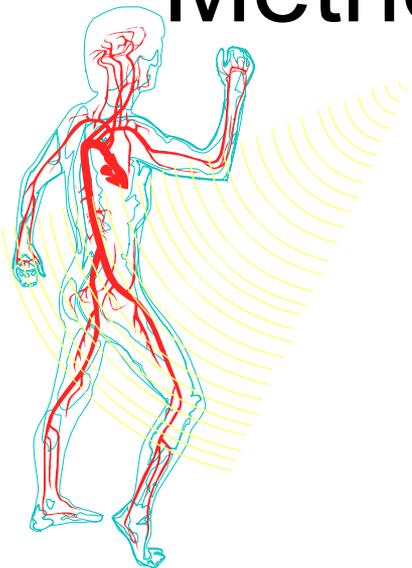
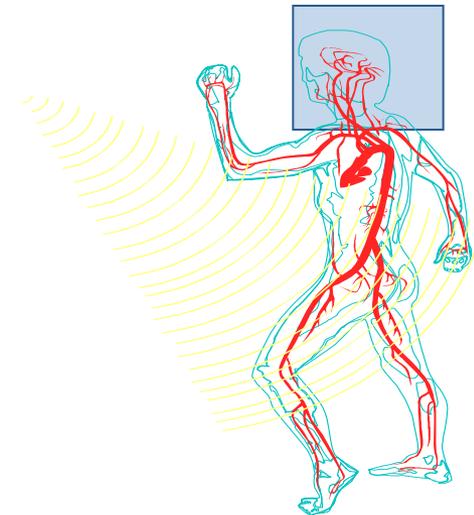


Examen Ultrasonographique des Axes Artériels Cervico- Céphaliques Méthodes et résultats normaux

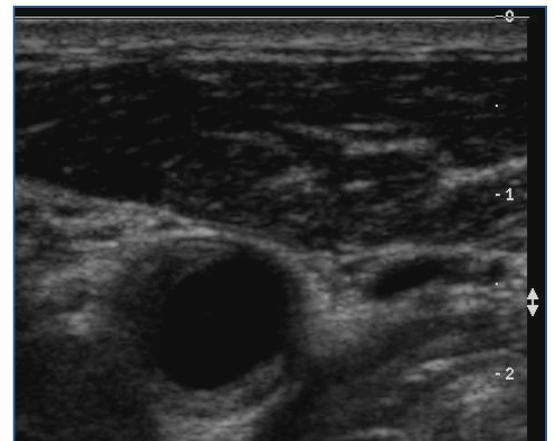
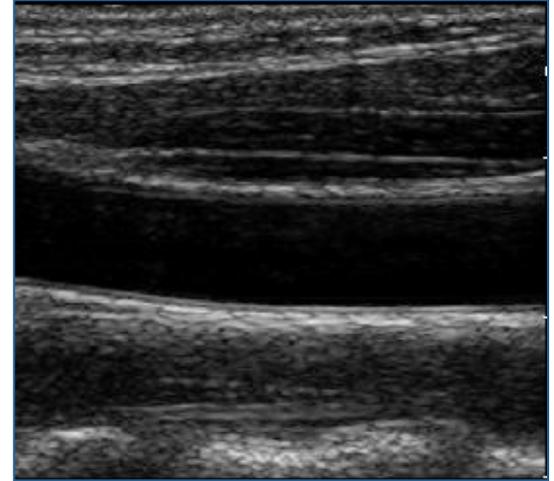


DIU échographie
Module vasculaire
Mars 2017
Sarah Coudray



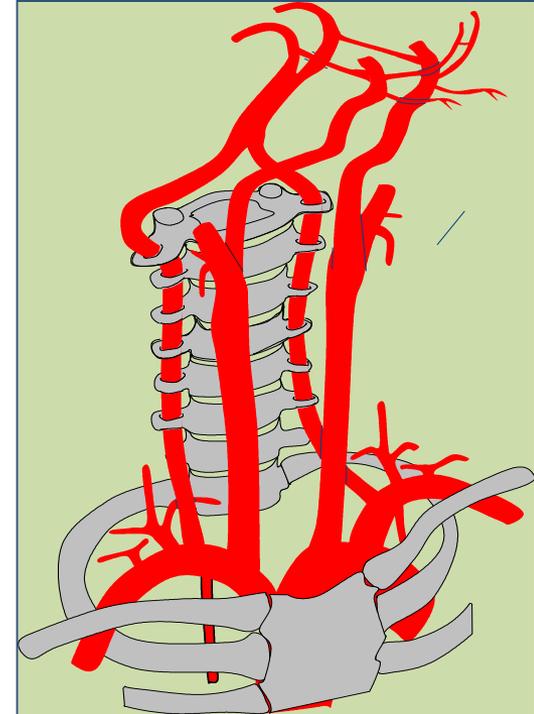
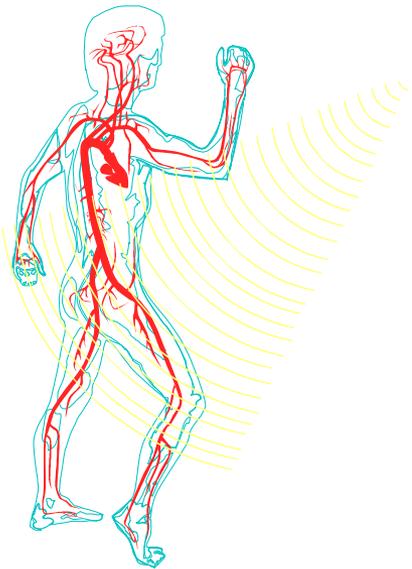
Étude Morphologique : Échographie

- Coupes longitudinales
- Coupes transversales

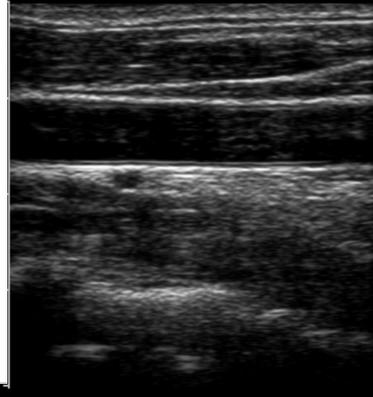
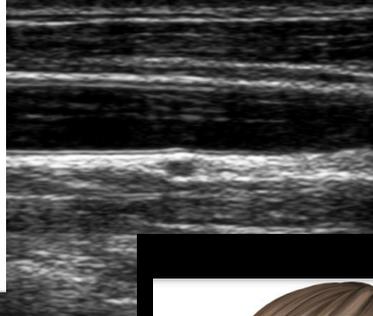
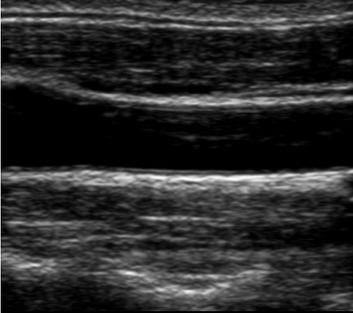


Axe carotidien

- Echo- anatomie
- Variations
- Sémiologie écho-Doppler Normale

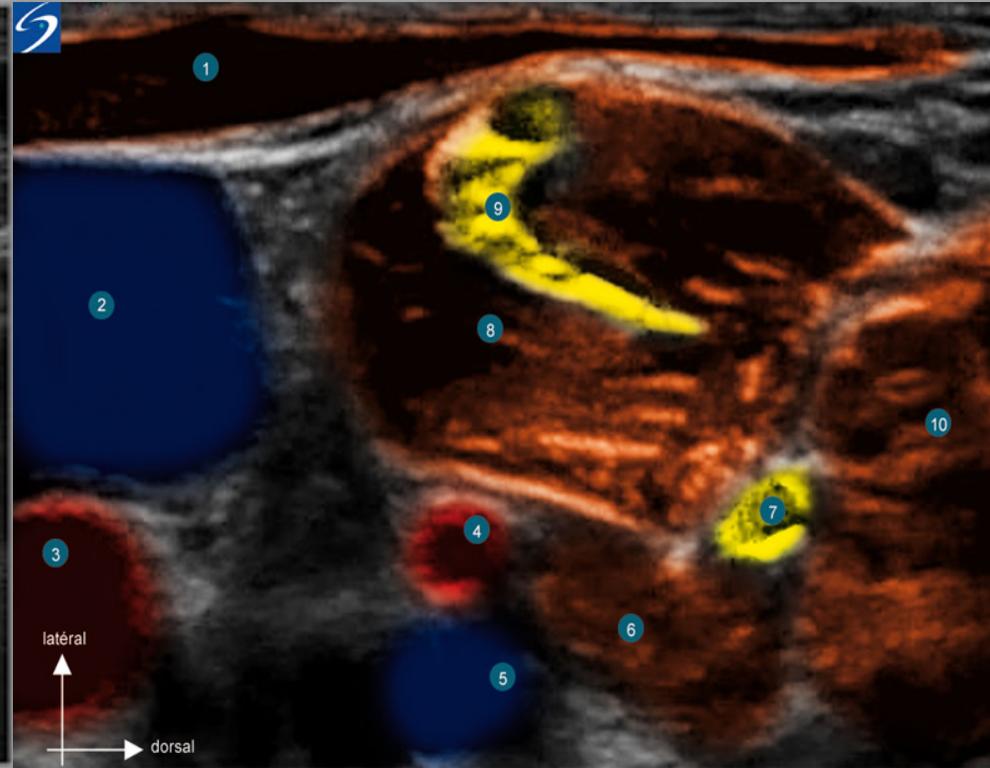
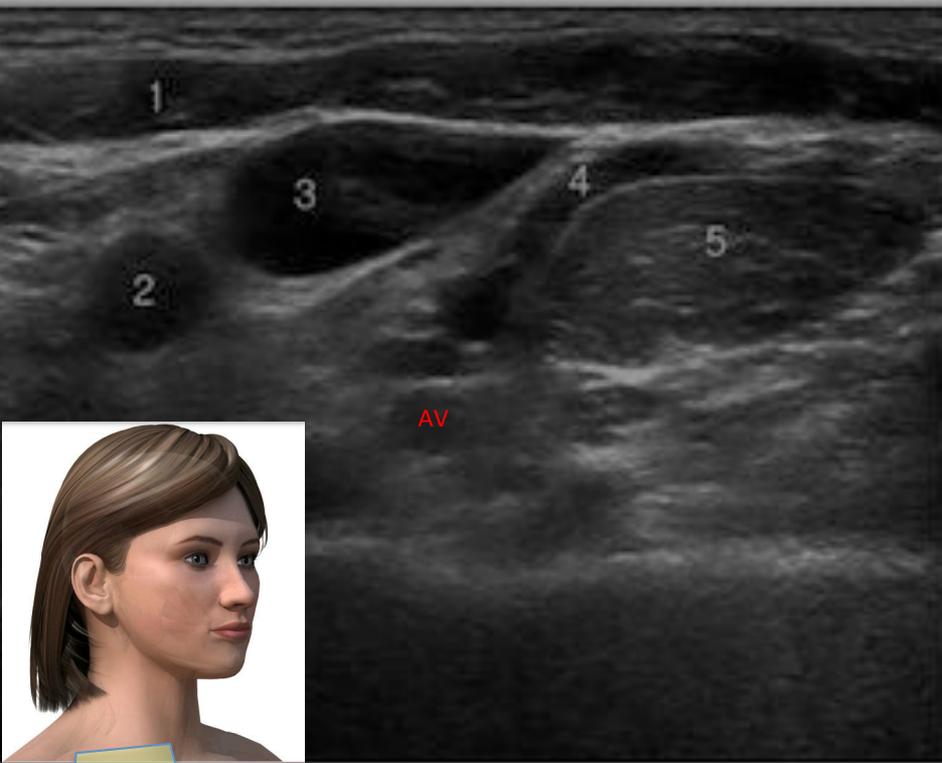


Echo-Anatomie Normale



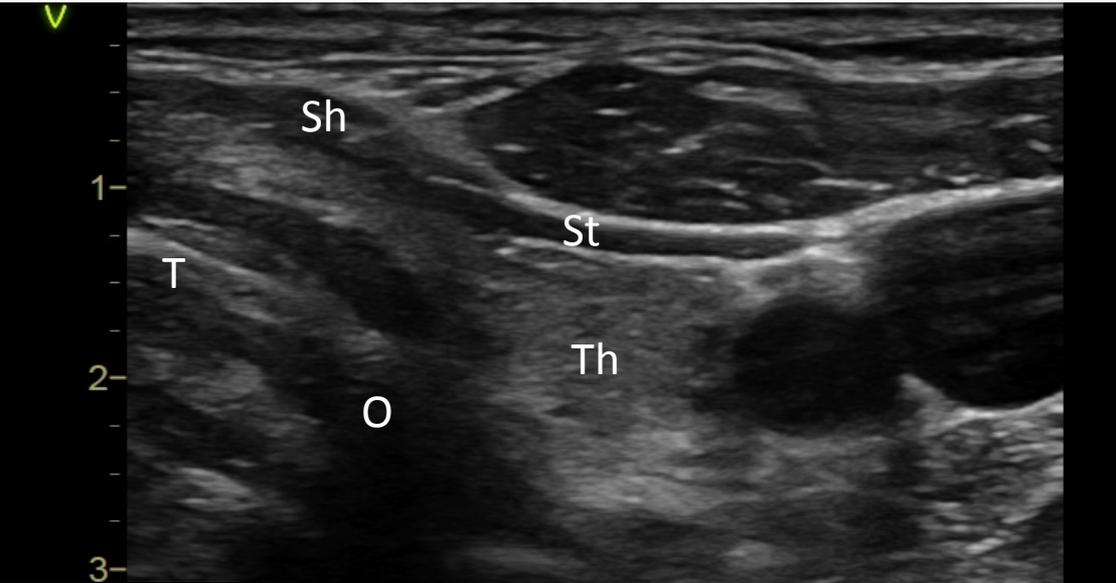
Carotide Commune
Coupe Longitudinale

Echo-Anatomie Normale

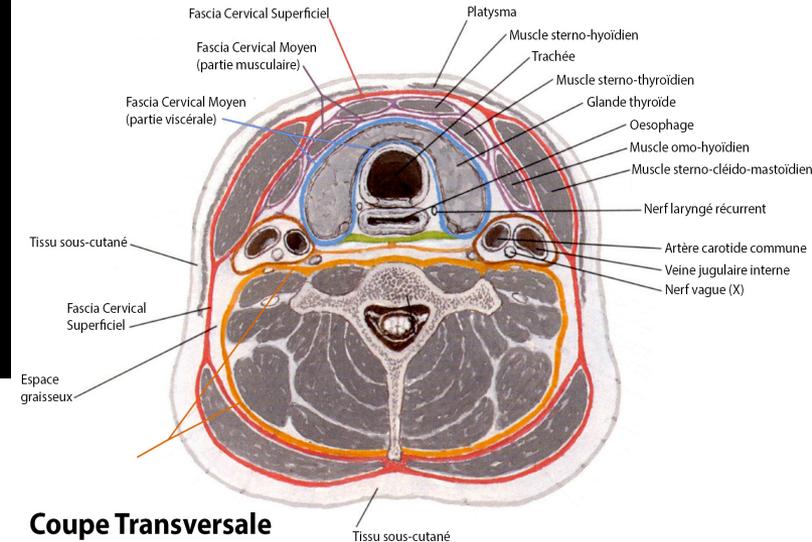
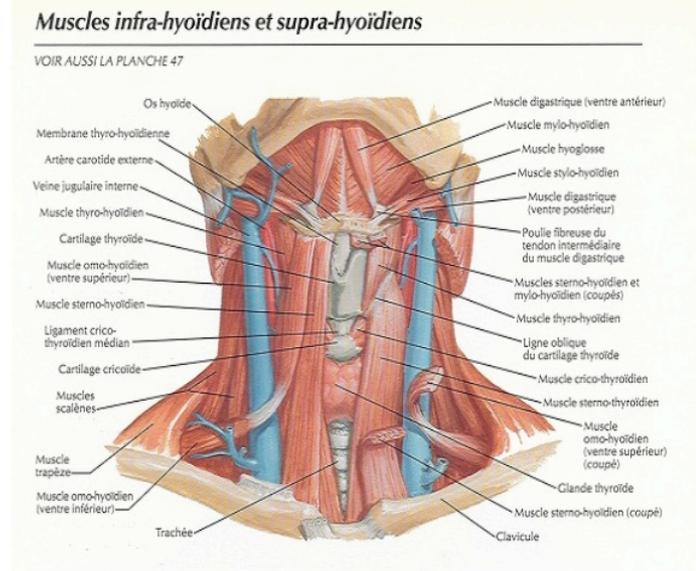


Carotide Commune
Coupe axial
Base du cou

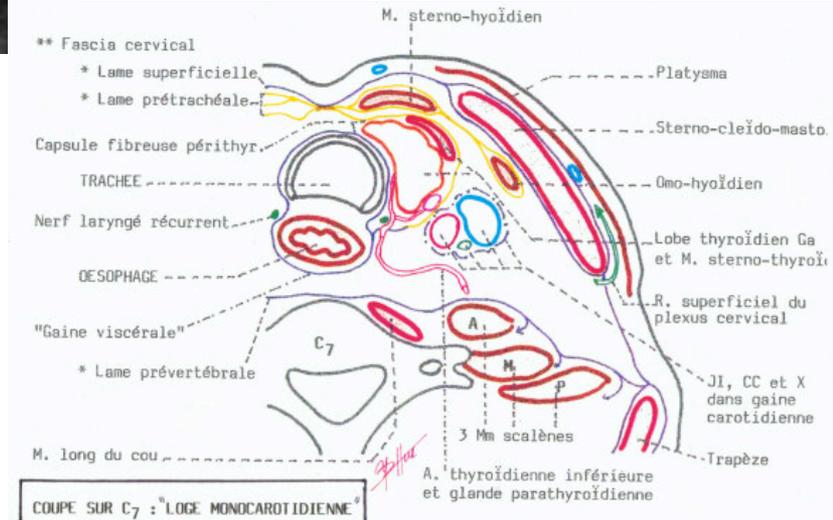
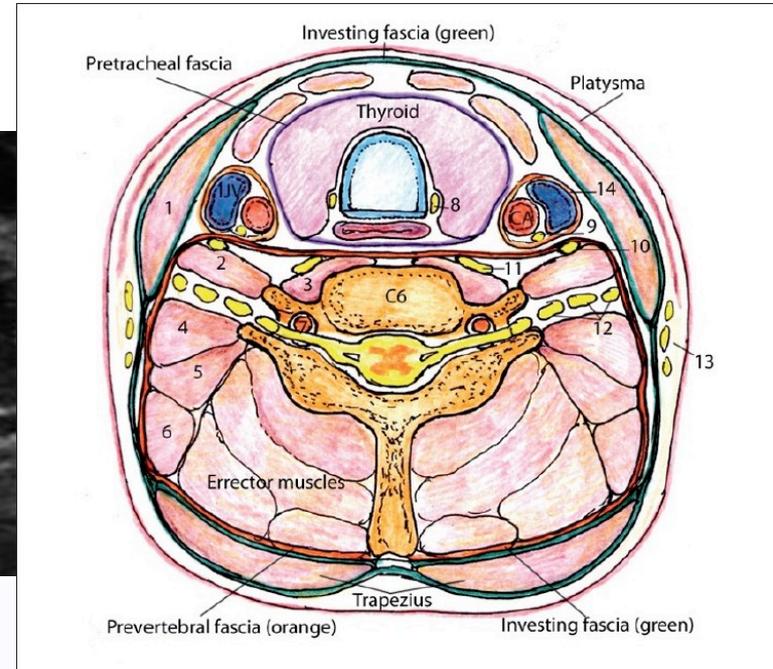
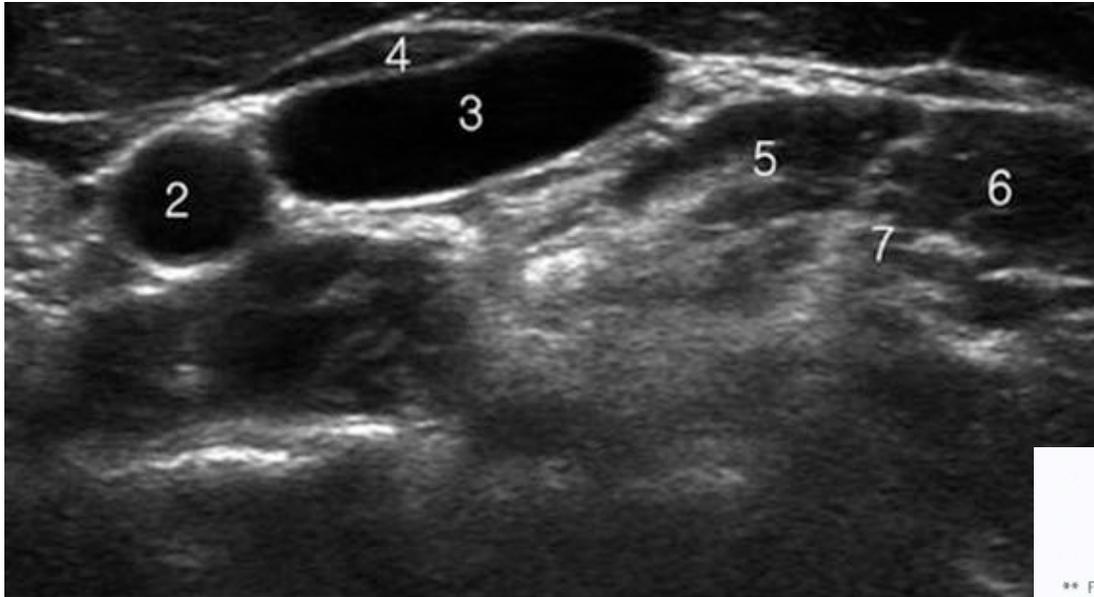
Echo-Anatomie Normale



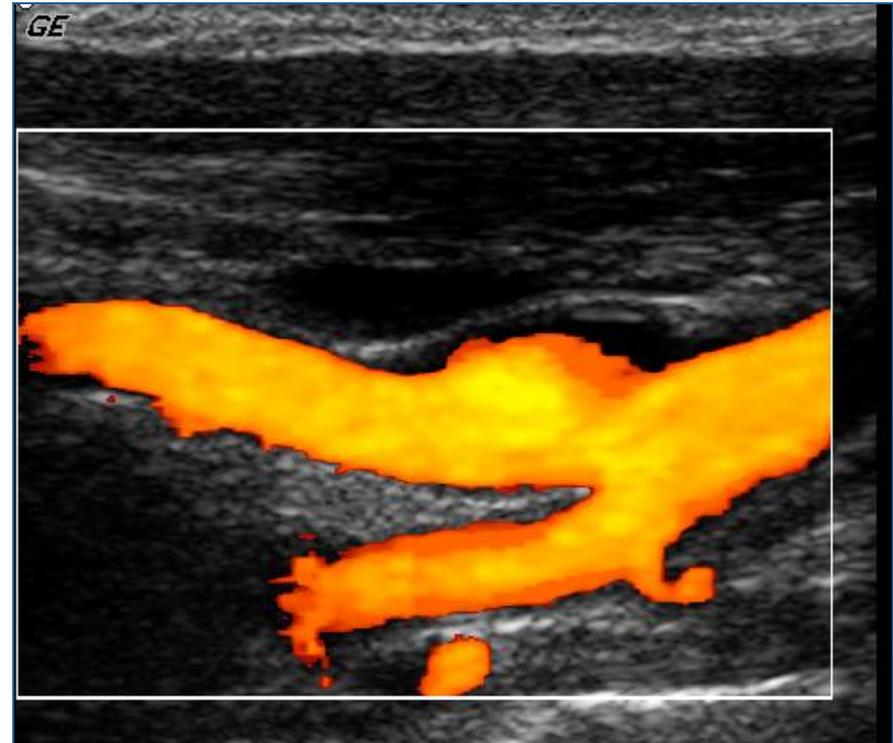
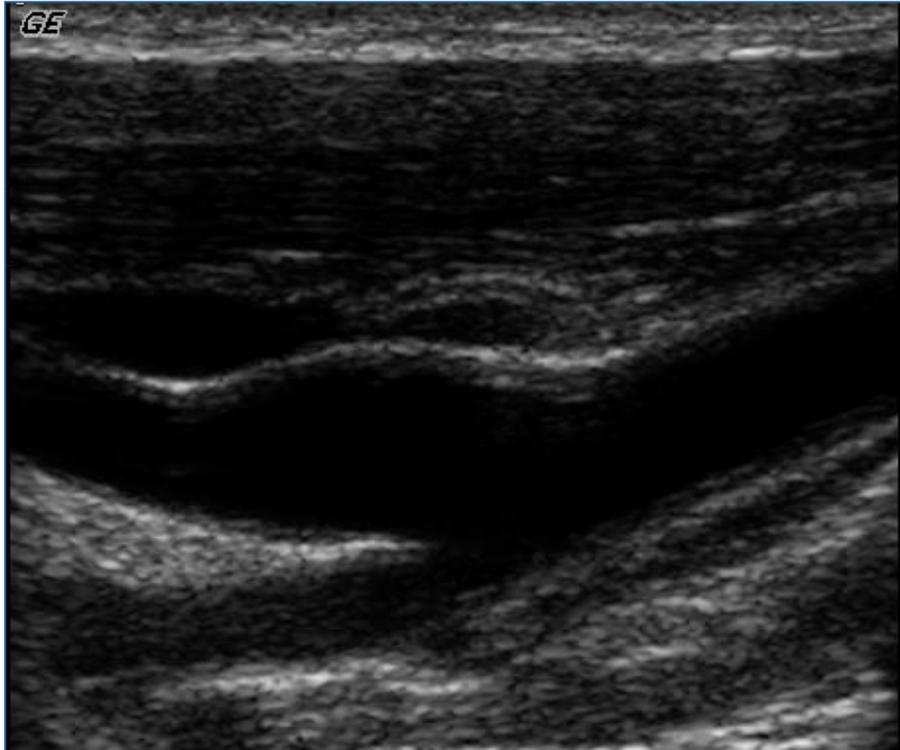
Carotide Commune
Coupe axial
Mi cou



Echo anatomie normale

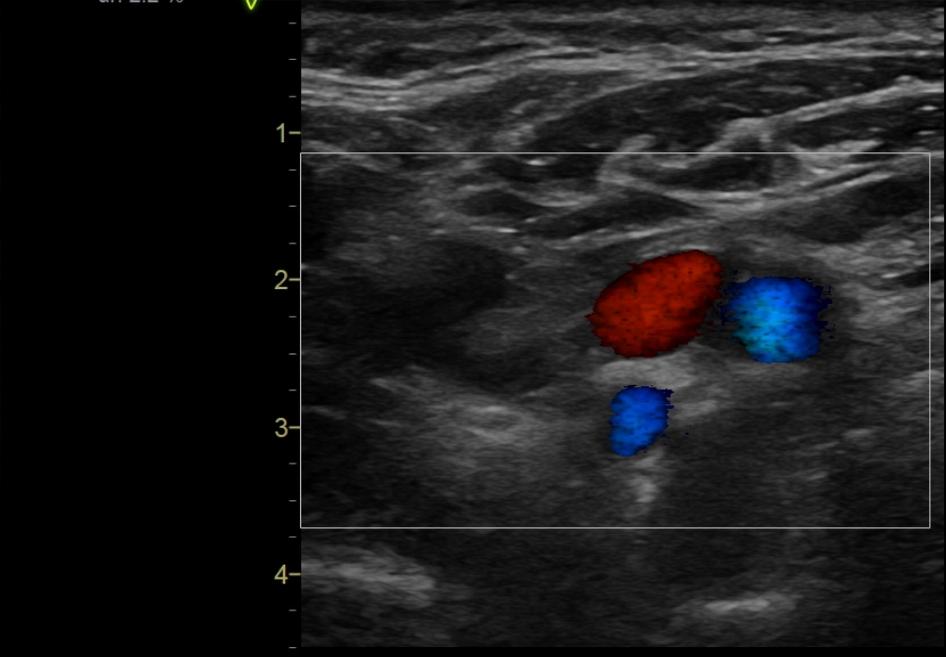
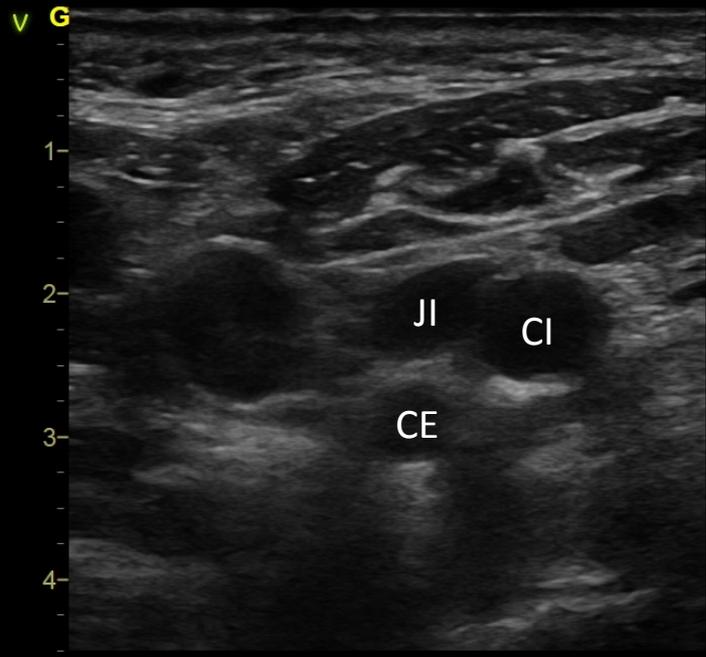
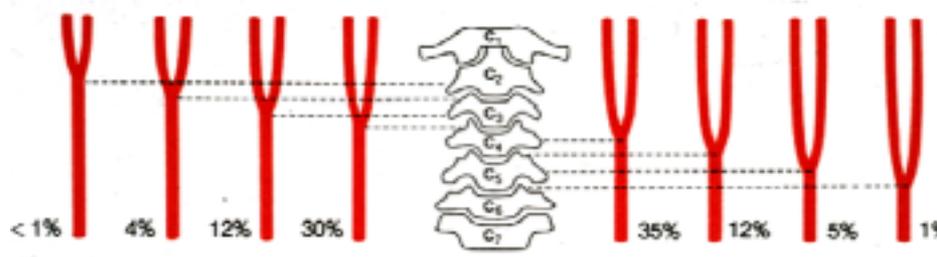


Echo-Anatomie Normale



Bifurcation Carotidienne, coupe longitudinale

Echo-Anatomie Normale



Bifurcation Carotidienne, Coupe axiale

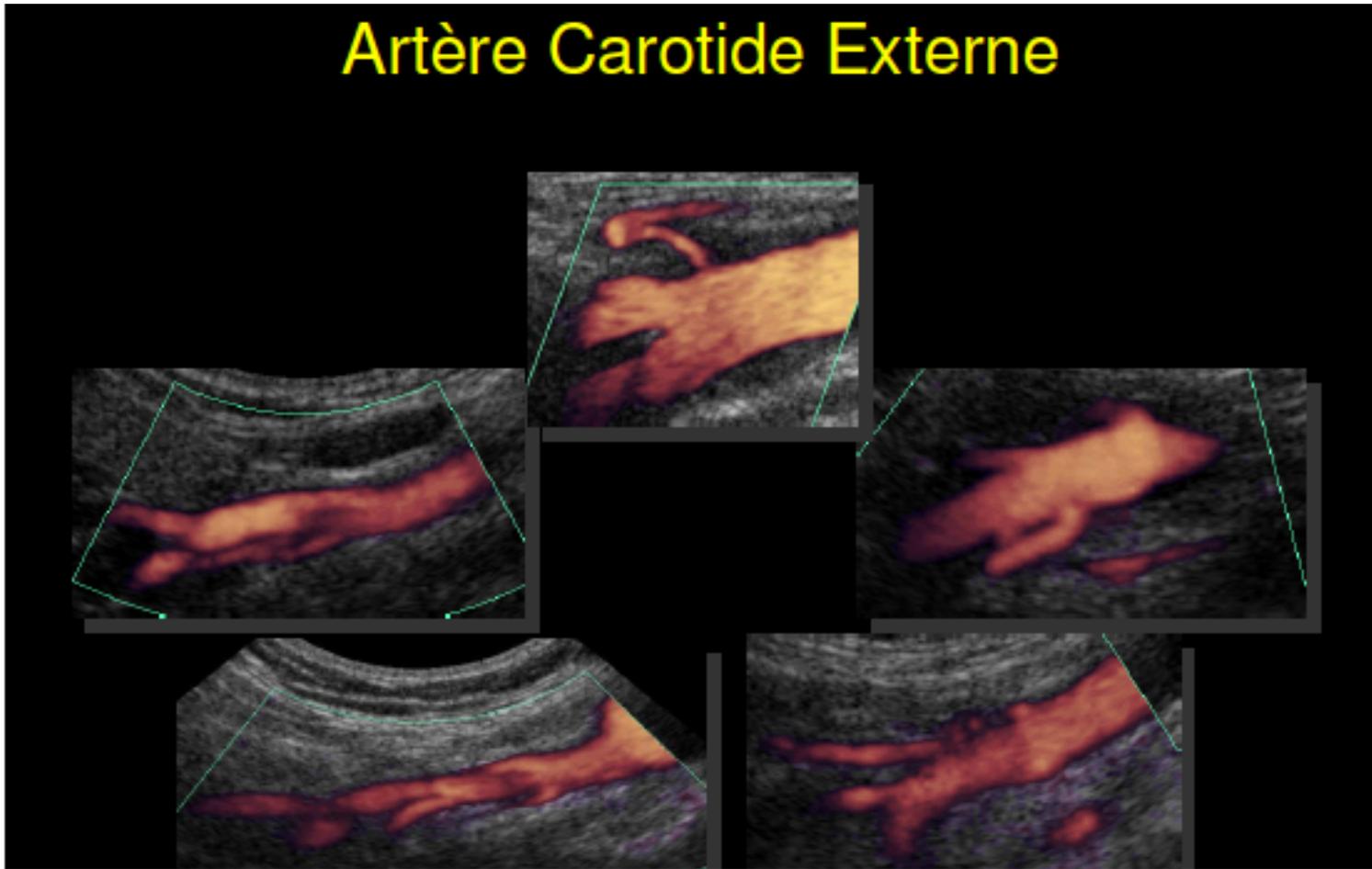
Echo- anatomie normale



Carotide externe

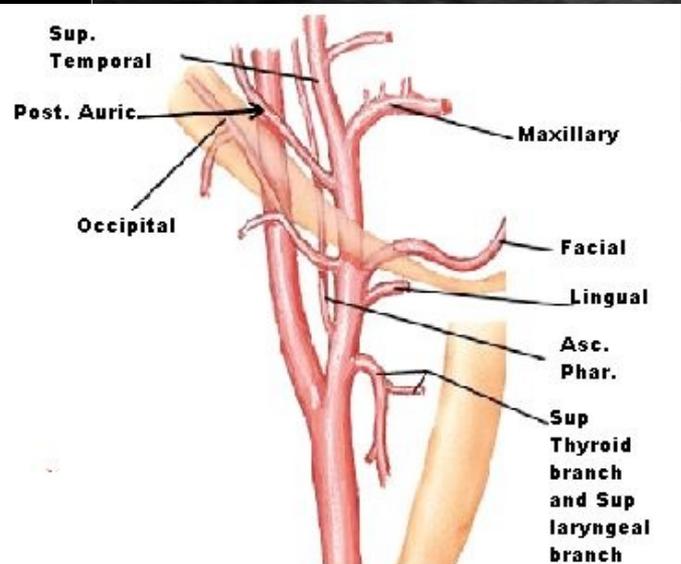
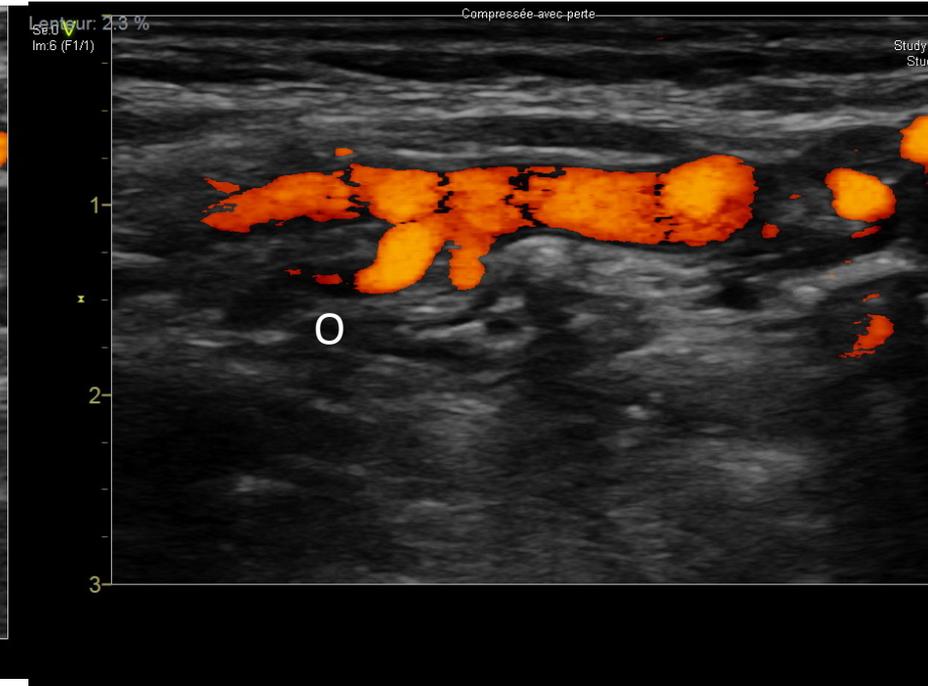
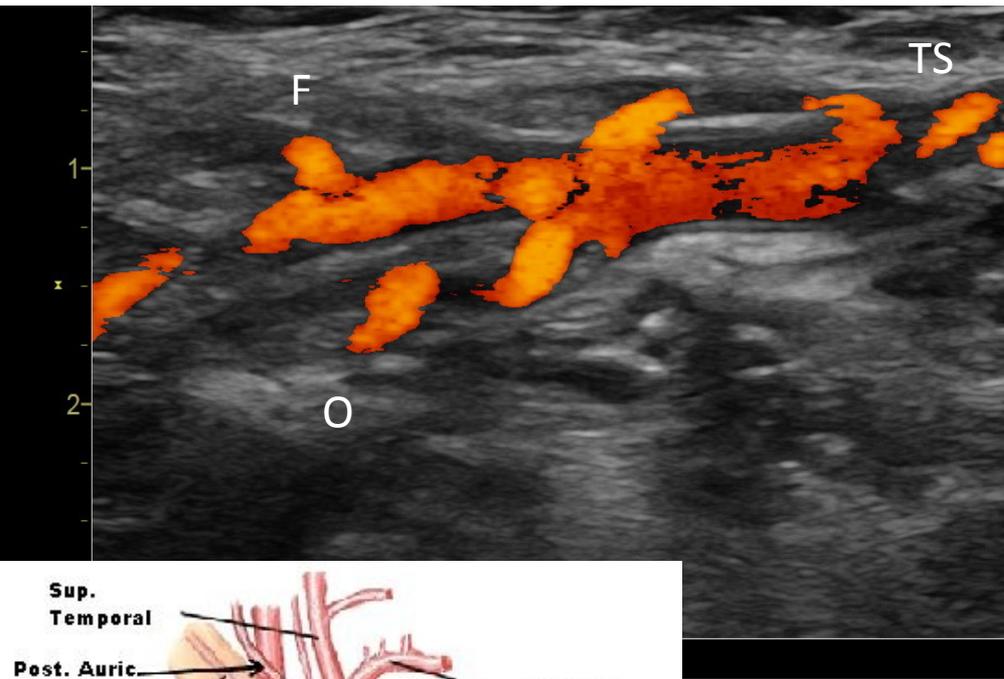
Echo- anatomie normale

Artère Carotide Externe



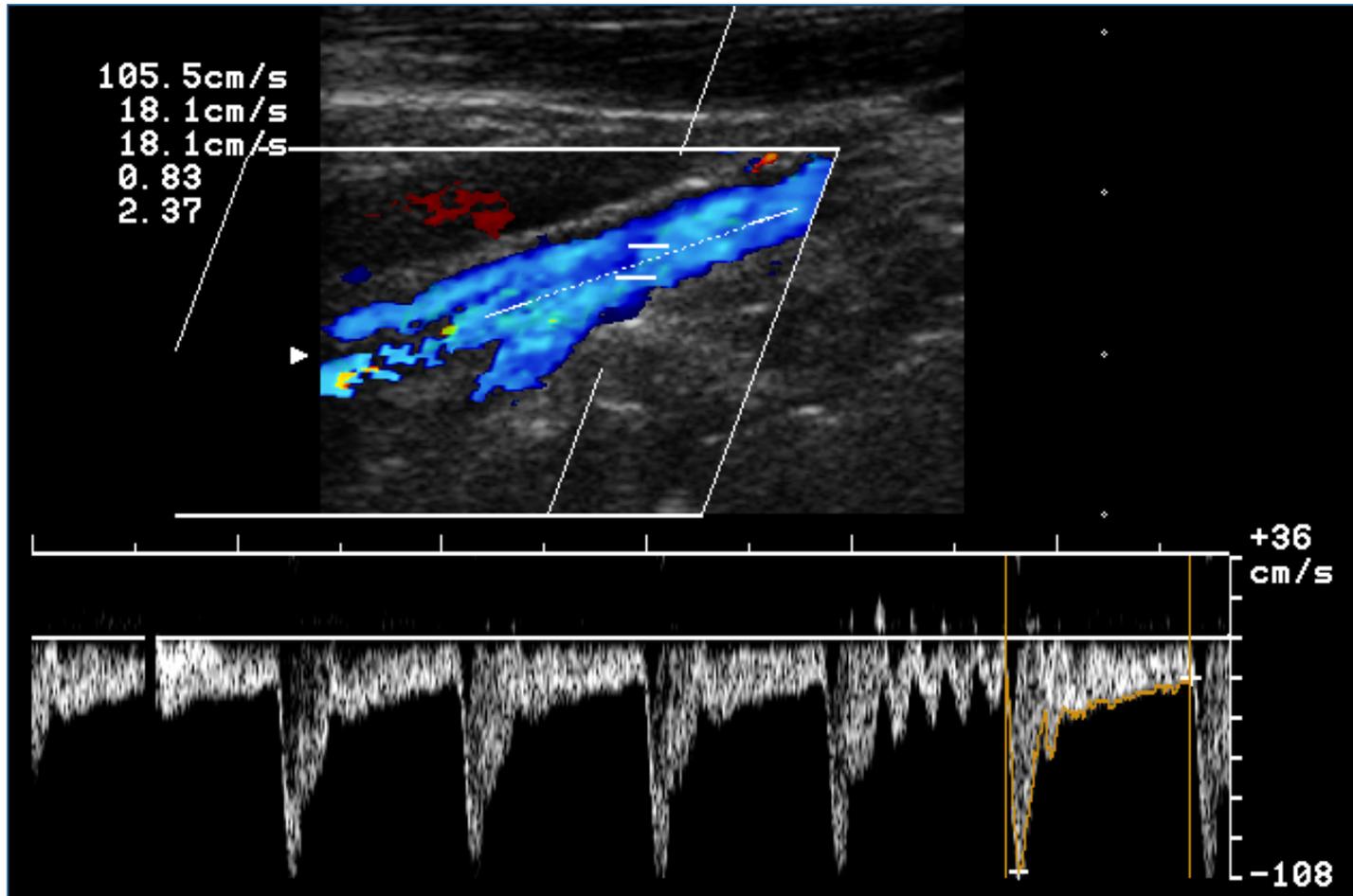
Carotide externe

Echo- anatomie normale



Carotide externe

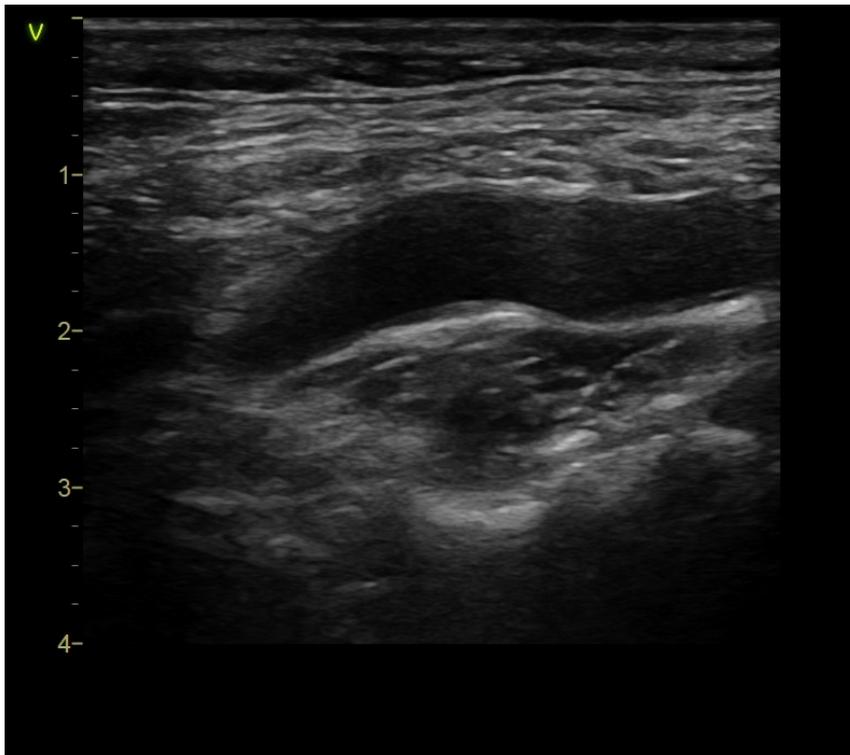
Echo- anatomie normale



Test identification Carotide externe

Echo anatomique normale

Coupe longitudinal

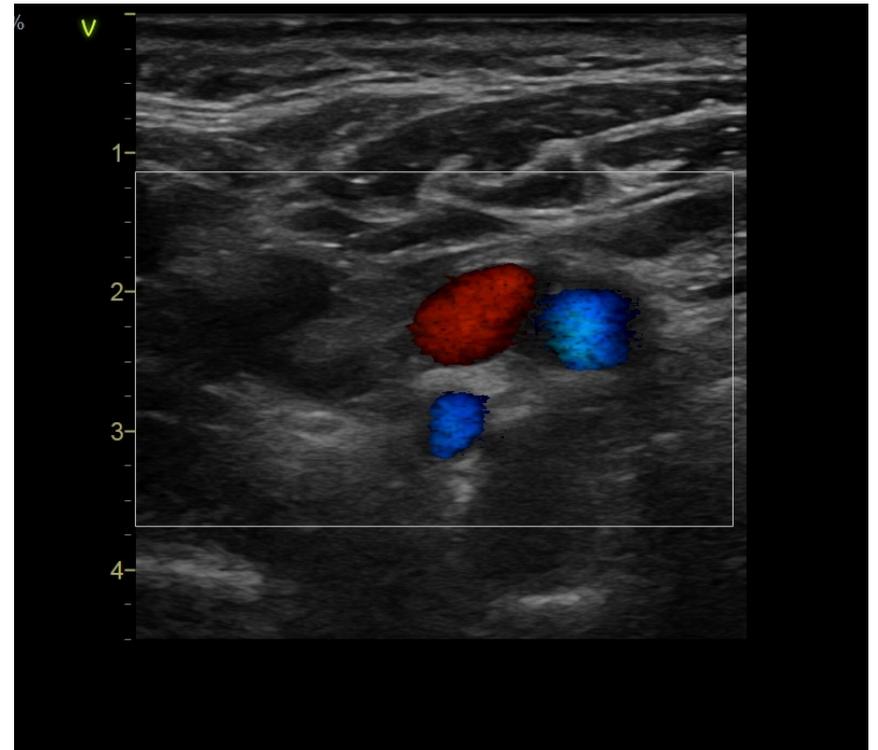
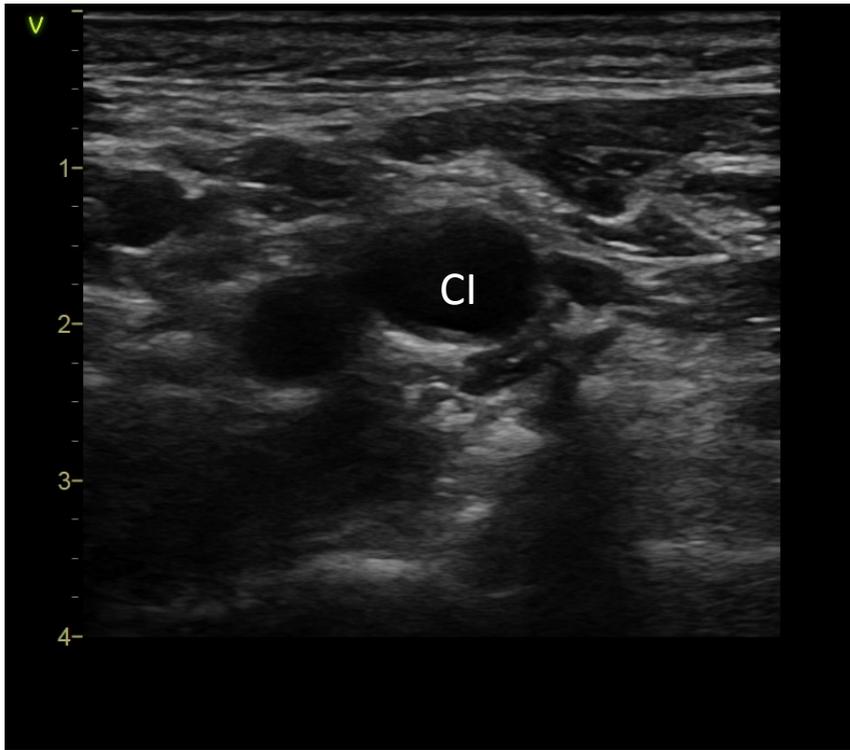


Carotide interne



Echo anatomique normale

Coupe axial, carotide interne



Echo- anatomie normale



Carotide Interne

Variation

- Bouche
- Agénésie/hypoplasie
- Variation de naissance de branche CE
- Niveau de bifurcation haute/ basse

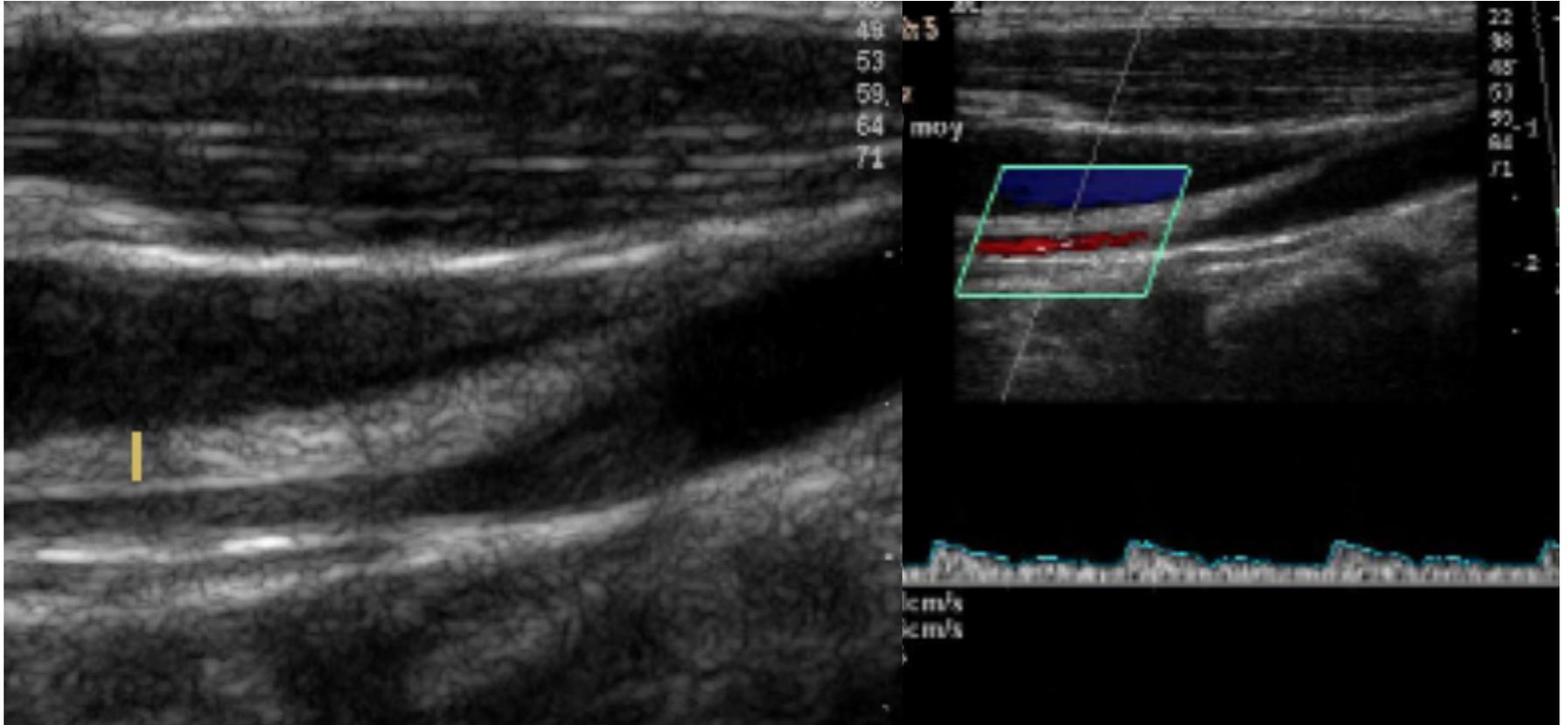
Boucle



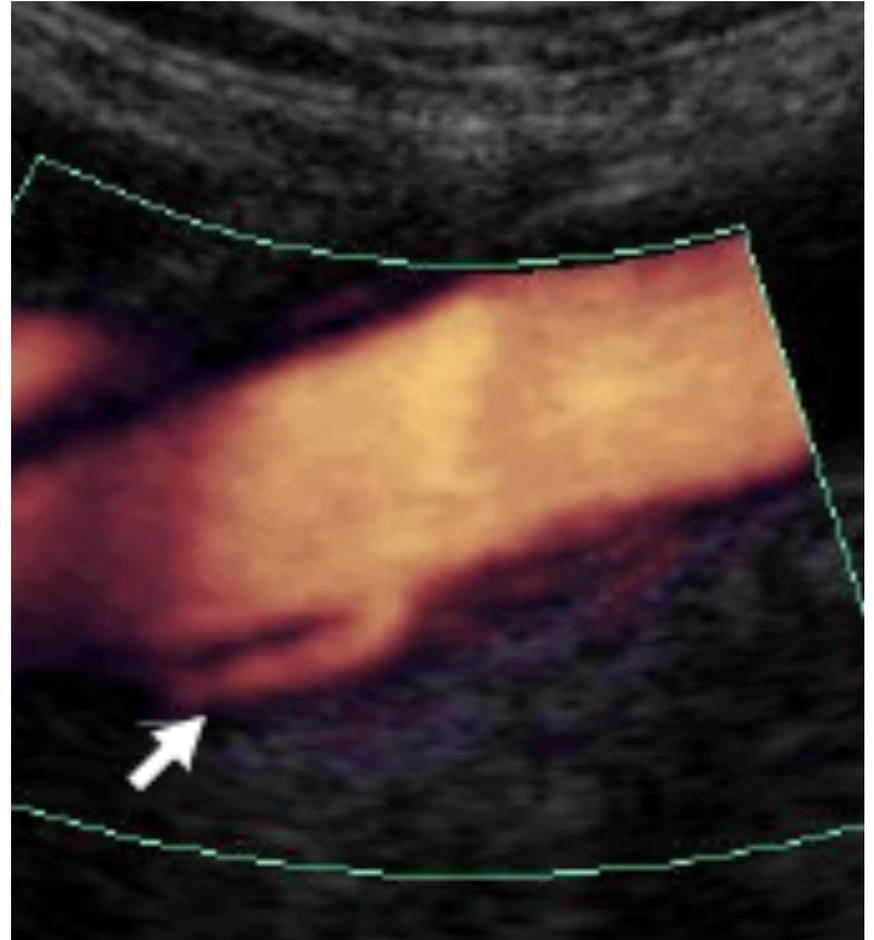
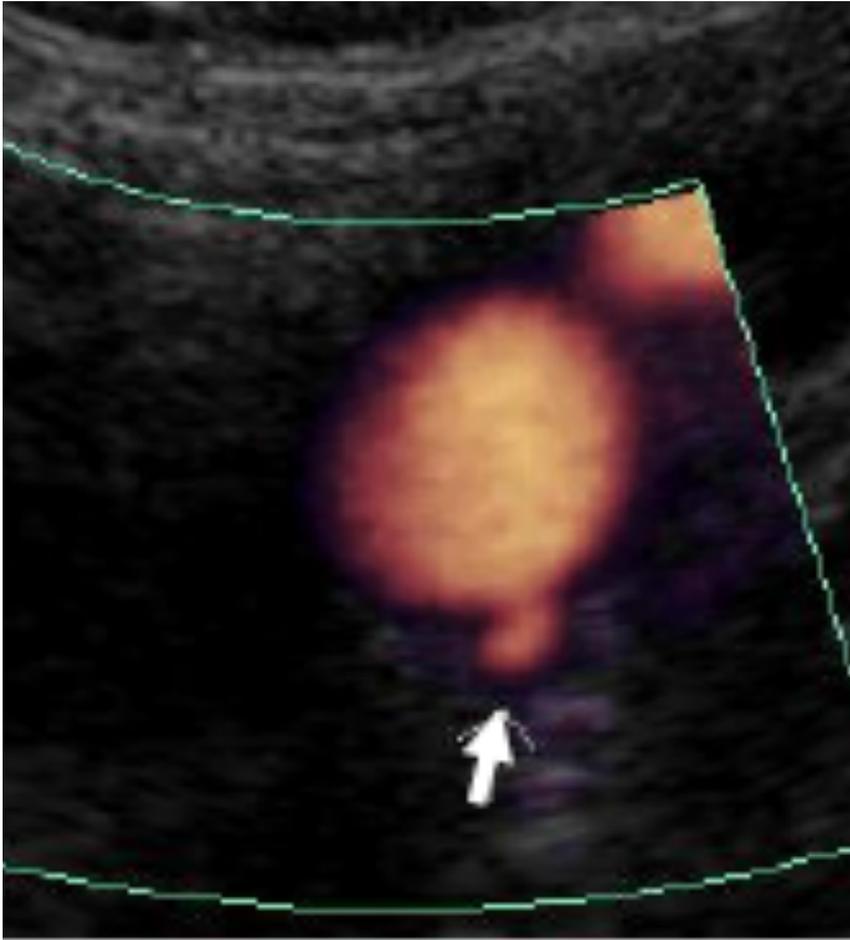
Boucle



Hypoplasie



Collatérale de CE naissant CI



Pièges



Artère Ophtalmique

Schéma anatomique

Rameau frontal de l'artère
temporale superficielle

A. Ethmoïdales

Carotide Interne

A. Maxillaire

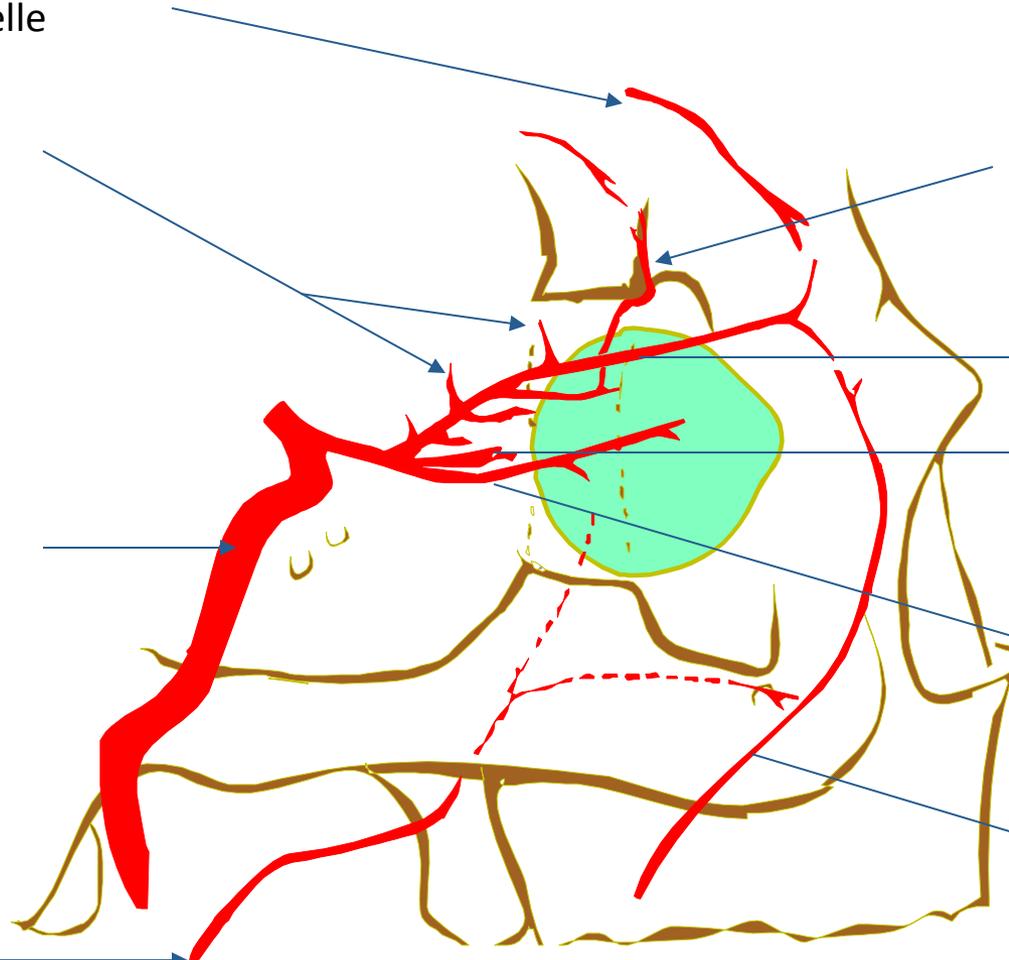
A. supra-orbitaire

A. Ophtalmique

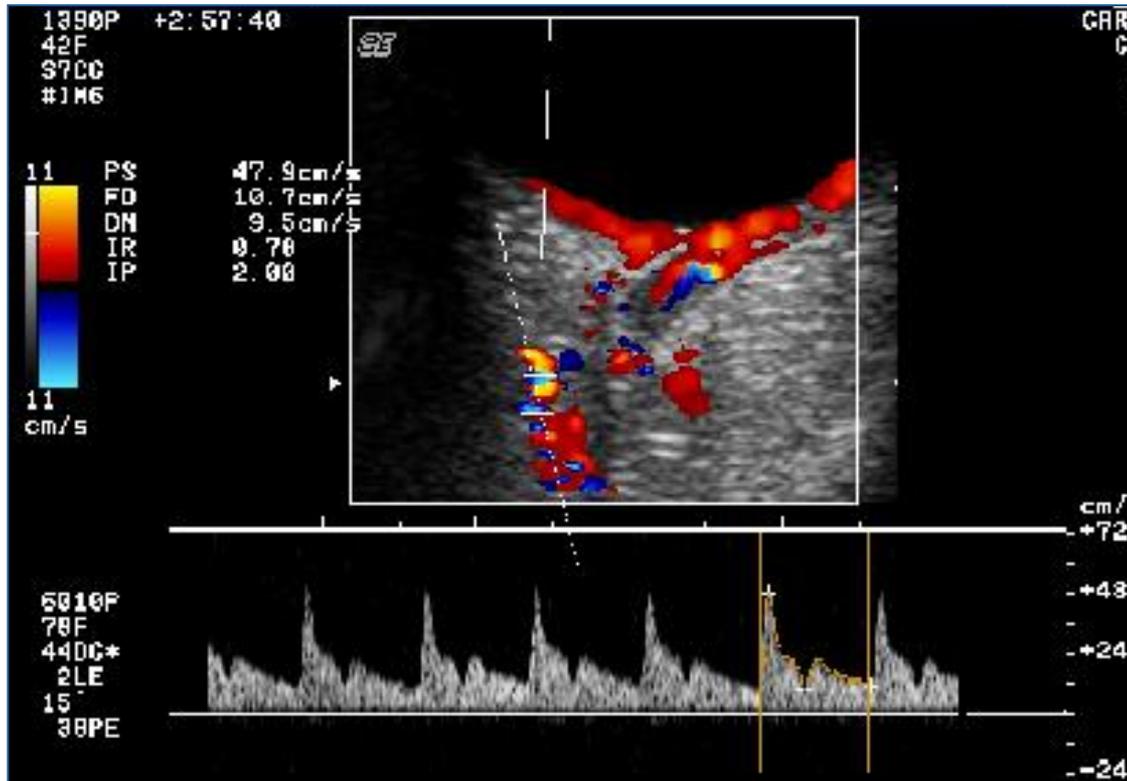
A. Ciliaires courtes

A. Lacrymale

A. Faciale



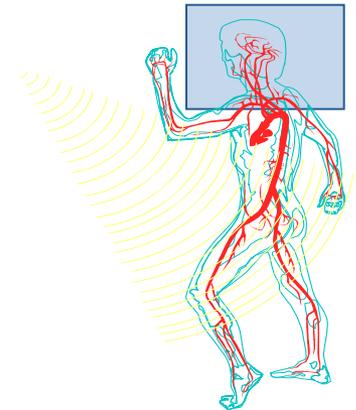
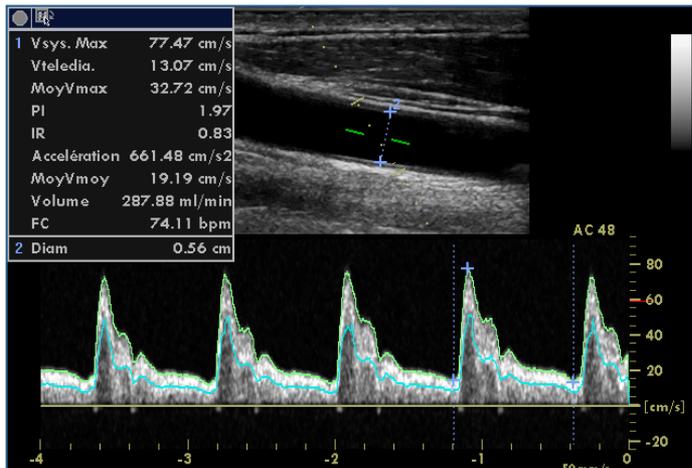
Étude Fonctionnelle : Doppler



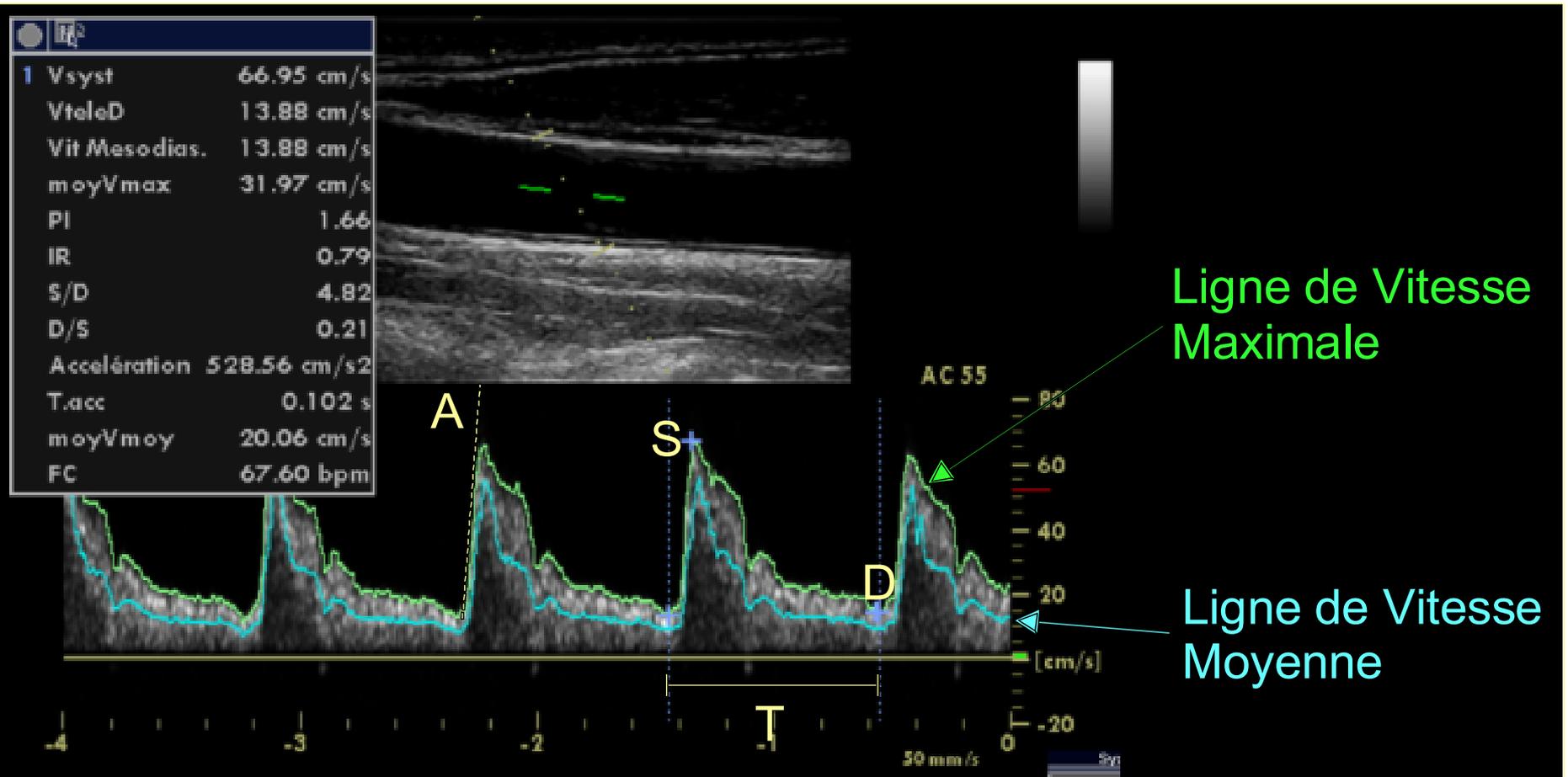
- Artère Ophthalmique :
 - Sens circulatoire +
 - Modulation
 - Vitesse circulatoire
 - Indice de Résistance
 - Tracé différent selon l'incidence

Étude Fonctionnelle : Doppler

- Profil d'écoulement
- Vitesses systoliques et diastoliques
- Indice de Résistance / de Pulsatilité

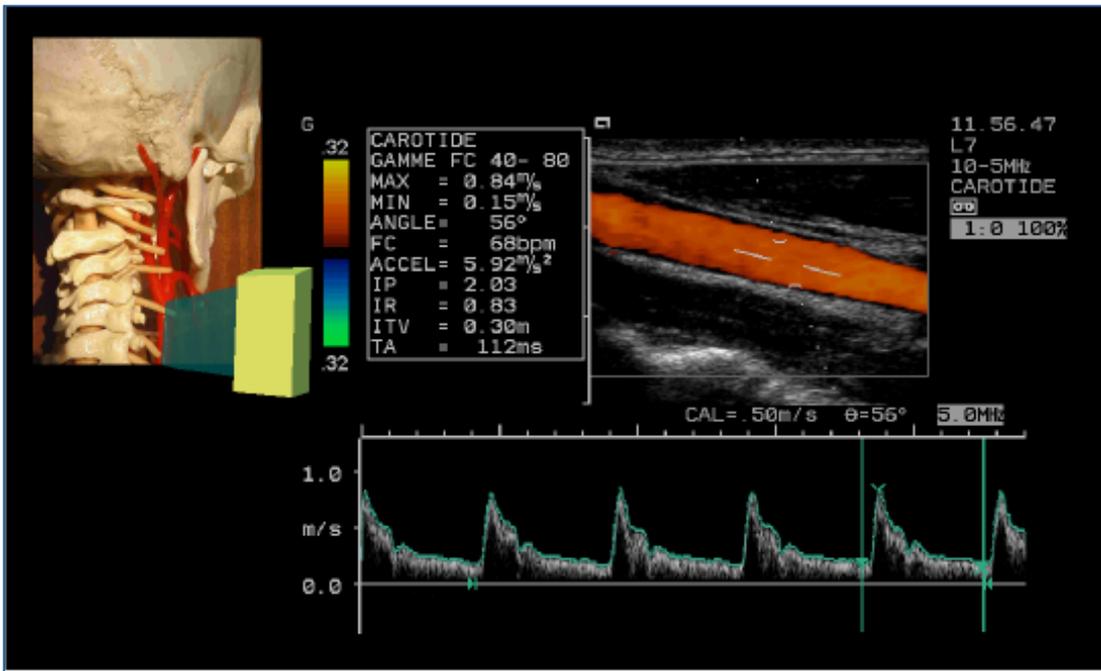


Analyse Spectrale en temps réel



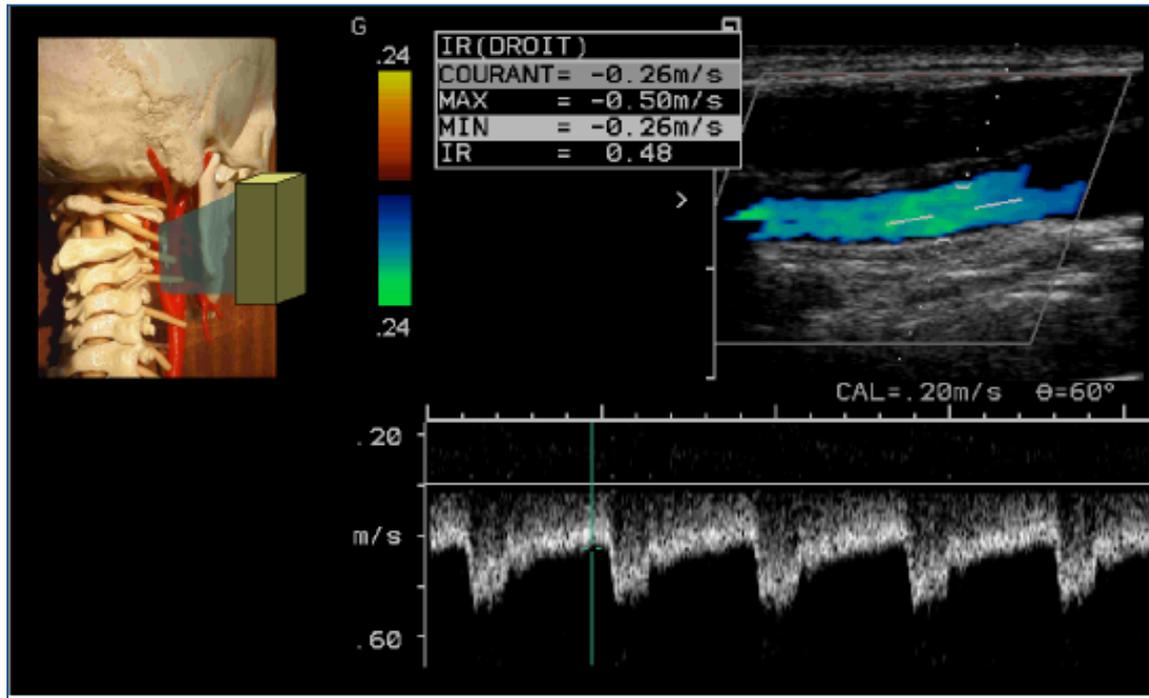
Mesures quantitatives : vitesses systolique, télé-diastolique, moyenne, indice de résistance et de pulsatilité, débit, accélération...

Étude Fonctionnelle : Doppler



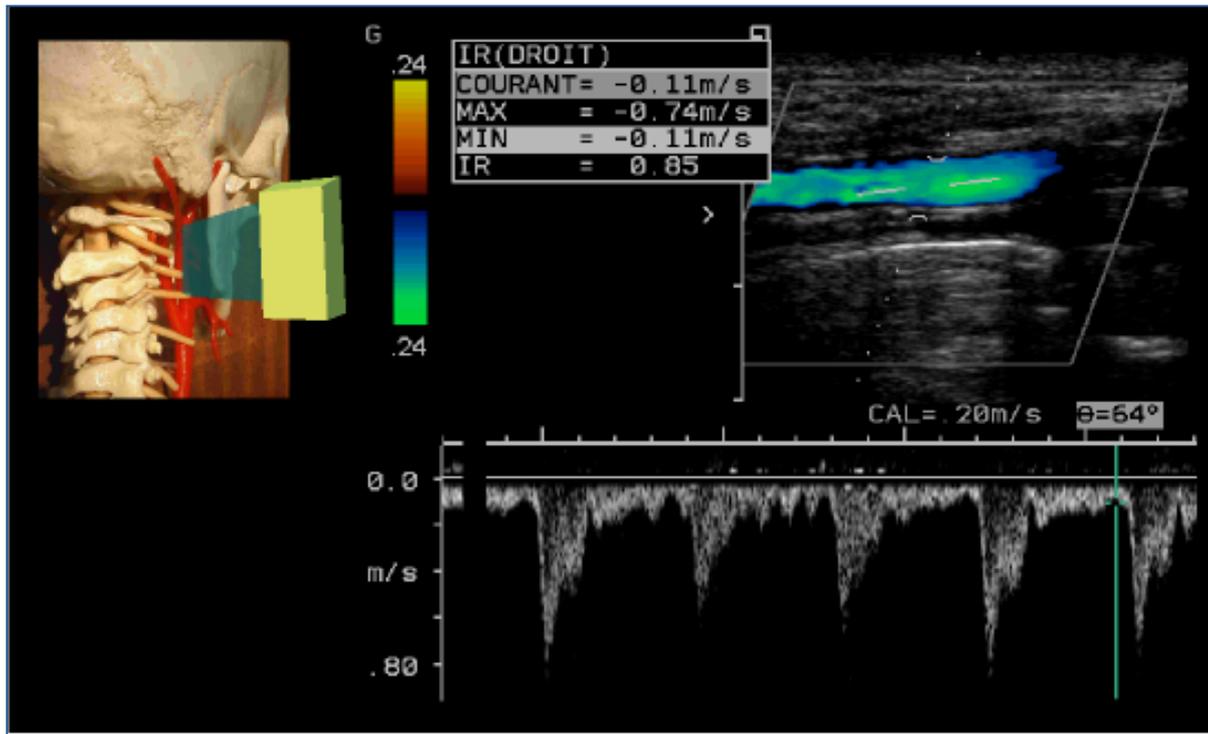
- Carotide Commune :
 - Pic systolique ample, à front raide
 - Décélération post-systolique rapide
 - Vitesse diastolique moyenne
 - Indice de Résistance 0,75 à 0,85

Étude Fonctionnelle : Doppler



- Carotide Interne :
 - Pic systolique à front raide
 - Décélération post-systolique progressive
 - Vitesse télé-diastolique élevée
 - Indice de Résistance bas

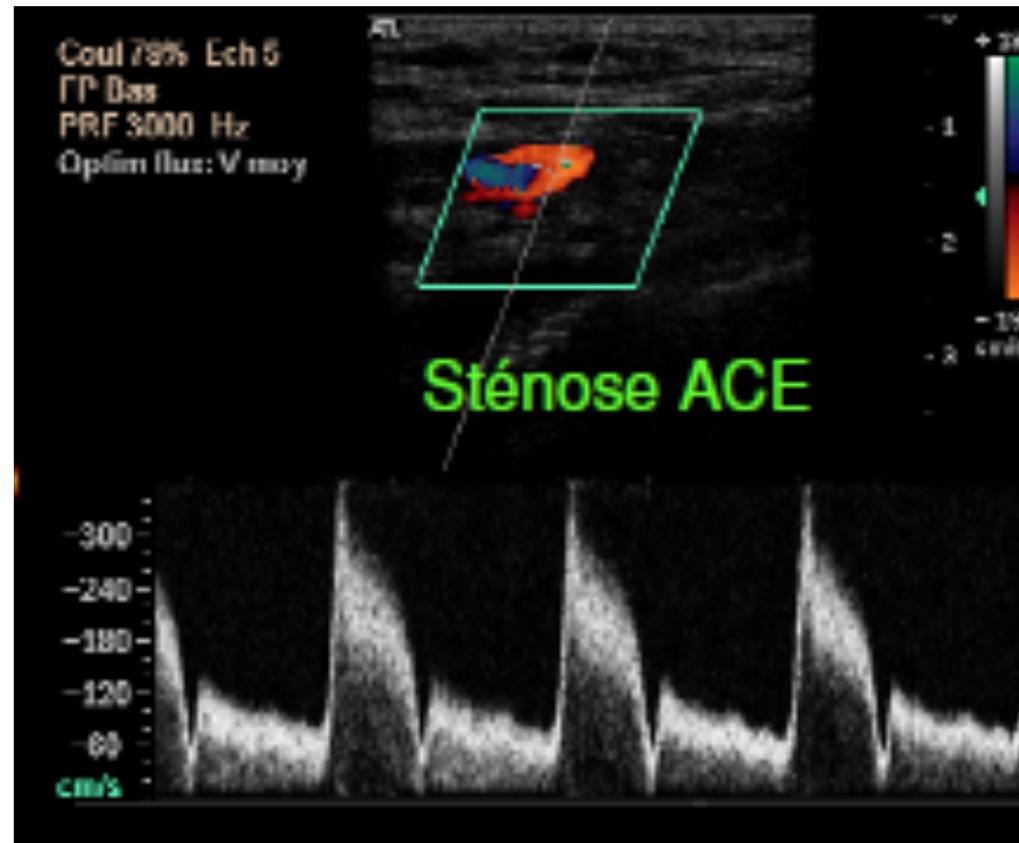
Étude Fonctionnelle : Doppler



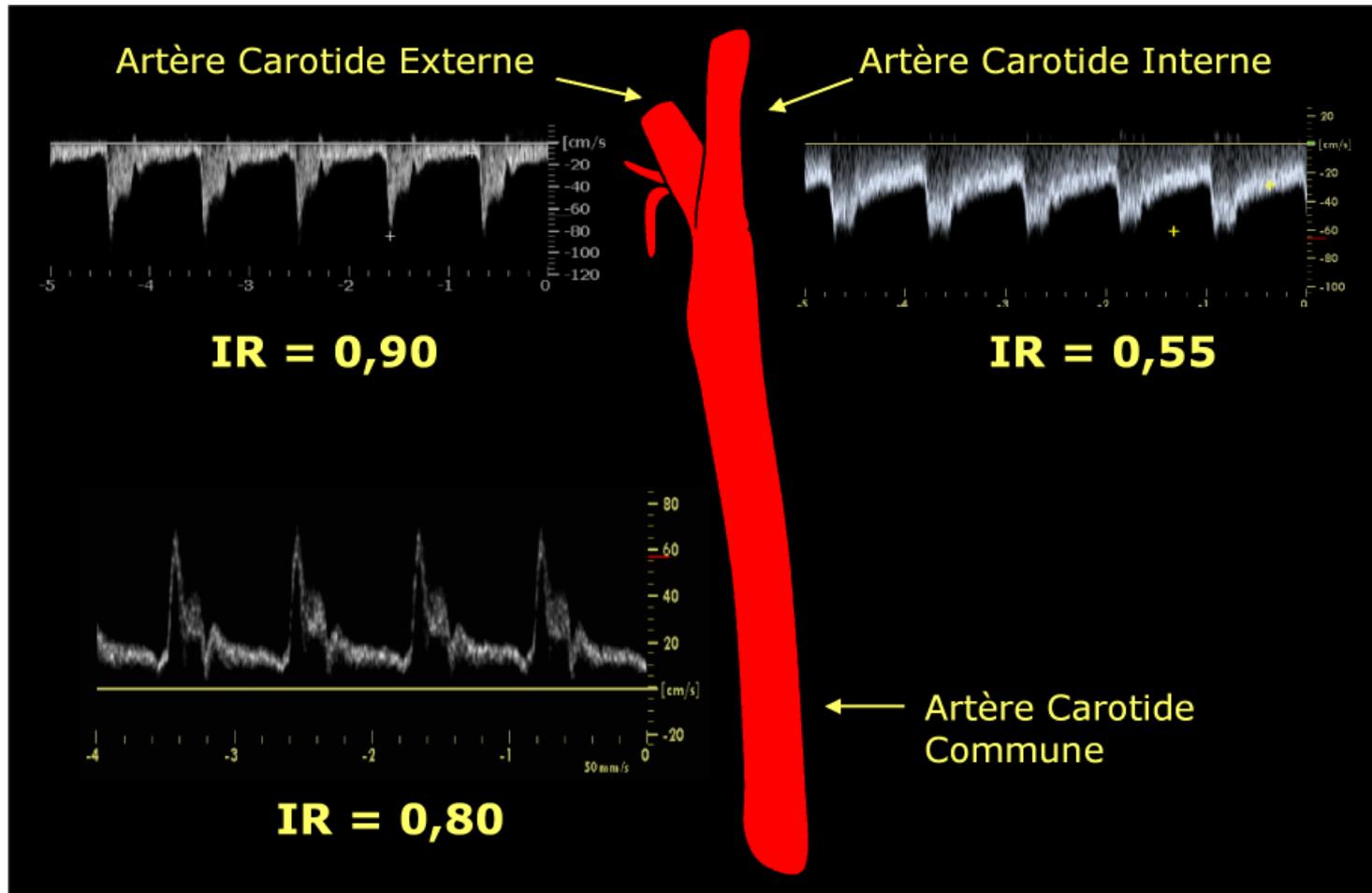
- Carotide Externe
 - Pic systolique à front raide
 - Décélération post-systolique brusque
 - Vitesse télé-diastolique faible ou nulle
 - Reflux post-systolique éventuel
 - Test : compression temporale superficielle

Etude fonctionnelle Doppler

- Artère carotide externe
 - Augmentation du flux diastolique
 - Suppléance ACE
 - ACE internalisé
 - Occlusion ACI
 - V/D faciale
 - Goître hypervasculaire
 - Sténose ACE
 - Baisse des résistances en aval



Résistance Circulatoire (ou impédance)



Différences de modulation des tracés Doppler en fonction du niveau de résistance circulatoire d'aval

Tracés Doppler Normaux

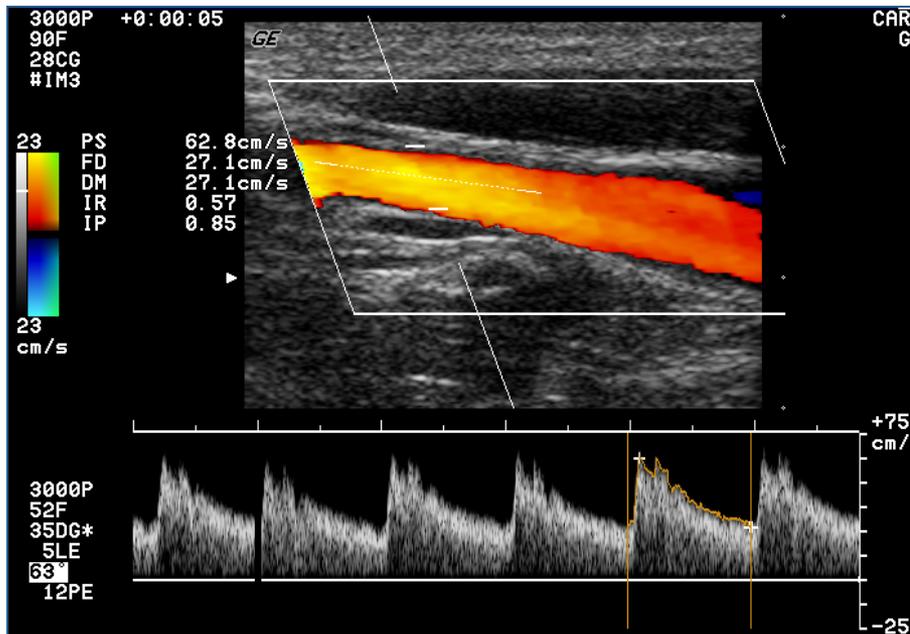
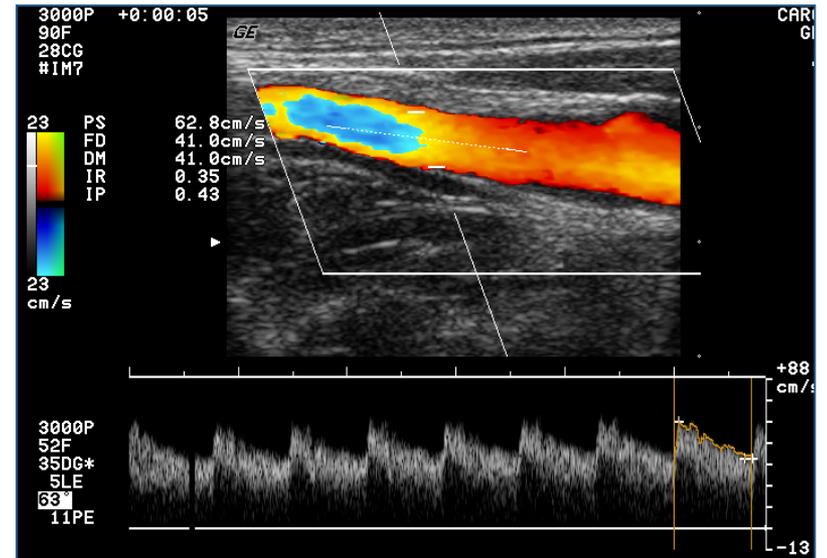
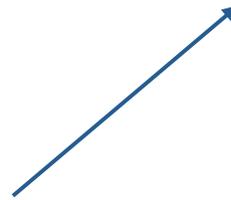


Bulbe carotidien : flux
tourbillonnaire normal

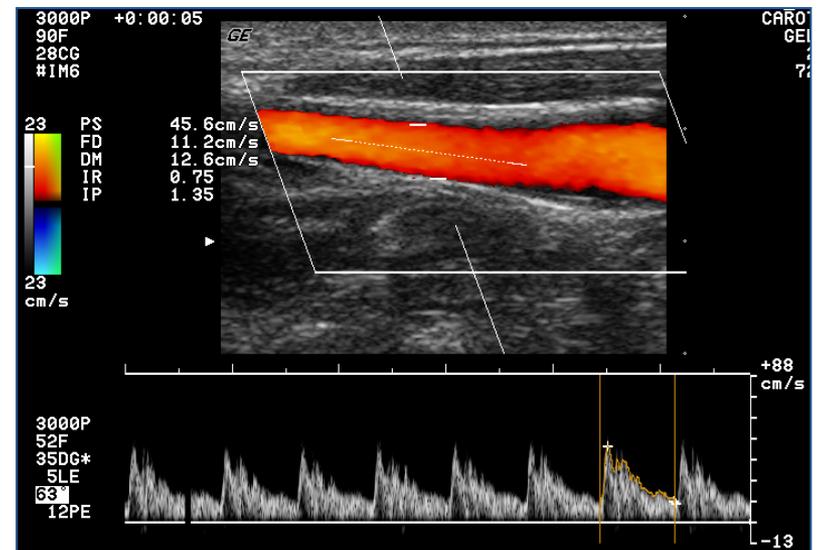
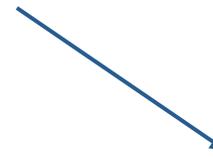
Physiologie

Carotide Interne

Apnée

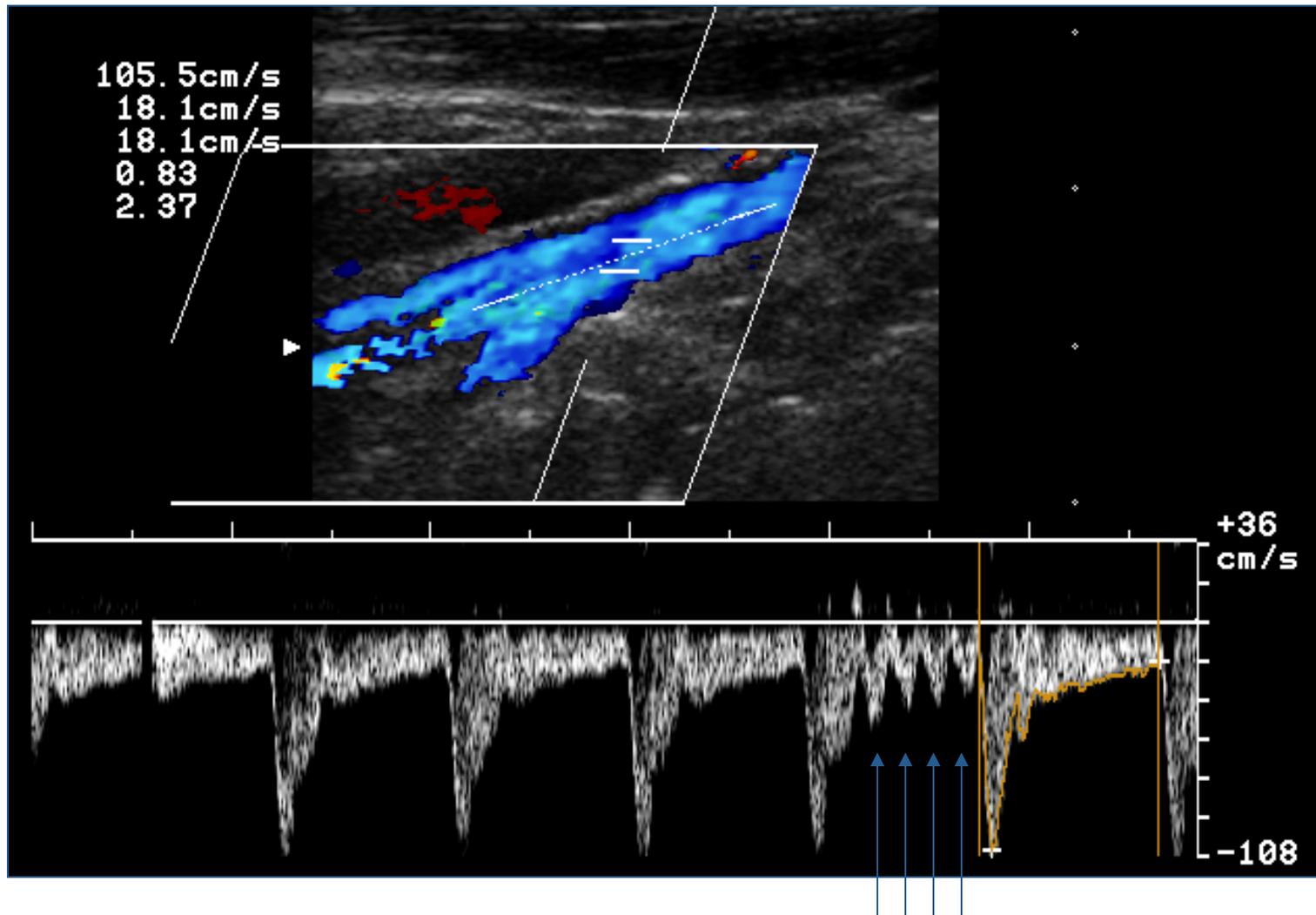


Ventilation Normale



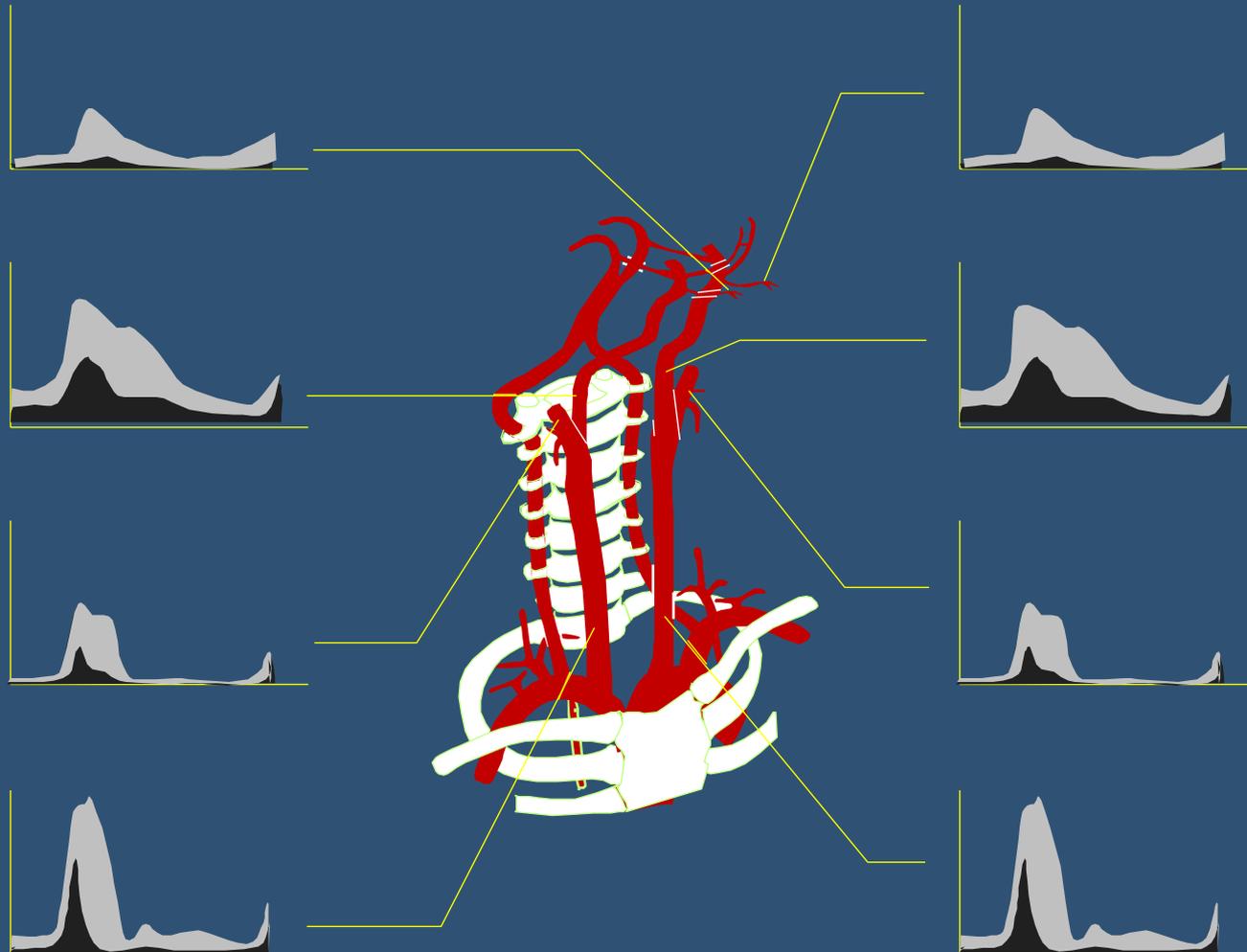
Hyper-Ventilation

Test d'identification



Compression oscillante de l'artère temporale superficielle pour l'identification de la Carotide Externe

Artères Carotides



Tracés Doppler Normaux

Réglage

Réglage angle



Réglage gain couleur/BFI





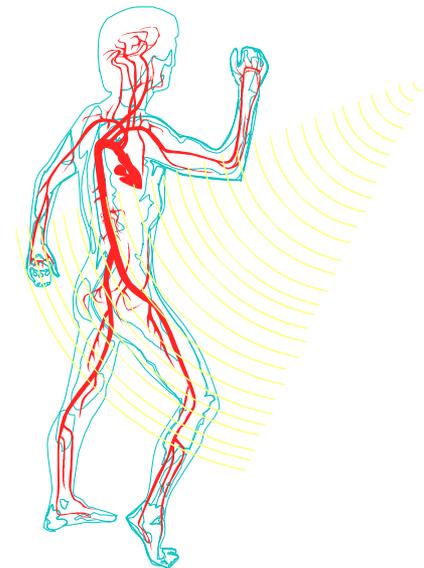
Artères Vertébrales

Examen Écho-Doppler

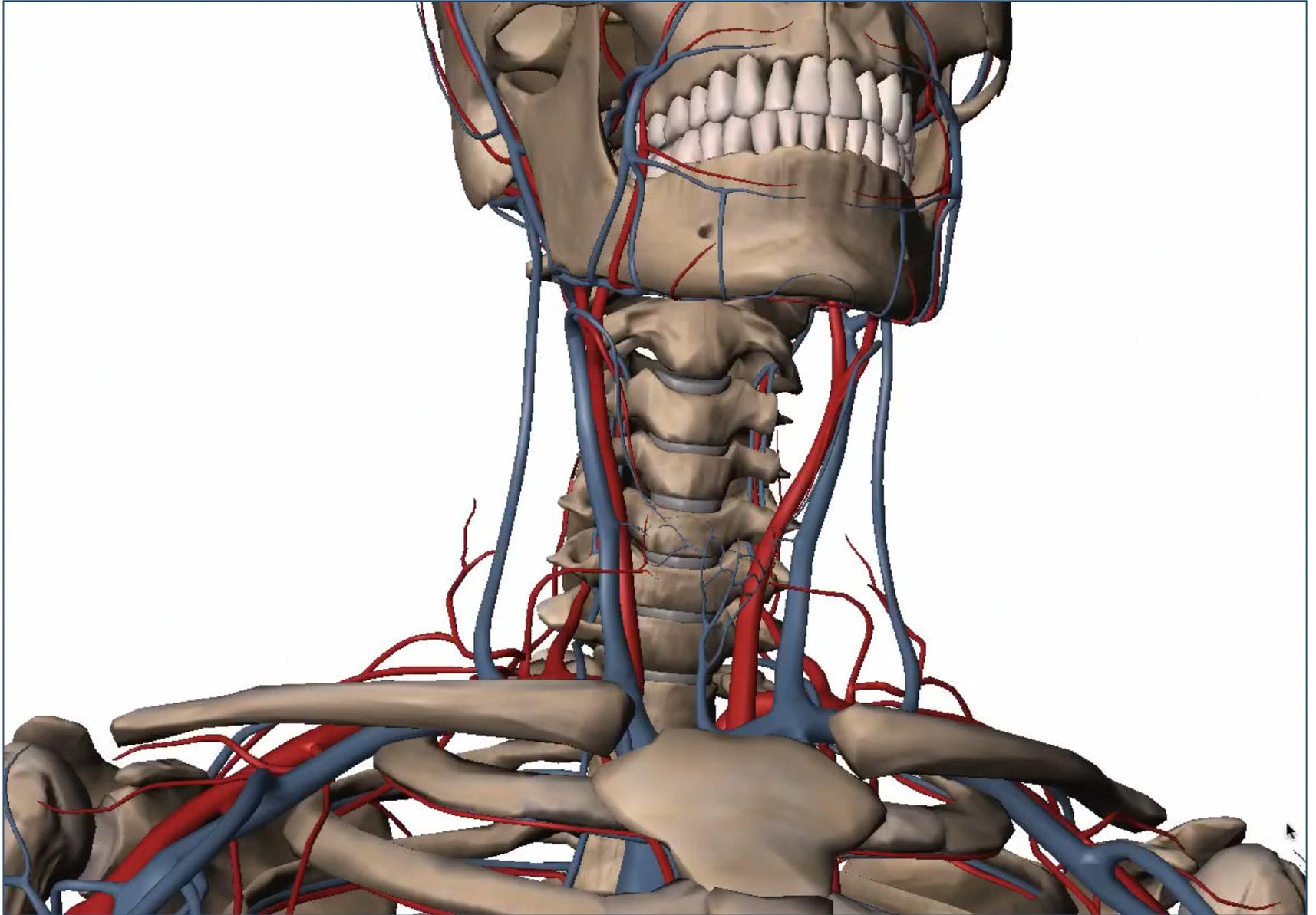


Artères vertébrales

- Echo- anatomie
 - Artère vertébrale
 - Artère subclavière
- Variation
- Sémiologie écho-Doppler Normale
- Vol vertébro sub clavier
- Piège



Anatomie Normale



Anatomie Normale

Vertébrale V3

Vertébrale V2

A. Cervic. Ascendante

A. Cervic. Profonde

Tc. Thyro-Cervical

Tc. Costo-Cervical

A. Subclavière

A. Thoracique Int.

A. Occipitale

Carotide Externe

Carotide Interne

Carotide Commune

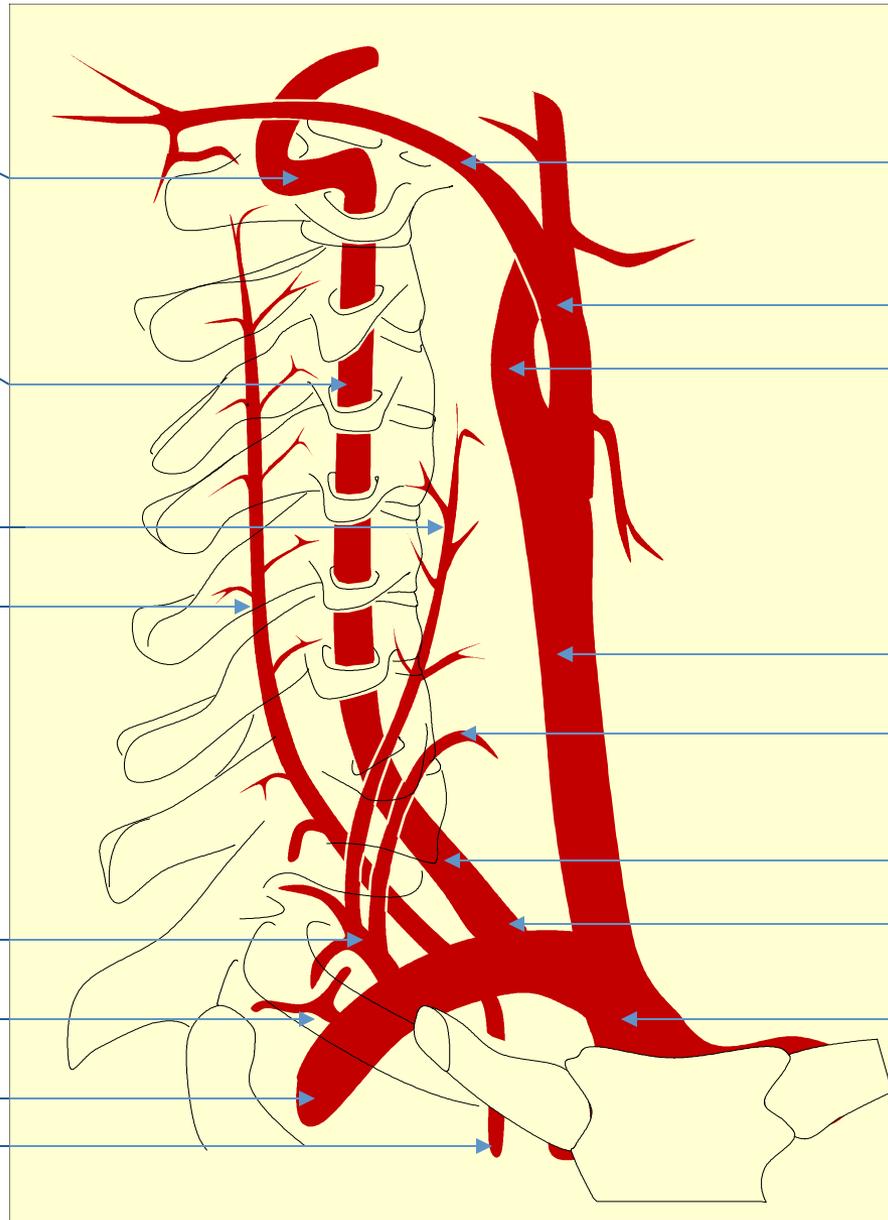
A. Thyroïdienne Inf.

Vertébrale V1

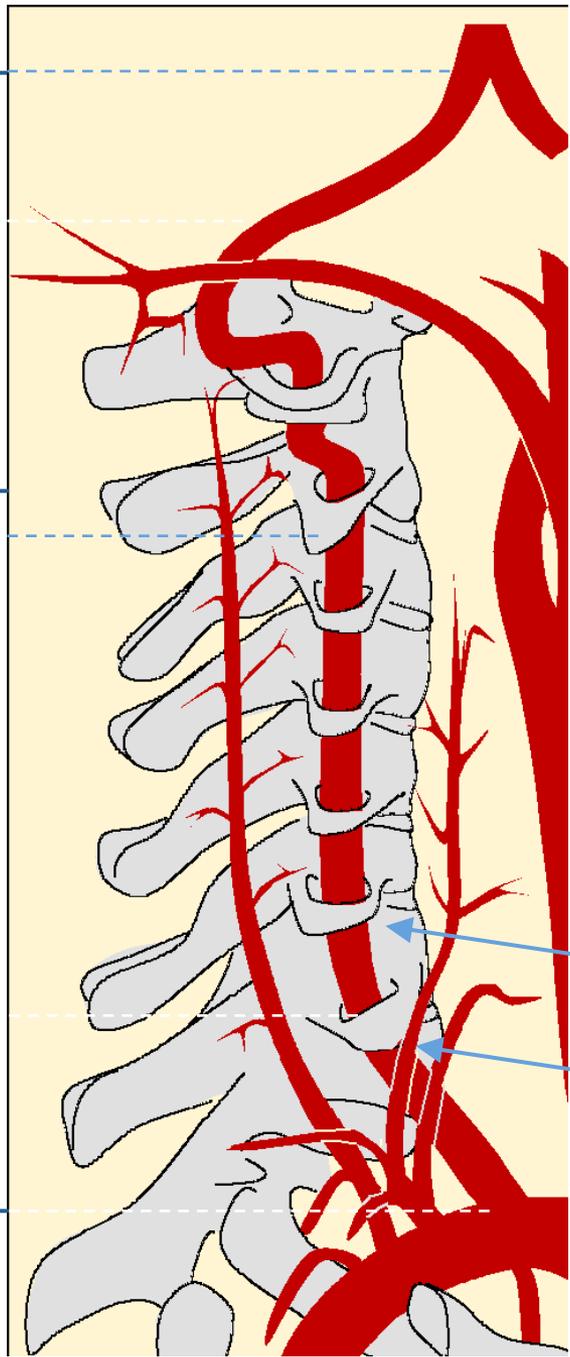
Vertébrale V0

Tc. Brachio-Céphalique

Schéma



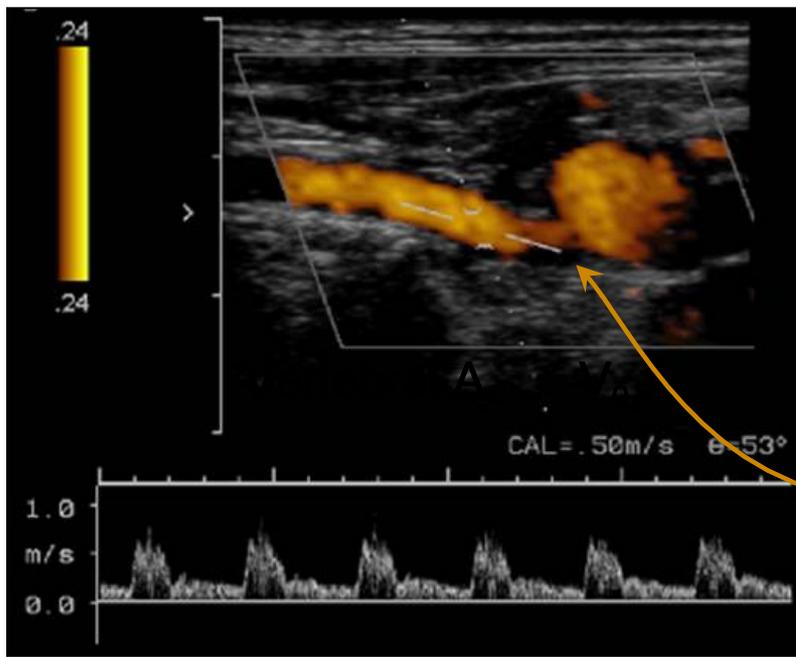
V₄ (intra-durale)
V₃ (C₂ à durale)
V₂ (foraminale)
V₁ (pré-foraminale)
V₀ (Origin)



Anatomie:

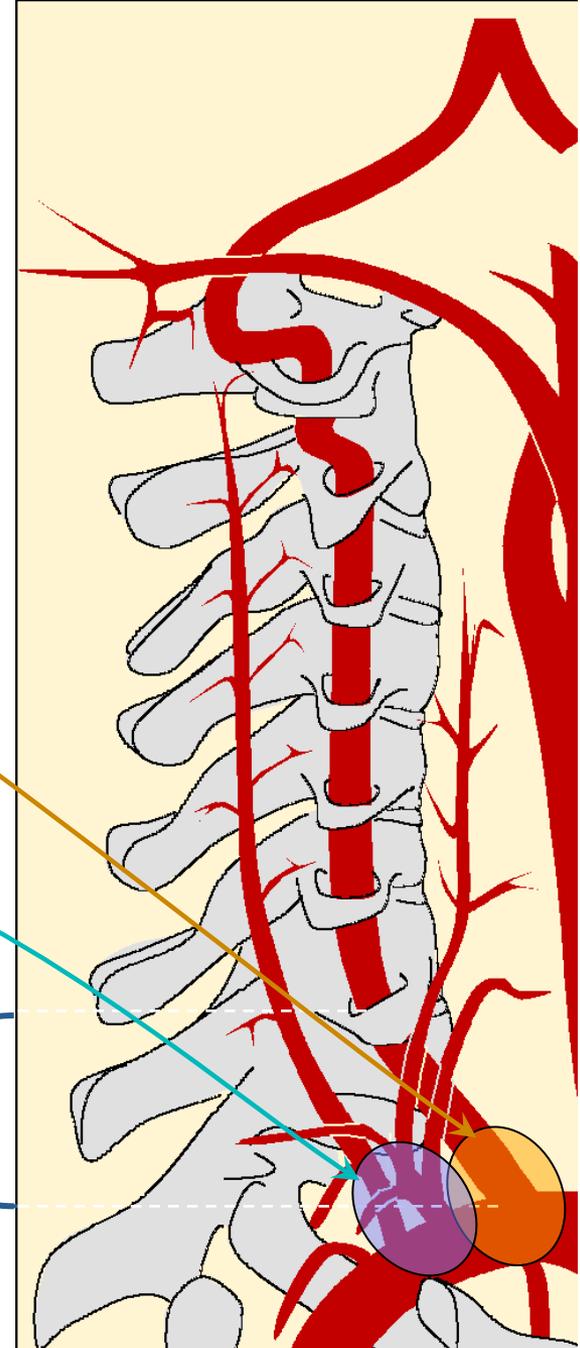
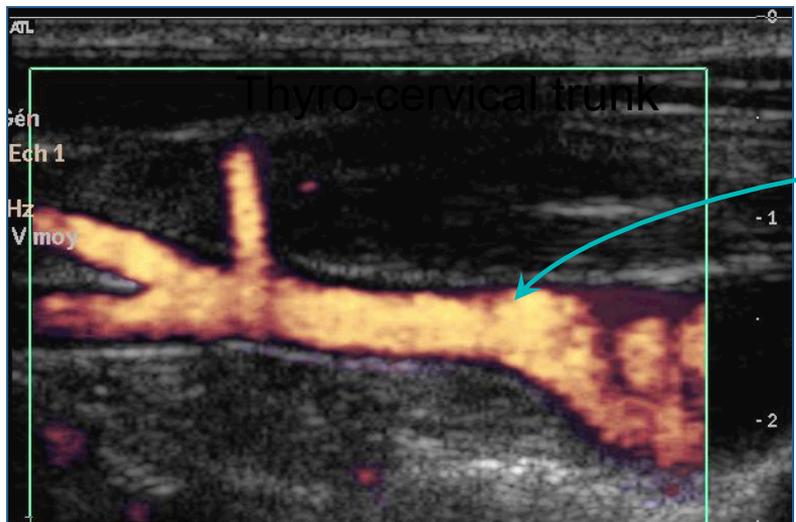
4 segments anatomiques de l'artère vertébrale

C₅ (5%)
C₆ (90%)



Echo-Doppler

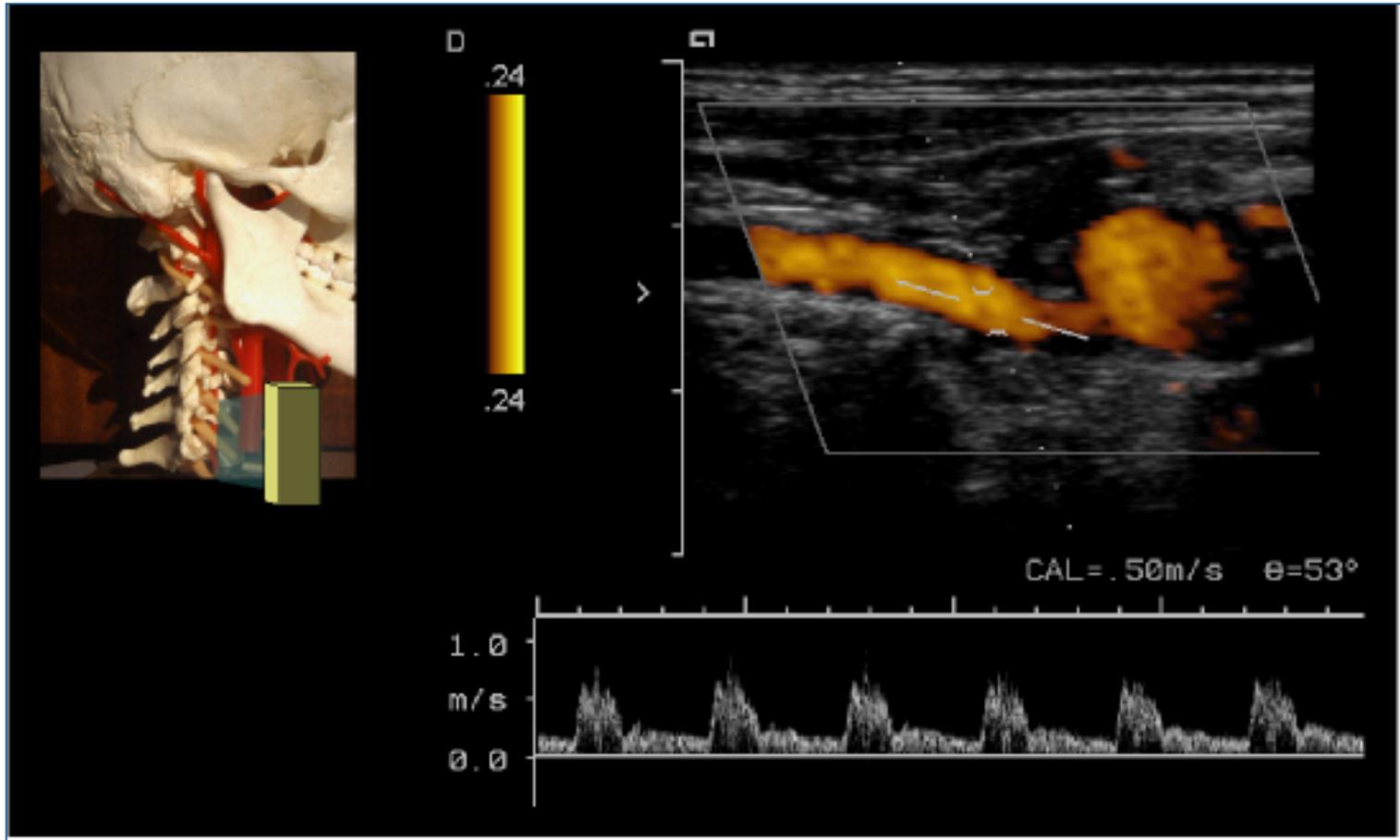
Segment pré-foraminal



V_1
 V_0

NB: artère vertébrale gauche naît de l'aorte ou de la partie proximale de l'artère subclavière dans 7% des cas

Echo-Anatomie

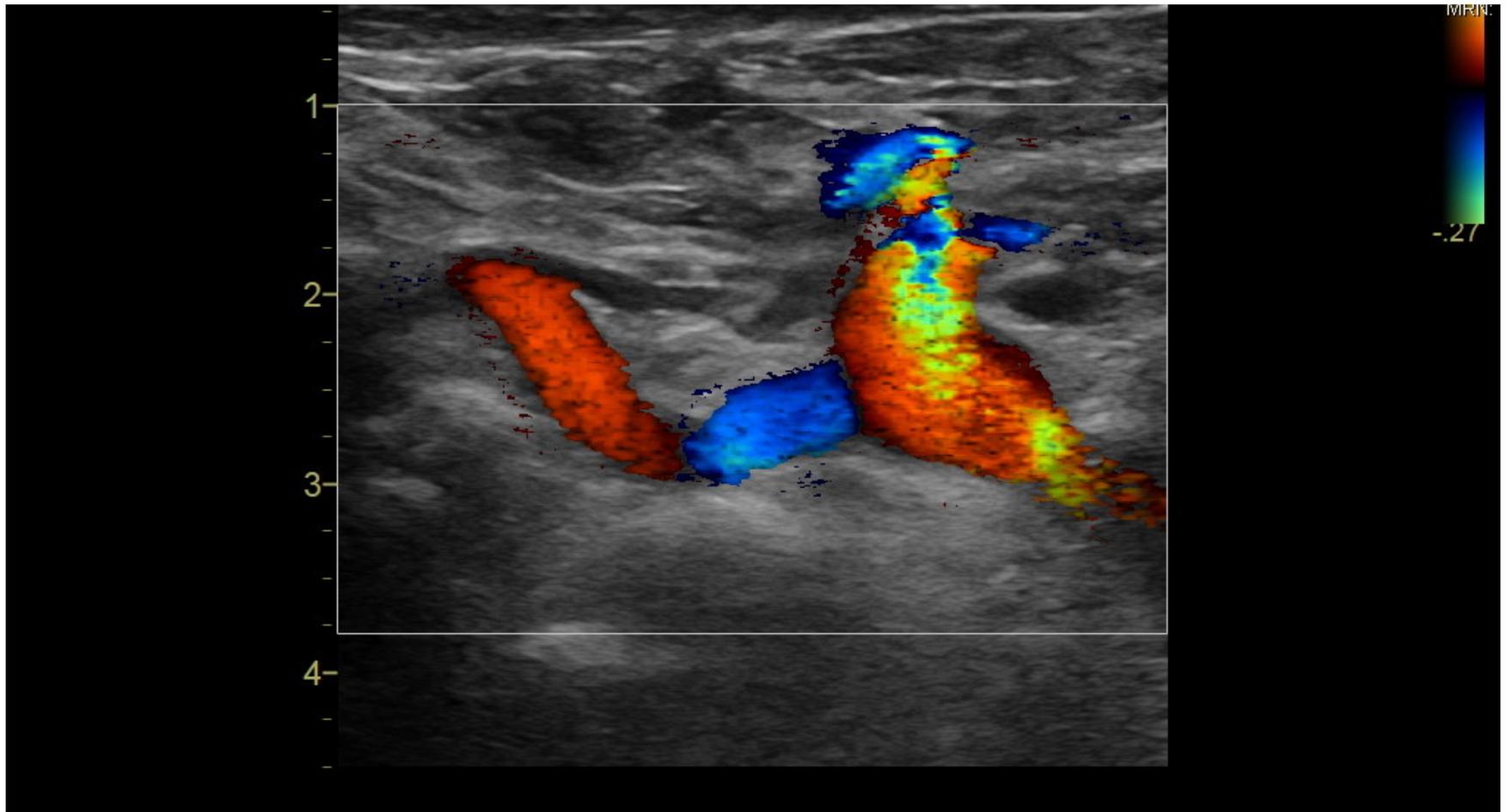


Artère Vertébrale – V0 – V1

V0 = Accessible dans 80% des cas à droite, 65% à gauche

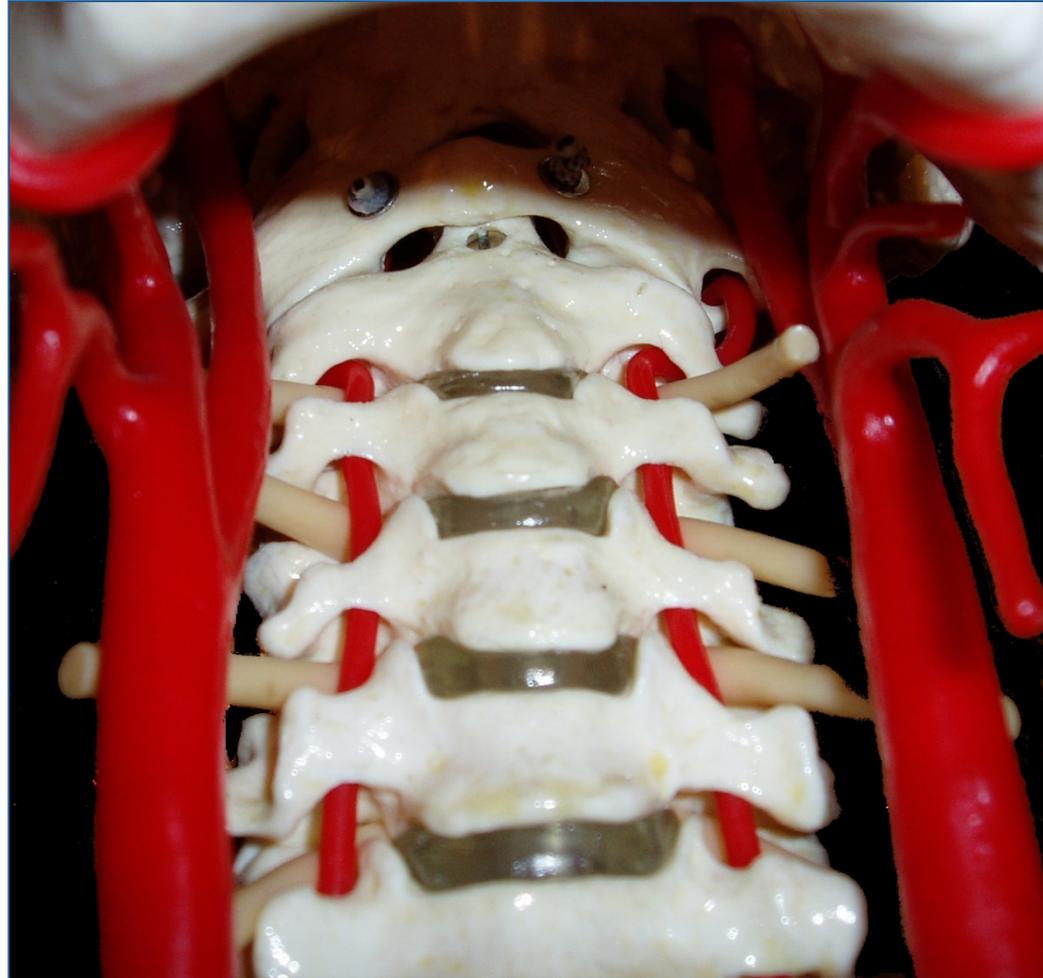
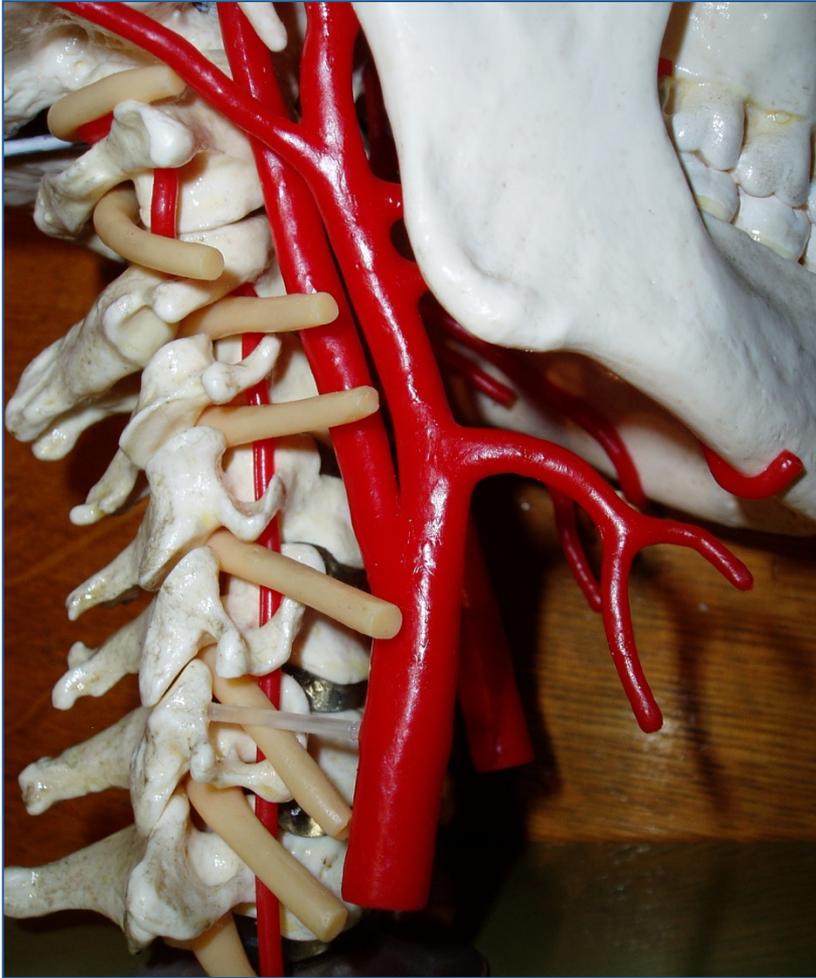
(Bartels E, Angiology 1992)

Echo- anatomie normale



V0

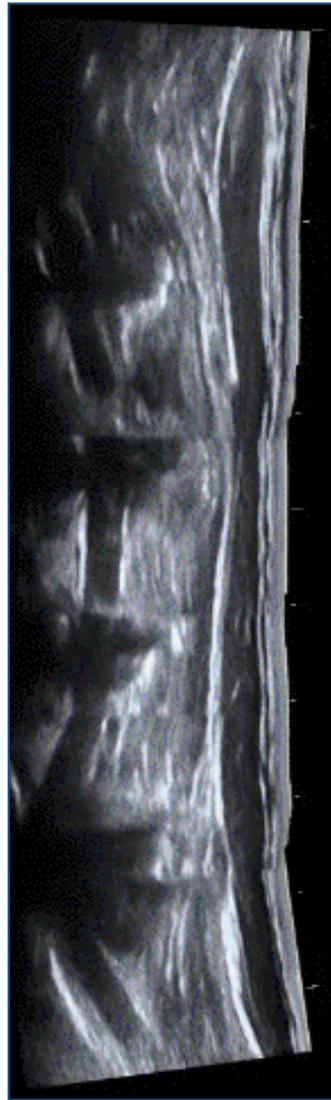
Echo-Anatomie



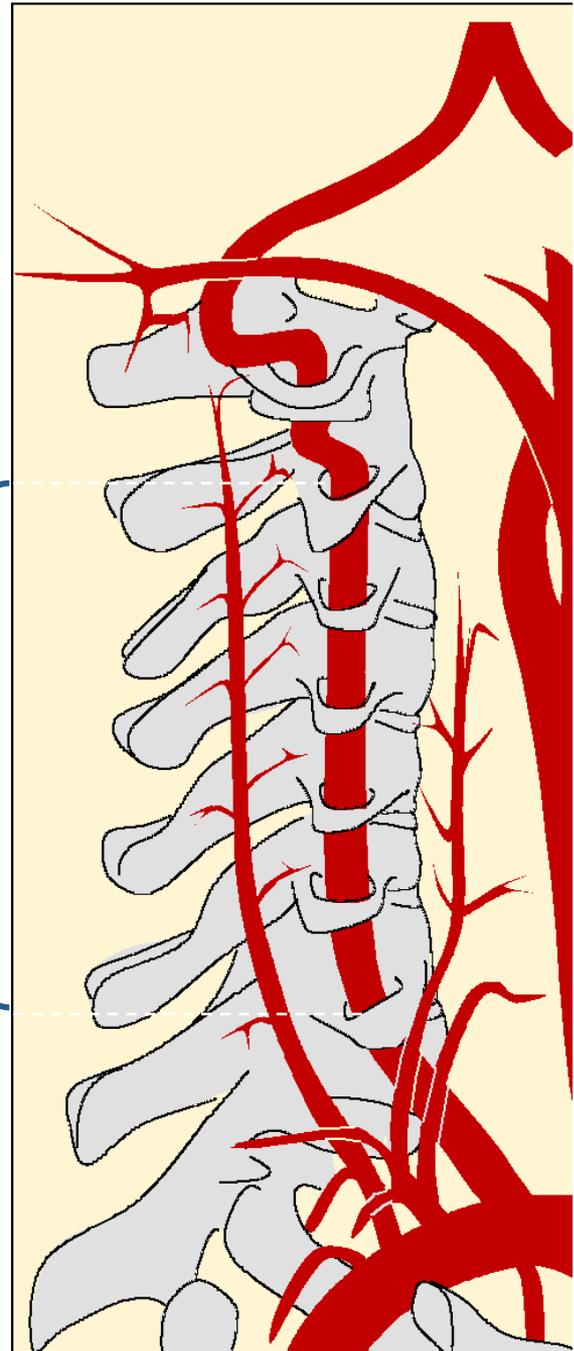
Artère Vertébrale – V2

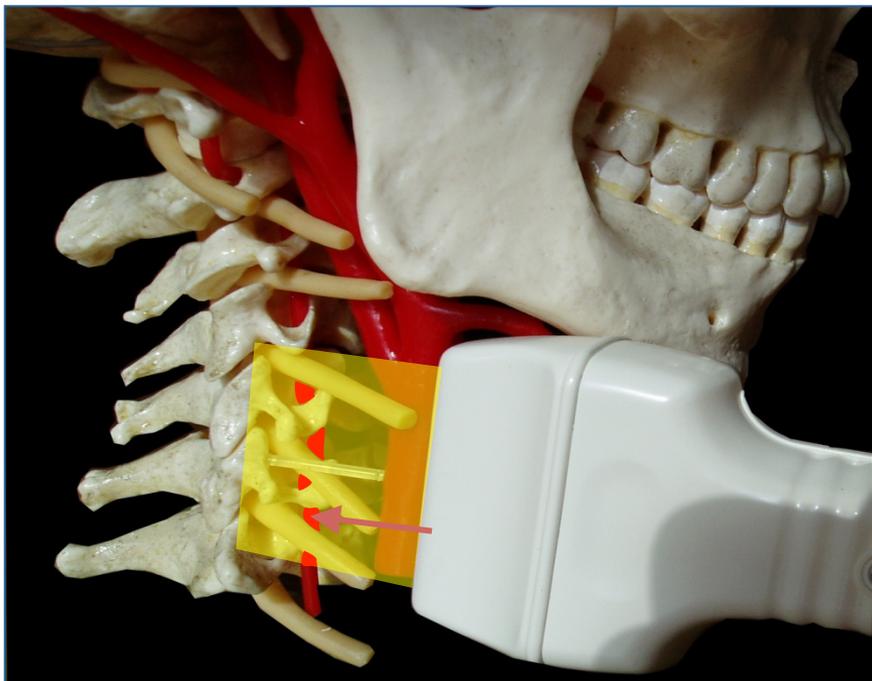
Echo-Doppler

Segment foraminal



V_2

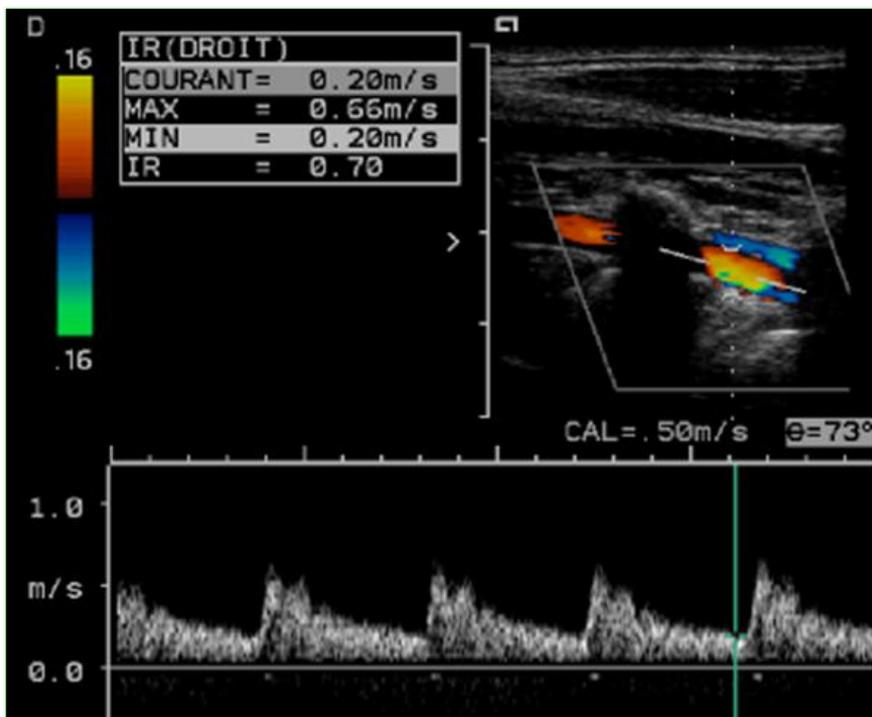
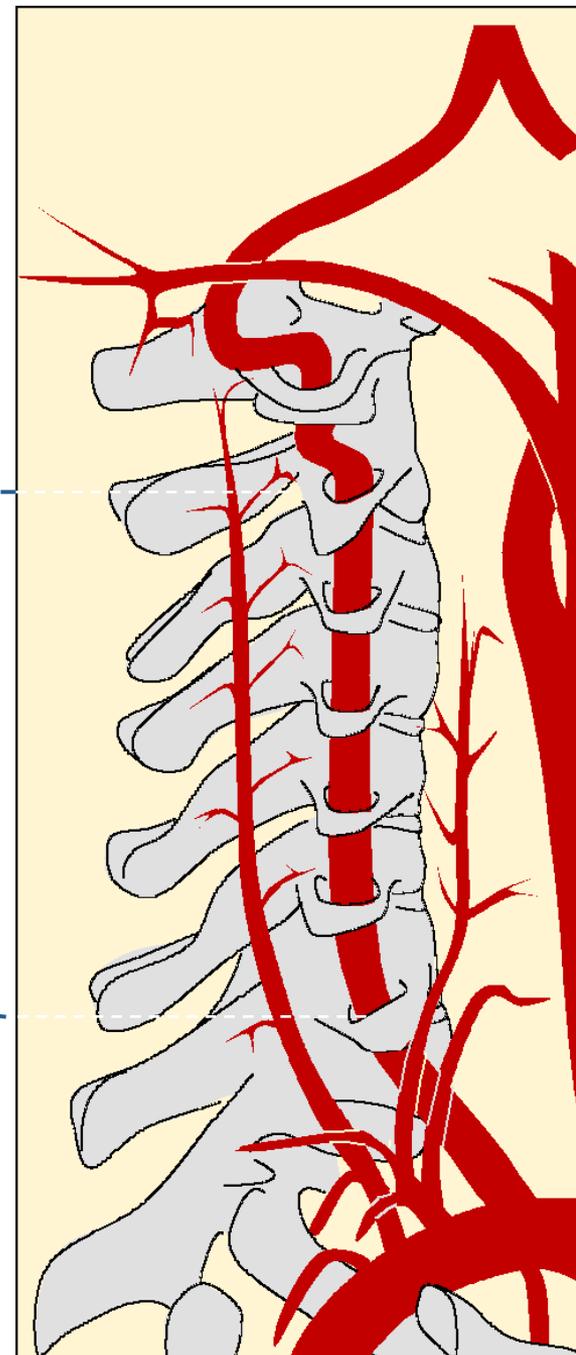


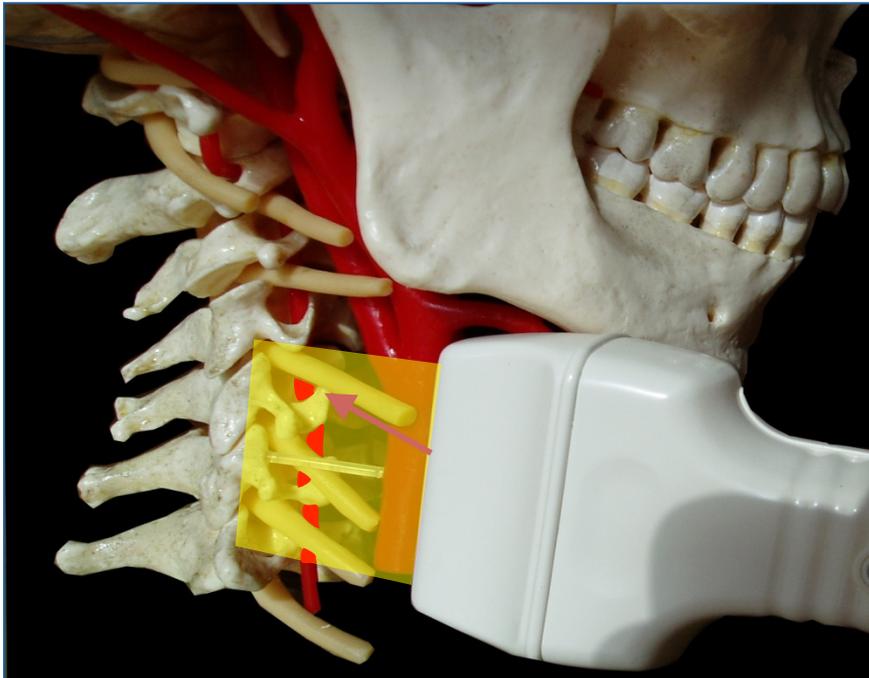


Echo-Doppler

Segment foraminal
C6 - C5

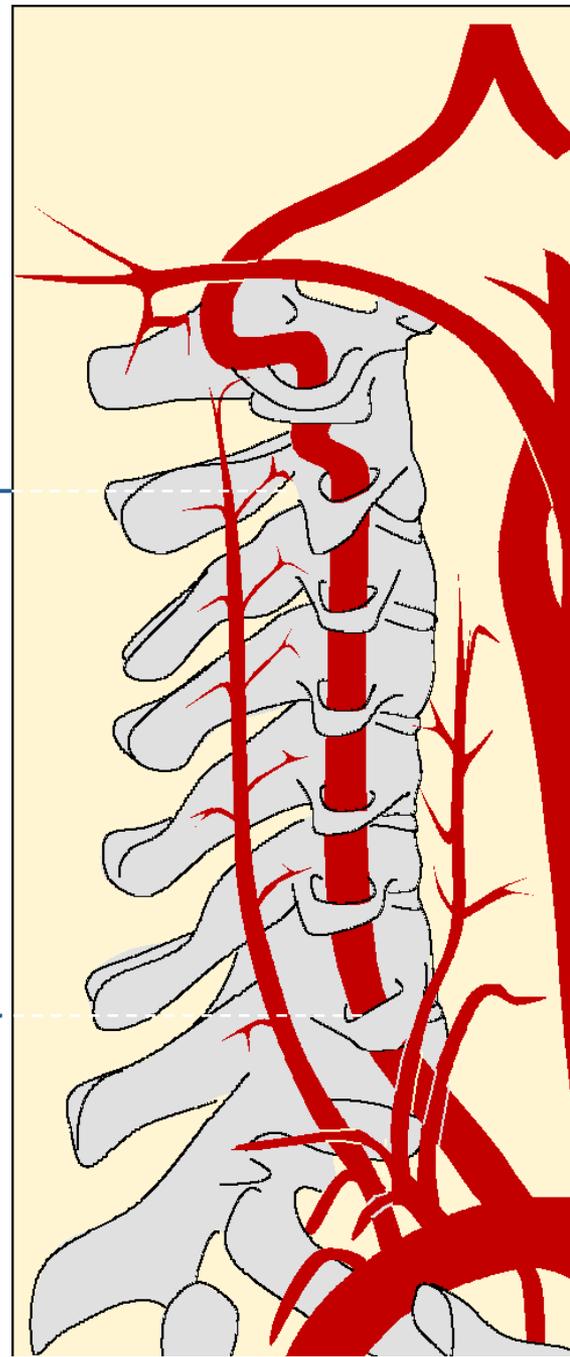
V_2



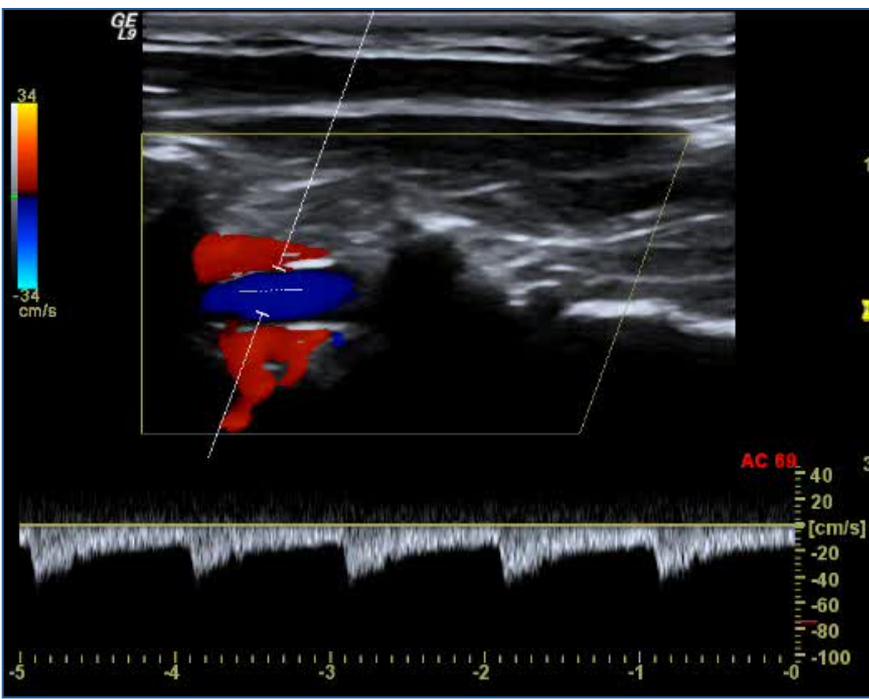


Echo-Doppler

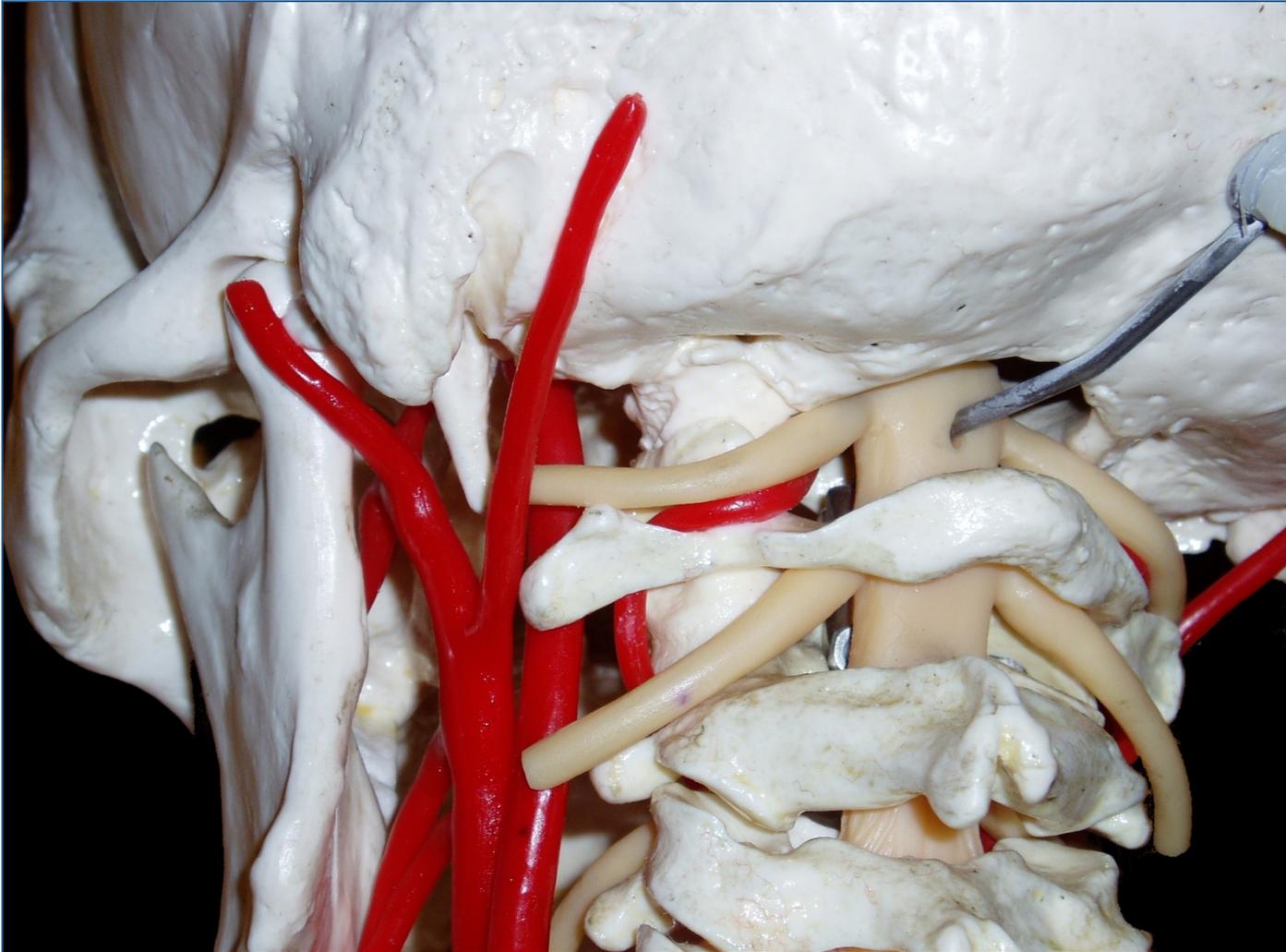
Segment foraminal
C4 - C3



V_2

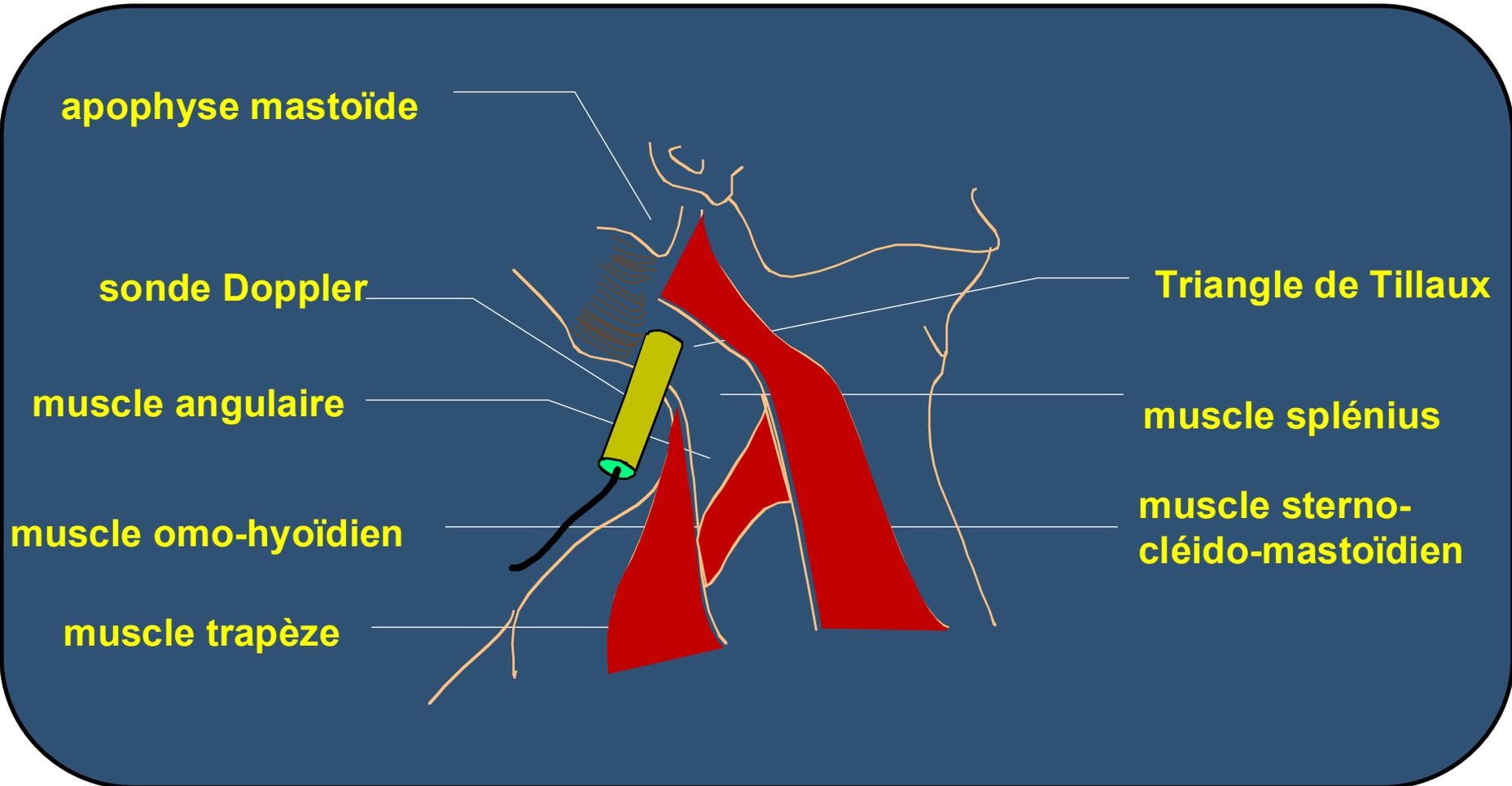


Echo-Anatomie



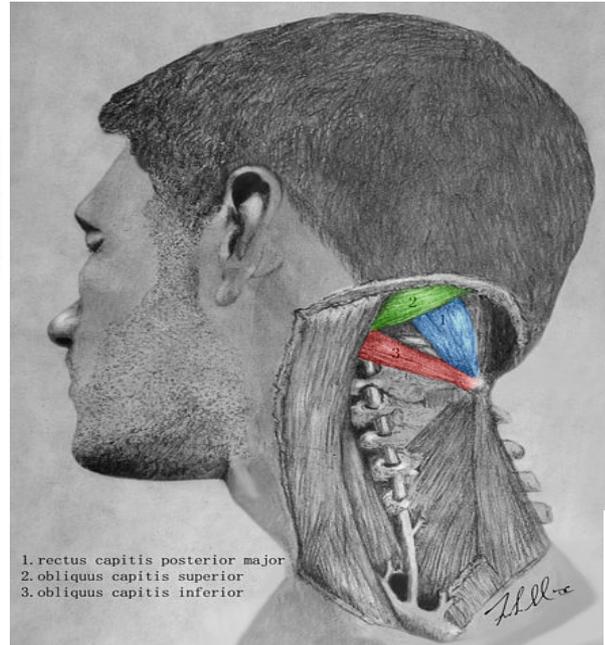
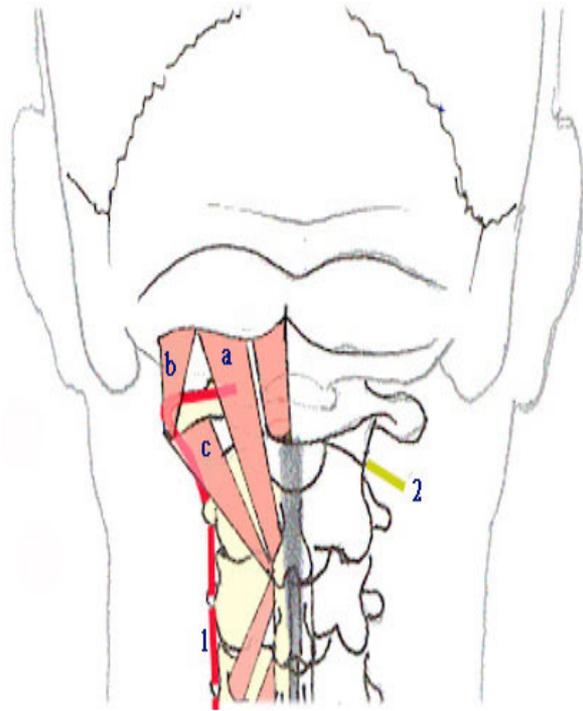
Artère Vertébrale en V3

Echo-Anatomie

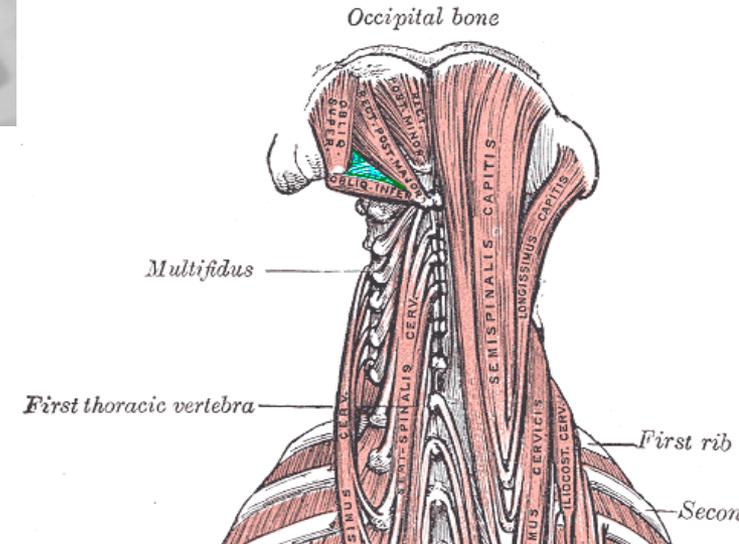


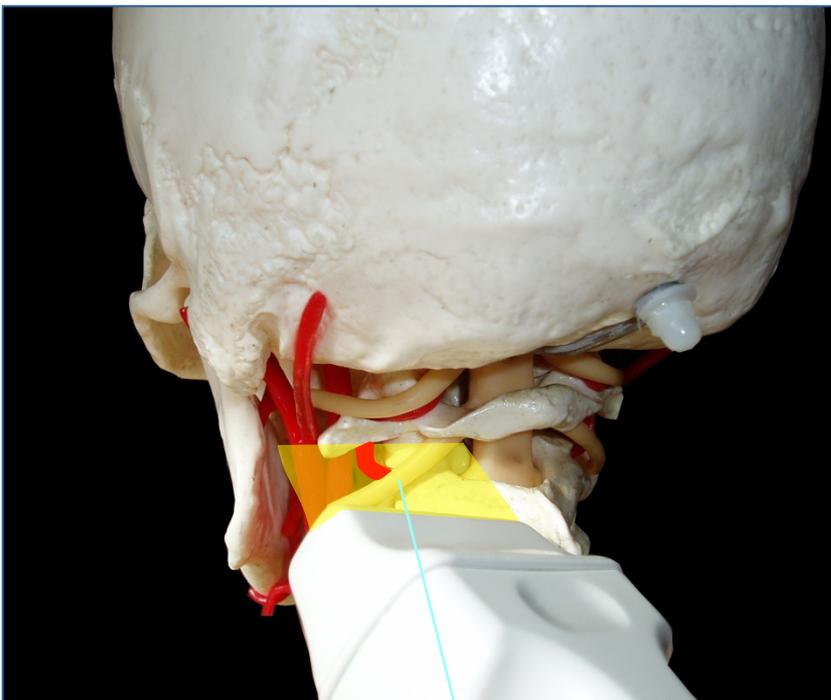
Artère Vertébrale – V3

Anatomie triangle de Tillaux



- a: muscles petit et grand droits postérieur
- b: muscle oblique supérieur de la tête
- c: muscle oblique inférieur
- 1: artère vertébrale
- 2: grand nerf occipital d'Arnold

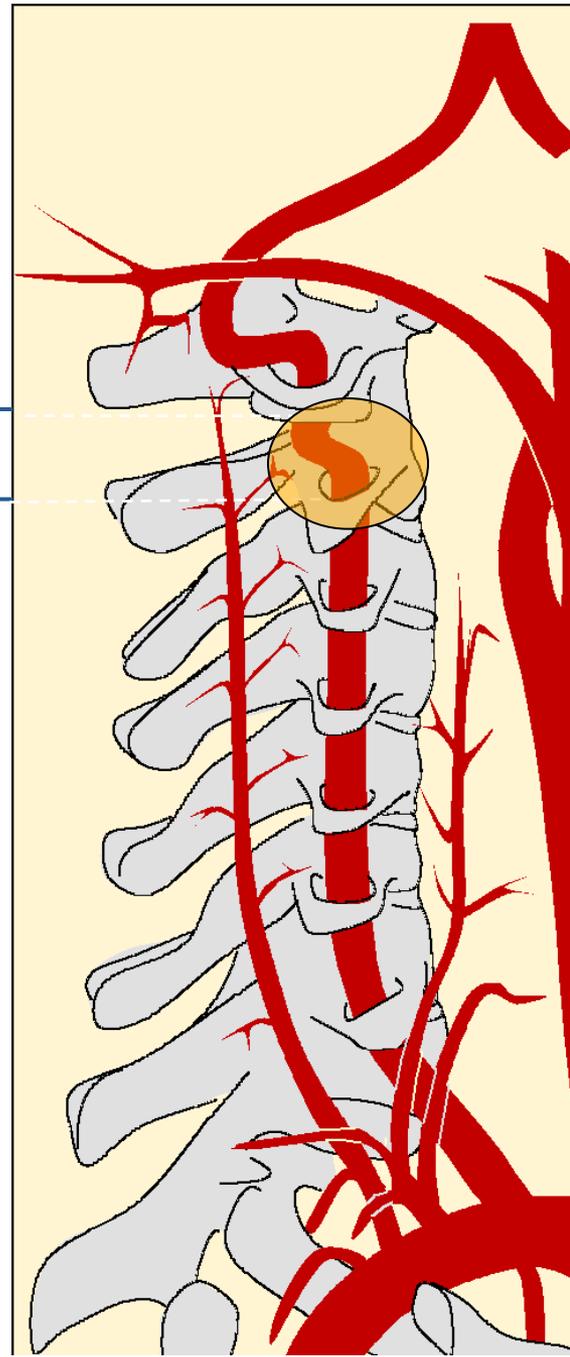




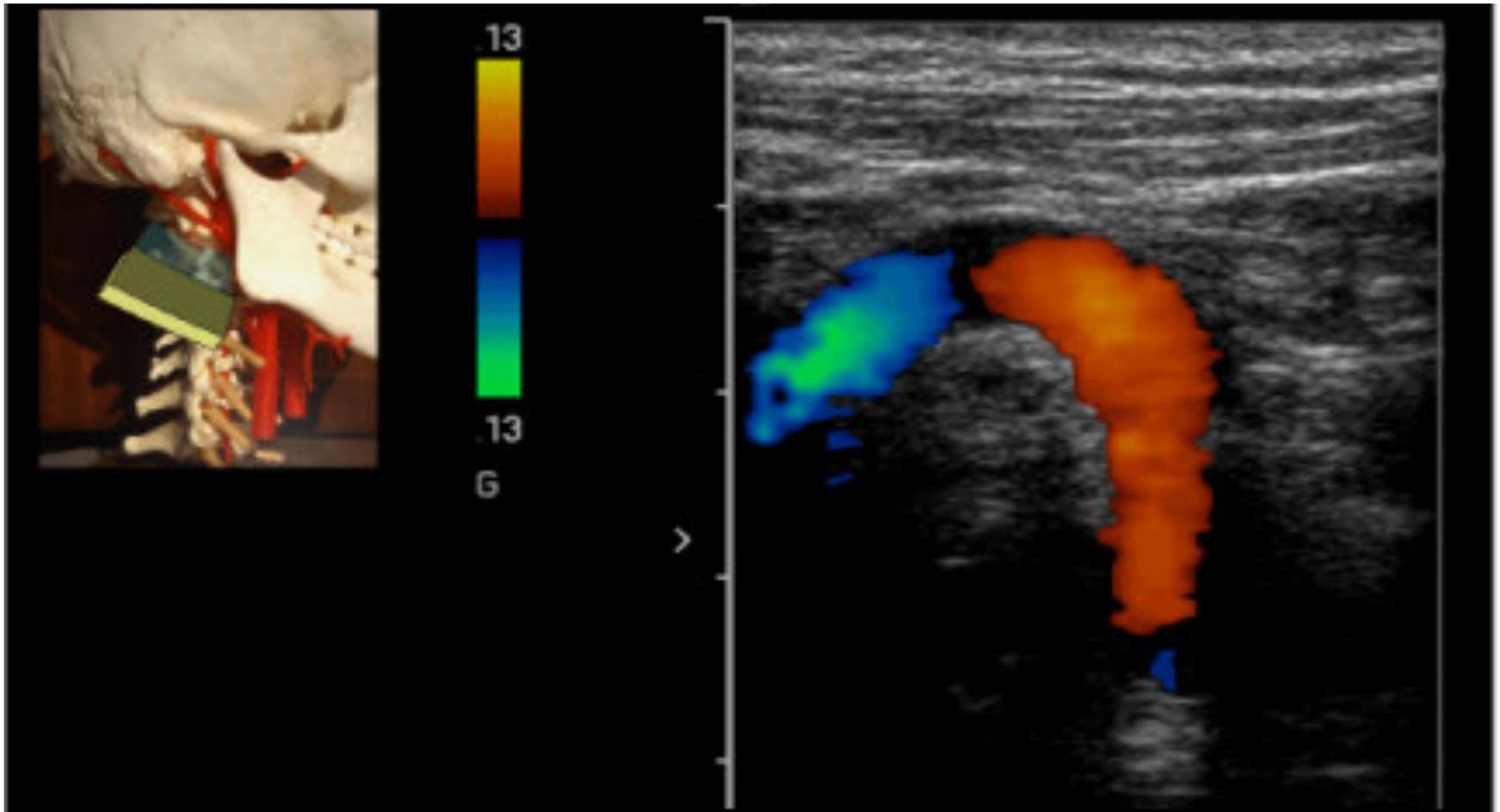
V_{3V}

Echo-Doppler

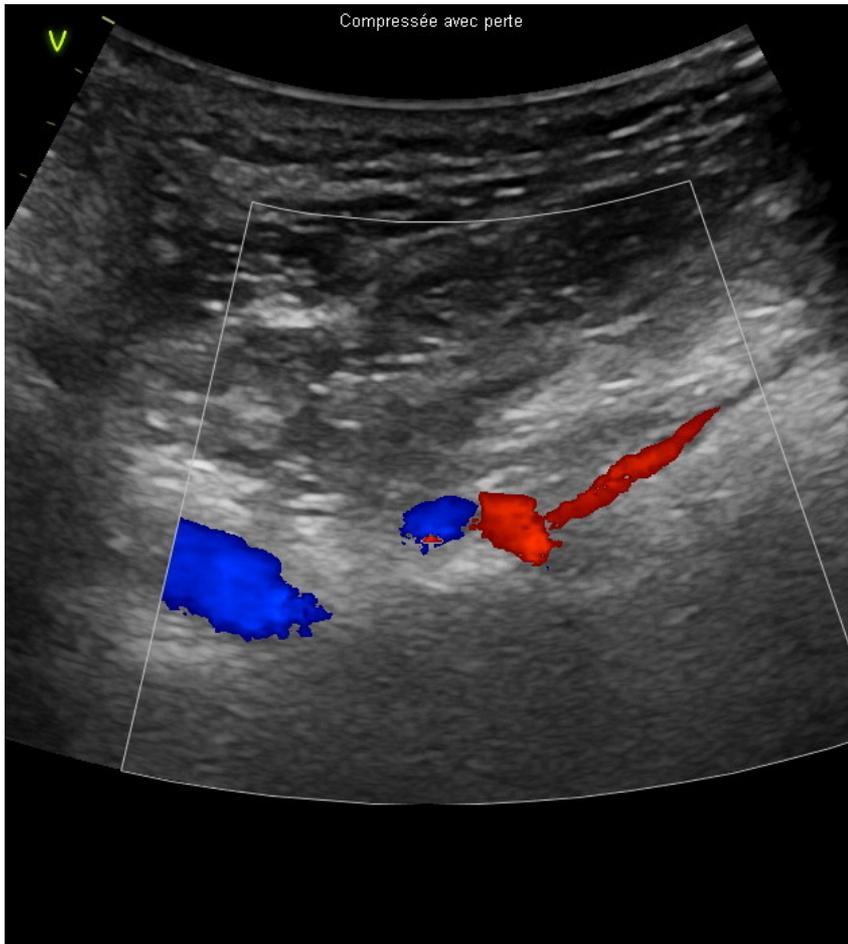
*Segment extra-dural vertical
C2 - dural*



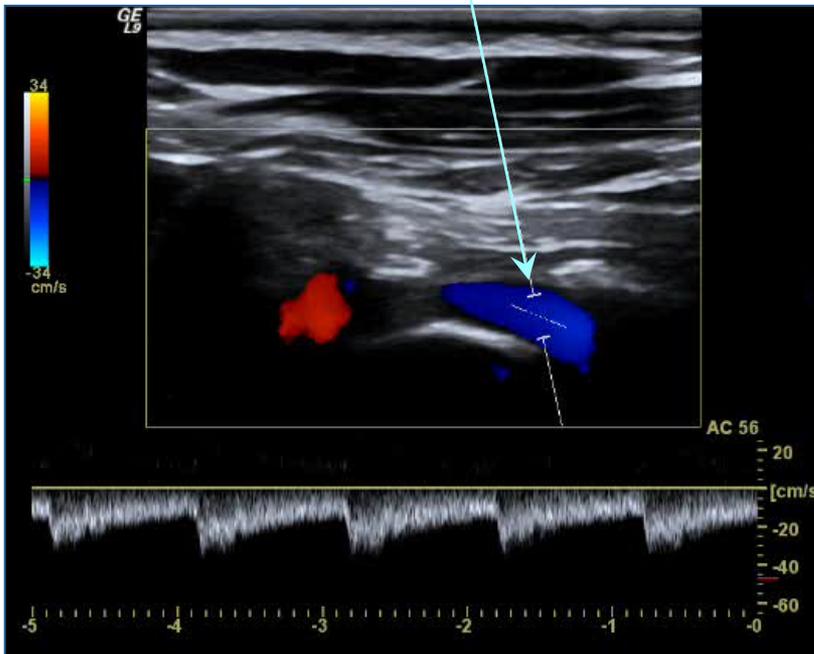
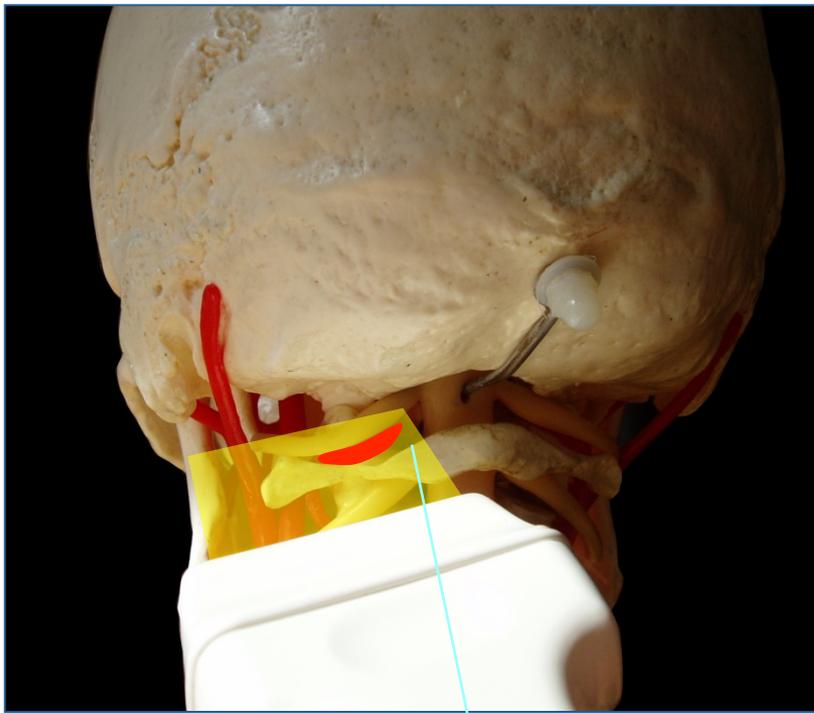
Echo anatomie: V3



Echo anatomie normale



- V3V

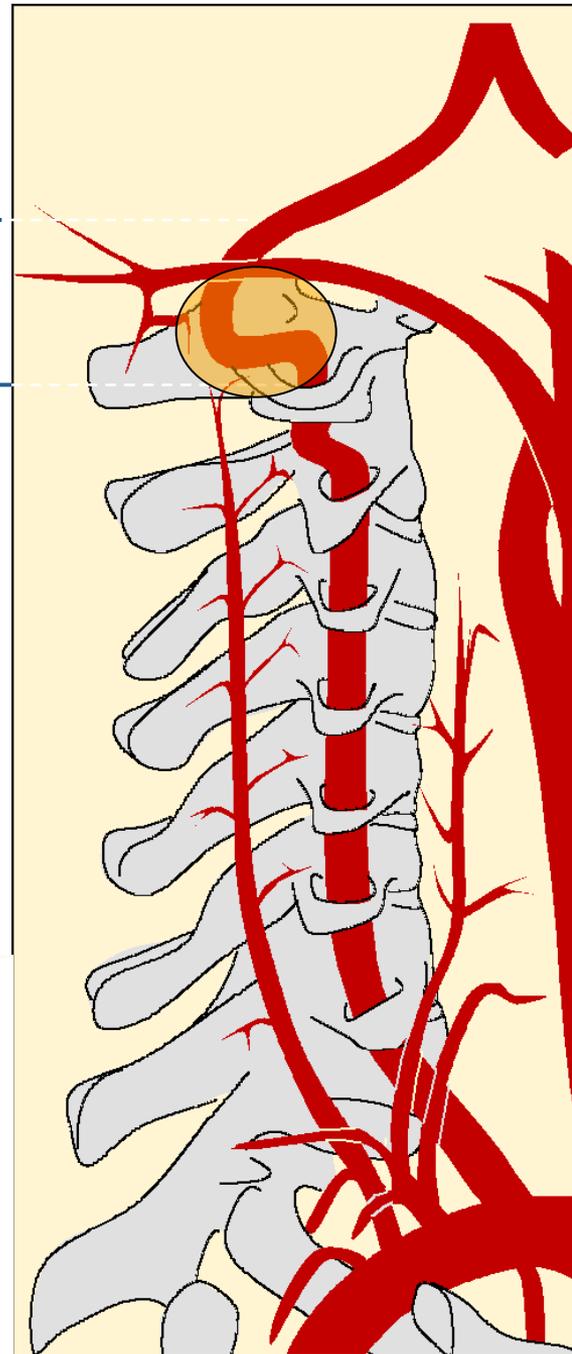
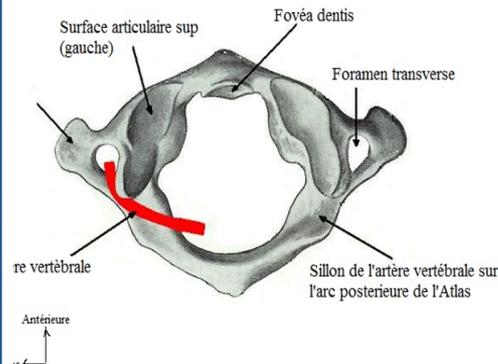


V_{3H}

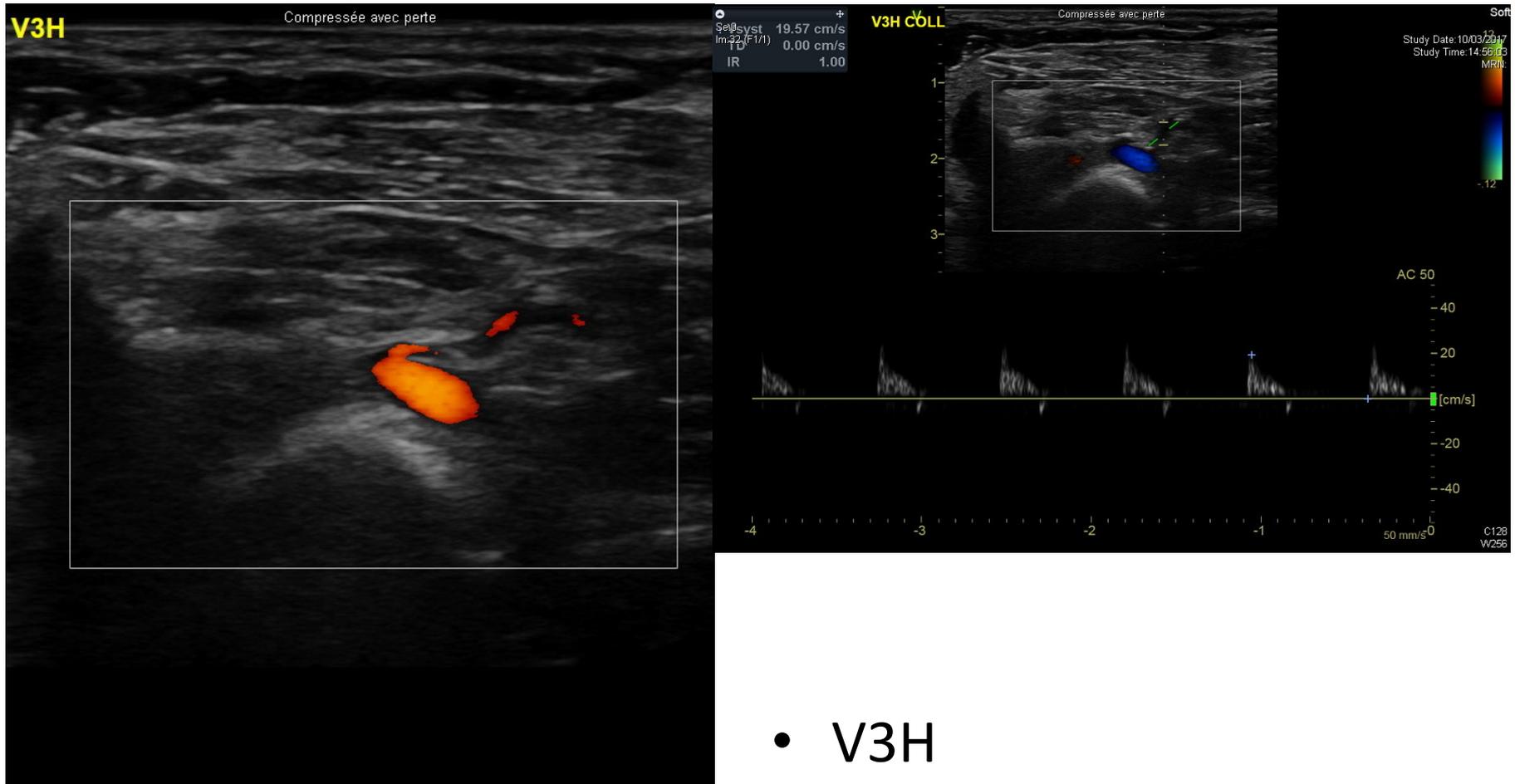
Echo-Doppler

Segment extra-dural horizontal C2 - C1

Supérieure de l'Atlas

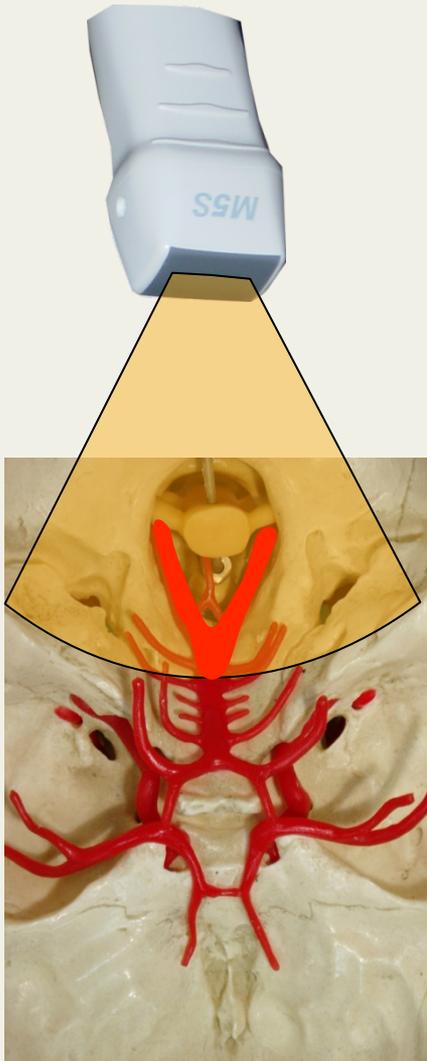


Echo anatomie normale

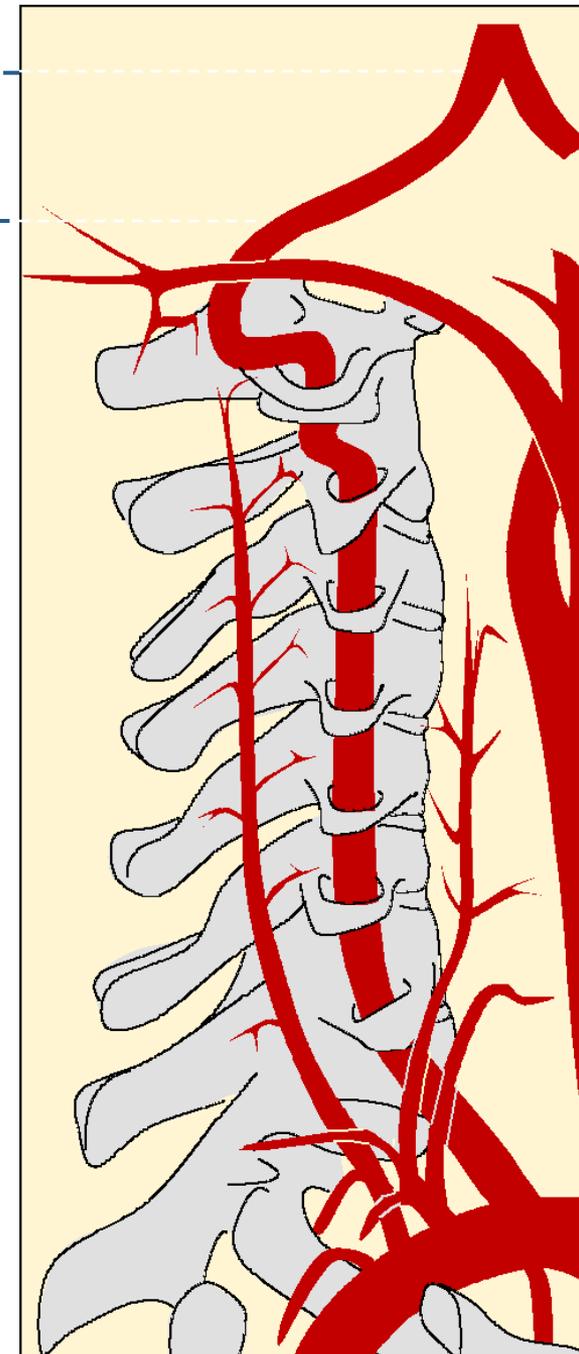
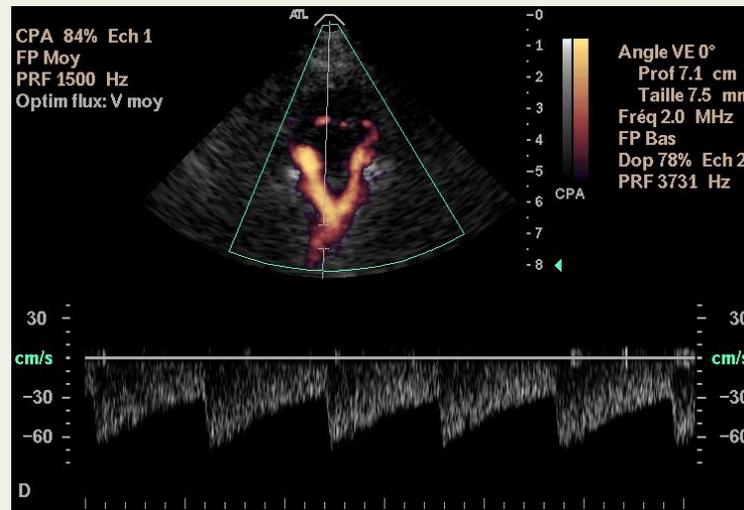


Examen Echographique : V₄

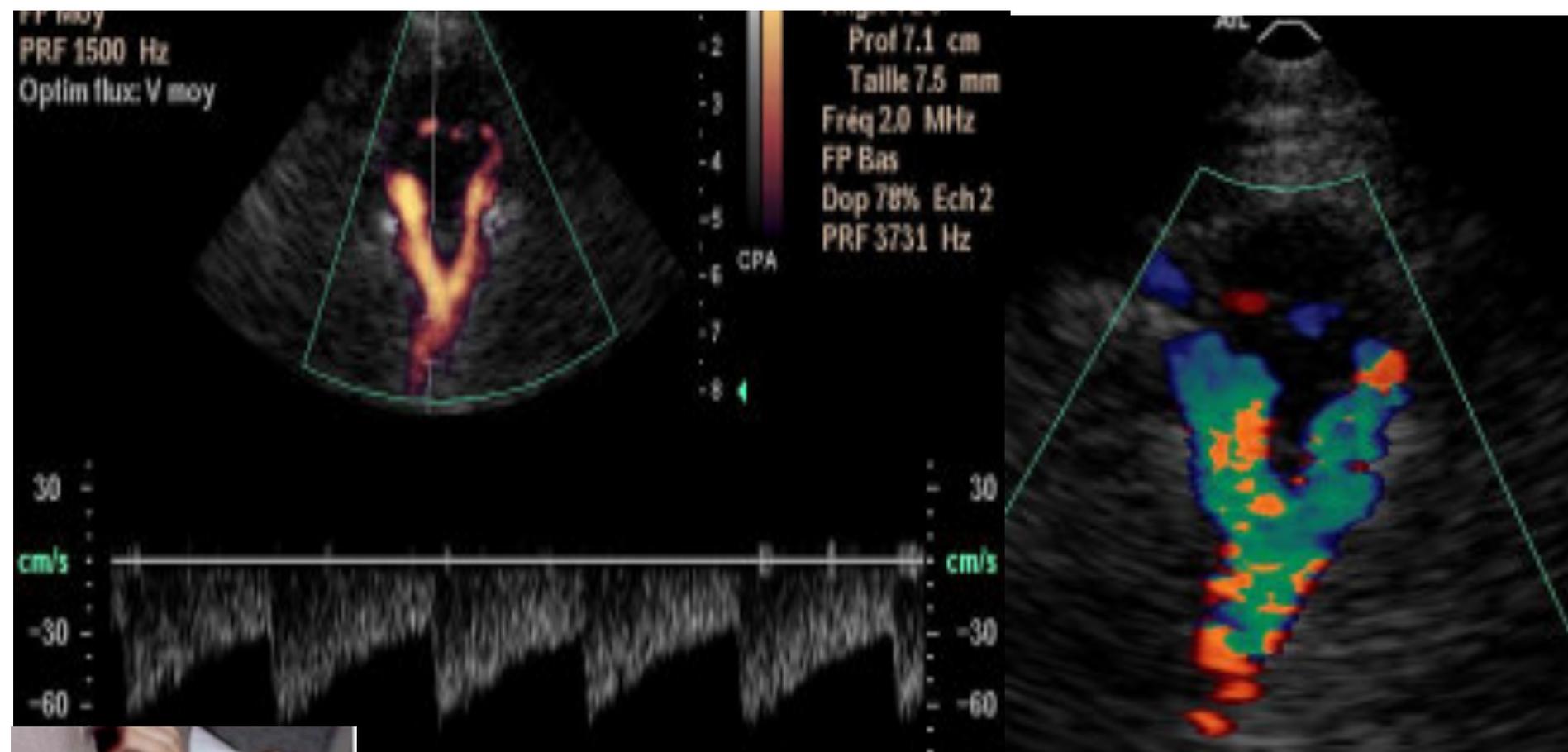
Segment intra-dural et intracrânien



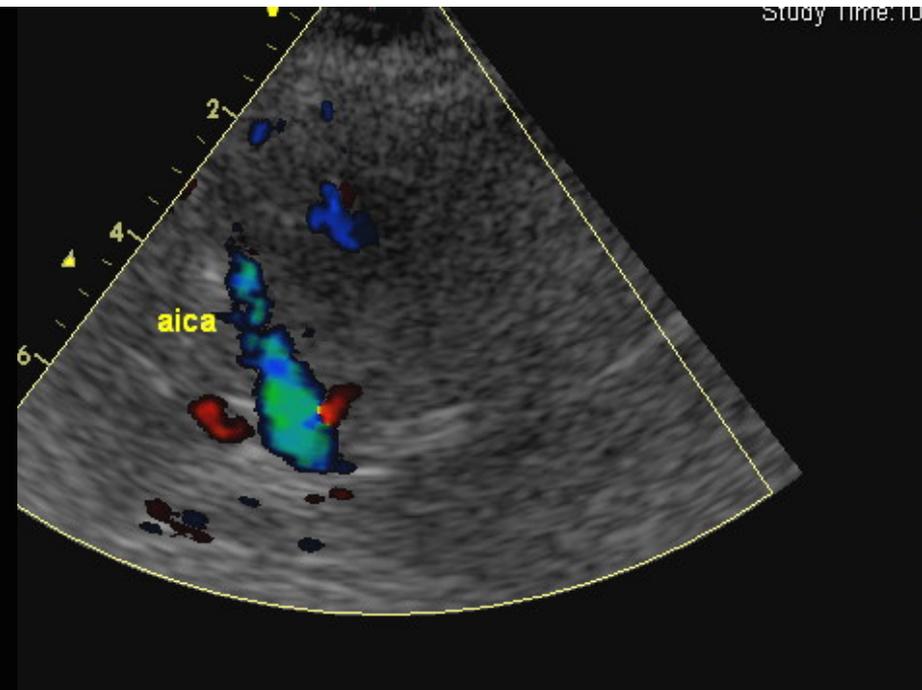
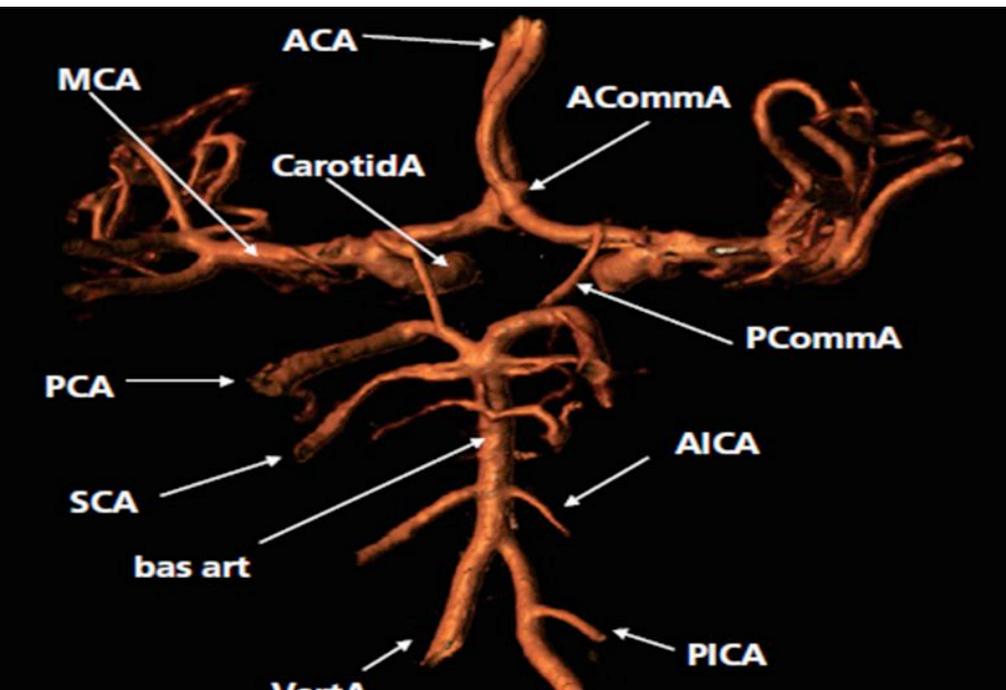
NB: A. Communicante Postérieure et / ou segment V₄ de l'A. Vertébrale absent ou de très petit diamètre d'un ou des deux côtés dans 45% des cas



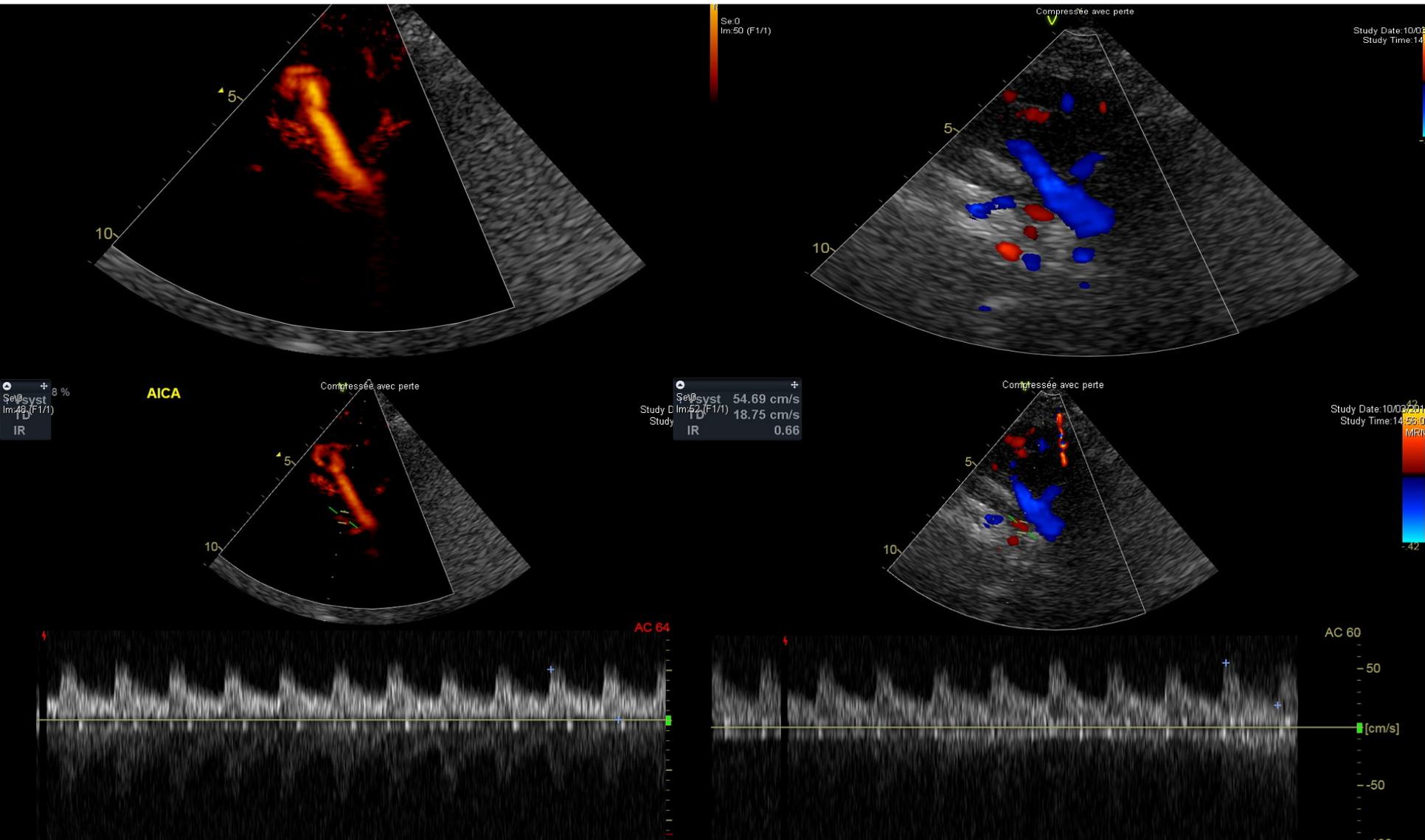
Echo anatomie



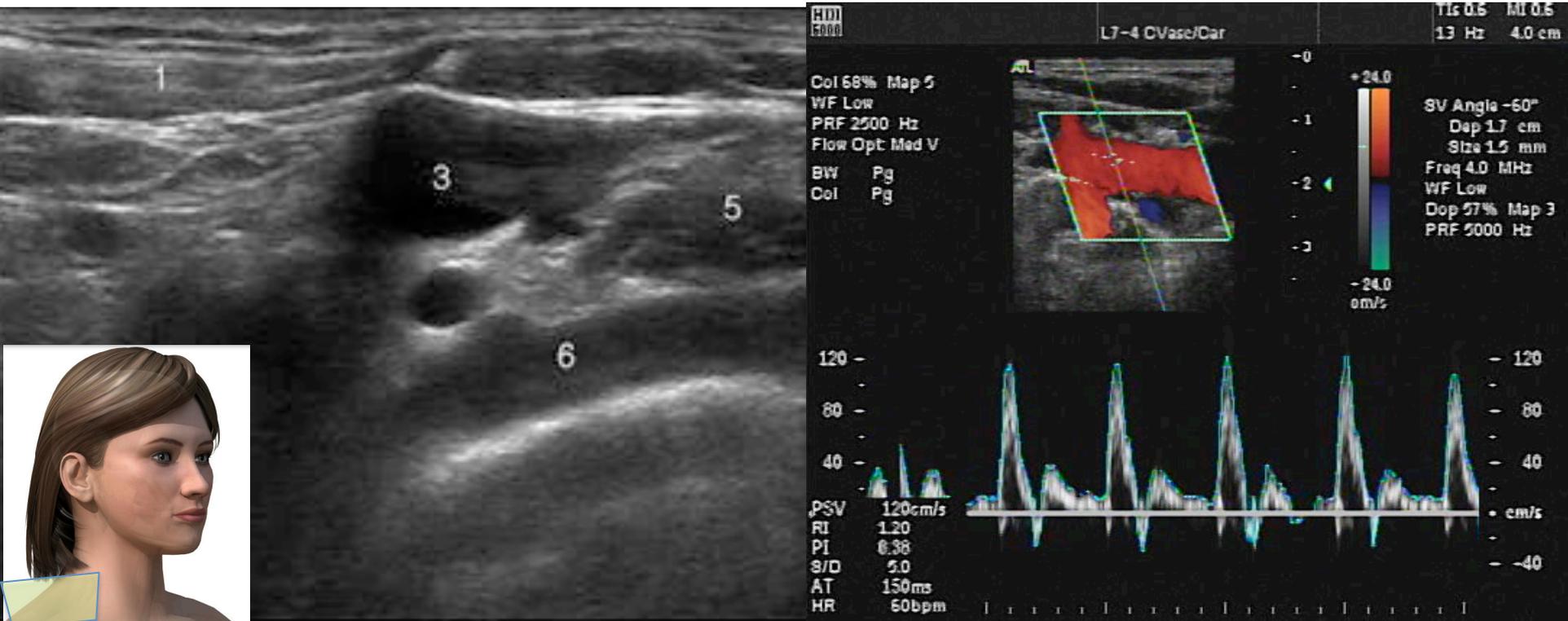
Echo anatomie



Echo anatomie

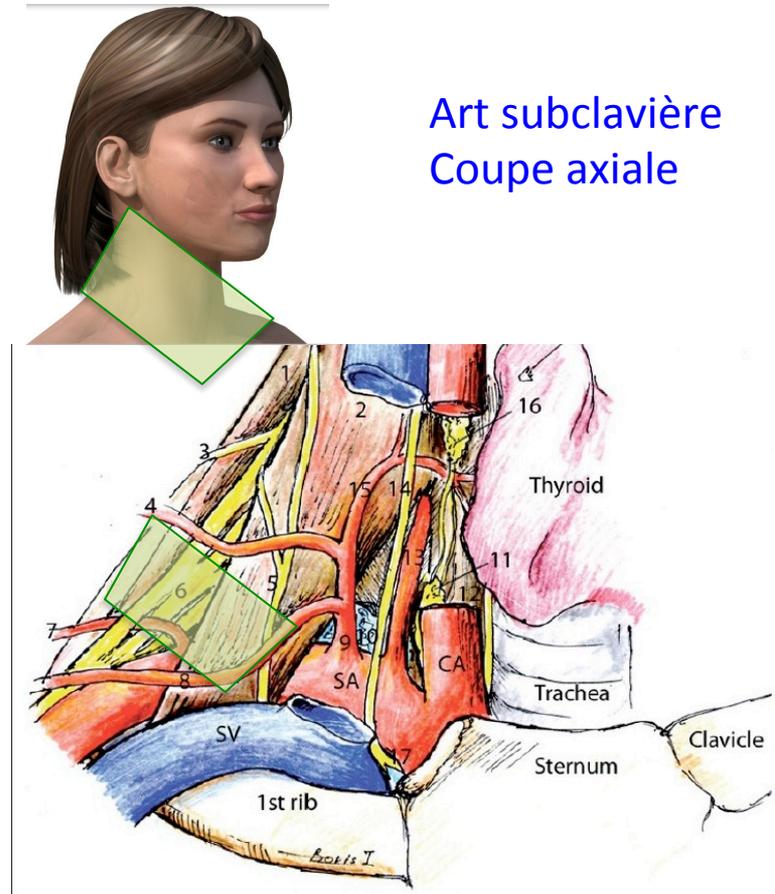
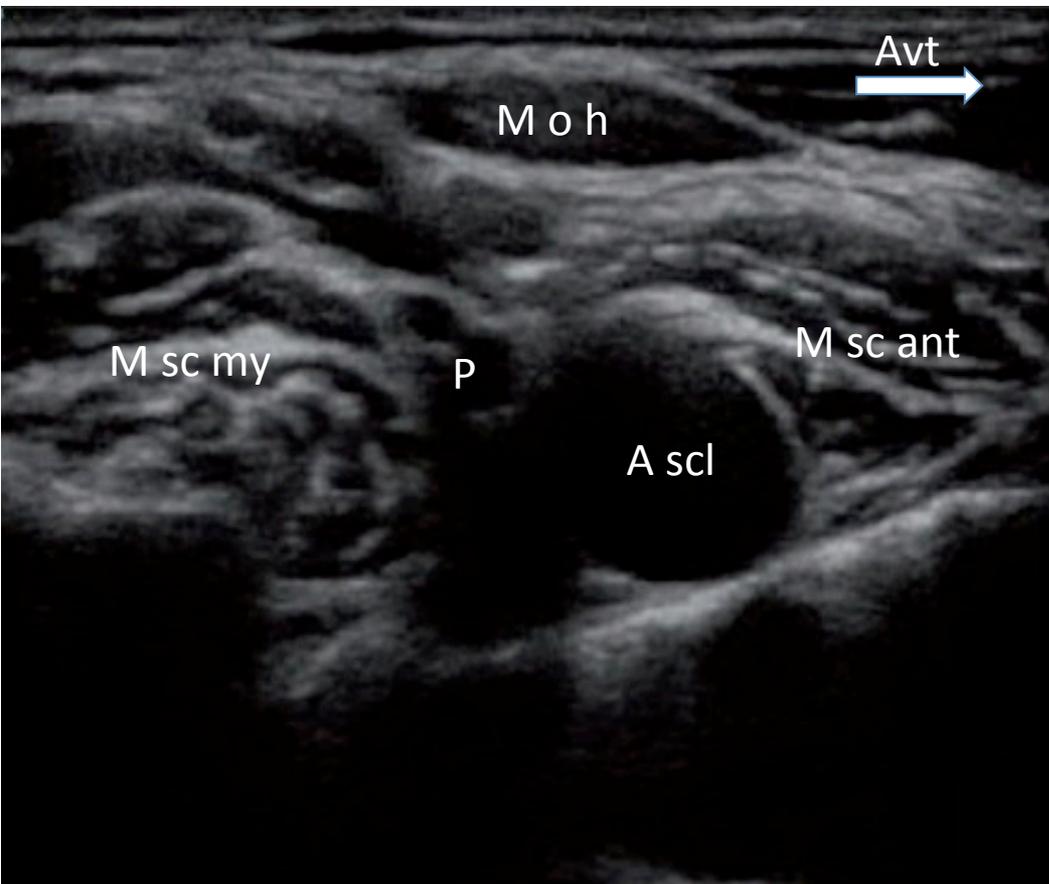


Echo-Anatomie Normale

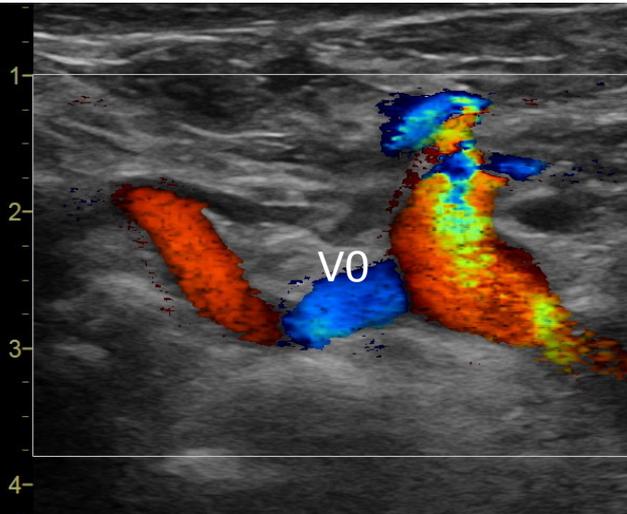


Art sub clavière
Coupe axial
Creux sus clavier

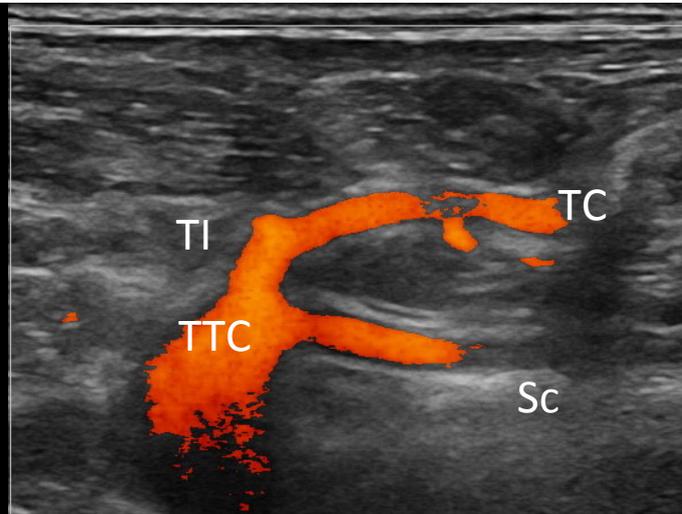
Echo anatomie normale



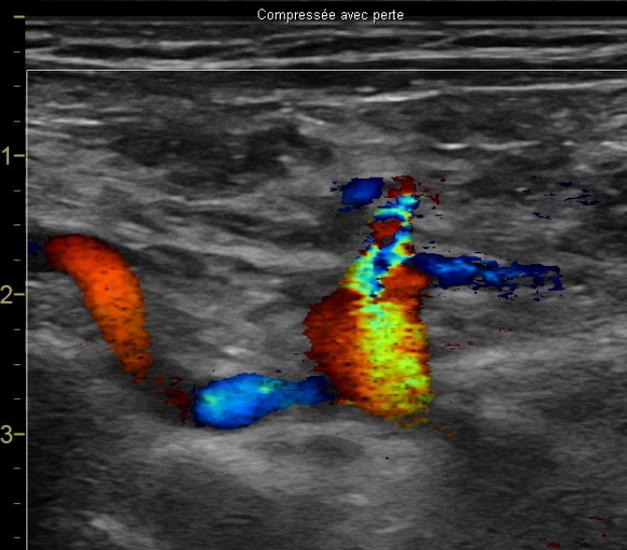
Echo anatomie normale



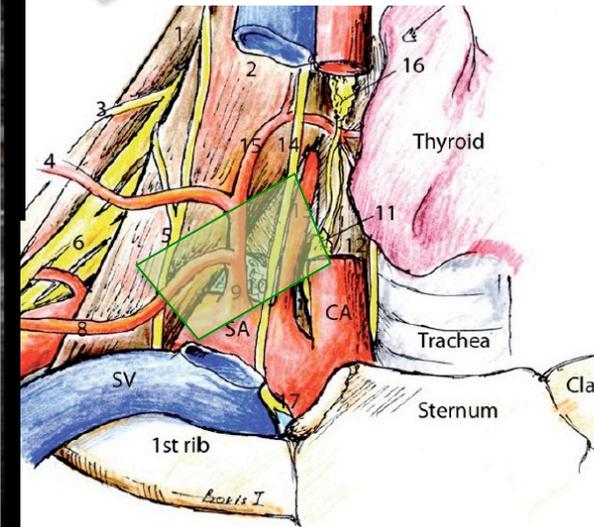
Compressée avec perte



Compressée avec perte

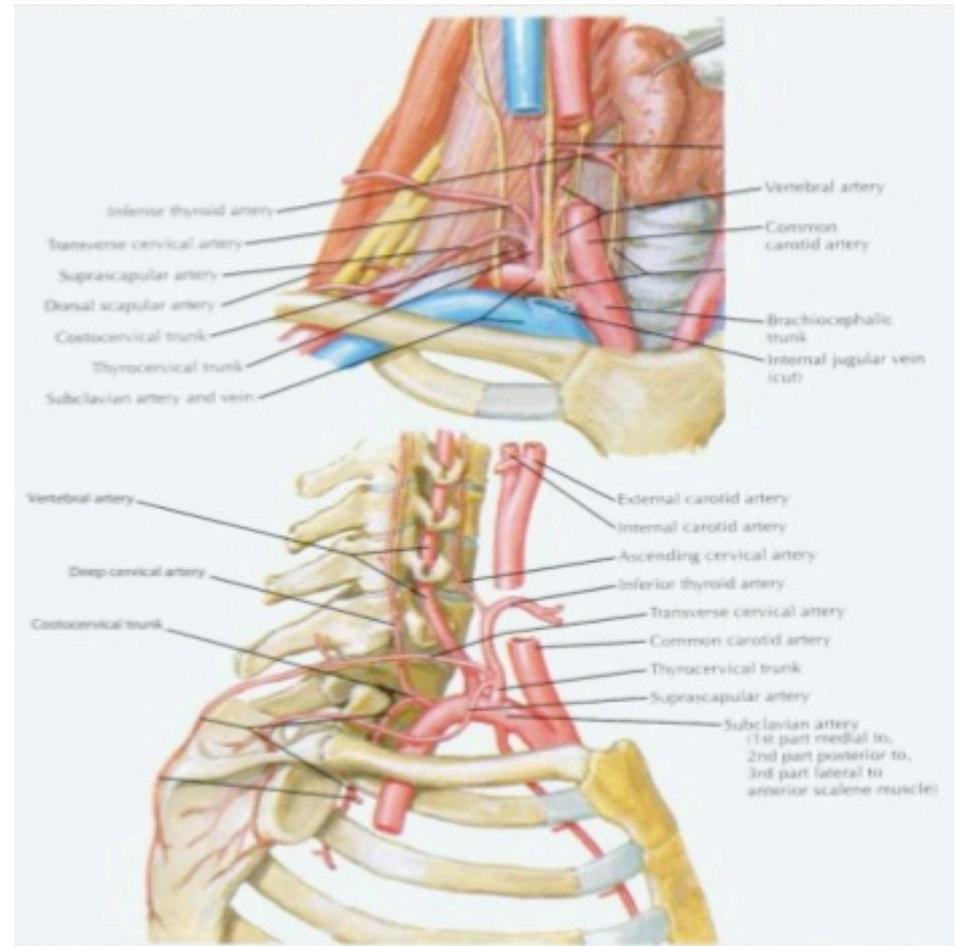
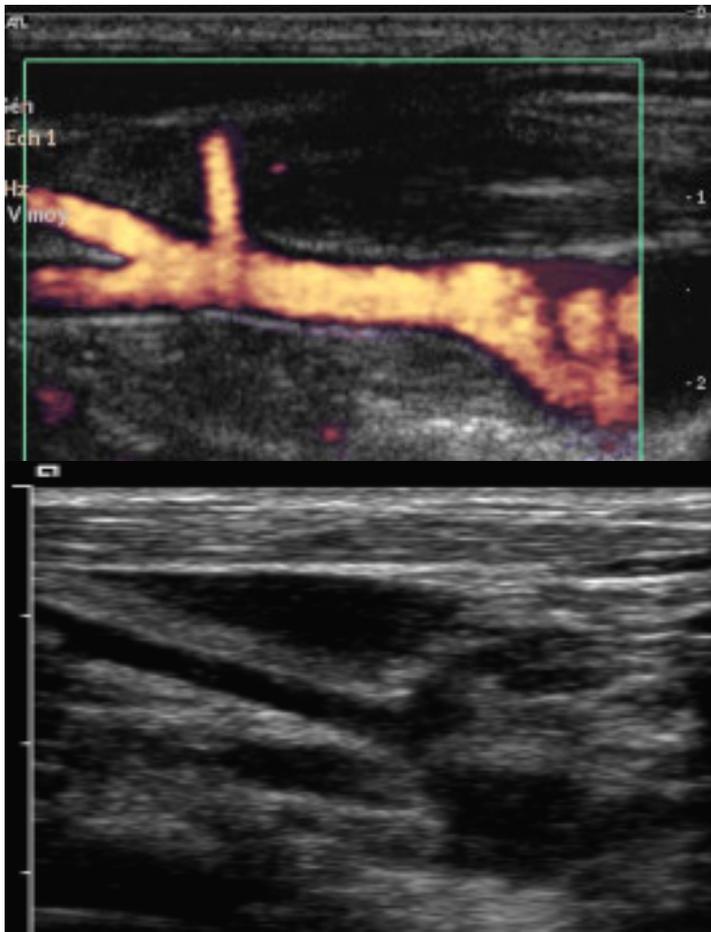


Tronc thyro cervical



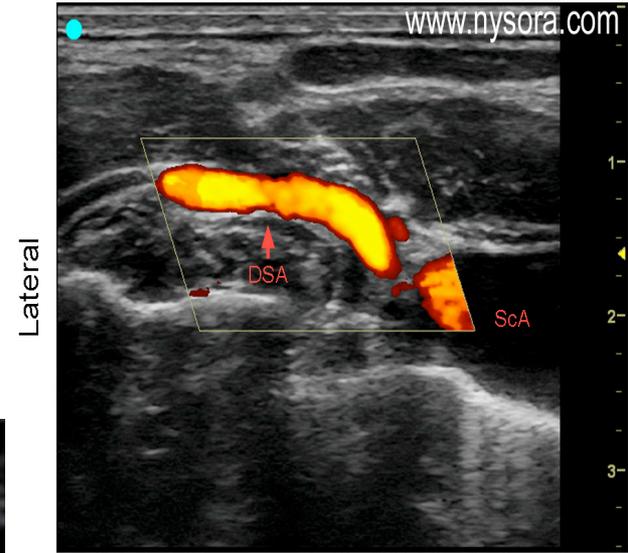
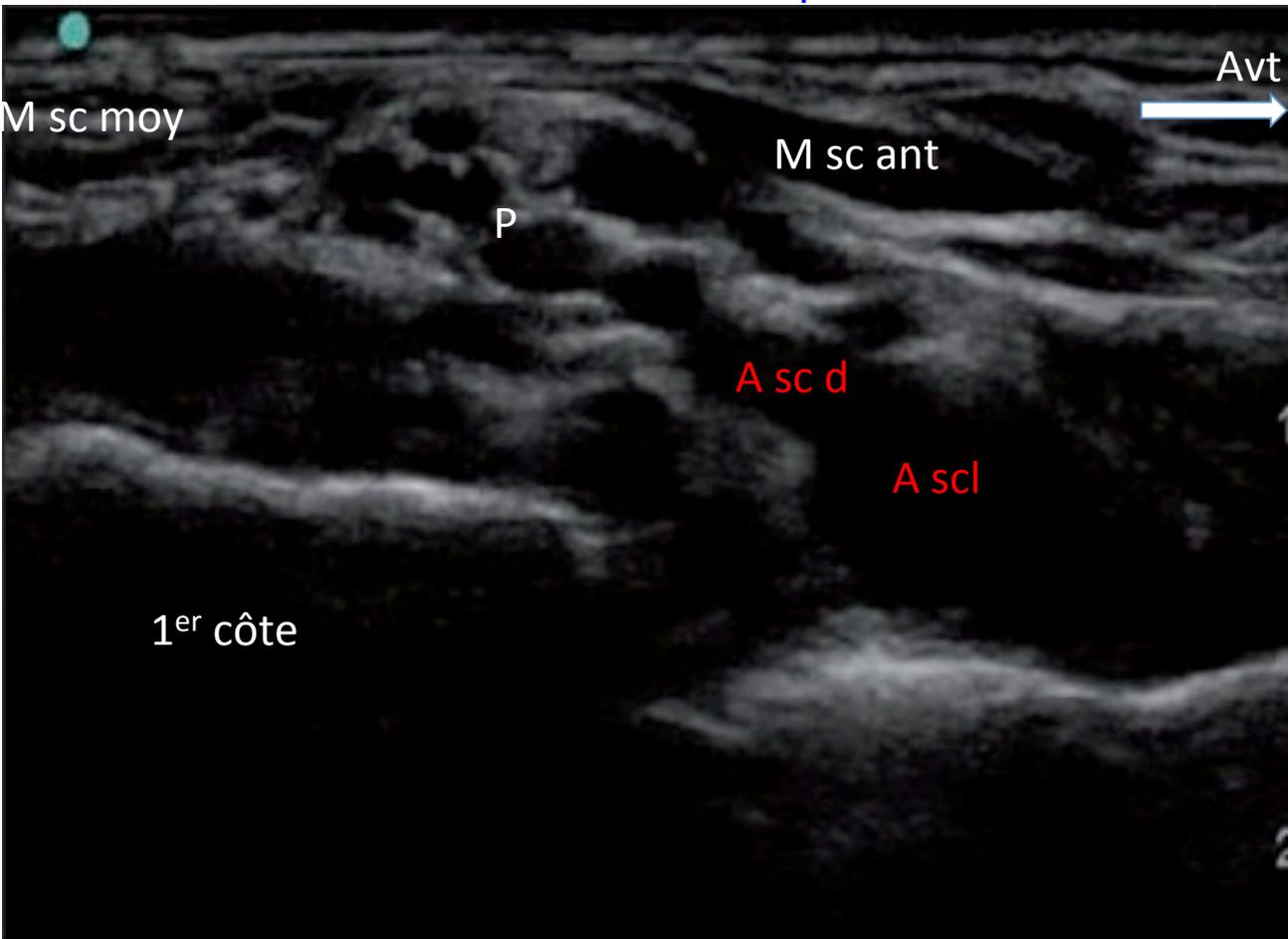
Echo-anatomie

Tronc thyro cervical



Echo - anatomie

Art subclavière Coupe axiale



Subclavian Artery and Dorsal Scapular Artery

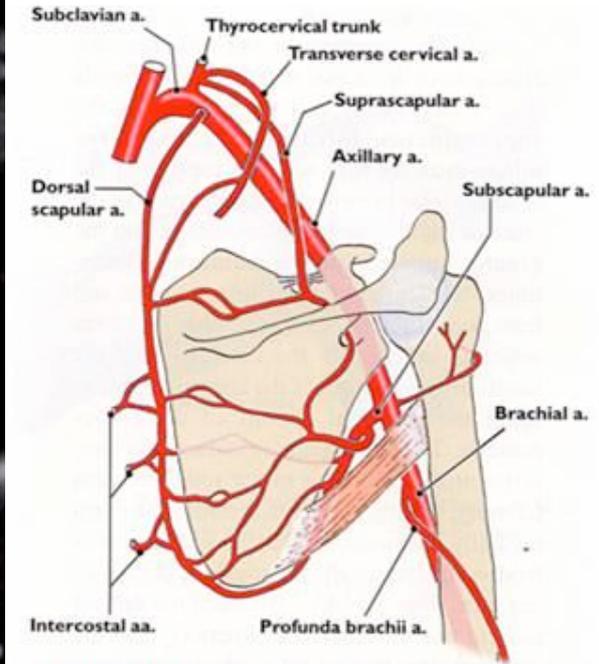
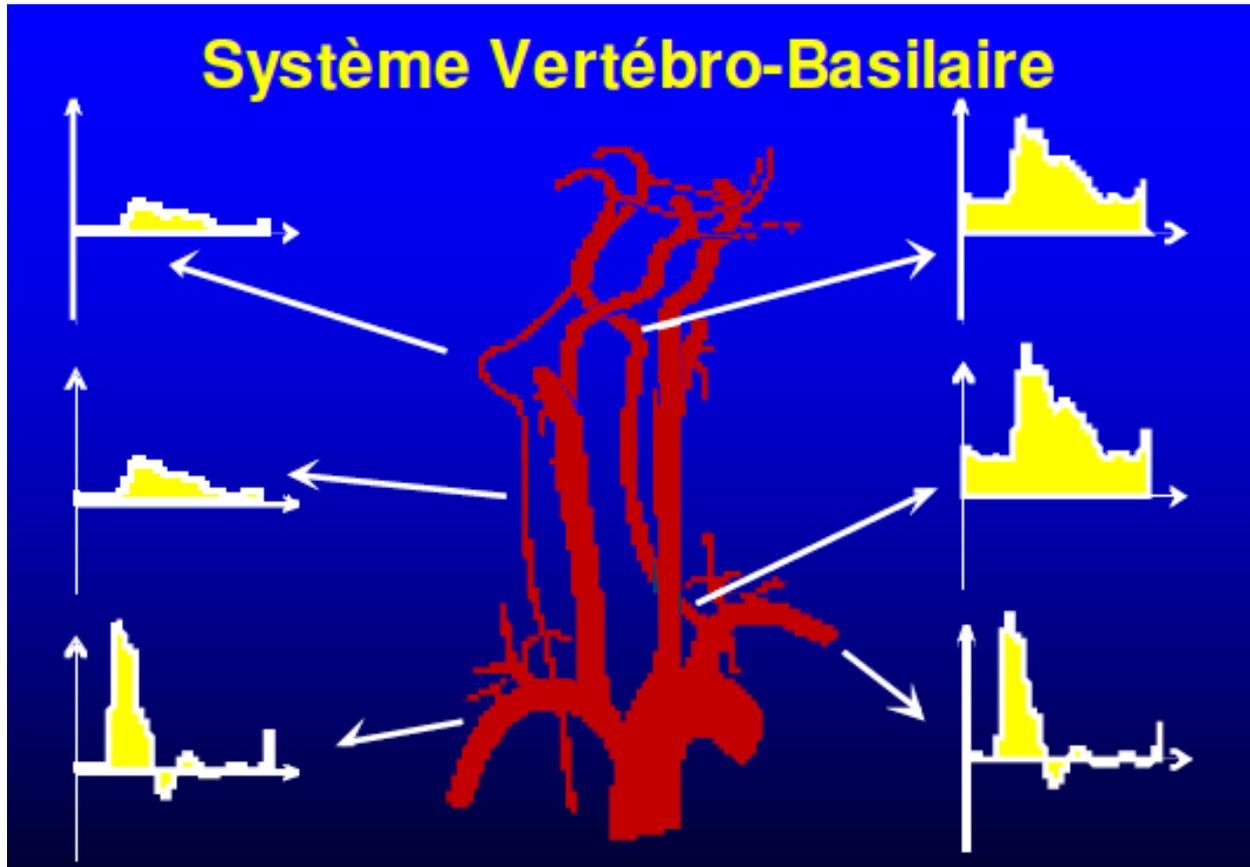


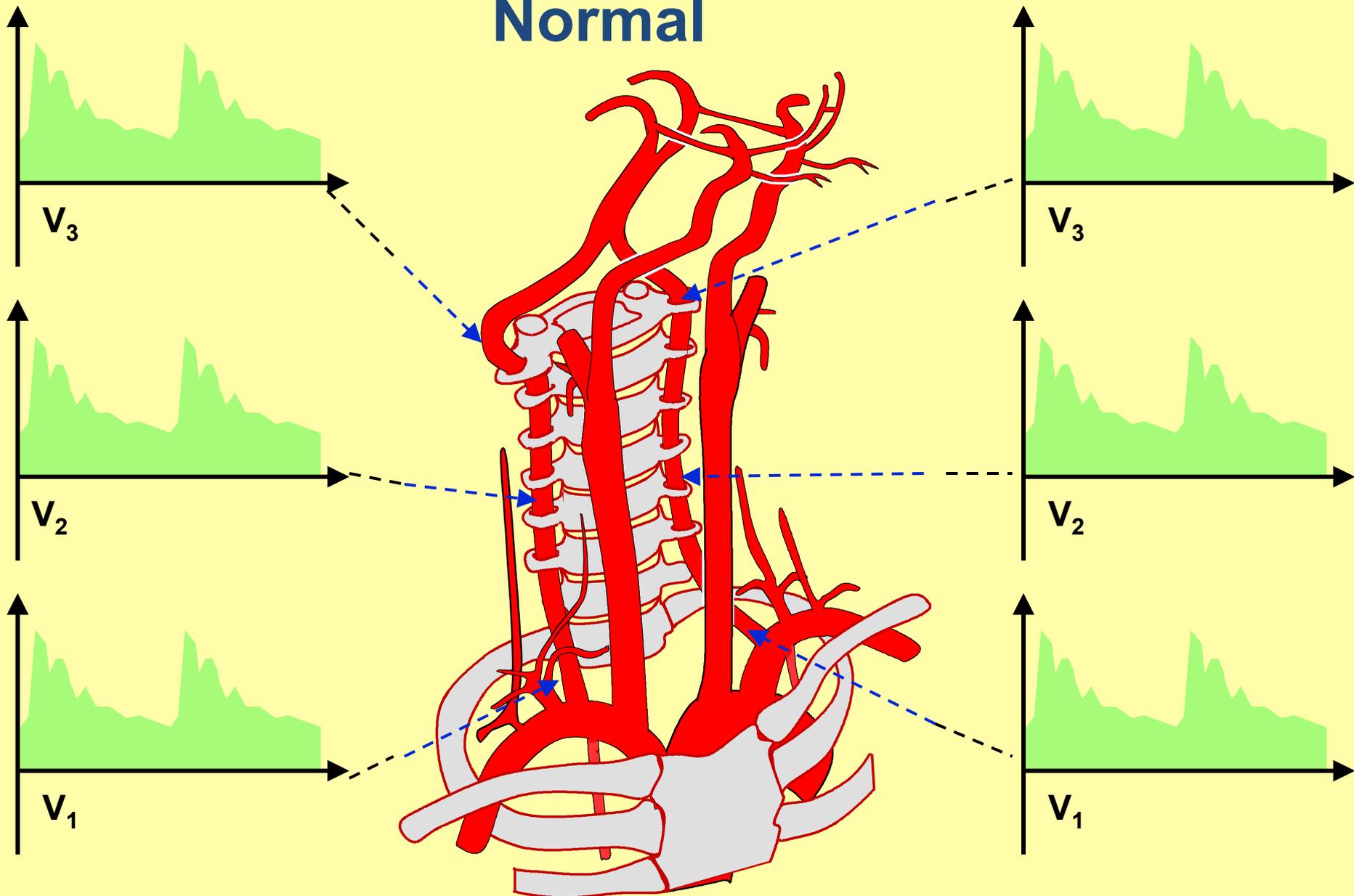
Figure 6.8. Extensive collateral blood supply of the scapular region.

Aspects écho- Doppler normaux

- Enregistrement en V0, V1, V2, V3, V4
- Asymétrie banale (de diamètre et de flux)



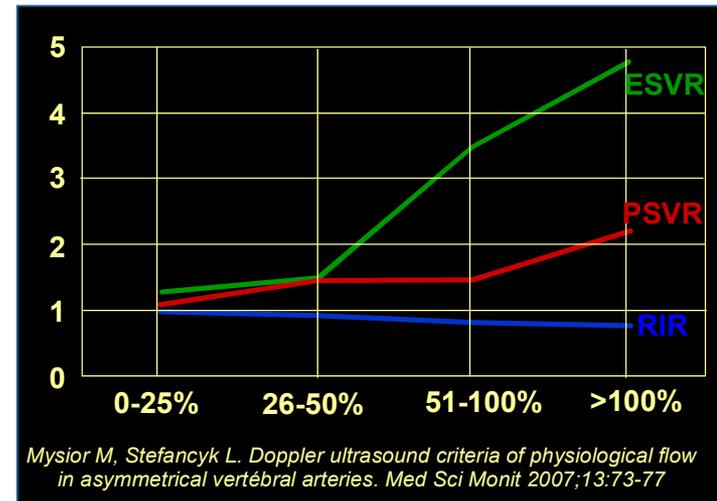
Normal



Même diamètre – même flux, bas IR / art. Vertébrale D & G V_1, V_2, V_3

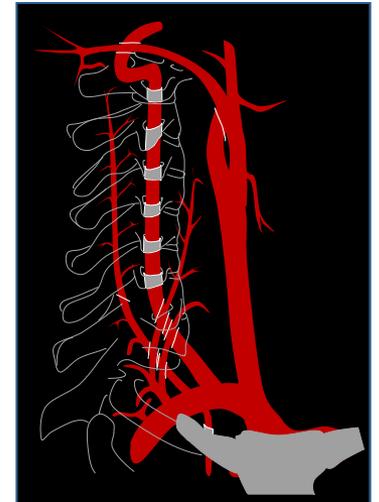
Aspects Écho-Doppler Normaux

- Enregistrement en V0, V1, V2, V3, V4
- Asymétrie banale (de diamètre et de flux) : 73%
G > D = 48% / D > G = 14%.
- Vitesses
43 ± 9 cm/s (*Bartels E, Angiology 1992*)
52 ± 15 cm/s (*Mysior M, Med Sci Monit 2007*)
- Débit :
51±28 ml/min
(*Oktar SO, AJNR 2006*)
85 ±37 ml/min
(*Yazici B. Diagn Interv Radiol 2005*)
50-150 ml/min (5-95th percentile)
(*Seidel E, Stroke 1999*)
- Valeurs stables avec l'âge
(*Nemati M. Cardiovascular Ultrasound 2009*)

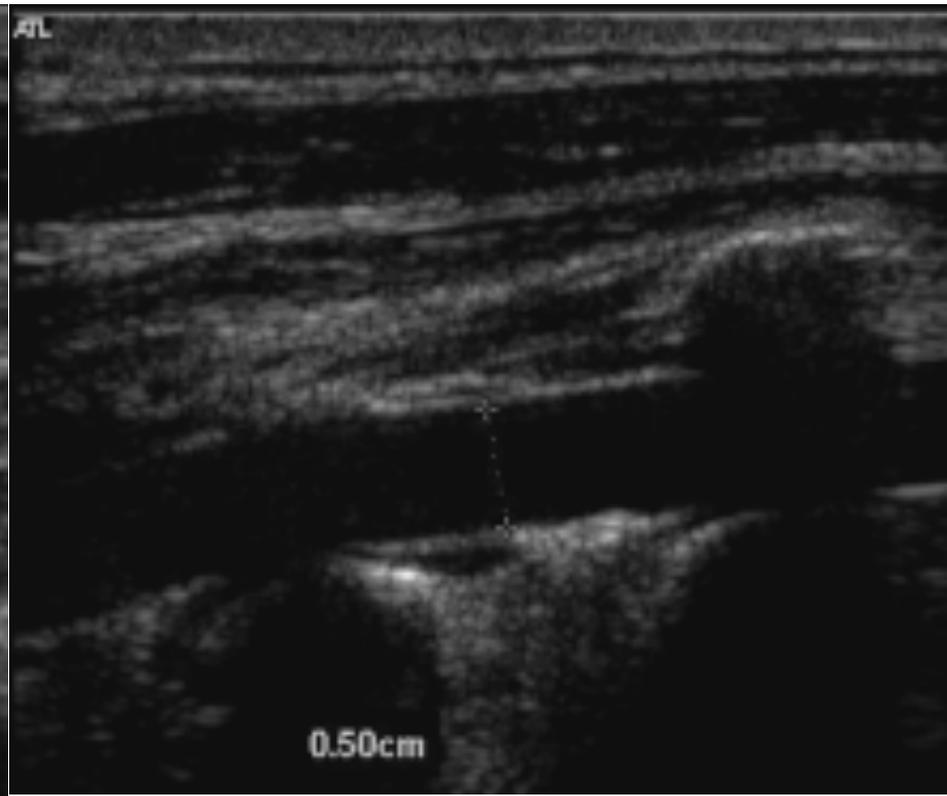
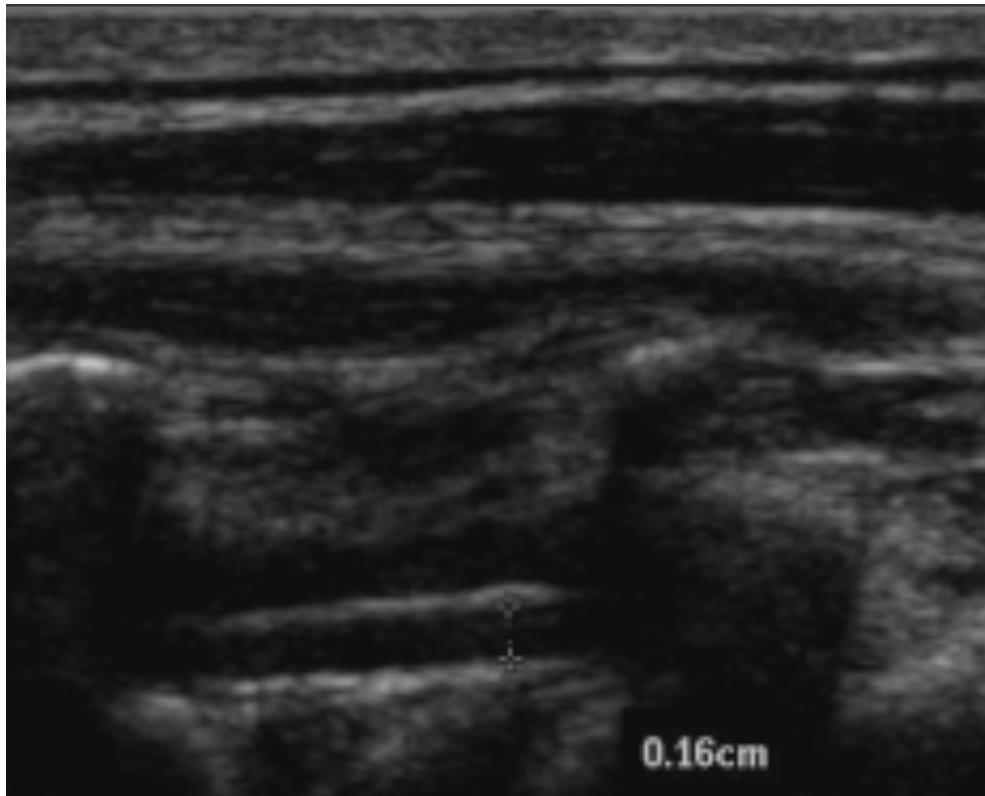


Variations anatomiques

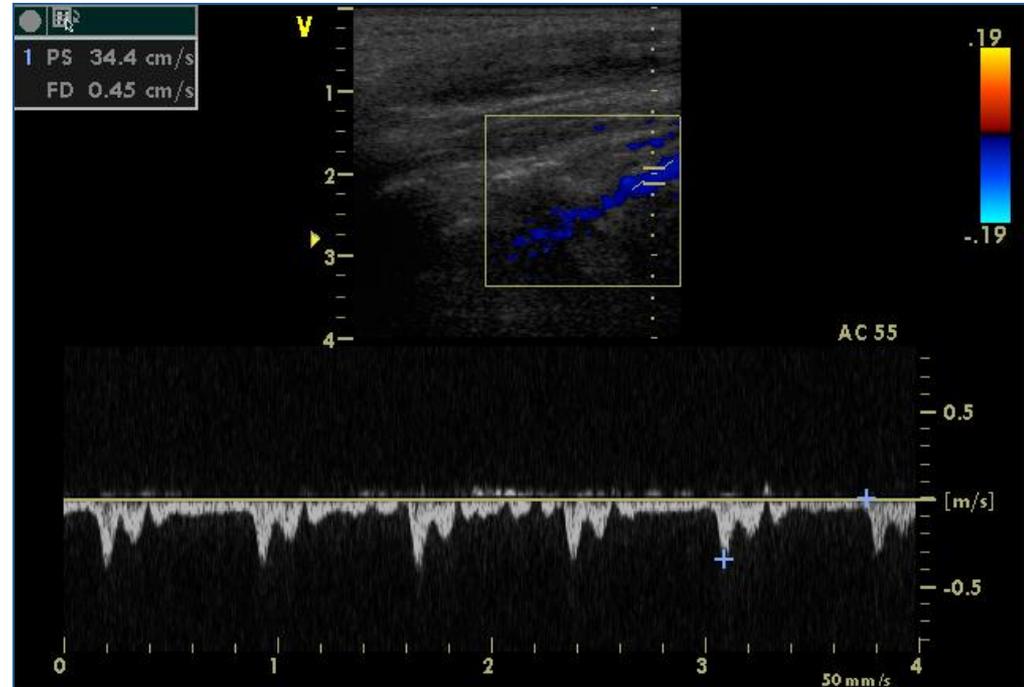
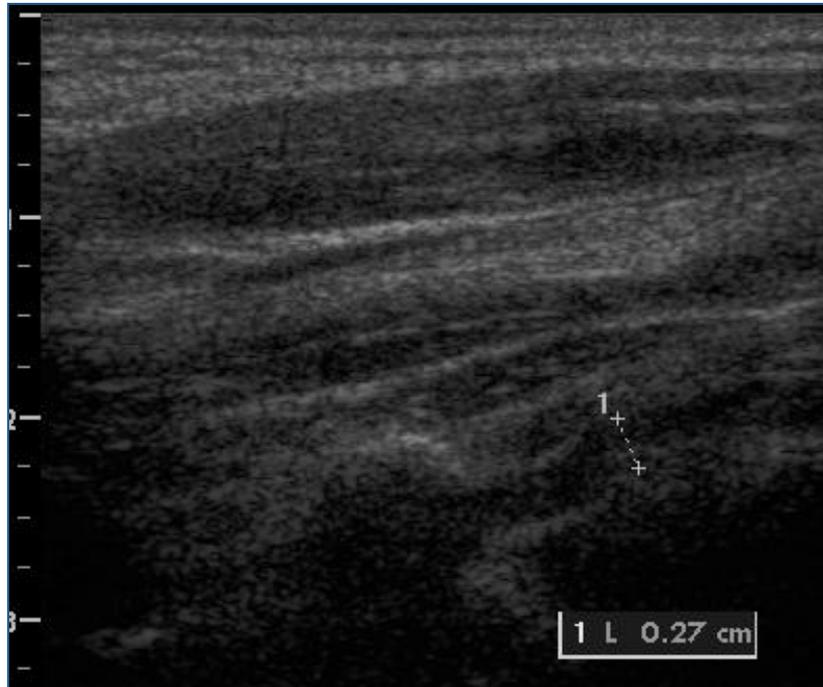
- Agénésie/ Hypoplasie
- Naissance sub clavière proximale Naissance de l'aorte (VG)
- Terminaison avant l'artère basilaire
 - Terminaison en PICA/ agénésie terminale
- Entrée dans canal transversaire haute
 - En C5 au lieu de C6
 - Aspect de segment V1 long
- Fenestration
- Duplication
- Variante de formation du polygone
- Sinuosité (boucle, coudure , plicature)



Hypoplasie vertébrale



Variantes Morphologiques



Hypoplasie Vertébrale