Bahan Ajar I

Spinal Transection

(complete and incomplete)

Supervisor :
Dr. dr. Jumraini Tammasse, Sp. S (K)

SISTEM NEUROPSIKIATRI
FAKULTAS KEDOKTERAN UNIVERSITAS HASANUDDIN MAKASSAR
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POKOK BAHASAN

1. Complete spinal transection
2. Incomplete spinal transection
   - Brown – Sequard syndrome
   - Anterior cord syndrome
   - Central cord syndrome

----------> Acute Medulla Compression

Definisi

Spinal transection (trauma medulla spinalis) : suatu kerusakan fungsi neurologis yg disebabkan oleh trauma pada daerah medulla spinalis → meyebabkan traksi dan kompresi pada medulla spinalis.

Etiologi

Traumatic injuries	
Motor vehicle accidents	Football
Falls	Gymnastics
Violence	Diving into shallow water

Non-traumatic injuries/illnesses	
Cancer	Osteoporosis
Multiple sclerosis	Inflammation of the spinal cord
Arthritis	

Klasifikasi

FRANKEL CLASSIFICATION
A - Absence of motor or sensory function below the level of the lesion
B - Absence of motor function, but with some degree of sensitivity preserved below the level of the lesion
C - Come degree of motor function but without practical usefulness
D - Useful motor function below the level of the lesion
E - Normal sensory and motor function, although there may be some abnormality of reflexes

Klasifikasi

*ASIA/ISCoS Exam Chart (ASIA Impairment Scale)	
Grade A	Complete lack of motor and sensory function below the level of injury (including the anal area)
Grade B	Some sensation below the level of the injury (including anal sensation)
Grade C	Some muscle movement is spared below the level of injury, but 50 percent of the muscles below the level of injury cannot move against gravity.
Grade D	Most (more than 50 percent) of the muscles that are spared below the level of injury are strong enough to move against gravity.
Grade E	All neurologic function has returned.

STANDARD NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY

MOTOR

KEY MUSCLES

	R	L	
C2			
C3			
C4			
C5			Elbow flexors
C6			Wrist extensors
C7			Elbow extensors
C8			Finger flexors (distal phalanx of middle finger)
T1			Finger abductors (little finger)
T2			
T3			
T4			
T5			
T6			
T7			
T8			
T9			
T10			
T11			
T12			
L1			
L2			Hip flexors
L3			Knee extensors
L4			Ankle dorsiflexors
L5			Long toe extensors
S1			Ankle plantar flexors
S2			
S3			
S4-5			Voluntary anal contraction (Yes/No)

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

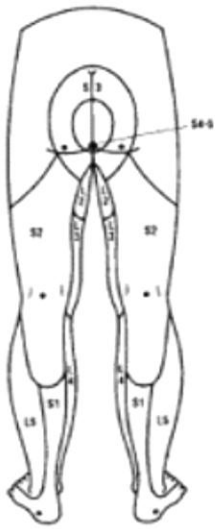
TOTALS ☐ + ☐ = ☐ **MOTOR SCORE**
(MAXIMUM) (50) (50) (100)

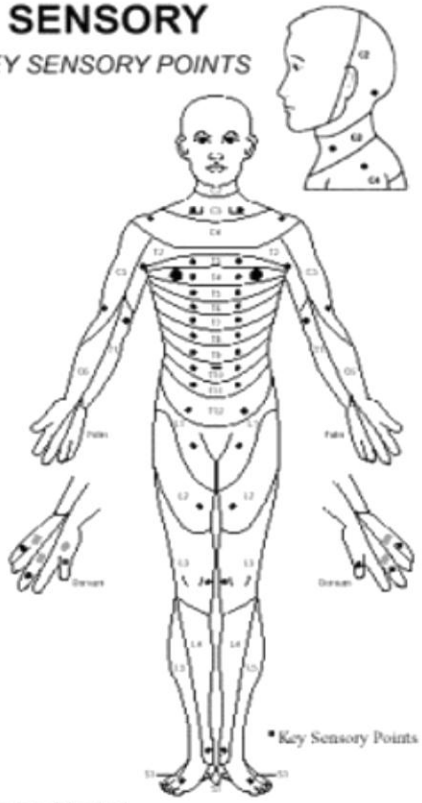
SENSORY

KEY SENSORY POINTS

	LIGHT TOUCH R	LIGHT TOUCH L	PIN PRICK R	PIN PRICK L
C2				
C3				
C4				
C5				
C6				
C7				
C8				
T1				
T2				
T3				
T4				
T5				
T6				
T7				
T8				
T9				
T10				
T11				
T12				
L1				
L2				
L3				
L4				
L5				
S1				
S2				
S3				
S4-5				

0 = absent
1 = impaired
2 = normal
NT = not testable





☐ Any anal sensation (Yes/No)

TOTALS ☐ + ☐ = ☐ **PIN PRICK SCORE** (max: 112)
(MAXIMUM) (56) (56) (56) (56) = ☐ **LIGHT TOUCH SCORE** (max: 112)

NEUROLOGICAL LEVEL
The most caudal segment with normal function

	R	L
SENSORY	☐	☐
MOTOR	☐	☐

COMPLETE OR INCOMPLETE? ☐
Incomplete = Any sensory or motor function in S4-S5

ASIA IMPAIRMENT SCALE ☐

ZONE OF PARTIAL PRESERVATION
Caudal extent of partially innervated segments

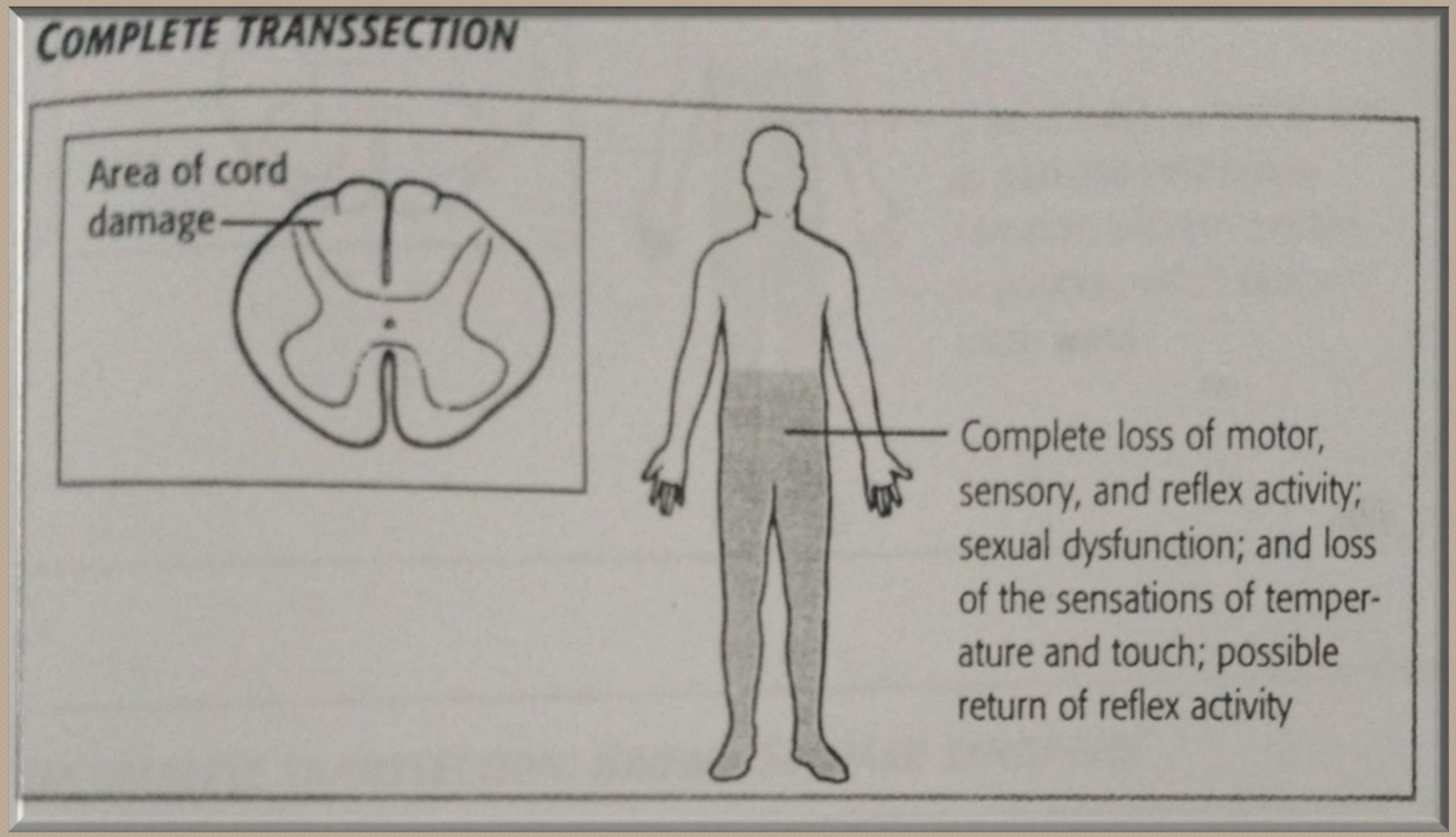
	R	L
SENSORY	☐	☐
MOTOR	☐	☐

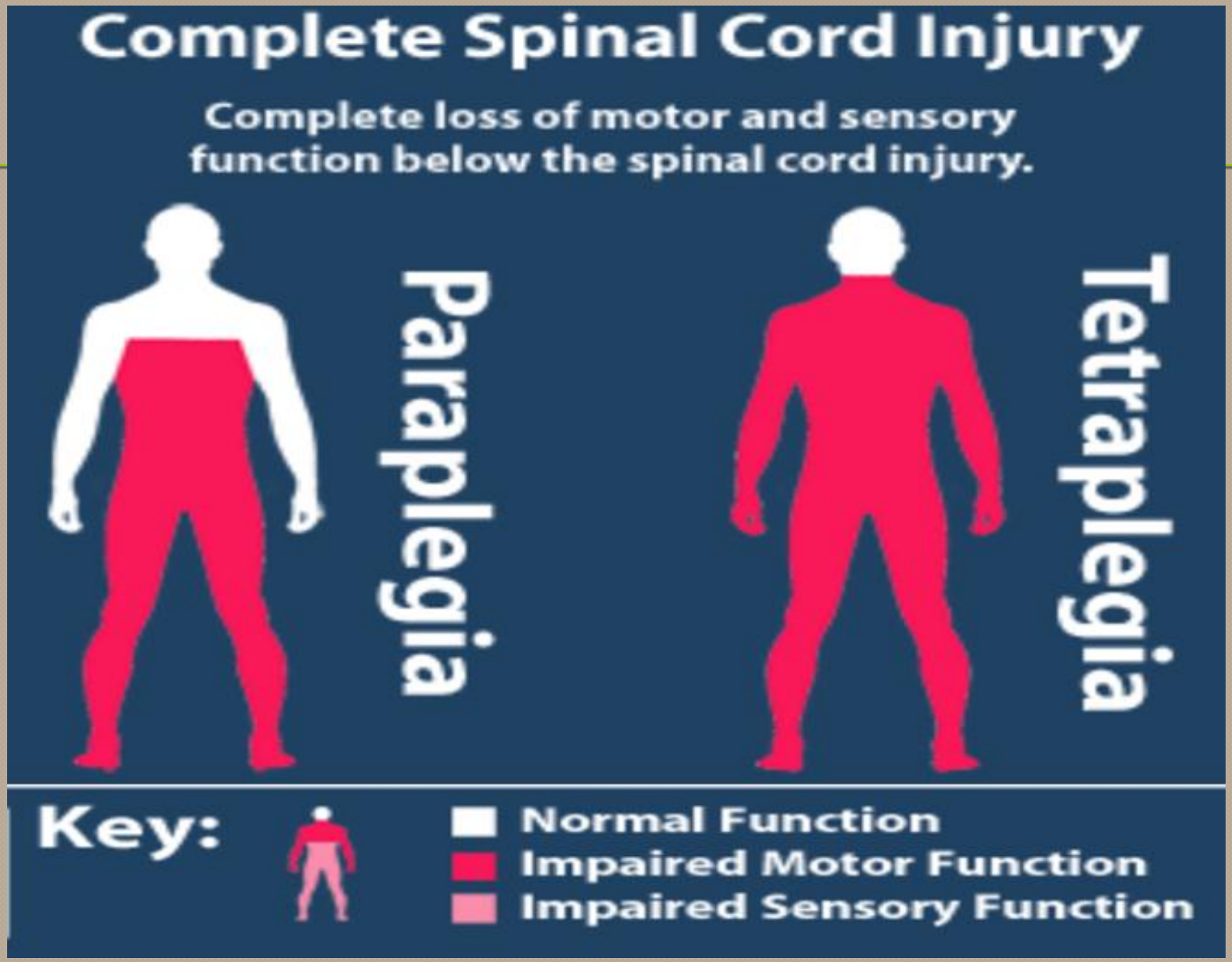
2000 Rev.

Complete Spinal Transection

Description disrupted	Signs and symptoms
All tracts of the spinal cord completely	Loss of motor function (quadriplegia) with cervical cord transsection; paraplegia wth thoracic cord transsection.
All functions involving the spinal cord below of the level transcetion lost	Muscle flaccidity Respiratory impairment.
Complete and permanent loss	Loss of all reflexes and sensory function below injury leve
	Bladder and bowel atony, ileus paralytic
	Loss of vasomotor tone in lower body → low & unstable blood pressure
	Loss perspiration below injury level → dry skin, pale

Complete Spinal Transection

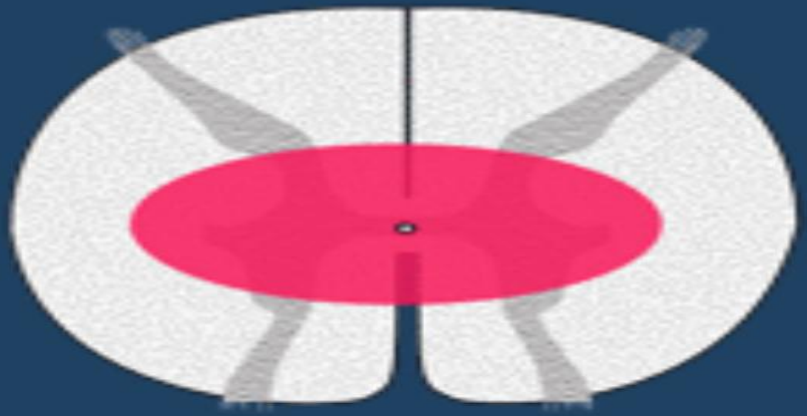



Complete Spinal Cord Injury
Complete loss of motor and sensory function below the spinal cord injury.
Paraplegia
Tetraplegia
Key:
Normal Function
Impaired Motor Function
Impaired Sensory Function

Central Cord Syndrome

Description disrupted	Signs and symptoms
Centre portion of cord affected	Motor deficits greater in upper than lower extremities
Typically from hyperextension injury	Variables degree of bladder dysfunction

Central Cord Syndrome



Results from cervical spinal injuries. Greater motor impairment in upper body compared to lower body. Variable sensory loss below the level of injury.

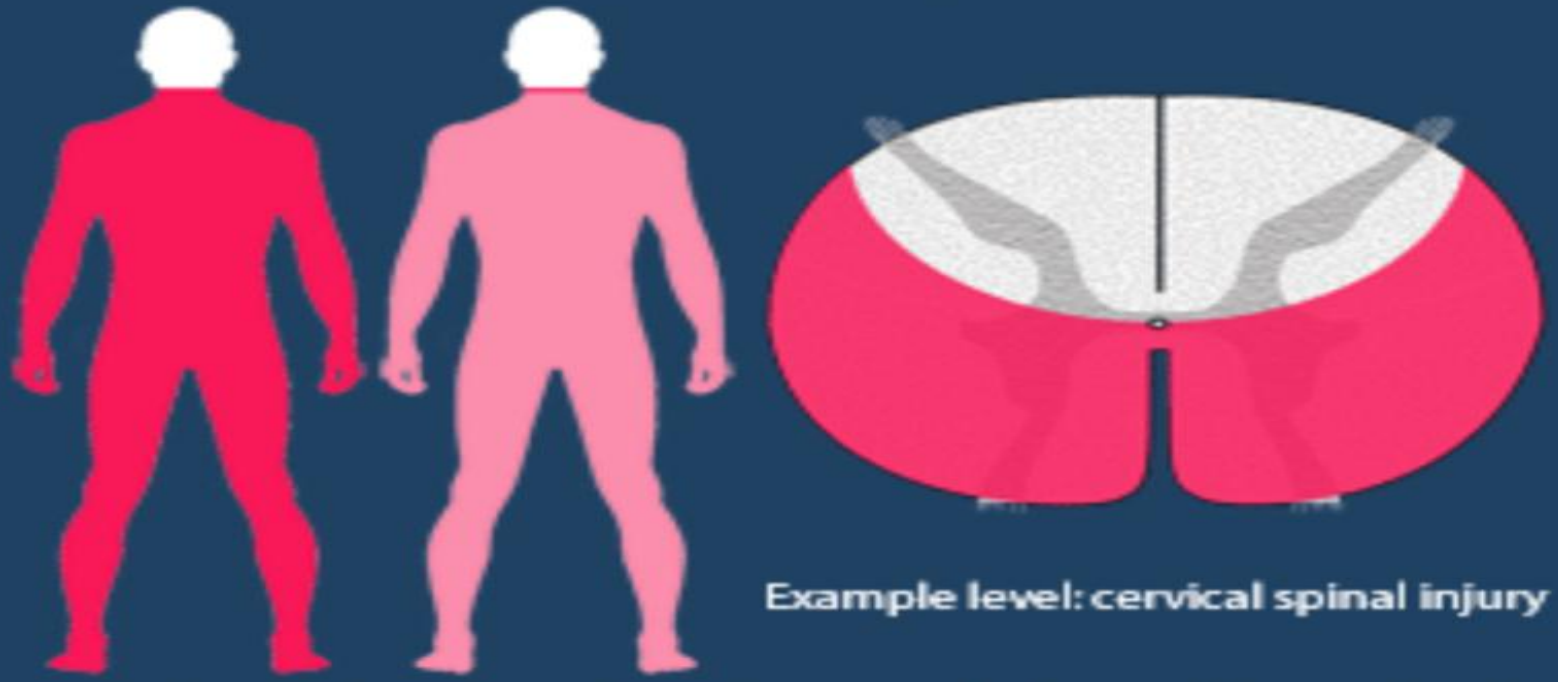
Key:

- Normal Function
- Impaired Motor Function
- Impaired Sensory Function

Anterior Cord Syndrome

Description disrupted	Signs and symptoms
Occlusion of anterior spinal artery	Loss of motor function below the level of the injury
	Intact touch, pressure, position, and vibration sense

Anterior Cord Syndrome



Example level: cervical spinal injury

Below injury level, motor paralysis and loss of pain and temperature sensation. Proprioception (position sense), touch and vibratory sensation preserved.

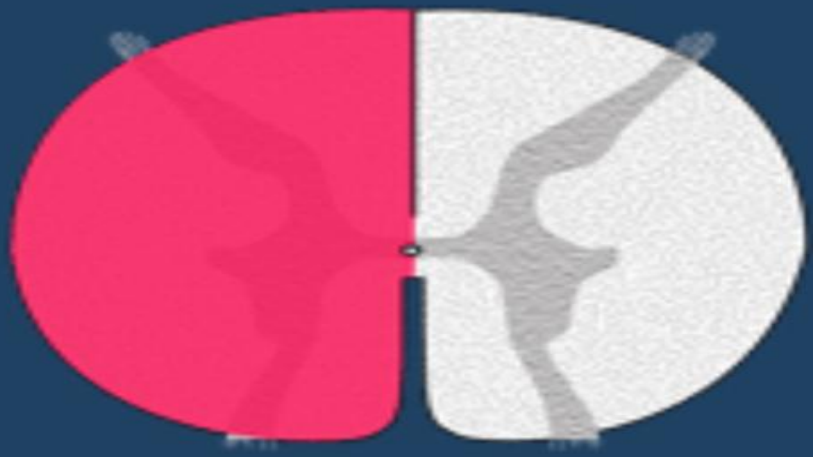
Key:

- Normal Function
- Impaired Motor Function
- Impaired Sensory Function

Brown Sequard Syndrome

Description disrupted	Signs and symptoms
Hemisection of cord affected	Ipsilateral paralysis or paresis below the level of the injury
Most common in stabbing and gunshot wounds	Ipsilateral loss of touch, pressure, vibration, and position sense below injury level
Damage to cord on only one side	Contralateral loss of pain and temperature sensations below the level of the injury

Brown-Séquard Syndrome



Example level: cervical spinal injury

Below injury level, motor weakness or paralysis on one side of the body (hemiparaplegia). Loss of sensation on the opposite side (hemianesthesia).

Key:

- Normal Function
- Impaired Motor Function
- Impaired Sensory Function

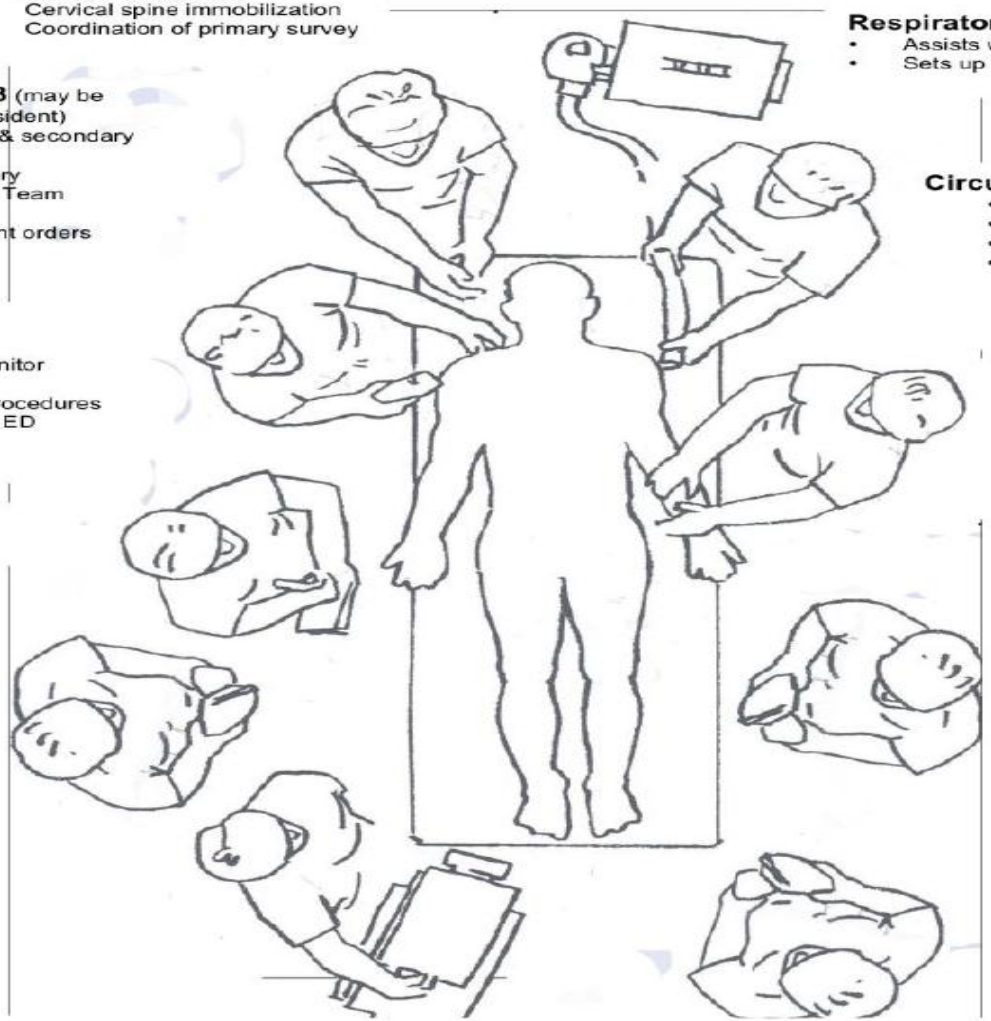
MULTIDISCIPLINARY TRAUMA TEAM
ROLES AND RESPONSIBILITIES

EM/MD #2 (may be EM resident, Anesthesiology Attending or Trauma Resident)
- Airway management
- Cervical spine immobilization
- Coordination of primary survey

Respiratory Therapist
- Assists with airway control
- Sets up ventilator

Primary MD/MD#3 (may be either 3rd or 2nd year resident)
- Performs primary & secondary assessment
- Performs necessary procedures under Team Leader
- Coordinates patient orders

Circulating Nurse/EM Paramedic
- Obtains 1st manual BP
- Assist with procedures
- Medication administration
- Obtain additional IV's as needed



Primary Nurse
- Prepares Trauma room
- Places pt on cardiac monitor
- Monitors vital signs
- Assists physician with procedures
- Accompanies pt outside ED

Trauma Team Leader
(may be Chief Resident or EM Attending)
- Leads Resuscitation
- Performs or assists with procedures
- Directs ongoing assessment

Ultrasound Tech
- FAST

Nursing Care Technician
- Set-up of trauma resuscitation area
- Obtains blood from blood bank as directed
- Assists with exposure of patient
- Processes lab specimens
- Assists with CPR
- Collects & Documents pt valuables
- Assists with patient

MD #4 (may be 1st year or higher)
- Assists with evaluation and management of patient under direction of MD#3

Scribe
- Documents resuscitation
- Assists with procedures as needed

Radiology Technologist
- Films as needed

Trauma Attending/Fellow
- Provides guidance to trauma team leader
- Performs or assists with procedures

Spinal cord injury Algorithm
Review definition and pathophysiology

Assess for the presence of risk factors

- Bullet or stab wound
- Direct trauma to the face, neck, head, or back (e.g., car accidents)
- Diving accident
- Electric shock
- Extreme twisting of the trunk
- Sports injury (landing on head)
- Major blow to the head or chest, car accident, fall from a great height

Source: http://www.nlm.nih.gov/medlineplus/ency/article/000029.htm

Are Risk Factors Present?

YES

Assess for s/s:

- Head held in unusual position
- Numbness or tingling that radiates down an arm or leg
- Weakness
- Difficulty walking
- Paralysis of arms or legs
- No bladder or bowel control
- Shock (pale, clammy skin; bluish lips and fingernails; acting dazed or semi-conscious)
- Unconscious
- Stiff neck, headache, or neck pain

Are positive findings present?

Potentially unstable?

Plan care for the client at risk for PC: Neurogenic shock, PC: autonomic dysreflexia, PC: spinal shock

See plan of care for hypoventilation, pneumonia, sepsis, DVT/PE, fracture, Neurogenic bladder, constipation vs. ileus, pain
Follow plan of care for Disuse Syndrome

NO

Initiate client education for Health Seeking Behaviors to identify:

- Encourage safety precautions:
  Helmets, seatbelts, avoidance of risk taking behaviors
- Prevent Risk factors
  Many patients experience SCI as a result of incidents involving drunk driving, assaults, and alcohol or drug abuse.
  Industrial hazards, such as equipment failures or inadequate safety precautions, are potentially preventable causes.
  Unfenced, shallow, or empty swimming pools are known hazards. Source: http://www.emedicine.com/EMERG/topic553.htm#section~Treatment

Newly diagnosed?

Initiate the plan of care for a Risk For Ineffective Therapeutic Regimen management

Review course and progression and requirements for rehabilitation
Discuss diagnostic procedures; radiological testing
Review s/s of complications; autonomic dysreflexia, Neurogenic shock, spinal shock
Discuss medications; steroids, atropine, vasopressors
Reinforce strategies to prevent complications of immobility

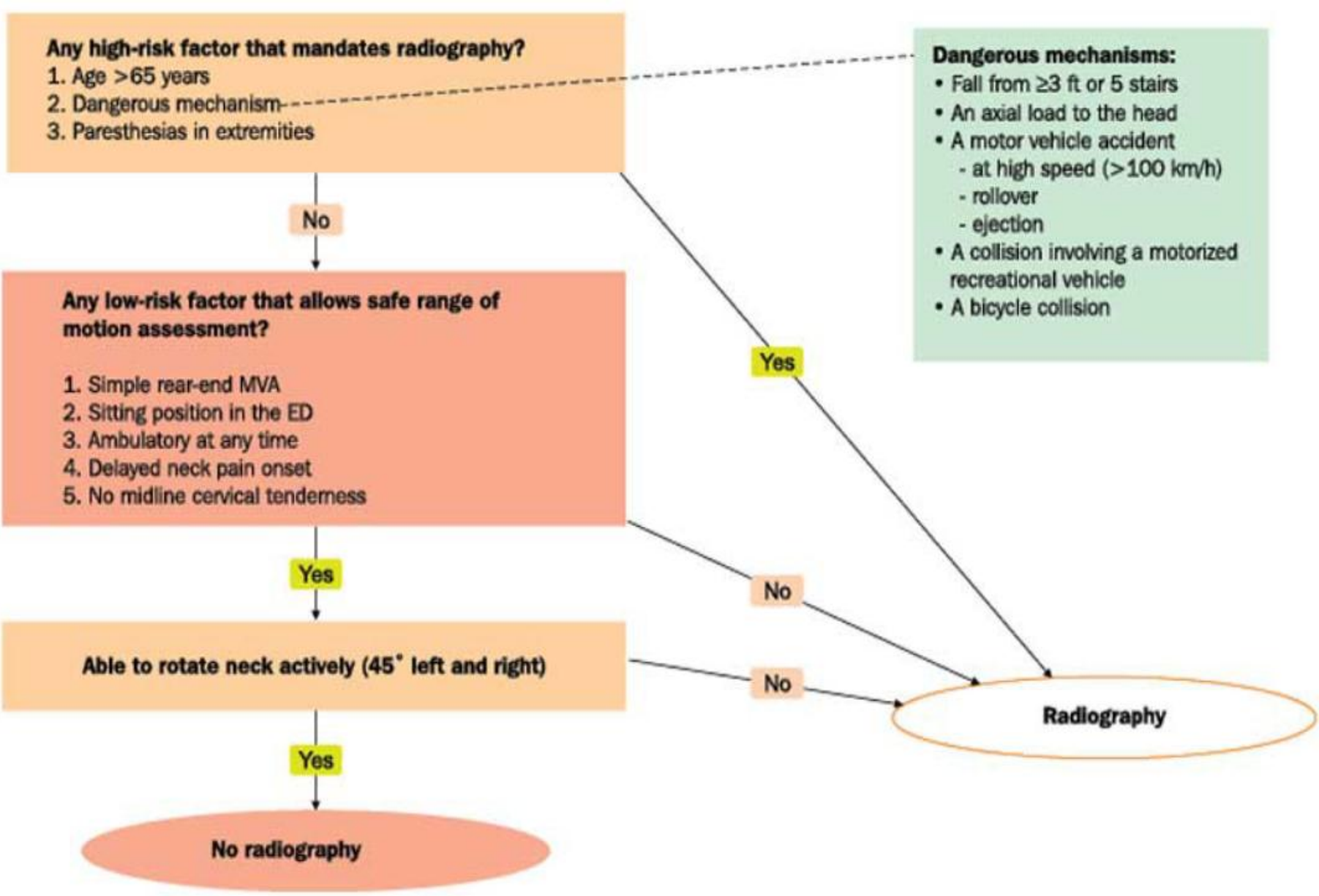


Fig. 2 : Canadian C-spine rule[4]

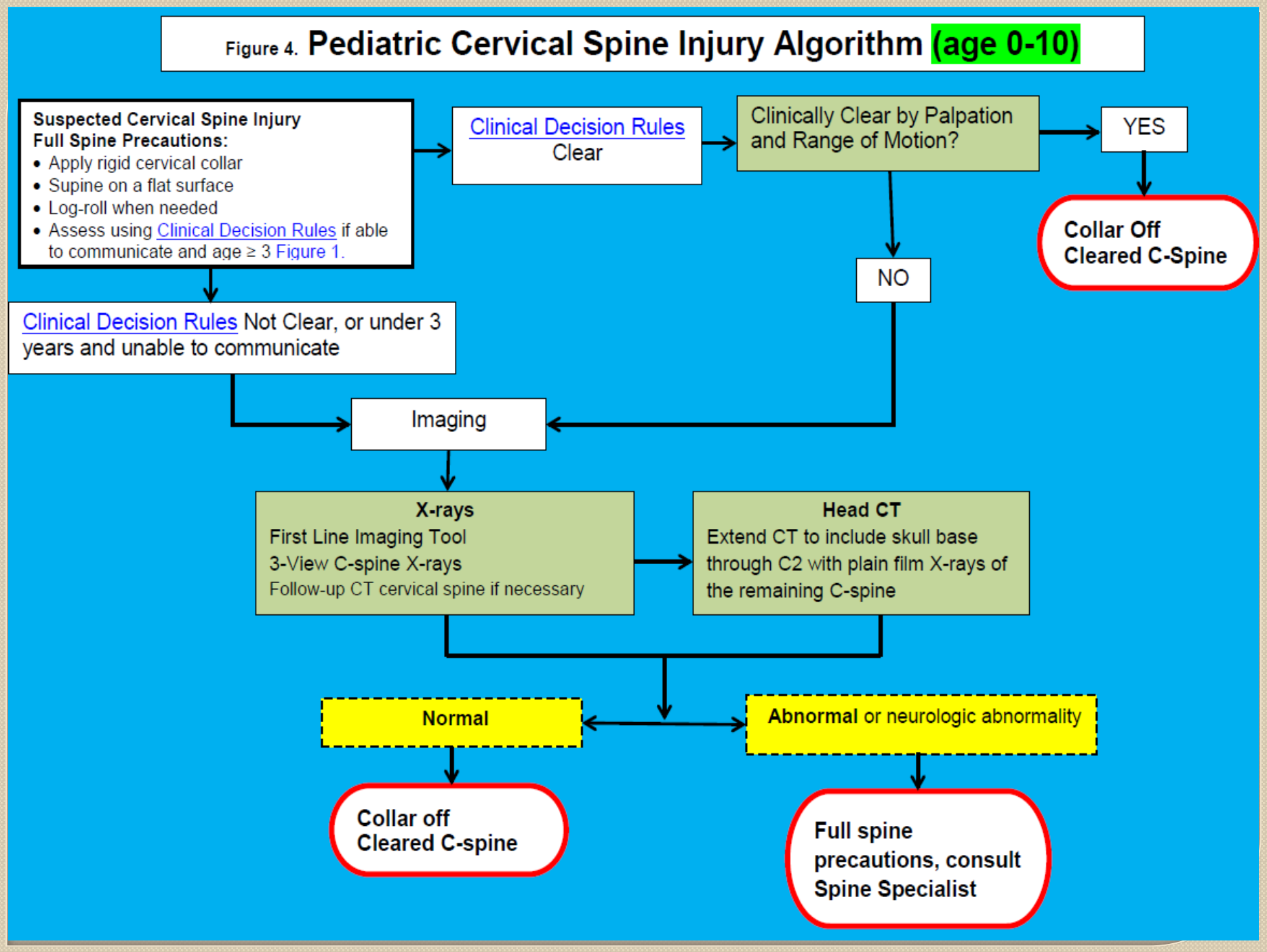
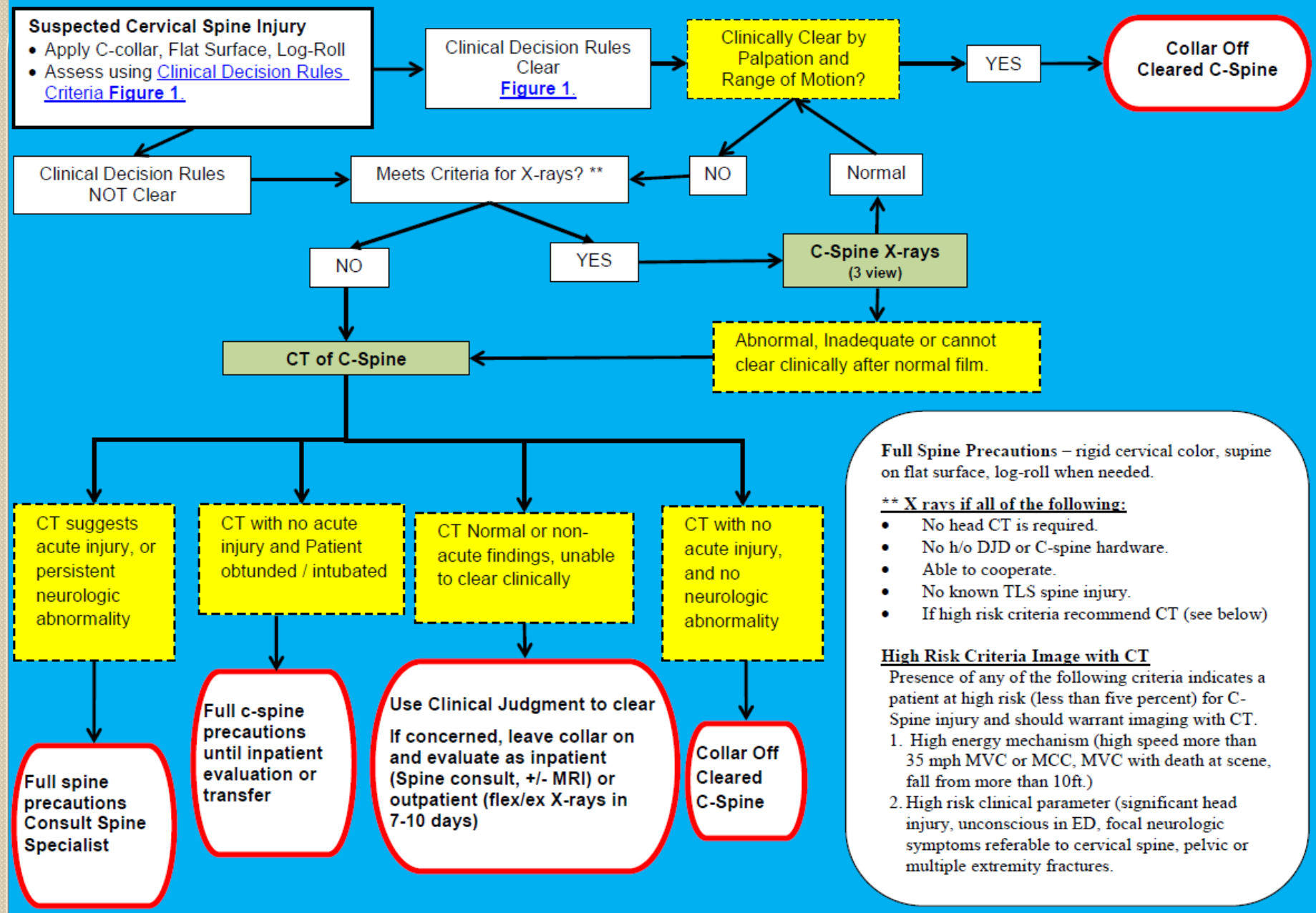


Figure 4. Pediatric Cervical Spine Injury Algorithm (age 0-10)
Suspected Cervical Spine Injury
Full Spine Precautions:
• Apply rigid cervical collar
• Supine on a flat surface
• Log-roll when needed
• Assess using Clinical Decision Rules if able to communicate and age ≥ 3 Figure 1.
Clinical Decision Rules
Clear
Clinically Clear by Palpation and Range of Motion?
YES
Collar Off
Cleared C-Spine
NO
Clinical Decision Rules Not Clear, or under 3 years and unable to communicate
Imaging
X-rays
First Line Imaging Tool
3-View C-spine X-rays
Follow-up CT cervical spine if necessary
Head CT
Extend CT to include skull base through C2 with plain film X-rays of the remaining C-spine
Normal
Abnormal or neurologic abnormality
Collar off
Cleared C-spine
Full spine precautions, consult Spine Specialist

Cervical Spine Injury Algorithm Adult (age 11- 64)



Full Spine Precautions – rigid cervical color, supine on flat surface, log-roll when needed.

**** X rays if all of the following:**

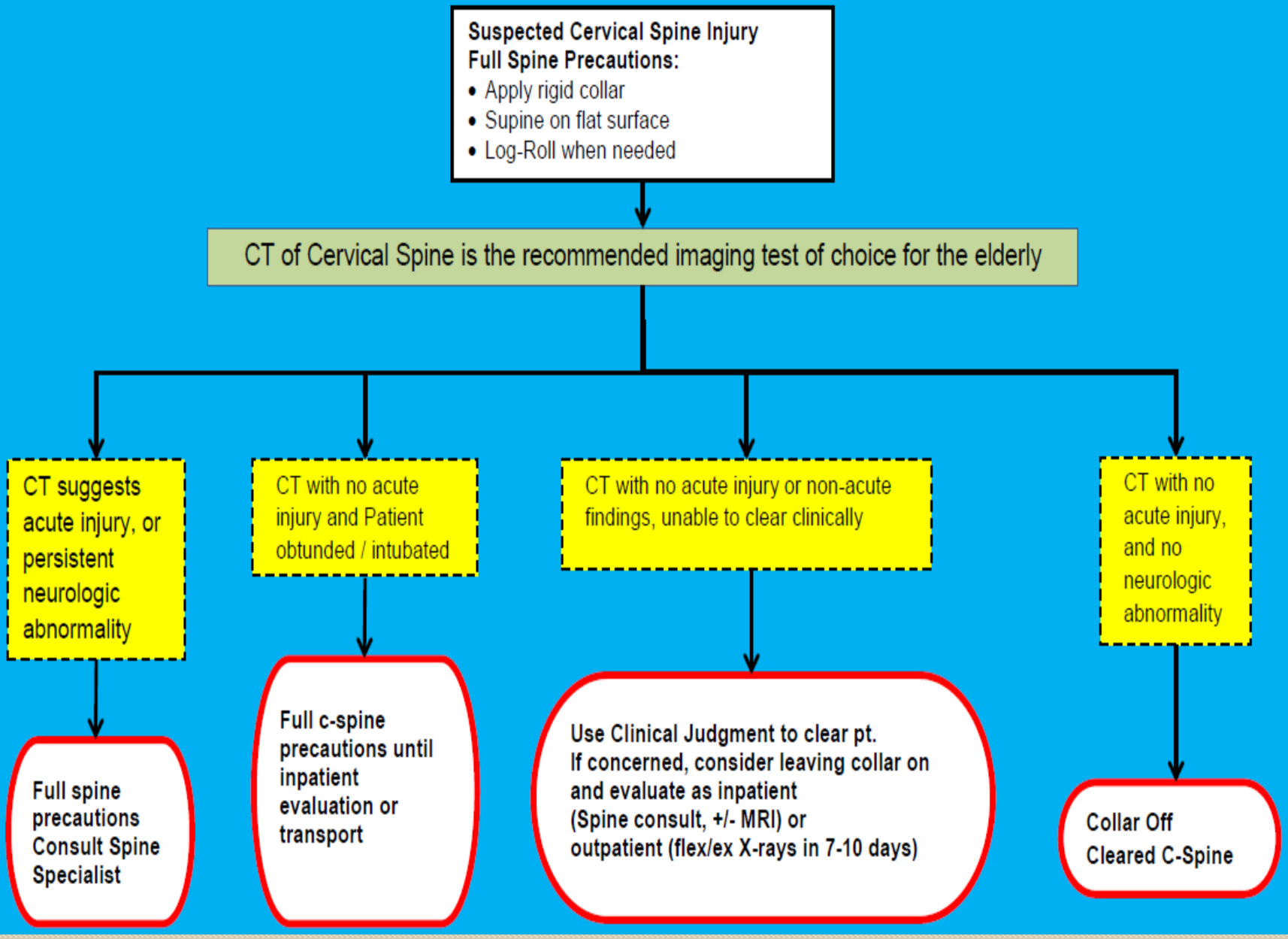
- No head CT is required.
- No h/o DJD or C-spine hardware.
- Able to cooperate.
- No known TLS spine injury.
- If high risk criteria recommend CT (see below)

High Risk Criteria Image with CT

Presence of any of the following criteria indicates a patient at high risk (less than five percent) for C-Spine injury and should warrant imaging with CT.

1. High energy mechanism (high speed more than 35 mph MVC or MCC, MVC with death at scene, fall from more than 10ft.)
2. High risk clinical parameter (significant head injury, unconscious in ED, focal neurologic symptoms referable to cervical spine, pelvic or multiple extremity fractures.

Cervical Spine Injury Algorithm Older Adult (age 65 and up)



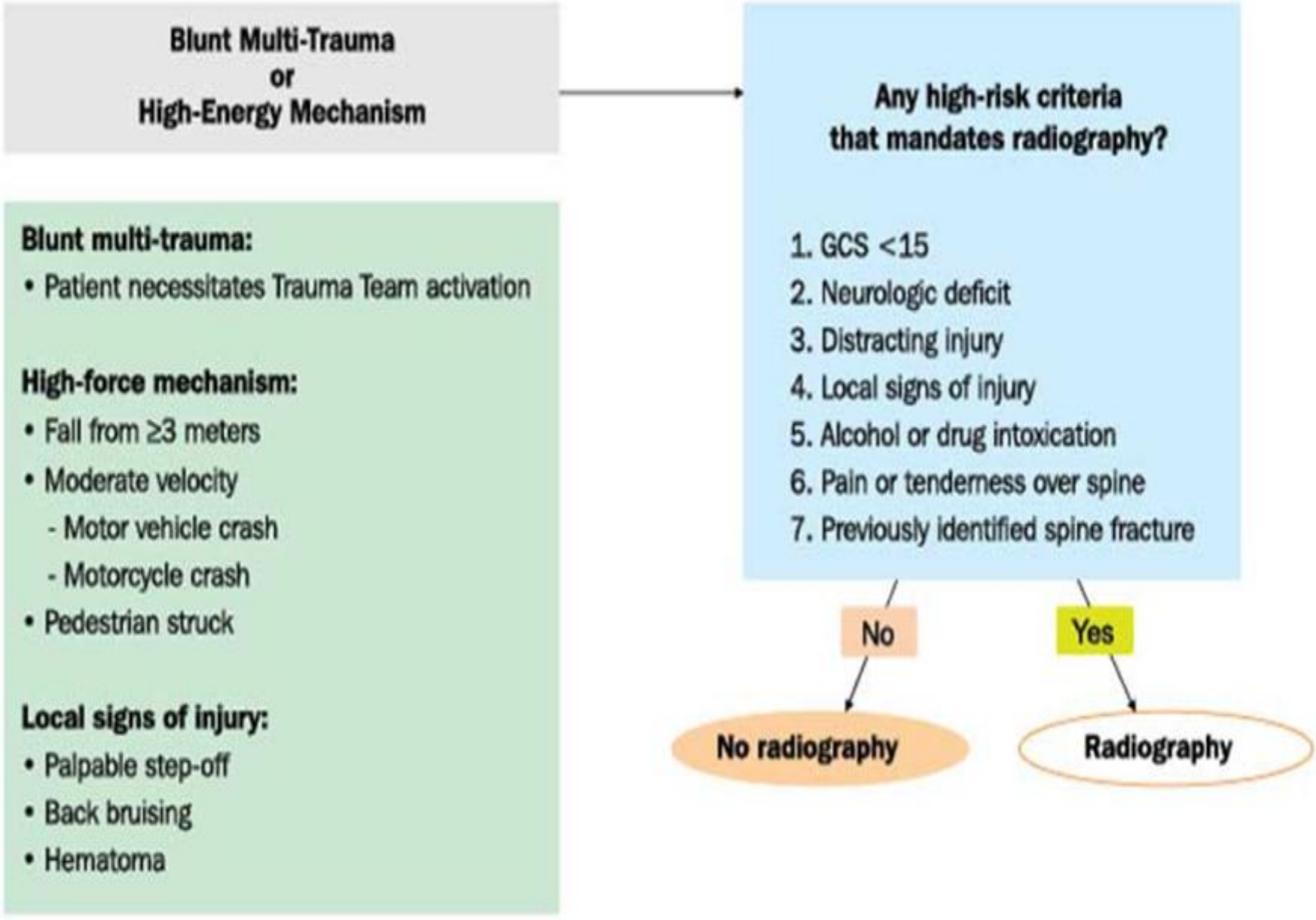


Fig. 3 : Evaluation of the thoracic and the lumbar spine[4]

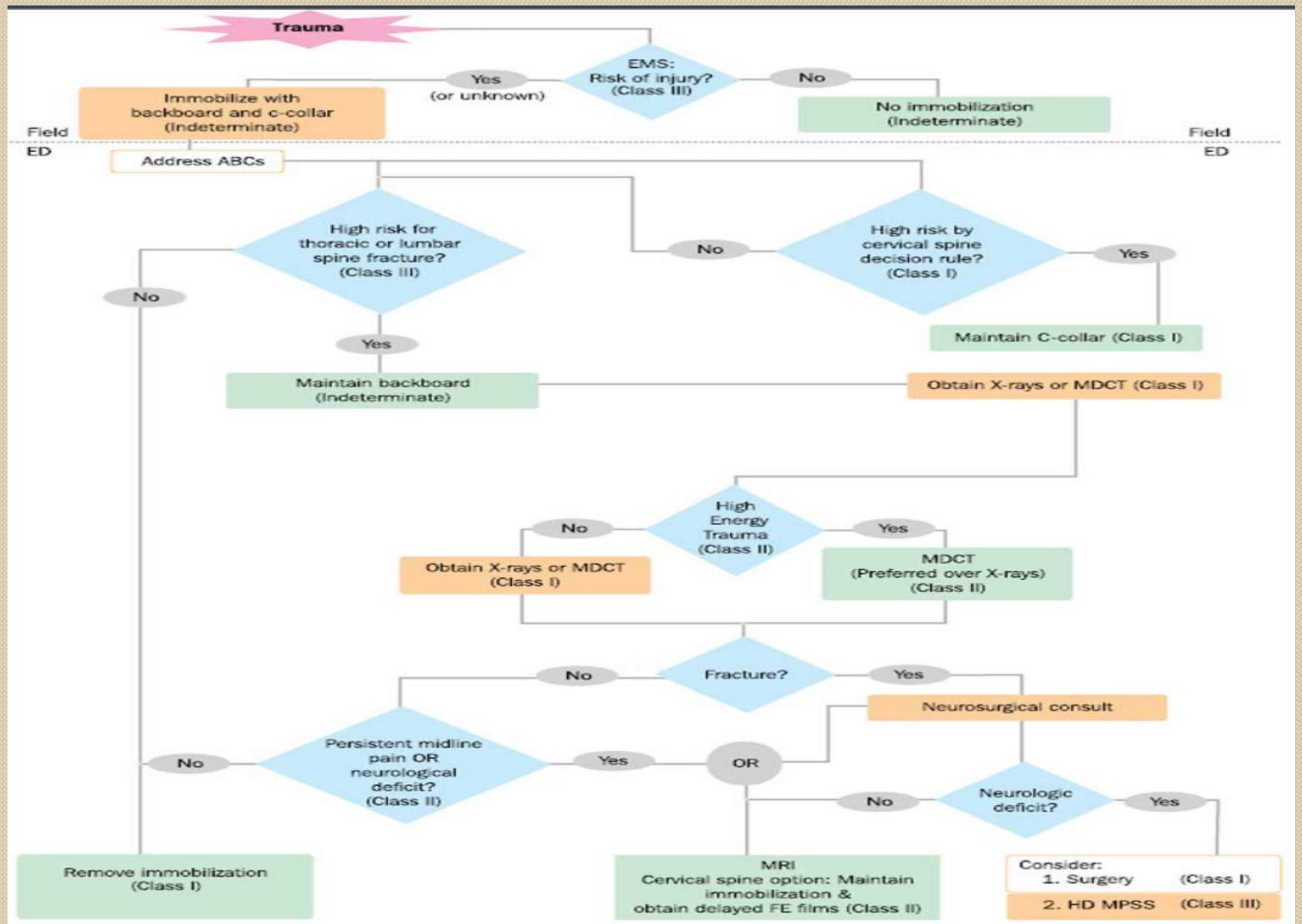


Fig. 4 : Assessmentof acute spinal cord injury[4]

KOMPLIKASI

PC: Neurogenic shock

Outcomes/Benchmarks:
No deformity, no worsening motor/sensory deficit
SBP>100, HR>60, T > 97.1

Are s/s present?
Injury above T6
Bradycardia, hypotension, hypothermia

YES

Initiate collaborative plan of care:
PC: Neurogenic shock

NO

Initiate plan of care to reduce ineffective therapeutic regimen:

- maintain spinal immobilization until cleared
- Log roll client
- Perform neurochecks as ordered and report changes in motor/sensory findings
- Monitor VS for bradycardia, hypotension and hypothermia

PC: Neurogenic shock

ASSESS s/s of Neurogenic shock

- Obvious trauma/deformity
- Motor/ sensory deficit
- Injury or inflammation affecting the spinal cord above T6
- HR < 60
- SBP <100
- Abnormally low body temperature
- Loss of bowel and bladder control

Identify High risk populations

- Injury above level T 6
- Inadequate immobilization

MONITOR for s/s Neurogenic shock
Initiate hemodynamic monitoring to identify alterations in ABCs
Inadequate airway, hypoventilation, bradycardia, hypotension (bradycardia associated with hypotension indicates Neurogenic shock)
Initiate pulse oximetry to identify desaturation associated with hypoventilation
Monitor continuous cardiac monitoring for dysrhythmia (tachycardia from hemorrhagic shock may be masked in clients experiencing Neurogenic shock)
Perform neuro checks (note the deficit will increase in the hours to days following acute injury)
Monitor reflexes (absence is noted in spinal shock below the level of injury and may last from hours to days)
Monitor I/O > 30 ml/hr
Perform routine trauma workup lab/diagnostics
Monitor x-ray reports

PC: Neurogenic shock

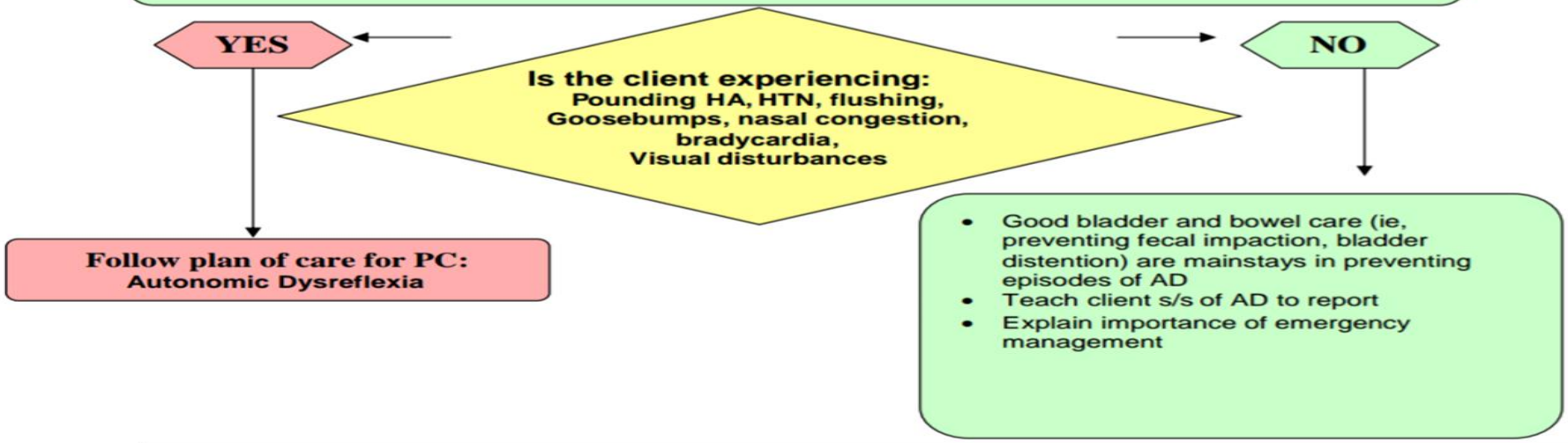
DO
Maintain spinal immobilization as ordered
Keep NPO in acute, initial management
Establish need for airway/intubation
Establish IV access and initiate IV fluid resuscitation
Insert Foley catheter
Administer atropine IV for bradycardia
Administer IV vasopressors as indicated to maintain BP & urine output
Administer high dose methylprednisone according to agency protocol
Insert NG tube to prevent ileus
Keep client warm using active external rewarming strategies
Provide supportive care for the client experiencing disuse syndrome

CALL

- Call for refractory hypotension, hemodynamic instability, worsening neuro status
- Initate ABC, shock management call ready response team and MD

PC: Autonomic Dysreflexia

Outcomes/Benchmarks:
100<SBP<140, 60<HR<100, skin pink warn dry, nares patent, no nasal congestion, no flushing/piloerection



PC: Autonomic Dysreflexia

ASSESS s/s of Autonomic Dysreflexia
- HTN, flushing, Goosebumps, nasal congestion, bradycardia, pounding HA, visual disturbances

Identify Contributing factors
SC Injuries above T6
Noxious stimuli that causes pain or irritation:
- Bladder /bowel distention
- pressure sores, cuts, burns, bruises, sunburn,
- pressure of any kind on the body
- ingrown toenails
- Tight clothing.

MONITOR for Autonomic Dysreflexia
Monitor for elevated blood pressure, decreased pulse. If present, repeat readings at 3-5 minute intervalss (elevated blood pressure may be the only sign)
An individual with spinal cord injury above T6 often has a normal systolic blood pressure in the 90-110 mm Hg range. Therefore, a blood pressure of 20 mm to 40 mm Hg above baseline may be a sign of autonomic dysreflexia. Source: http://www.guideline.gov/summary/summary.aspx?doc_id=2964

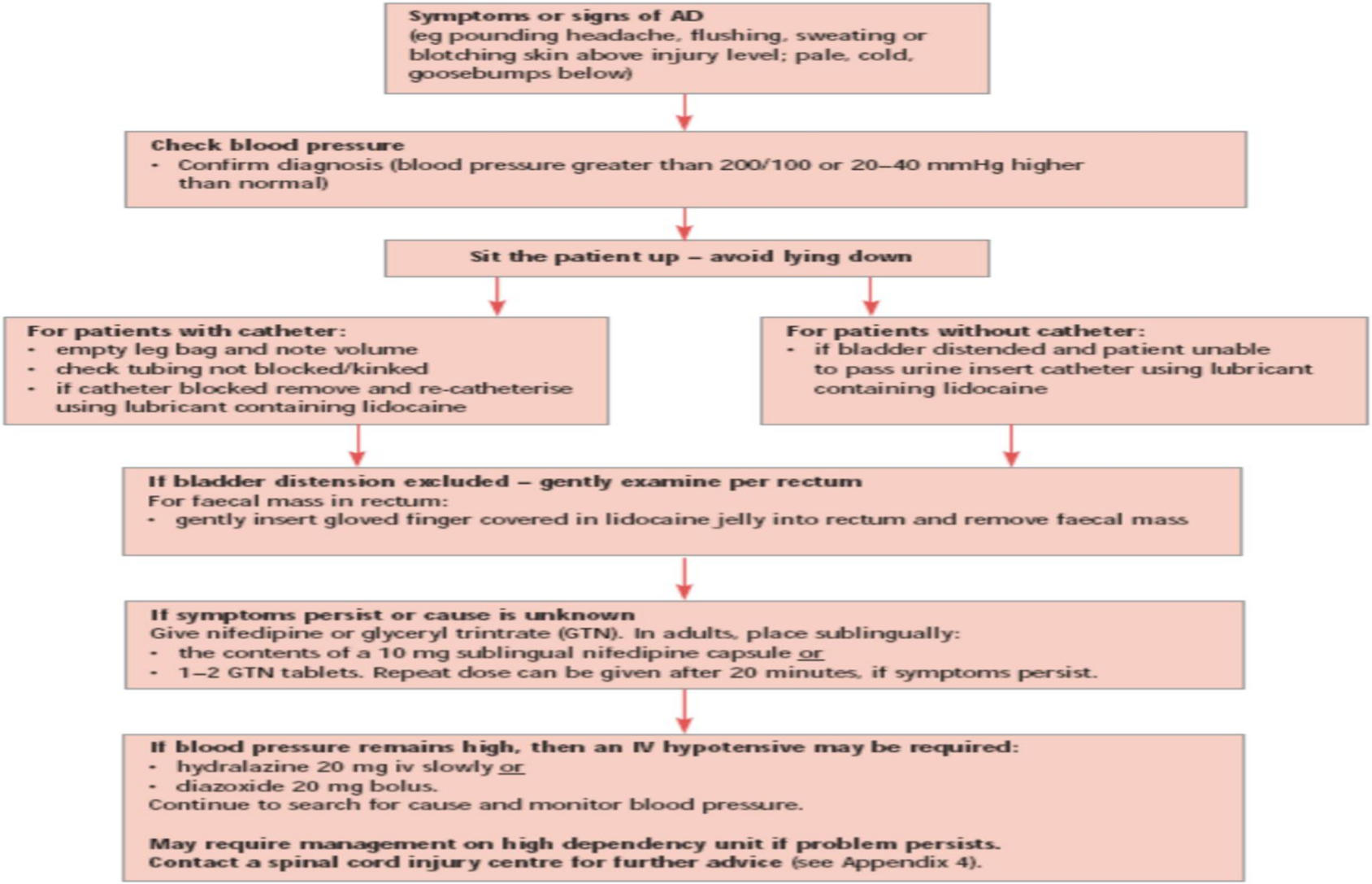
PC: Autonomic Dysreflexia

DO
- placed in an upright position immediately
- inspect to identify the source of painful stimuli (eg, catheter, restrictive clothing, leg bag straps, etc
- Assess for bladder distension & insert catheter, if present
- **Prior to inserting the catheter, instill 2 percent Lidocaine jelly (if immediately available) into the urethra and wait 2 minutes, if possible.**
- If the individual has an indwelling urinary catheter, check the system along its entire length for kinks, folds, constrictions, or obstructions and for correct placement of the indwelling catheter.
- **If the catheter appears to be blocked, gently irrigate the bladder with a small amount (10-15 cc) of fluid, such as normal saline at body temperature.**
- Check rectum for stool using Lidocaine jelly as lubricant and disimpact client
- **Administer an antihypertensive agent with rapid onset and short duration while the causes are being investigated.**

CALL

Call MD and ready response team for recurring hypertension or **symptomatic hypotension.** Initiate ABCs, provide supportive care

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



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

Acute Medulla Compression

Penatalaksanaan

- Farmakologi
  - ✓ Dosis standar : 30mg/kgBB, bolus IV selama 15 menit → jeda 5 menit → dilanjutkan 5,4mg/kgBB/jam dengan infus selama 23 jam (jk terapi dimulai < 3 jam onset)
  - ✓ Infus methylprednisolon dilanjutkan selama 4 8 jam jika terapi dimulai saat onset 3 – 8 jam.
  - ✓ Kontraindikasi : luka terbuka → resiko infeksi, dan perkiraan efek obat lebih kecil drpd manfaat.
  - ✓ Efek samping : hipersensitivitas, peningkatan resiko infeksi

Penatalaksanaan Komplikasi

- Neurogenic shock → jk cedera terjadi pd level Th.6 ke atas → terganggunya kontrol sistem saraf simpatis (Th1 –L1)yg berfungsi mengontrol tonus vaskular. → bradikardi, hipotensi, akral hangat, output urin normal, central venous return menurun.
  - ✓ terapi profilaksis thromboembolism u/ pasien dgn defisit motorik yg berat → 3 bulan
  - ✓ Heparin dosis rendah dikombinasi dgn

Penatalaksanaan Komplikasi

- Deep Venous Thrombosis (DVT) dan Thromboembolism
  - terapi profilaksis thromboembolism u/ pasien dgn defisit motorik yg berat → 3 bulan
  - Heparin dosis rendah dikombinasi dgn *pneumatic compression stockings* atau *electrical stimulation* → profilaksis.
  - *Vena cava filters* → u/ pasien yg gagal dgn antikoagulan, atau pasien yg tdk memenuhi kriteria penggunaan antikoagulan.

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