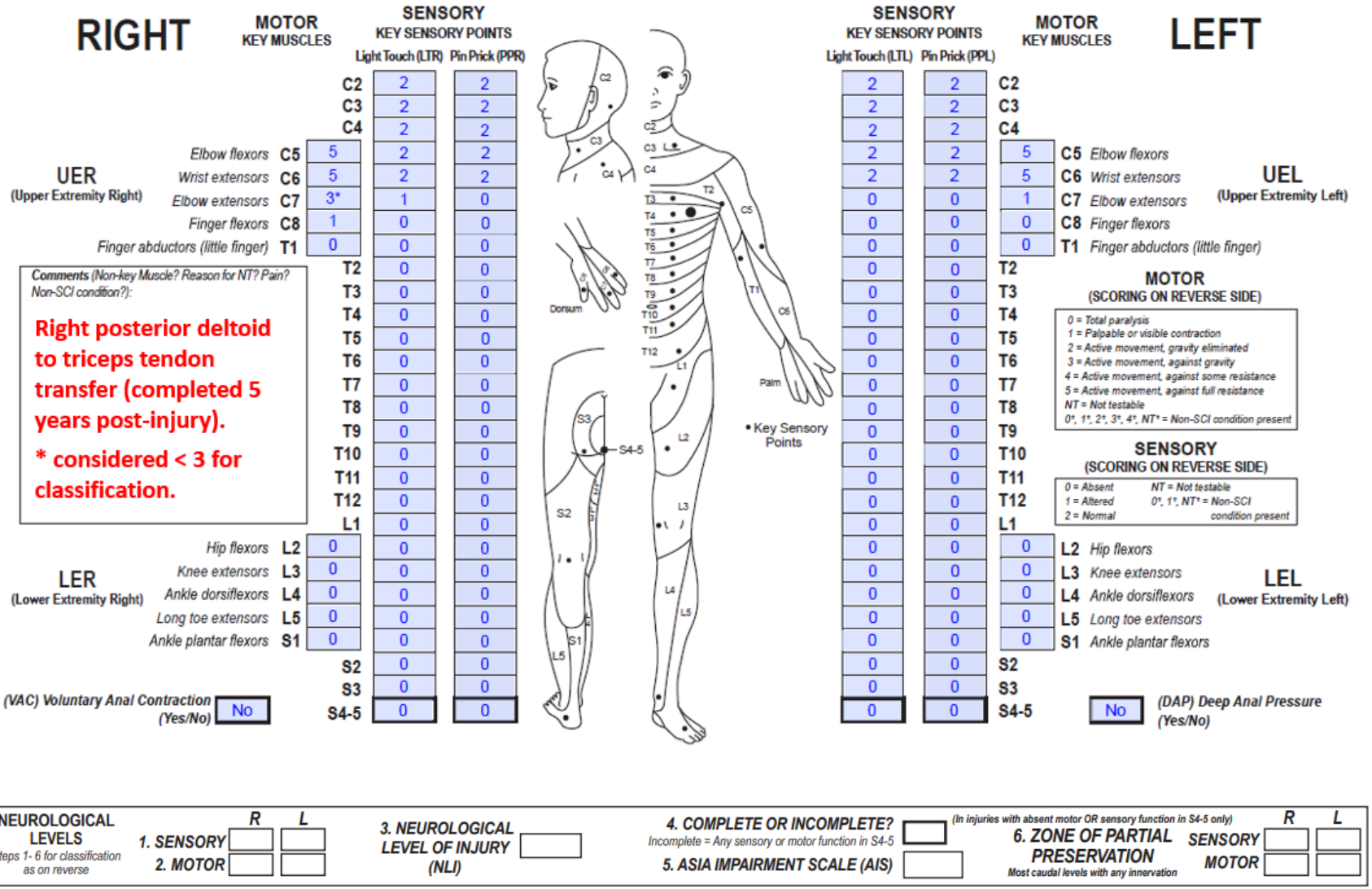
Motor levels: The motor level is C6 bilaterally as this is the most caudal key muscle on both sides with a motor grade ≥3, and all motor function rostral to this level is presumed to be intact.

NLI: The NLI is C5 as this is the most rostral of the sensory and motor levels.

Completeness/AIS: While the thoracic level injury appears to be neurologically complete, the cervical injury is most likely incomplete. As such, completeness and AIS cannot be determined, and ND should therefore be recorded for these classification variables. A similar case and detailed recommendation of the International Standards Committee has been previously published[18].

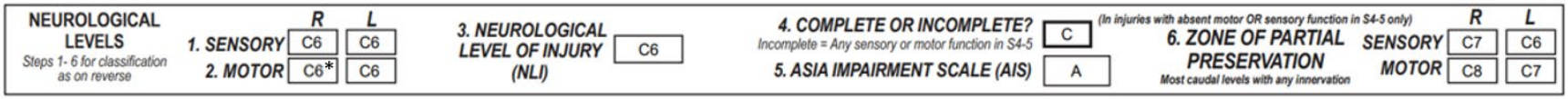
Sensory/Motor ZPPs: All ZPPs are also recorded as ND. With the cervical level injury considered alone, sacral sparing may have been present, and in that case, one or more ZPPs would have been NA. With addition of the thoracic level injury, sacral sparing is now absent, technically rendering the ZPPs applicable. However, because injury completeness is unable to be determined, and therefore ZPP applicability for the separate injuries cannot be determined with certainty, ND should be recorded in the boxes for ZPP.

Case 26


RIGHT
MOTOR
KEY MUSCLES
SENSORY
KEY SENSORY POINTS
Light Touch (LTR)
Pin Prick (PPR)
C2 2 2
C3 2 2
C4 2 2
Elbow flexors C5 5 2 2
Wrist extensors C6 5 2 2
Elbow extensors C7 3* 1 0
Finger flexors C8 1 0 0
Finger abductors (little finger) T1 0 0 0
T2 0 0
T3 0 0
T4 0 0
T5 0 0
T6 0 0
T7 0 0
T8 0 0
T9 0 0
T10 0 0
T11 0 0
T12 0 0
L1 0 0
Hip flexors L2 0 0 0
Knee extensors L3 0 0 0
Ankle dorsiflexors L4 0 0 0
Long toe extensors L5 0 0 0
Ankle plantar flexors S1 0 0 0
S2 0 0
S3 0 0
S4-5 0 0
UER
(Upper Extremity Right)
LER
(Lower Extremity Right)
Comments (Non-key Muscle? Reason for NT? Pain? Non-SCI condition?):
Right posterior deltoid to triceps tendon transfer (completed 5 years post-injury).
* considered < 3 for classification.
(VAC) Voluntary Anal Contraction (Yes/No)
No
Dorsum
Palm
• Key Sensory Points
SENSORY
KEY SENSORY POINTS
Light Touch (LTL)
Pin Prick (PPL)
MOTOR
KEY MUSCLES
LEFT
2 2 C2
2 2 C3
2 2 C4
2 2 5 C5 Elbow flexors
2 2 5 C6 Wrist extensors
0 0 1 C7 Elbow extensors
0 0 0 C8 Finger flexors
0 0 0 T1 Finger abductors (little finger)
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
L1
0 0 L2 Hip flexors
0 0 L3 Knee extensors
0 0 L4 Ankle dorsiflexors
0 0 L5 Long toe extensors
0 0 S1 Ankle plantar flexors
S2
S3
0 0 S4-5
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
NT = Not testable
0*, 1*, 2*, 3*, 4*, NT* = Non-SCI condition present
SENSORY
(SCORING ON REVERSE SIDE)
0 = Absent
1 = Altered
2 = Normal
NT = Not testable
0*, 1*, NT* = Non-SCI condition present
No
(DAP) Deep Anal Pressure (Yes/No)
NEUROLOGICAL LEVELS
Steps 1- 6 for classification as on reverse
1. SENSORY
2. MOTOR
R
L
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 injuries with absent motor OR sensory function in S4-5 only)
6. ZONE OF PARTIAL PRESERVATION
Most caudal levels with any innervation
SENSORY
MOTOR

ANSWER

Case 26



Sensory levels: The sensory level is C6 bilaterally as this is the most caudal dermatome on both sides with intact sensory function, and sensation above this level is also intact.

Motor levels: The right motor level is C6* because even though motor function is rated 3* at C7, the tested strength is impacted by a non-SCI condition, i.e., a tendon transfer of the right posterior deltoid to the triceps. The tendon transfer does not affect the innervation to the triceps at the C7 segment. The motor grade at C7 without the transfer is presumed to be <3 (otherwise the tendon transfer would not have been indicated), so the right motor level is C6*; this requires an "*" because the designation is based on this clinical assumption. The left motor level is also C6 as this is the most caudal myotome with a motor grade ≥3, and all motor function rostral to this level is presumed to be intact.

NLI: The NLI is C6 as the sensory levels and left motor level are C6. The right motor level is also C6 based on clinical judgement (or would be C7 if strictly using the examined score). Therefore, the NLI does not require an "*" as it is not impacted by the non-SCI condition, which in this rare case leads to an improvement of muscle strength. Note that in the majority of cases involving a non-SCI condition, the non-SCI condition leads to an additional impairment of motor function, and therefore the NLI would require an "*" if any of the sensory or motor levels were "*"-tagged.

Completeness: There is no sacral sparing, so this is a complete injury.

AIS: The AIS grade is A because this is a complete injury.

Sensory ZPPs: The sensory ZPP is applicable bilaterally because there is no sensory sacral sparing. The sensory ZPP is C7 on the right and C6 on the left, as these are the most caudal segments on the respective sides with preserved sensory function.

Motor ZPPs: The motor ZPP is applicable on both sides in the absence of VAC. The motor ZPP is C8 on the right and C7 on the left, as these are the most caudal myotomes on each side with any motor function.

REFERENCES

1. American Spinal Injury Association. Standards for Neurological Classifications of Spinal Injured Patients. ASIA. Chicago 1982.
2. American Spinal Injury Association. International Standards for Neurological Classification of Spinal Cord Injury. ASIA. Richmond 2019.
3. Solinsky R, Kirshblum SC. Challenging questions regarding the international standards. J Spinal Cord Med. 2018;41(6):684-90.
4. Kirshblum S, Schmidt Read M, Rupp R. Classification challenges of the 2019 revised International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI). Spinal Cord. 2022;60(1):11-17.
5. Chafetz RS, Vogel LC, Betz RR, Gaughan JP, Mulcahey MJ. International Standards for Neurological Classification of Spinal Cord Injury: Training effect on accurate classification. J Spinal Cord Med. 2008;31(5):538-42.
6. Cohen ME, Ditunno JF, Donovan WH, Maynard FM. A test of the 1992 International Standards for Neurological and Functional Classification of Spinal Cord Injury. Spinal Cord. 1998;36(8):554-560.
7. Osunronbi T, Sharma H. International Standards for Neurological Classification of Spinal Cord Injury: Factors influencing the frequency, completion and accuracy of documentation of neurology for patients with traumatic spinal cord injuries. Eur J Orthop Surg Traumatol. 2019;29(8):1639-48.
8. Armstrong AJ, Clark JM, Ho DT, Payne CJ, Nolan S, et al. Achieving assessor accuracy on the International Standards for Neurological Classification of Spinal Cord Injury. Spinal Cord. 2017;55(11):994-1001.
9. Schuld C, Franz S, van Hedel HJA, Moosburger J, Maier D, et al. International Standards for Neurological Classification of Spinal Cord Injury: Classification skills of clinicians versus computational algorithms. Spinal Cord. 2015;53(4)324-331.
10. Snider B, Eren F, Reeves R, Rupp R, Kirshblum S. International Standards for Neurological Classification of Spinal Cord Injury: Classification Accuracy and Challenges. Top Spinal Cord Inj Rehabil. 2023;29(1):1-15.
11. Rupp R, Biering-Sørensen F, Burns F, Graves D, Guest, DE, et al. International Standards for Neurological Classification of Spinal Cord Injury: Revised 2019. Top Spinal Cord Inj Rehabil. 2021;27(2):1-22.
12. ASIA and ISCoS International Standards Committee. The 2019 revision of the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) – What's new? Spinal Cord. 2019;57:815-7.
13. Rupp R, Schuld C, Biering-Sørensen F, Walden K, Rodriguez G, Kirshblum S. ASIA International Standards Committee. A taxonomy for consistent handling of conditions not related to the spinal cord injury (SCI) in the International Standards for Neurological Classification of SCI (ISNCSCI). Spinal Cord. 2022;60(1):18-29.
14. EMSCI ISNCSCI Calculator. https://calculator.emsci.org/beta/.
15. Praxis ISNCSCI Algorithm. https://www.isncscialgorithm.com/.
16. ASIA e-Learning Center - American Spinal Injury Association (asia-spinalinjury.org). https://asia-spinalinjury.org/learning/.
17. Kirshblum S, Botticello A, Byrne R, Dyson-Hudson T, Marino R, Lammertse D. Patterns of Sacral Sparing Components on Neurological Recovery in Newly Injured Persons with Traumatic Spinal Cord Injury. Arch Phys Med Rehabil. 2016;97(10):1647-55.

18. Kirshblum SC, Biering-Sorenson F, Betz R, Burns S, Donovan W, et al. International Standards for Neurological Classification of Spinal Cord Injury: Cases with classification challenges. J Spinal Cord Med. 2014;37(2):120-7.