CONTROVERSES ET ACTUALITÉS EN CHIRURGIE VASCULAIRE

CONTROVERSIES & UPDATES IN VASCULAR SURGERY

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MARRIOTT RIVE GAUCHE & CONFERENCE CENTER

PARIS, FRANCE WWW.CACVS.ORG

Paget-Schroetter syndrome should be treated very aggressively (resection of the ribs and venous reconstruction) Against …?

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I have the following potential conflicts of interest to report:

- ☐ Consulting
- ☐ Employment in industry
- ☐ Shareholder in a healthcare company
- ☐ Owner of a healthcare company
- ☐ Other(s)
- ☐ **I do not have any potential conflict of interest**

Subclavian vein thrombosis overwiew

Thrombosis of the upper limbs (Cruveilhier 1816 – Paget 1875 – Schroetter 1884)
5-10% Venous thromboembolism
Primary venous thrombosis (20-30%):

- Idiopathic
- Effort (Paget-Von Schroetter syndrome): intense (bodybuilding, heavy loads) or repeated (movements in height, hyperabduction)
- Thoracic Outlet Syndrom

Secondary vein thrombosis (70-80%) :

- Clavicle fracture displaced, shoulder surgery..
- Cancers (40%): Cervical mass or thoracic, Bronchial and breast adenocarcinomas,
  Lymphomas,Myeloproliferative syndromes
  Hypercoagulability related to cancer, treatment
- Intravenous device (50-60%): implantable chamber, pace maker, defibrillators, hemodyalisis, central venous tract

Pulmonary embolism : < lower limb DVT, 7 %
19/154 = 12,3 % autopsy study of PE *(Lindblad & Al – Br Med J, 1991; 302: 709-11)*
Post-thrombotic syndrome : Retrospective studies 7%, Prospective studies 17 %

Higher mortality : compared to lower limbs due to underlying co-morbidity

Subclavian vein thrombosis overwiew

D-Dimer > 500 µg/l : Confidence Interval 95 % (74-100) Very low specificity …
Ultrasound +/-Doppler : Specificity 97 % (CI 95% : 90-100) - Incompressibility
Sensitivity (CI 95 % : 87-100)
In case of negativity and doubt, repeat 3 to 5 days after
Deficit of fibrinolysis is controversial : history of the thrombosis, risk factor indisputable in the management, however
Prandoni (26%) – Héron (44 % Idiopathic and 13 % Effort)

Treatment :

- Anticoagulation: Low molecular weight heparins, fondaparinux, intravenous or subcutaneous heparin (Grade IB). Rivaroxaban (Case studies)
  Duration: three months (Extended in case of cancer, Tinzaparin ++)
- Thrombolysis : Obstructive syndrome (7-40%), young people J7 ++
- Surgery : Phlebolysis, venous plasty, stent +/- medicated, endovenous lasers.. Artériolysis, Plexolysis Coast Resection

Clinical aspects: TOS

Arterial Signs: 30%

Pain and fatigue on exercise

Asymmetrical Raynaud syndrome, touching certain fingers, blue fingers, dead-arm sensation → IF 11% of cases

Super-acute ischemia (aneurysm with emboli), digital necrosis

Venous signs: 15%

Edema hands and fingers (dorsal surface +++)

Venous dilatation

Cyanosis

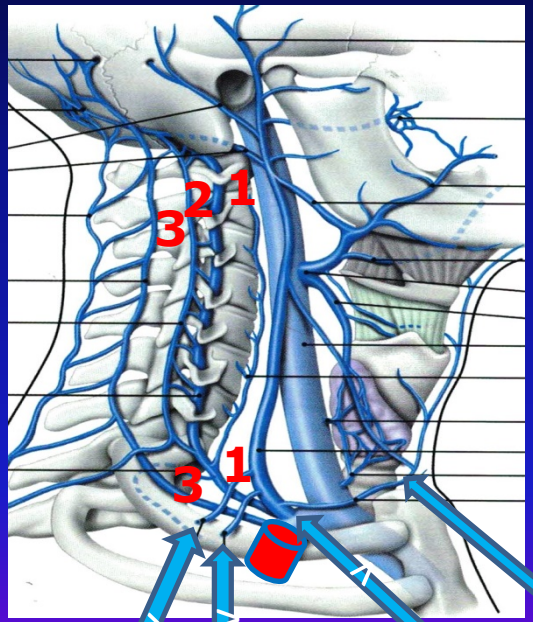
Thrombosis of effort, puncture (anesthetic)

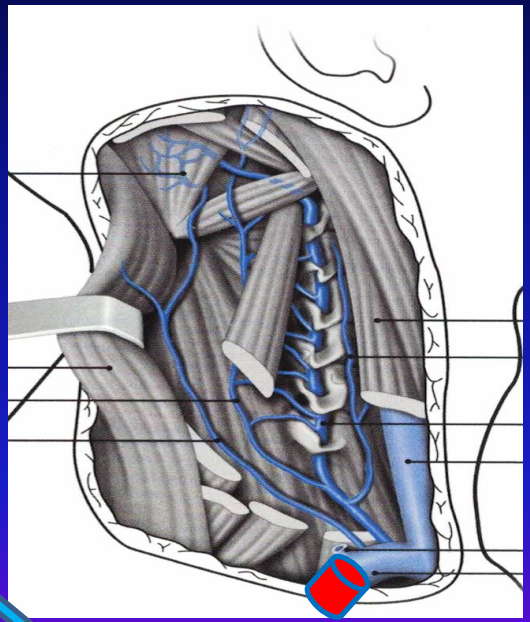
Lymphatic signs: edema, pachydermia, infections (thrombosis)
Post-thrombotic syndrome

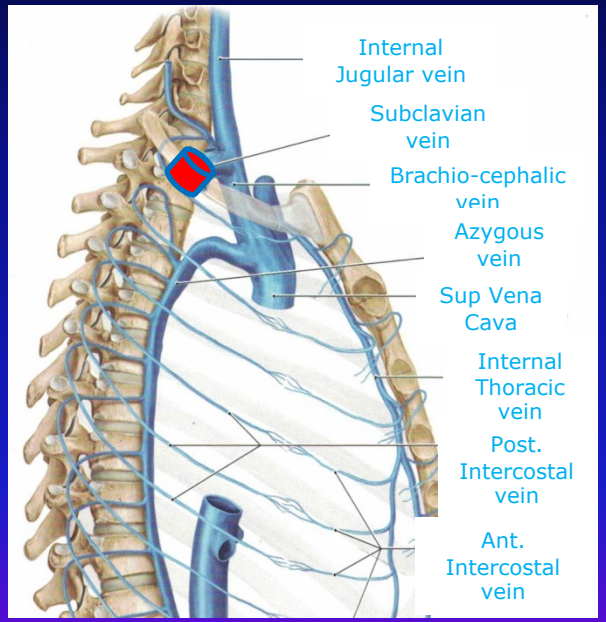
Rifgt Subclavian Vein Thrombosis

Subclavian Vein Thrombosis
Collaterality

Vertebral vein (1)
Vertebral accessory vein (2)
Deep cervical vein (3)







External, anterior jugular vein

Suprascapular vein

Transverse vein of the neck

Clinical aspects : History of TOS

Neurological signs: 90%

Pain, paresthesia, shooting pains, muscular atrophy (hypothenar ++) aggravated by retropulsion, sleep, carrying loads, work with arms raised, rarely permanent
Posterior headaches → Arnold neuralgia, Hemicranias
Sympathetic hyper-reactivity, sweating, feeling hot / cold hands → Algodystrophy
Heaviness of MS, alteration of gestures - hypothenar atrophy and thenarism,

High Plexic syndrome (scalene defile): anterolateral neck pain, upper thorax, jaw, atrial, inter scapulo-vertebral posterior, trapezius, deltoid, external arm (C5-C6)

Low Plexic syndrome (costoclavicular defile): Hollow-supraclavicular, subclavicular and axillary pain (posterior), inner face of the arm radiating to 4^{th} and 5^{th} fingers (C8-T1)

Syndrome of carpal tunnel: 35% of cases, confused with STTB
(patients operated without improvement of TOS)

Clinical aspects : History of TOS

Atrophy of the right Hypothenard eminence

Aggravating Factors

- Bone abnormalities, muscle, fascial ligament, cervical trauma, clavicular fracture

- Sports: heavy weight training, combat, MS traction (motorcycle, paragliding, horse riding, water skiing, Kite-surfing or ski, volleyball, tennis, paragliding ..

- Profession: (no recognition in occupational disease) heavy loads, carpentry and windows, shelving, storekeepers, painters, pallet pulling (estimate weight of loads)

- Hormonal treatments : Ethinyl Estradiol +/-, Ovarian stimulation ++

DEFILE OPENER MUSCLES

Physiotherapy ++

Large serrated

trapezoids

(upper and middle)

Rhomboid

Sterno-cleido-mastoid

Angular

DEFILE SHRINKER MUSCLES

Scalenus anterior and middle (bodybuilding ++)

Subclavian

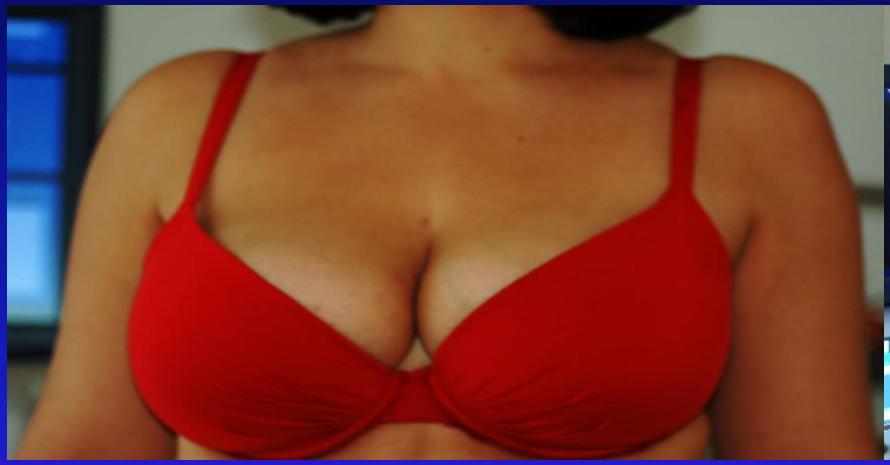
Small pectoral

Large pectoral

Large dorsal

Rib elevator

Clinical aspects



Pseudo-athletic shoulders
TOS ?

Athletic shoulders
Paget - Von Schroetter ?

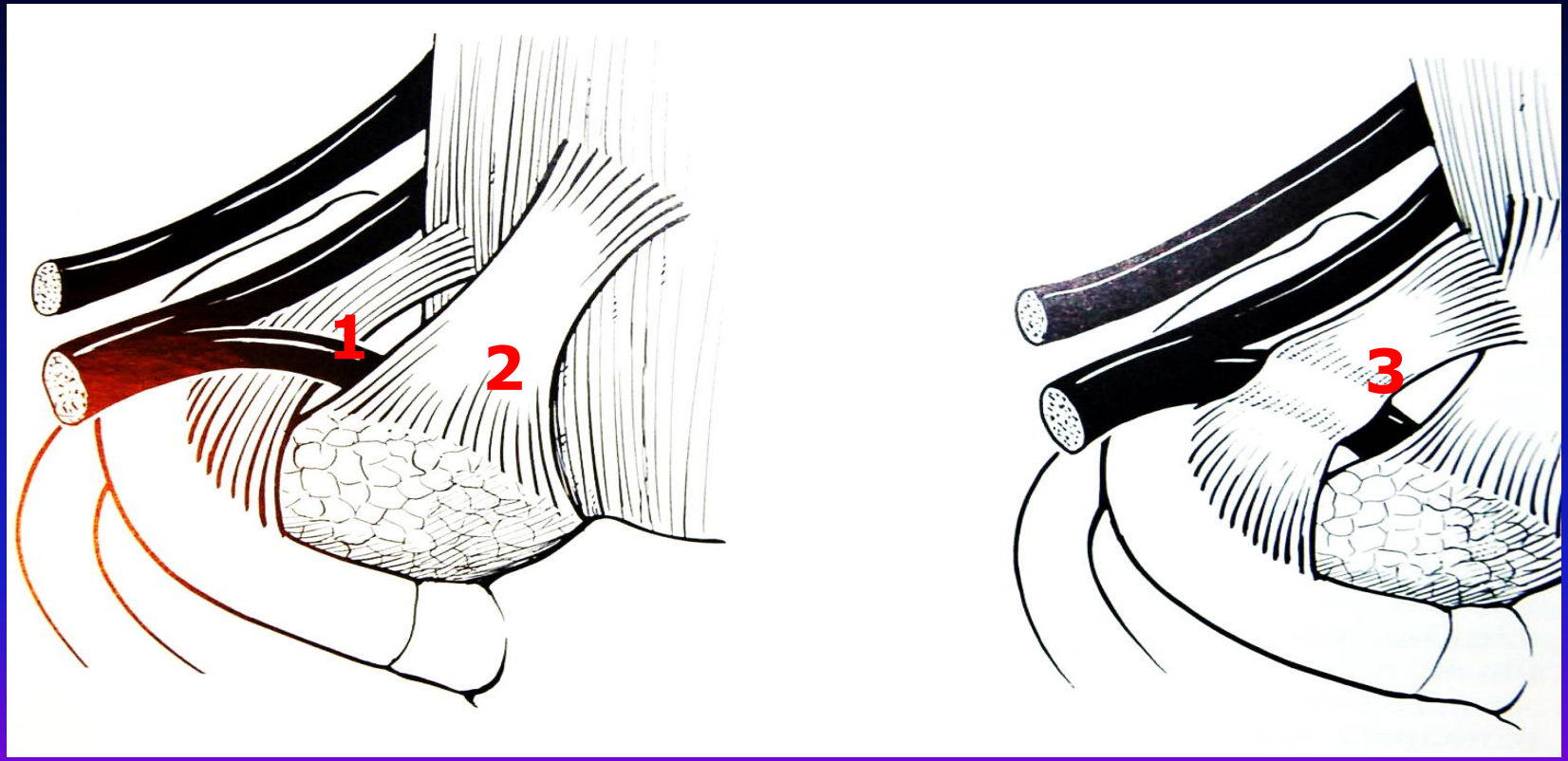
Anatomical abnormalities

Muscles and ligaments:

- Anterior scalenes, middle, sub-cavian
- Inter-scalenic ligament, scalene accessory
- Costo-pleural ligament, costo-costal ligament
- Fibrous cord: cervical rib, C7 apophysomegaly, C1 agenesis

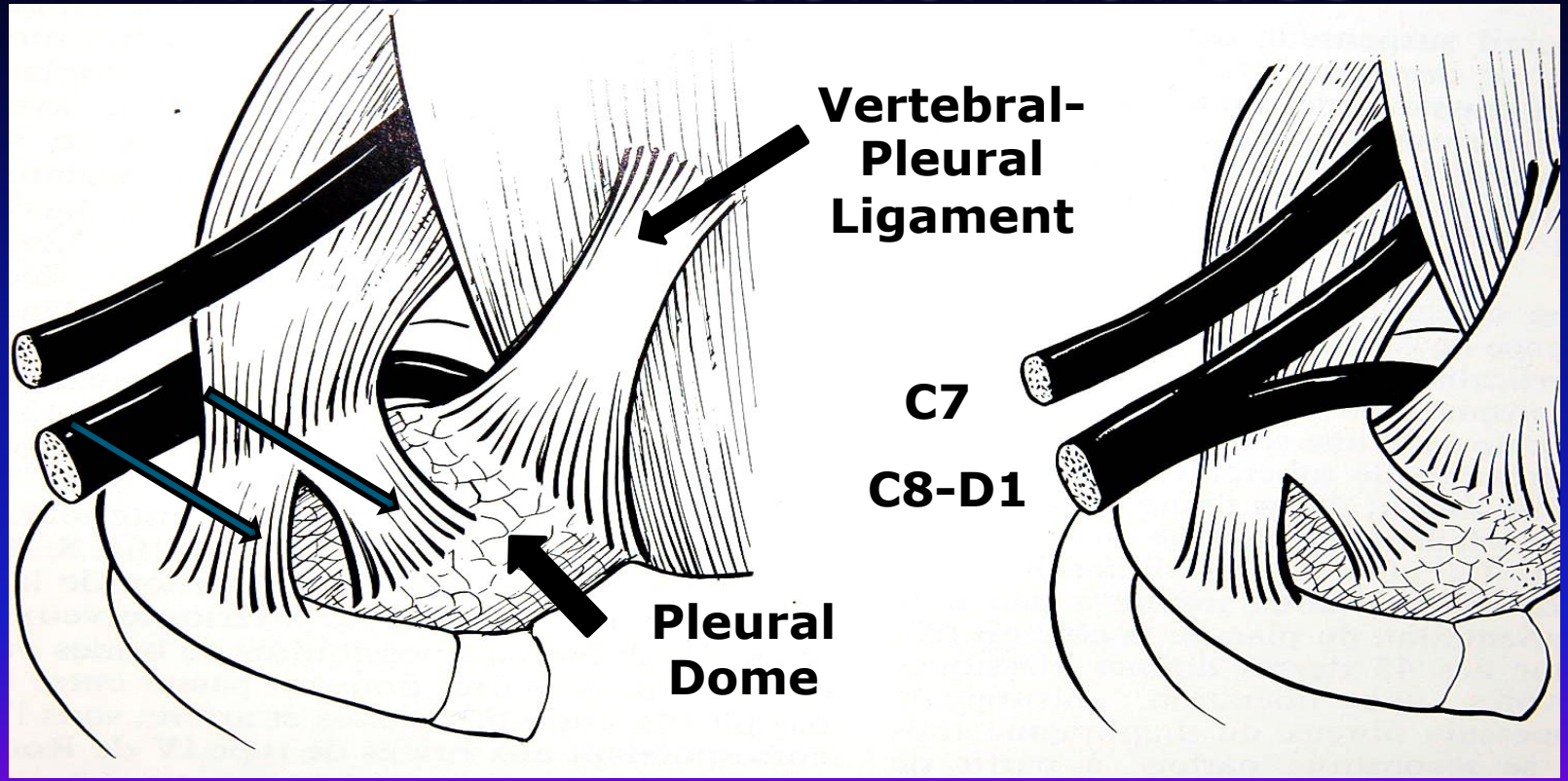
- **Bones:**
- Cervical Rib
- Apophysomegaly C7
- First rib (C1) anomaly
- Clavicular anomaly
- Spine abnormality
- Synostosis C1-C2

Anatomical abnormalities



D1 compression with a large transverse-costal ligament (1) and vertebropleural (2) or a transverse-costo-costal ligament (3)

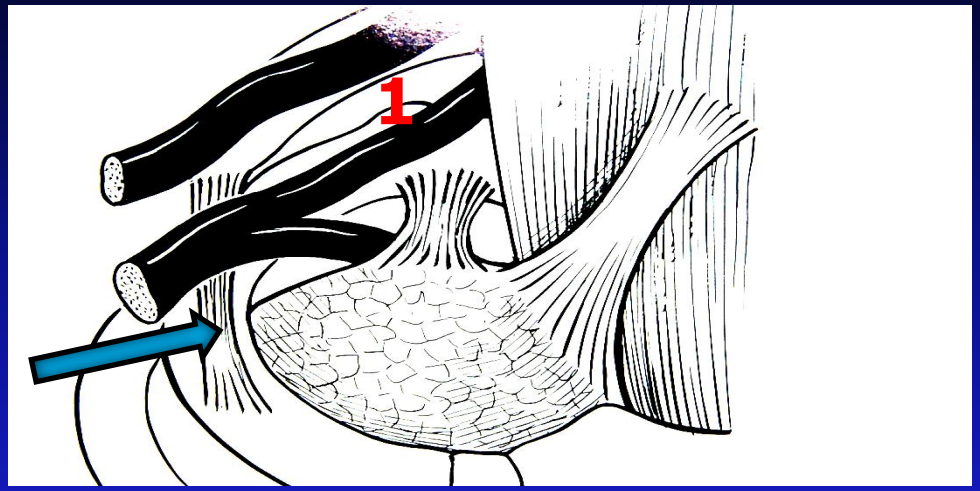
Anatomical abnormalities



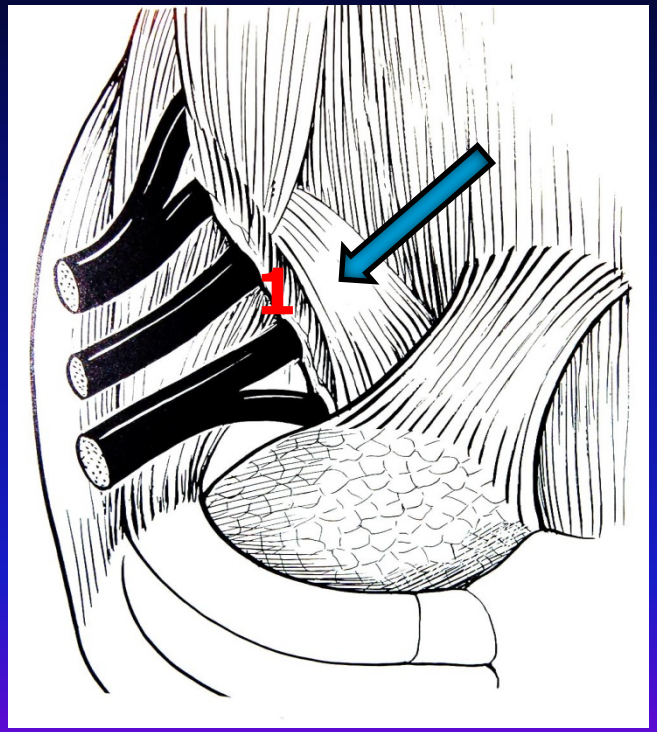
(Left): Small scalene passing between C7 and D1 pleural dome insertion

(Right): Small scalene passing behind the lower plexus
with elevation of the rib block for C8-D1

Anomalies anatomiques

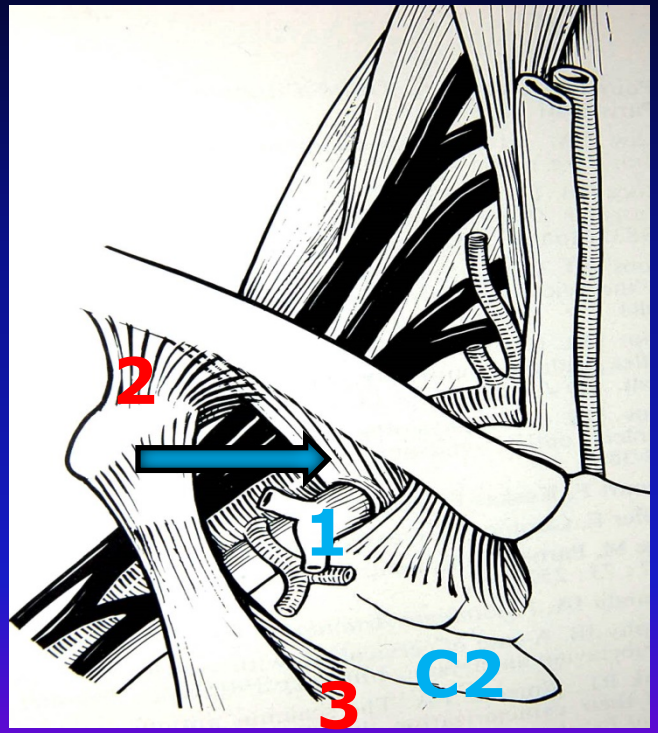


Cervical rib or C7 apophysomegaly **(1)**
Roos type I or II bridle



Scalene anterior intricate resected **(1)**
other scalenes, long neck, straight anterior

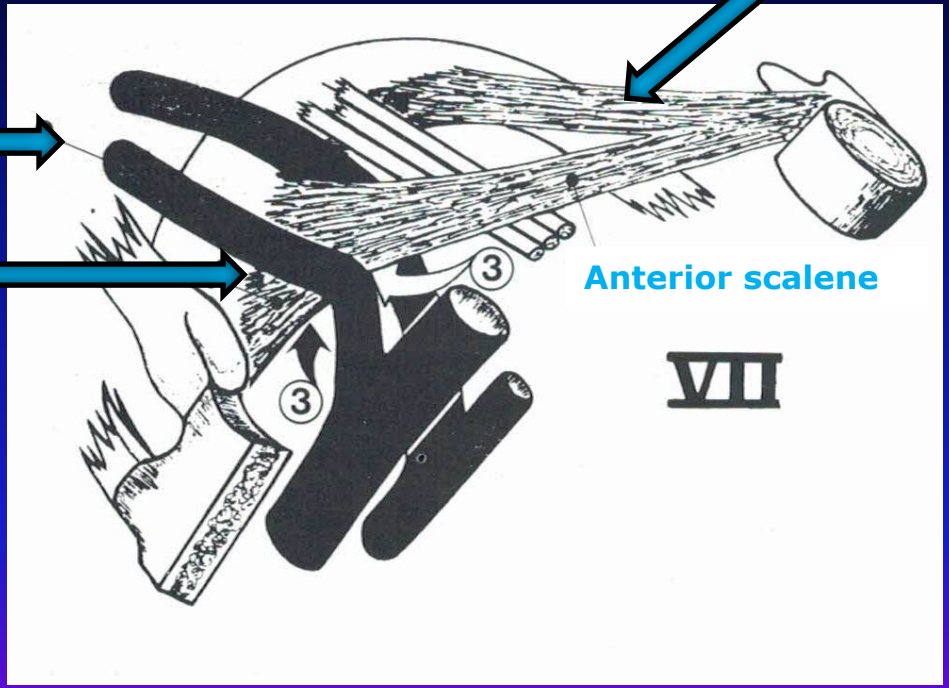
Anatomical abnormalities



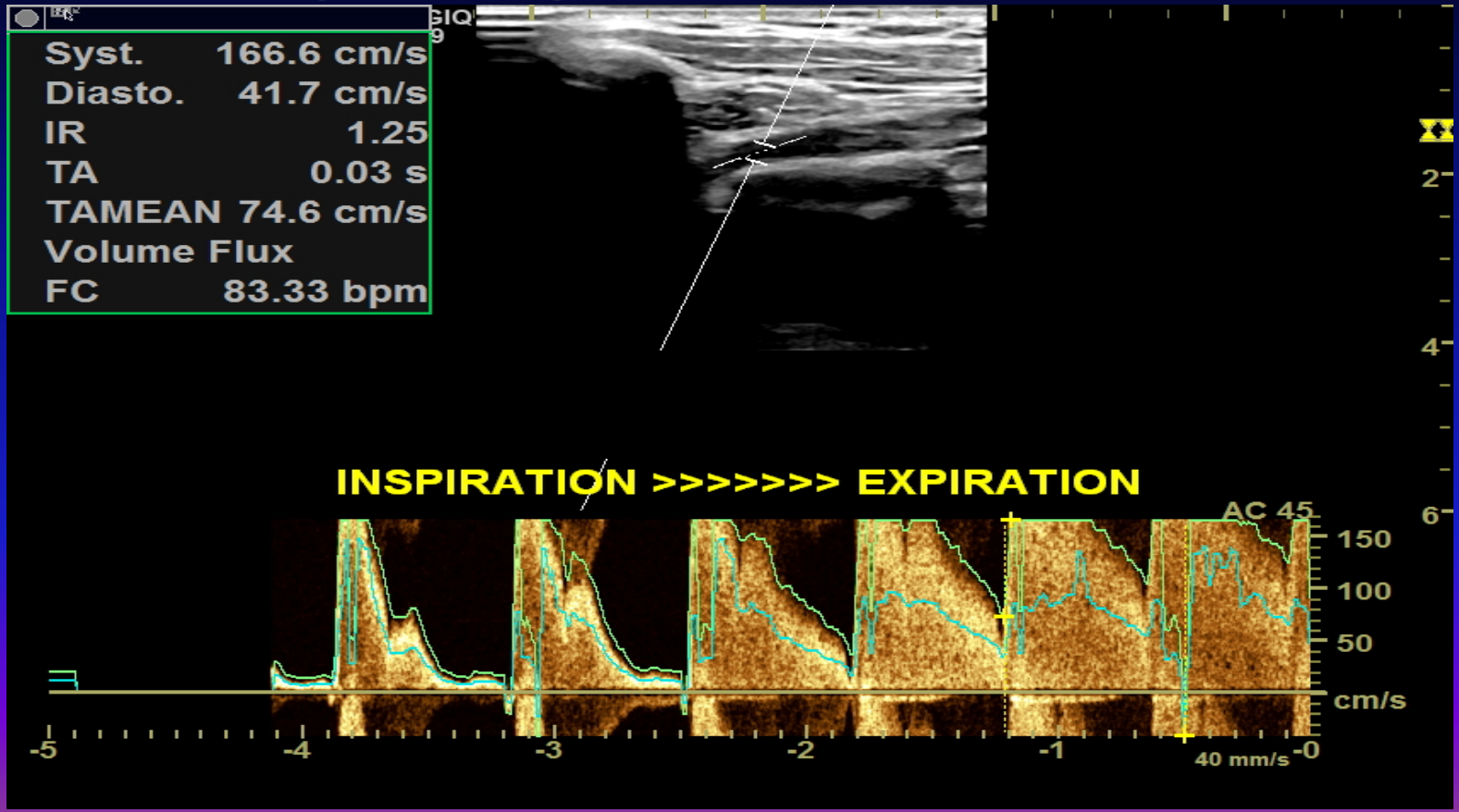
Subclavian muscle perforated by the Subclavian vein **(1)**

Upper insertions of the subclavian muscle combined with the medial coraco-clavicular ligament **(2)**. This ligament shares fibers with the coracoid tendon of the pectoralis minor, which emits an abnormal head towards C2 **(3)**.

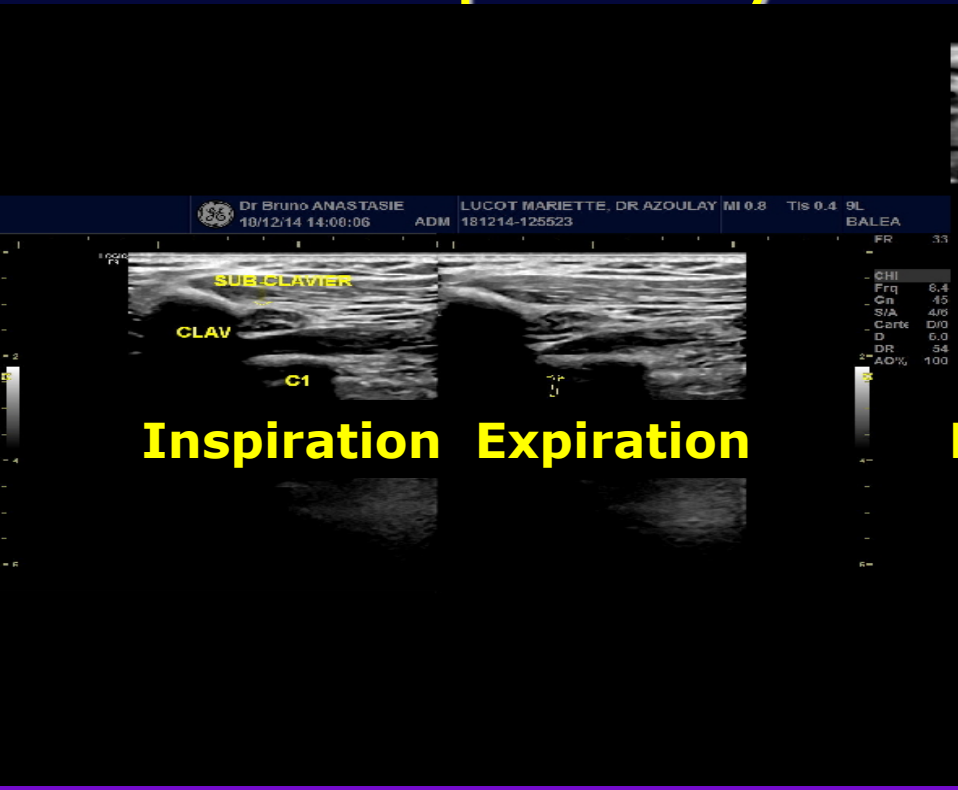
Anatomical abnormalities
Congenital band type VII of Roos

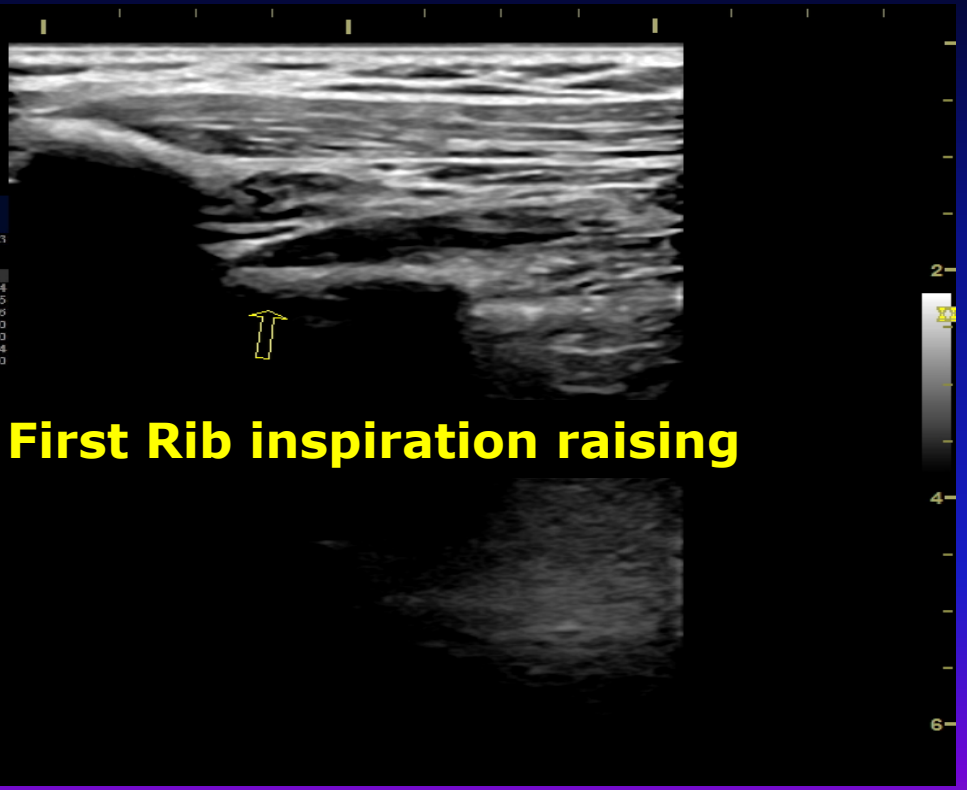


Anatomical abnormalities
Expiratory Paradoxical Effect

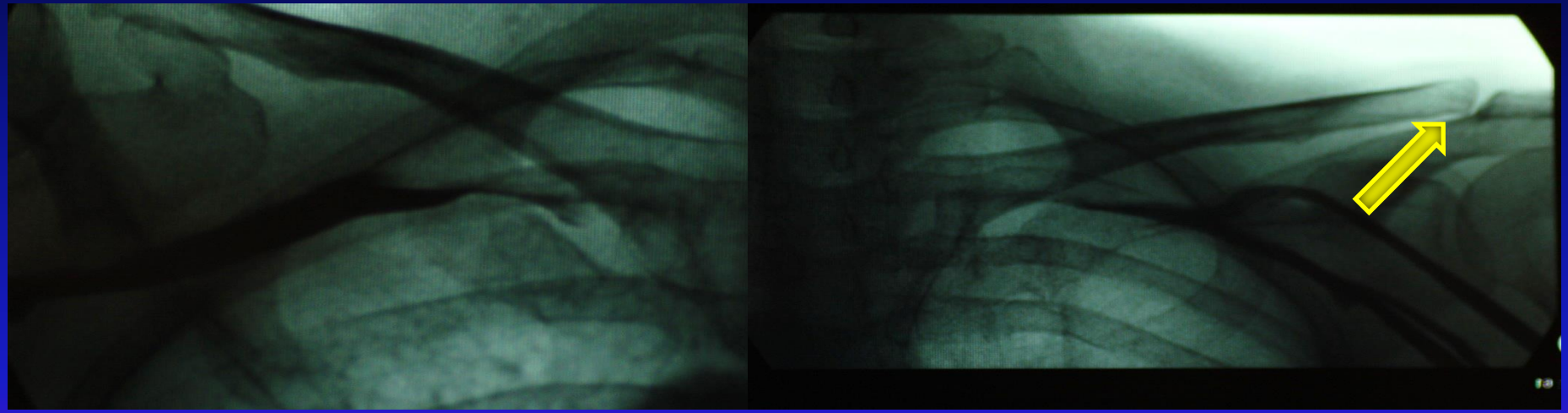


Anatomical abnormalities
Expiratory Paradoxical Effect

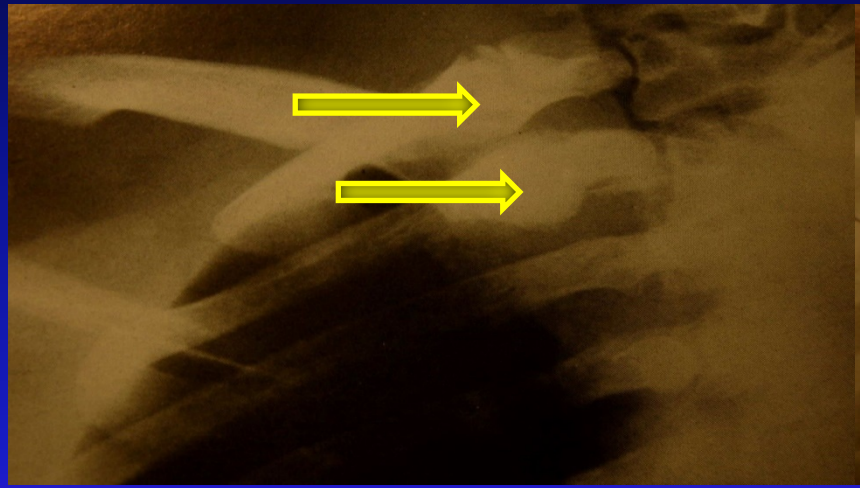




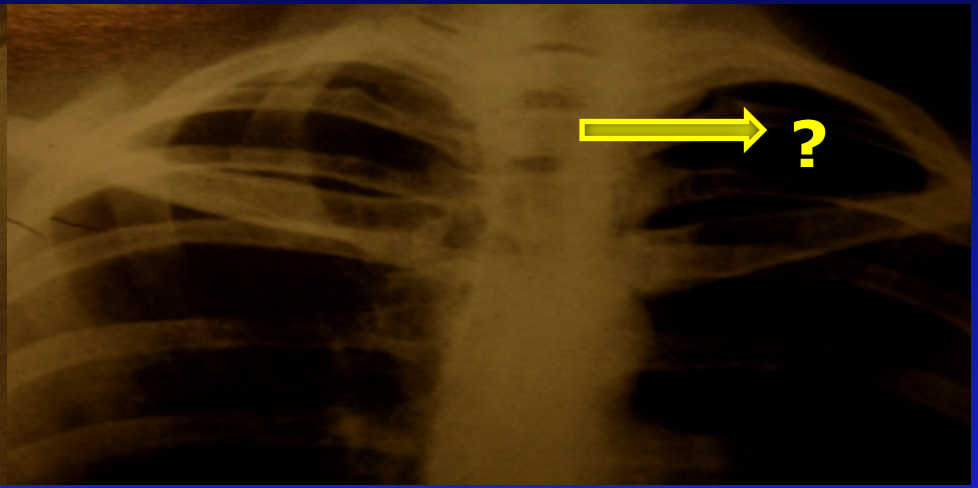
Bone anatomical abnormalities
Clavicular pseudarthrosis



Bone anatomical abnormalities

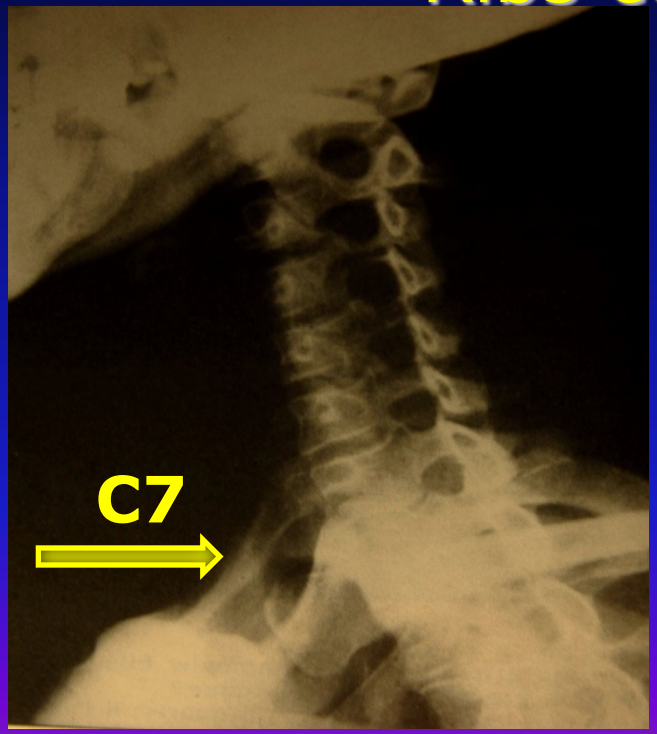


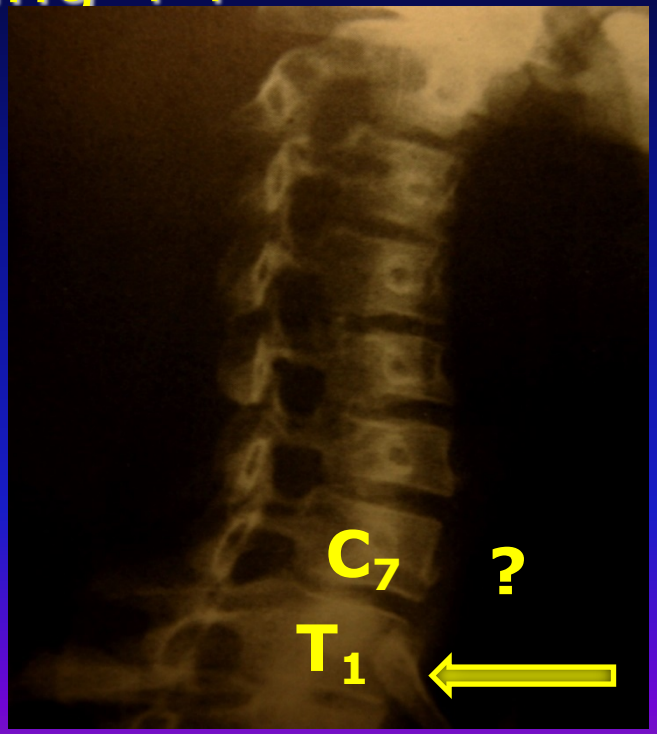
Fracture C1-C2 (exostosis)



Left C1 agenesis

Bone anatomical abnormalities
Apohysomegalia C7 or agenesis C1?
Ribs counting ++





Bone anatomical abnormalities
C_7 Apohysomegaly

Dynamic tests with active movements +++ Standardization of vascular and nervous exploration

Patient standing, profile, arms relaxed, operator front of the patient's left (right-handed), monitoring of the patient ++

Eden maneuver: simultaneous bilateral retropulsion

Pectoral parade

Wright maneuver (Candlestick):

Abduction (90 ° +++ →150-180 °), degree of abduction is noted

Retropulsion (45 °) → Hyperabduction syndrome ++

Calb and Roth maneuver (Medium scalene):

Wright + Contralateral rotation + blocked inspiration → Expiratory flow (lifting stenosis, expiratory paradoxical effect)

Adson maneuver (Anterior scalene): same with ipsilateral rotation of the head

Dynamic tests with active movements

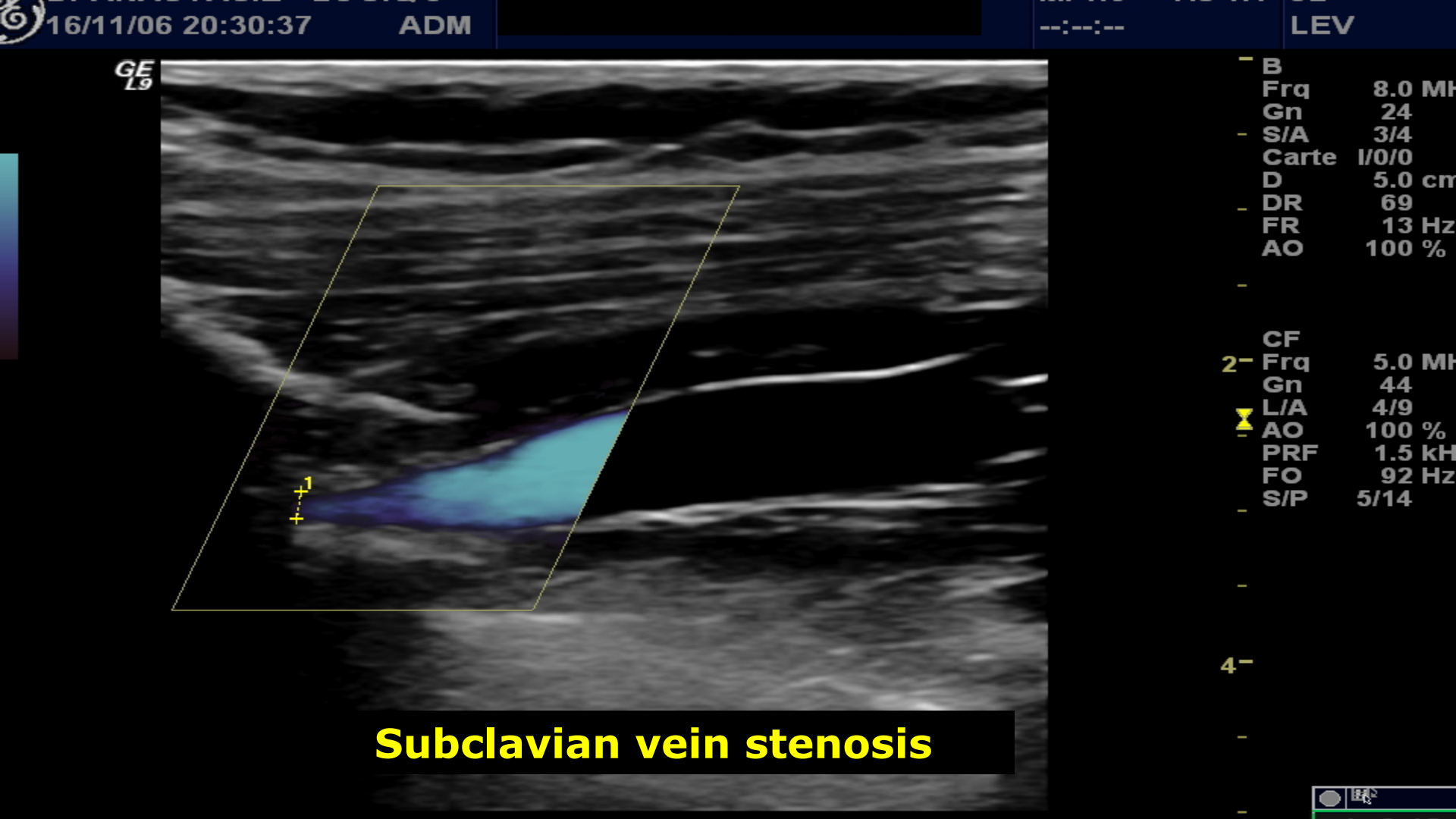
Post-Ischemic Flow: End of Test, Arms Relaxed, Speed ASC, Index of Resistance, Time Measurement Time on System Clock ☐ Degree of Compression

Small pectoral maneuver: antepulsion, opposing opposition of both hands

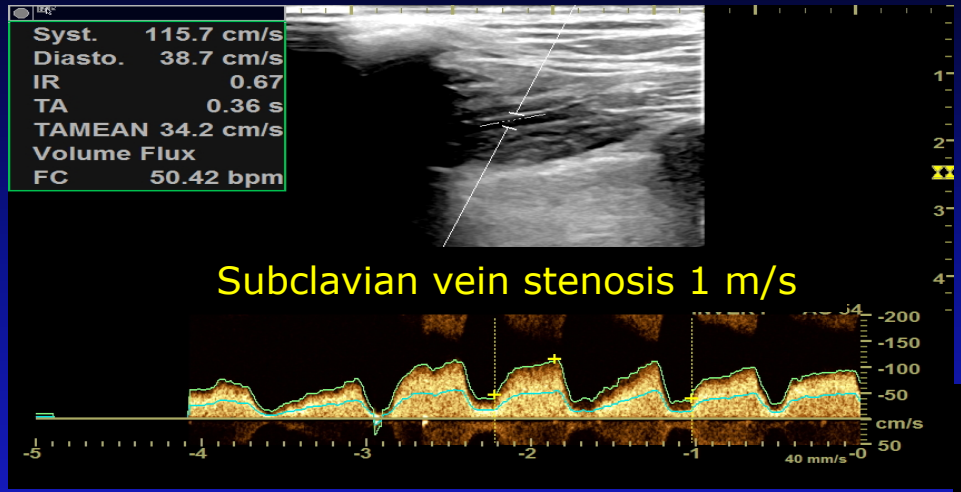
Radial ulnar division height: anatomical abnormalities

Study of scalenes (anterior and middle), brachial plexus: arms relaxed at rest, comparative measurements

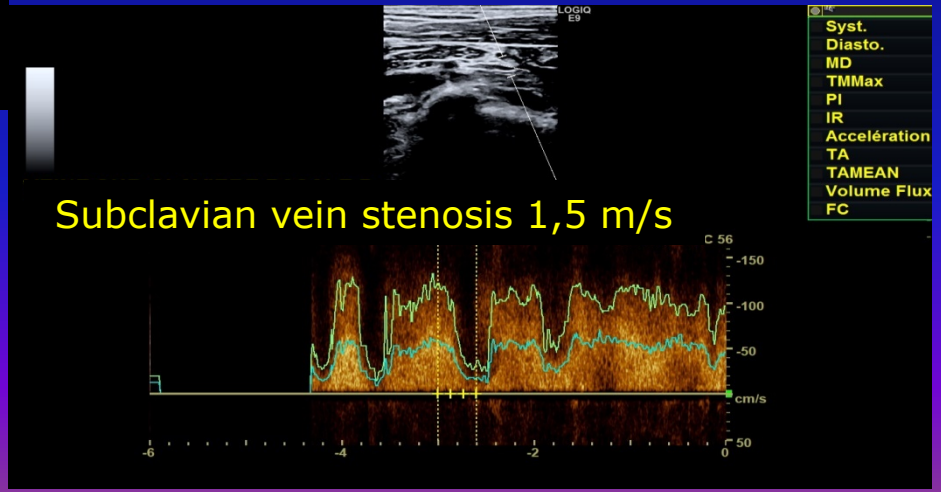
Study of the median nerve: axial and sagittal section next to the lunatum (Carpal tunnel syndrome)


16/11/06 20:30:37
ADM
--:--:--
LEV
GE
L9
B
Frq 8.0 MH
Gn 24
S/A 3/4
Carte I/0/0
D 5.0 cm
DR 69
FR 13 Hz
AO 100 %
CF
Frq 5.0 MH
Gn 44
L/A 4/9
AO 100 %
PRF 1.5 kH
FO 92 Hz
S/P 5/14
Subclavian vein stenosis

Subclavian vein stenosis

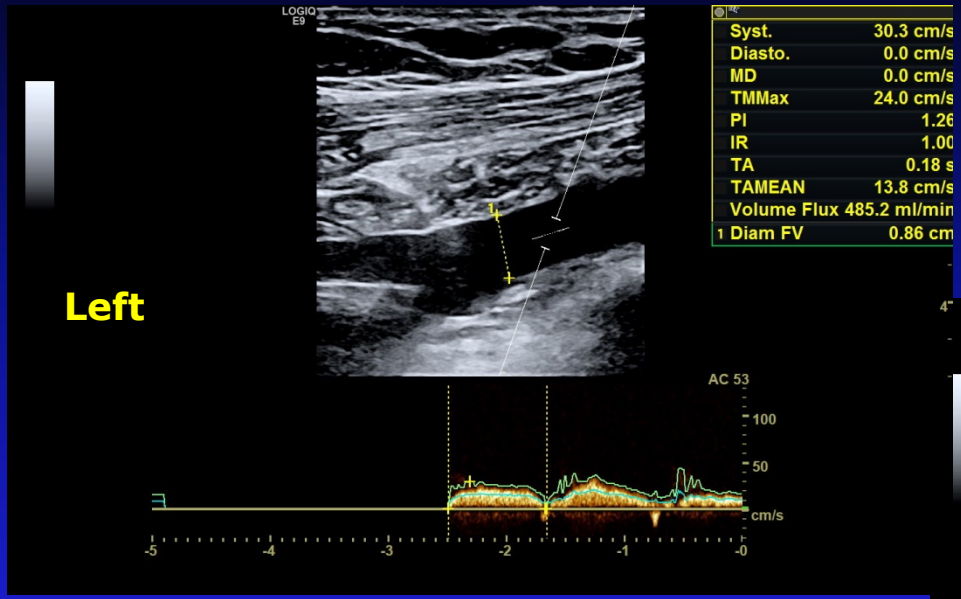


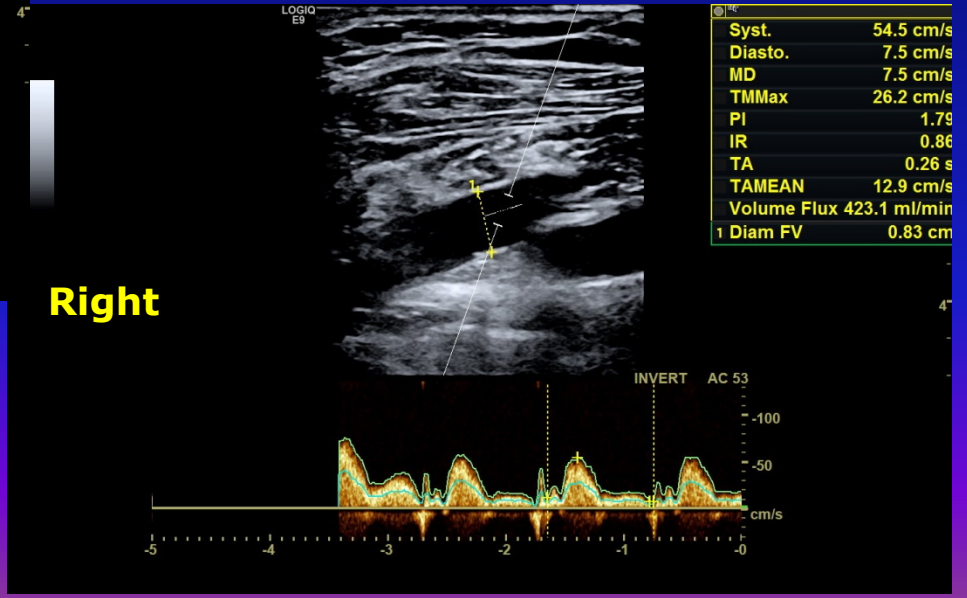
Subclavian vein stenosis 1 m/s



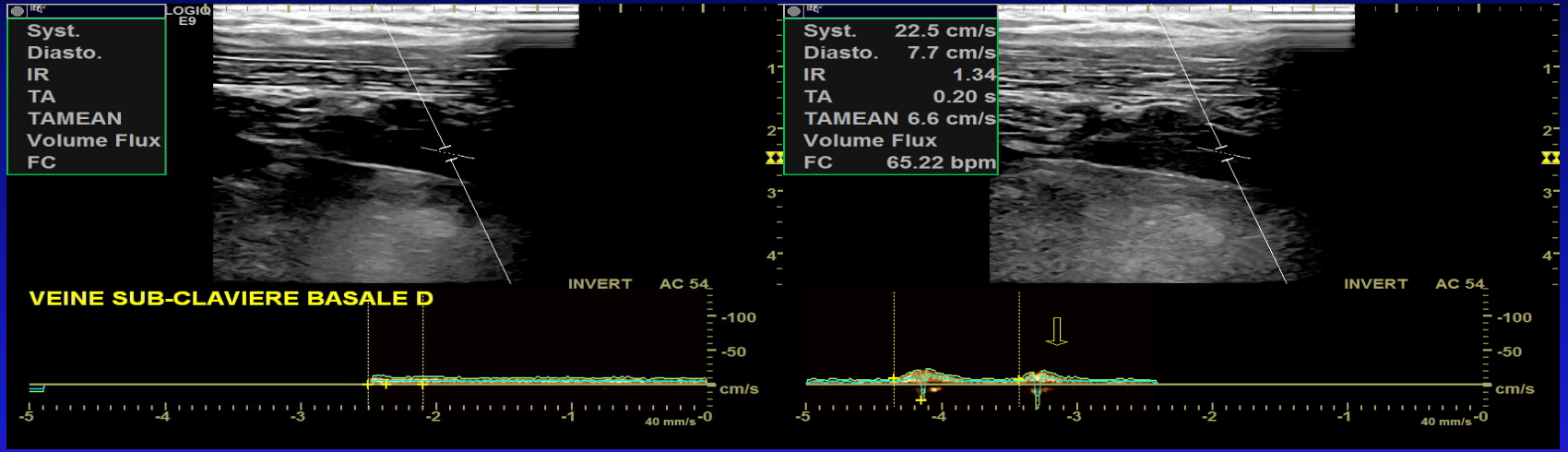
Subclavian vein stenosis 1,5 m/s

Subclavian veinous flow





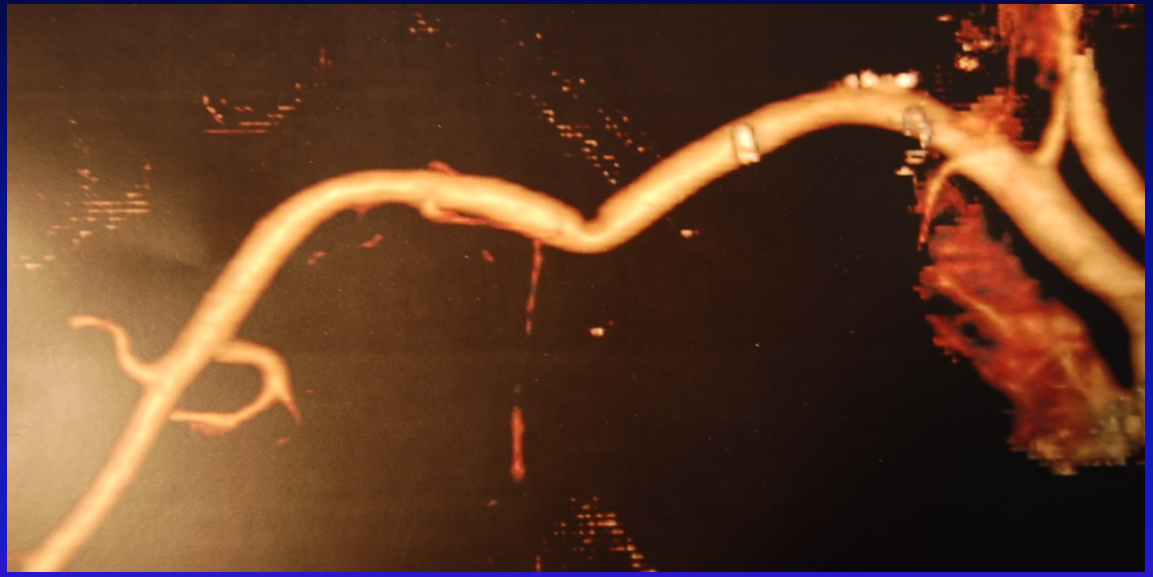
Subclavian vein thrombosis
Cyanosis Right upper limb
Post-thrombotic syndrome



Demodulated venous flow

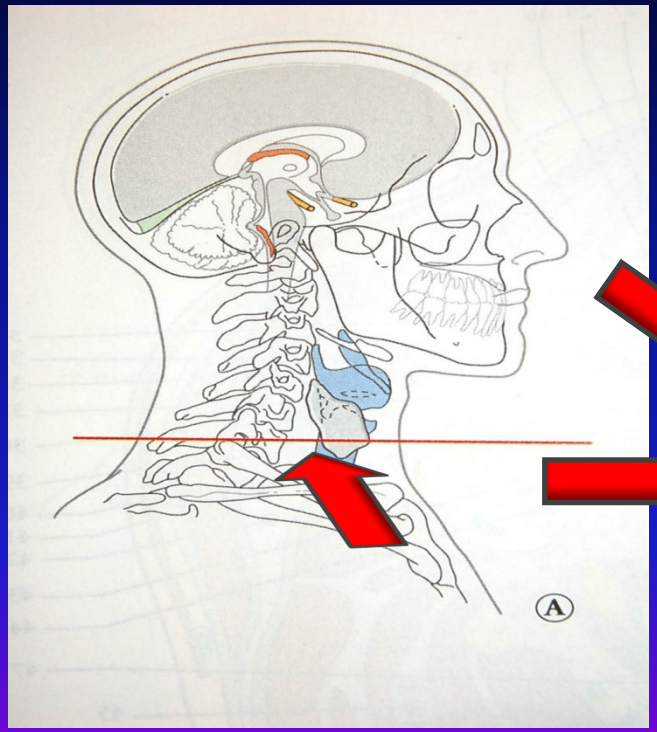
Deaden venous flow

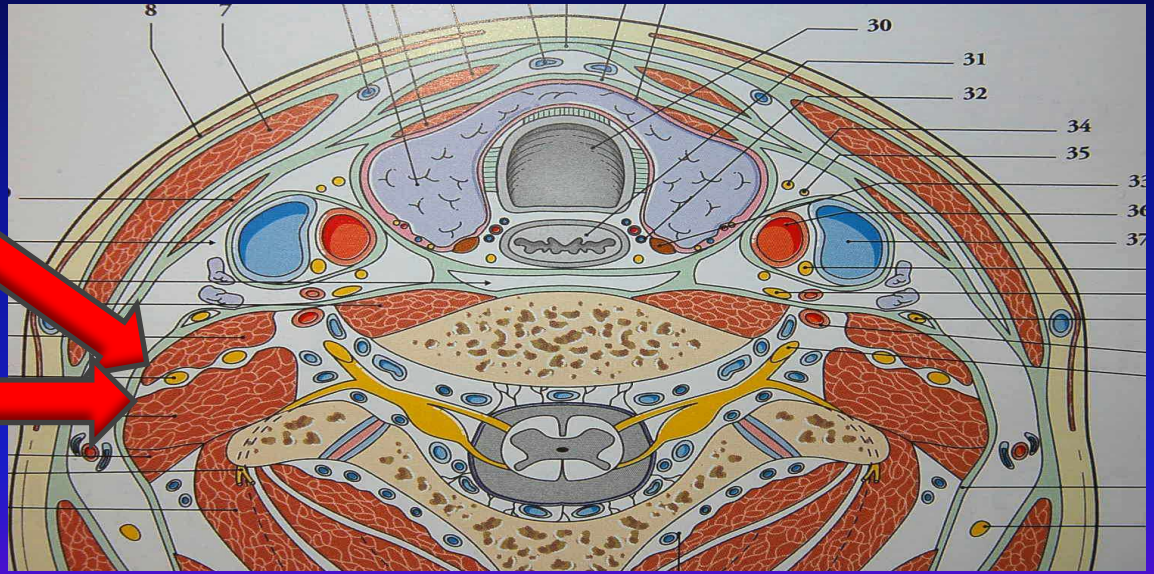
Subclavian vein compression



Curvature on the middle arc of the first rib - Phléboscan

Locating the anterior scalene muscle

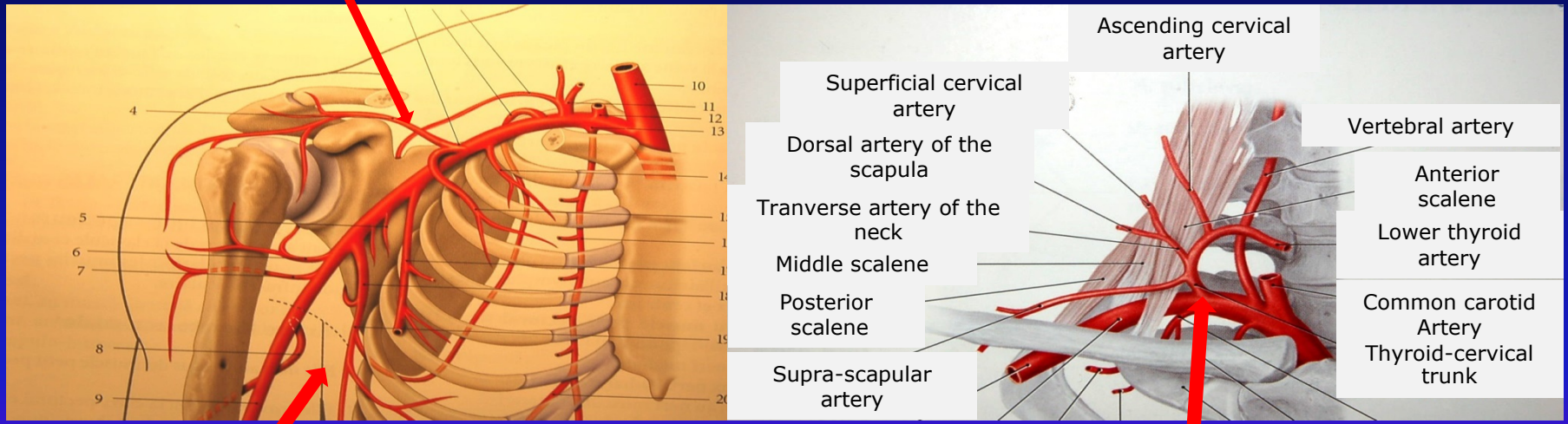




Locating the anterior scalene muscle

Locating the anterior scalene muscle
Thyroid-cervical trunk (within)

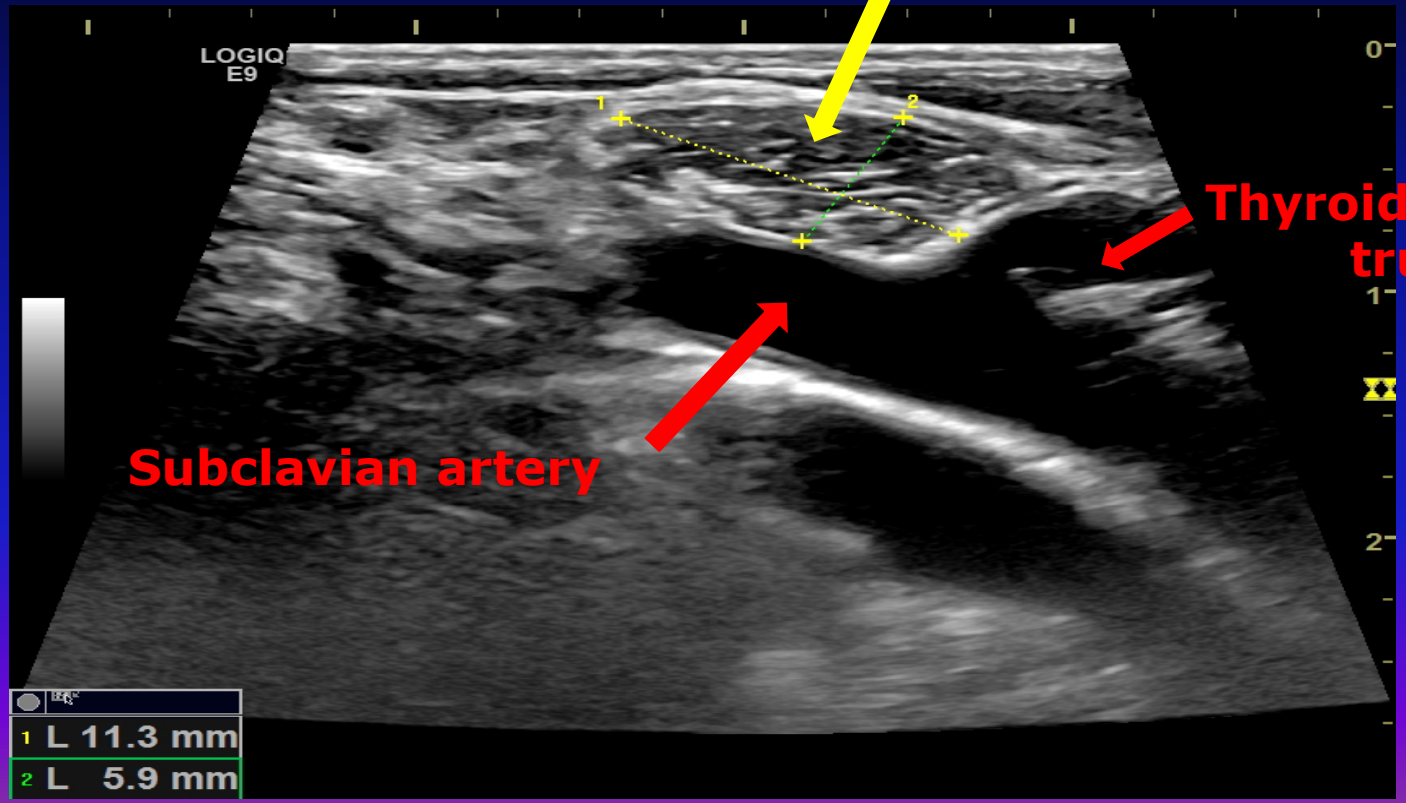
Thoraco-acromial → Acromial and pectoral division



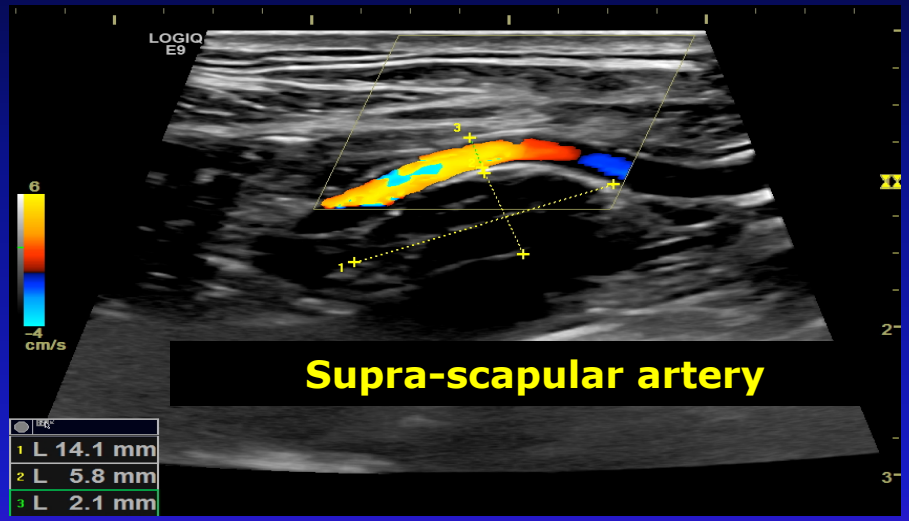
Sub-scapular artery

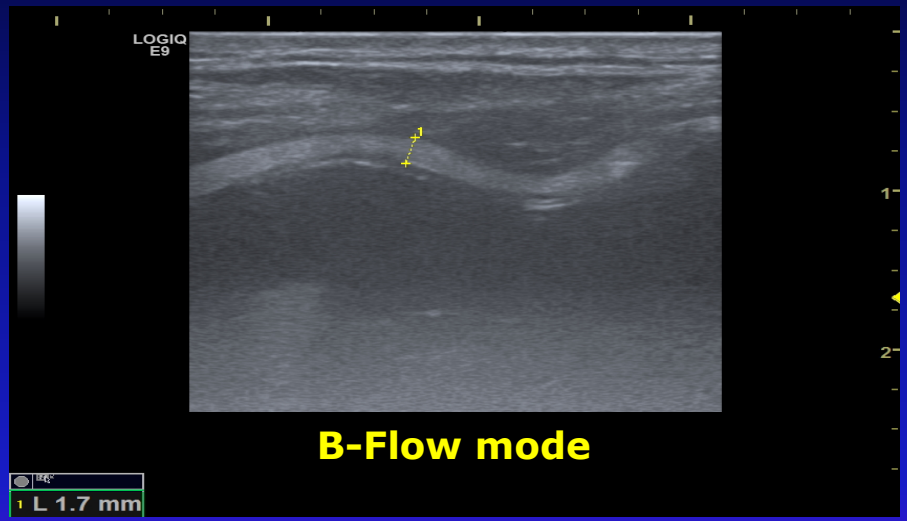
Thyroid-cervical Trunk

Thyroid-cervical trunk
Within the anterior scalene



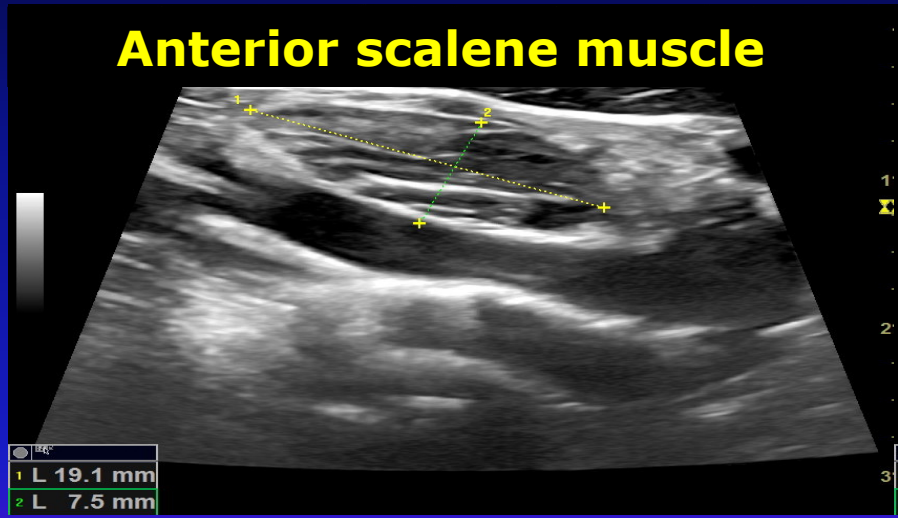
Anterieur scalene muscle

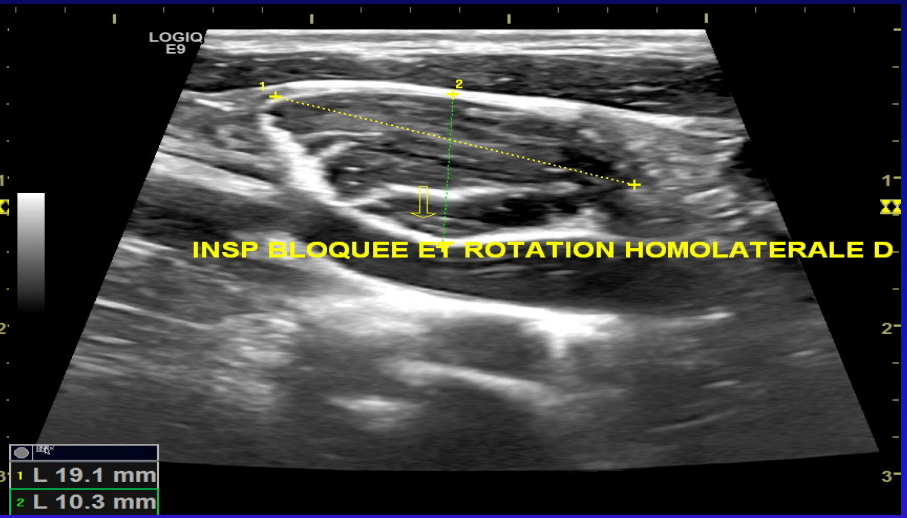




Supra-scapular artery in front of the anterior scalene

Anterior scalene
Inspiratory hypertrophy

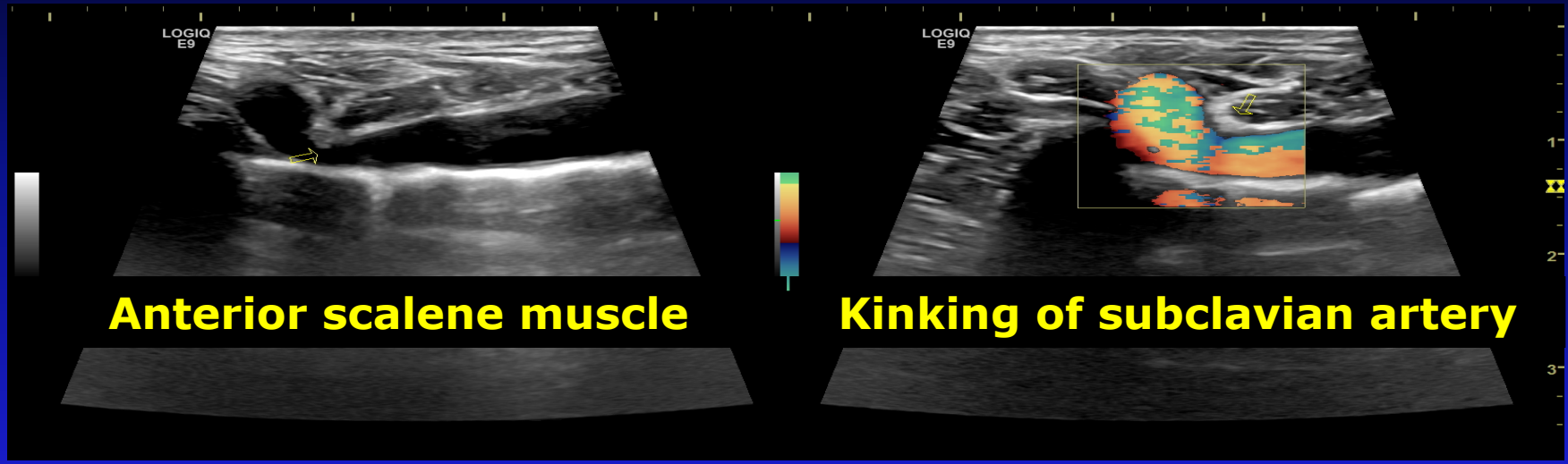




Anterior scalene in physiological position

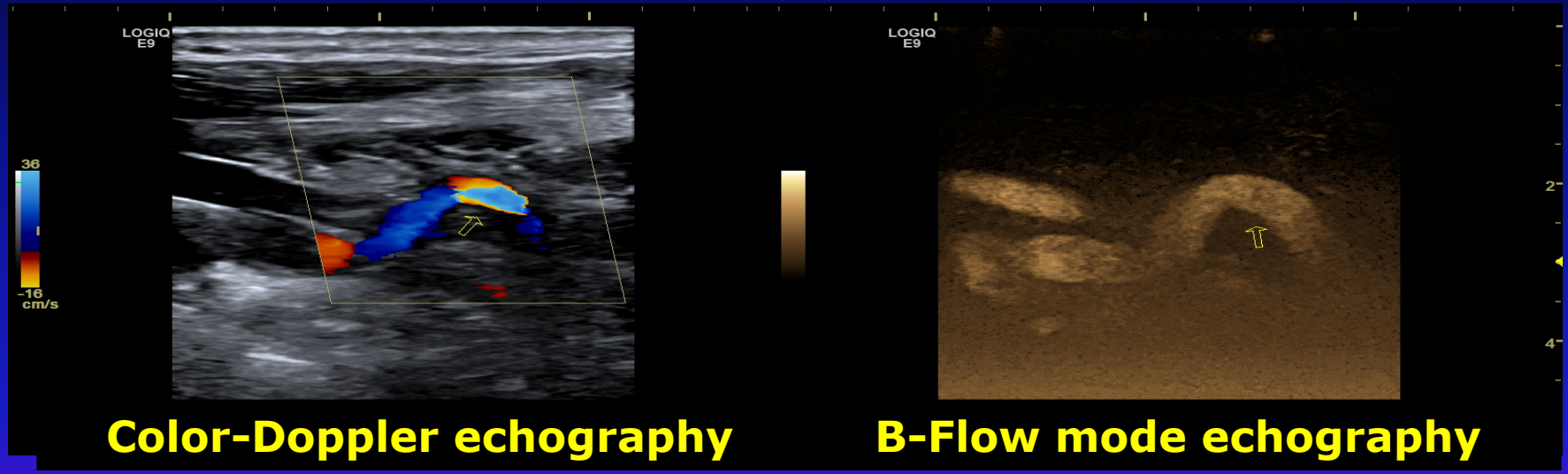
Ipsilateral rotation of the head and deep inspiration blocked

Anterior scalene muscle (Right)



The right subclavian artery comes to bend on the posterior face of the anterior scalene muscle in contralateral rotation, abduction and deep inspiration blocked

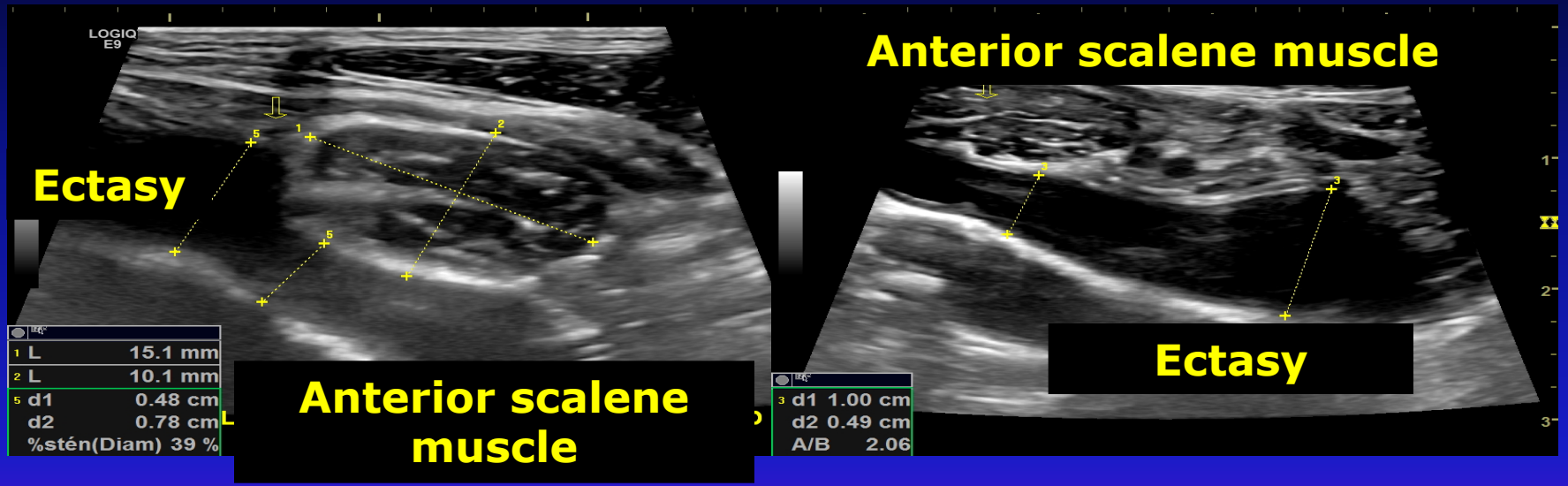
Scalene muscle anterior accessory



Color-Doppler echography **B-Flow mode echography**

Supra-scapular artery in front of the anterior scalene
Compression by an accessory scalene muscle

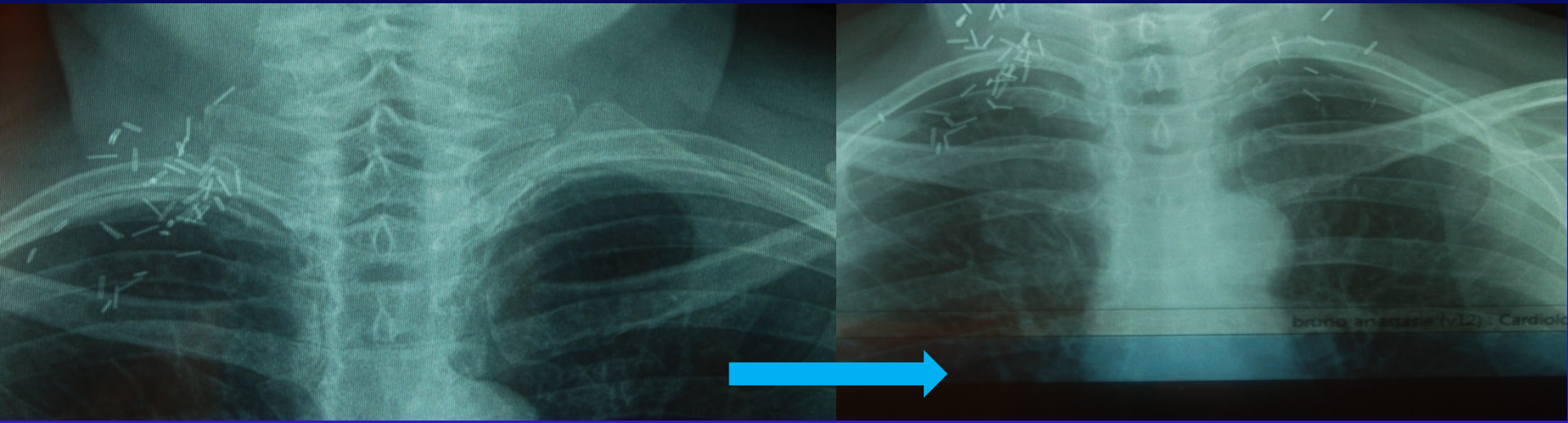
Anterior scalene muscle (Right)



Anterior scalene compresses and generates ectasia of a right subclavian artery
(downstream image left and upstream right image)

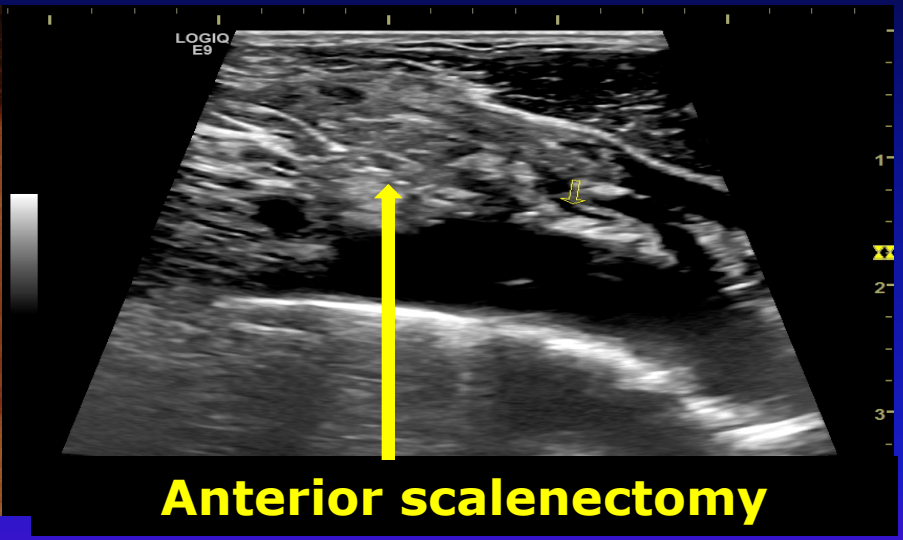
Scalenectomy
Plexolysis, Phlebolysis, Arteriolysis

Scalenectomy
Plexolysis, Phlebolysis, Arteriolysis

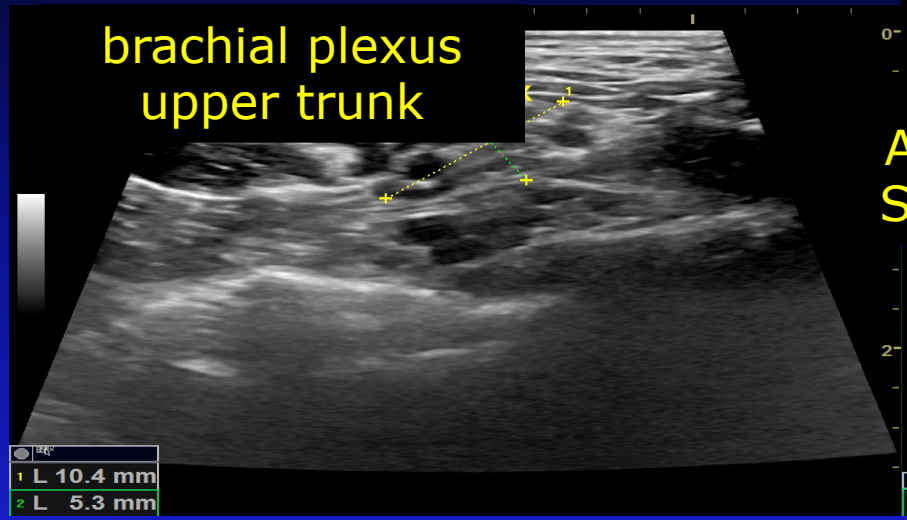


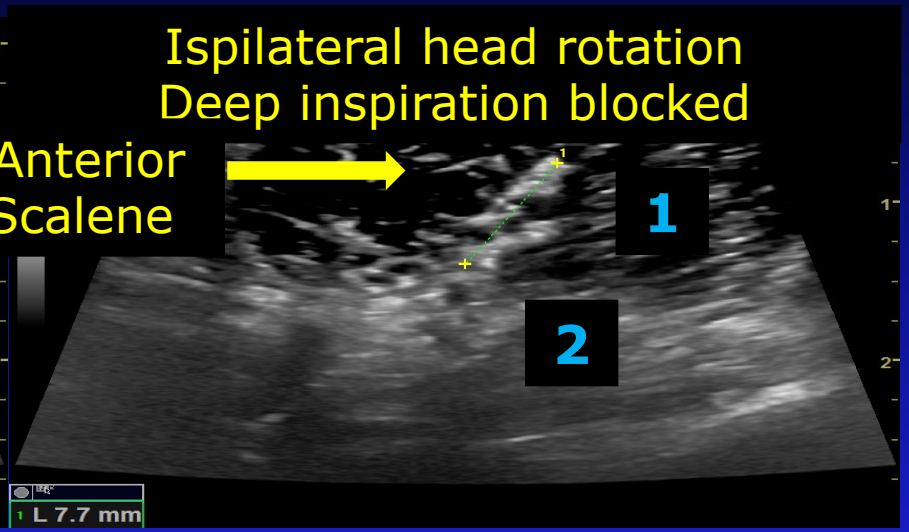
Resection C1 right then left

Brachial plexus



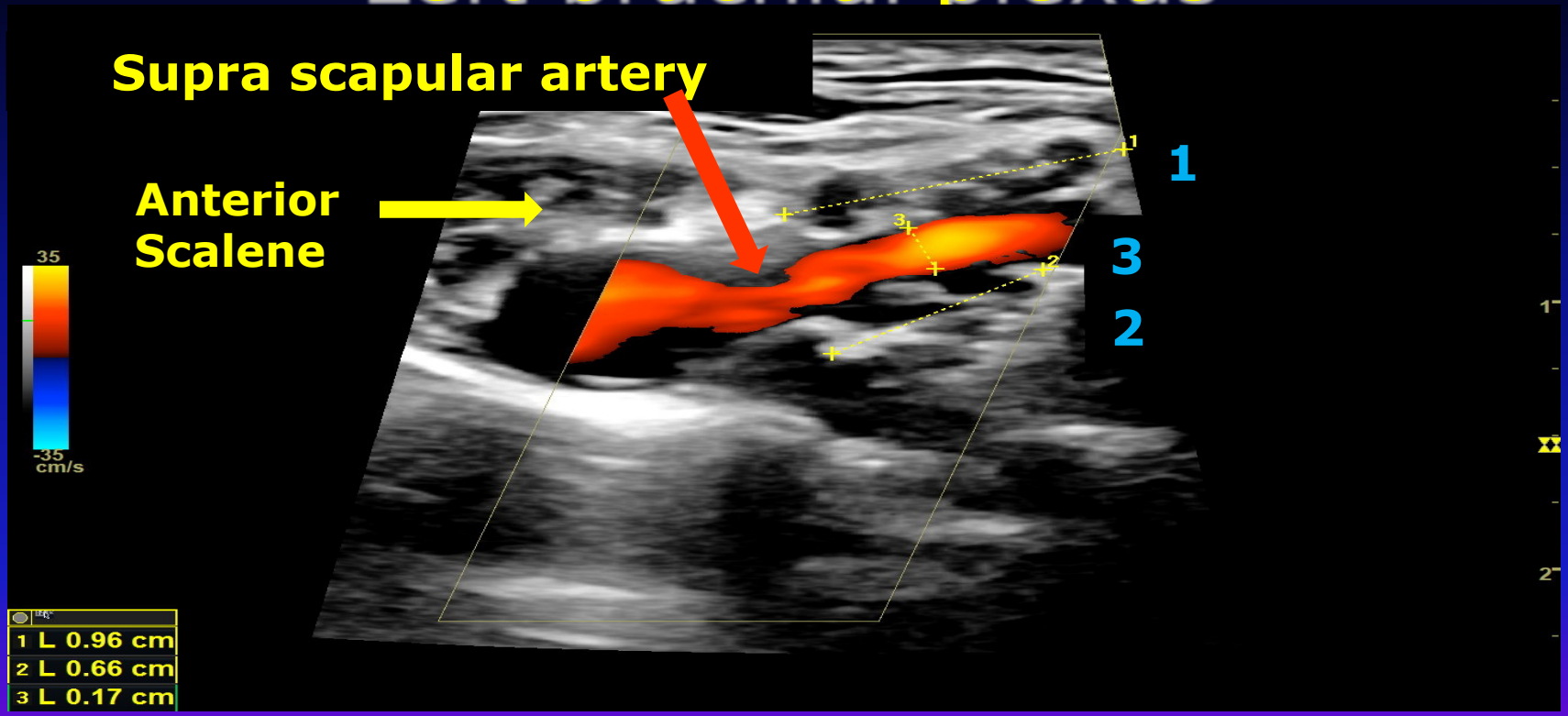
Left brachial plexus





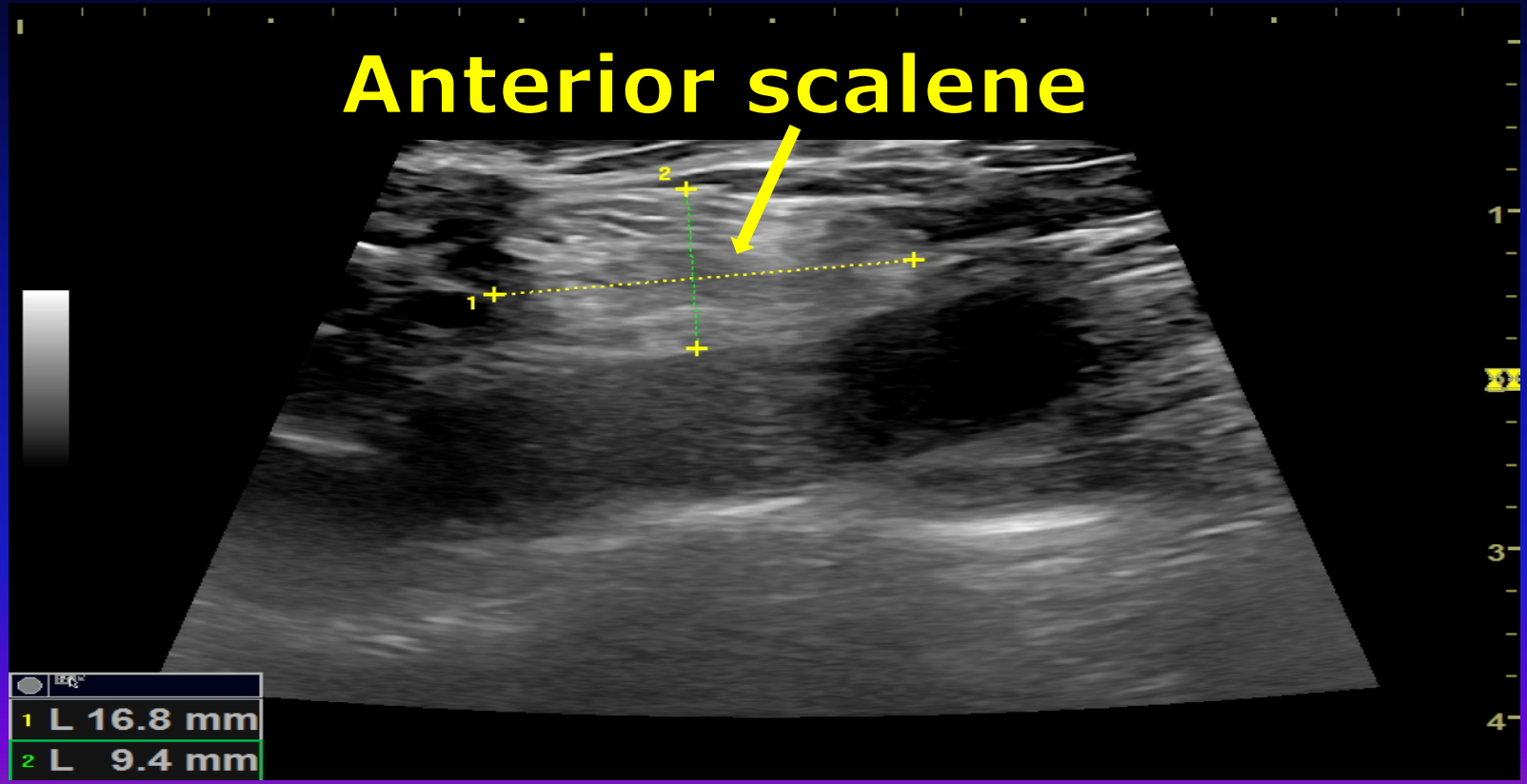
Back trunk left brachial plexus to inspiration translating an inter-scalenic compression on the trunks (superior-1 and middle–2) of the brachial plexus

Left brachial plexus

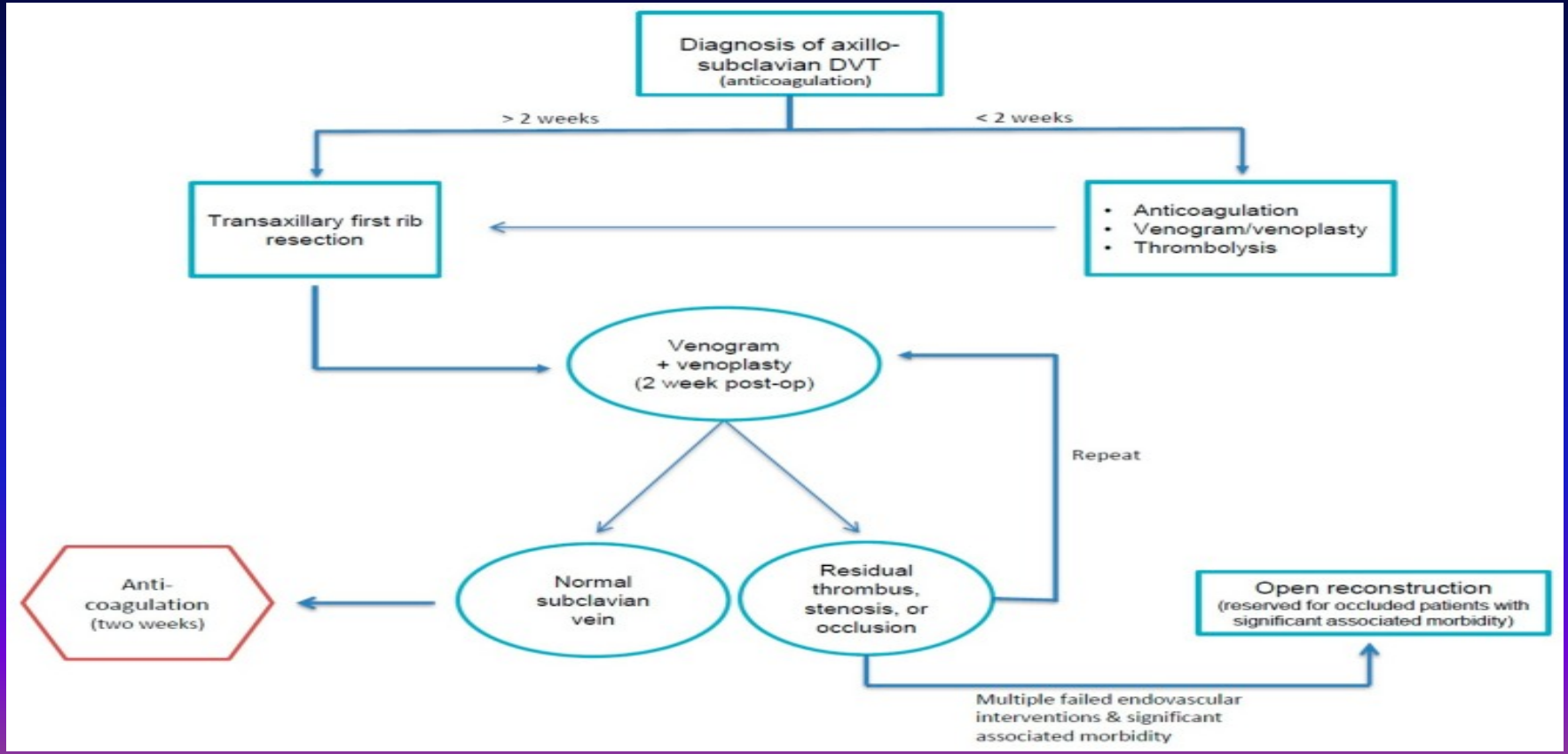


Supra-scapular artery (3) passing behind the anterior scalene between the upper (1) and middle (2) trunk of the brachial plexus

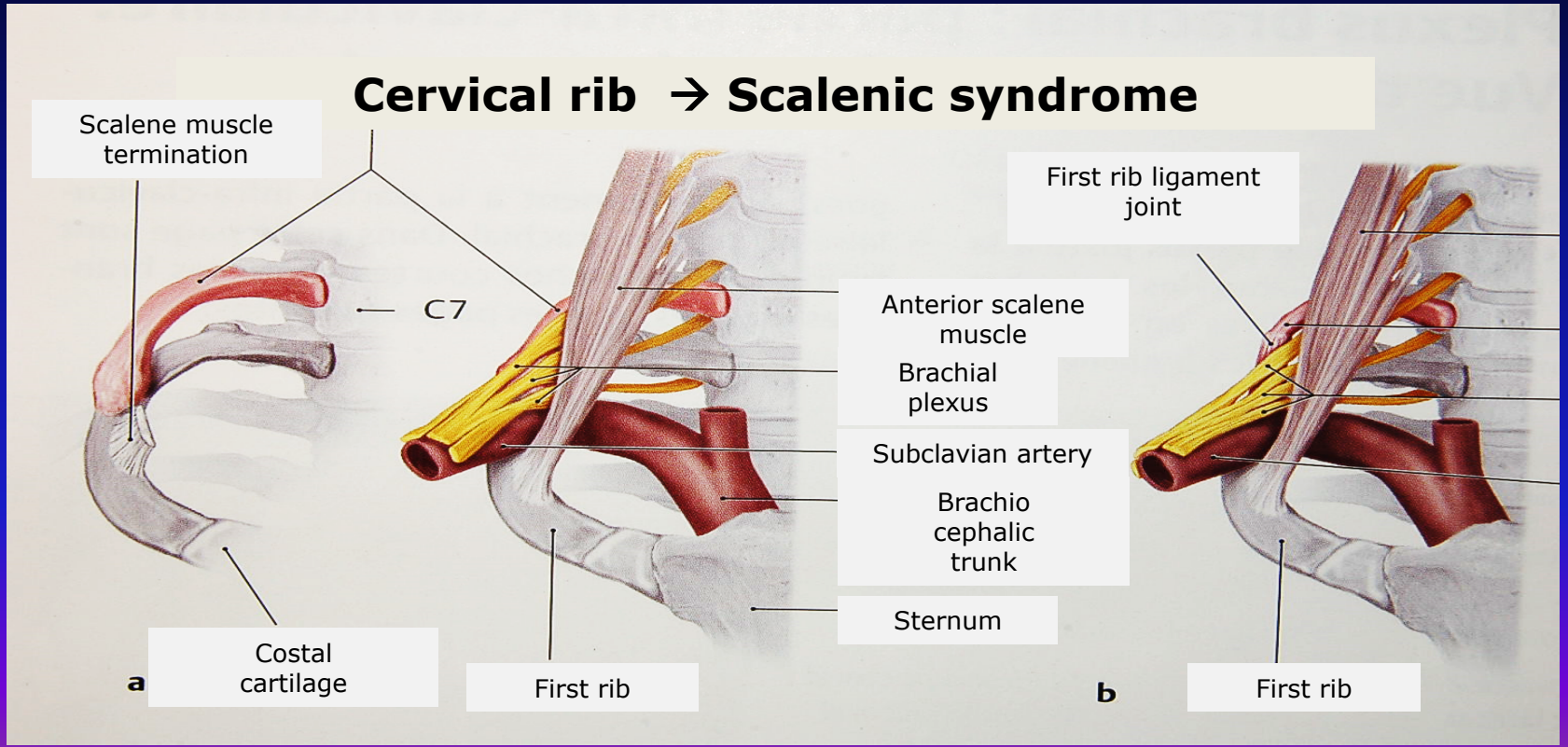
Anterior scalene: fatty degeneration



Diagnostics (Basel). 2017 Jun 10;7(2).
Vascular TOS-Creating a Protocol and Sticking to It
Archie M., Rigberg D.

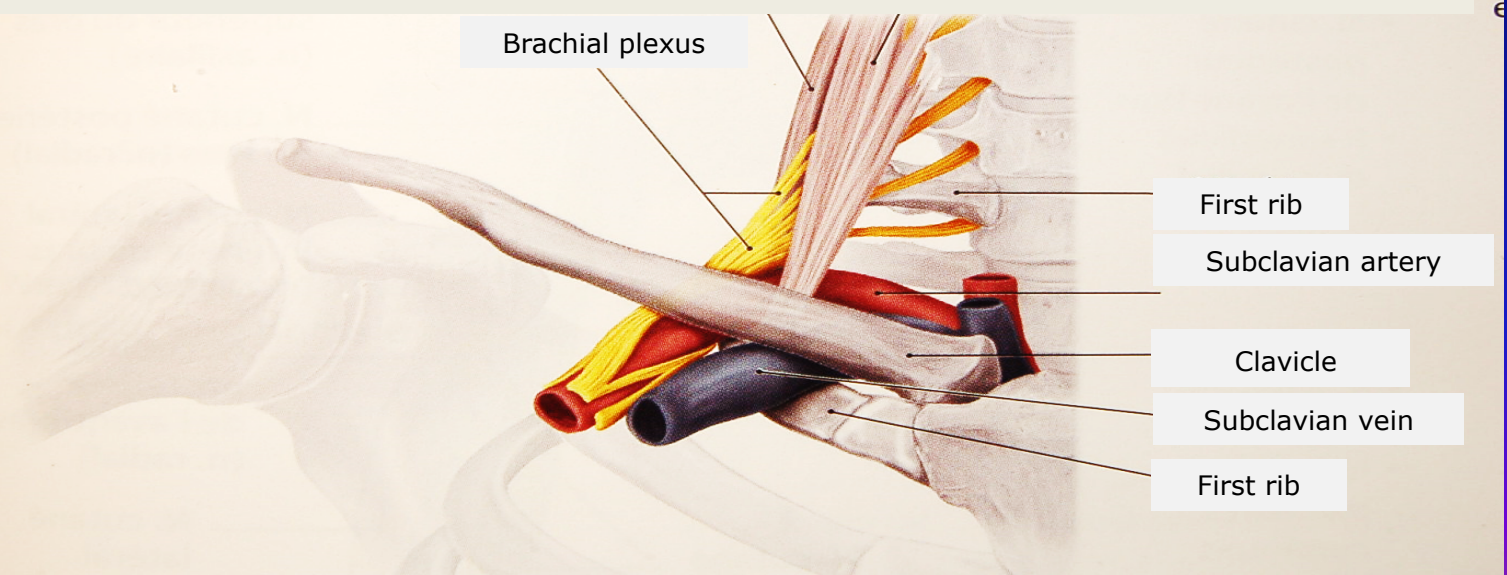


3 Anatomical syndromes



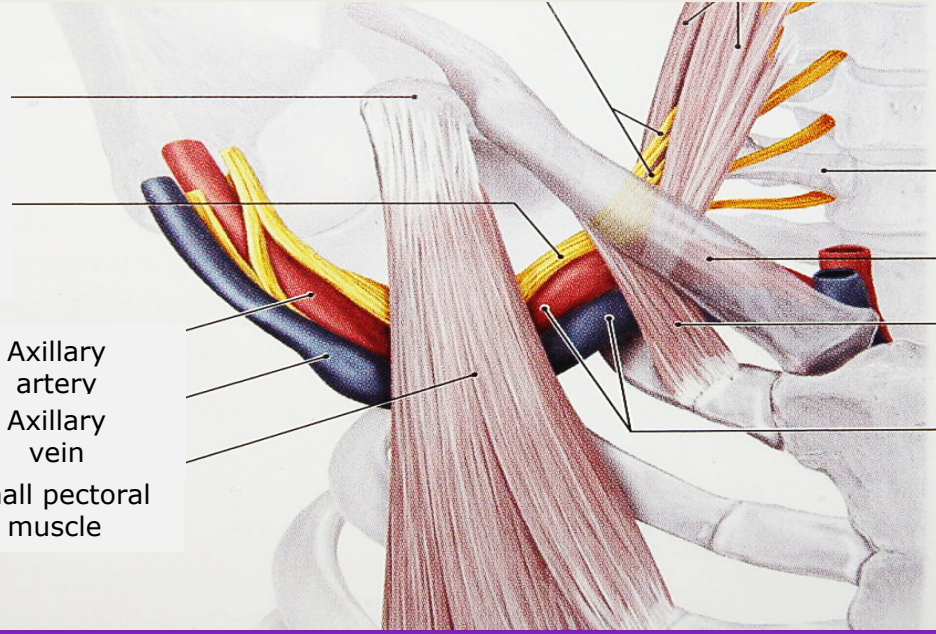
3 Anatomical syndromes

Costoclavicular syndrome by compression of the vasculo-nervous bundle between clavicle and C1
Middle Scalene Anterior Scalene

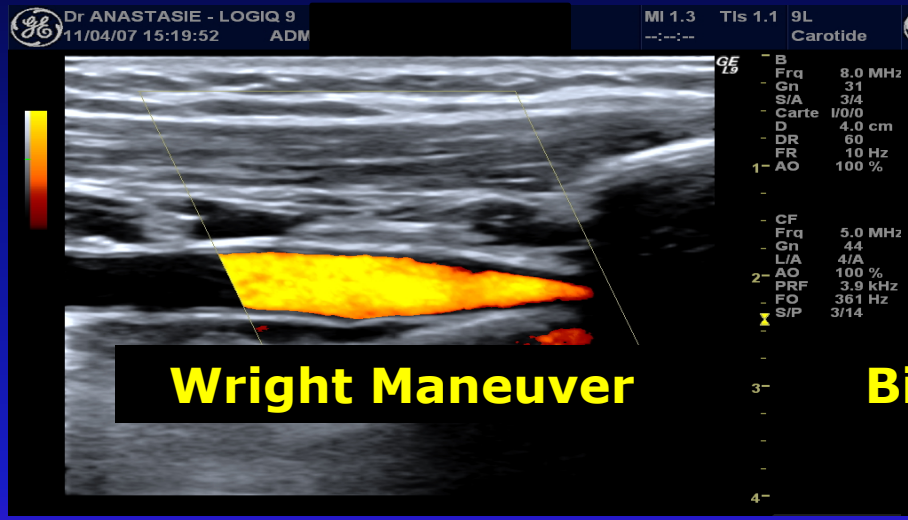


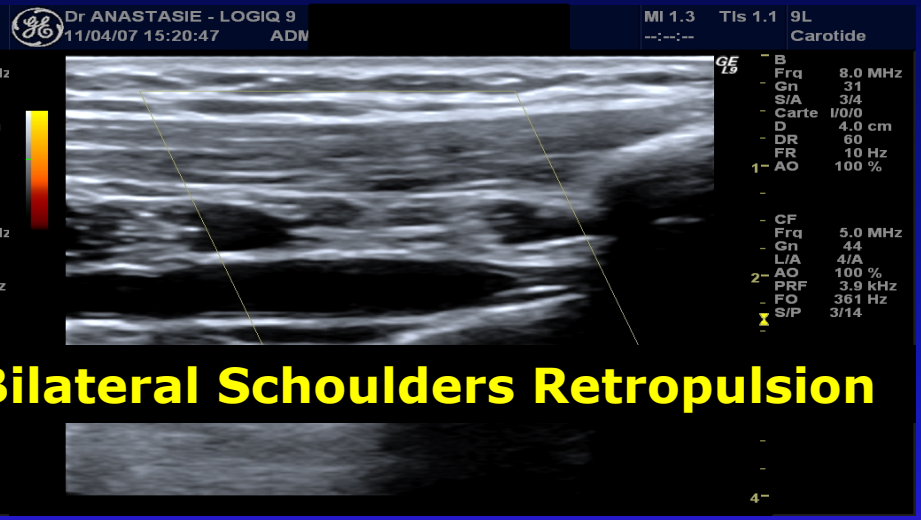
3 Anatomical syndromes

Hyperabduction syndrome with vasculoneural compression under the small pectoralis muscle or the coracoid process above the second rib



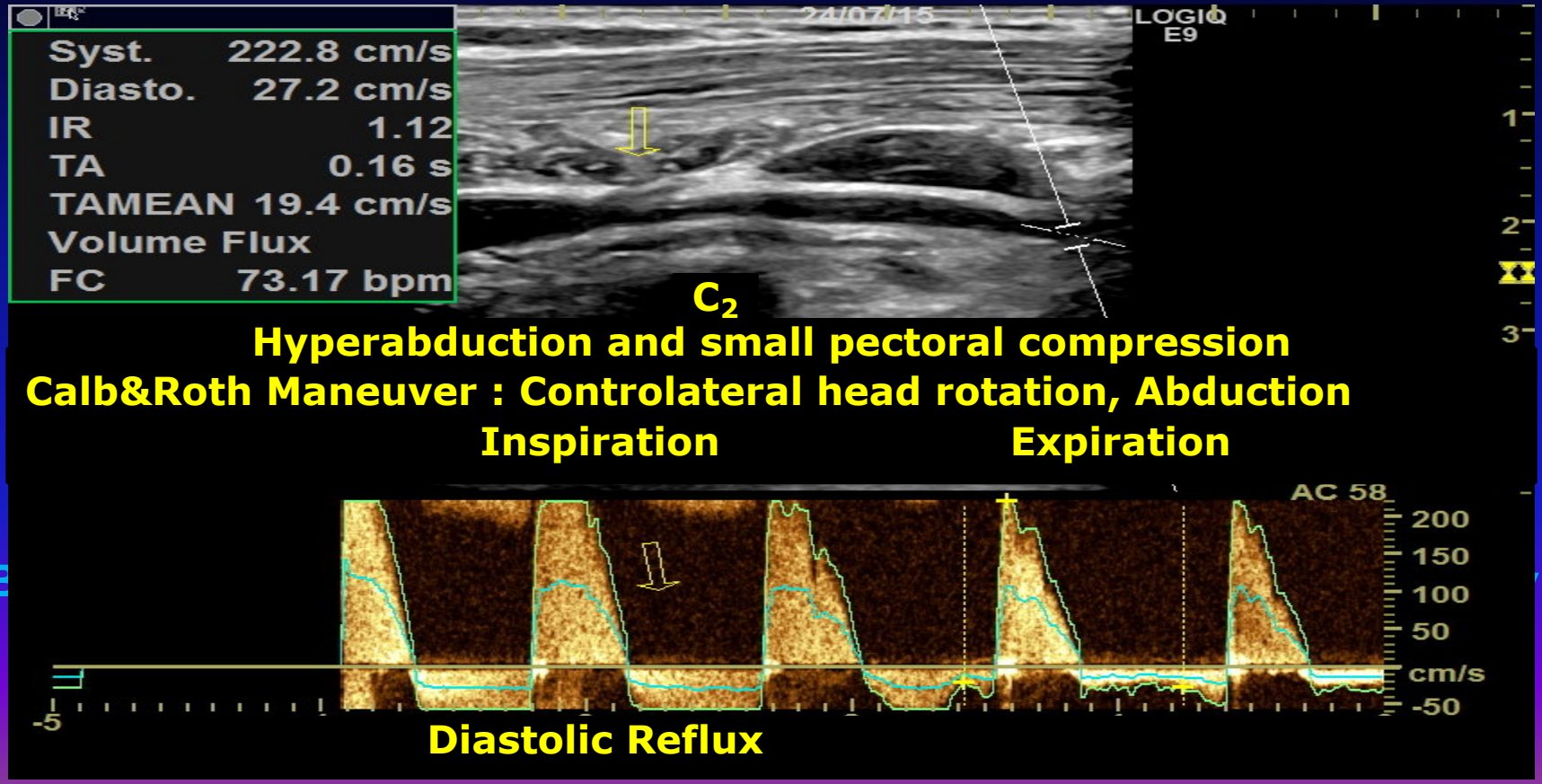
Costal-Clavicular + Hyperabduction Syndromes





Bilateral retropulsion marks occlusion of subclavian right artery. The degree of abduction is noted to obtain the occlusion

Hyperabduction (small pectoral compression) + Costal-clavicular + Costal-scalenic Syndromes (Right)



Our Study

- 27 operated patients (2015-2019) for TOS, Middle age : 40,25 years
- 4 patients with subclavian vein thrombosis (14,8%)
  2 men-2 women, Middle age : 36 years
  Large anterior scalene, small scalene accessory and plexic digits (3)
  C7 apophysomegaly additionally (1),
  2 women smokers with estro-progestative contraception
- 16 : Monstrous anterior scalene + small scalene + plexic digitations
- 11 : Large Scalene Plating Plexus Against First Rib Often On Sharp Edge
  4 - Fibrous cord between C7 apophysomegaly and the first rib
  1 – Fibrous cord stretched in the concavity of the first rib

Conclusion
Against indication of medical treatment ?

- Rigorous process → Comparative (control at the end of physiotherapy)
- Anamnesis and syndrome history, careful clinical examination
- Venous echo-Doppler then positional arteriel echo-doppler

  Positional venous echo-doppler is not specific

  → new standards of venous examination +++
- Differential diagnosis often entangled (radicular, carpal tunnel syndrome)
- Syndrome anatomy → Cervical Radio up to T1-T2, Cervical RMI, Electromyography ++, Hemostasis Pathology ++, Cancerous context
- Nerve exploration (entanglement) with the same vascular maneuvers
- Specific physiotherapy, Self- physiotherapy → Patient education
- Statural and ponderal correction
- Patient informed of surgical decision ++
- Absence of declaration in occupational disease in France

Thanks for your attention !

- Angio-Surgical Collaboration !