TRAUMATISMES MÉDULLAIRES

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ÉPIDÉMIOLOGIE

- Entre 10.4 et 83 par millions dans le monde
- 40 par millions aux États-Unis en 2010, 12 400 cas annuellement
- 930 patients entre 1995 et 2004 en Colombie-Britannique

ÉPIDÉMIOLOGIE

TABLE 1. Overall Traumatic Spinal Cord Injury Demographics (1995–2004, Total = 930)	
Age at injury (yr)	Median = 35.0, IQR = (25.0, 51.0), range = (13.0, 92.0)
Sex (% men)	80.0
Level of injury (%)	C1–C4 (10.4), C5–C7 (34.7), thoracic (24.5), L/S (20.9), unspecific (9.5)
Mechanism of injury (%)	MVA (51.4%), fall (28.5%), sports (17.9%), violence (1.5%)
Injury Severity Score (0–75)	Mean = 26.9; SD = 13.9
ASIA Impairment Scale (%)	A (45.3%), B (9.3%), C (13.3%), D (24.7%), cauda equina syndrome (5.2%), unspecific (2.3%)
Tetraplegia (%)	46.2
Operation rate	69.2% operated
Length of stay (d)	Median = 26.0, IQR = (15.0, 47.0), range = (0, 275)

ASIA indicates American Spinal Injury Association; IQR, interquartile range; MVA, motor vehicle accident.

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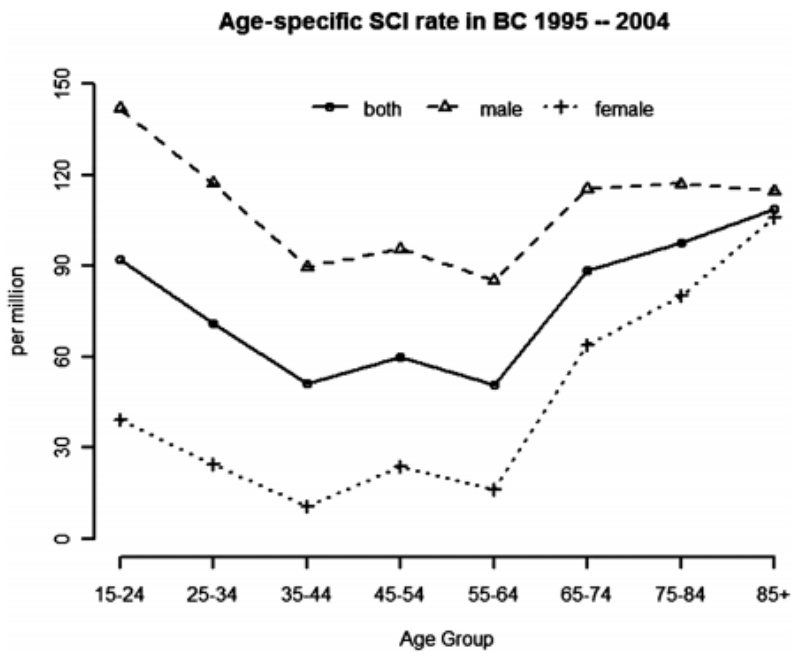
TABLE 2. Spinal Cord Injury Demographics in British Columbia 1995–2004

	Year									
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
No. of cases	102	106	97	102	77	103	83	85	87	88
Incidence rate (per million)	42.2	43.4	39.4	38.4	27.9	40.3	33.8	30.4	28.7	32.5
Men (%)	81.4	75.5	82.5	79.4	79.2	71.8	81.9	83.5	87.4	79.6
Age (yr, median/IQR)	34.5 (23.0–51.0)	34.0 (26.0–51.0)	33.0 (24.0–50.0)	29.5 (24.0–46.0)	38.0 (24.0–46.0)	35.0 (25.0–51.0)	37.0 (26.0–54.0)	34.0 (24.0–48.0)	39.0 (26.0–54.0)	41.5 (25.0–61.0)
ISS (mean/SD)	27.9/17.4	24.9/12.7	28.0/14.7	27.5/15.1	23.9/11.5	27.5/13.1	27.1/12.5	25.3/11.9	27.4/12.9	29.6/14.3
OP (%)	61.8	51.9	71.1	60.8	63.6	73.8	69.9	84.7	73.6	86.4
LOS (d, median/IQR)	32.0 (16.0–56.0)	25.5 (12.0–46.0)	36.0 (20.0–53.0)	25.0 (14.0–38.0)	22.0 (12.0–36.0)	21.0 (13.0–32.0)	21.0 (14.0–40.0)	23.0 (14.0–37.0)	26.0 (17.0–50.0)	41.5 (24.5–67.0)

IQR indicates interquartile range; ISS, Injury Severity Score; LOS, length of stay; OP, operative rate.

ÉPIDÉMIOLOGIE



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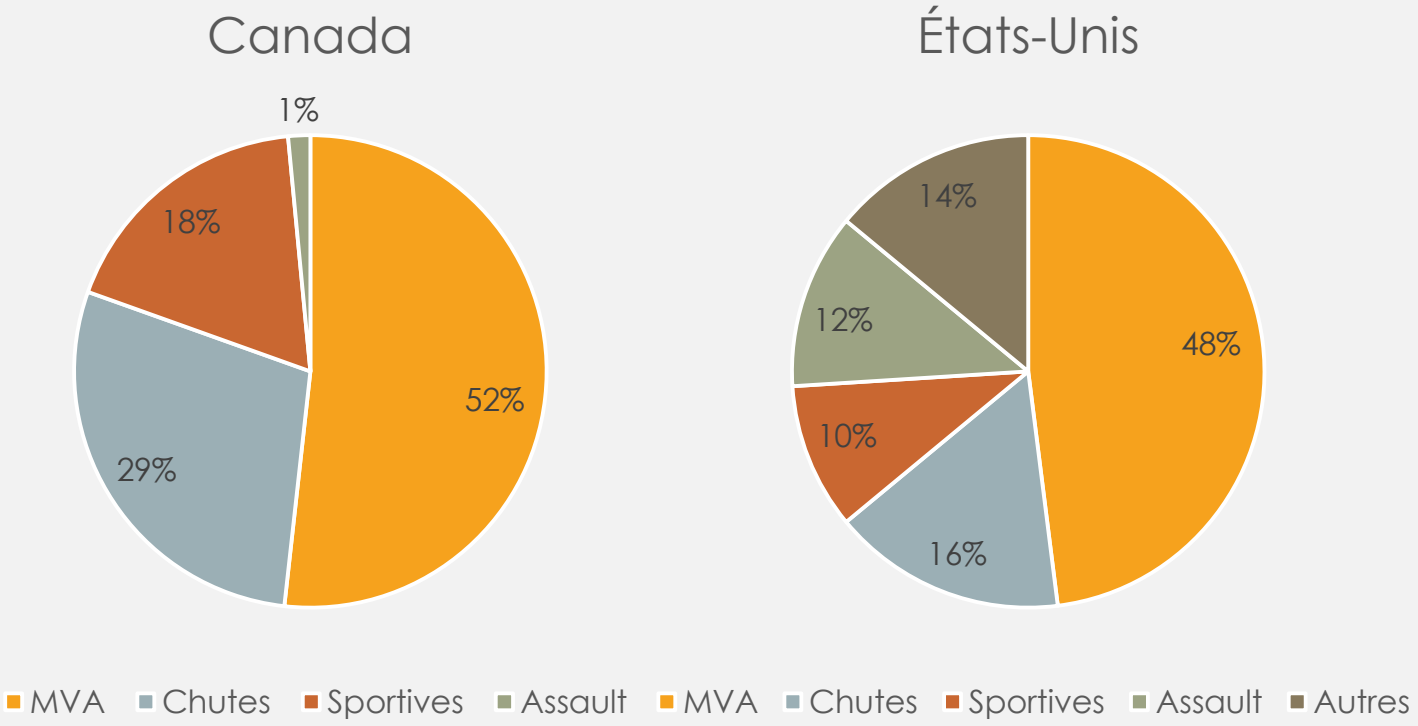
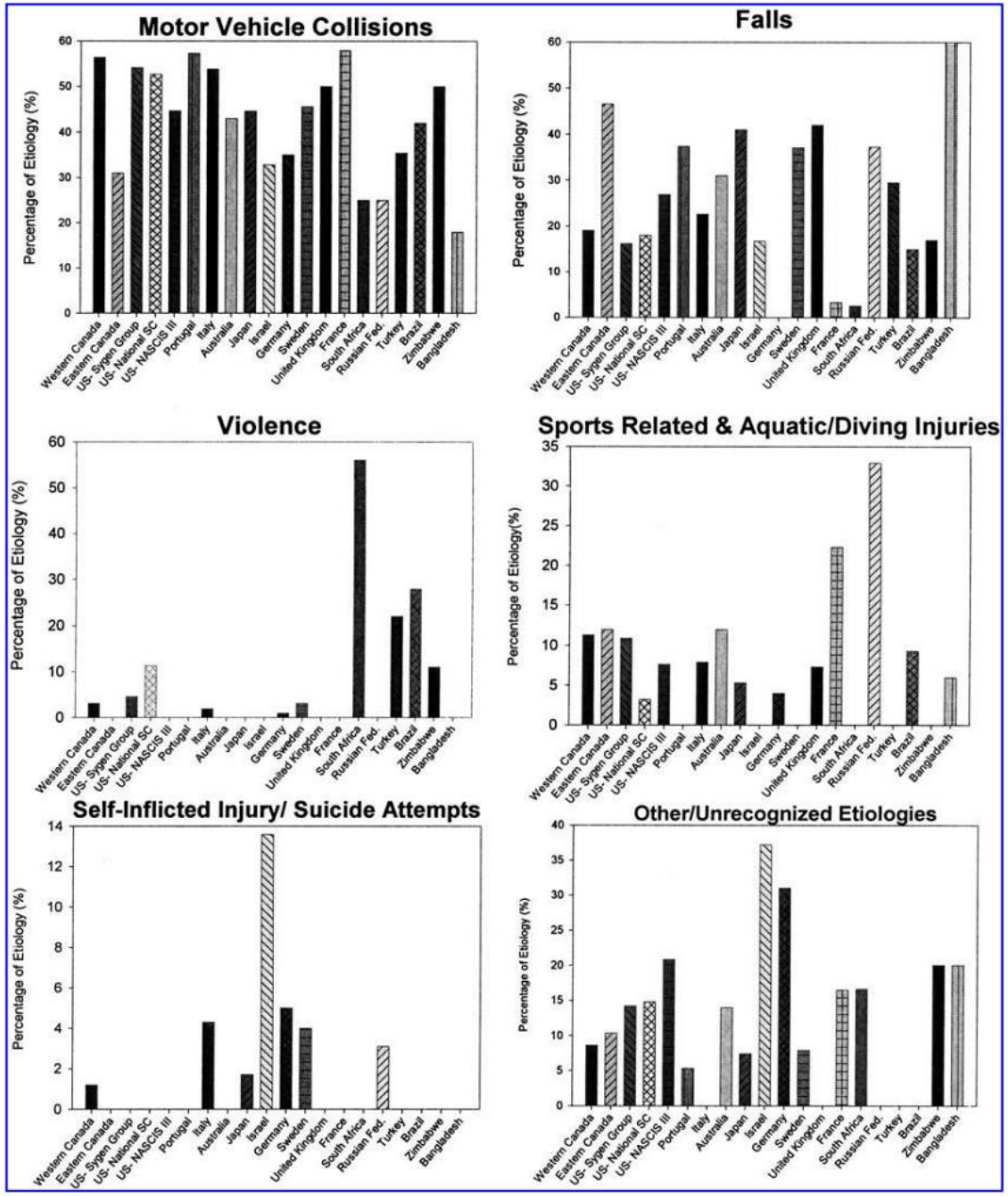



Motor Vehicle Collisions
Falls
Violence
Sports Related & Aquatic/Diving Injuries
Self-Inflicted Injury/ Suicide Attempts
Other/Unrecognized Etiologies
Percentage of Etiology (%)
Western Canada
Eastern Canada
US- Sygen Group
US- National SC
US- NASCIS III
Portugal
Italy
Australia
Japan
Israel
Germany
Sweden
United Kingdom
France
South Africa
Russian Fed.
Turkey
Brazil
Zimbabwe
Bangladesh

ÉPIDÉMIOLOGIE

Facteurs de risques
ROH (34% des cas)
Instabilité AA préexistante
Ostéoporose
PAR, spondylite ankylosante
Anomalies congénitales
Arthropathie dégénérative colonne cervicale

PHYSIOLOGIE

$$PPM = TAM - PIC$$

$$DO2 = CO\ x\ (1.34\ x\ Hb\ x\ SaO2 + (0.003\ x\ PaO2))$$

PHYSIOLOGIE

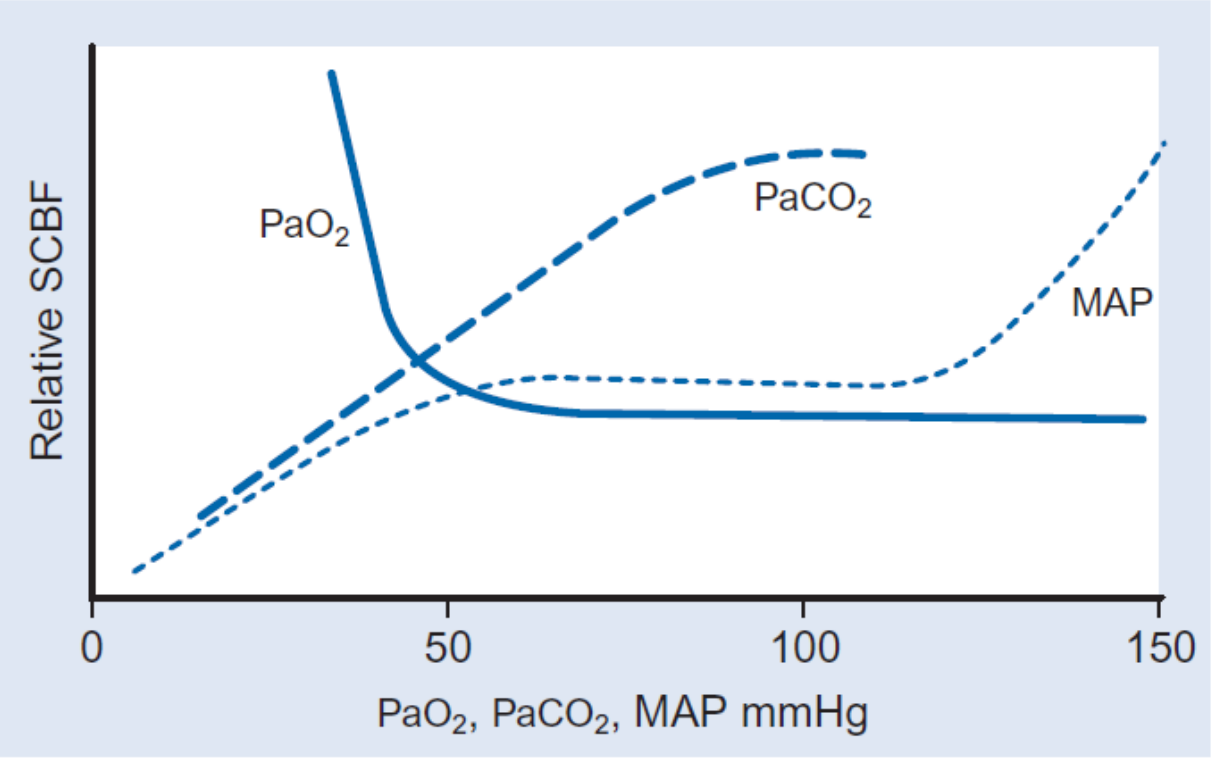
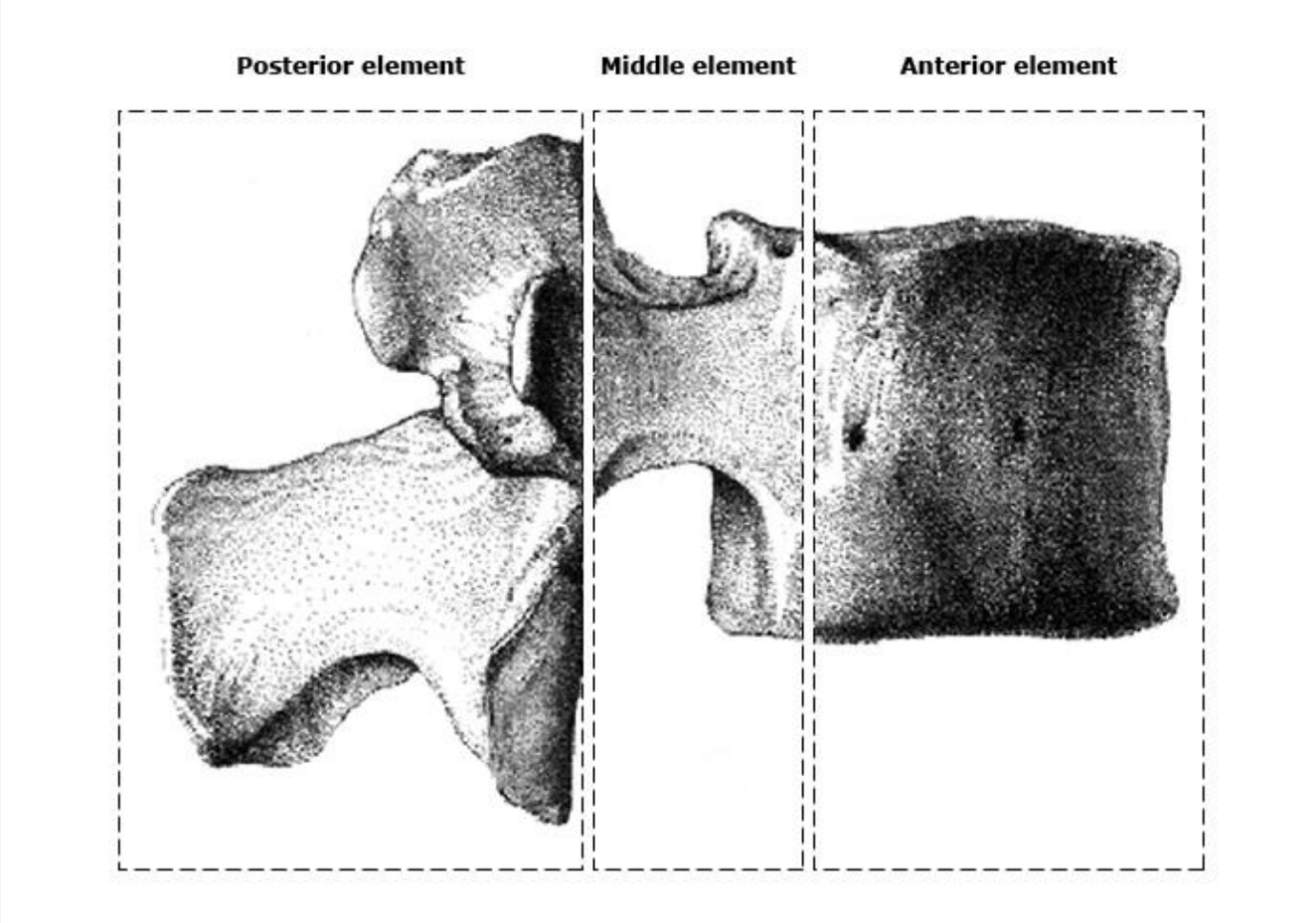


Fig. 21.10 Illustration of effect of changes in $PaCO_2$, PaO_2, and mean arterial pressure (MAP) on spinal cord blood flow (SCBF).

MÉCANISMES DE TRAUMA

- Flexions, distraction, rotation



MÉCANISMES DE TRAUMA

Wedge

- 50-70% fractures thoraco-lombaire
- Flexion-extension colonne antérieure
- Stable si pas d'atteinte LLP

MÉCANISMES DE TRAUMA

Burst

- 14% fractures thoraco-lombaire
- Compression axiale colonne ant-moy
- Fx instable si migration osseuse dans le canal

MÉCANISMES DE TRAUMA

Chance

- 10% fractures thoraco-lombaire
- Flexion + distraction colonne moy-post
- ''Lap belt'' injury
- Trauma intra-abodminal à R/O
- Potentiellement instable

MÉCANISMES DE TRAUMA

Fracture-dislocation

- Trauma massif
- Souvent T10-L2
- Toujours instable
- Plupart des patients tétraplégiques ont ce genre de lésion

Classification of spinal injuries

Mechanisms of spinal injury	Stability
Flexion	
Anterior wedge fracture	Stable
Flexion teardrop fracture	Extremely unstable
Clay shoveler's fracture	Stable
Subluxation	Potentially unstable
Bilateral facet dislocation	Always unstable
Atlanto-occipital dislocation	Unstable
Anterior atlantoaxial dislocation with or without fracture	Unstable
Odontoid fracture with lateral displacement	Unstable
Fracture of transverse process	Stable
Flexion-rotation	
Unilateral facet dislocation	Stable
Rotary atlantoaxial dislocation	Unstable
Extension	
Posterior neural arch fracture (C1)	Unstable
Hangman's fracture (C2)	Unstable
Extension teardrop fracture	Usually stable in flexion; unstable in extension
Posterior atlantoaxial dislocation with or without fracture	Unstable
Vertical compression	
Burst fracture of vertebral body	Stable
Jefferson fracture (C1)	Extremely unstable
Isolated fractures of articular pillar and vertebral body	Stable

MÉCANISMES DE TRAUMA

Facteurs de risques de trauma médullaire

- Trauma véhicule haute vélocité
- Décès lors de l'accident
- Chute de plus de 3 mètres
- TCC significatif au scan cérébral
- Signes et symptômes de lésion médullaire
- Trauma pelvien ou fractures os longs multiples

APPROCHE INITIALE

- Homme 34 ans, trauma auto-décor, haute vélocité, incarcéré pendant 45 minutes
- SV: 80/40, FC 40, SaO2 90% 100% O2, Temp 33.4 C
- GSC 12
- Paralysie flasque 4 membres
- FAST +, liquide libre abdomen

CONSIDÉRATIONS ANESTHÉSIQUES?

- Polytrauma/situation urgente
- Trauma médullaire
- Trauma intra-abdominal
- Choc (spinal vs neurogénique vs autre)
- Altération de l'état de conscience
- Hypothermie
- Insuffisance respiratoire
- Estomac plein
- AW potentiellement difficile
- (Chirugie spinale)
- (Position ventral)

TRAUMA MÉDULLAIRE

Which of the following are consistent with spinal shock following a C5-C6 fracture dislocation?

a) Tachycardia
b) Sweating
c) Normal tidal volume
d) Cold extremities

CHOC SPINAL VS CHOC NEUROGÉNIQUE

«Perte de sensation, paralysie flasque + aréflexie caudale niveau de la lésion»

DURÉE DU CHOC SPINAL

A) Quelques heures

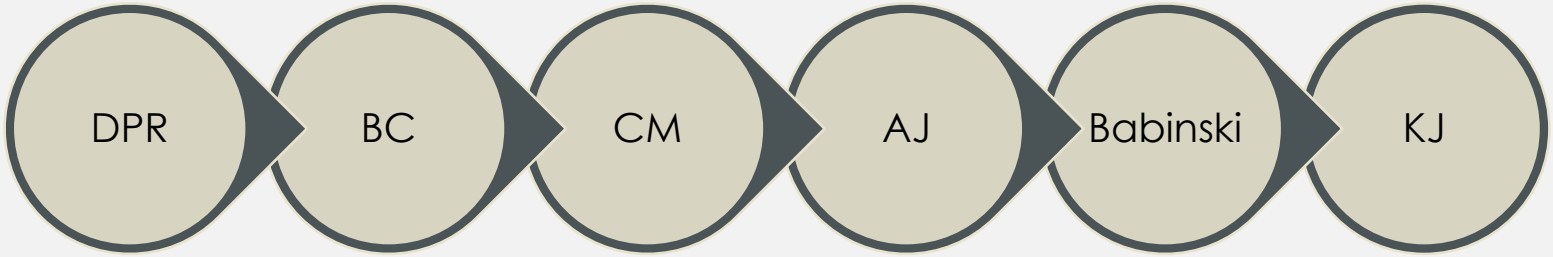
B) 1 semaine

C) 1 mois

D) 6-12 mois

CHOC SPINAL

- Retour des réflexes se fait dans cet ordre :



DPR: delayed plantar reflex ; BC: réflexe bulbocaverneux ; CM: réflex crémaster; AJ: réflexe achilléen ; KJ: réflexe rotulien

CHOC SPINAL

Phases	Caractéristiques cliniques
1 (0-1 jour)	Aréflexie - hyporéflexie
2 (1-3 jours)	Retour réflexes cutanés
3 (1-4 semaines)	Retour DTR
4 (1-12 mois)	Hyper-réflexie et spasticité

CHOC NEUROGÉNIQUE

« Instabilité hémodynamique causée par la perte du tonus sympathique sous la lésion »

CHOC NEUROGÉNIQUE

- Lésions au-dessus T1-T6
- ↓ SNS
- ↓ RVS
- ↓ RV
- ↓ Réponse hypovolémie et au changement de position
- ↓ Contractilité myocardique
- HypoTa et HTO
- Brady/BAV/asystolie

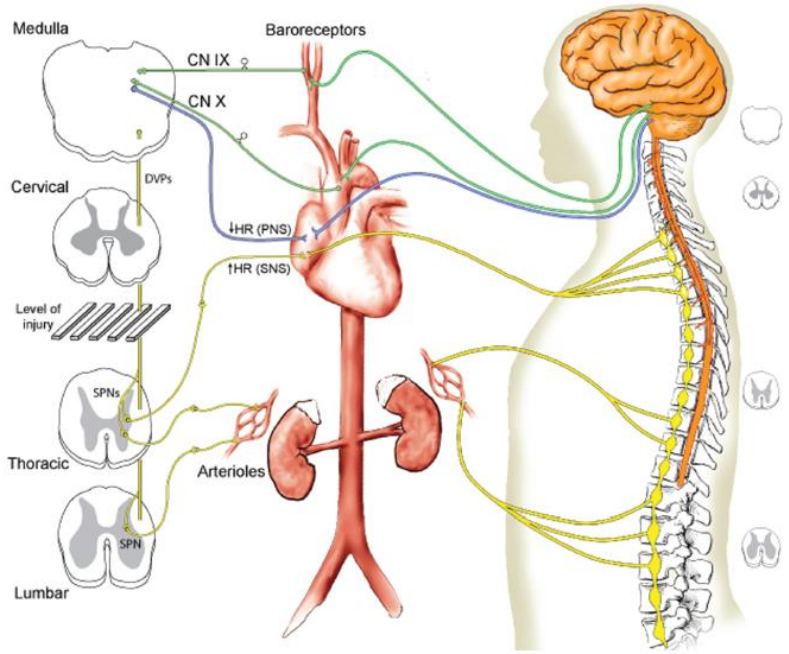


FIG. 1. Schematic representation of the central and autonomic innervation of the cardiovascular system. On the left (front view of spinal cord), the spinal sympathetic preganglionic neurons (SPNs) are shown as disconnected from the medullary cardiovascular centers by a cervical SCI, whereas the parasympathetic nervous system (PNS) is intact. Parasympathetic cardiac innervation *(in blue)* and sympathetic cardiac innervation *(in yellow)* can reduce and increase heart rate (HR), respectively. Parasympathetic afferents from baroreceptors of the aortic arch and carotid artery travel to the medulla oblongata through cranial nerves (CN) IX (glossopharyngeal nerve; *in green*) and X (vagus nerve; *in green*). Efferent fibers are denoted by *yellow* or *blue lines*, afferent fibers by *green lines*. The right-sided figure schematically depicts the neuroanatomy of the cardiovascular innervation including central nervous system *(orange)*, extramedullary SNS *(yellow)*, and extramedullary PNS *(blue)*. DVPs = descending vasomotor pathways.

CHOC NEUROGÉNIQUE

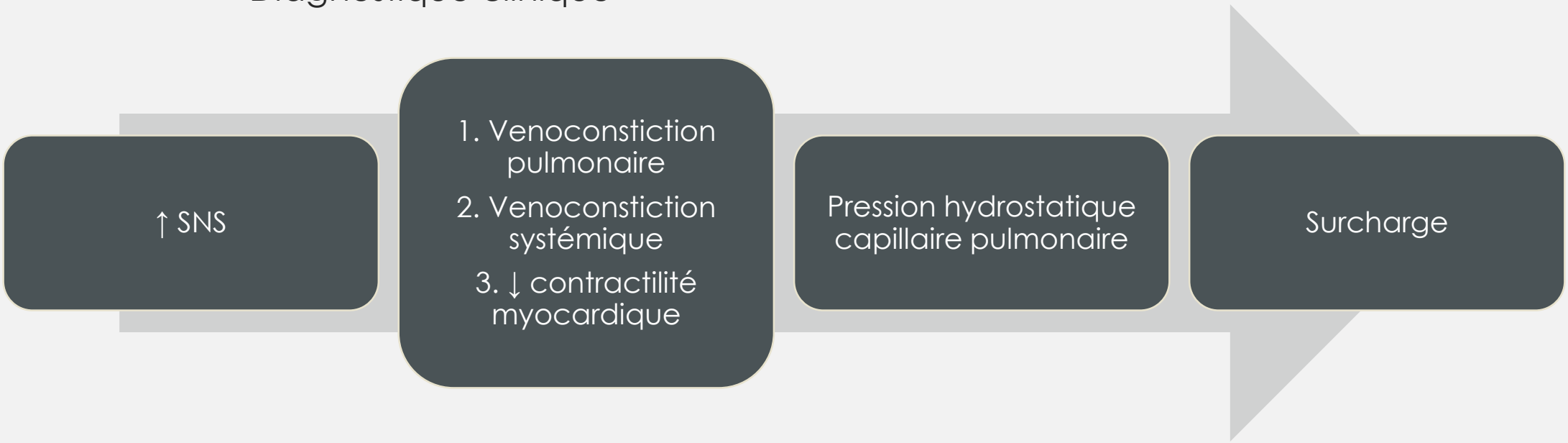
- 60-70% des trauma cervicaux
- Se développe en dedans de 30 minutes, peut durer jusqu'à 6 semaines
- Lésion complète cervicale → 100% patients avec FR < 60 bpm, 70% FR < 45 bpm

L'absence de sensation de douleur peut masquer un trauma significatif

Toujours exclure une autre cause d'hypotension chez le patient avec trauma médullaire

ŒDÈME PULMONAIRE NEUROGÉNIQUE

- Plus fréquent en TBI
- Se produit lors du trauma initial
- Diagnostique clinique



COMPLICATIONS RESPIRATOIRES

In C6 injury, all are decreased EXCEPT:

a) FEV1
b) Expiratory reserve volume
c) Lung elastic recoil
d) Inspiratory capacity

COMPLICATIONS RESPIRATOIRES

- **Dépend du niveau de la lésion**
- **Complication la plus fréquente BM (80%)**
- **90% dans les 3 premiers jours**
- **Cause principale décès per-hospitalisation**

COMPLICATIONS RESPIRATOIRES

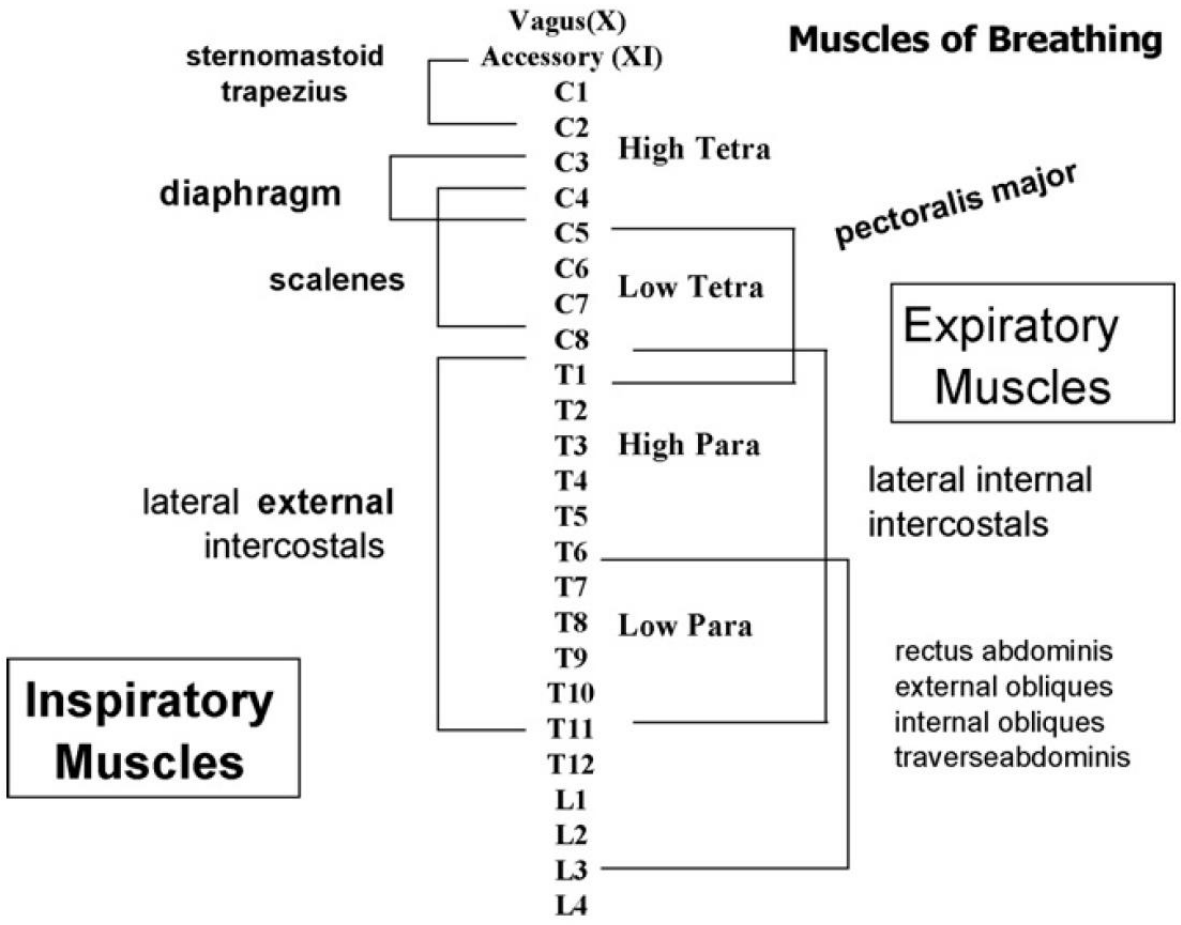


Fig. 1. Diagram showing levels of innervation of the inspiratory and expiratory muscles.

COMPLICATIONS RESPIRATOIRES

- Faiblesse des muscles respiratoires avec insuffisance respiratoire mixte
- Respiration paradoxale
- ''Rapid shallow breathing''
- Augmentation du travail respiratoire

Niveau de la lésion	C1-C4	C5-C8	Thoracique
Nb jours moyen ventilation mécanique	65 jours	22 jours	12 jours

COMPLICATIONS RESPIRATOIRES

C3-C5	C6-C8	T1-12
Diminution 20-25% CV	Diminution 30% CV	
	Respiration paradoxale	
Utilisation muscles accessoires	Utilisation muscles accessoires	
Paralysie variable du diaphragme	Fonction diaphragmatique préservée	
Pertes des muscles intercostaux et abdominaux	Pertes des muscles intercostaux et abdominaux	Fonction variable des muscles intercostaux et abdominaux

COMPLICATIONS RESPIRATOIRES

Traumatic Spinal Cord Injury

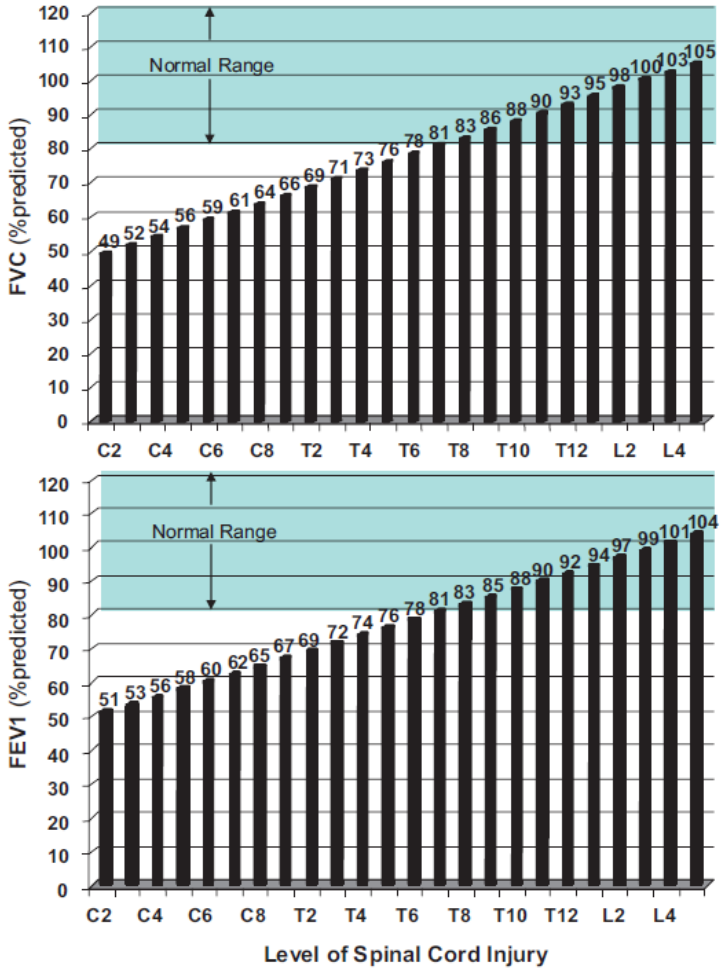
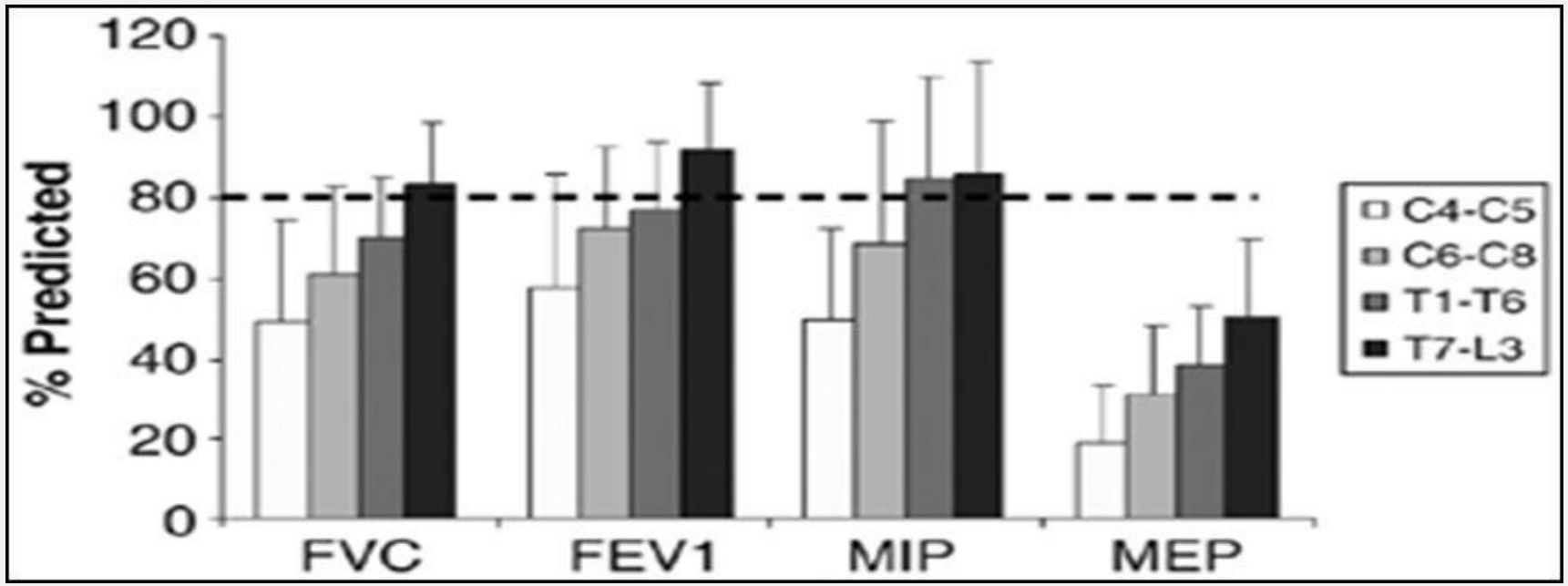


Fig. 2. Level of injury and pulmonary function abnormality. (*Adapted from* Linn WS, Spungen AM, Gong H Jr, et al. Forced vital capacity in two large outpatient populations with chronic spinal cord injury. Spinal Cord 2001;39(5):263–8; with permission.)

COMPLICATIONS RESPIRATOIRES



COMPLICATIONS RESPIRATOIRES

La dynamique respiratoire chez les BM est meilleure en position assise qu'en décubitus dorsal? **Vrai ou faux?**

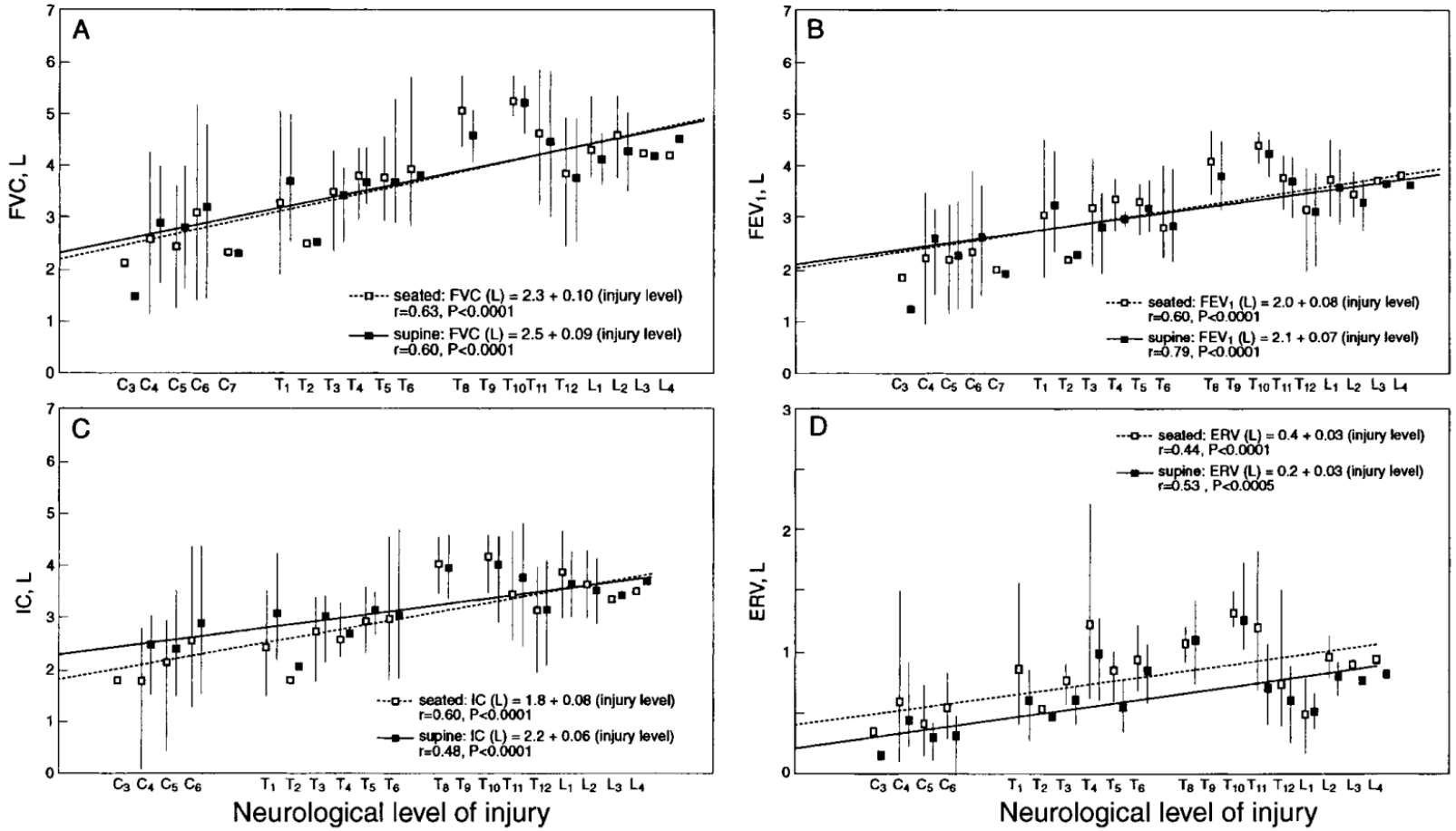


Fig. 3. Spirometric variables in spinal cord-injured subjects in seated and supine postures distributed according to lesion level. *A*: FVC (n = 74). *B*: FEV_1 (n = 74). *C*: IC (n = 73). *D*: ERV (n = 73). Values are means and ranges of absolute values in liters. See text for details.

COMPLICATIONS RESPIRATOIRES

- Toux inefficace/mauvaise gestion des sécrétions
- Risque d'aspiration et pneumonies
  - 1-3% par jour d'intubation
  - Mortalité 27% et 43% si *P. aeruginosa*
- Atélectasie
- Autres traumas associés
- CV < 25% FR ventilation mécanique

HYPERREACTIVITÉE BRONCHIQUE

Table 2
Response to ipratropium bromide in spinal cord injury

Pulmonary Function Parameter	Tetraplegia n = 6		Paraplegia n = 6	
	Mean ± SD	% Change	Mean ± SD	% Change
FEV1, L	2.11 ± 0.57	(12 ± 6)[a]	3.24 ± 0.64	(2 ± 3)
FEV1/FVC ratio	75 ± 4	(5 ± 7)	82 ± 7	(0 ± 2)
ERV, L	0.63 ± 0.56	(57 ± 63)[a]	1.09 ± 0.45	(−7 ± 30)
FRC, L	2.67 ± 1.02	(0 ± 10)	3.16 ± 0.58	(−5 ± 4)[a]
sGaw, $cmH_2O^{-1}s^{-1}$	0.13 ± 0.05	(135 ± 47)[a]	0.26 ± 0.02	(19 ± 7)[a]

Values are mean ± SD for prebronchodilator measurements. Numbers in parentheses represent percent change after administration of ipratropium bromide.

Abbreviations: ERV, Expiratory reserve volume; FEV1/FVC, The ratio of the FEV1 to the forced vital capacity; FEV1, Forced expired volume in 1 second; FRC, functional residual capacity; sGaw, specific airway conductance.

[a] $P<.05$ for percent change from baseline value.

Adapted from Schilero GJ, Spungen AM, Bauman WA, et al. Pulmonary function and spinal cord injury. Respir Physiol Neurobiol 2009;166(3):133; with permission.

PRISE EN CHARGE

Immobilisation
Stabilisation chirurgicale
Maintenir pression perfusion médullaire
Éviter hypo/hyperglycémie
Éviter l'hypoxémie
Optimiser DC et Hb
Normothermie, pH, CO2
Prévention dommages secondaires

A

1. Immobilisation

Limiter les dommages secondaires en présence d'une lésion spinale instable

Certains risques

1. Aspiration
2. Insuffisance respiratoire
3. Plaie de pression/ulcères
4. Gestion du AW + difficile
5. Augmentation PIC

A

- **1. Immobilisation**
  - 45,284 traumas pénétrants
  - **14.7% vs 7.2% mortalité**
  - **0.01% lesion médullaire**
  - **NNT 1032**

TABLE 3. Multiple Logistic Regression Showing Odds Ratio of Death for Penetrating Trauma Patients With Pre-Hospital Spine Immobilization

	OR of Death	95% CI	*p*
Prehospital procedures			
Spine immobilization	2.06	1.35–3.13	0.001
Intubation	1.31	0.97–1.77	0.079
IV fluids	1.95	1.55–2.47	<0.001
MAST	0.64	0.52–0.80	<0.001
Chest decompression	0.63	0.52–0.77	<0.001
Splint	3.83	0.30–48.96	0.301

CANADIAN C-SPINE RULE

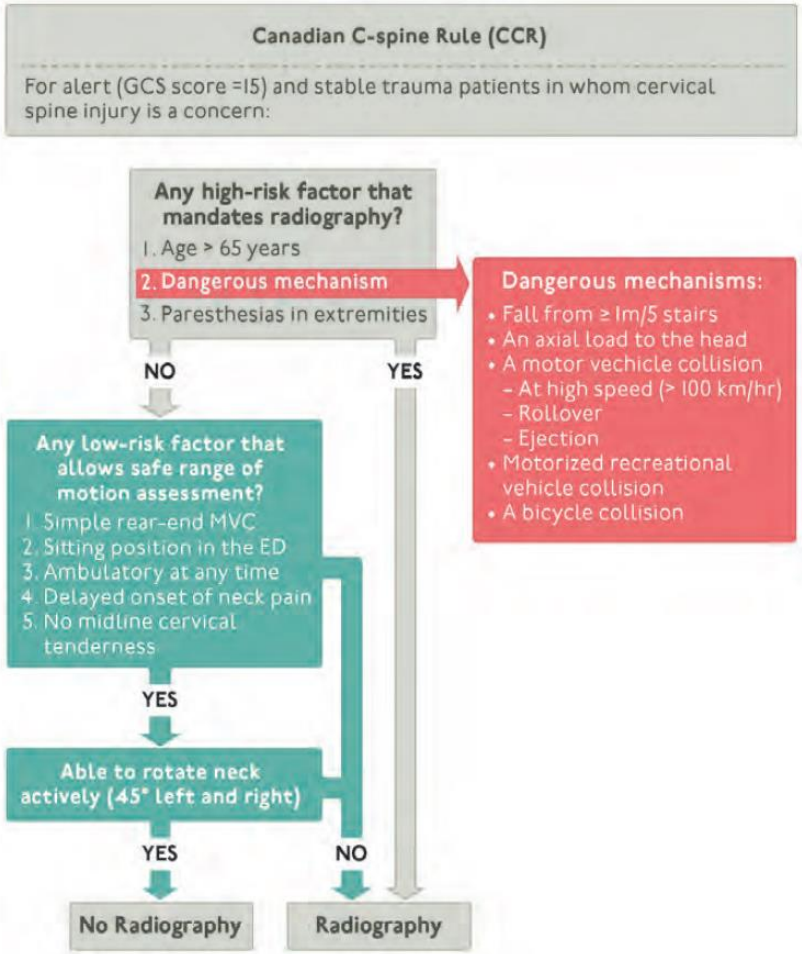
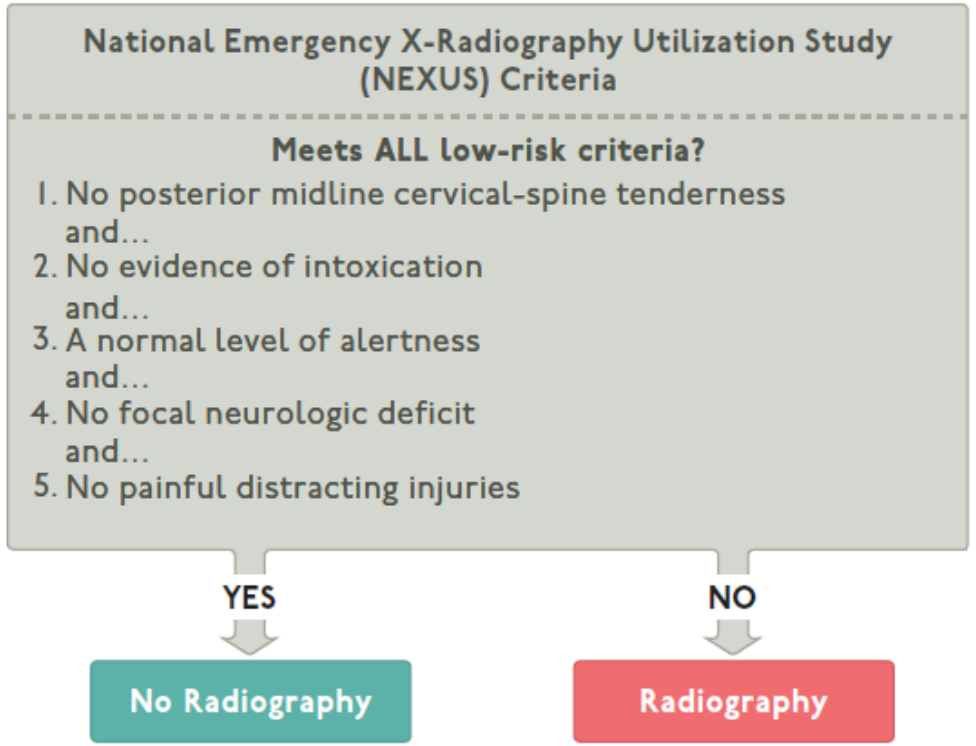


FIGURE 7-8 Canadian C-Spine Rule. A clinical decision tool for cervical spine evaluation. MVC = motor vehicle collison; ED = emergency department. Adapted from Stiell IG, Wells GA, Vandemheen KL, et al. The Canadian C-Spine rule of radiography in alert and stable trauma patients. *JAMA* 2001;286:1841–1848.

NEXUS



NEXUS Mnemonic

N– **N**euro deficit
E– **E**tOH (alcohol)/intoxication
X– e**X**treme distracting injury(ies)
U– **U**nable to provide history (altered level of consciousness)
S– **S**pinal tenderness (midline)

A

- Immobilisation

Current Level of Recommendation	Recommendation 2012
Level II	Spinal immobilization of all trauma patients with a cervical spine or SCI or with a mechanism of injury having the potential to cause cervical spinal injury is recommended.
	Triage of patients with potential spinal injury at the scene by trained and experienced EMS personnel to determine the need for immobilization during transport is recommended.
	Immobilization of trauma patients who are awake, alert, and not intoxicated; who are without neck pain or tenderness; who do not have an abnormal motor or sensory examination; and who do not have any significant associated injury that might detract from their general evaluation is not recommended.
Level III	Spinal immobilization in patients with penetrating trauma is not recommended because of the increased mortality from delayed resuscitation.
Level III	Whenever possible, the transport of patients with acute cervical spine injuries or SCIs to specialized acute SCI treatment centers is recommended.

A

Collier cervical souple

- 96% flexion normale
- 73% extension normale
- Pas de restriction des mouvements latéraux et rotation

A

Collier cervical rigide et semi-rigide

- 30% extension et flexion
- 45% rotation et flexion latérale

A

Avec coussins latéraux

- Extension 35%
- Flexion, flexion latérale et rotation 5%

A

Fixation

- 4% flexion et extension
- 1% rotation

GESTIONS DES VOIE AÉRIENNES

- Apnée vs éveillé?
- Glidescope vs LD vs autre
- RSI ou induction titrée?
- Sellick ou non?
- SML ou non?
- Garder le collet ou non?

A

Gestion des voie aériennes

Objectif : sécuriser les voie aériennes de façon sécuritaire sans causer de dommage médullaire secondaire

Considérations

1. Où vous êtes et le matériel disponible
2. Niveau de la lésion et degré d'instabilité
3. Urgence de la situation
4. Collet cervical en place
5. Statut respiratoire et CVS
6. Présence TBI et HTIC
7. Présence de trauma maxillo-facial
8. Niveau de coopération/intoxication
9. Estomac plein/RSI
10. Expérience de l'anesthésiste

GESTION DES VOIES AÉRIENNES

- Maneuvres de bases
  - Chin lift/jaw thrust → 5 mm d'élargissement de l'espace C5-C6
  - Sellick → 4.6 à 5 mm
  - Head tilt, canule oro/naso-phagyngée → mouvement minime
  - Traction manuelle en ligne → **Non recommandée**

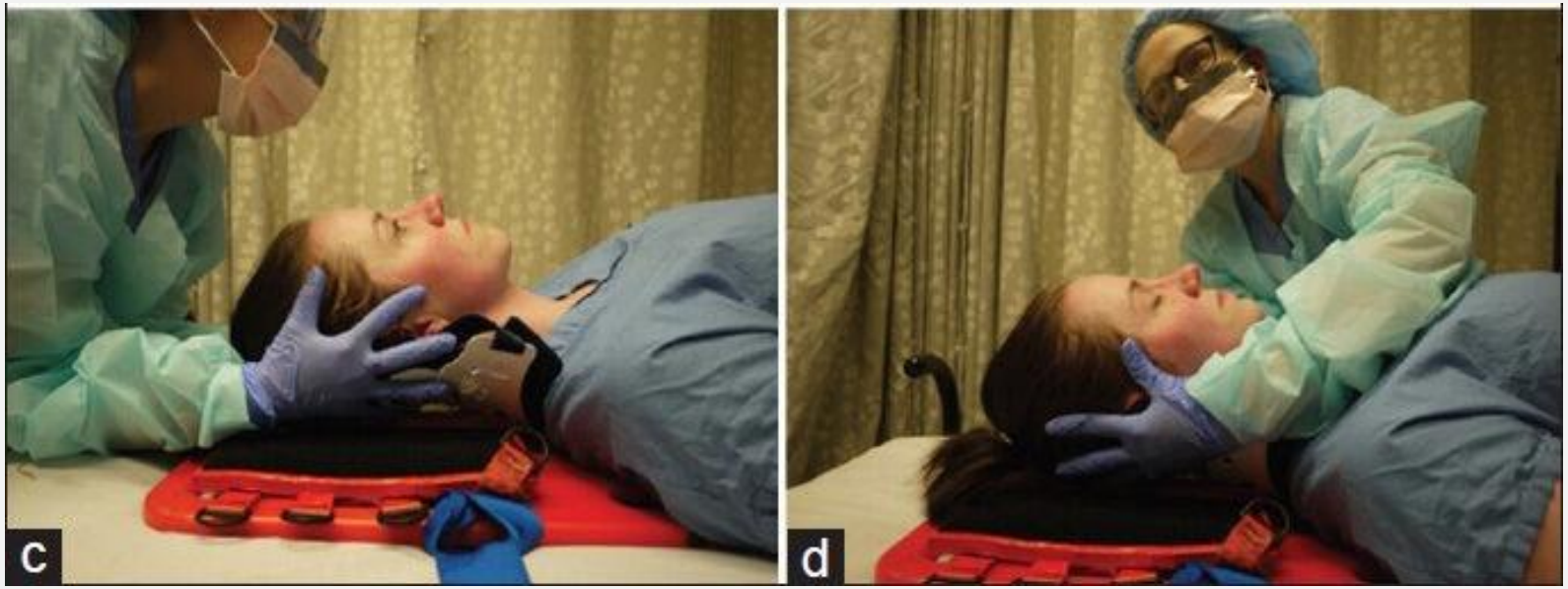
Table 21.8 Airway Management Techniques and Their Effects on the Cervical Spine

Maneuver	Condition	Result
Laryngoscopy	Normal, anesthetized	• Extension at the occipitoatlantal and C1–C2 articulations • C2–C5 displaced only minimally • Sniffing position-flexing lower neck on the chest and extending the head on the upper neck
	Cadaver, C5–C6 instability	• 3–4 mm widening of the disk space at the level of injury
Straight vs. curved blade	Normal, anesthetized	• No difference in cervical spine movement
GlideScope®	Normal, anesthetized	• Overall spine movement reduced 50% at C2–C5 as compared to curved blade
Bullard laryngoscope	Normal, anesthetized, in-line stabilization	• Overall cervical spine movement reduced at C2–C5 • Less extension at occipitoatlantoaxial complex but similar occiput–C5 extension compared with direct laryngoscopy with Macintosh blade if no manual in-line immobilization
Augustine guide	Normal, healthy	• Less spine extension than with direct laryngoscopy
Rigid indirect laryngoscopy		• Cervical spine movements less than with direct laryngoscopy • Better visualization of the glottis than direct laryngoscopy
Intubating laryngeal mask airway		• Exerts high pressures against upper cervical vertebrae with insertion and manipulation • May produce posterior displacement of upper cervical spine • For insertion, C5 and superior spinal segments flexed <2°; during intubation, C4 and superior segments flexed <3°; little movement of the spine above C3
Cricoid pressure	Normal, anesthetized, in-line stabilization	• Single-handed cricoid pressure causes vertical displacement of neck ≈ 5 mm, but no spine movement
Blind nasotracheal	Cadaver, C5–C6 instability	• Up to 2 mm subluxation but no increase in disk space; intubation >5 mm subluxation when neck is stabilized anteriorly by hand pressure
Airway support		
Chin lift/jaw thrust	Cadaver, C5–C6 instability	• >5 mm widening disk space at level of injury
Oral/nasopharyngeal	Cadaver, C5–C6 instability	• ≈2 mm widening disk space at level of injury
Mask ventilation	Cadaver	• Significant anteroposterior translation displacement with maximal flexion and extension of the head

GESTION DES VOIES AÉRIENNES

LMA	LD	VL	FOB	Crico
• Déplacement postérieur colonne cervicale • Rescue uniquement	• 3-4 mm déplacement C4-C5 • Diminution de 60% si SML • Grade 3-4 22% SML et 64% si collet + cousins latéraux	• Meilleure vision glottique surtout si SML et moins de mouvement rachis cervical • + long	• Technique la plus sécuritaire • + difficile si patient instable, HTIC, non-collaborant ou trauma facial • Éviter toux ++	• Pas d'études • Complications fréquentes (32%) • Délais intubation (13%) • Échec (8-25%) • Saignement (5%)

SML



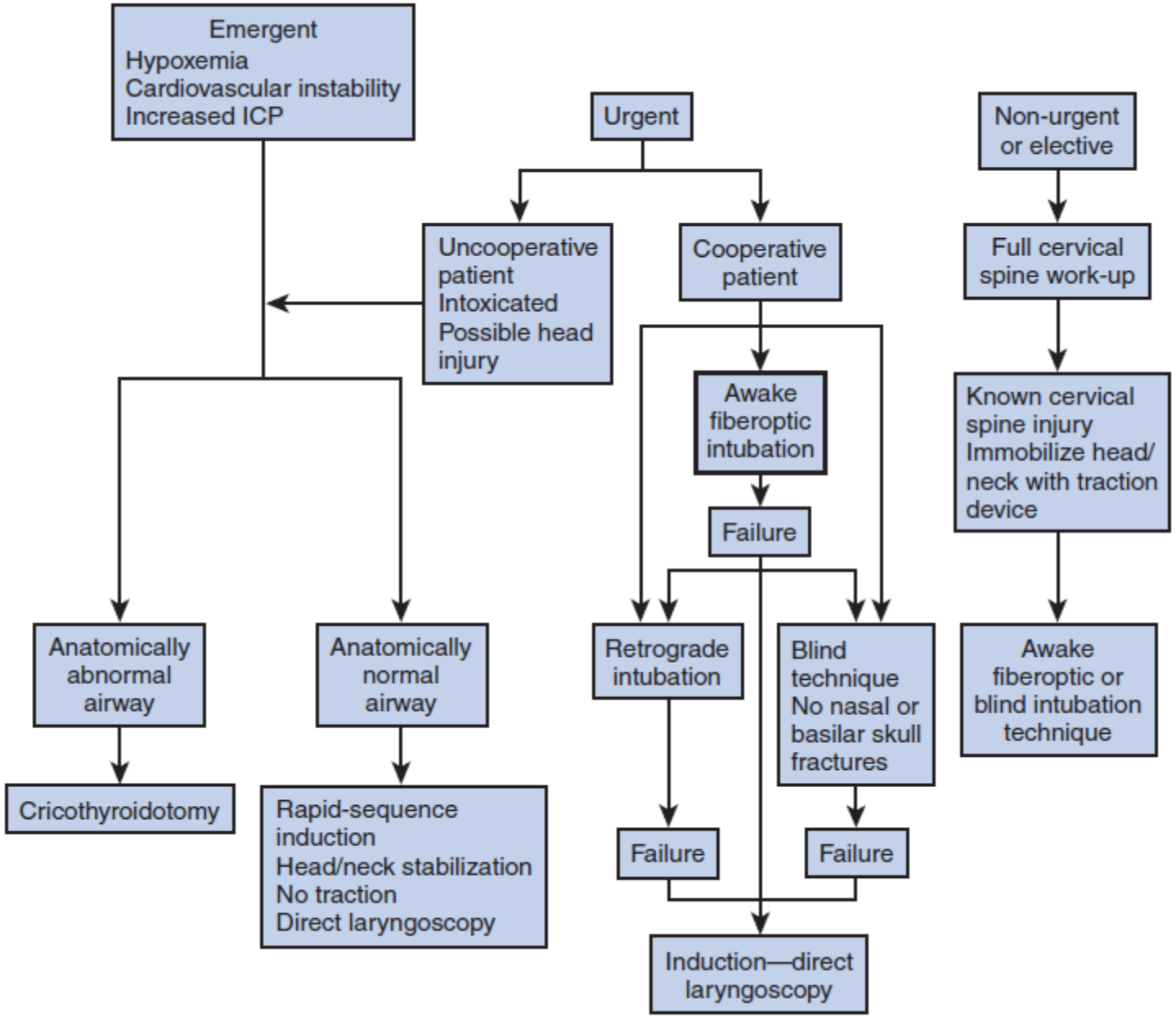


Fig. 10.12 Endotracheal intubation in the patient with suspected cervical spine injury. ICP, intracranial pressure.

A

Which of the following is a concern during the 1st 72 hours after C-spine transection?

A. Spinal shock
B. Sensitivity to succinylcholine
C. Autonomic hyperreflexia
D. Decrease in lean tissue mass
E. Muscle spasm in response to surgical stimulation

Éviter la succinylcholine 24-48h après le trauma

B

- Degré variable d'insuffisance respiratoire
- Oxygénation et ventilation peuvent être difficile en présence d'un trauma thoracique/contusions pulmonaires
- Garder en tête la possibilité d'un pneumothorax occulte lors de l'initiation de la VPP

B
Pneumothorax ouvert ou sous tension
Hémothorax massif
Disruption arbre trachéo-bronchique
Tamponnade cardiaque

C

- Après le pneumothorax sous tension, l'hémorragie est la première cause d'instabilité hémodynamique en trauma
- L'hypotension contrôlée est CI dans le contexte de trauma médullaire/TBI
- Maintien PPM est essentielle
- La plupart des études sont animales ou inférées des études en TBI

1 seul épisode HypoTa < 90 mmHg entraine une augmentation de la mortalité de 150% en TBI

TABLE 8.1. Summary of Reports on Blood Pressure Management after Acute Spinal Cord Injury[a]

Series (Ref. No.)	Description of Study	Evidence Class	Conclusions
Vale et al., 1997 (26)	Prospective assessment of 77 ASCI patients treated in ICU, aggressive hemodynamic support, MAP >85. No control group.	III	Improved outcome with aggressive medical care, distinct from potential benefit from surgery at 1-yr follow-up.
Levi et al., 1993 (13)	50 patients treated in ICU, aggressive medical treatment, MAP >90.	III	Improved outcome with aggressive hemodynamic support at 6 wk postinjury.
Levi et al., 1991 (14)	103 ACSI patients, 50 incomplete (Group A), 53 complete (Group B), ICU care, hemodynamic support, MAP >85.	III	Improved neurological outcome, no significant difference between early and late surgery in either group.
Wolf et al., 1991 (28)	52 patients with locked facets reduced within 4 h, ICU care, MAP >85. 49 operated on, 23 day 1, 26 delayed.	III	Closed reduction 61%. 52% 1-yr follow-up. In general, improved neurological outcome with hemodynamic therapy.
Tator et al., 1984 (23)	144 ASCI patients managed per protocol of ICU care, hemodynamic support. Compared with earlier cohort.	III	Improved neurological outcome, less mortality with early transfer and ICU care.
Zach et al., 1976 (29)	Prospective assessment of 117 ACSI patients at Swiss center, ICU setting. Aggressive medical therapy and blood pressure support (Rheomacrodex[b] × 7 d; dexamethasone × 10 d). No comparison or control group.	III	Improved neurological outcome with aggressive medical treatment and blood pressure management. Better outcome for early referrals.

[a] ASCI, acute spinal cord injury; MAP, mean arterial pressure; ICU, intensive care unit.
[b] Rheomacrodex, dextran 40 (Medisan, Parsippany, NJ).

C

- Maintien TAM 85-90 de 5-7j
- Maintient DO2
  - Oxygénation adéquate
  - Optimiser le débit cardiaque (surtout si choc neurogénique)
  - Hb selon la sévérité du saignement, les comorbidité du patient et statut hémodynamique
  - Lactates, SvO2 comme marqueurs de perfusion

Management of patients with acute SCI in a monitored setting is recommended.	Level III
Maintaining a mean arterial blood pressure of 85-90 mm Hg after SCI is recommended.	

D

- 5% des TCC ont une atteinte spinale associée
- 25% des BM ont un TCC associé

- **Niveau de la lésion** → segment le plus caudal avec force d'au moins 3/5 et fonction sensitive préservée (toucher léger, pinprick)

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

ASIA — American Spinal Injury Association | ISCOS — International Spinal Cord Society

Patient Name _____ Date/Time of Exam _____

Examiner Name _____ Signature _____

RIGHT

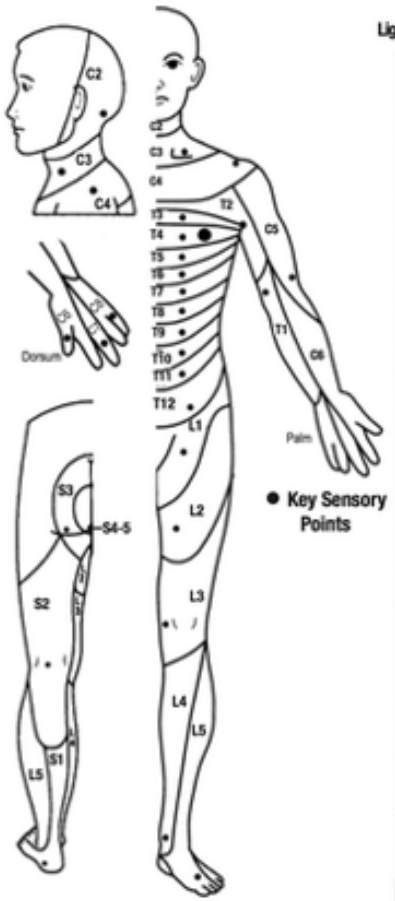
MOTOR KEY MUSCLES		SENSORY KEY SENSORY POINTS Light Touch (LTR)	Pin Prick (PPR)
	C2		
	C3		
	C4		
Elbow flexors	C5		
Wrist extensors	C6		
Elbow extensors	C7		
Finger flexors	C8		
Finger abductors (little finger)	T1		
	T2		
	T3		
	T4		
	T5		
	T6		
	T7		
	T8		
	T9		
	T10		
	T11		
	T12		
	L1		
Hip flexors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

UER (Upper Extremity Right)

LER (Lower Extremity Right)

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

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



LEFT

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

UEL (Upper Extremity Left)

LEL (Lower Extremity Left)

(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
5* = normal corrected for pain/disuse
NT = not testable

SENSORY (SCORING ON REVERSE SIDE)

0 = absent | 2 = normal
1 = altered | NT = not testable

MOTOR SUBSCORES

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

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

SENSORY SUBSCORES

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

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

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

	R	L
1. SENSORY	☐	☐
2. MOTOR	☐	☐

3. NEUROLOGICAL LEVEL OF INJURY (NLI) ☐

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

5. ASIA IMPAIRMENT SCALE (AIS) ☐

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

	R	L
SENSORY	☐	☐
MOTOR	☐	☐

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REV 11/15

ASIA Impairment Scale	*Description*
A	Complete. No sensory or motor function is preserved in the sacral segments S4–S5.
B	Incomplete. Sensory but not motor function is preserved below the neurological level and includes the sacral segments S4–S5.
C	Incomplete. Motor function is preserved below the neurological level, and more than half of key muscles below the neurological level have a muscle grade less than 3 (grades 0–2).
D	Incomplete. Motor function is preserved below the neurological level, and at least half of key muscles below the neurological level have a muscle grade greater than or equal to 3.
E	Normal. Sensory and motor function are normal.

TABLE 1. *ASIA impairment scale*

Grade	Description	Incidence (%)	Outcome
A	Complete motor and sensory loss	25	10–15% convert to grades B–D; 3% to grade D
B	Incomplete sensory loss, complete motor loss	15	54% convert to grade C–D
C	Incomplete motor and sensory loss; >50% of muscles <3/5	10	86% of grades C–D eventually regain ambulating ability
D	Incomplete motor and sensory loss; >50% of muscles ≥3/5	30	
E	Normal motor and sensory function		

ASIA = American Spinal Injury Association.
From references 8–10 and 24.

D

- Protection pharmacologique de la moelle
- Aucun agent démontré efficace

Pharmacology management: corticosteroids	Option	Treatment with methylprednisolone for either 24 or 48 h is recommended as an option in the treatment of patients with acute SCIs. It should be undertaken only with the knowledge that the evidence suggesting harmful side effects is more consistent than any suggestion of clinical benefit.	Level I	Administration of methylprednisolone for the treatment of acute SCI is not recommended. Clinicians considering methylprednisolone therapy should bear in mind that the drug is not approved by the Food and Drug Administration for this application. There is no Class I or Class II medical evidence supporting the clinical benefit of methylprednisolone in the treatment of acute SCI. Scattered reports of Class III evidence claim inconsistent effects likely related to random chance or selection bias. However, Class I, II, and III evidence exists that high-dose steroids are associated with harmful side effects, including death.
Pharmacology management: GM-1 ganglioside	Option	Treatment of patients with acute SCIs with GM-1 ganglioside is recommended as an option without demonstrated clinical benefit.	Level I	Administration of GM-1 ganglioside (Sygen) for the treatment of acute SCI is not recommended.

PRISE EN CHARGE

- Même patient se présente 10 ans plus tard pour une lithiase au niveau de l'uretère proximale gauche.
- SV 70\40, FC 60, Temp 39, SaO2 92% 2L O2
- Urologue veut procéder URS + double J
- Quadraplégique ASIA A C6 s/p fusion instrumentation C3-T1

CONSIDÉRATIONS ANESTHÉSIQUES

- Chirurgie urgente
- Sepsis
- Blessé médullaire
- Risque dysréflexie autonomique
- URS/double J
- Estomac plein
- AW potentiellement difficile

COMPLICATIONS CHRONIQUES BLESSÉ MÉDULLAIRE

Cardiovasculaire

- MCAS très fréquente (3-10x plus que la population générale)
- Ischémie silencieuse chez les BM lésion haute
- Hypotension orthostatique
- Diminution SNS en réponse effort/stress
- Bradycardie de base et risque bradyarrthymies

COMPLICATIONS CHRONIQUES BLESSÉ MÉDULLAIRE

Pulmonaire

- Syndrome mixte
- Possiblement ventilo-dépendant selon niveau de la lésion
- Pauvre tolérance effort
- Toux inefficace/pneumonies à répétition
- TPP/EP

COMPLICATIONS CHRONIQUES BLESSÉ MÉDULLAIRE

Musculosquelettiques

- Ostéoporose
- Contractures musculaires/spasticité
- Ulcères de pression
- Douleur chronique

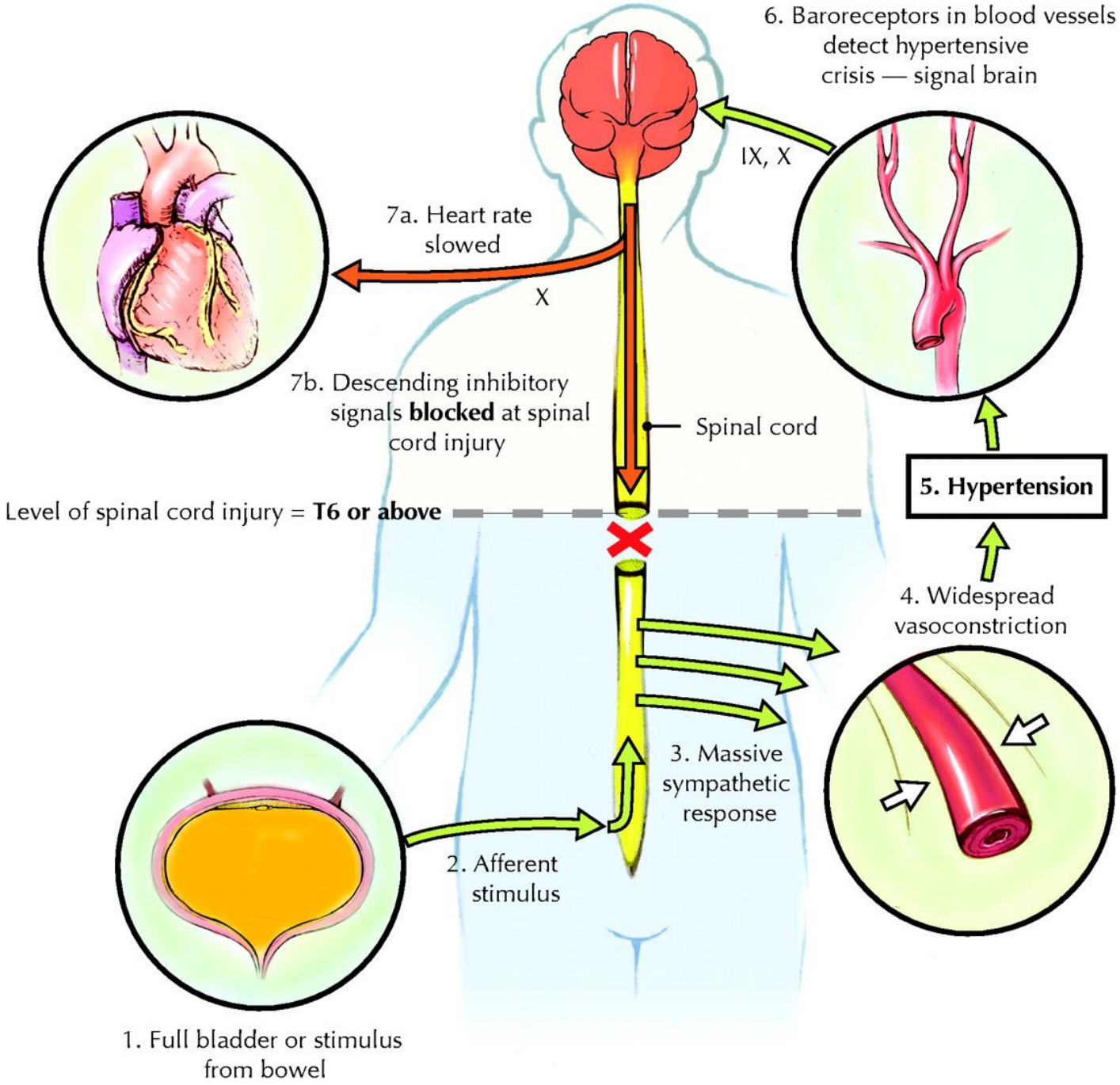
DYSRÉFLEXIE AUTONOMIQUE

Autonomic dysreflexia associated with spinal cord injury is due to:

A. Adrenergic receptor proliferation
B. Partial spinal cord transection
C. Decreased inhibition of reflex sympathetic outflow
D. Unopposed vagal outflow

DYSRÉFLEXIE AUTONOMIQUE

- 20-70% patient avec lésion au dessus de T6 (85%)
- Distension vésicale, viscérale
- Ulcères pressions, fractures
- Travail/accouchement



DYSRÉFLEXIE AUTONOMIQUE

- 3-6 mois après le trauma initial

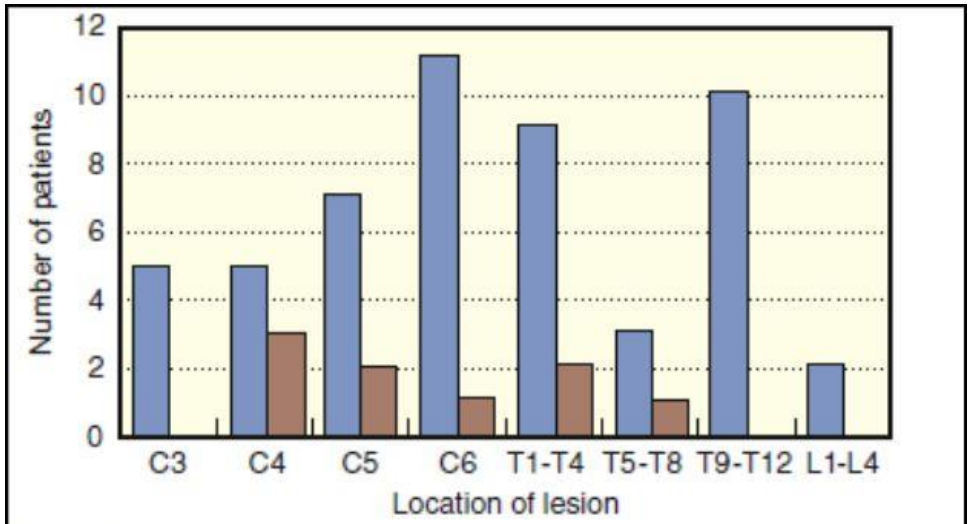


FIGURE 11-3 Incidence of autonomic hyperreflexia in patients with spinal cord injury undergoing extracorporeal shock wave lithotripsy. This reflex did not occur in any patient with an injury below T9. Blue bars show the distribution of lesion sites in all patients with spinal cord injury (n = 52); orange bars show the lesion sites in the subset of patients developing autonomic hyperreflexia (n = 9). *(Adapted from Stowe DF, Bernstein JS, Madsen KE, et al. Autonomic hyperreflexia in spinal cord injured patients during extracorporeal shock wave lithotripsy.* Anesth Analg. *1989;68:788-791.)*

DYSRÉFLEXIE AUTONOMIQUE

Cliniquement

- HTA ± bradycardie réflexe
- Ischémie myocardique, LVHF
- Céphalée/nausée/vision floue
- Diaphorèse, flushing/piloérection/congestion nasale
- HTIC, saignement IC, convulsions
- Anxiété

DYSRÉFLEXIE AUTONOMIQUE

Prise en charge per-opératoire

- ALR vs AG selon le type de chirurgie et la position nécessaire
- Si chirurgie dans une zone non-sensible et lésion sous T6, sédation possible
- Rachis mieux qu'épidurale
- Difficile d'évaluer le niveau sensitif chez BM

DYSRÉFLEXIE AUTONOMIQUE

Traitement

- 100% O2, aviser chirurgien, appel à l'aide
- Retirer stimulus douloureux
- Approfondir anesthésie
- Position anti-trandel
- Traitement arrythmies selon ACLS
- Vasodilatateur artériel

Niprid-nitro-nicardipine
Hydralazine
Labetalol selon FC

DA ET TRAVAIL

- Augmentation risque TPT (19%)
- 9 patients sur 12 ont symptômes AD si lésion au dessus de T5
- C/S 47% si lésion au-dessus de T5, 26% si en dessous
- T5-T10 → travail sans douleur

Box 49-1

Medical Complications of Spinal Cord Injury Aggravated by Pregnancy

Pulmonary

- Decreased respiratory reserve
- Atelectasis and pneumonia
- Impaired cough

Hematologic

- Anemia
- Deep vein thrombosis
- Thromboembolic phenomena

Urogenital

- Chronic urinary tract infections
- Urinary tract calculi
- Proteinuria
- Renal insufficiency

Dermatologic

- Decubitus ulcers

Cardiovascular

- Hypertension
- Autonomic hyperreflexia

From Crosby E, St. Jean B, Reid D, Elliot RD. Obstetric anaesthesia and analgesia in chronic spinal cord-injured women. Can J Anaesth 1992; 39:487-94.

DA ET TRAVAIL

Gestion anesthésique

- DA vs HTA vs PE?
- Monitoring invasif lors du travail
- Épidurale vs rachis continue (précoce)→ technique plus difficile
- Évaluation du niveau sensitif difficile
- Test dose?
- Vasodilatateurs PRN, $MgSO_4$

PÉDIATRIE

- Rare (5%)
- 0-8 ans → trauma véhicule → occiput - C2 (75%)
- 8-14 ans → MVC + sports → C3-C7 (50%)

PÉDIATRIE

Différences anatomiques
Tête plus grosse en proportion → augmentation flexion/extension et shearing forces
Muscles para-spinaux peu développés + ligaments laxe → augmentation mobilité rachis cervical
Vertèbres moins développées et facettes articulaires horizontales → plus glissement
Contenu eau + plus grande élasticité disques intervertébraux → augmentation charge verticale
Plaques de croissances immatures
Diamètre canal spinal + grand que diamètre moelle
Colonne cervicale + flexible que la moelle → SCIWORA

PÉDIATRIE

Prise en charge

- Histoire et examen physique plus difficile
- Mécanisme de trauma et lésions associées sont importantes
- Pas d'imagerie à tous les patients
- Approche similaire adulte/ATLS
- SCIWORA