28th Annual Gabor Racz Advanced Interventional Pain Conference and Workshop
Budapest, Hungary August 25-27, 2025

Regenerative Medicine – Why, When, How?

Andrea Trescot MD ABIPP FIPP CIPS

Special thanks to:

Agnes Stogicza MD PhD FIPP CIPS

DISCLOSURE

Andrea Trescot, MD, ABIPP, FIPP, CIPS

- Former Professor, University of Washington
- Former Director, Pain Fellowship Program, University of Washington and University of Florida
- Past President, American Society of Interventional Pain Physicians
- Past President, Florida and Alaska Societies of Interventional Pain Physicians
- Co-founder – Pain School International (PSI)
- Chief Medical Officer – Curonix
- Chief Medical Officer – Beaches Recovery

What is Regenerative Medicine?

The process of replacing, engineering or regenerating human cells and tissues to restore normal function

Evolving Applications

- Regrowth of damaged organs – bladder, liver, kidney, pancreas
- Osteoarthritis
- Vascular – Cardiac, peripheral
- Peripheral and Spinal cord injury
- Burns
- Craniofacial and plastics reconstruction (breast reconstruction)
- Limb reconstruction and therapy from damage sustained secondary to a compartment syndrome
- Macular Degeneration

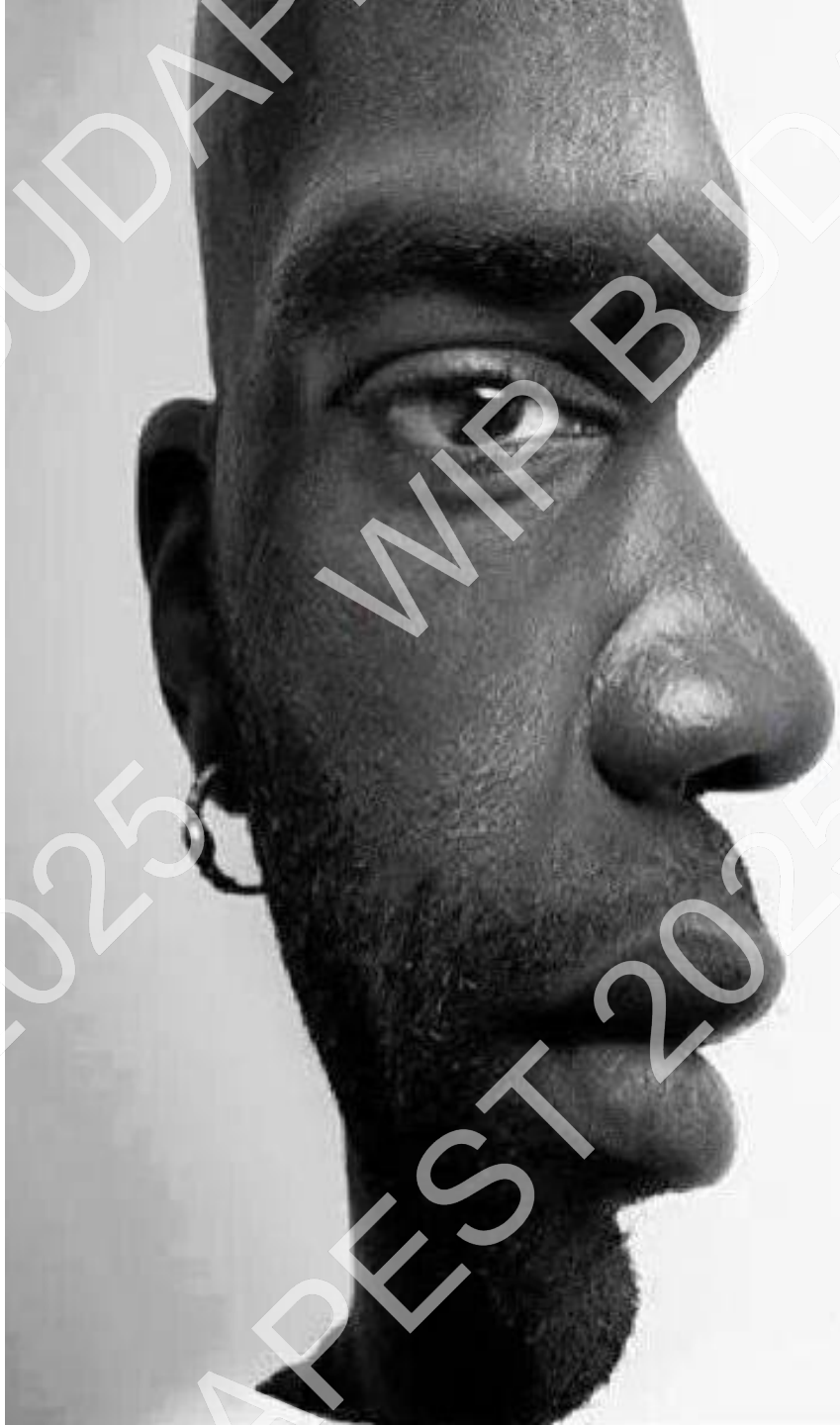
Having shrewdly cemented a solid-gold bar to the sidewalk in front of his office, Dr. Nertman immediately experienced a 70 percent increase in business.

So - Your Patient is Not Getting Better

- You have tried
  - Epidurals
  - Facets/RF
  - Trigger point injections
  - SCS
- The patient gets temporarily better, but the pain keeps coming back

Are We Looking at the Problem in the Right Way?

Or Are We Only Looking at Half of the Problem?



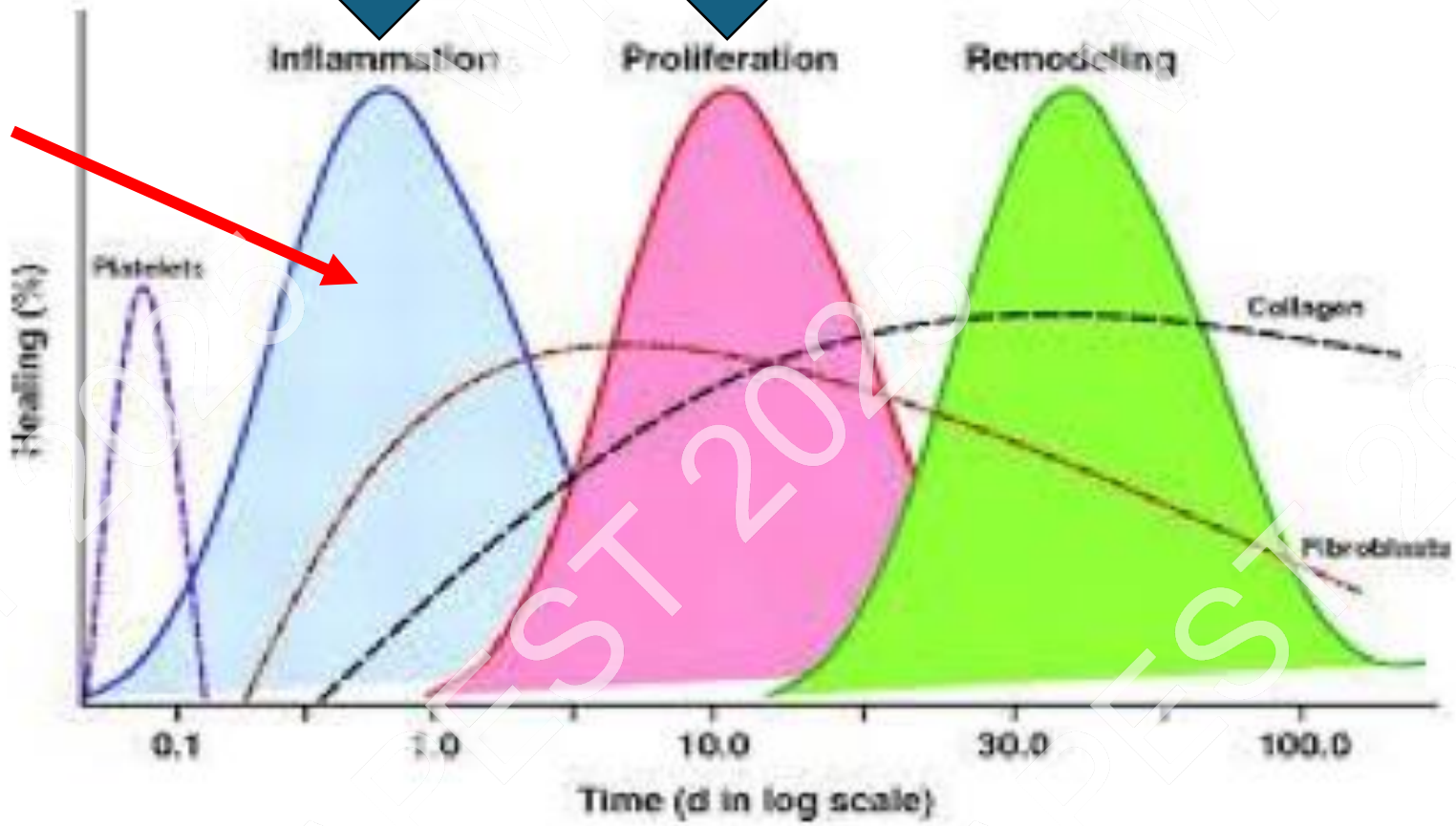
Musculoskeletal applications of platelet-rich plasma: Fad or future? Lee KS, Wilson JJ, Rabago DP, et al. AJR 2011;196: 628-636

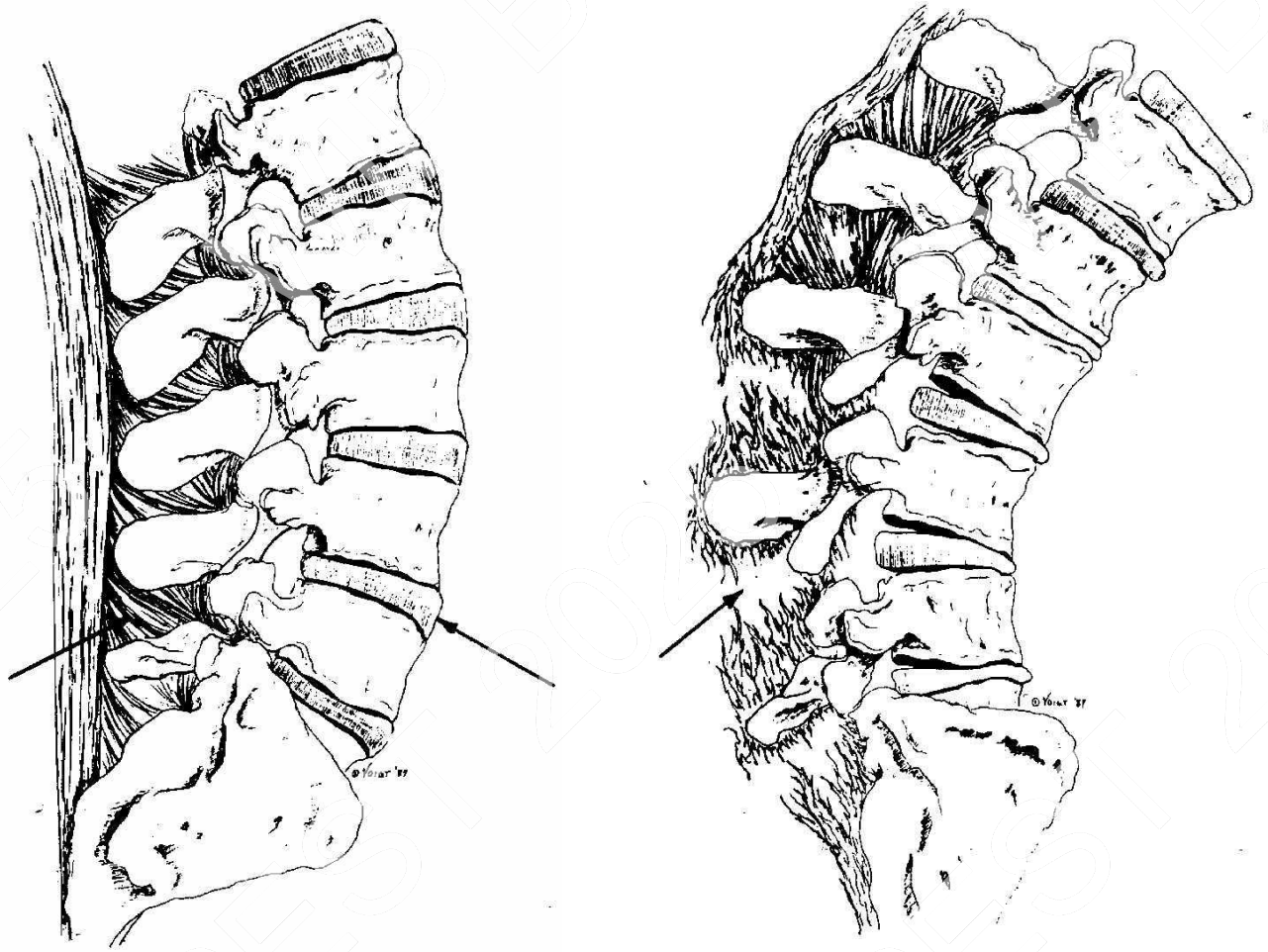
Healing Cascade

Prolotherapy

PRP/BMC

NSAIDs





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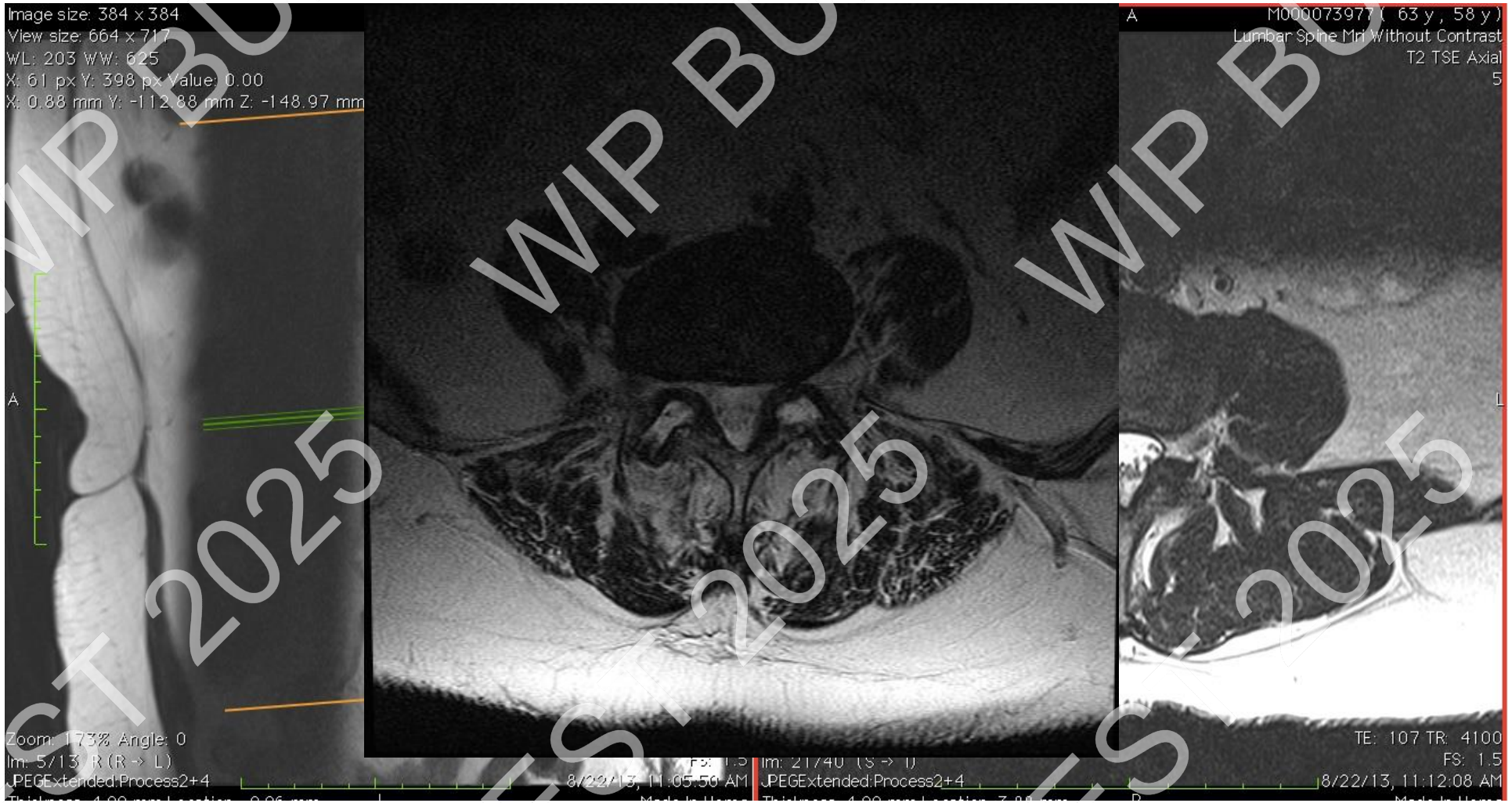
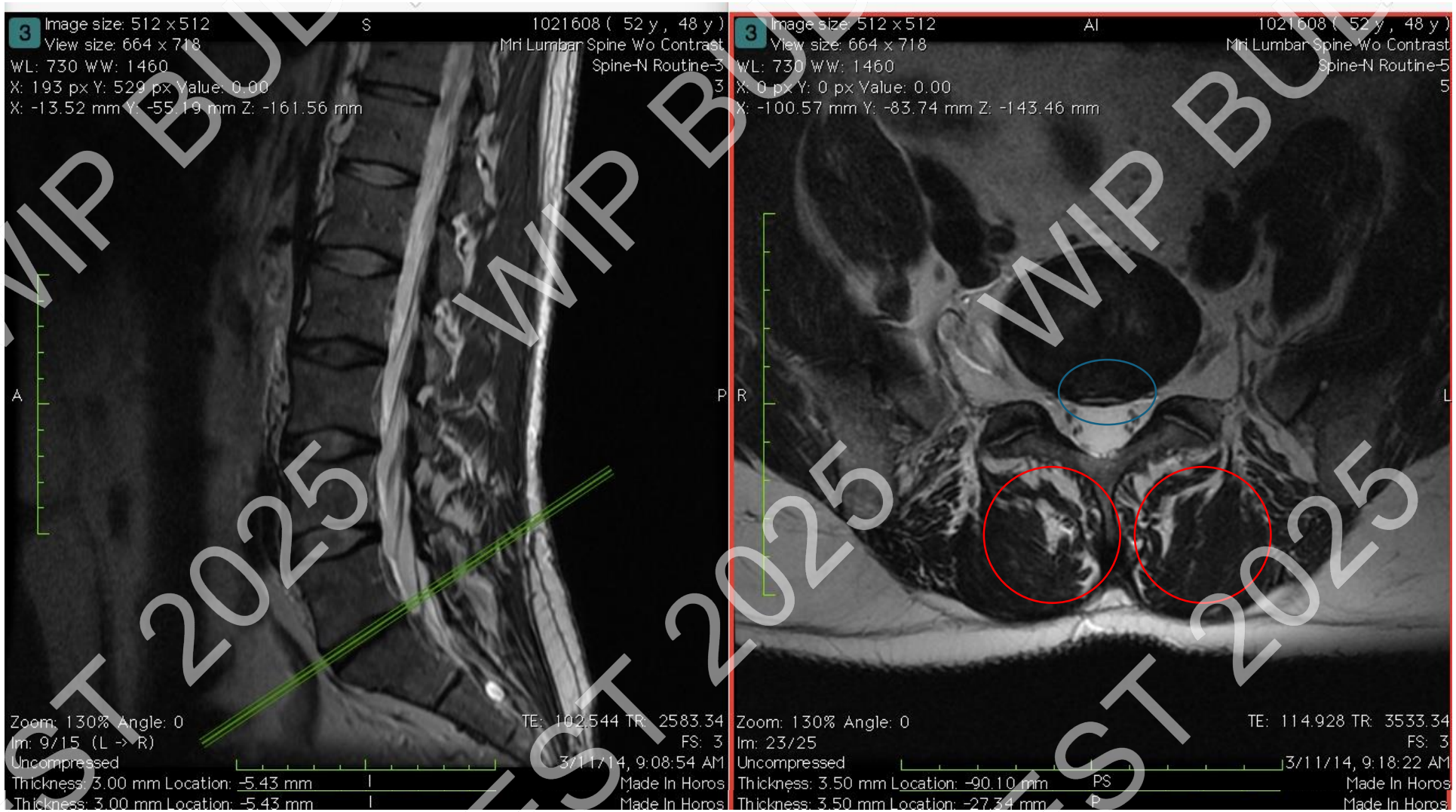




GEORGE STUART HACKETT

LIGAMENT AND TENDON RELAXATION

(*Skeletal Disability*)

TREATED BY PROLOTHERAPY

(*Fibro-Osseous Proliferation*)

Revised and Enlarged

THIRD

EDITION

Faber WJ, Walker M. *Pain, Pain, Go Away*. Ishi Press, 2009

Faber WJ, Walker M. *Pain, Pain, Go Away*. Ishi Press, 2009

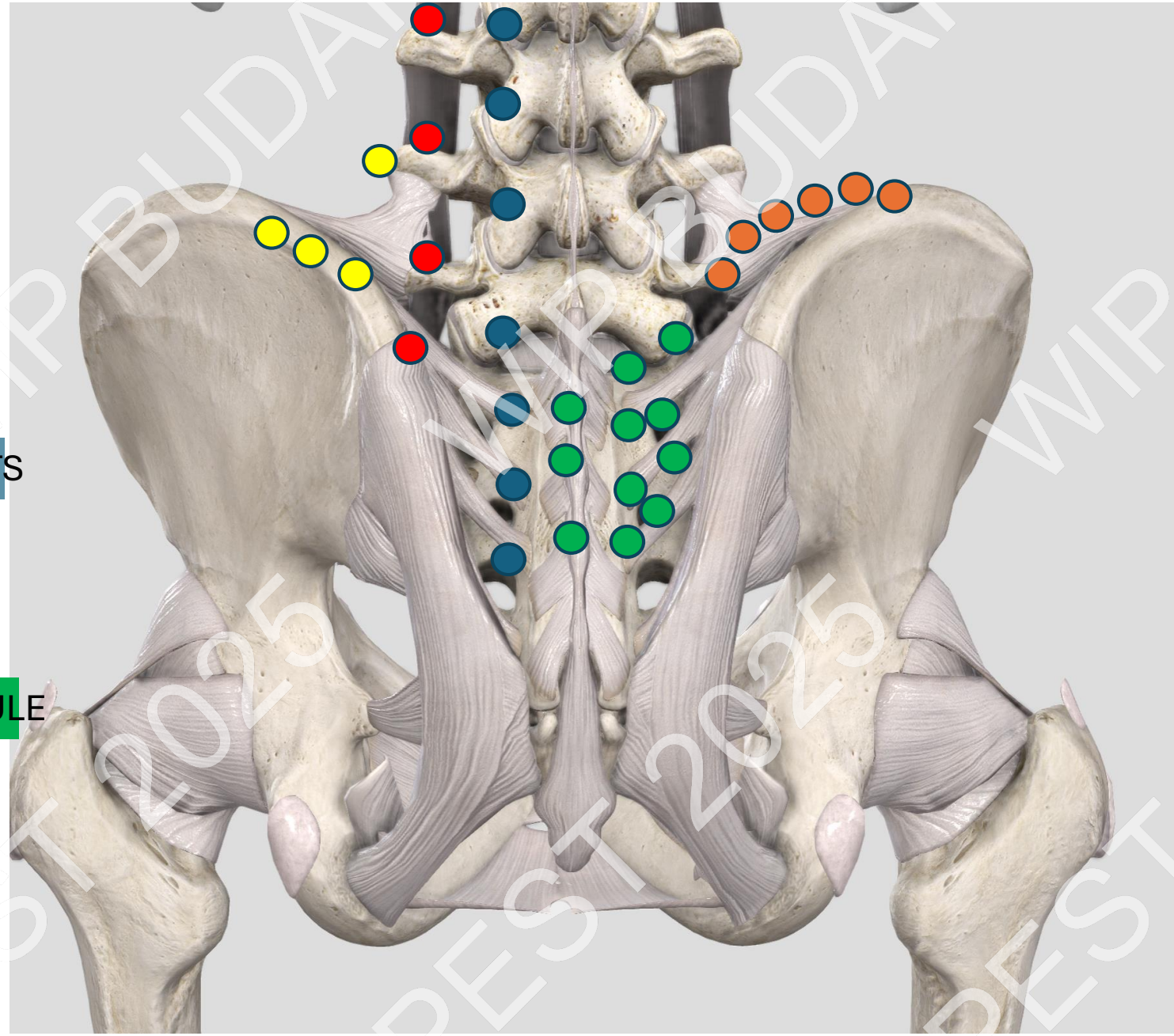
ILIOLUMBAR LIGAMENTS

SUPRASPINOUS LIGAMENTS

FACETS

SI JOINT, POSTERIOR CAPSULE

TLF



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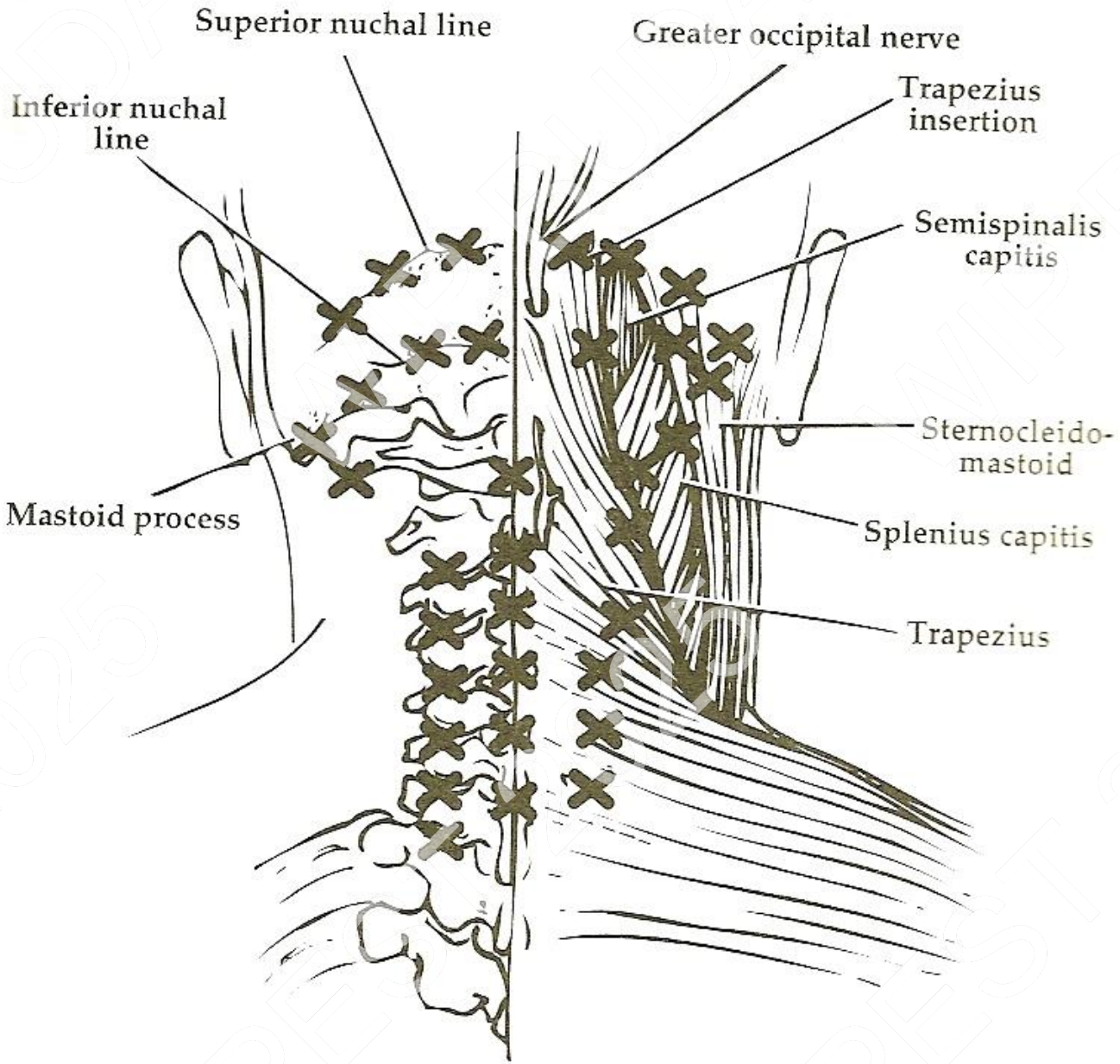
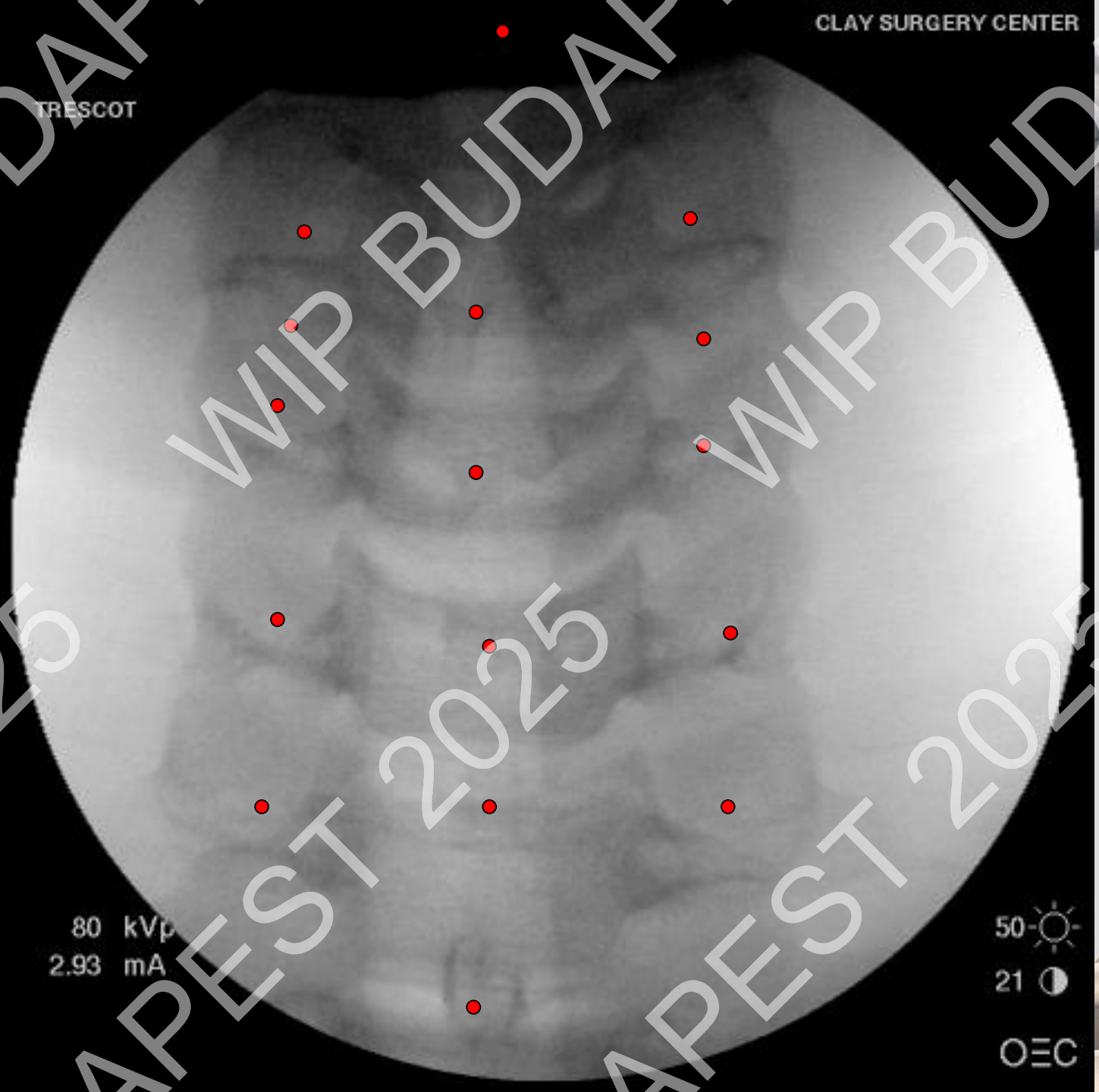
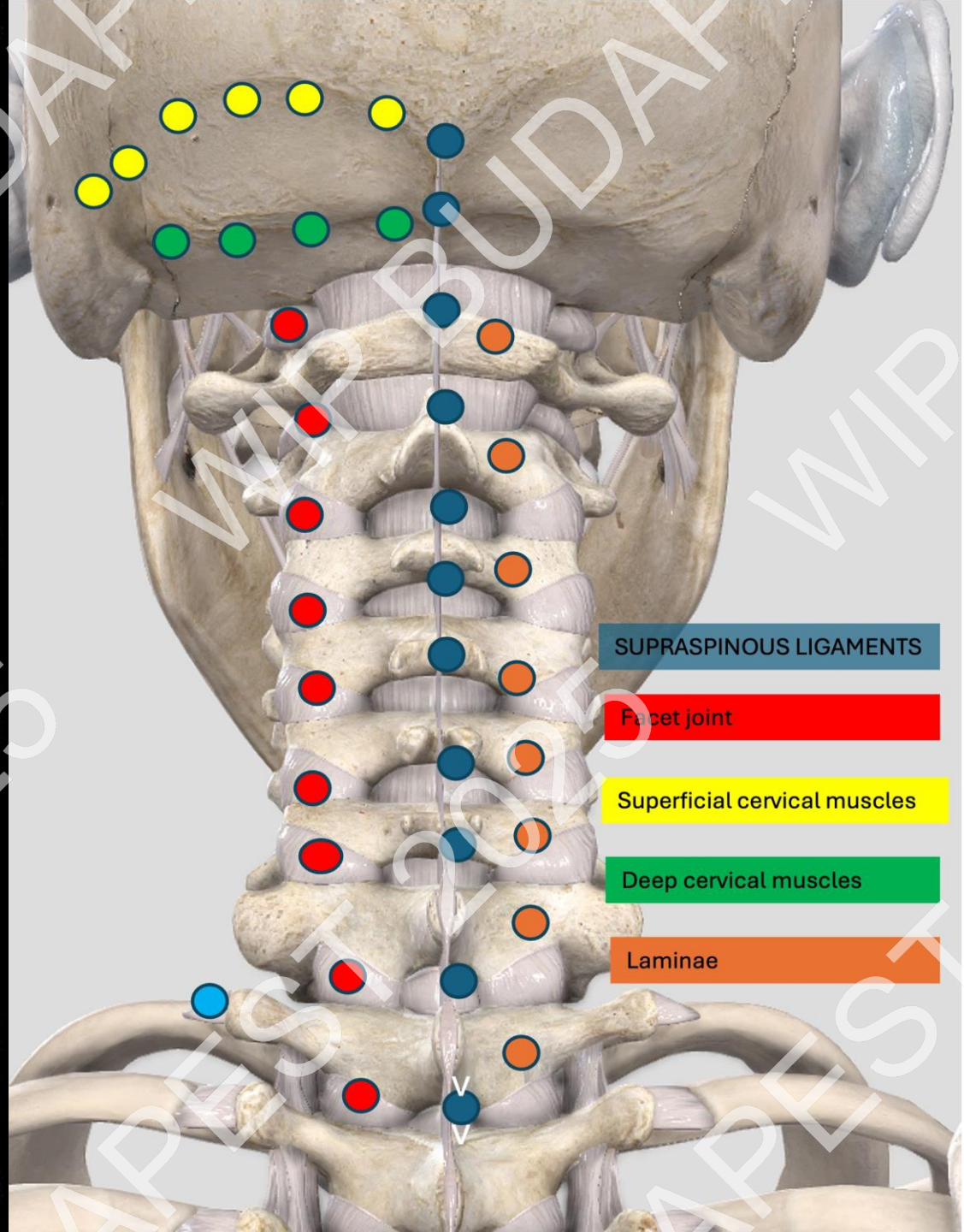
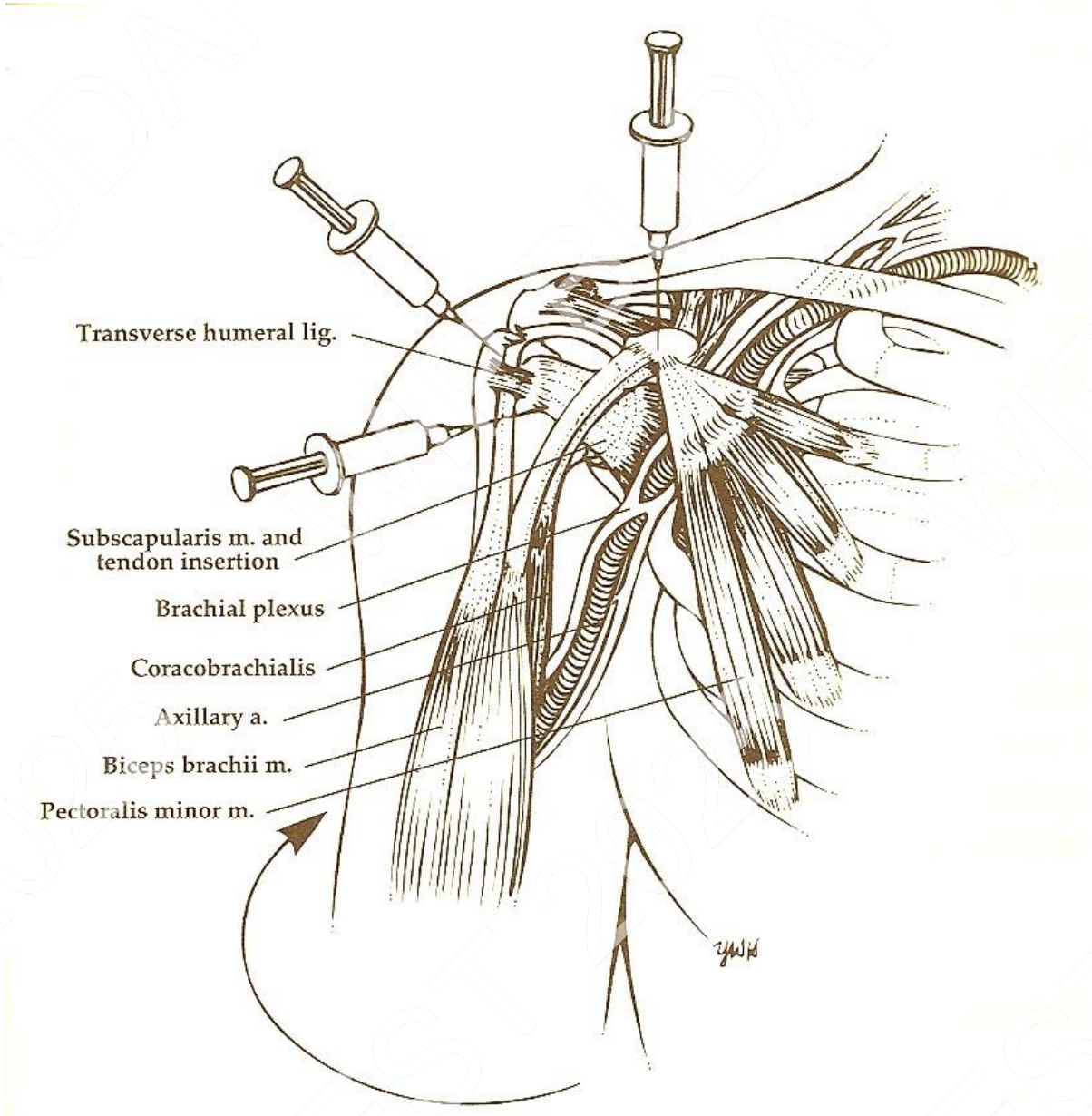
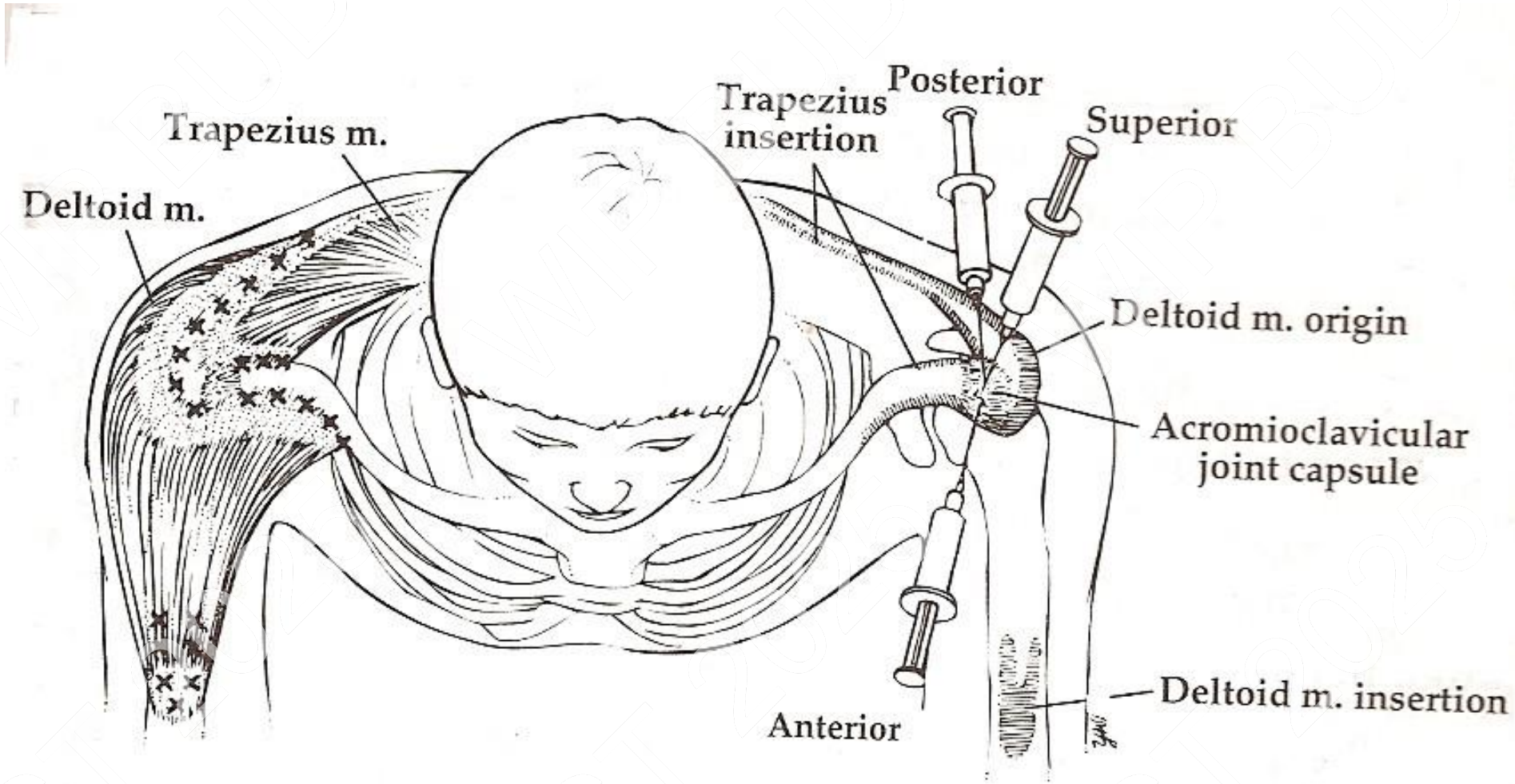
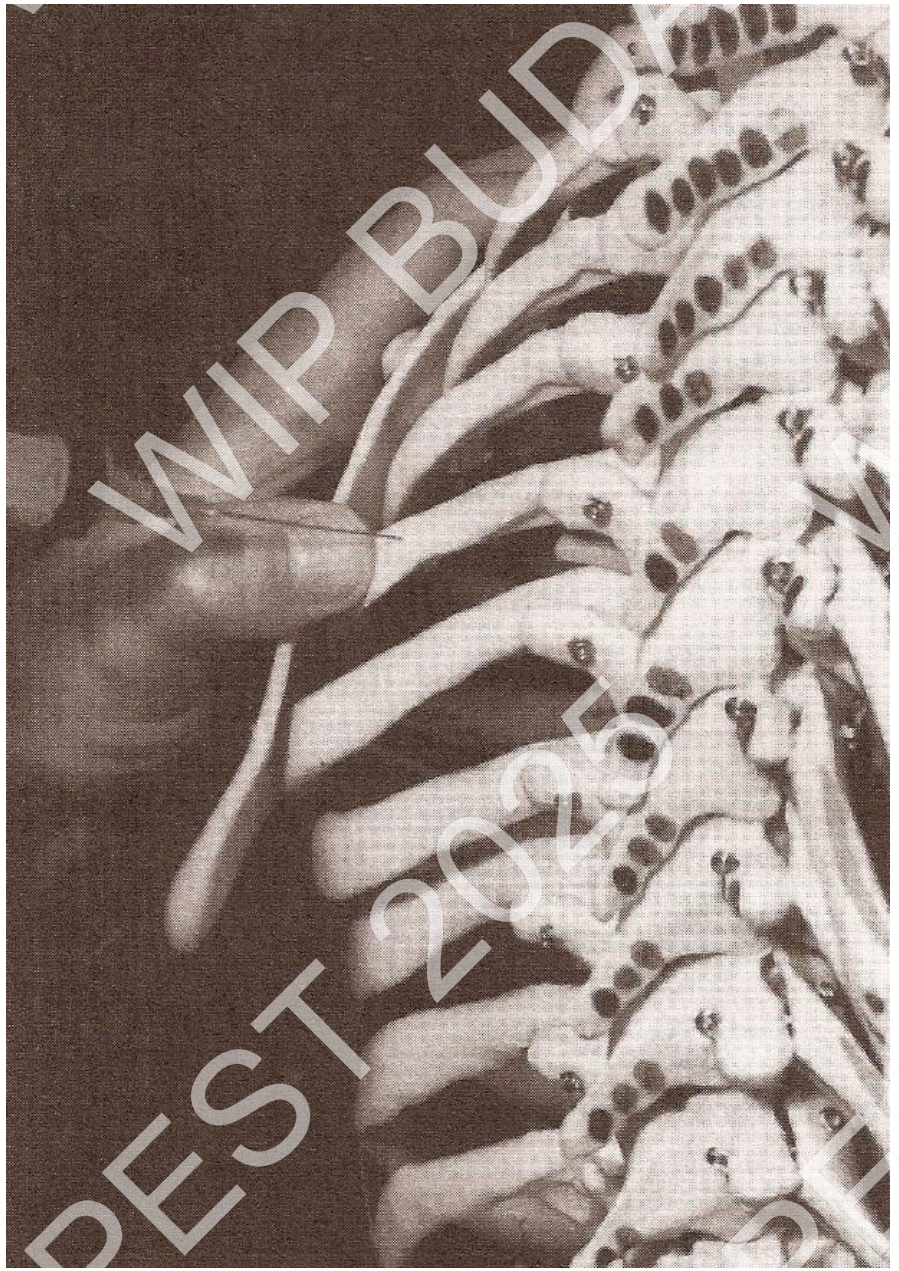


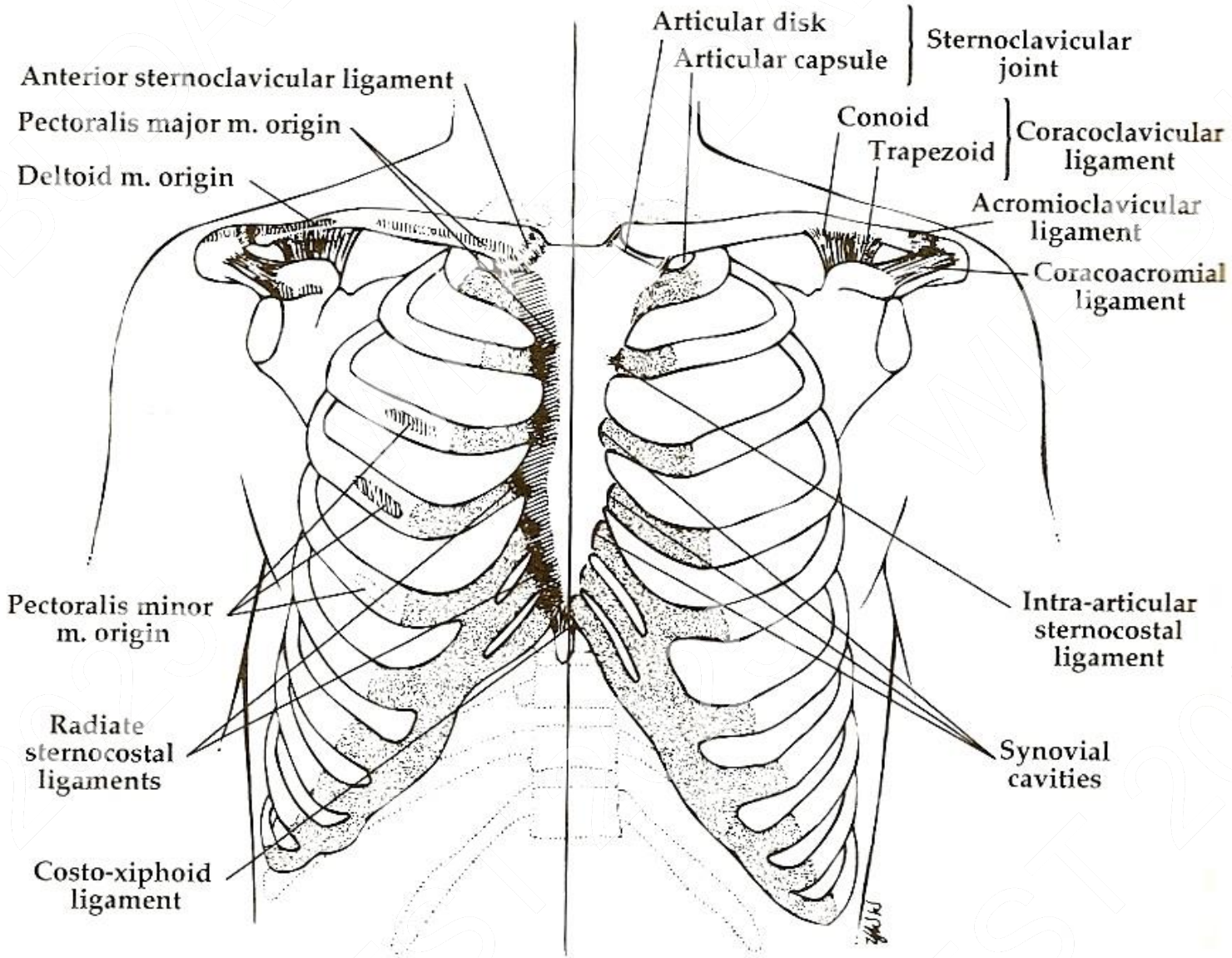




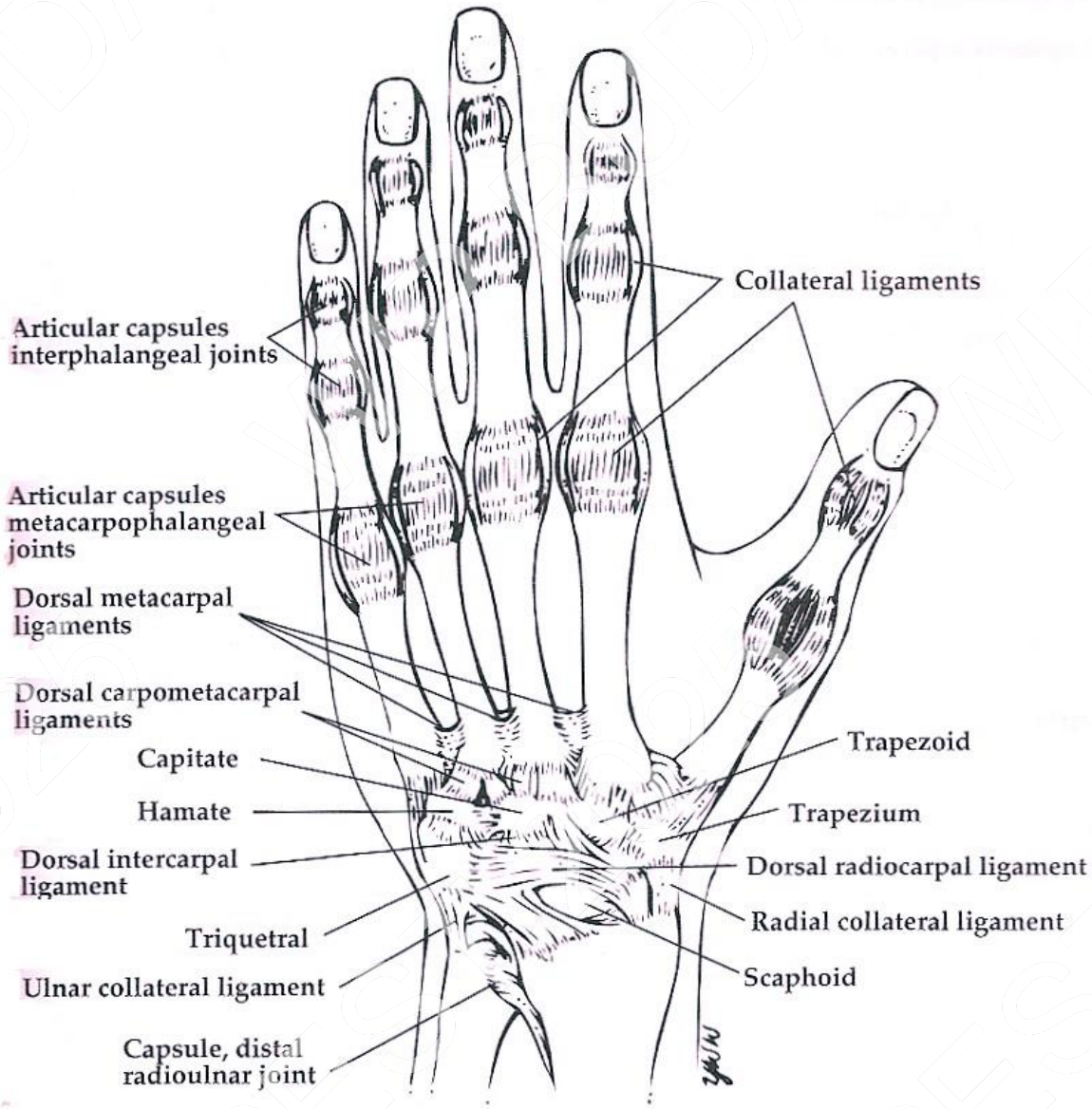

Transverse humeral lig.
Subscapularis m. and tendon insertion
Brachial plexus
Coracobrachialis
Axillary a.
Biceps brachii m.
Pectoralis minor m.

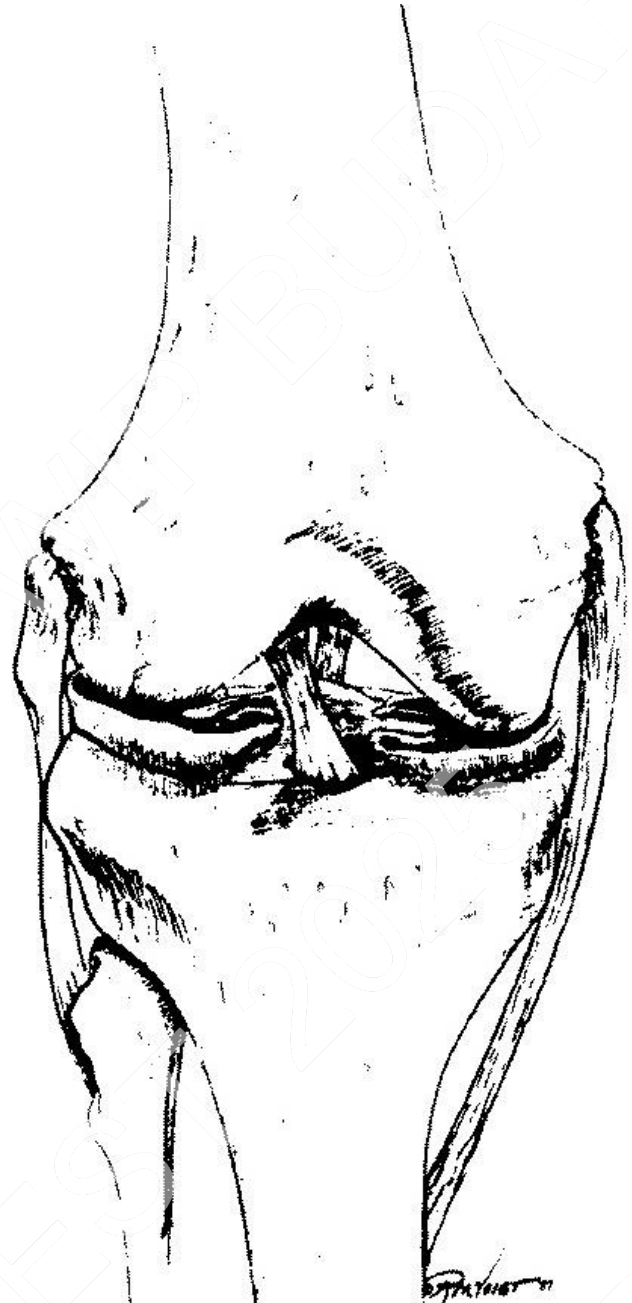

Trapezius m.
Deltoid m.
Trapezius insertion
Posterior
Superior
Deltoid m. origin
Acromioclavicular joint capsule
Anterior
Deltoid m. insertion




Articular disk
Articular capsule
Sternoclavicular joint
Anterior sternoclavicular ligament
Pectoralis major m. origin
Deltoid m. origin
Conoid
Trapezoid
Coracoclavicular ligament
Acromioclavicular ligament
Coracoacromial ligament
Pectoralis minor m. origin
Intra-articular sternocostal ligament
Radiate sternocostal ligaments
Synovial cavities
Costo-xiphoid ligament

Hackett GS, Hemwall GA, Montgomery GA. *Ligament and Tendon Relaxation Treated by Prolotherapy*.. Charles C. Thomas, 1958





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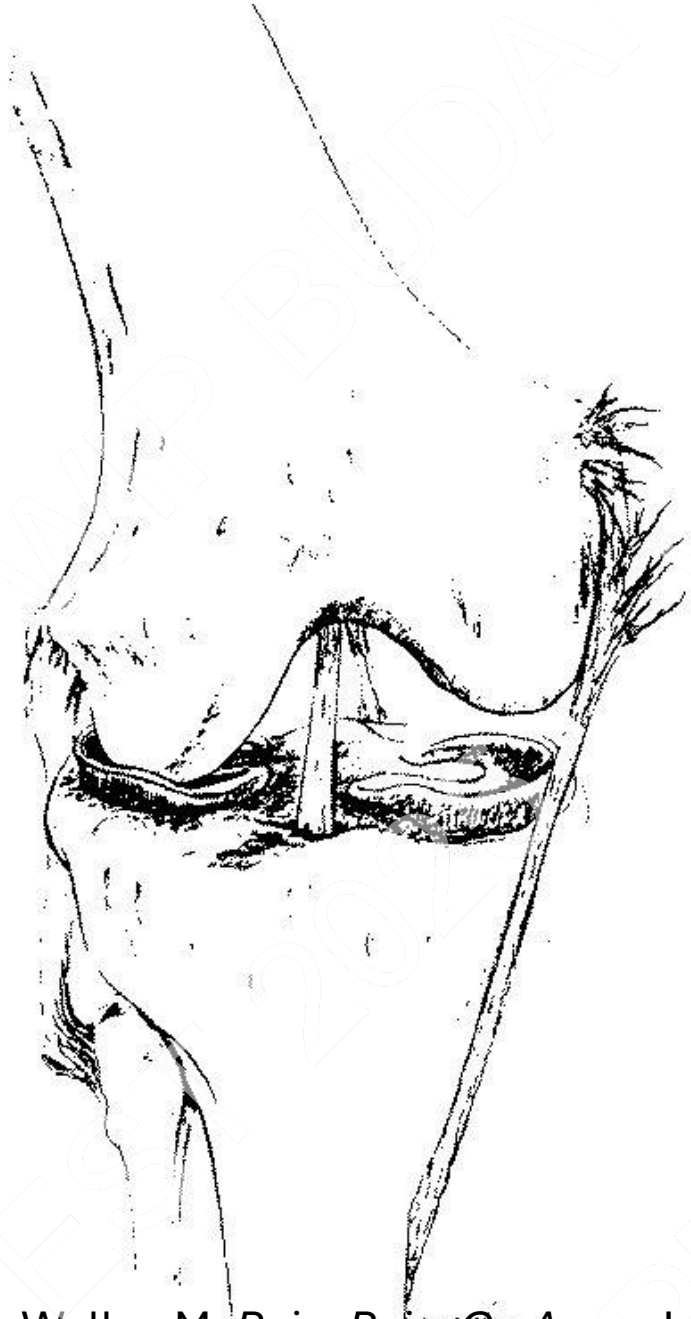

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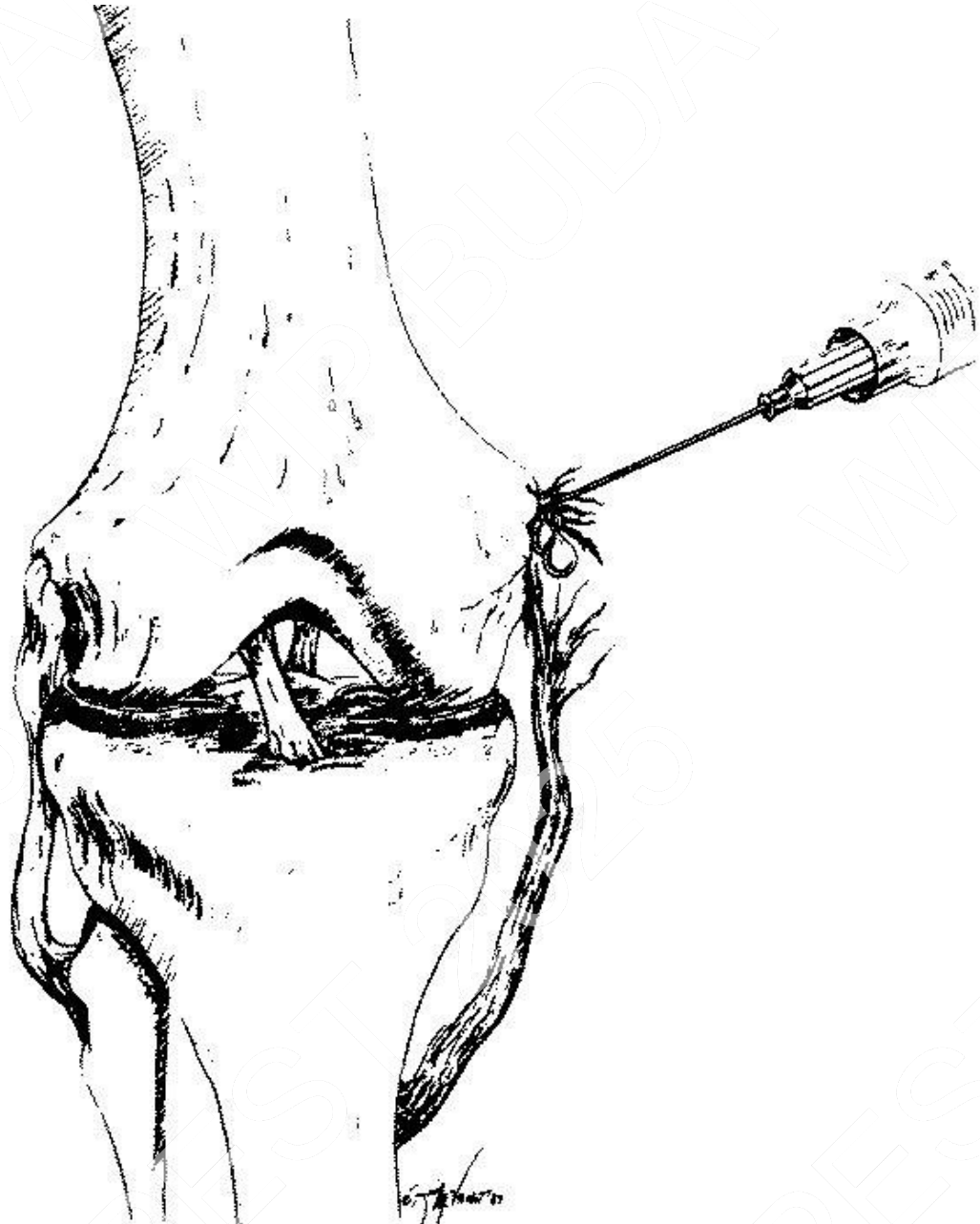

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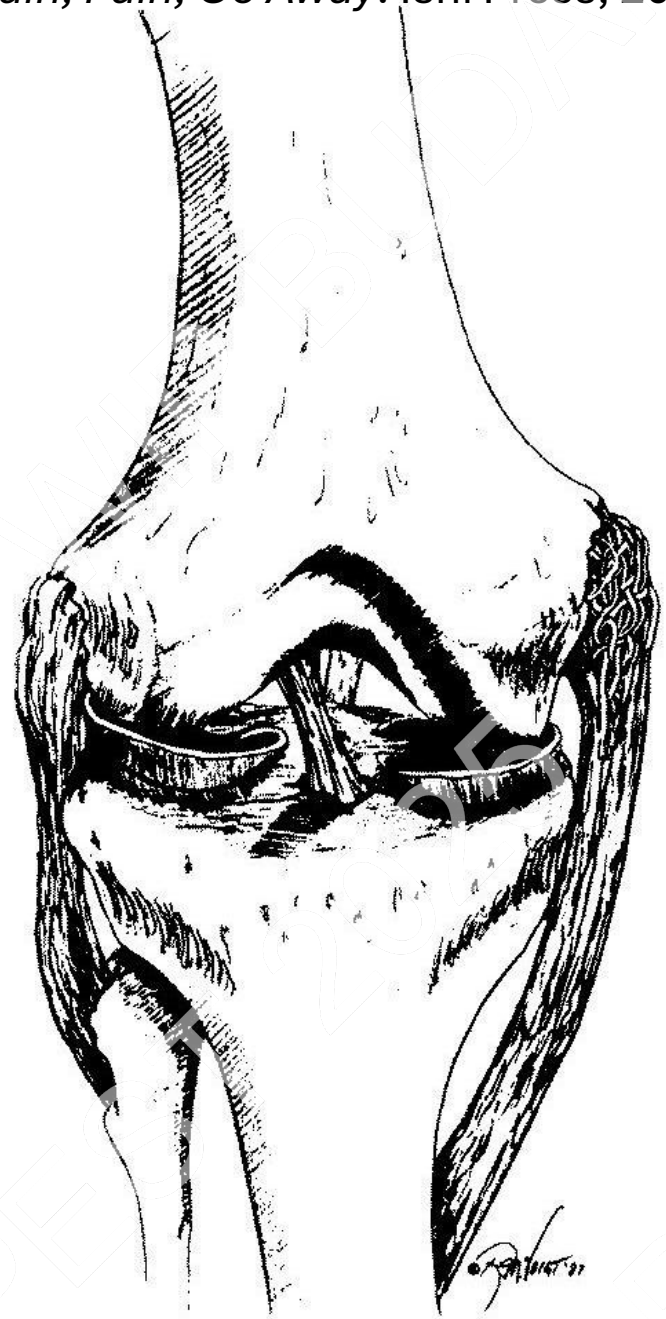

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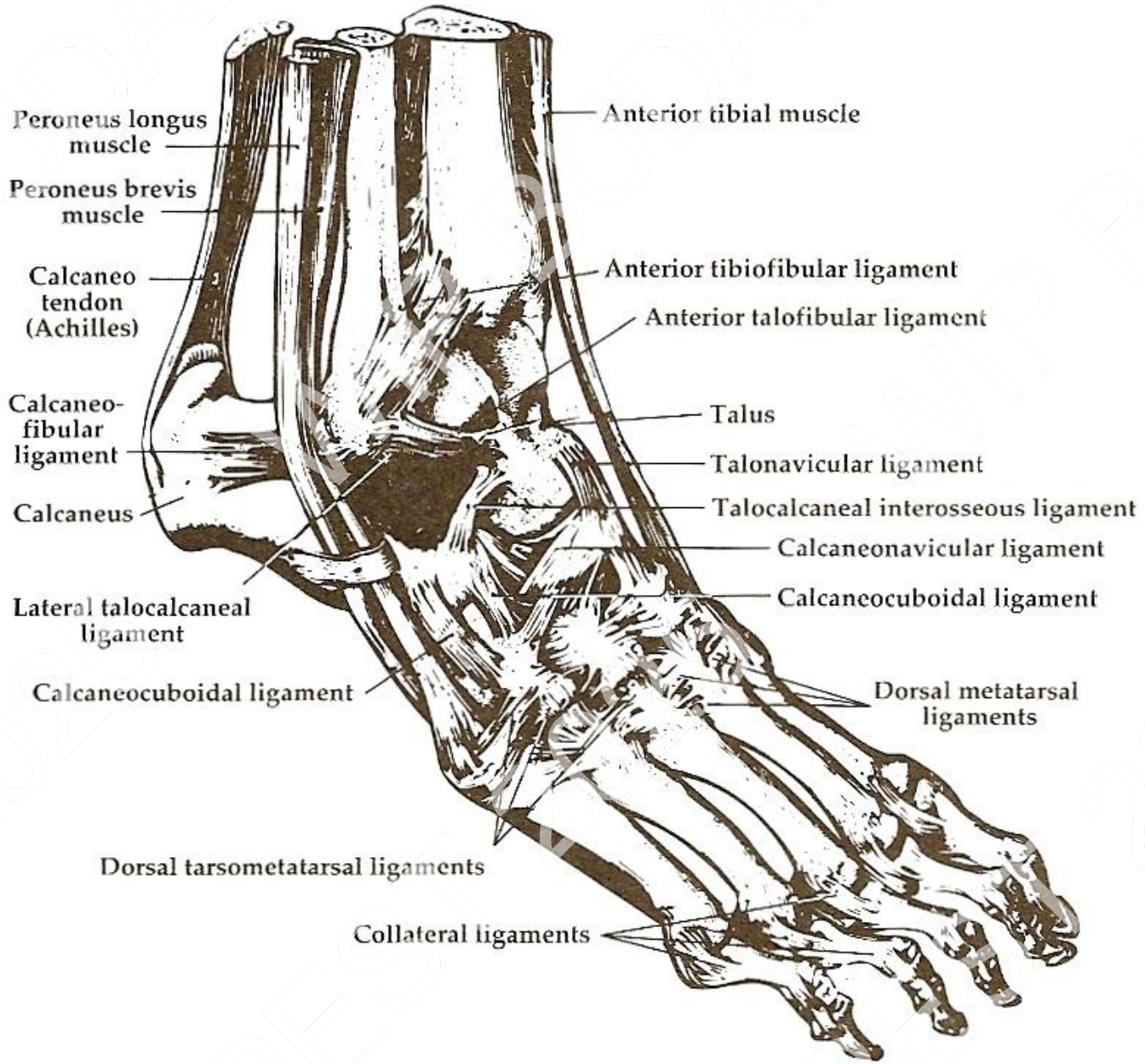
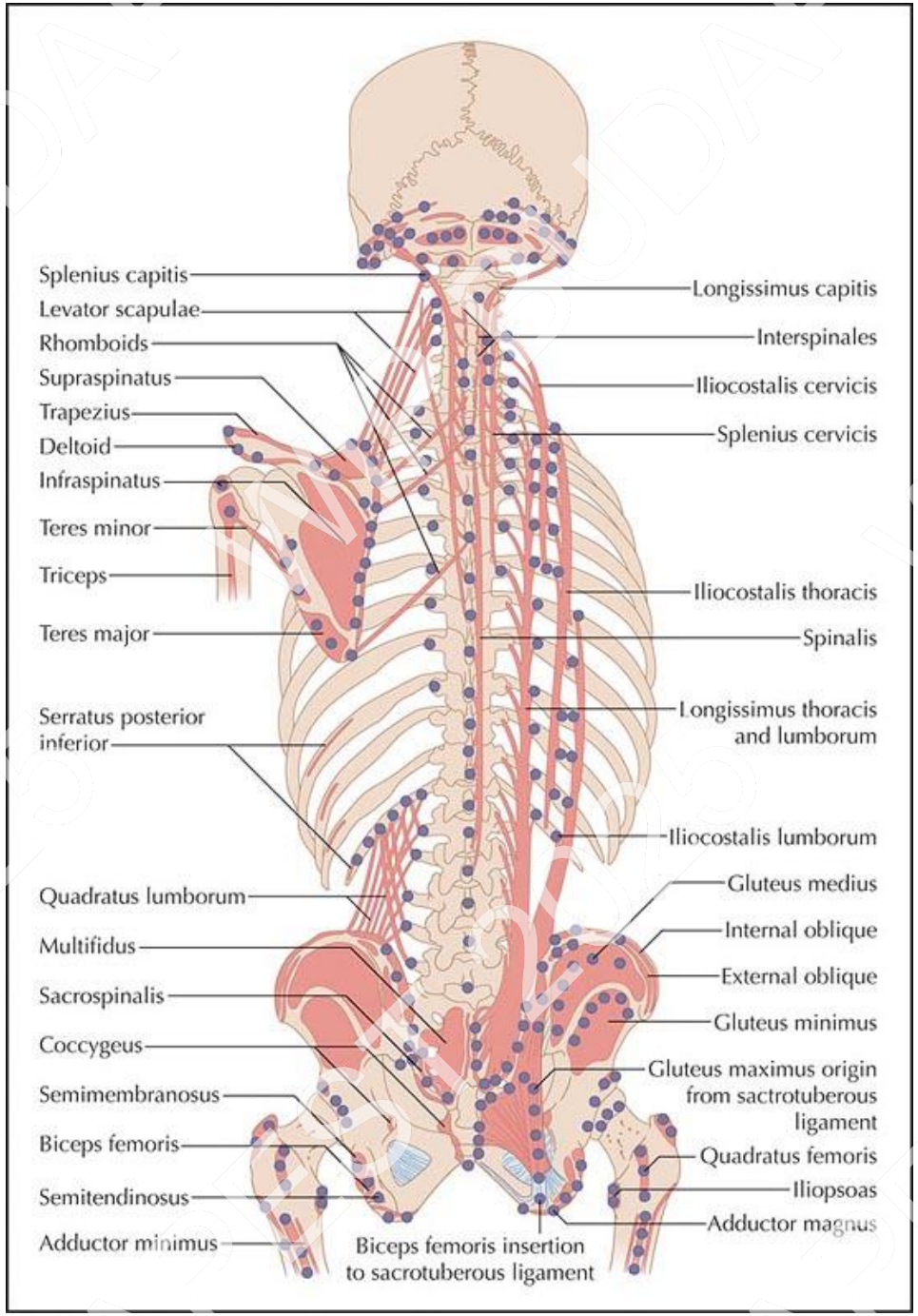



Splenius capitis
Levator scapulae
Rhomboids
Supraspinatus
Trapezius
Deltoid
Infraspinatus
Teres minor
Triceps
Teres major
Serratus posterior inferior
Quadratus lumborum
Multifidus
Sacrospinalis
Coccygeus
Semimembranosus
Biceps femoris
Semitendinosus
Adductor minimus
Longissimus capitis
Interspinales
Iliocostalis cervicis
Splenius cervicis
Iliocostalis thoracis
Spinalis
Longissimus thoracis and lumborum
Iliocostalis lumborum
Gluteus medius
Internal oblique
External oblique
Gluteus minimus
Gluteus maximus origin from sactrotuberous ligament
Quadratus femoris
Iliopsoas
Adductor magnus
Biceps femoris insertion to sacrotuberous ligament


Platelet-poor plasma
Buffy coat (platelets and white blood cells)
Red blood cells

Platelet Rich Plasma

- Function of:
  - Baseline platelet count
  - Baseline platelet function
  - System for concentration
    - Optimal concentration of a platelet-rich plasma (PRP) for angiogenesis is 1.5 – 3.0 million platelets/µL
      - About 10X baseline normal platelet count
    - Some systems only concentrate 4X

Comparison of the Platelet-Rich Plasma System

Anticoagulated Blood Processed (ml)	Baseline Platelet Count X10^3/µl	Platelet Concentrate Vol-mL	Platelet Concentrate Count X10^3/µl	Platelet Yield %	Total Platelets X 10^6	CV %
Harvest 60 ml / n=47	226 ± 29	10.1 ± 0.17	1019 ± 145	75.8 ± 4.7	10291 ± 658	6.2
Harvest 60 ml / n=21	223 ± 18.6	7.2 ± 0.3	1445 ± 177	78.5 ± 3.4	10259 ± 430	4.3
Biomet 60 ml / n=6	192 ± 48	5.5 ± 0.2	809 ± 396	42.6 ± 9.0	4450 ± 350	21.1
Arteriocyte 60 ml / n=6	224 ± 26.4	10 ± 0.1	818 ± 168	60.9 ± 5.5	8180 ± 204	9.0
CASCADE 10 ml / n=6	232 ± 41.4	5.0 ± 1.0	246 ± 51.3	57.9 ± 11.9	1230 ± 291	20.5
Arthrex 10 ml / n=6	185 ± 45	4.3 ± 0.6	265 ± 111	61.5 ± 14	1140 ± 303	22.7
Angel 60ml / n=5	186 ± 35.5	7.2 ± 0.5	736 ± 0.5	46.6 ± 5.1	5203 ± 1159	10.9

A comparison of the PRP products prepared by various systems.
The baseline whole blood samples are indicated. CV-Coefficient of variation.

Potential Benefits of PRP

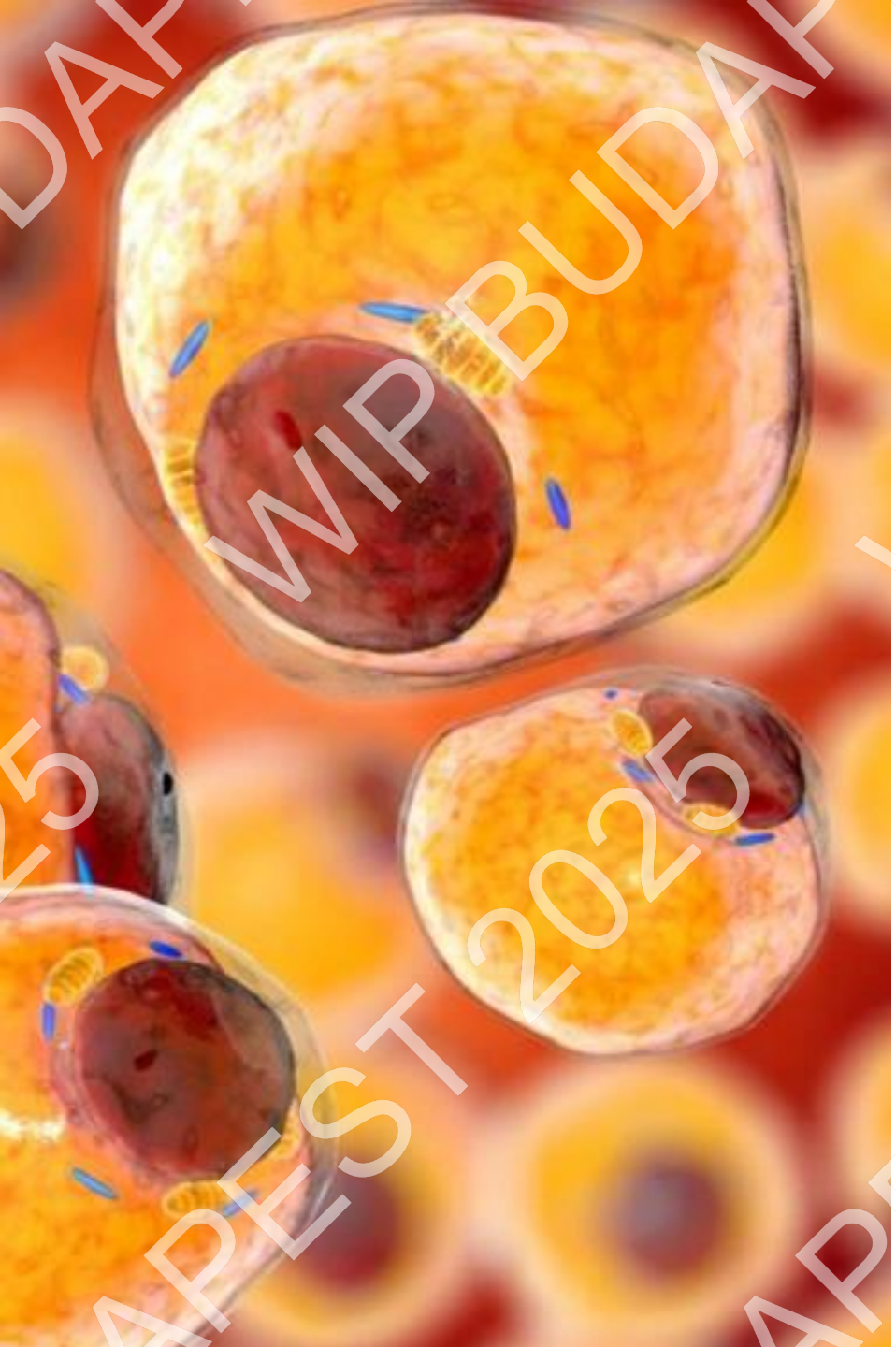
- It's autologous; resulting in no immunogenic response or pathogenic transmissions
- Provides the full array of naturally occurring growth factors to initiate both soft tissue and bone healing
- Enhances angiogenesis
- Increases collagen content
- Bactericidal / antimicrobial effect at the wound site (WBC's and direct antimicrobial effects)

Stem Cell Sources

- Bone marrow aspiration
- Fat mini liposuction
- Enhanced blood filtration
- Autologous stem cell culture (not allowed in USA)
- Umbilical/amniotic fluid-derived allogenic stem cells

Bone Marrow Aspirate and Concentration (BMAC)

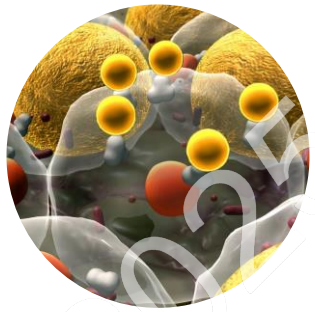
Bone Marrow contains both hematopoetic and mesenchymal cells, as well as many other premature multipotent stem cells



WHAT IS MICROFAT (MFAT)?

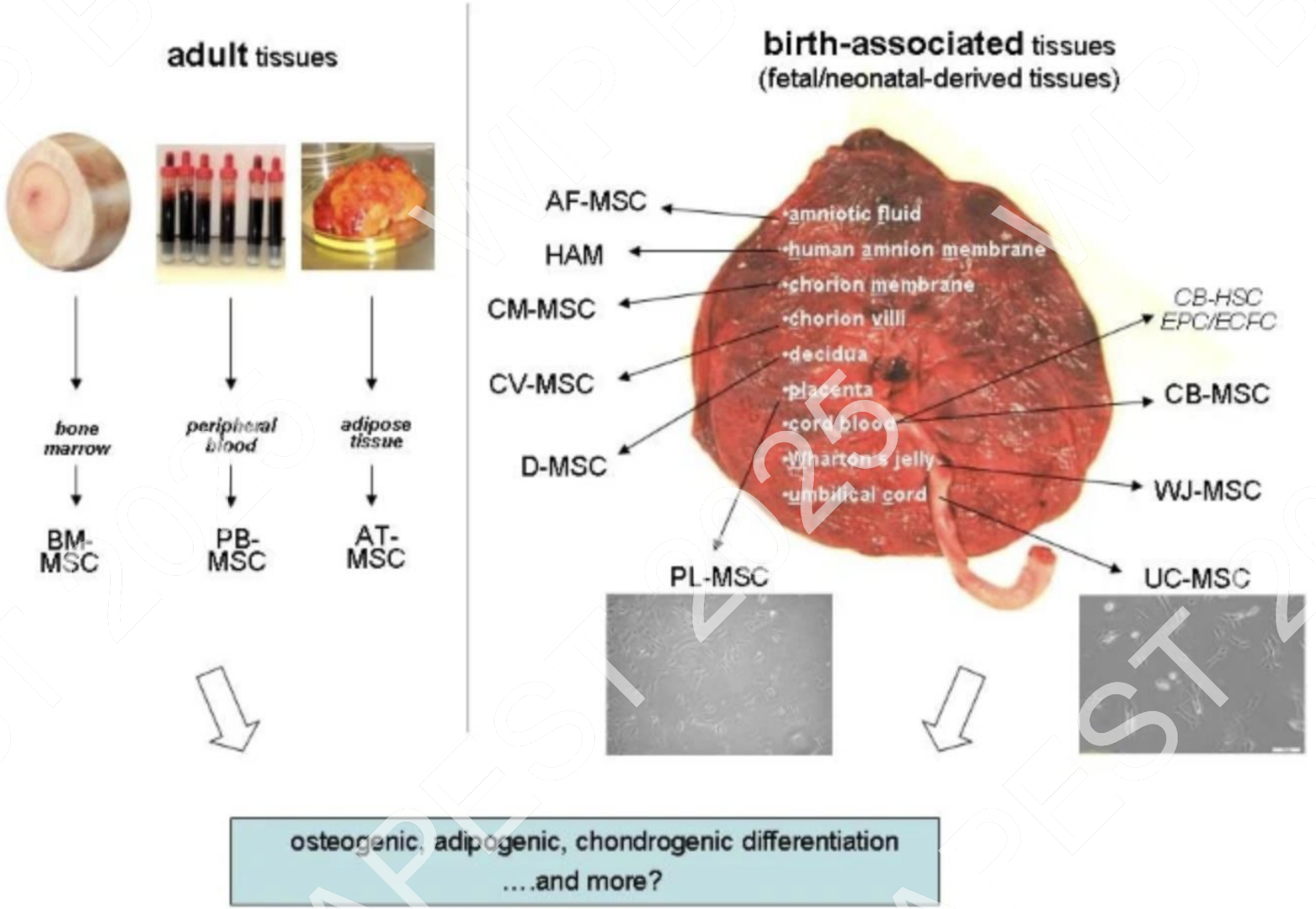
- Microfragmented fat contains adipose (fat) tissue, stromal cells preserved in their native niche.

- It consists of all components of adipose tissue



- Microfat is typically 300microns-800µm and considered an autologous biological substance for healing, restoration, and repair of tissues.

Placental Derived Stem Cells



Stem Cell Grafts Indications

1. Severe tendon degeneration, defects
2. Moderate to severe arthritis
3. Non healing fractures
4. Osteochondral defects OCD's
5. Avascular necrosis AVN
6. Failed PRP treatment
7. Cartilage , labral, and meniscal repair

So What Kind of Regenerative Injections?
Prolotherapy vs PRP vs BMC vs Adipose vs Stem Cell Products

PRP vs BMAC

Platelet Rich Plasma

- Derived from a patient's own blood
- Contains platelets and growth factors
- DOES NOT contain stem cells

Bone Marrow Concentrate

- Derived from a patient's own bone marrow
- Contains platelets and growth factors
- Contains adult stem cells
  - Mesenchymal stem cells
  - Hematopoietic stem cells
  - Endothelial progenitor cells
- **Provides both cells and growth factors to treatment location**

Comparison of Component Parts

BMAC Composition

- Plastic adherent stromal cells (MSC)
- Hematopoietic stem cells (HSC; CD34+)
- Endothelial Progenitor Cells (EPC)
- Non adherent mesenchymal stem cells
- Platelets
- Lymphocytes
- Monocytes & macrophages
- Granulocytes

Culture Expanded MSC

- Plastic adherent stromal cells expanded to large numbers in culture (a sub-population of more mature MSC's)

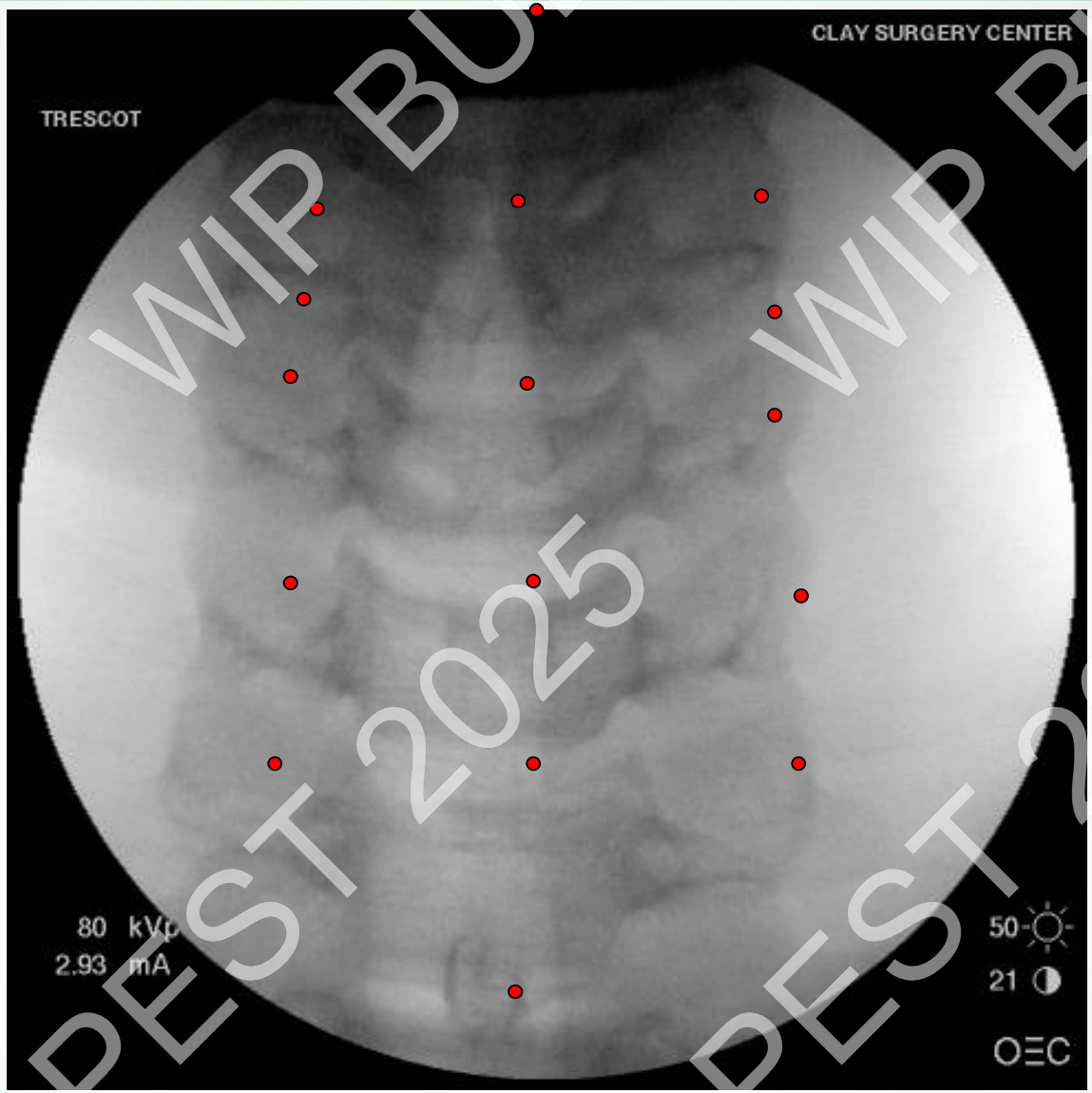
Zhang et al ; Therapeutic potential of non-adherent BM-derived mesenchymal stem cells in tissue regeneration. *Bone Marrow Transplantation* 2009 43 69-81

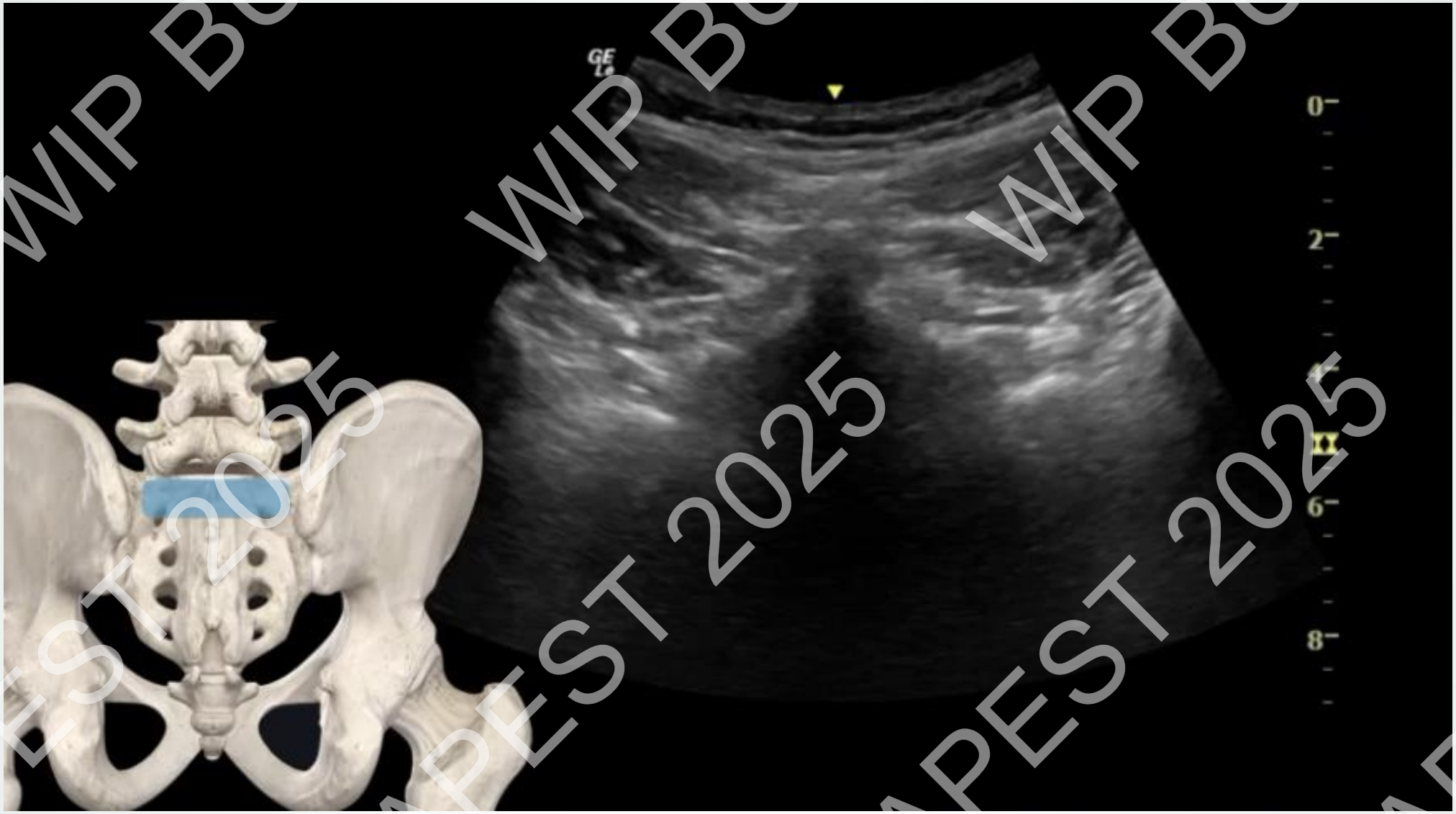
When?

- When all else has failed??
- After degenerative changes have occurred?
- At onset of pain?
- At onset of injury?
- Prophylactically?

How?

- Although I often do prolotherapy landmark-guided in patients with good anatomy, I am meticulous about where (and therefore how) I inject these very expensive orthobiologics, so I use imaging.
  - Fluoro
    - Fast
    - Big field
    - Excellent bony landmarks
  - US
    - More likely to be in your office
    - No radiation
    - Smaller field





Pre-Injection Protocol

NSAIDs have a negative effect on platelet function, which may decrease GF release

- Most authors recommend stopping for 7 days before and up to two weeks post injection

I insist on no tobacco for 14 days

Post Injection Rehab

- There are no studies on post procedure rehabilitation protocols

- Authors vary from no restrictions to temporary restriction with gradual return to full activities

Contraindications

Anti-platelet medications- high dose ASA, Plavix, Ticlid

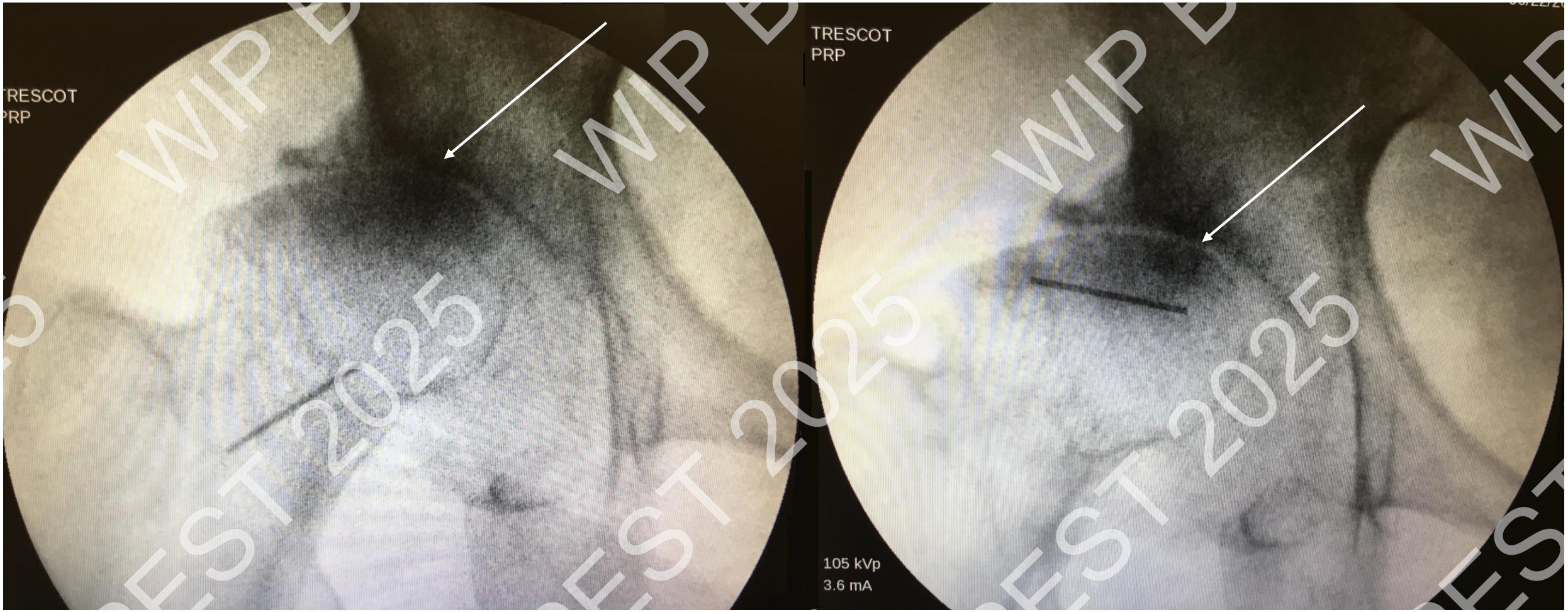
Anti-coagulants-Coumadin

Bleeding/clotting disorders

Thrombocytopenia < 50K

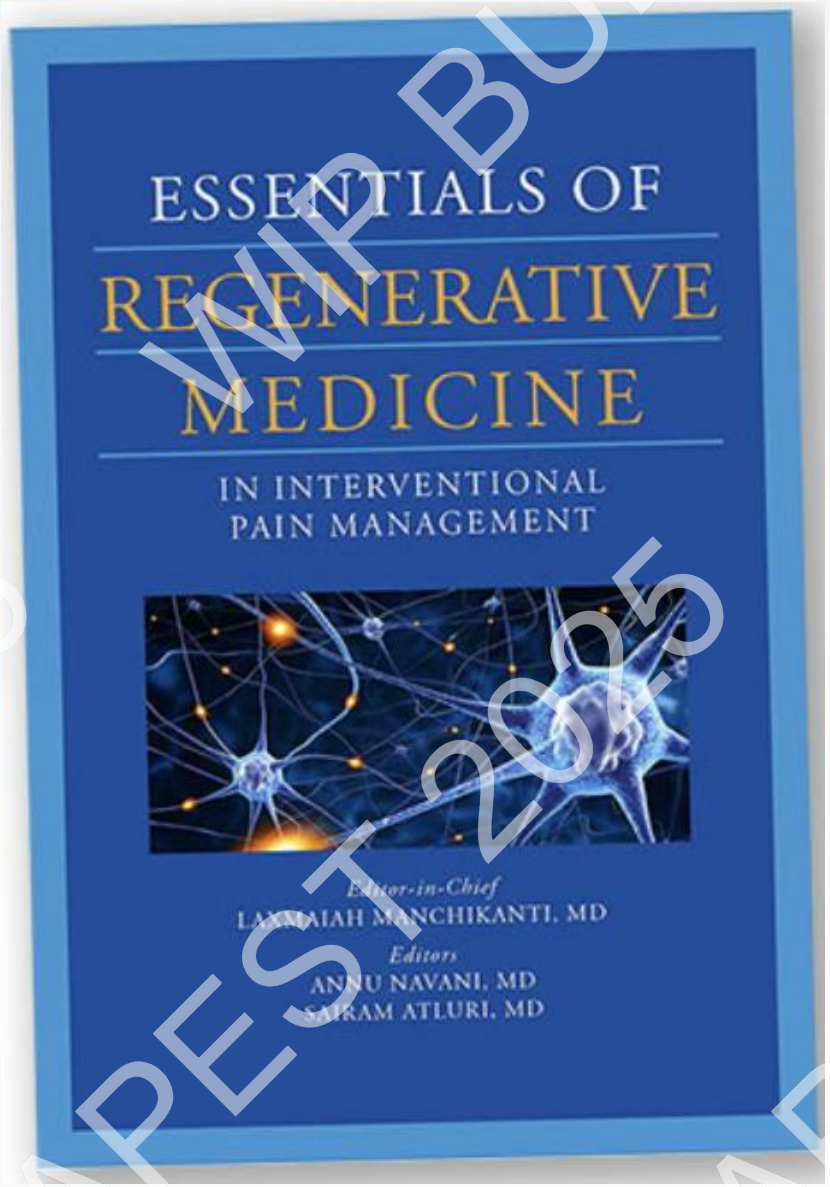
Blood borne cancers-lymphoma, leukemia

Does Regenerative Injection Therapy Really Work?

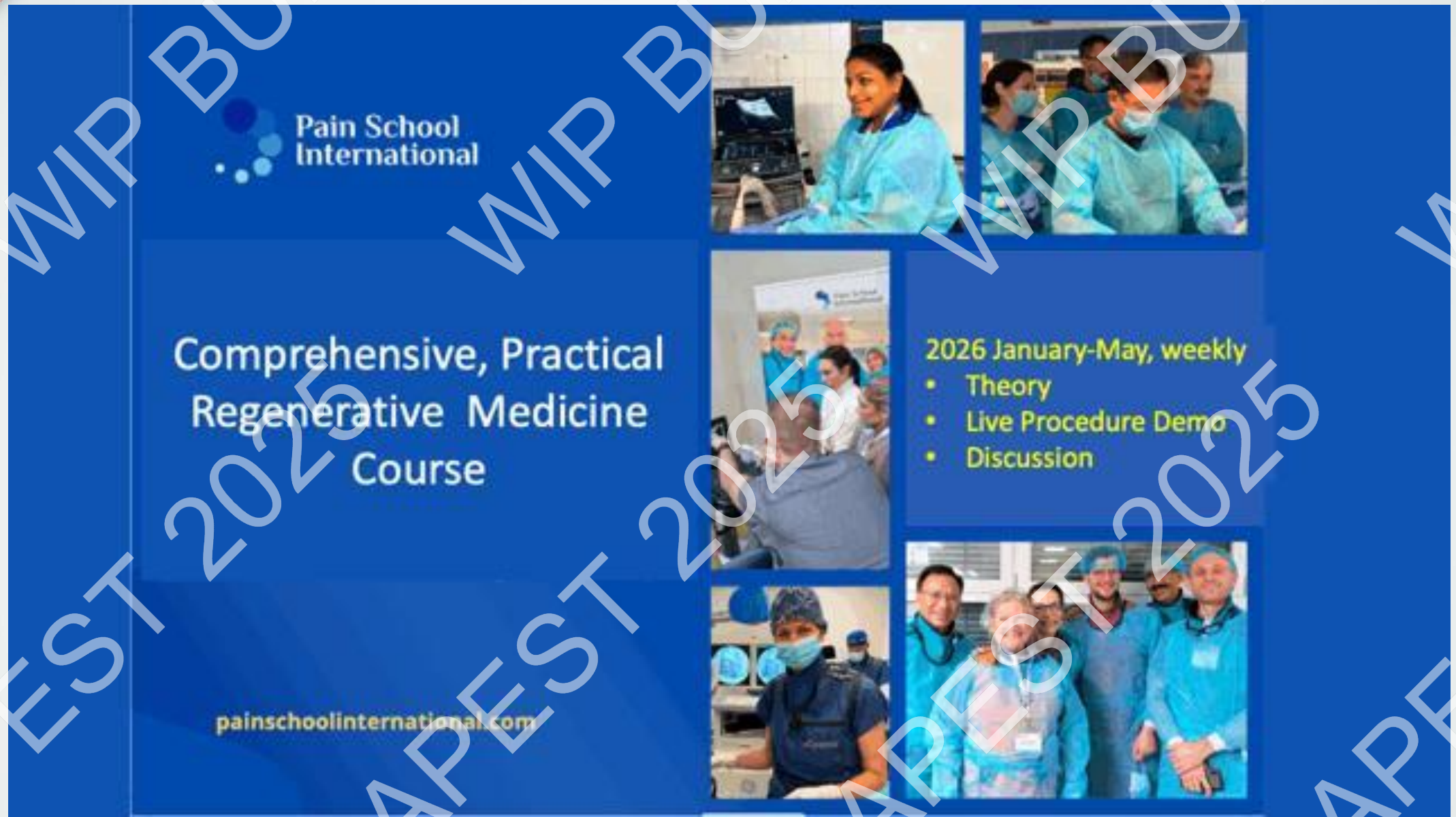


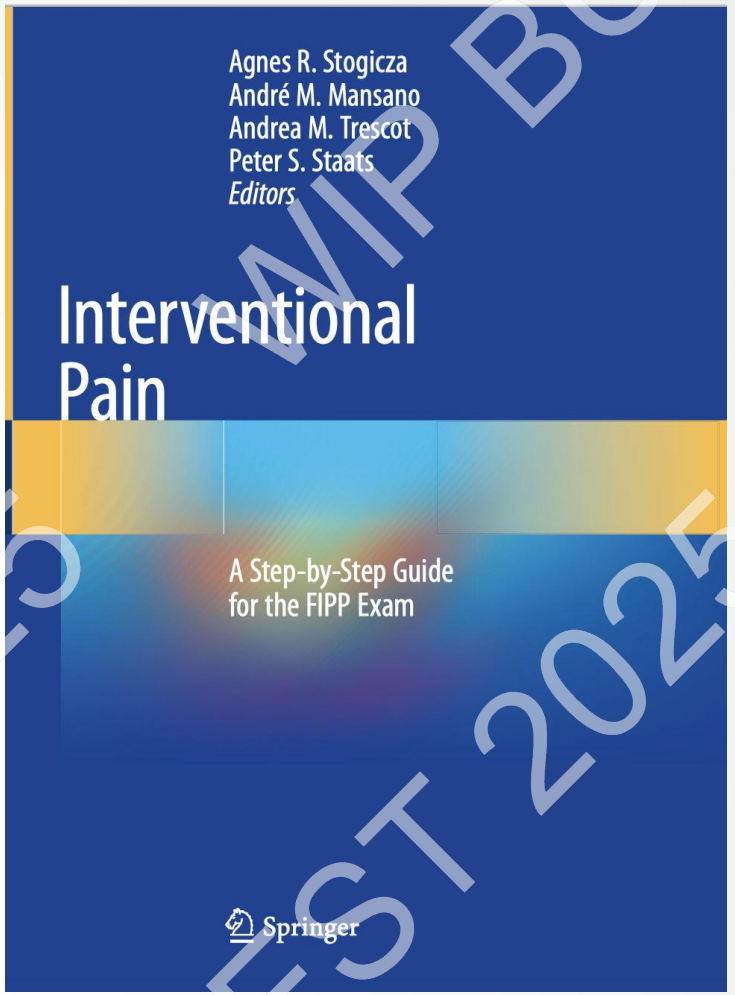
Who Makes a Good Candidate for Regenerative Injection Therapy?

- No evidence of severe stenosis or HNP.
- No active radiculopathy.
- No internal disk disruption/annular fissures/HIZ.
- Pain arising from sacroiliac joints, facet joint, and posterior ligaments.
- Leg pain caused by referred phenomena from ligament and joint.
- Patients with good job satisfaction and with good employers/employee relationships.
- Patient with a high motivation to return to work that will be honest about reporting improvement.
- Patient willing to submit to invasive procedure for the treatment of pain.



www.ASIPP.org





Thank you

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