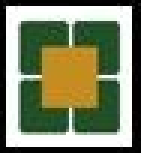
DECISION-MAKING in SPINE TRAUMA

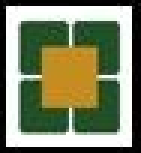
Edward C. Benzel, MD

Cleveland Clinic



The
First Mission

Establish
the
Primary and Secondary
Diagnoses and Related Pitfalls

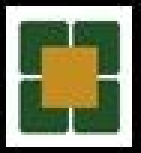


The Injury
The Deficit
The Co-Morbidities
The Potential Medical Complications
The Potential Surgical Complications

The Pitfalls

The
Second Mission

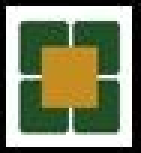
Establish
the
Plan



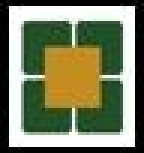
DIAGNOSES AND PITFALLS

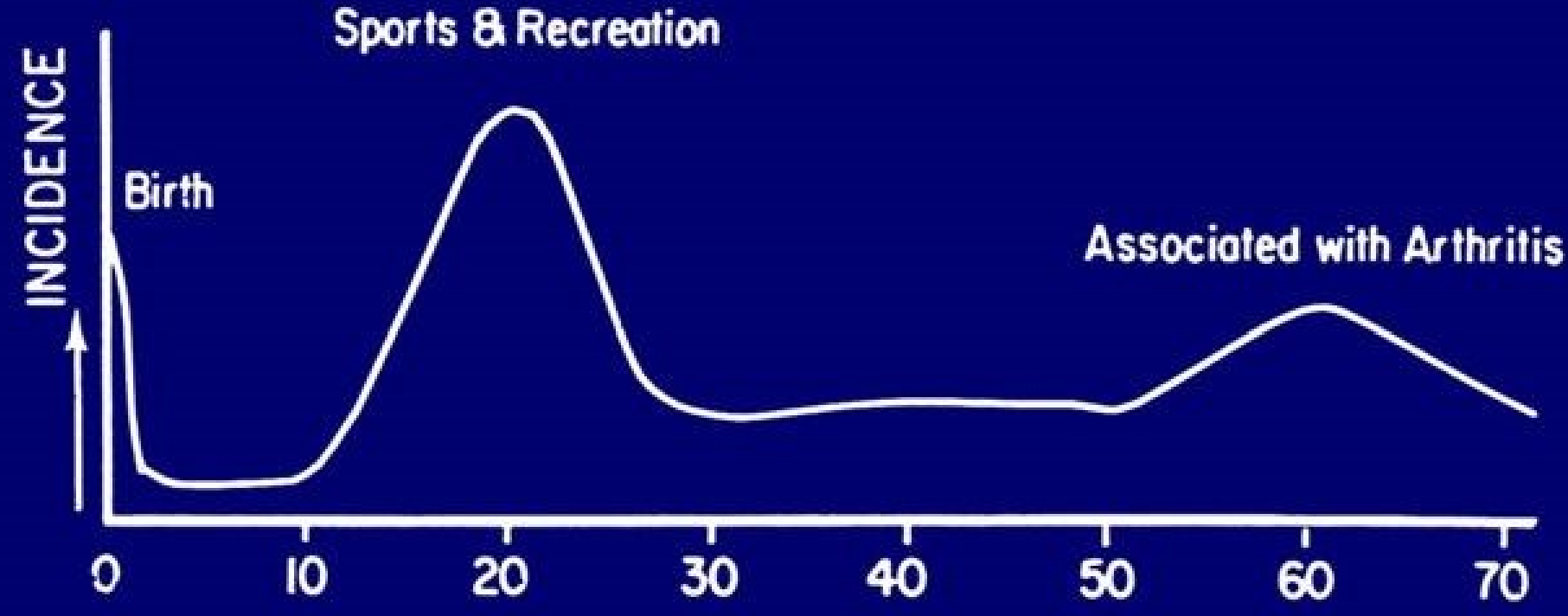
The Injury
The Deficit
The Co-Morbidities
The Potential Medical Complications
The Potential Surgical Complications

The Pitfalls

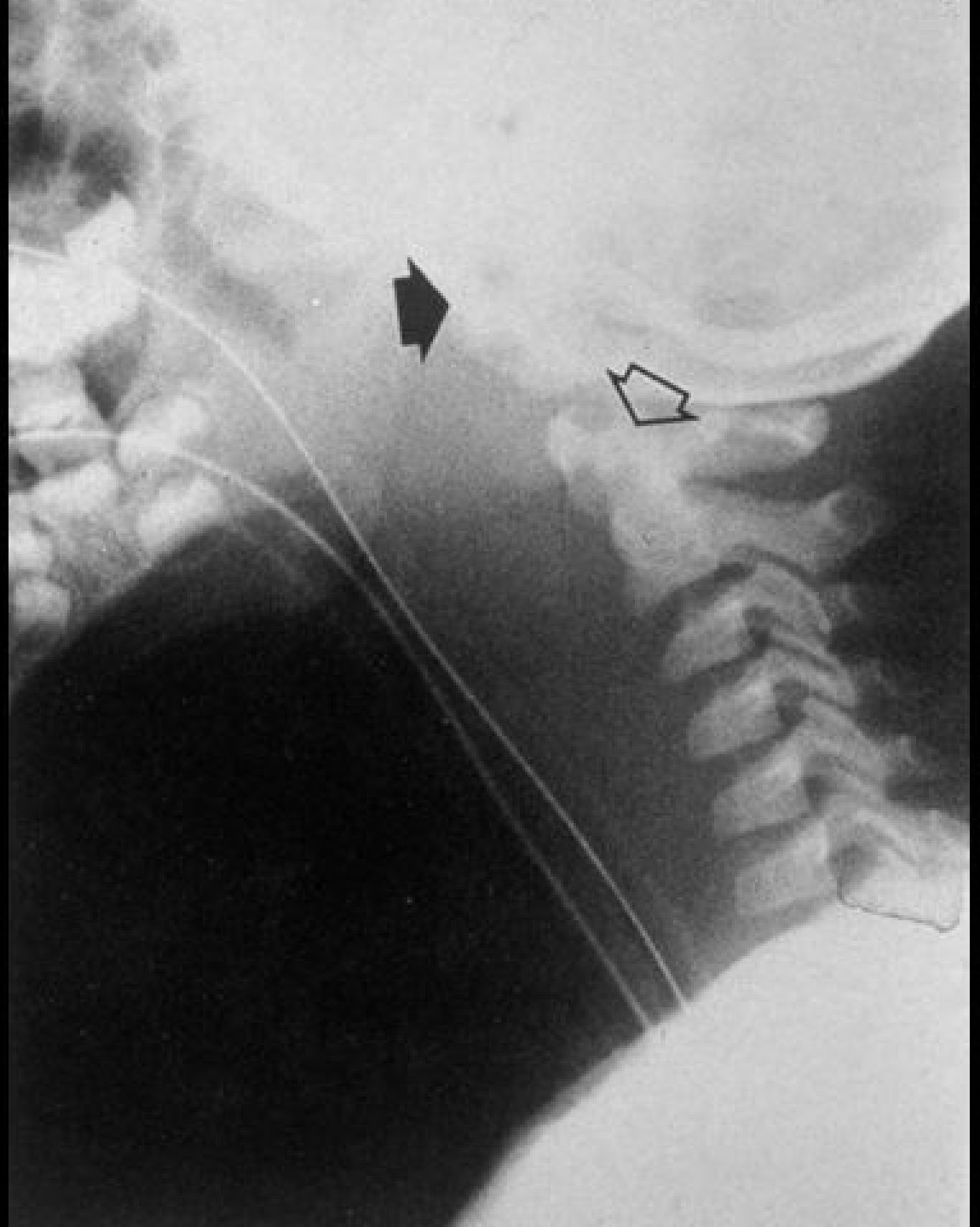


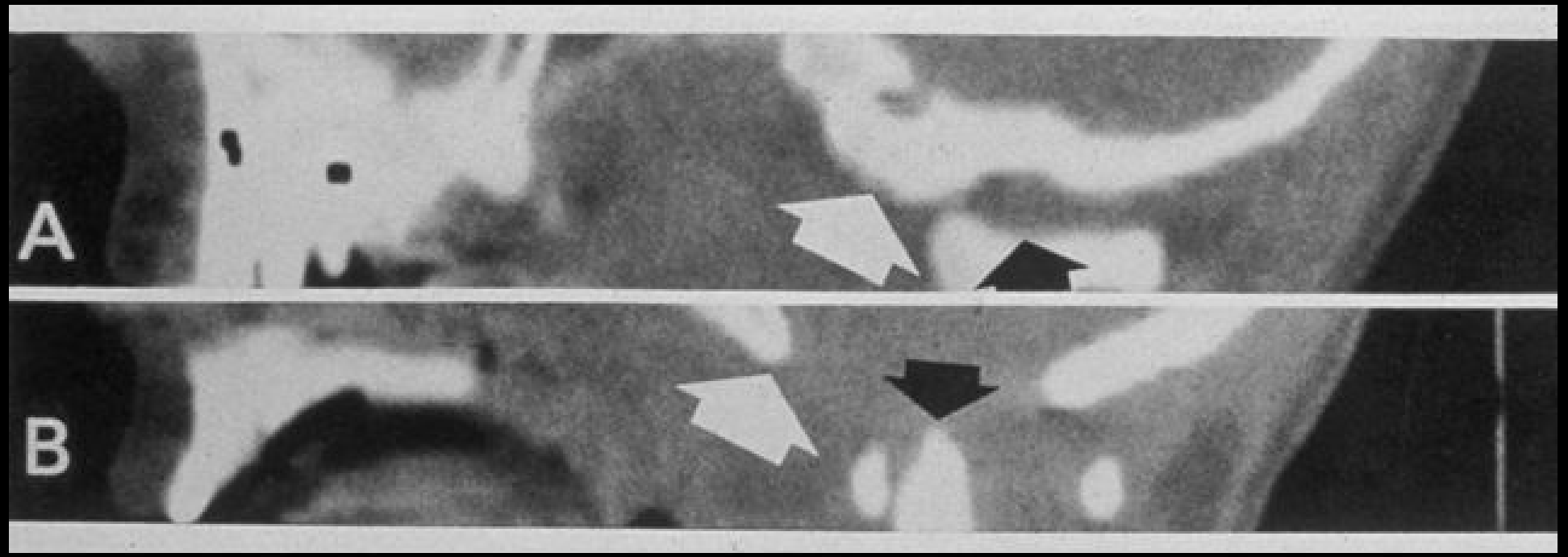
Let's
Go Back
to the
Very Basics

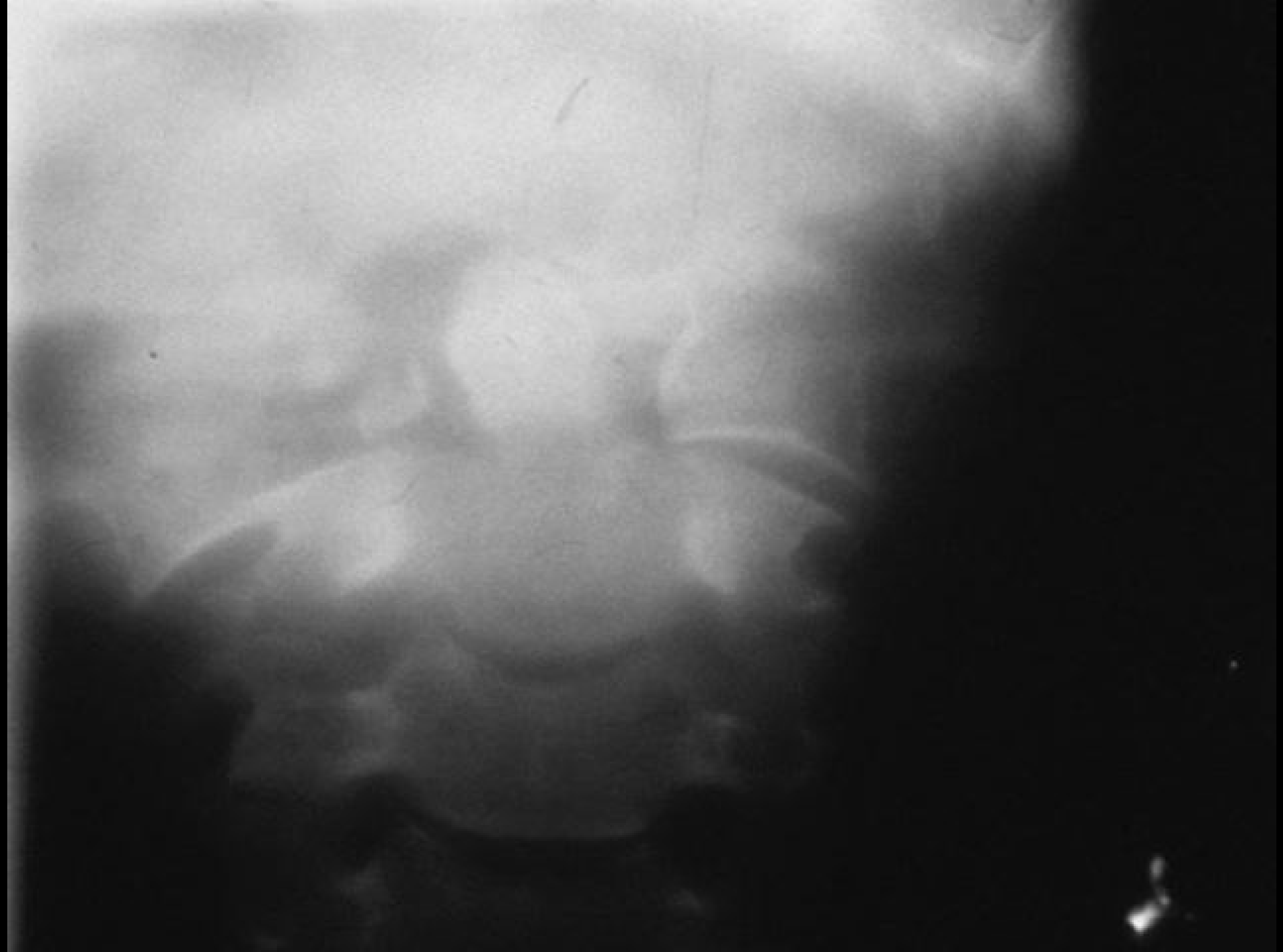




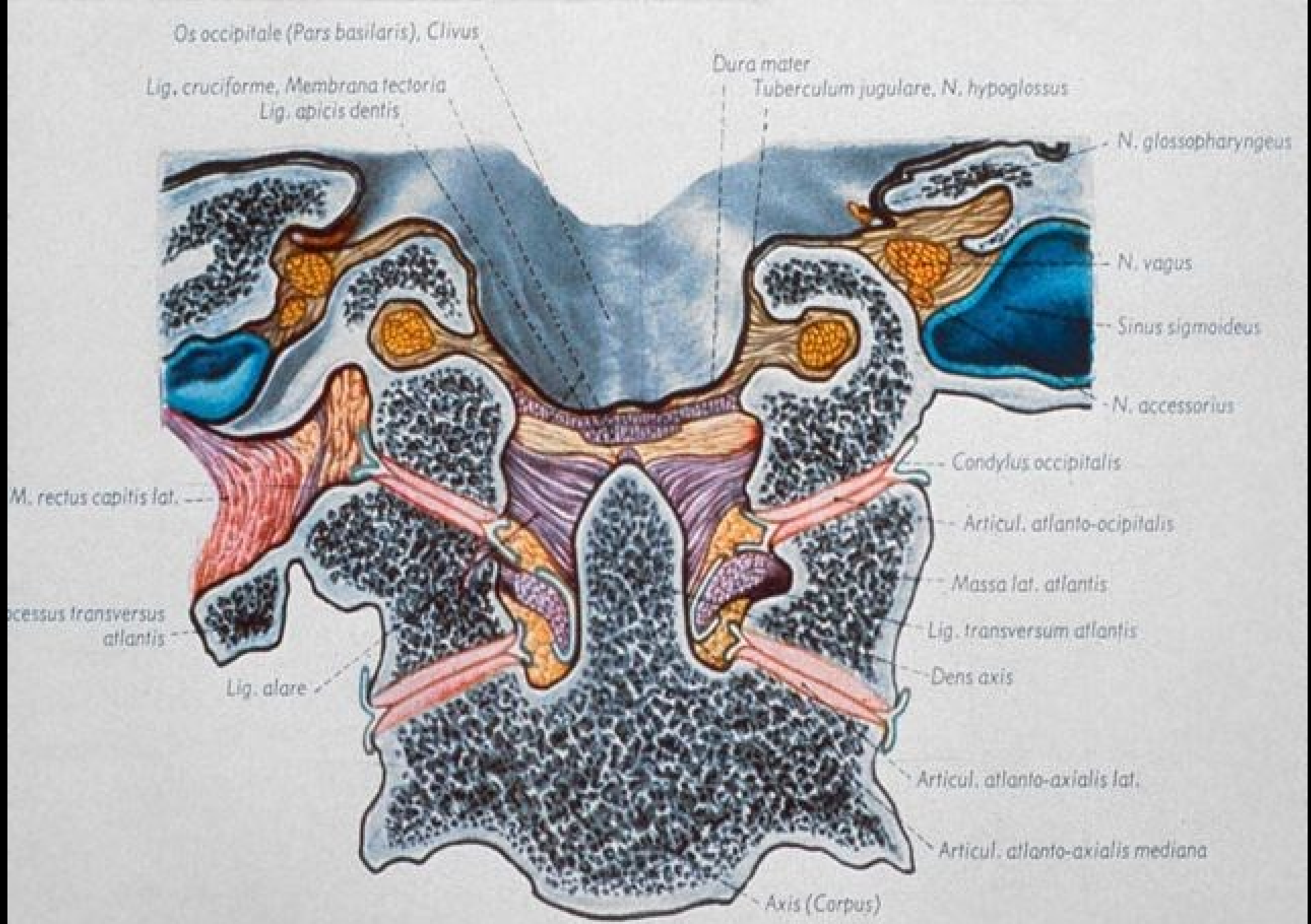
AGE RELATED INCIDENCE OF SPINAL CORD TRAUMA



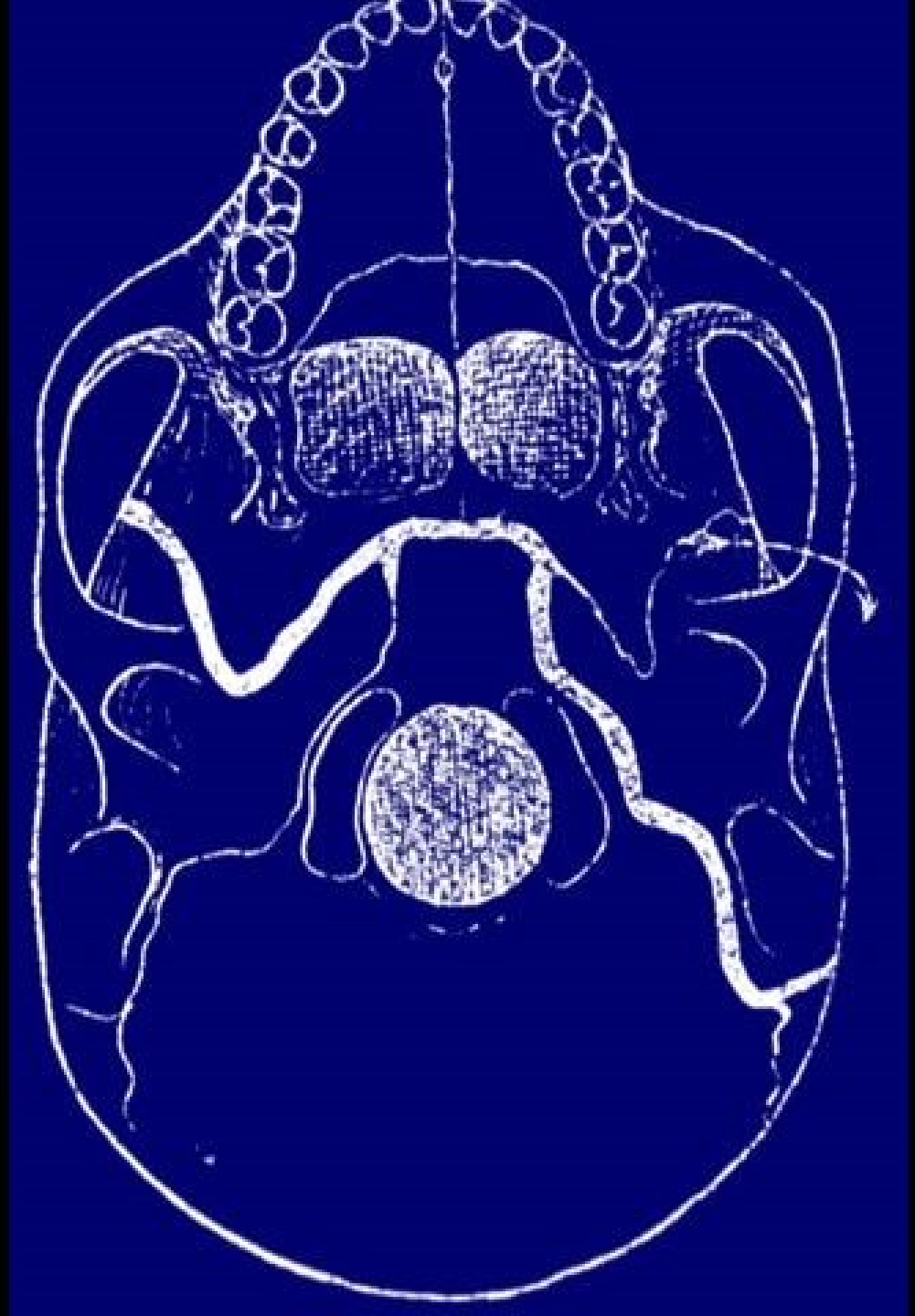

A
B

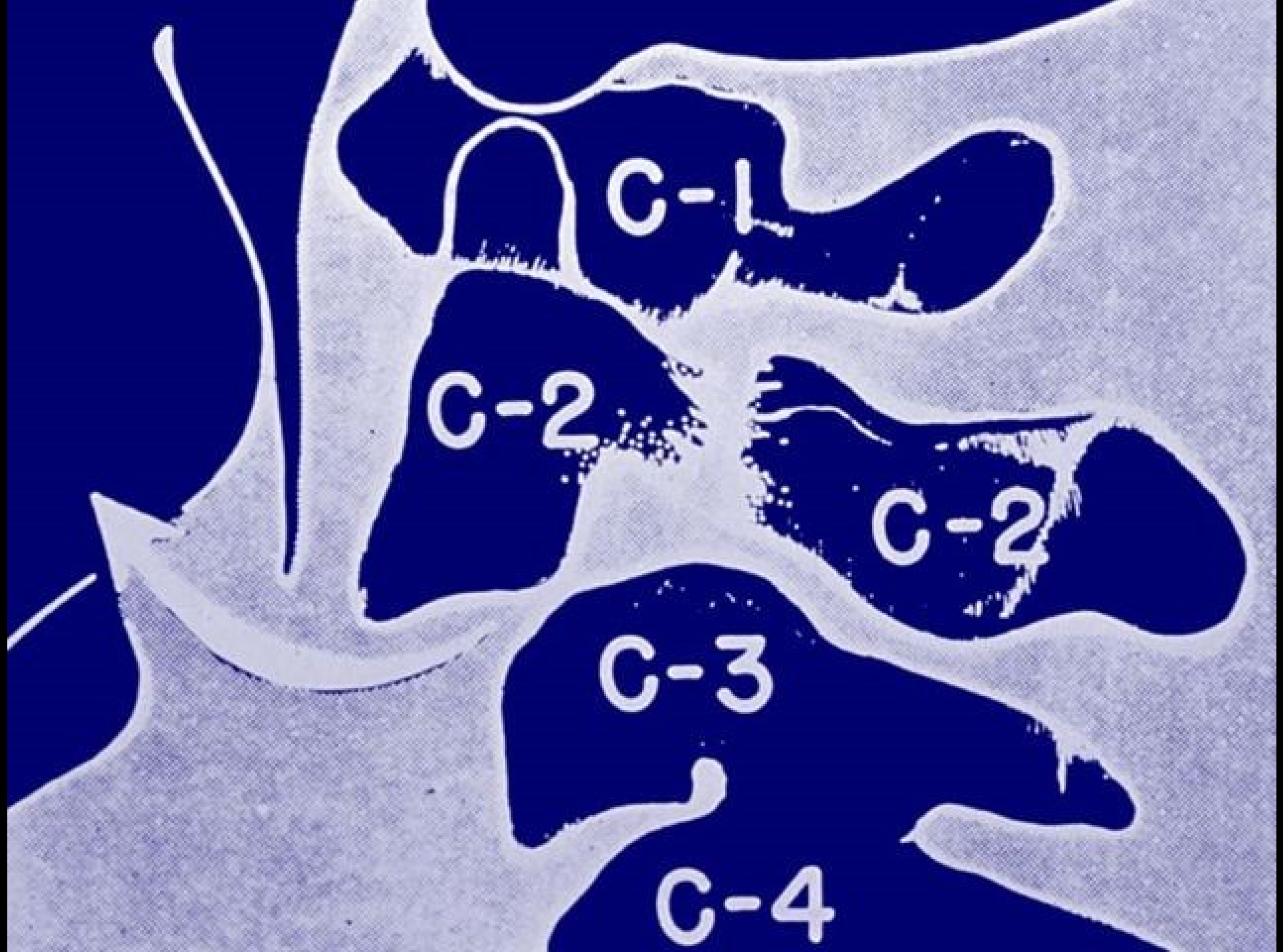


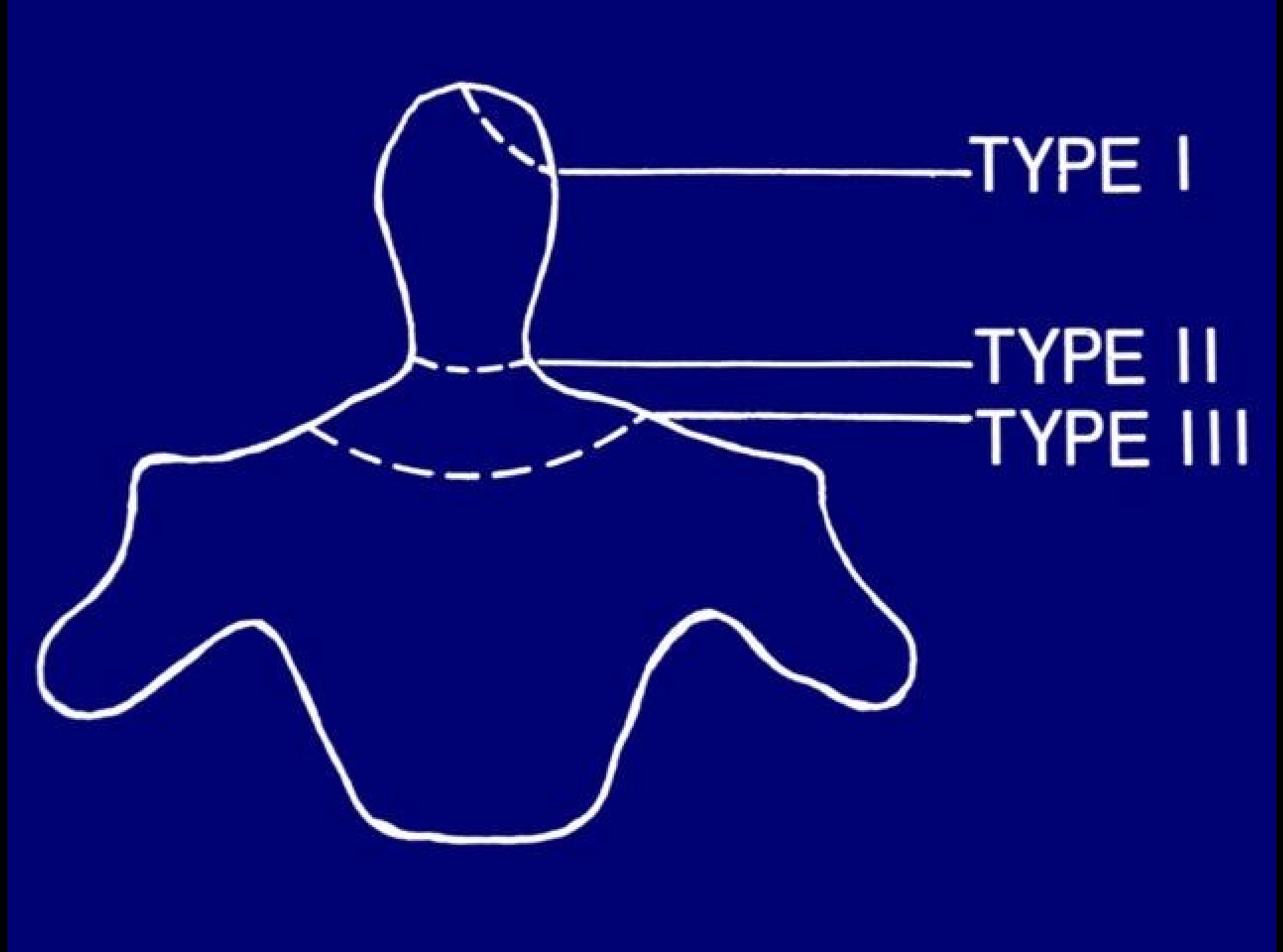

08:55:22
MA 50
SEC 8
512
1/2
CF XSPINE
?CENT 54

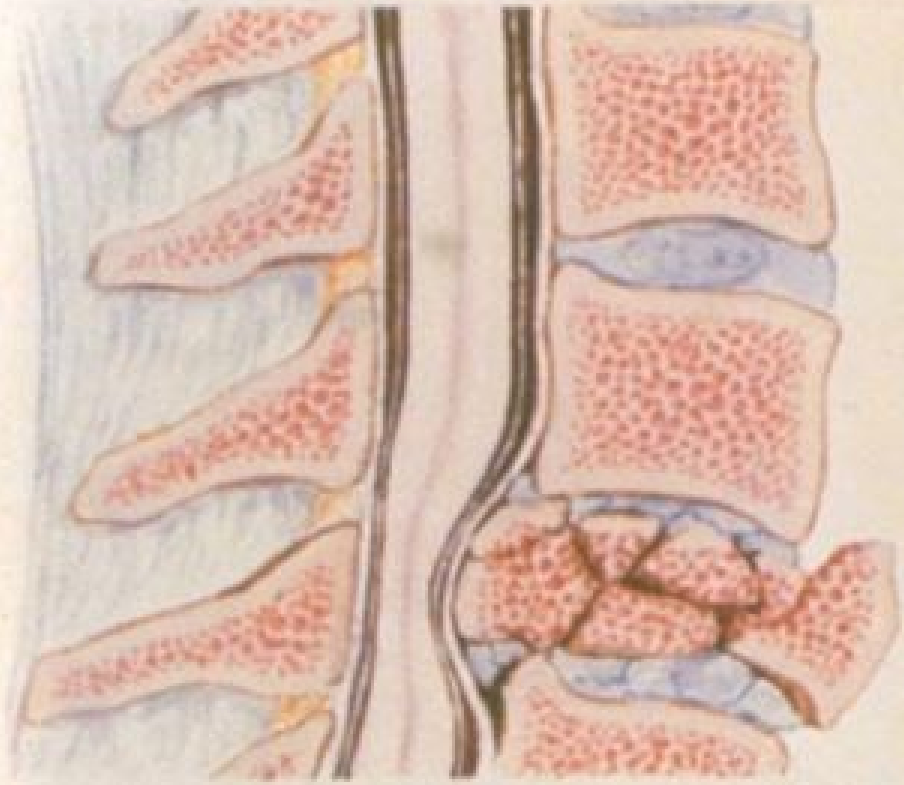

Os occipitale (Pars basilaris), Clivus
Lig. cruciforme, Membrana tectoria
Lig. apicis dentis
Dura mater
Tuberculum jugulare, N. hypoglossus
N. glossopharyngeus
N. vagus
Sinus sigmoideus
N. accessorius
Condylus occipitalis
M. rectus capitis lat.
Articul. atlanto-occipitalis
Massa lat. atlantis
ocessus transversus atlantis
Lig. transversum atlantis
Dens axis
Lig. alare
Articul. atlanto-axialis lat.
Articul. atlanto-axialis mediana
Axis (Corpus)


C-1
C-2
C-2
C-3
C-4




C-1
C-2
C-2
C-3
C-4


TYPE I
TYPE II
TYPE III

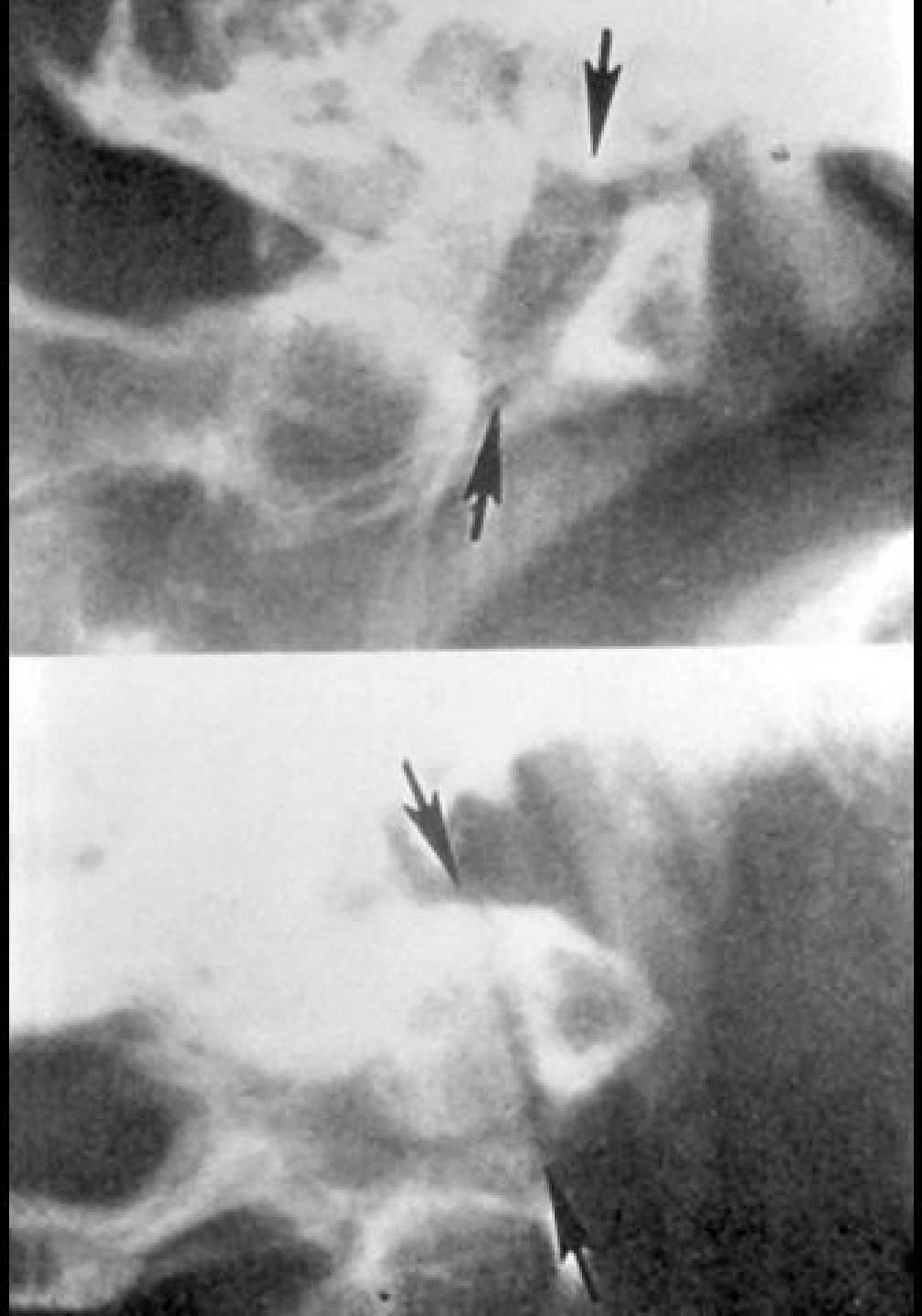


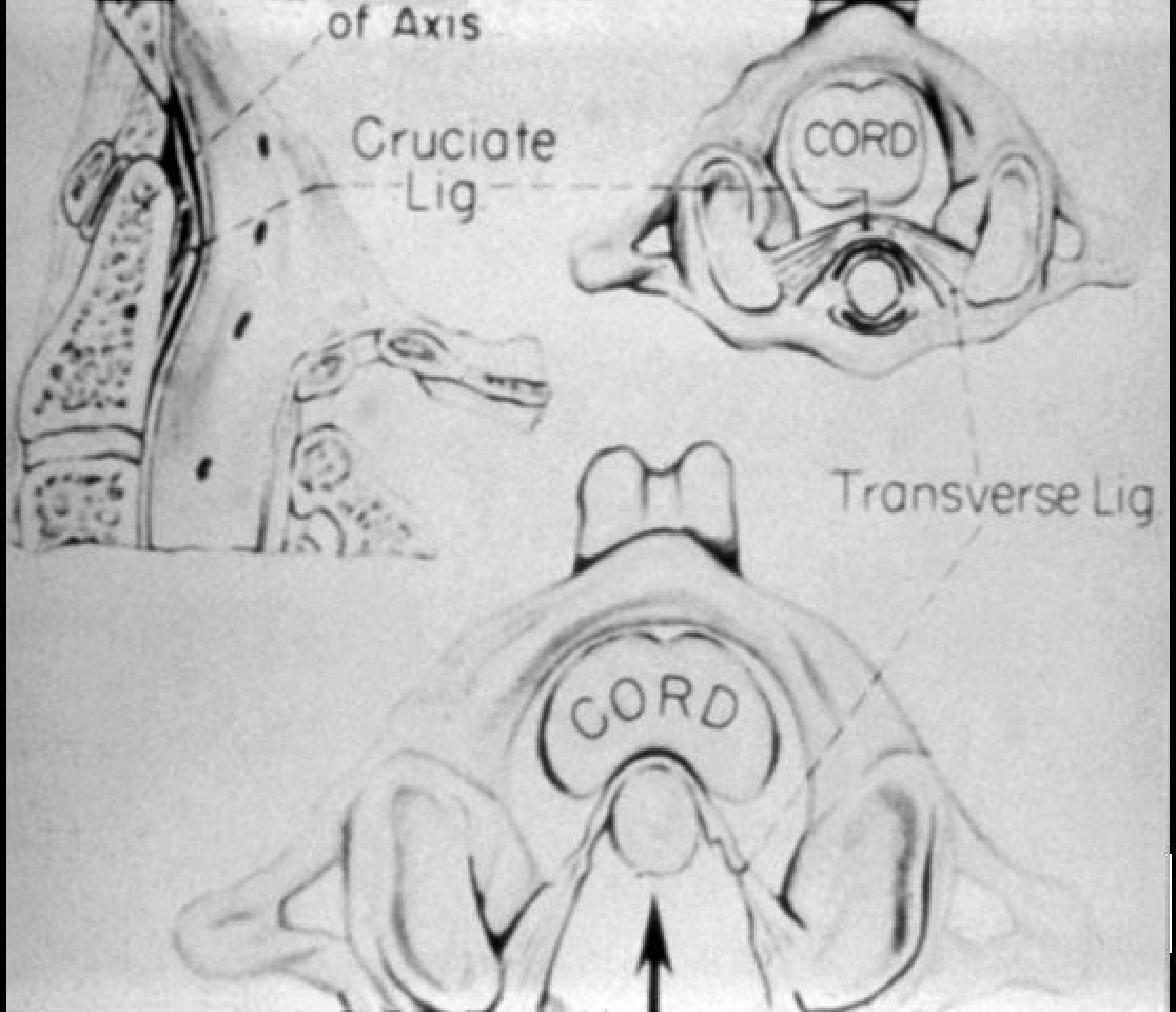
Type IV. "Burst" fracture. Entire vertebral body crushed, with intraspinal bone fragments

X-ray film: Type IV fracture of C6

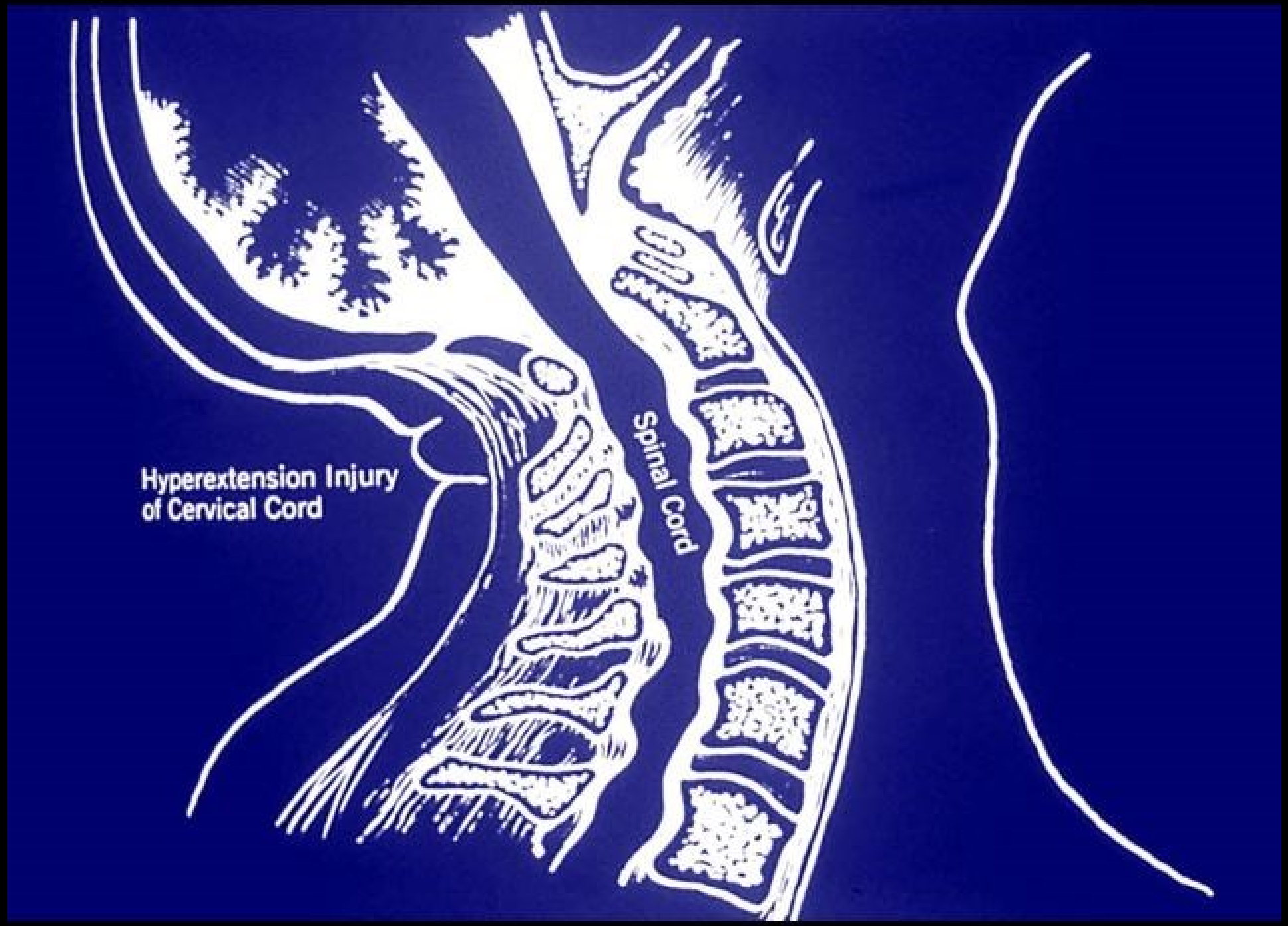

C58
4 2

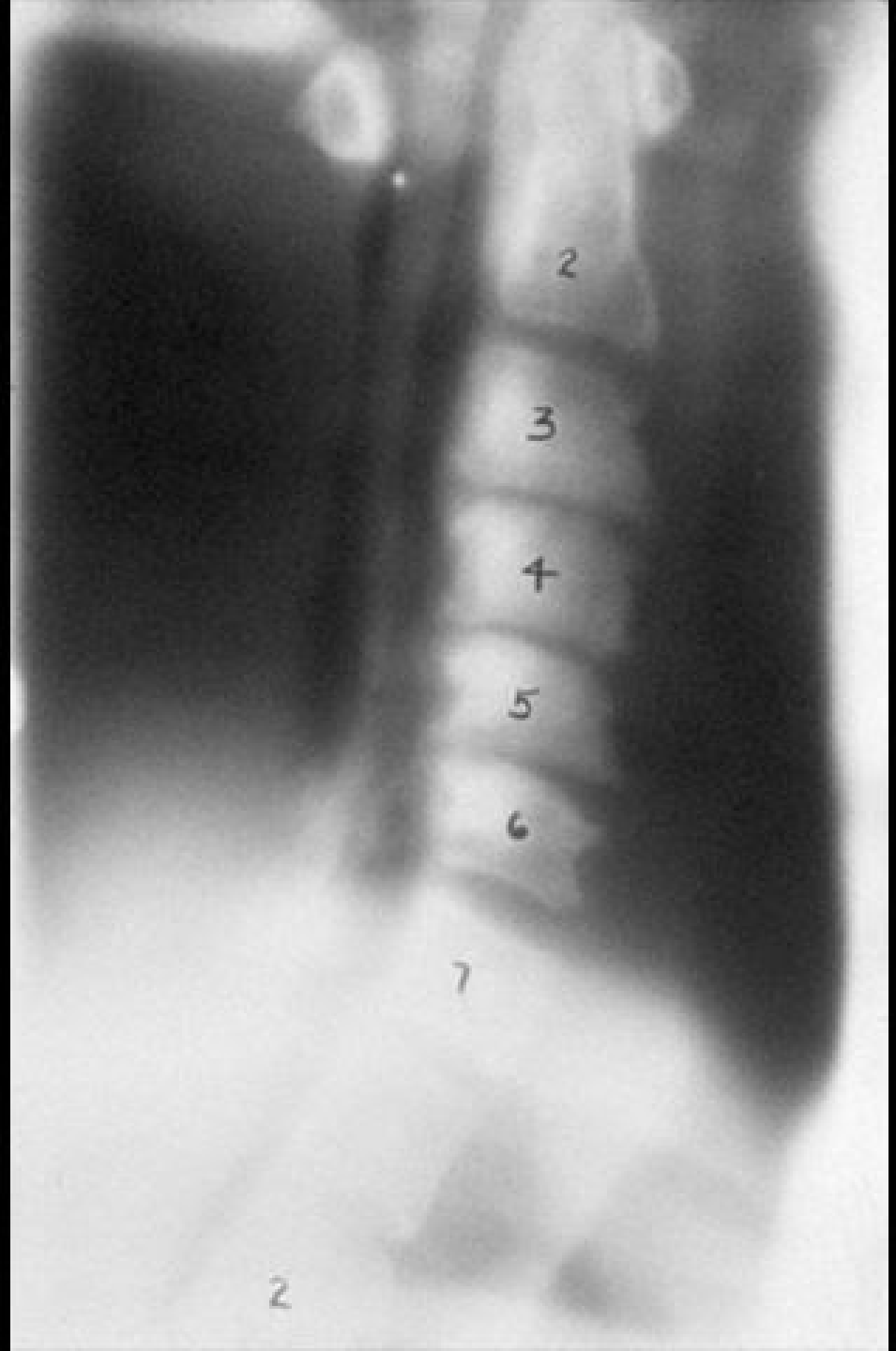
MG

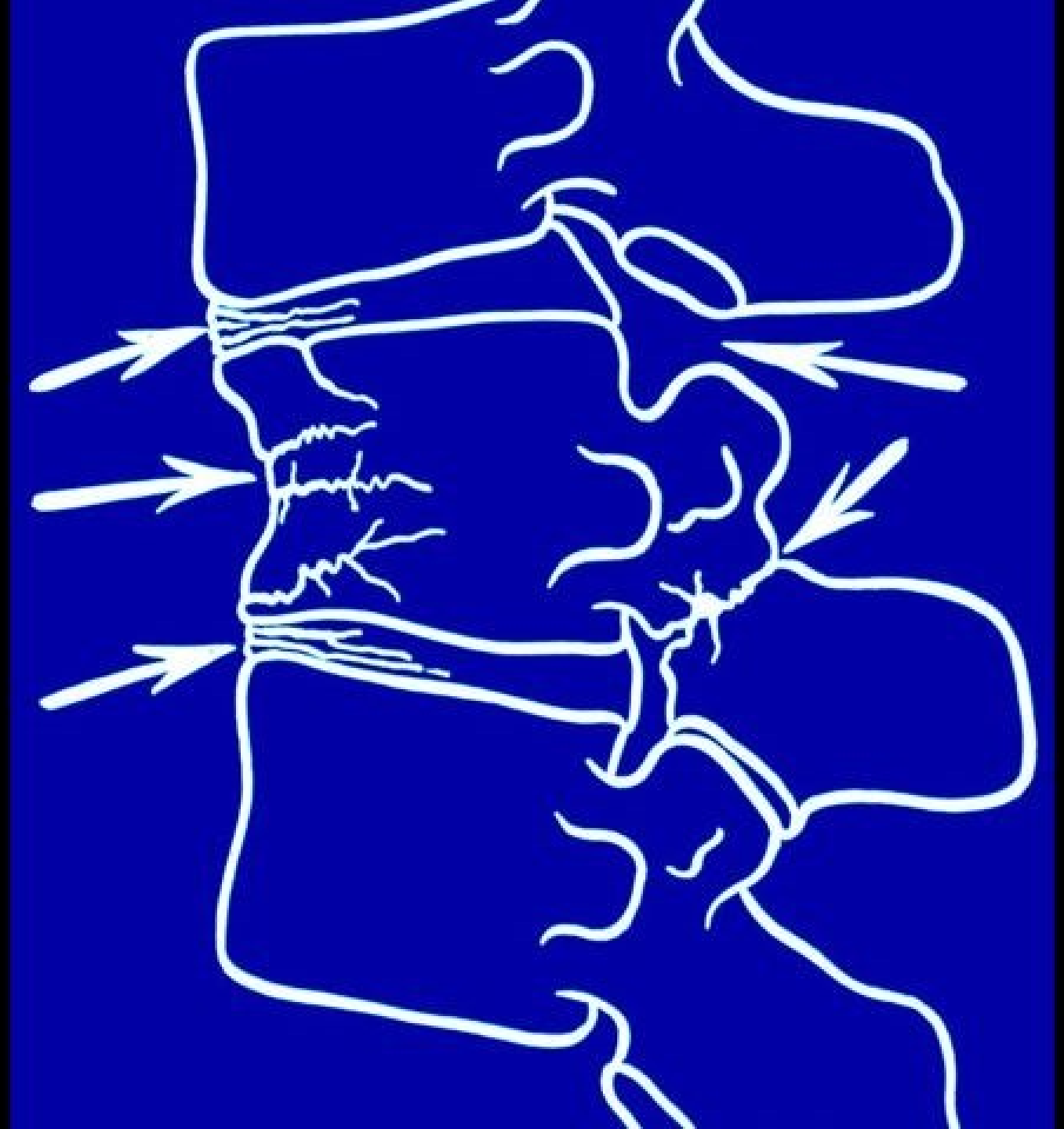



of Axis
Cruciate
Lig
CORD
Transverse Lig
CORD


R


Hyperextension Injury
of Cervical Cord
Spinal Cord


2
3
4
5
6
7
2



Pain

EXCEPTIONS

. . . .

VERY OLD

. . . .

VERY YOUNG

Motor

MYOTOMES

DELTOIDS C5

BICEPS C5, 6

TRICEPS C6, 7

INTEROSSEI C8

UPPER ABDOMINAL T8, 9

LOWER ABDOMINAL T10-12

HIP FLEXOR L1, 2

QUADRACEPS L3, 4

FOOT DORSIFLEXION L4, 5

FOOT PLANTARFLEXION S1, 2

Sensory

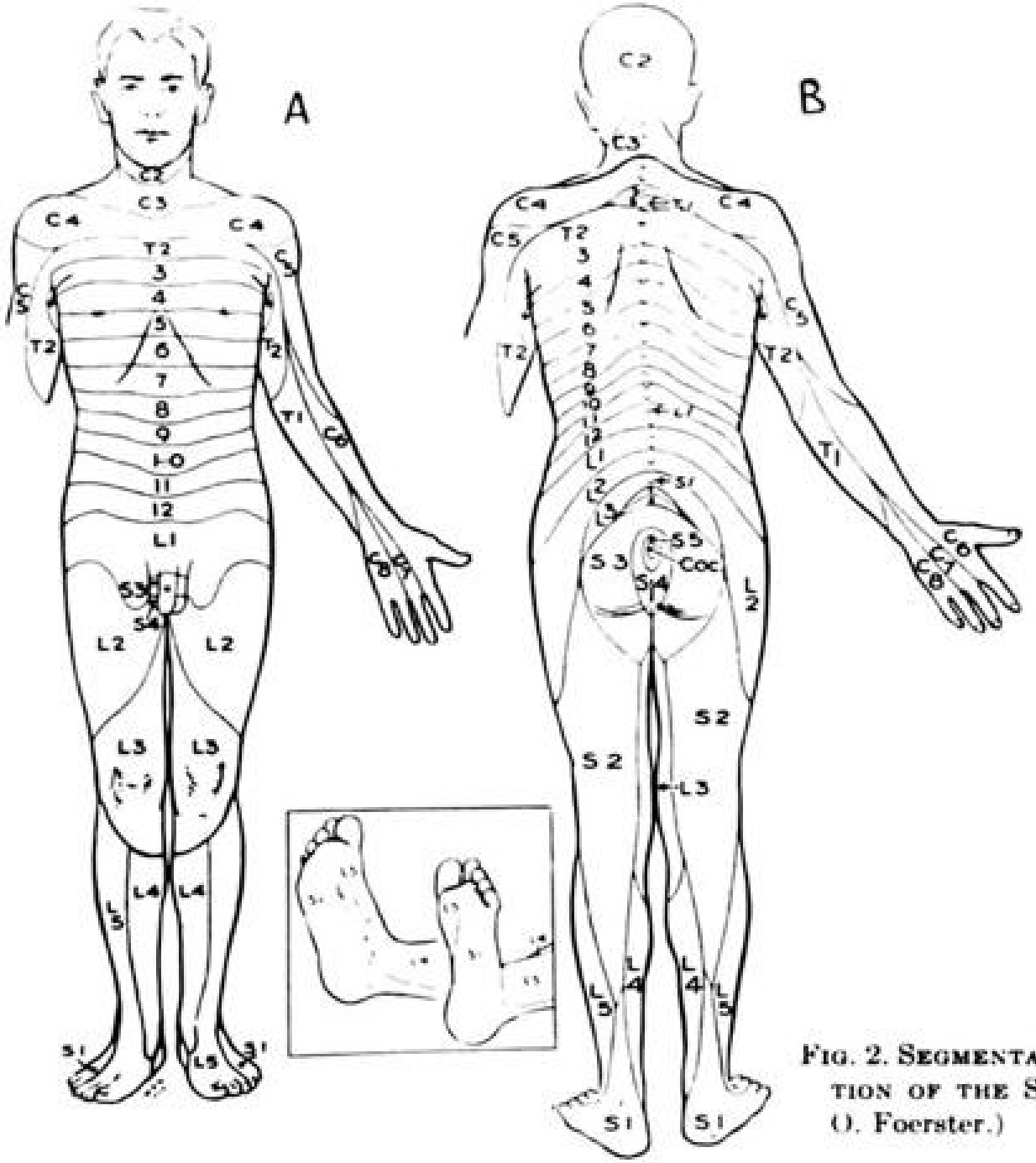


FIG. 2. SEGMENTAL INNERVATION OF THE SKIN. (After O. Foerster.)

Autonomic

SPINAL SHOCK

LOSS OF SYMPATHETIC TONE

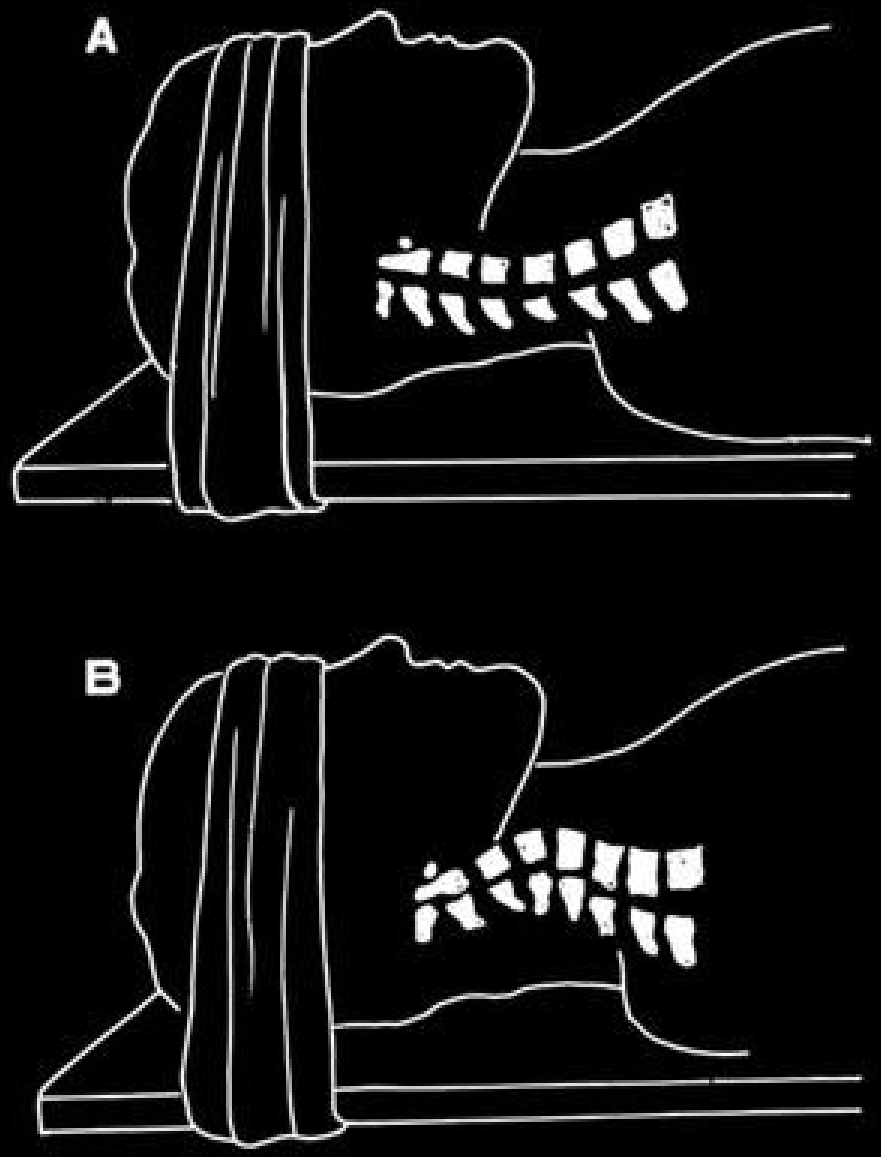
FLACCID MUSCLES & SPHINCTERS

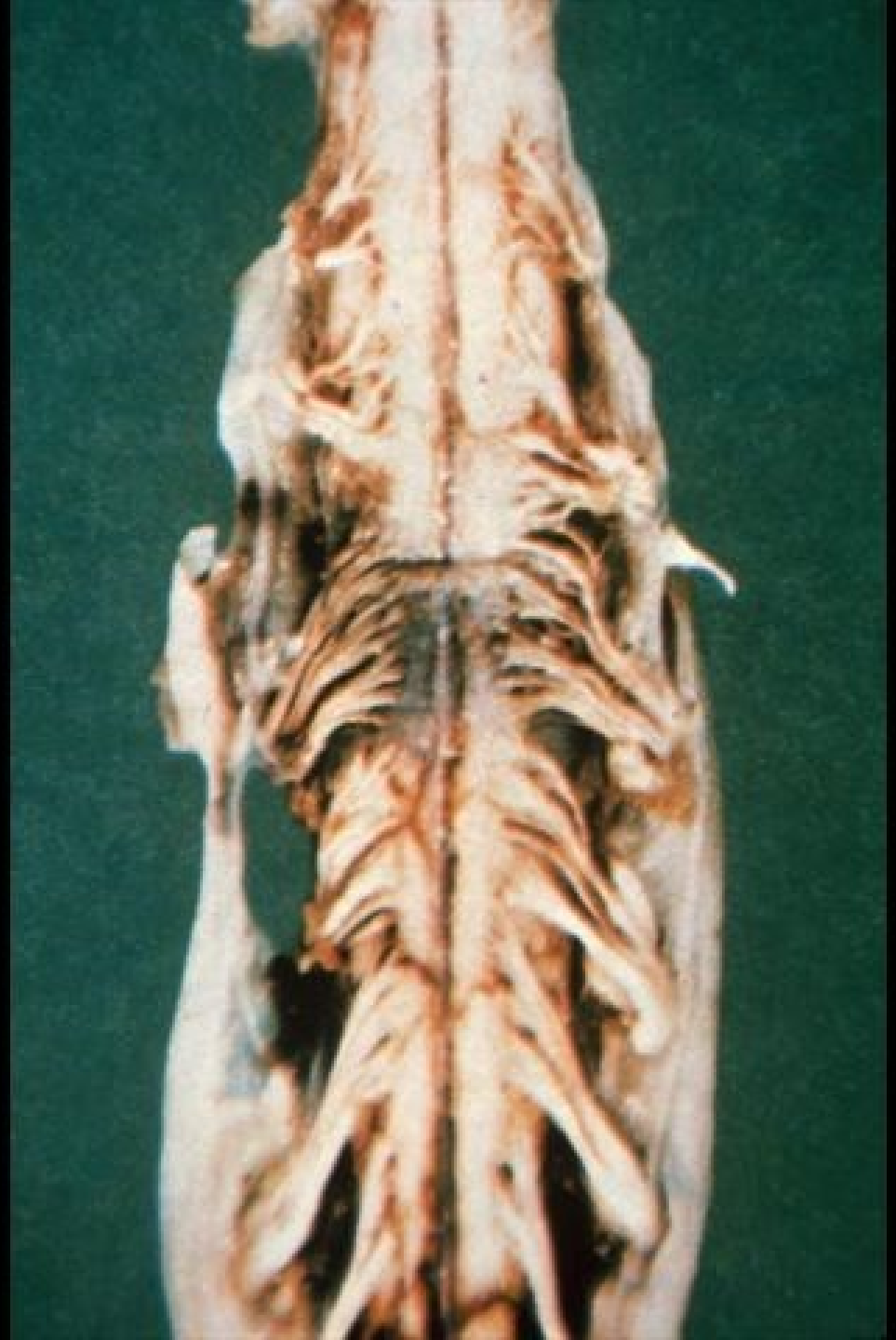
UP TO 50% VOLUME DEFICIT

↓ CARDIAC OUTPUT

HEAT LOSS


CARE FOR ACCIDENT VICTIM


A
B

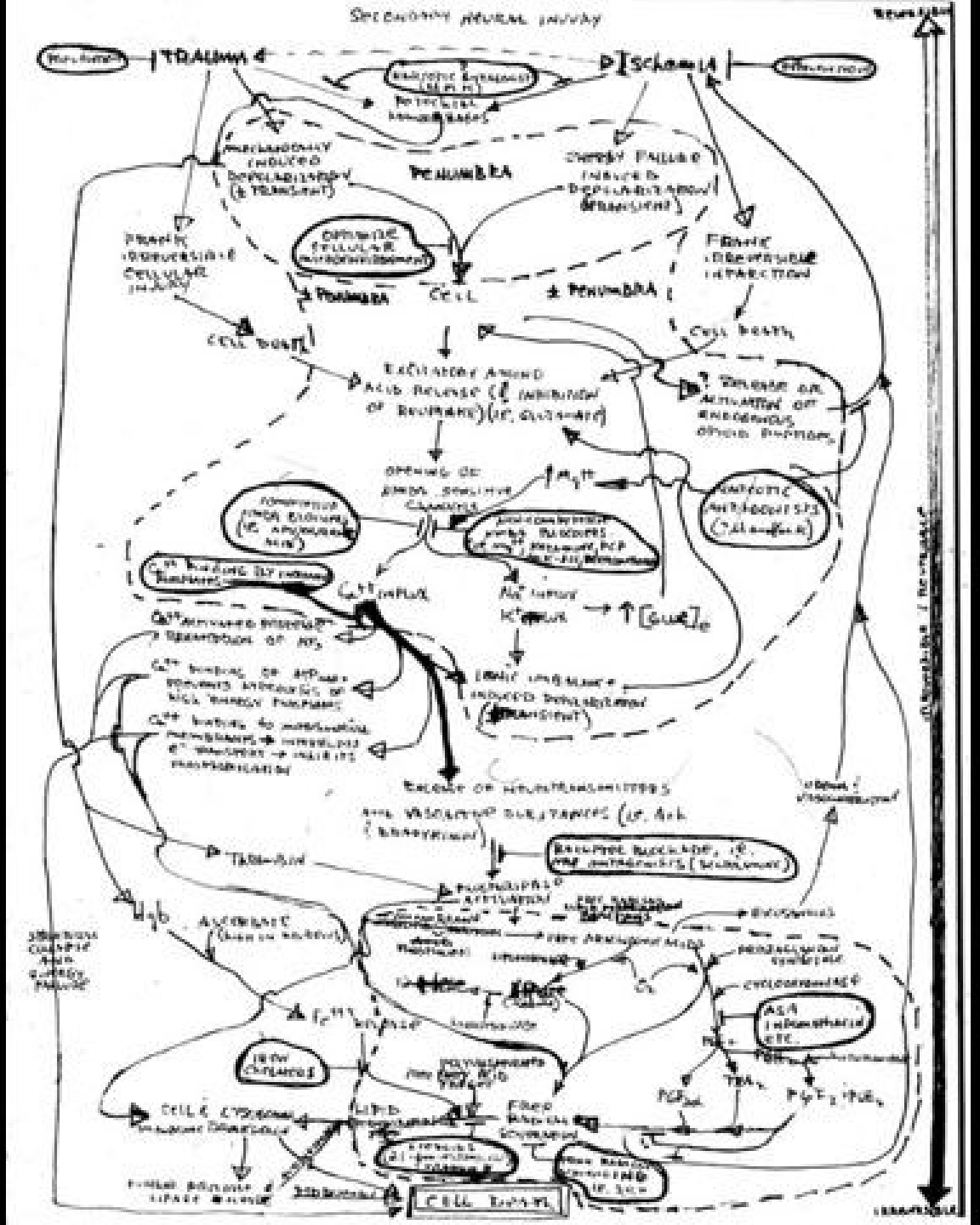


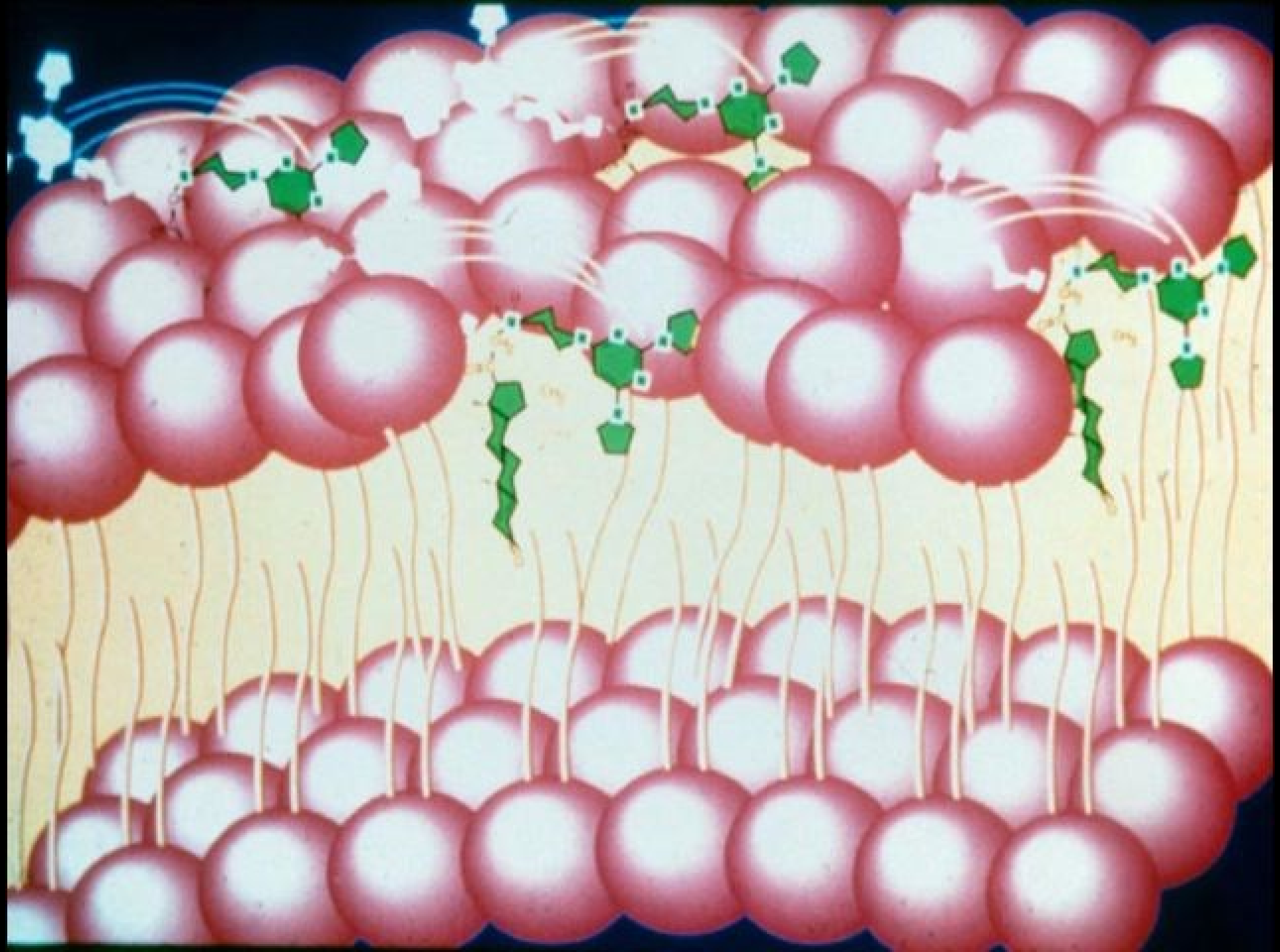
PRIMARY INJURY

Distortion

Disruption

Metabolic

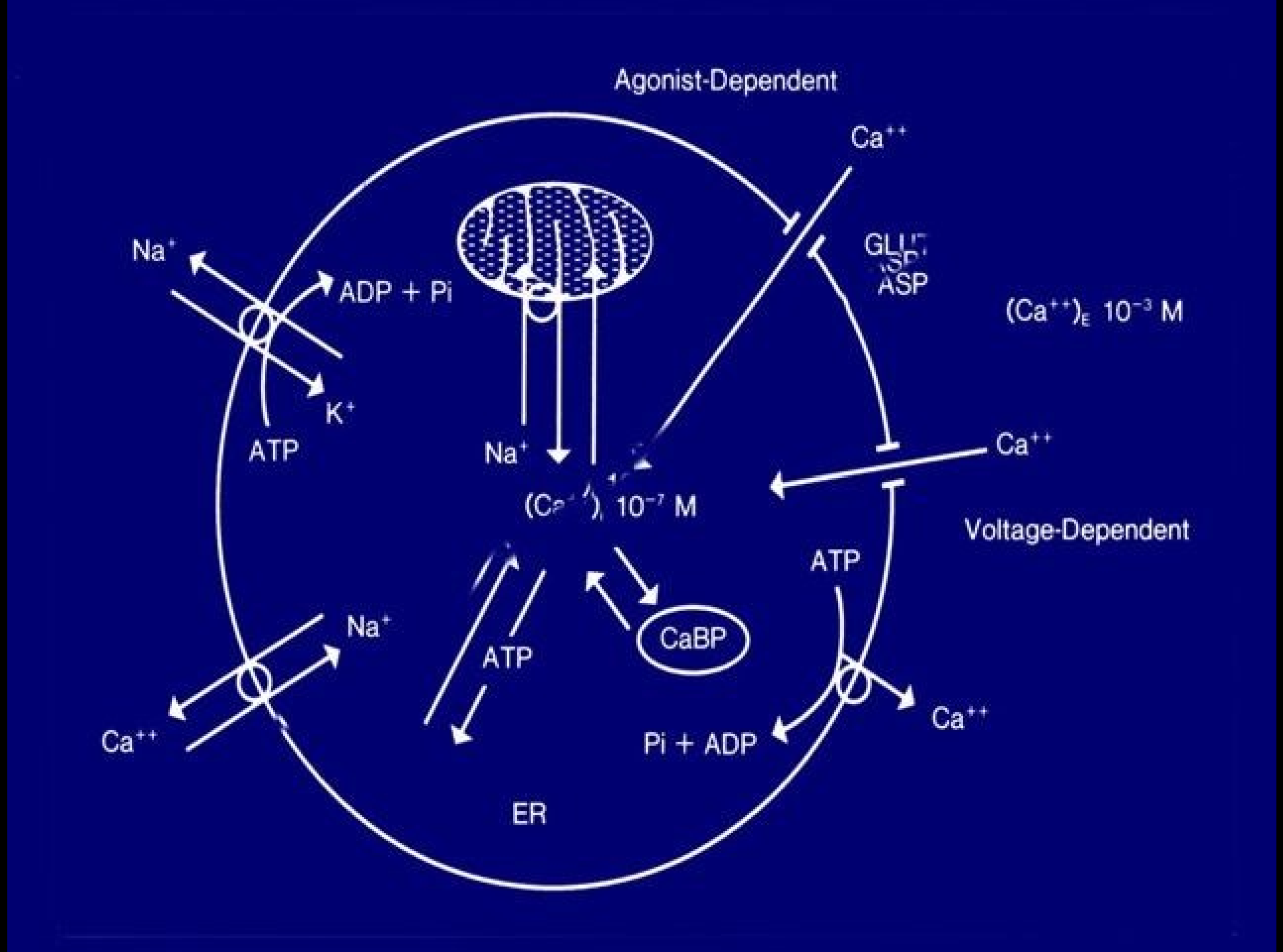

SECONDARY NEURAL INJURY
TRAUMA
ISCHEMIA
PENUMBRA
CELL DEATH
EXCITATORY AMINO ACID RELEASE
CELL DEATH



MYRIAD OF AGENTS

Ca ++

NMDA


Agonist-Dependent
Ca++
Na+
ADP + Pi
K+
ATP
Na+
(Ca++)E 10−3 M
Ca++
Voltage-Dependent
(Ca++)i 10−7 M
ATP
Na+
ATP
CaBP
Ca++
Pi + ADP
Ca++
ER

STEROIDS

LOW
HIGH
ULTRA-HIGH

INFLAMMATION
VS.
CASCADE

CARDIOVASCULAR MANAGEMENT

HYPOVOLEMIA

- - - - -

RELATIVE

CPP = MABP - ICP

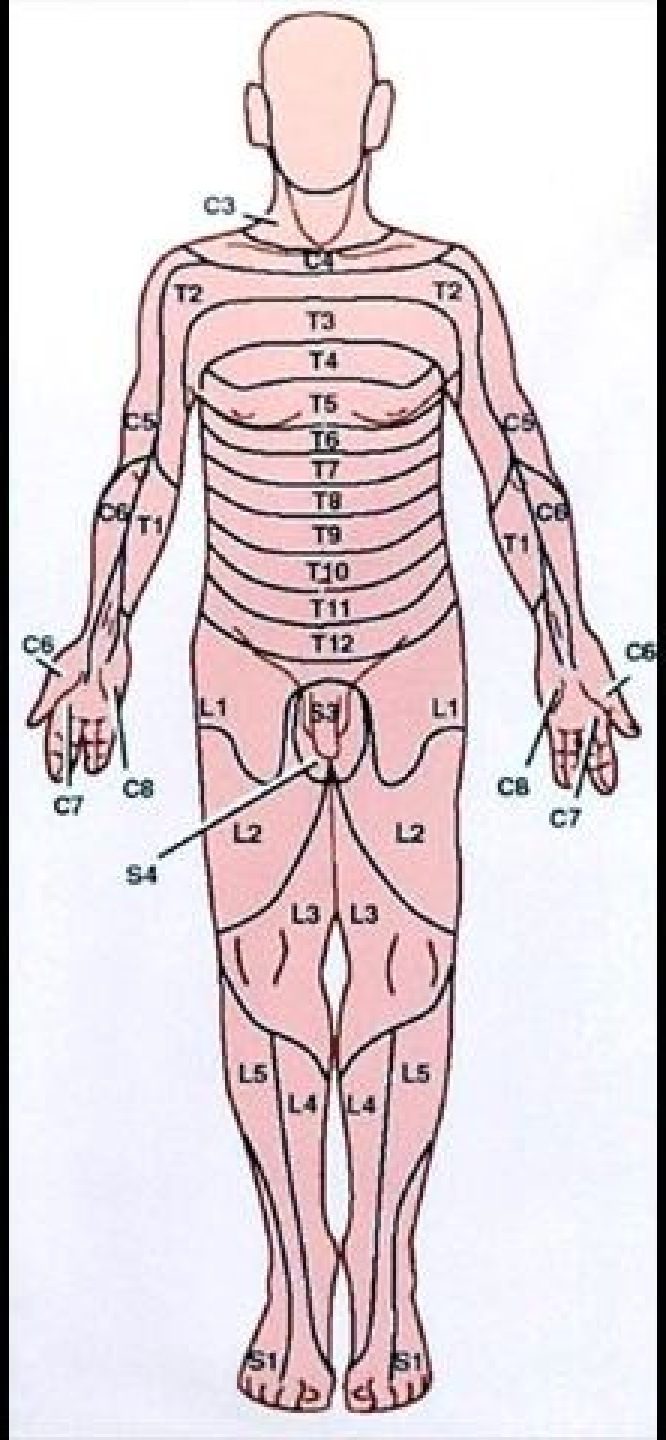
↑ SCPP

HYPOTHERMIA

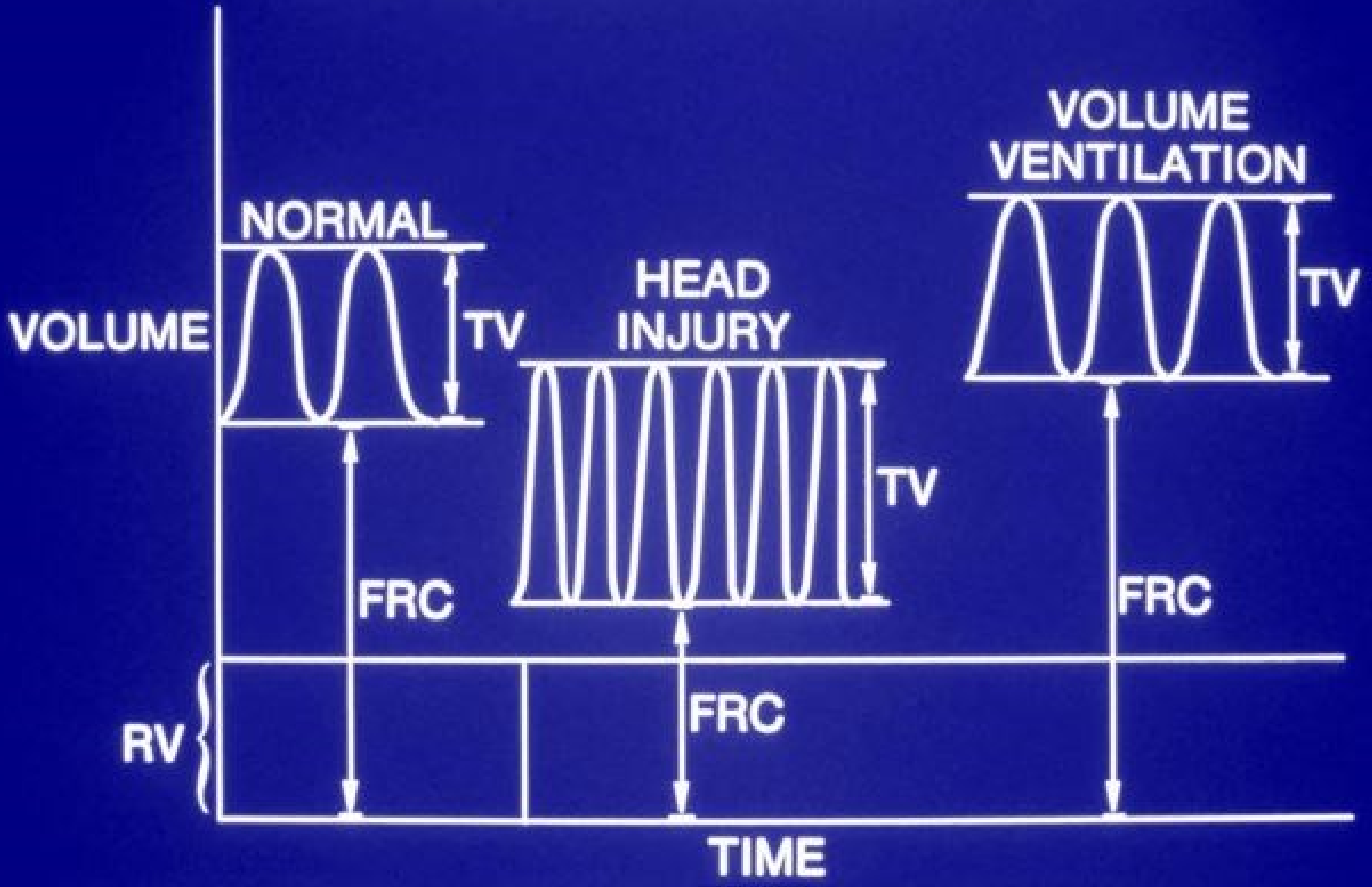
- - - - -

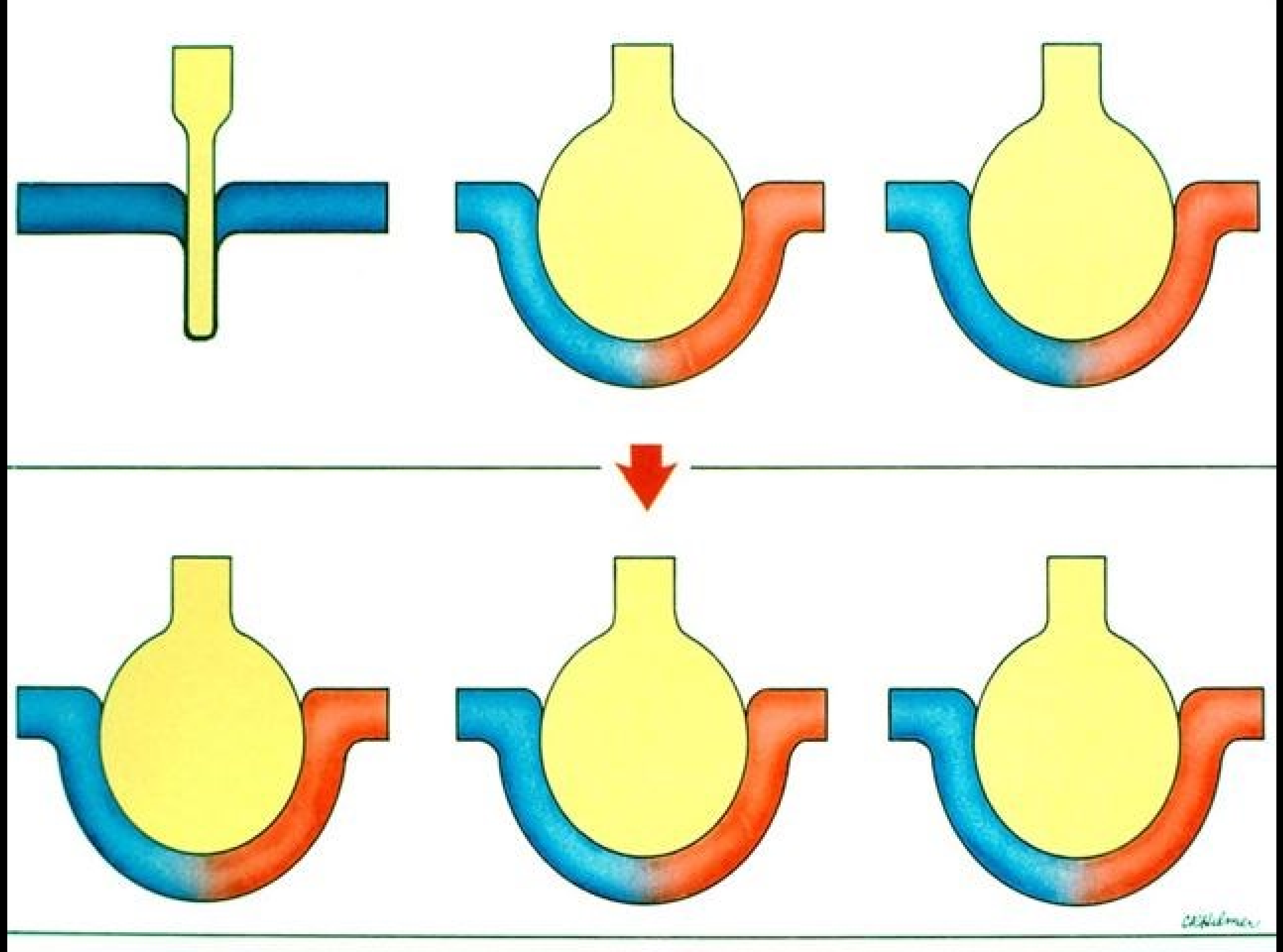
‘RADIATOR EFFECT’

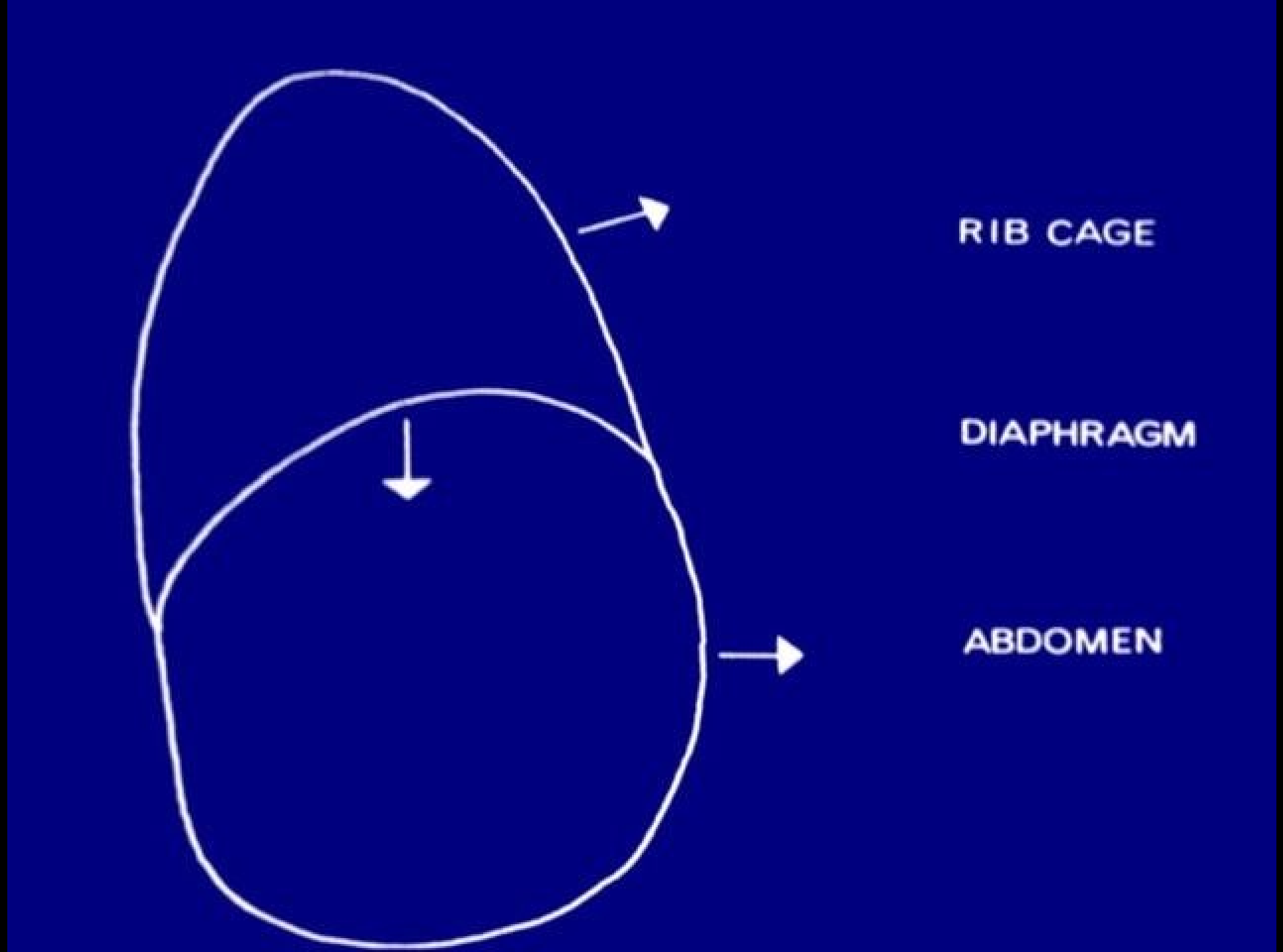
RESPIRATORY CARE


C3
C4
T2
T2
T3
T4
T5
C5
C5
T6
T7
T8
C6
T1
T9
C6
T1
T10
T11
T12
C6
C6
L1
S3
L1
C8
C8
C7
C7
L2
L2
S4
L3
L3
L5
L4
L4
L5
S1
S1

PATHOPHYSIOLOGY OF RESPIRATION IN HEAD INJURY






RIB CAGE
DIAPHRAGM
ABDOMEN

R_x

- - - - -

VOLUME VENTILATION

CHEST PHYSIOTHERAPY

AGGRESSIVE MANAGEMENT

CATABOLIC RESPONSE

- - - - -

2 MONTHS

Neg NITROGEN BALANCE

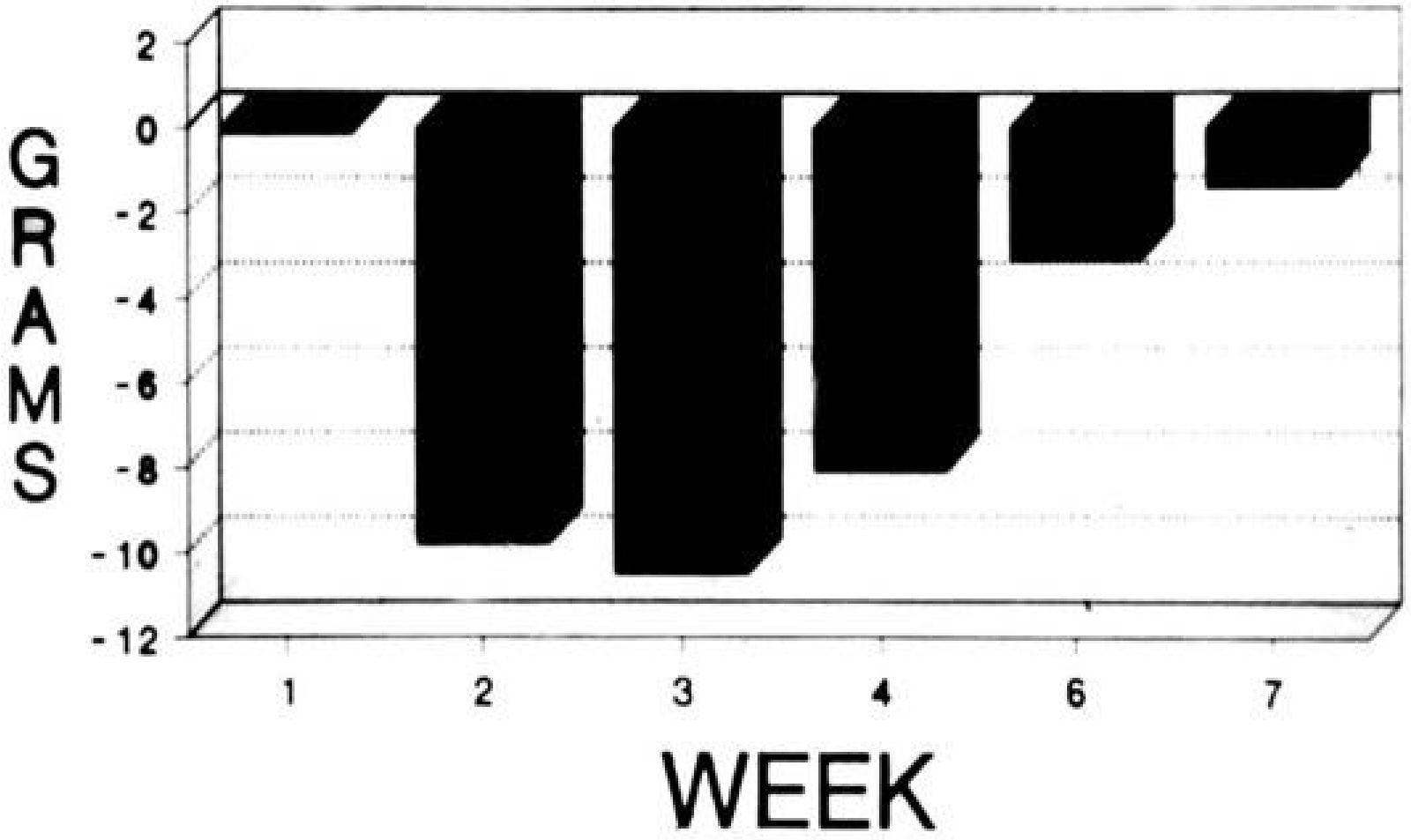
OVER (or UNDER) FEEDING

RESPIRATORY MUSCLES

- - - - -

↓ NUTRITION

MEAN WEEKLY NITROGEN BALANCE (SCI PATIENTS)



R_x

- - - - -

ESTIMATE REQUIREMENTS

REPLENISH

DOCUMENT EFFICACY

Men (kcal/day):

BEE = 66 + (13.8 x kg) + 5 x cm) - (6.8 x age)

$$PEE = BEE \times 1.2 \times 1.6$$

REPLENISH

- - - - -

PO

VS

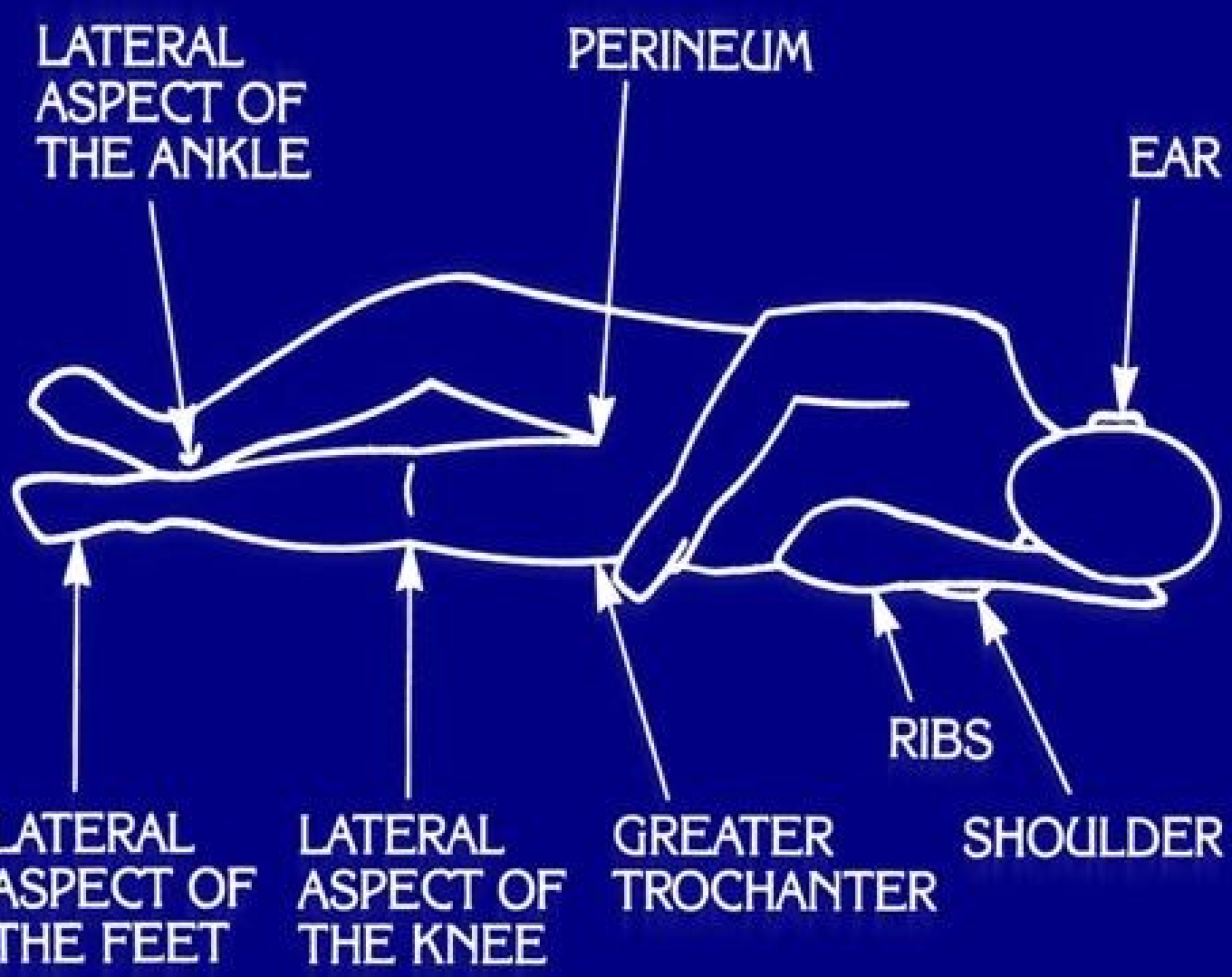
IV

FOLEY

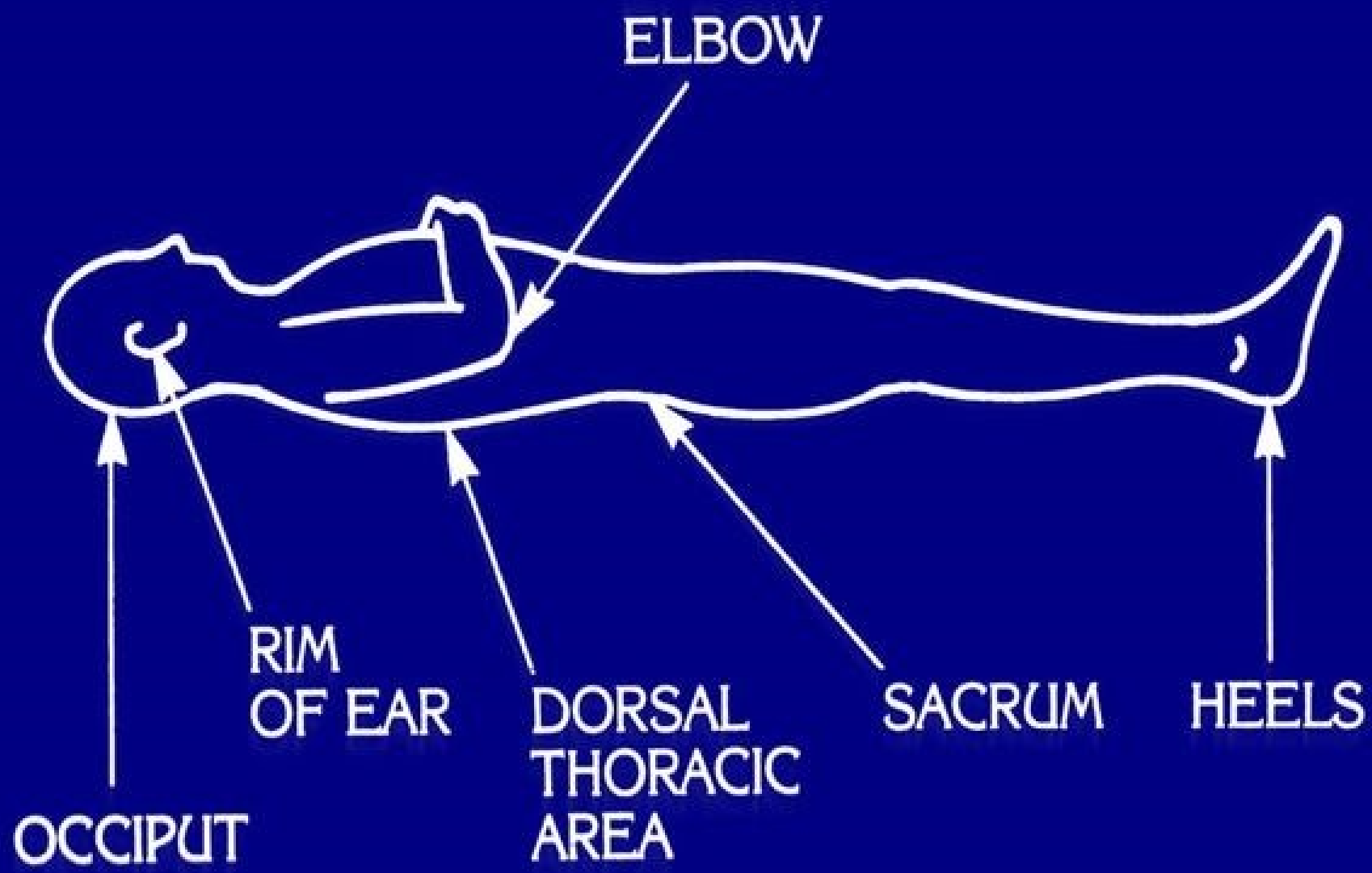
INTERMITTENT CATH.

SKIN CARE

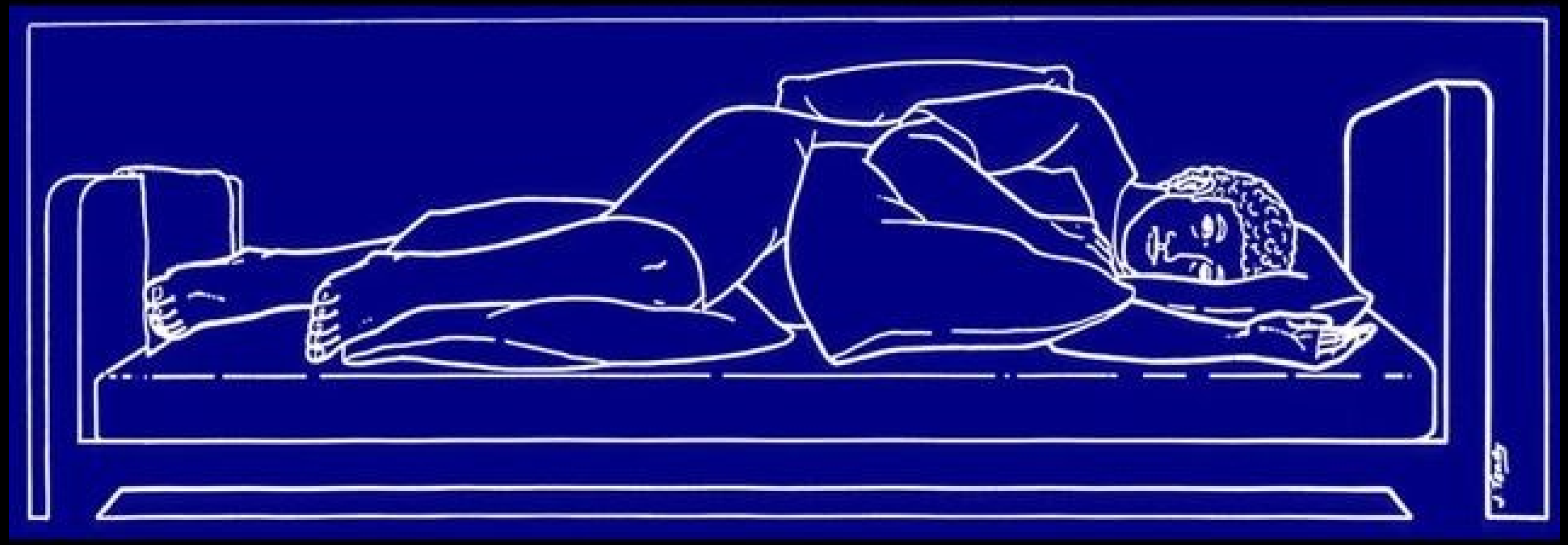
Side lying pressure points



Supine pressure points

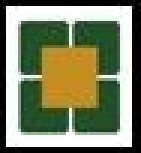


Sitting pressure points



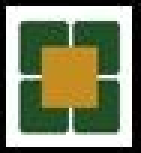
The
Second Mission

Establish
the
Plan



When?

How?



Spinal Cord Injury

Emergent or Urgent Surgery

What is Emergent?

What is Urgent?

Definitions

may vary

DEPENDING ON CIRCUMSTANCES

1 hour
3 hours
8 hours
24 hours
72 hours

Logistics, Logistics, Logistics

Vary from Institution to Institution
and from
Surgeon to Surgeon

Laboratory Research

Rats

are not

Humans

Fiber Tracts
Somatotopic Arrangement Differs

Locomotor Command System

Human Research?

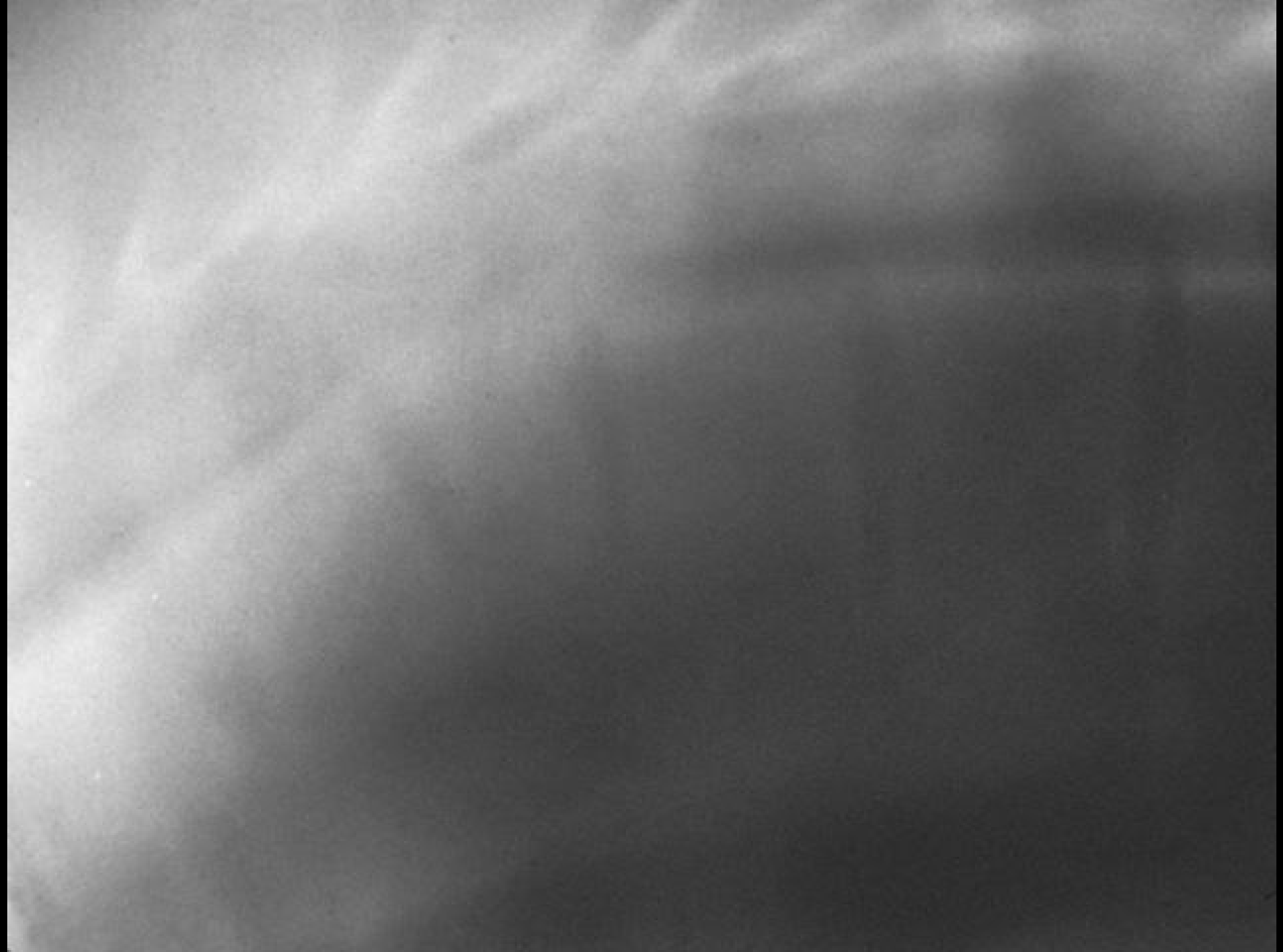
Have we proven that surgery is efficacious?????

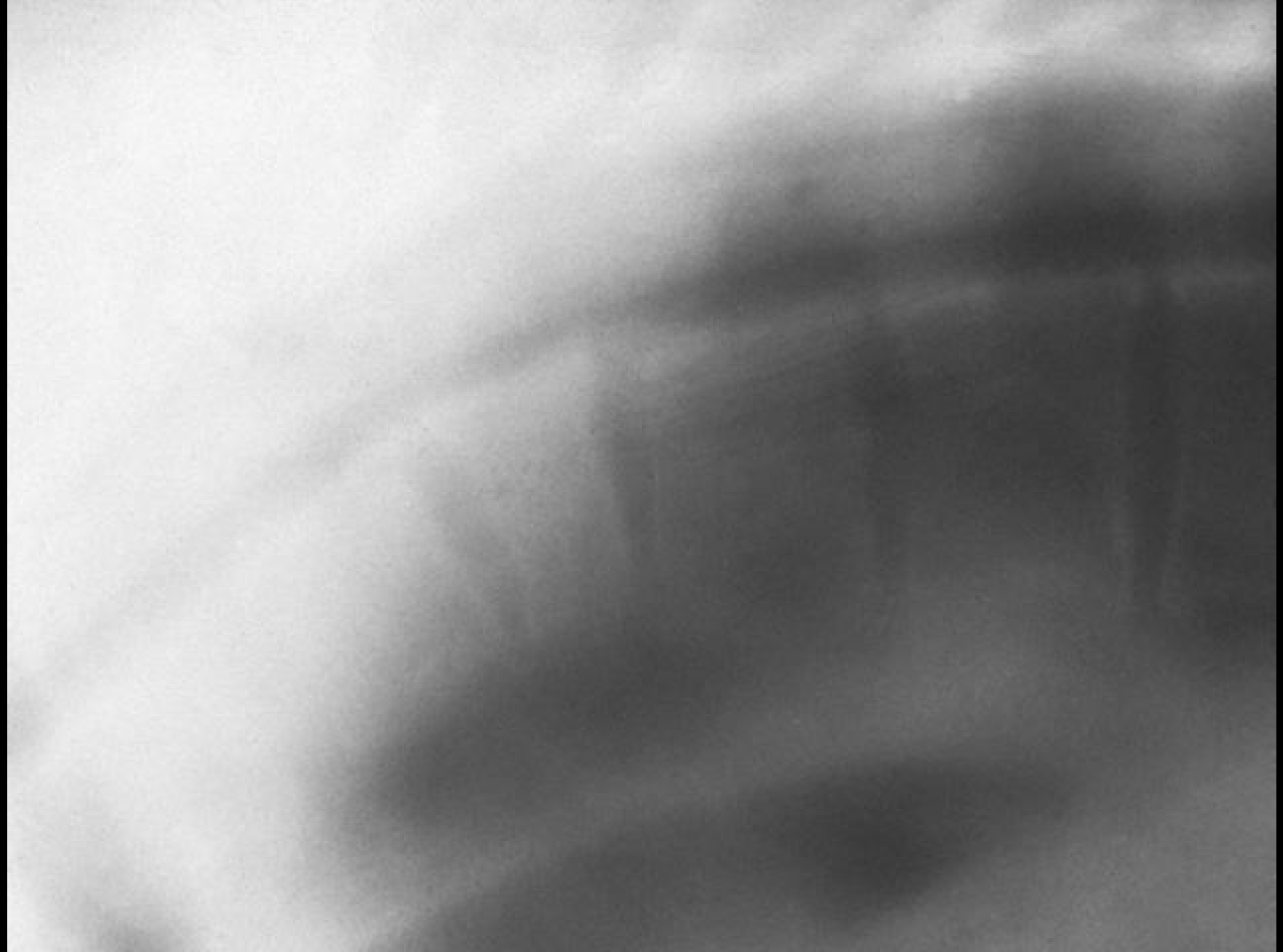
TABLE 7

Pre- and Postoperative Functional State

Preoperative		Postoperative						
		Neurological grade						
Neurological grade	No. of cases	I	II	III	IV	V	VI	VII
I	34	(34)[a]						
II	10		(6)	2	1	1		
III	10			(1)	2	6	1	
IV	12				(0)	6	6	
V	11					(1)	10	
VI	21						(4)	17
VII	7							(7)

[a] The numbers in parentheses indicate the total number of unimproved patients in each functional category.





Have we proven that surgery is efficacious?????

Not unequivocally!!!!!

Yet, we keep talking about
timing of surgery!!!!!

If decompression surgery is not proven,

will doing surgery earlier help make our case?

Legitimate Evidence

Sparse

TIMING OF SURGERY FOR ACUTE SCI

No standards re ROLE AND TIMING of decompression in acute SCI

Urgent decompression for bilateral locked facets in incomplete myelopathy

Urgent decompression for neurological deterioration

Urgent decompression for acute SCI – reasonable practice option

Urgent decompression for acute SCI – can be performed safely

EMERGING EVIDENCE – Surgery within 24 hrs MAY reduce length of ICU stay

EMERGING EVIDENCE – Surgery within 24 hrs MAY reduce medical complications

Fehlings et al Spine, 2006

Study Planned

U of Toronto and Thomas Jefferson

Not Randomized

24 hours

Investigator Bias

Patient Selection Bias

Winner-Loser Bias

Closed Reduction of Locked Facets

8% incidence of neurological deterioration

Tator et al; JNS Spine 1999

Emotion

vs

Evidence

If my foot was on your spinal cord,
you would want me to take it off!!!

NOW!!!!!

Its just not that simple.

The removing of the foot requires
both
Anesthesia and Surgery

in a

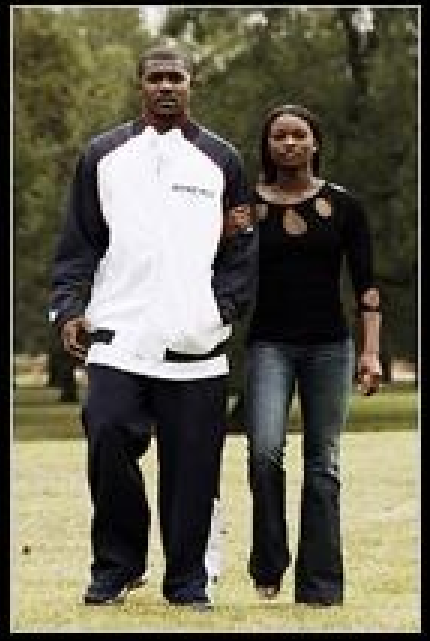
Medically Vulnerable Patient

Much Hype in Player's Treatment, Doctors Say

By ALAN SCHWARZ

Published: January 15, 2008

For all the images of athletes running and jumping in 2007, the sight of Kevin Everett merely walking was one of the most newsworthy.



We must focus on the study of objective, non-biased metrics.....

.....and make decisions based on the data derived!!!!!!

CHEMISTRY

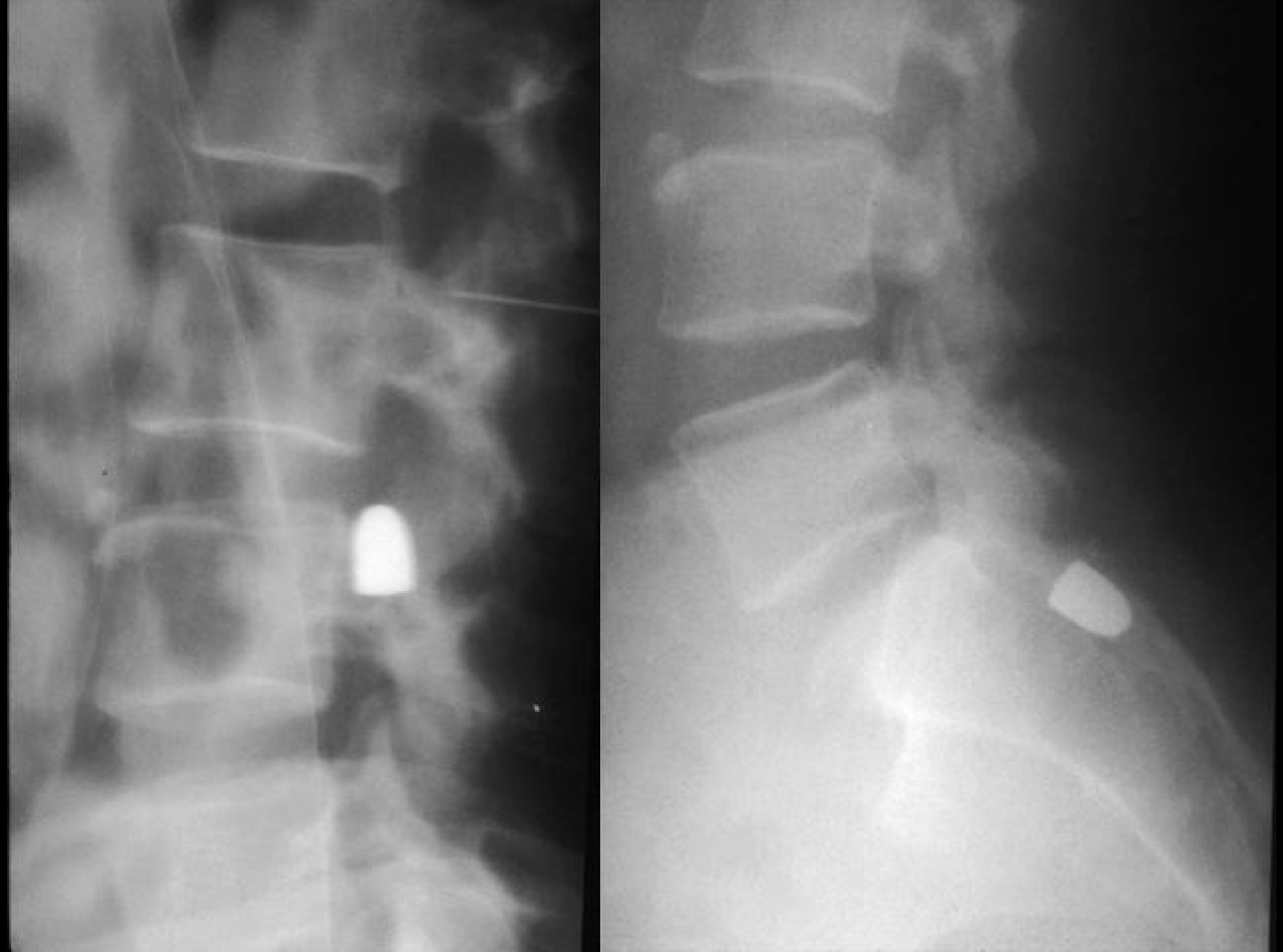
CHEMISTRY

If it works for you…..
…..it works for you!!!!

CHEMISTRY

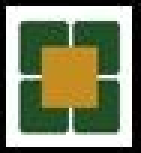
….and it probably works for your patients!!!!

Penetrating Injuries

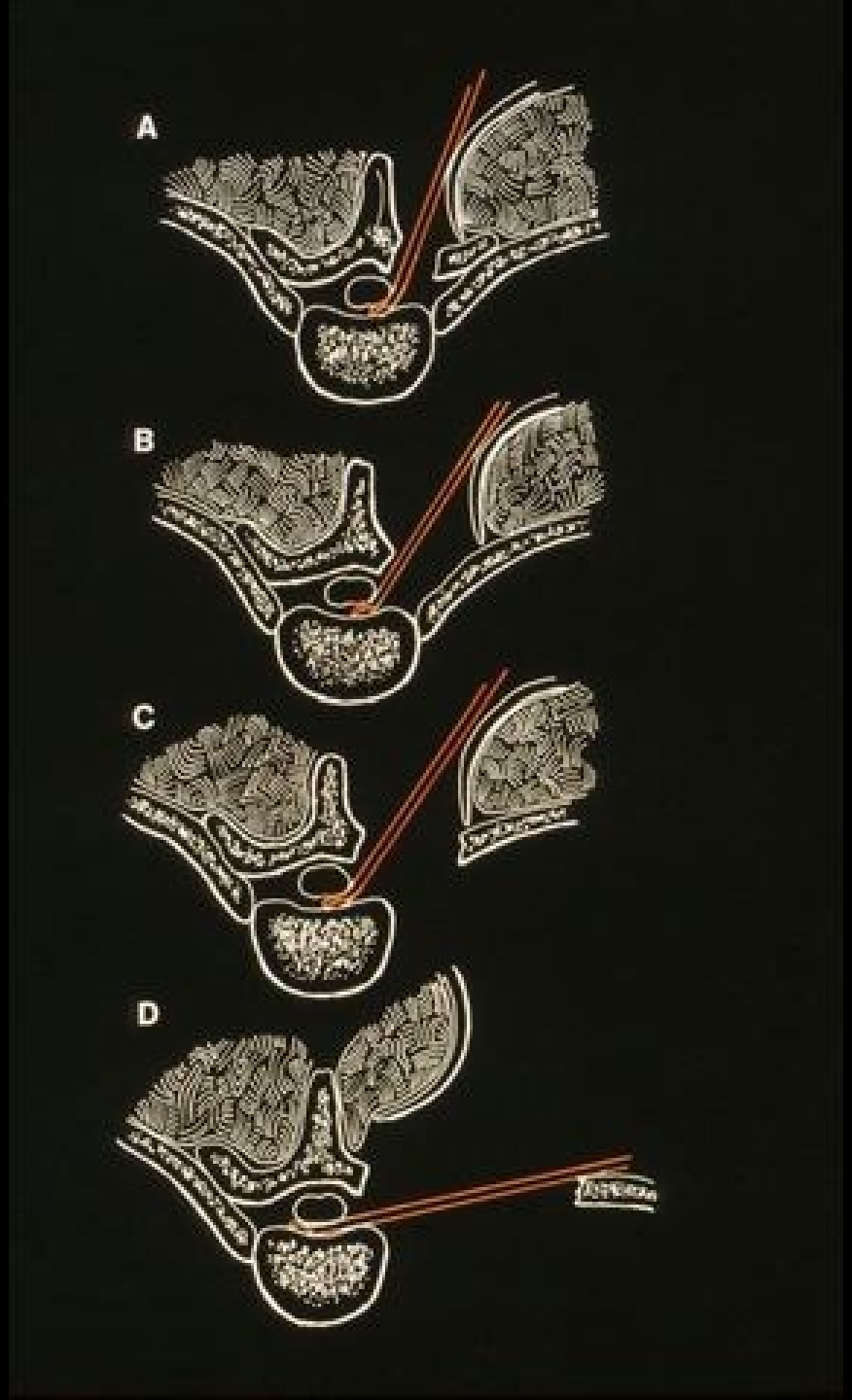


When?

How?



Surgical Strategies


A
B
C
D

Fuse Long

Fuse Short

Front

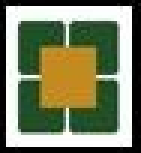
Back

Both

EVIDENCE-BASED METHODOLOGIES

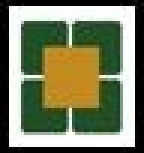
"The conscientious, explicit, and judicious use of the current best evidence in making decisions about the care of individual patients"

Sackett

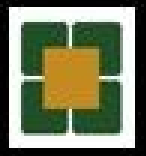


"Good doctors use both individual clinical expertise and the best available external evidence, and neither alone is enough. Without clinical expertise, practice risks becoming tyrannized by evidence, because even excellent external evidence may be inapplicable to or inappropriate for an individual patient. Without current best evidence, practice risks rapidly becoming out of date, to the detriment of patients."

Sackett DL: Evidence-Based Medicine. Spine 23:1085-1086, 1998



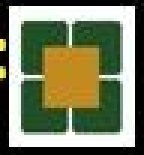
PBDM



PBDM

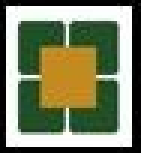
A Clinical Decision-Making Strategy That Employs the Best Available Information and a Logic-Based Decision Making-Process

- Separation of a Complex Problem into its Component Parts
- Prioritization of the Component Parts
- Serial Solution of the Prioritized Component Parts (Problems)



THORACOLUMBAR TRAUMA

- Neurological
- Ventral Column Restoration Capacity
- Deformity Prevention

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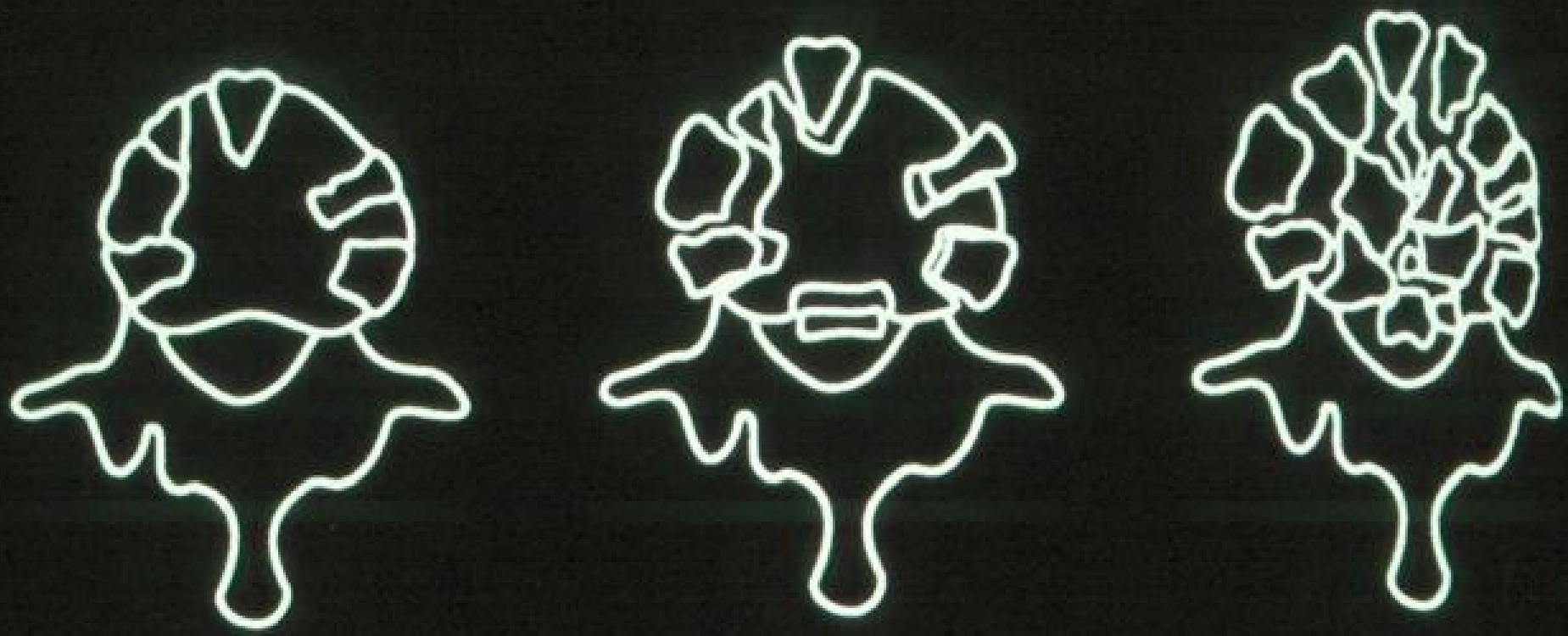

MINIMAL
1

SPREAD
2

WIDE
3

THORACOLUMBAR TRAUMA

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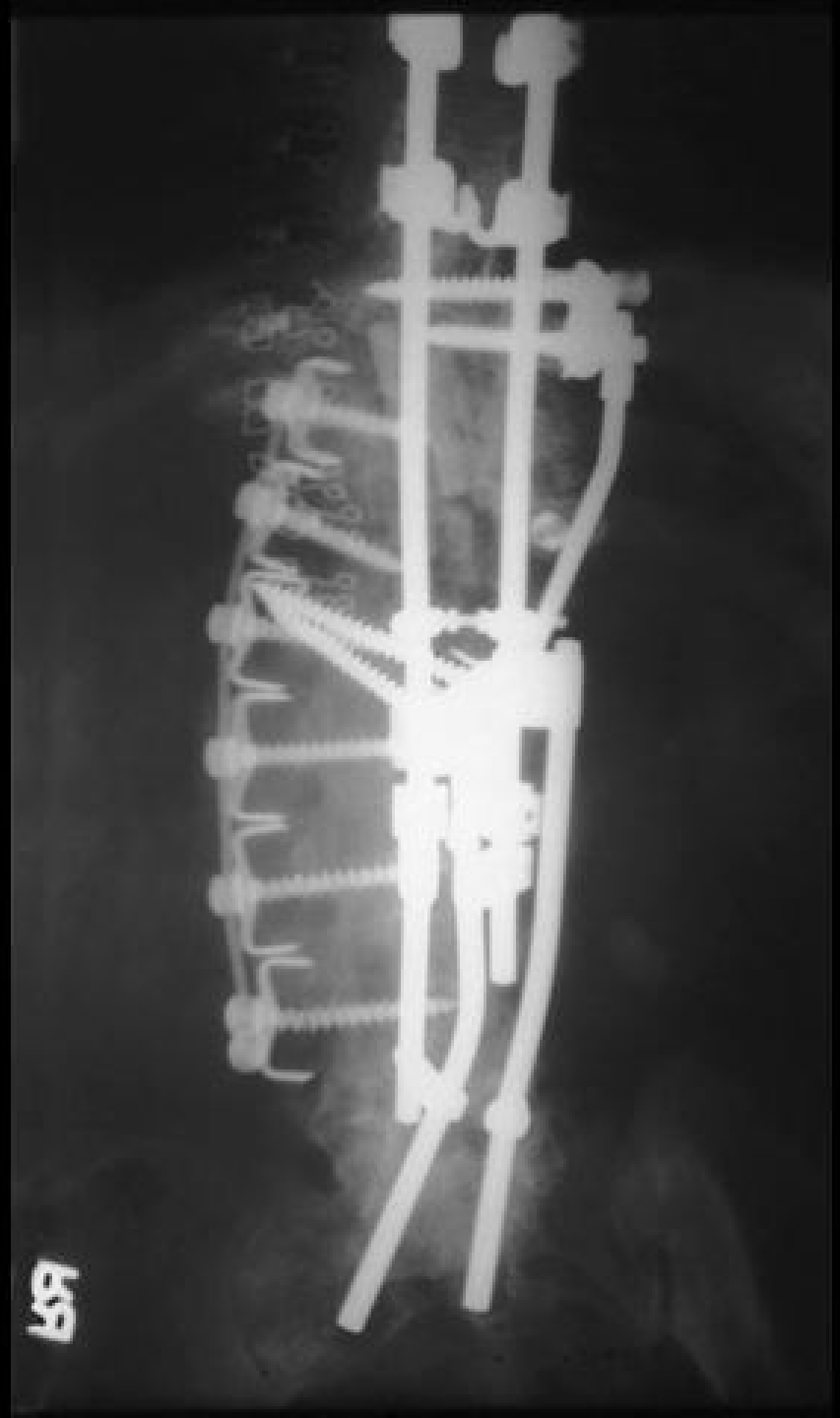
SPINE SURGERY BEGETS SPINE SURGERY




THANK YOU!!!