L’échographie permet-elle de diminuer les risques liés à l’accès aux voies veineuses centrales percutanés ?

ARRES 2013
Toulouse

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Epidémiologie

> 5 millions en 2009 (Catalin et al Anesth Analg 2009)

> 200 000 en 2002 (NHS)

COMPLICATIONS MÉCANIQUES FRÉQUENTES DES VVC POSES AVEC DES REPÈRES DE SURFACE

1- LE PNEUMOTHORAX > 5% EN SOUS CLAVIER

2 L'HÉMATOME PAR PONCTION ARTERIELLE > 10%

3- L'ECHEC DE MISE EN PLACE > 10%

4- LA POSITION INCORRECTE DU CATHETER >10%

Complications des abords veineux centraux «classiques»

Mechanical Complications of Central Venous Catheters Lewis A. Eisen 2006 .

Journal of Intensive Care Medicine

Mechanical Complications of Central Venous Catheters

Table 2. Mechanical Complications by Catheter Insertion Site

	All Catheters (n = 385)	Subclavian (n = 218)	Internal Jugular (n = 40)	Femoral (n=127)	*P*
Complications	129 (33.2)	85 (39.0)	13 (32.5)	31 (24.4)	.022
Pneumothorax	5 (1.3) (n = 258)	5 (2.3)	0	N/A	.144
Arterial puncture	18 (4.7)	7 (3.2)	2 (5.0)	9 (7.1)	.257
Incorrect position	14 (3.6)	14 (6.4)	0	0	.004
Hemothorax	1 (0.3) (n = 258)	1 (0.5)	0	N/A	.361
Subcutaneous hematoma	3 (0.8)	1 (0.5)	0	2 (1.6)	.440
Death	1 (0.3)	0	1 (2.5)	0	.361
Failure to place	86 (22.3)	57 (26.1)	10 (25.0)	19 (15.0)	.051

14%

- Peris et al Anesth Analg 2010
- McGee et al The New England Journal of Medicine 2003

Plus rarement...

- Hématome thoracique massif (Shinzato & al J Anesth 2010; Deogaonkar & al Ressuscitation 2007)
- Perforation aortique (Haaverstad & al CJEM 2007)
- Hématome rétropharyngé asphyxiant (Coignet & al Ann Fr Anesth Reanim 2008)
- Cathétérisme du tronc artériel (Choi et al Korean J Anesthesiol 2011)

- Lésion du plexus brachial (Trentman & al Reg Anesth 1996 / Rieke & al J Cardiothorac Anesth 1989 / Garcia-Fages & al Ann Fr Anesth Réanim 1990)
- Perfusion massive intra-pleurale (Omar & al Int Arch Med 2010)
- Infarctus cérébral (Saxena & al Can J Anaesth 2005)
- Tamponade (Shamir & al Anesth Analg 2011)

Quels sont les facteurs de risque des échecs et des complications?

Les variations anatomiques

US-guided Puncture of the Internal Jugular Vein: Complications and Anatomic Considerations[1]

Andrew C. Gordon, MBBS, BSc, MRCP, FRCR
John C. Saliken, MD, FRCPC
Daniel Johns, BSc
Richard Owen, MBBch, MRCP, FRCR
Robin R. Gray, MDCM, FRCPC

J Vasc Interv Radiol 1998

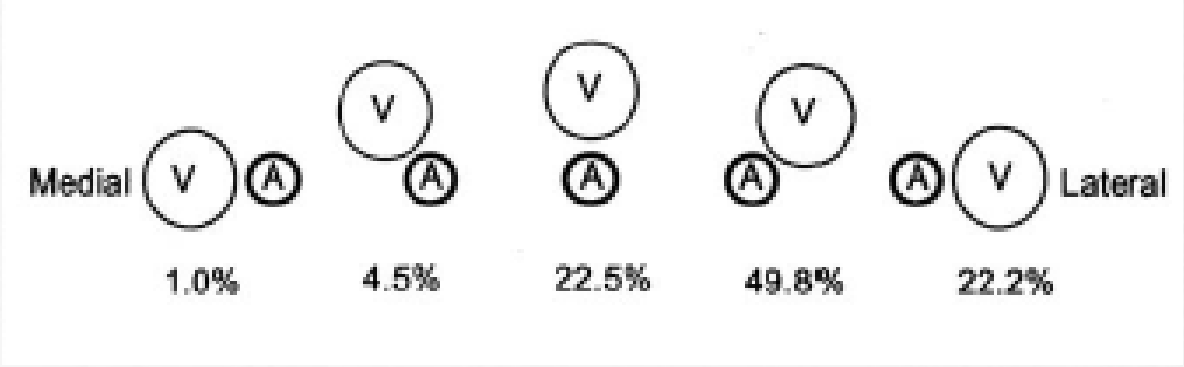


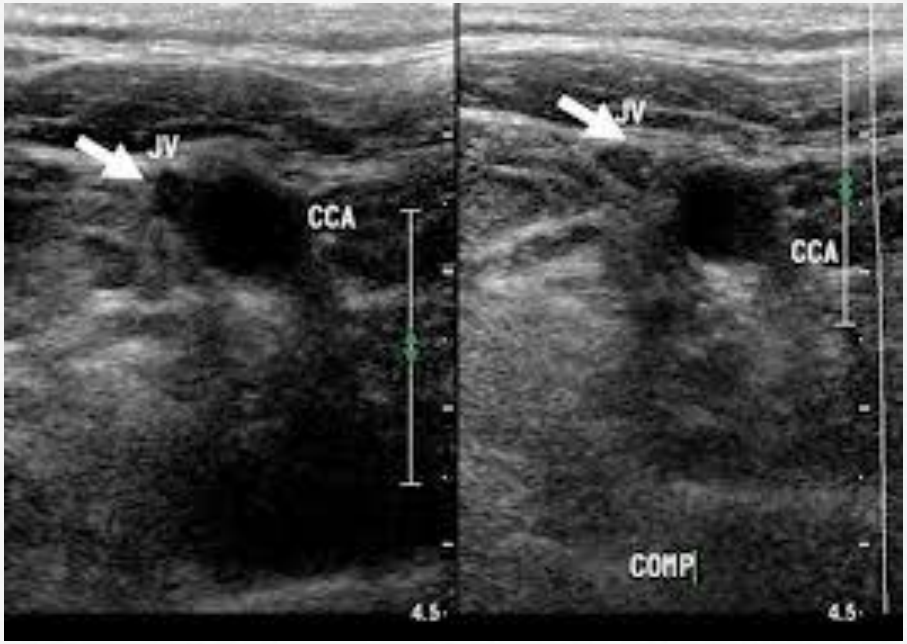
Figure 1. The five anatomical arrangements of the IJV (*V*) and CCA (*A*) observed in 659 patients. US evaluation with the patient's head turned in the opposite or contralateral direction. The percentages indicate the relative proportions of patients with the various arrangements.

The Accuracy of the Central Landmark Used for Central Venous Catheterization of the Internal Jugular Vein

Peter L. Bailey, MD, Emmett E. Whitaker, Linda S. Palmer,
Department of Anesthesiology, University of Rochester, Rochester, New York

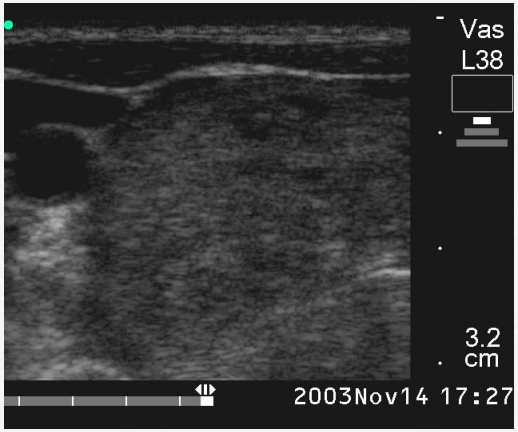
ANESTHESIA & ANALGESIA
The Gold Standard in Anesthesiology

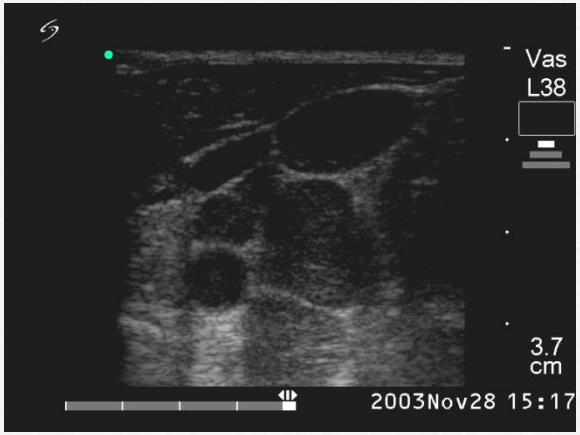
- Diamètre de la veine jugulaire interne: 2,5 à 61 mm
  Bailey, P. Whitaker, et al. 2006
- Doublement des complications et échecs lorsque diamètre < 7 mm
  Mey et al, Support Care Cancer 2003
- Déviation / centre de la veine
  Chen & al J Clin Anesth 2007



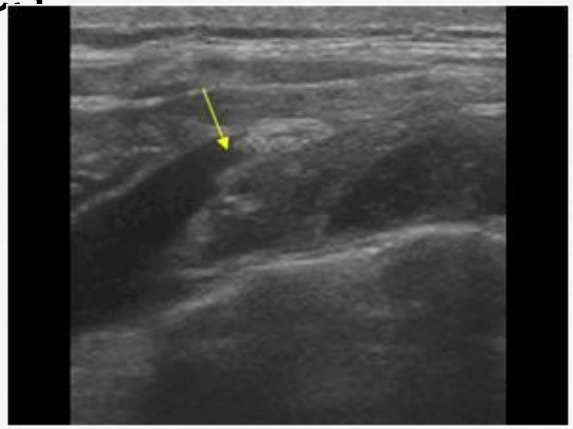
et d'autres ...

- Variations liées à des organes de voisinage :
  - Thyroïde
  - Ganglions





- Thromboses veineuses



Central Venous Access: The Effects of Approach, Position, and Head Rotation on Internal Jugular Vein Cross-Sectional Area

Thomas Suarez, MD*, Jeffrey P. Baerwald, PhD†, and Chadd Kraus†

*Sinai Hospital of Baltimore, Johns Hopkins University, Baltimore, Maryland; and †Loyola College in Maryland, Baltimore, Maryland

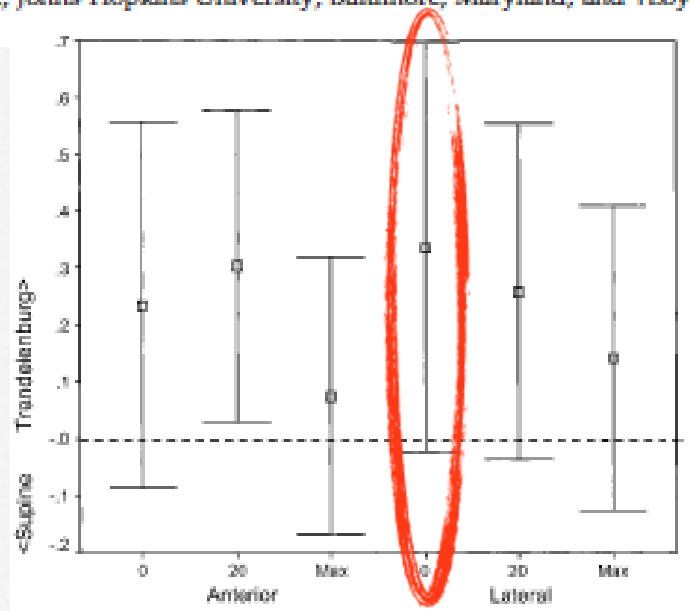


Figure 3. Difference scores between supine and Trendelenburg approaches across anterior and lateral approaches across head rotation. Values > 0 indicate greater internal jugular vein area in the Trendelenburg approach. Boxes represent means and wings indicate ± 1 SD.

ANESTHESIA & ANALGESIA IARS
The Gold Standard in Anesthesiology

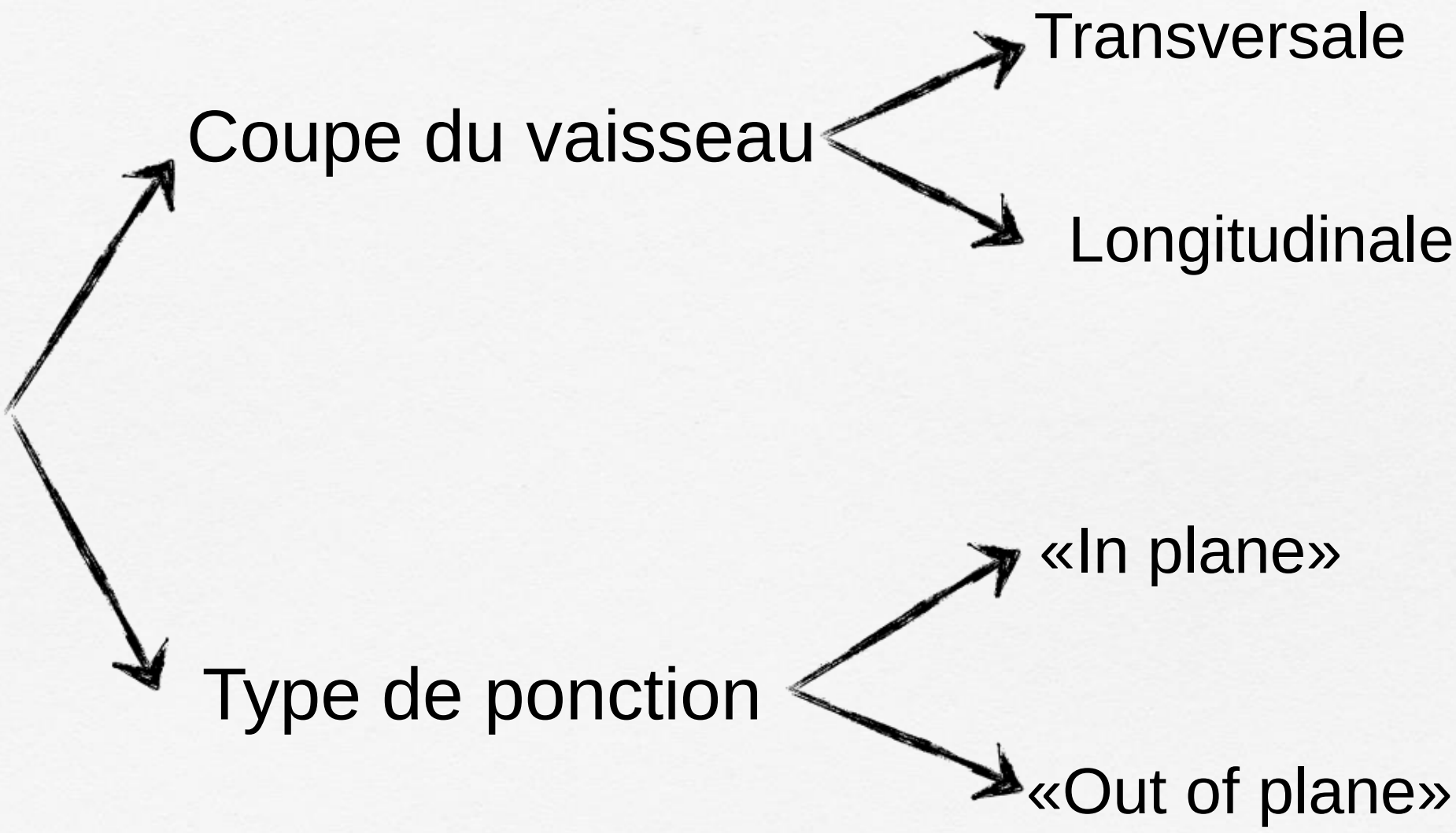
- ATCD d’échecs de pose
- Nombre de tentatives
- Malformations
- Obésité
- Thrombophlébite (Akihiro Suzuki Anesth Analg 2008)
- Inexpérience du médecin (Szajder & al Arch Intern Med 1986 19,4% à 10,1% d’échec)

McGee & al The New England Journal of Medicine 2003

Comment ponctionner en VVC

- 1-Le vaisseaux doit toujours être vu en coupe transversale au moment de la ponction
- 2-Le vaisseaux peut être vu en coupe longitudinale au moment de la ponction
- 3-La ponction est plus simple « dans le plan »
- 4-La ponction est plus simple « en dehors du plan »

Comment ponctionner sous échographie?

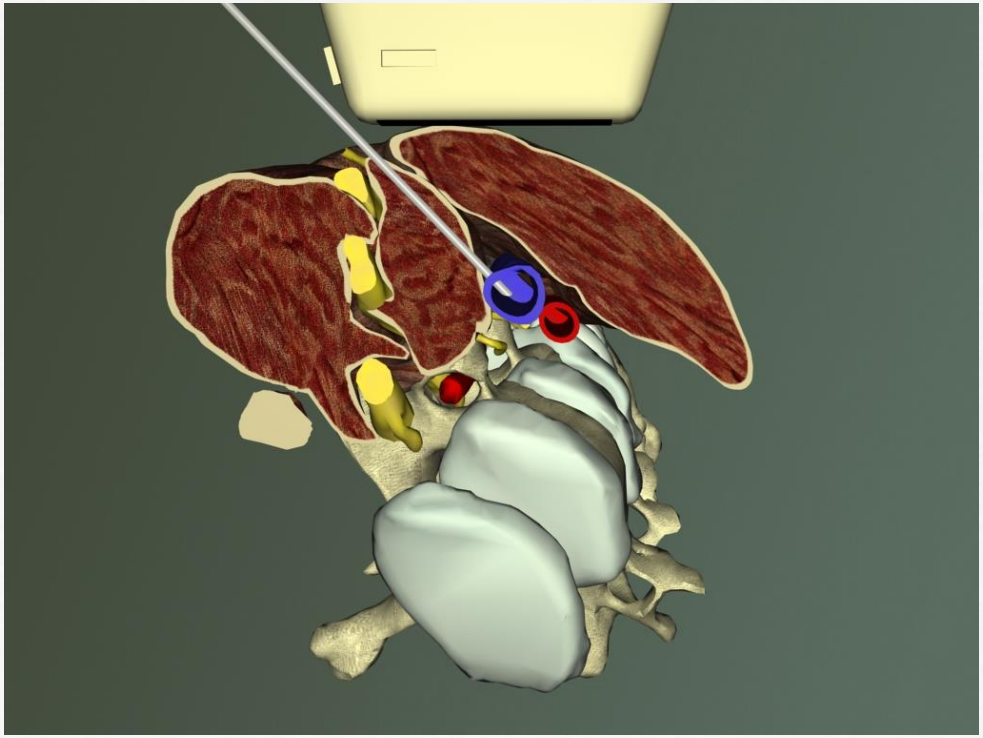

Transversale
Coupe du vaisseau
Longitudinale
«In plane»
Type de ponction
«Out of plane»

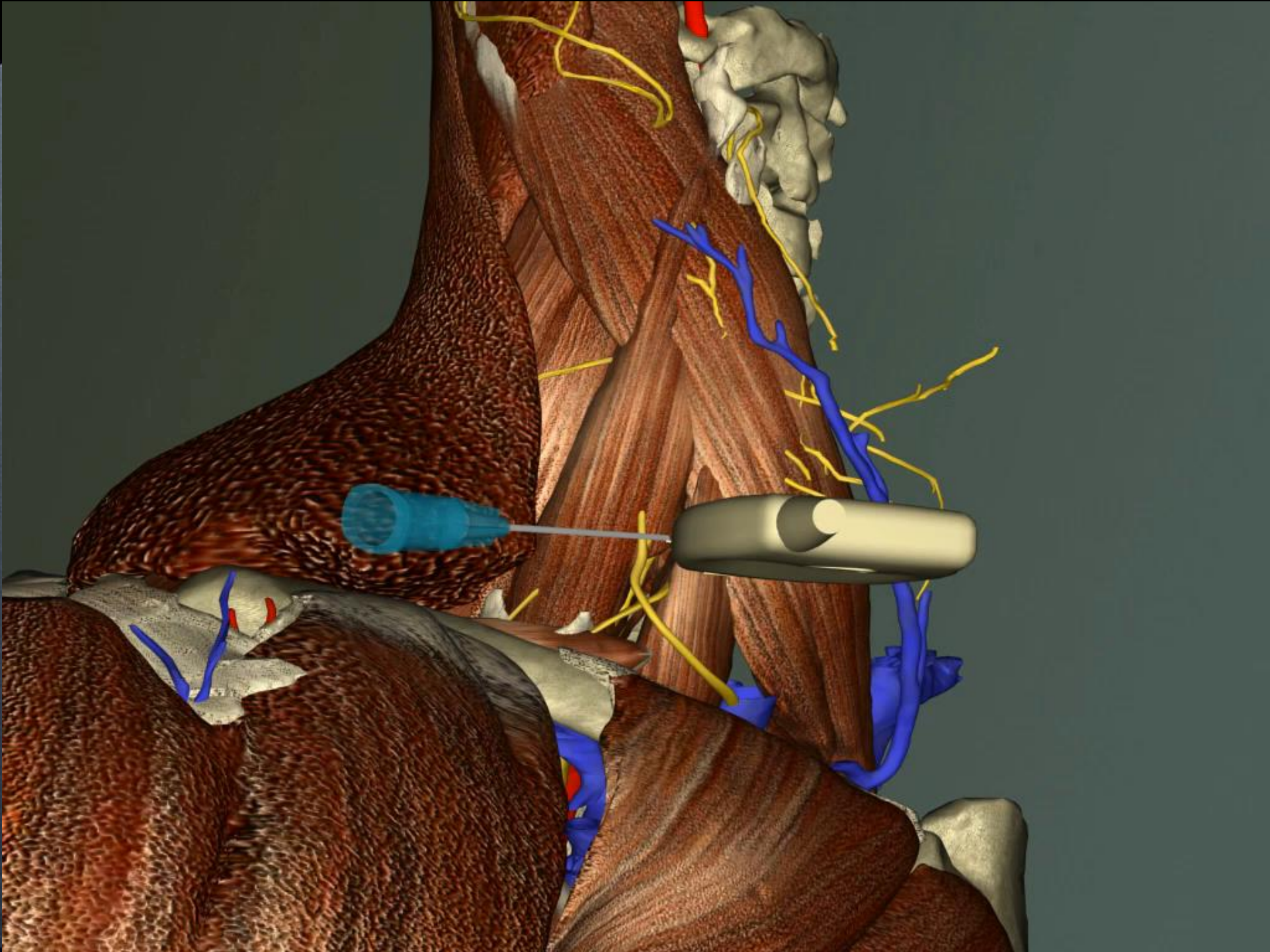
La coupe transversale

- Artère: Pulsatile, non compressible, renforcement postérieur
- Veine: Non pulsatile, compressible, forme variable, sans renforcement postérieur

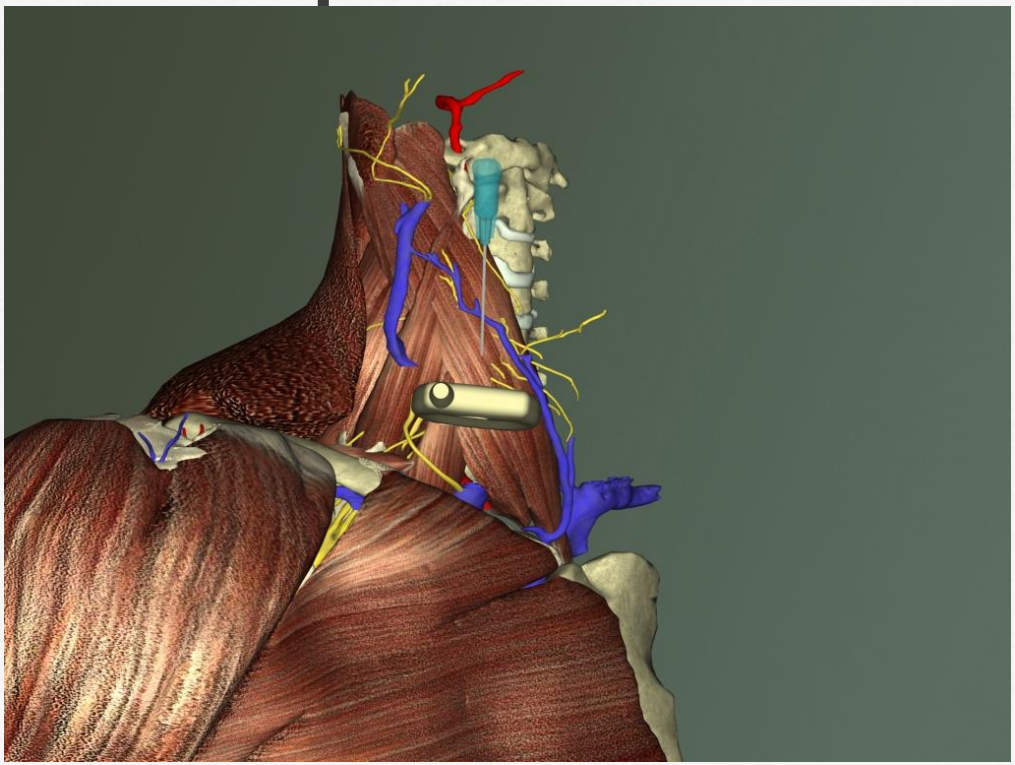
La coupe longitudinale

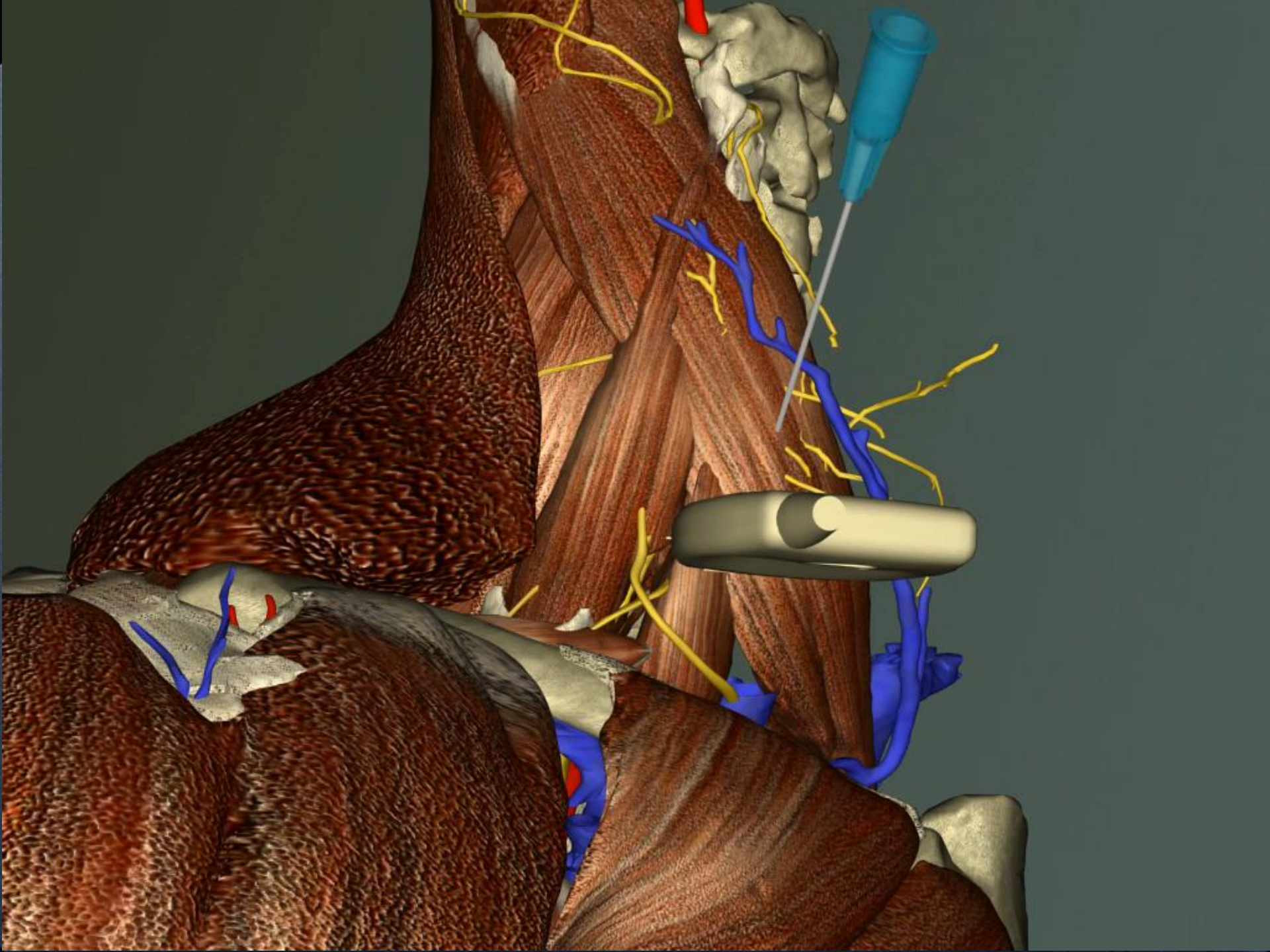
La ponction grand axe ou «In plane»



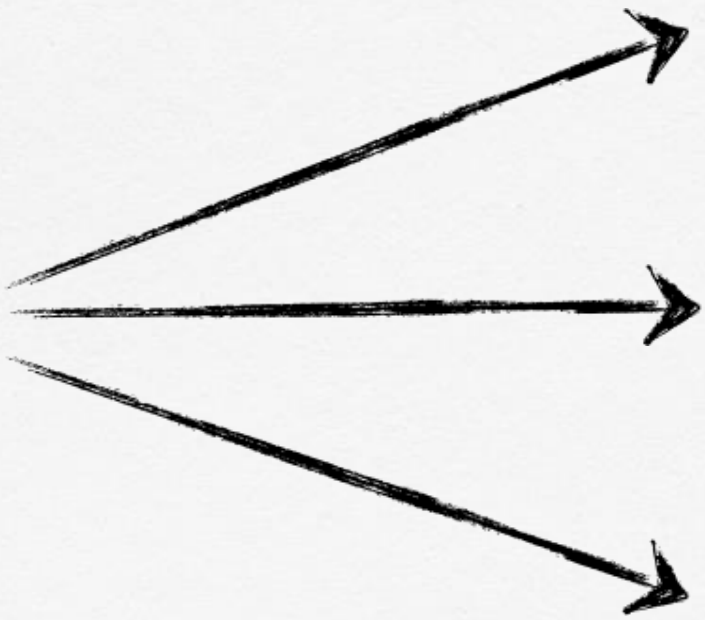


La ponction petit axe ou «Out of plane»





Quelle voie d’abord choisir?



Veine Jugulaire Interne

Veine sous-clavière

Veine fémorale

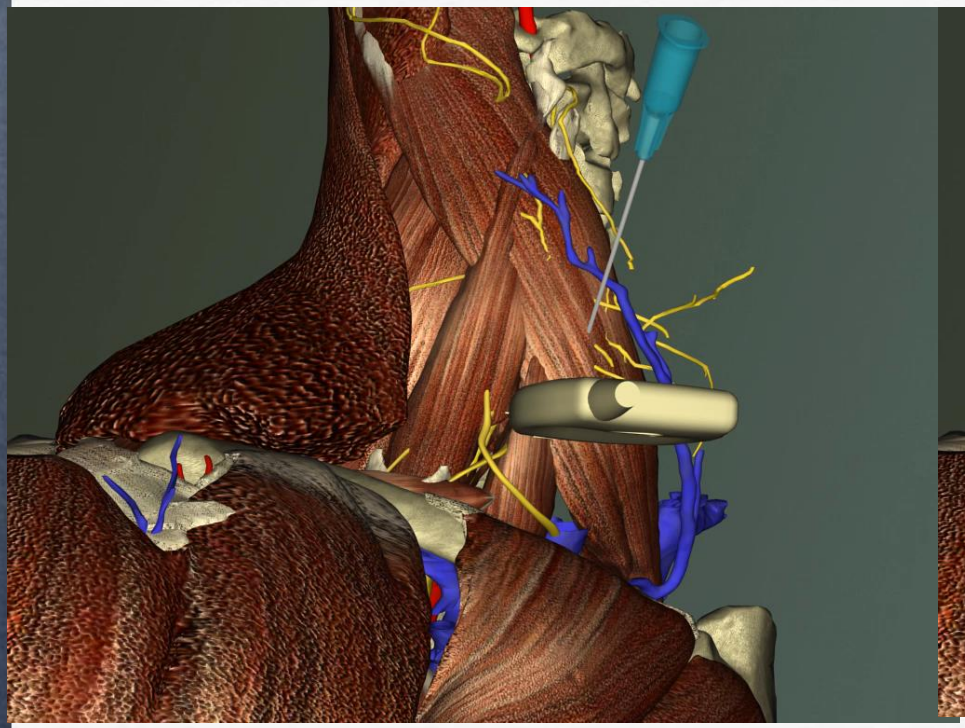
La veine jugulaire interne

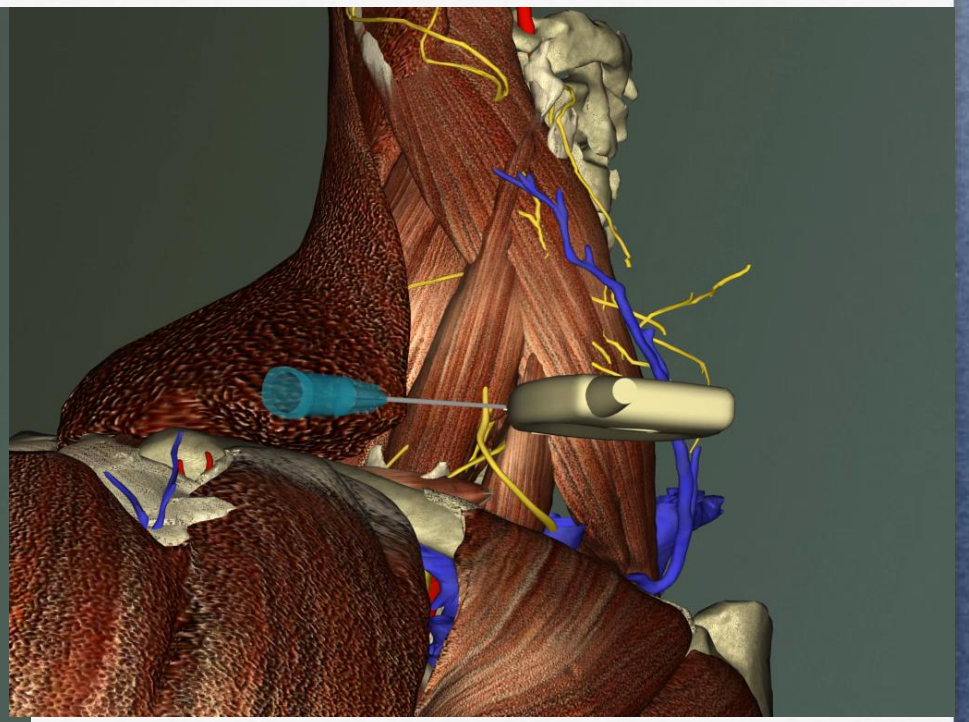
+

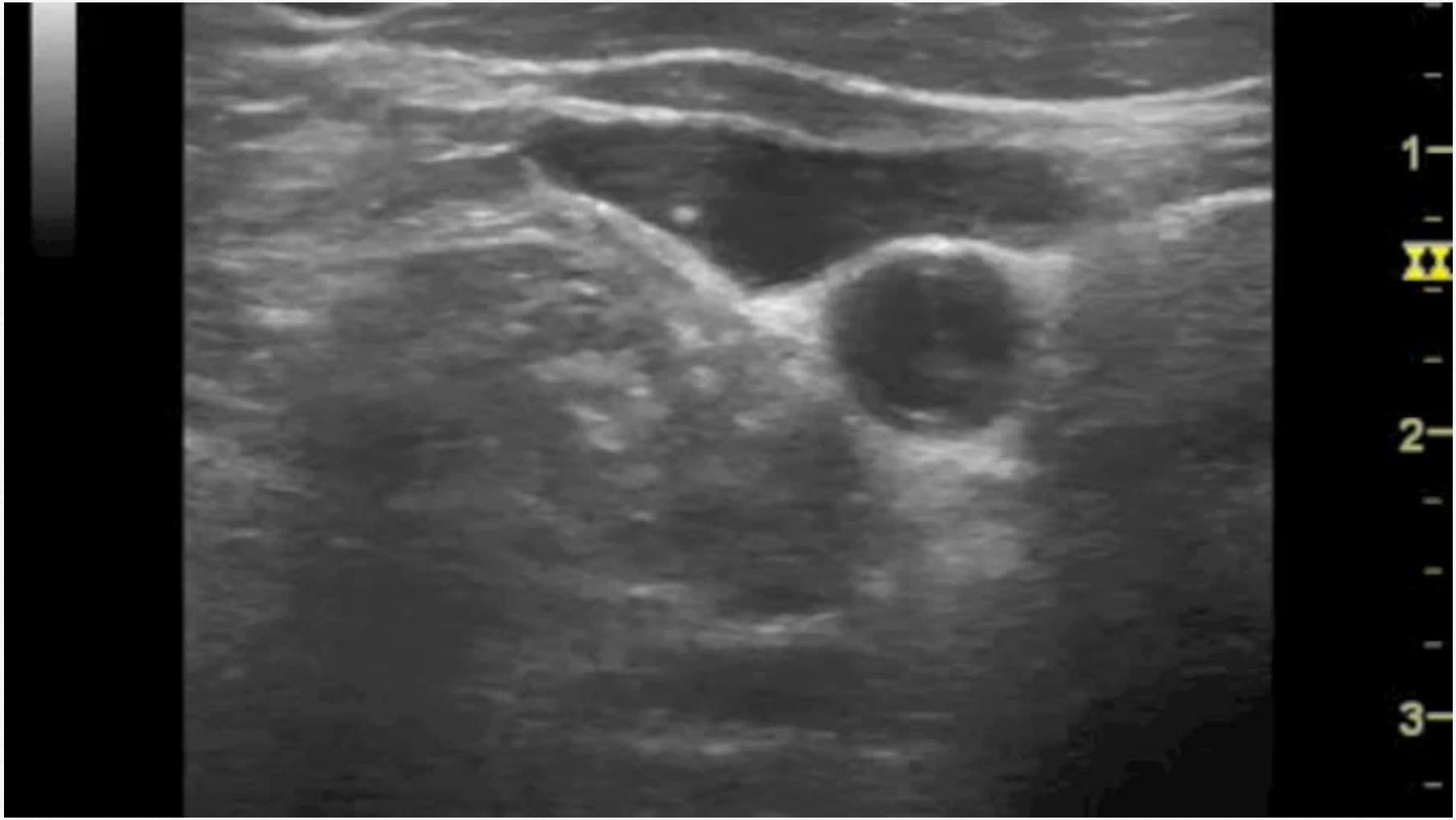
- Veine très superficielle
- Absence de relief osseux
- Plèvre à bonne distance

-

- Diamètre de la veine variable
- Position de la veine variable
- Problèmes infectieux






1
2
3

La veine sous clavière

- Risque infectieux limité
- Confort du patient

- Veine profonde
- Fenêtre échographique limitée

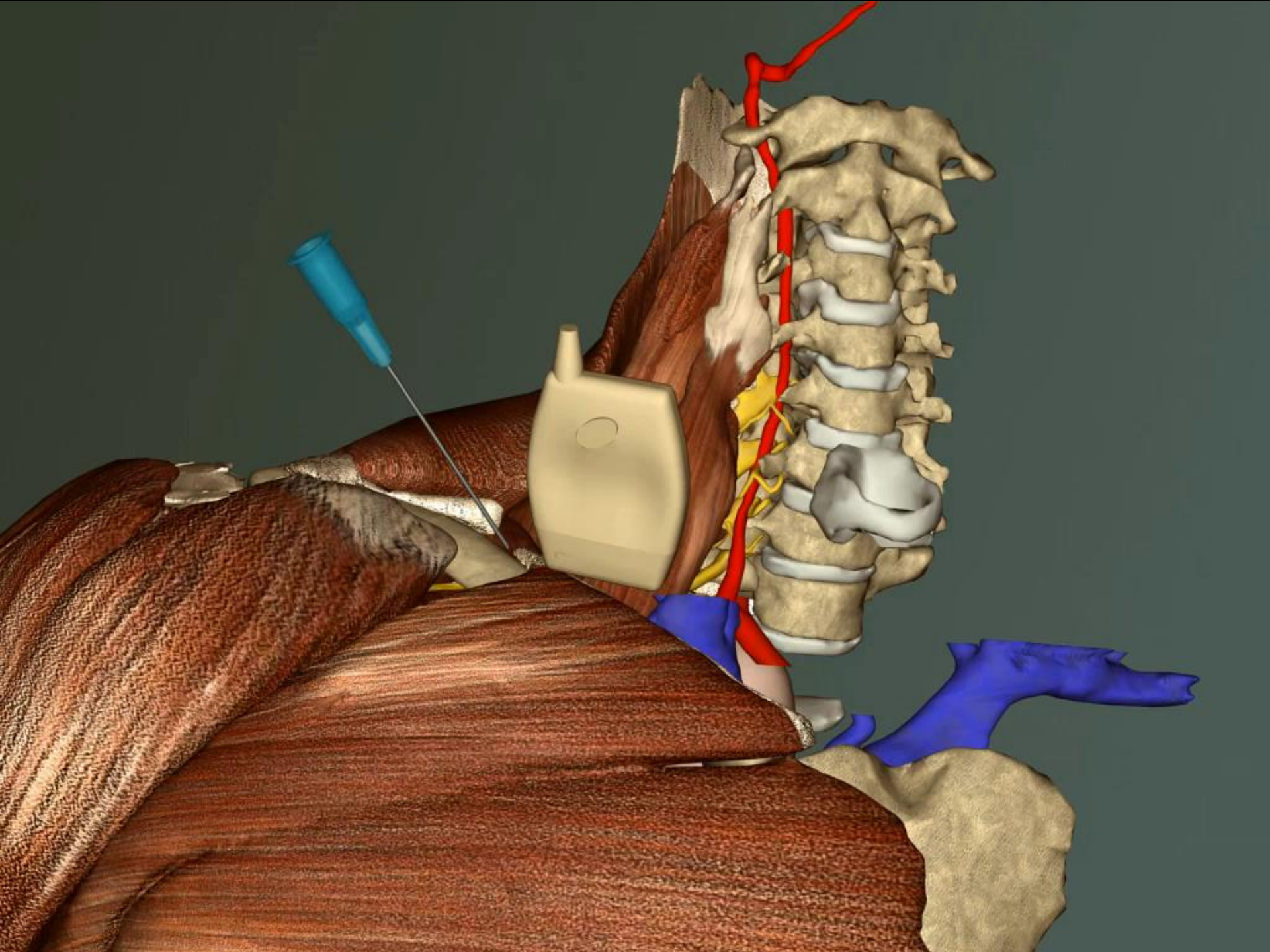
La veine sous clavière par voie supra-claviculaire

+

- Veine très superficielle
- Dôme pleural protégé par la veine
- Fenêtre échographique plus favorable

−

- Procédure «ultra-rigoureuse»
- Risque de confusion entre le confluent jugulo-sousclavier et le tronc artériel brachiocéphalique



La veine fémorale

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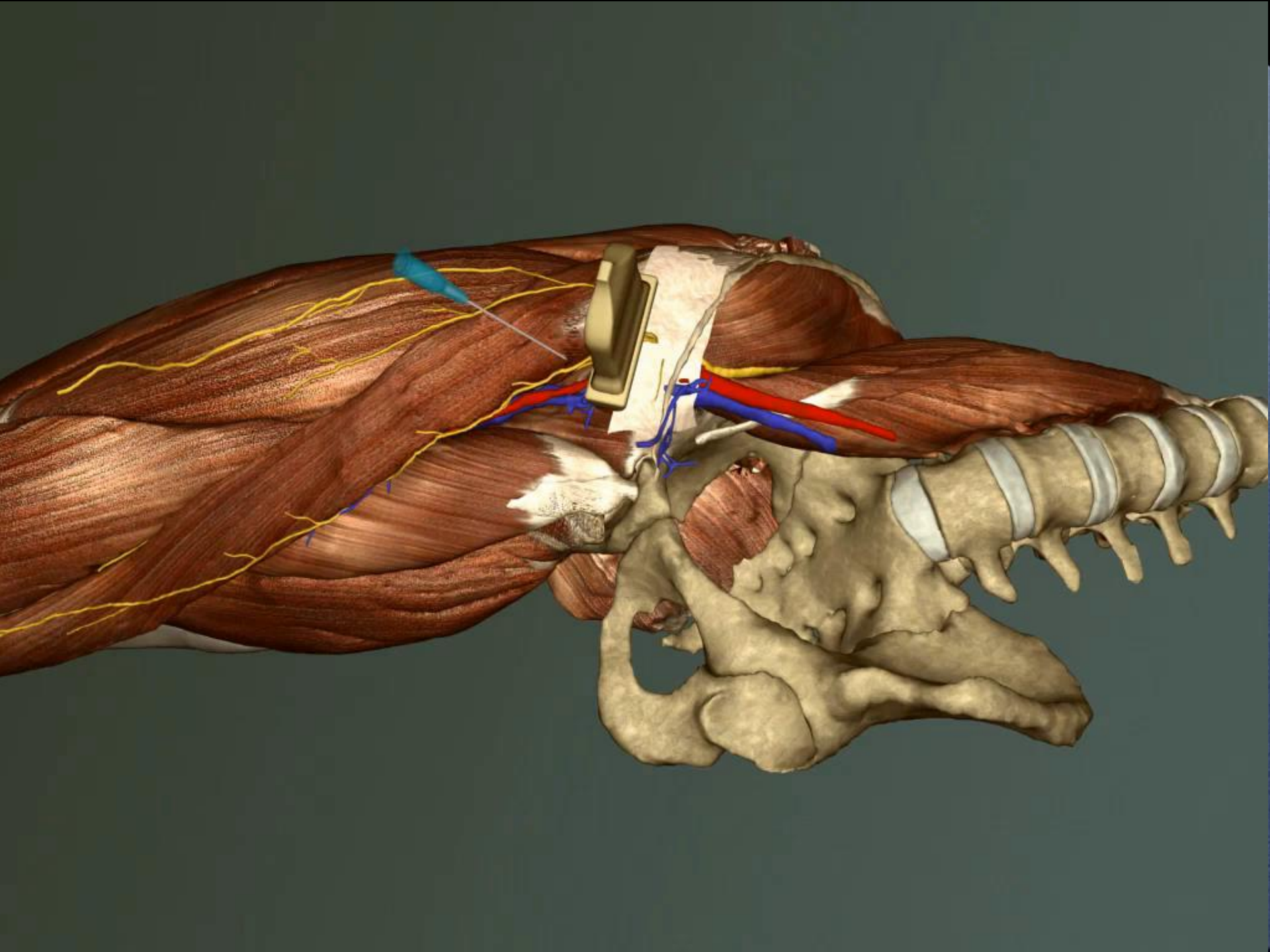
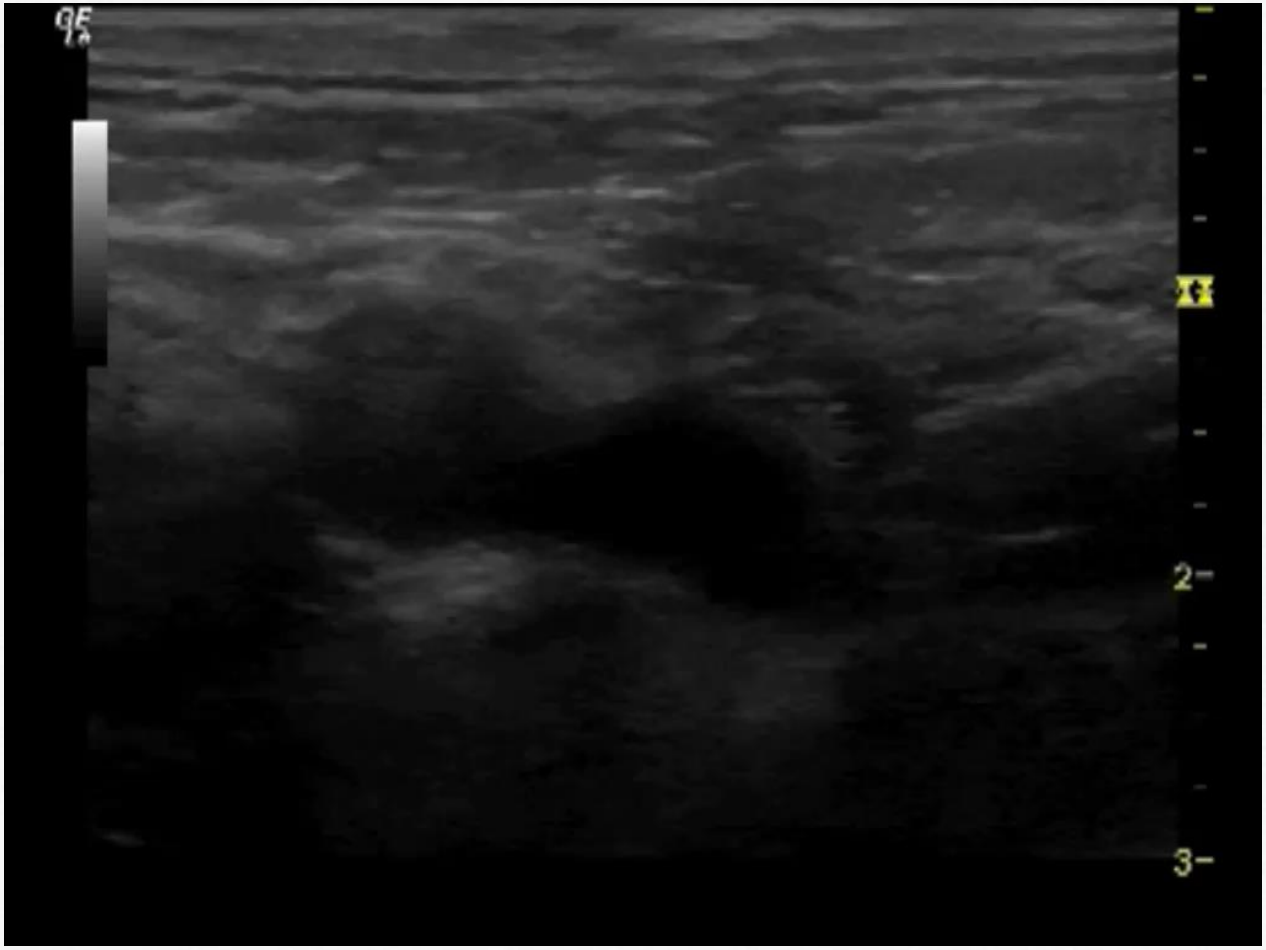
- Abord très simple
- Veine très superficielle
- Fenêtre échographique favorable

-

- Risque infectieux
- Risque thrombotique
- Inconfort du patient



La veine fémorale



Echographie et VVC

- 1-L’échographie n’augmente pas le taux de réussite dans la pose de VVC
- 2-L’échographie permet de diminuer le nombre de ponctions durant la réalisation de la pose d’une VVC
- 3-L’échographie permet de choisir le coté à ponctionner
- 4-L’échographie augmente le temps de pose de la VVC

Augmente-t-on le taux de réussite?

Méta-analyse de Hind, BMJ 2003

La plupart des études comparent :

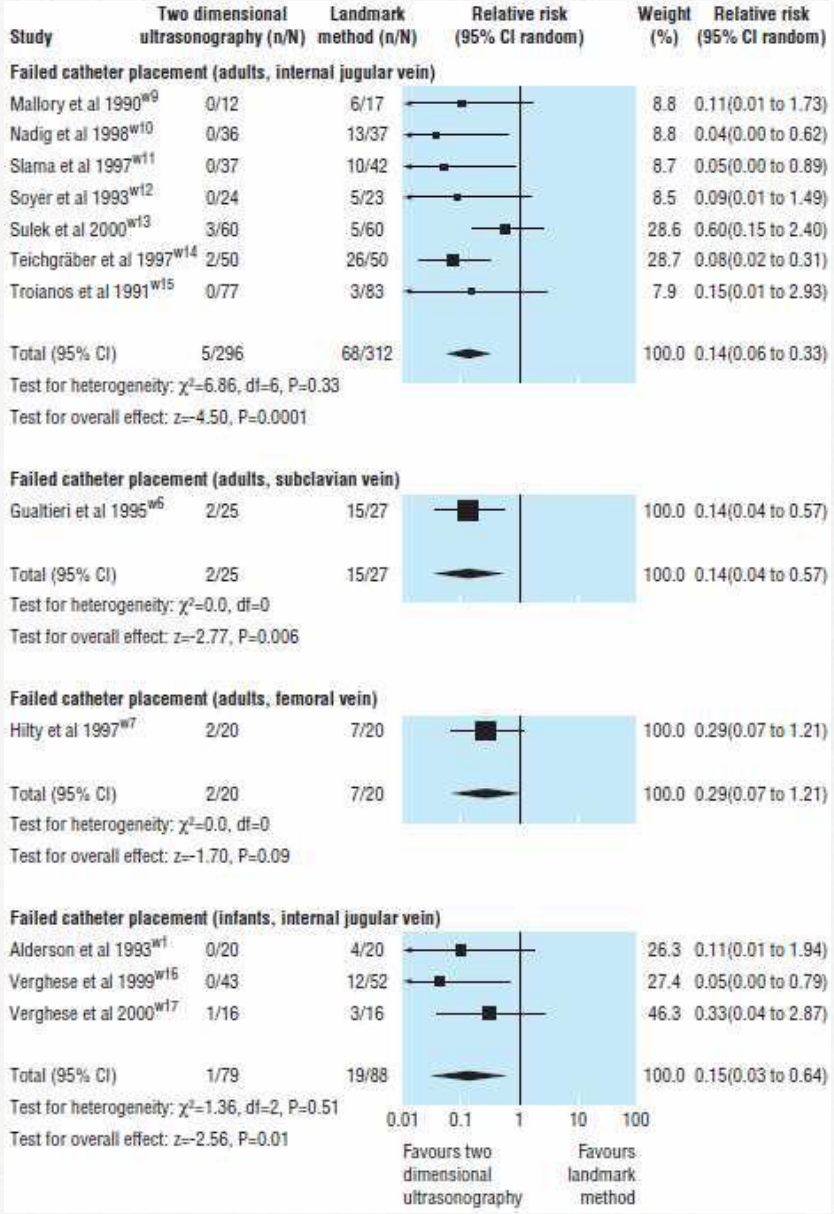
-la ponction échoguidée

-le guidage sonore par Doppler

-la ponction par repères anatomiques

18 essais randomisés (1649 pts) dont :

- 4 en soins intensifs
- 1 dans la réanimation de l'arrêt cardiaque
- 3 chez l'enfant



Veine Jugulaire interne	Veine Sous-clavière	Veine fémorale
Peris & al 2010 Anesth Analg 94,4%	Hameeteman & al 2010 J Vasc Access •Sakamoto & al 2010 Cardiovasc Intervent Radiol 96,5% / 98,6%	Prabhu & al 2010 Clin J Am Soc Nephrol 98,2%
Teichgraber & al 2011 Eur Radiol 99,8%	Rhondali & al 2011 Paediatr Anaesth 100%	

Amélioration de la réussite à la première ponction

Implantation of 3951 Long-Term Central Venous Catheters: Performances, Risk Analysis, and Patient Comfort After Ultrasound-Guidance Introduction

Adriano Peris, MD,* Giovanni Zagli, MD,* Manuela Bonizzoli, MD,* Giovanni Cianchi, MD,* Marco Ciapetti, MD,* Rosario Spina, MD,* Valentina Anichini, MD,* Francesco Lapi, PharmD, PhD,†and Stefano Batacchi, MD*

2010

Table 2. Early Complications of Long-Term Central Venous Catheter (LT-CVC) Placement in the Overall Population and Subgroups

Access site	Group	Number of patients	Operative complications, % (*N*)				Number of attempts			
			Arterial puncture	Difficult in wire advance	Hematoma	Pneumothorax	% (*N*) 1	2	>2	
Overall	LM group	1578	6.9% (110)	11.2% (177)	8.2% (129)	3.1% (49)	76.2% (120[illegible])	14.3% (225)	9.5% (151)	
	US group	2367	1.4%[a] (33)	3.4%[a] (81)	1.6%[a] (38)	1.3%[a] (30)	93.2%[a] (220[illegible])	4.6%[a] (108)	2.2%[a] (53)	
	US group I	591	2.2% (13)	6.1% (36)	0.2% (12)	1.5% (9)				
	US group II	1776	1.1% (20)	2.5%[b] (45)	1.5% (26)	1.2% (21)	1.07 ± 0.33[illegible]	94.4% [illegible]677)	3.7%[b] (65)	1.9%[a] (34)
IJV	LM group	777	5.8% (45)	8.6% (67)	9.1% (71)	3% (23)	1.38 [illegible].61	80.5% (625)	[illegible]	5.8% (45)
route	US group	2242	0.9%[a] (19)	3%[a] (68)	1.2%[a] (26)	1.2%[a] (26)	1.08 ± 0.37[c]	94.4%[a] (2116)	3.8%[a] (85)	1.8%[a] (41)
	US group I	542	1.1% (6)	5.5% (30)	1.5% (8)	1.5% (8)	1.13 ± 0.45[d]	91.1% (494)	6.1% (33)	2.8% (15)
	US group II	1700	0.8% (12)	2.2%[b] (38)	1.1% (18)	1.1% (18)	1.06 ± 0.31[d]	95.4%[b] (1621)	3.1%[b] (53)	1.5%[b] (26)
SV	LM group	801	8.1% (65)	13.7% (110)	7.2% (58)	3.3% (26)	1.46 ± 0.85	72.1% (577)	14.7 (118)	13.2% (106)
route	US group	125	11.2% (14)	10.4% (13)	9.6% (12)	3.2% (4)	1.44 ± 0.46	72.2% (90)	18.1% (23)	9.7% (12)
	US group I	49	12.5% (7)	12.3% (6)	8.2% (4)	4.1% (2)	1.48 ± 0.98	69.4% (34)	22.4% (11)	8.2 (4)
	US group II	76	10.5% (8)	9.2% (7)	10.5% (8)	2.6% (2)	1.43 ± 0.52	73.7% (56)	15.8% (12)	10.5% (8)

Patients were analyzed on the basis of access site (internal jugular vein, IJV; subclavian vein, SV) and on technique used: landmark method group (LM group) and ultrasound-guided group (US group). US group was also subanalyzed on the basis of the first year of US-guided cannulation (US group I) vs. the subsequent 3 years (US group II). The 6 patients in whom the femoral route was used were excluded from the total population of the LM group. Percentages are referred to as the total population of each subgroup.

[a] For χ^2 test, US group vs. LM group ($p < 0.001$).

[b] For χ^2 test, US group I vs. US group II ($p < 0.01$).

[c] For Student's *t* test, US group vs. LM group ($p < 0.01$).

[d] For Student's *t* test, US group I and US group II vs. LM group ($p < 0.01$).

ANESTHESIA & ANALGESIA IARS
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Outcome analysis in 3,160 implantations of radiologically guided placements of totally implantable central venous port systems

Ulf K. M. Teichgräber · Stephan Kausche · Sebastian N. Nagel · Bernhard Gebauer

Received: 28 June 2010 / Revised: 22 October 2010 / Accepted: 28 October 2010 / Published online: 5 January 2011

Table 2 Complications during the Intervention

Complications	No.	%	Actions taken	
			Correction	Break implantation
Pneumothoraces	0	0,00	0	0
Bleeding	3	0.09	2[a]	0
Arterial puncture	5	0.16	4	1
vasovagal reaction	1	0.03	1	0
Venous collaterals	3	0.09	1	2
Vomiting	1	0.03	1	0
Haematoma	2	0.06	2	0
Cardiac arrhythmia	4	0.13	4	0
Venous thrombosis	16	0.51	12	4
Pain	5	0.16	5	0
Allergic response	2	0.06	2	0
Total	42	1.33	34	7

[a] Explantation of one port system within the first 24 h of implantation

Augmente-t-on le temps de pose?

- 5 min sur VSC (Di Nardo & al J Vasc Access 2011)
- 7 min +/- 4,7 min sur VJI (Duran-briones & al Cir Cir 2010)
- <5 min sur VJI (Rhondali & al Paediatr Anaesth 2011)

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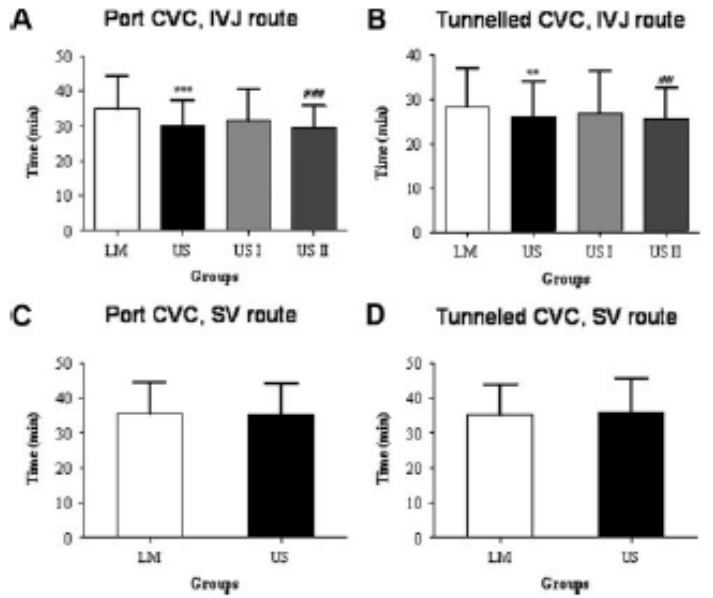


Figure 2. Procedural time of long-term central venous catheters (LT-CVC) placement analyzed on the basis of access site (internal jugular vein, IJV; subclavian vein, SV) and catheter type (port and tunneled catheters). Patients were divided on the basis of technique used: landmark method group (LM group) and ultrasound-guided group (US group). The US group was also analyzed on the basis of the first year of US-guided cannulation (US group I) vs. the subsequent 3 years (US group II). Student's *t* test: $^{**}P<0.001$ and $^{***}P<0.0001$, LM group versus US group; $\#\#P<0.001$ and $\#\#\#P<0.0001$, US group I versus US group II.

Diminue-t-on les complications?

Oui…

- Diminution du risque de complications mécaniques (Hameeteman J Vasc Acces 2010 8,4% / Peris Anesth Analg 2010 18,2 à 5,5%)
- Diminution du risque de ponction artérielle (Moak Am J Emerg Med 2011/Stone Am J Emerg Med 2010)
- Diagnostic préalable de thrombose veineuse
- Diminution du risque infectieux (3,8/1000j de cathéter vs 0,15/1000j de cathéter) (Nagashima J Infect Chemother 2006 / Teichgraber Eur Radiol 2011)

Echographie et VVC

- 1-L’échographie doit être utilisée pour la pose de VVC en cas de troubles de l’hémostase
- 2-L’échographie fait l’objet de recommandations dans de nombreux pays pour la pose de VVC
- 3-L’échographie peut être utilisée à la place de la radio pulmonaire pour confirmer le bon positionnement du cathéter
- 4-Le principal frein au développement est le prix des machines

Sécurise-t-on les ponctions dans des circonstances à risque?

Oui

- Trouble de l’hémostase (Tercan Eur J Radiol 2008)
- Chez l’Obèse (Brusasco Obes Surg 2009; Wollmeister Rev Bras Anestesiol 2008)
- Positions inusuelles (Brederlau Eur J anaesthesiol 2004; Sofi & Arab Saudi J Anaesth 2010)

US-guided placement of central vein catheters in patients with disorders of hemostasis.

- Tercan, F et al. 2008. Eur J Radiol
- 133 patients avec troubles de l'hémostase
- INR > 1.3 : 95 000 (12 à 330 000)
- TCA > 37 sec: 54 sec (22 to 100 sec)
- Plaquettes < 150 O00 : 1.8 (1.2 to 3)

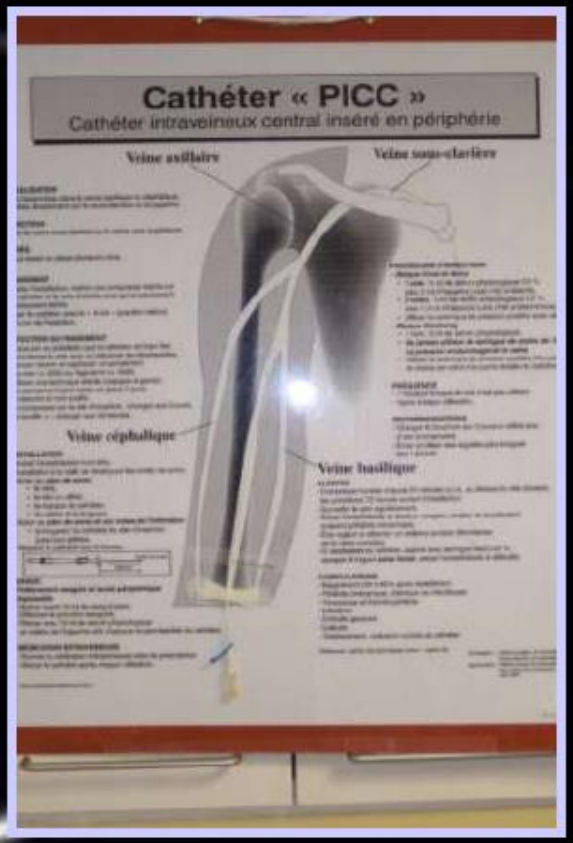
Details of Four Patients with Bleeding Complications

	Diagnosis	PLT Count ($\times 10^9$/L)	PTT (sec)	INR	Number of Passes
Patient 1	Multiple myeloma	12	24	1.2	1
Patient 2	Septic shock	31	34	1.5	2
Patient 3	Renal failure	46	42	1.1	1
Patient 4*	Multiple myeloma	154	35	1.1	2

** Patient with abnormal hemostasis corrected before central venous cannulation.*
PLT = platelet; PTT = partial thromboplastin time; INR = international normalized ratio.

PICCLINE
Peripherally Inserted Central venous Catheter

- Autres services ICU
- Réduction risque PNTX/saignement
- Augmentation risque thrombose
- Sonographie/fluoroscopie guidance
  - Réduction malpositionnement
  - Cost-effectiveness



Où en est l’échographie dans le monde?

- Imposé par le N.I.C.E. en Septembre 2002

- «The Agency for Healthcare Research and Quality»: «as one of the 11 patient care improvement practice»

N.I.C.E. 2002

National Institute for Clinical Excellence

1. Guidance

1.1 Two-dimensional (2-D) imaging ultrasound guidance is recommended as the preferred method for insertion of central venous catheters (CVCs) into the internal jugular vein (IJV) in adults and children in elective situations.

1.2 The use of two-dimensional (2-D) imaging ultrasound guidance should be considered in most clinical circumstances where CVC insertion is necessary either electively or in an emergency situation.

1.3 It is recommended that all those involved in placing CVCs using two-dimensional (2-D) imaging ultrasound guidance should undertake appropriate training to achieve competence.

1.4 Audio-guided Doppler ultrasound guidance is not recommended for CVC insertion.

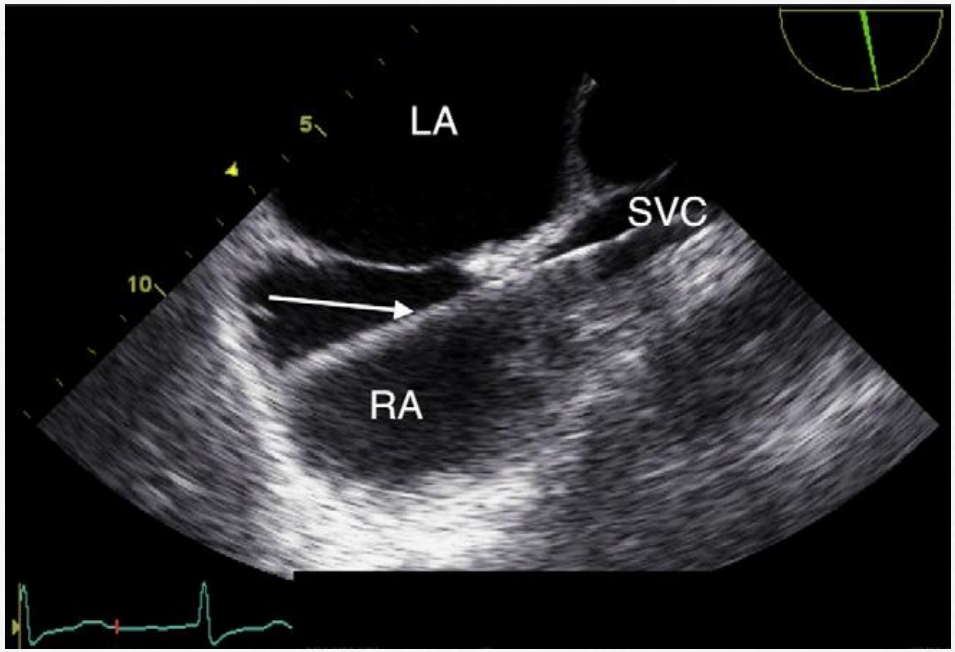
Guidelines for Performing Ultrasound Guided Vascular Cannulation: Recommendations of the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists . J Am Soc Echocardiogr 2011.

Successful cannulation of the IJ vein

with a guidewire shown entering

the right atrium (RA)

via the superior vena Cava (SVC).



It is recommended that properly trained clinicians use real-time ultrasoundduring IJ cannulation whenever possible to improve cannulation successand reduce the incidence of complications associated with the insertion oflarge-bore catheters. This recommendation is based on category A,level 1 evidence.

http://av.vimeo.com/72673/075/130387851.mp4?token=1362790257_e6b787c0ca755c466ce81c59d225a516

- 27% en routine / 35% si difficulté

(McGrattan & al 2008)

37% en routine / Taux équipement 85%

(Matera & al 2010)

- Anesth. cardiovasc: 15% parfois ou toujours, 67% jamais

(Bailey & al Anesth Analg 2007)

12% en routine, 60% si difficultés

(Schummer & al 2009)

- 8% en routine en réanimation chirurgicale / Taux d’équipement de 68%

(Mimoz & al 2010)

Les freins aux développement

- Disponibilité des machines
- Formation des médecins (900$/médecin) (Peris & al Anesth Analg 2010)