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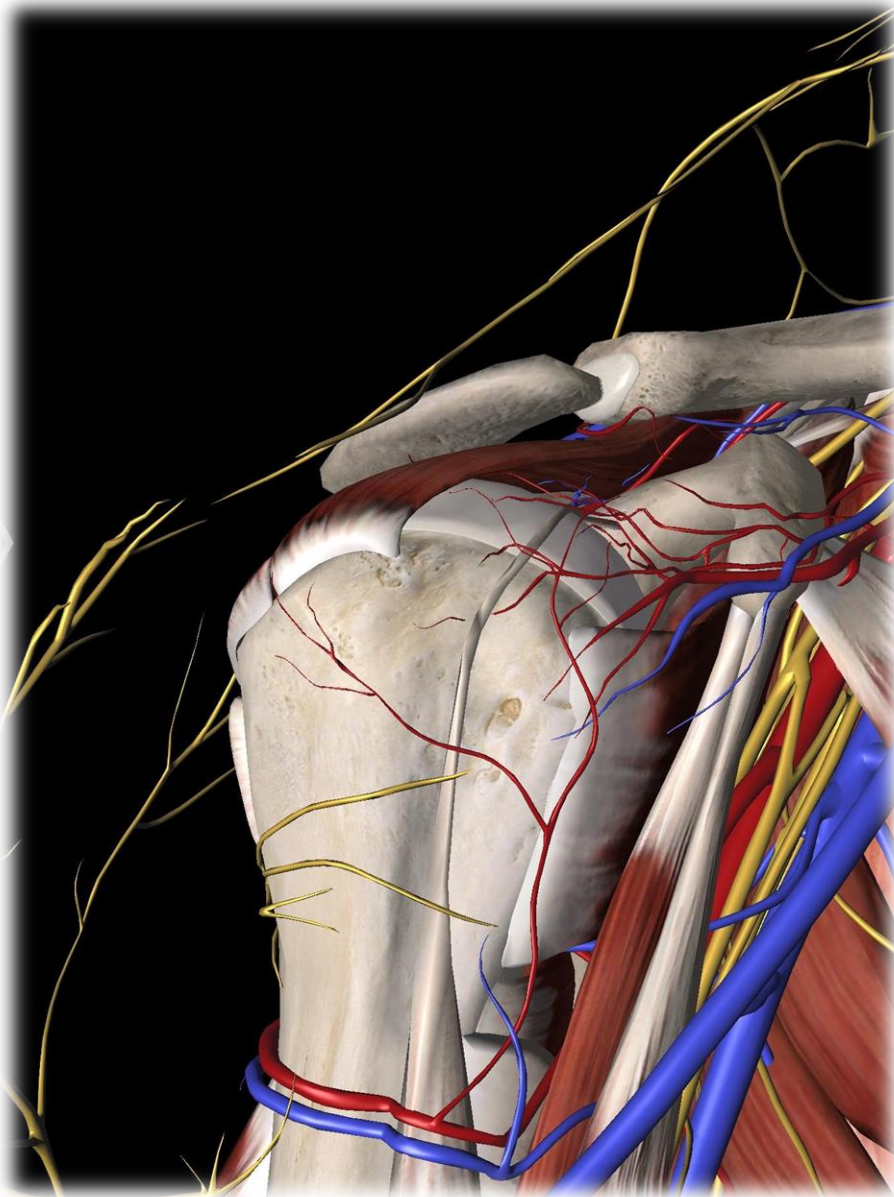
MC-XXXXXX

Focus: Le site IO humérus proximal

Stéphane Petitot | 10-05-2016



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SOMMAIRE:

1. *Avantages de la voie IO_{HP}*
2. *Anatomie de la tête humérale*
3. *Repérage du site d'insertion*



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Avantages de la voie IO humérale

Avantages de la voie IO humérale



Avantages de la voie IO humérale

Risque faible de transfixion (Diamètre ~6 cm chez un adulte)

Pas de risque de syndrome des loges. Aucun cas de syndrome des loges a été rapporté sur ce site.

Meilleurs débits¹

- Humérus: 5 L/H (avec CP: 300 mm d'Hg)
- Tibia: 1 L/H (avec CP: 300 mm d'Hg)

1. Internal study report. Protocol 2013-06: Clinical Studies to Determine the Optimal Technique to Identify the Proximal Humerus Intraosseous Vascular Access Insertion Site. Vidacare Corporation, May 2013.

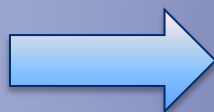
Avantages de la voie IO humérale

Douleur moins importante au moment du flush¹

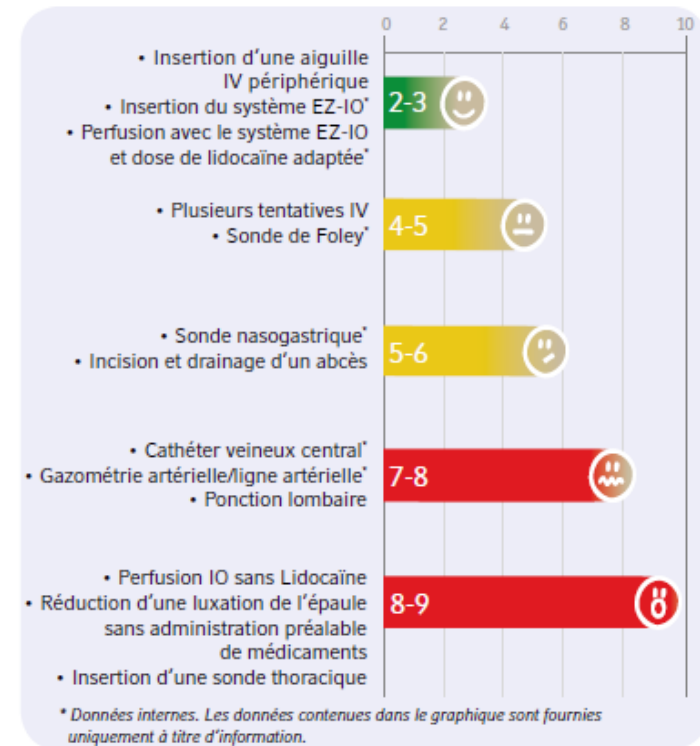
Insertion: $EVA_{IO_{TP}} = 4$ vs $EVA_{IO_{HP}} = 3$
Flush: $EVA_{IO_{TP}} = 7,3$ vs $EVA_{IO_{HP}} = 4,6$

Causes:

- Cavité intra-médullaire plus grande
- Travées osseuses moins denses



Diminution du recours aux antalgiques¹



1. Philbeck TE, Miller LJ, Montez D, Puga T. Hurt so good; easing IO pain and pressure. JEMS. 2010;35(9):58-69

Avantages de la voie IO humérale

Meilleures caractéristiques pharmacocinétiques

- 3 sec pour atteindre le cœur¹ (débit cardiaque normal)
- Proximité de l'oreillette droite
- Système veine cave supérieure
- Dans l'arrêt cardiaque:
 - Cinétique équivalente VVC vs IO_{HP}²
 - Cinétique équivalente IO_{ST} vs IO_{HP}³: $32,5 \pm 4,1$ vs 35 ± 3 sec
 - Adrenaline plus rapidement efficace en IO_{ST} vs IO_{TP}⁴: 48 ± 10 vs 121 ± 30 sec.

1. Internal study report. Protocol 2013-06: Clinical Studies to Determine the Optimal Technique to Identify the Proximal Humerus Intraosseous Vascular Access Insertion Site. Vidacare Corporation, May 2013.

2. Hoskins SL, Kramer GC, Stephens CT, Zachariah BS. Efficacy of epinephrine delivery via the intraosseous humeral head route during CPR. Circulation. 2006;(114):1204.

3. Hoskins SL, Zachariah BS, Copper N, Kramer GC. Comparison of intraosseous proximal humerus and sternal routes for drug delivery during CPR. Circulation. 2007;(116).

4. Hoskins SL, do Nascimento P, Lima RM, Espana-Tenorio JM, Kramer GC. Pharmacokinetics of intraosseous and central venous drug delivery during cardiopulmonary resuscitation. Resuscitation. 2012 Jan;83(1):107-12

Avantages de la voie IO humérale

Amélioration du RACS ?

- Etude de 2015 de Don Johnson et al. (*Annals of Medicine and surgery*)
- Effectifs 21 porcs:
 - 3 groupes:
 - Groupe 1 (contrôle) : RCP + défibrillation
 - Groupe 2: IO_{HP} + RCP + défibrillation
 - Groupe 3: IV + RCP + défibrillation

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Effects of humeral intraosseous versus intravenous epinephrine on pharmacokinetics and return of spontaneous circulation in a porcine cardiac arrest model: A randomized control trial

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HIGHLIGHTS

- No difference in concentration maximum (C_{max}) and time to maximum concentration (T_{max}) in epinephrine between humeral intraosseous and intravenous routes of administration over time.
- Humeral intraosseous delivers higher concentration than intravenous at 30 s after administration of epinephrine.
- Humeral intraosseous facilitates rapid delivery of epinephrine during cardiac arrest.
- Use of humeral intraosseous had higher number of subjects survived.

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ABSTRACT

Cardiopulmonary resuscitation (CPR), defibrillation, and epinephrine administration are pillars of advanced cardiac life support (ACLS). Intraosseous (IO) access is an alternative route for epinephrine administration when intravenous (IV) access is unavailable. Previous studies indicate the pharmacokinetics of epinephrine administration via IO and IV routes differ, but it is not known if the difference influences return of spontaneous circulation (ROSC). The purpose of this prospective, experimental study was to determine the effects of humeral IO (HIO) and IV epinephrine administration during cardiac arrest on pharmacokinetics, ROSC, and odds of survival. Swine (n = 21) were randomized into 3 groups: humeral IO (HIO), peripheral IV (PIV) and CPR/defibrillation control. Cardiac arrest was induced under general anesthesia. The chest remained in arrest for 2 min without intervention. Chest compressions were initiated and continued for 2 min. Epinephrine was administered and arterial blood samples collected for pharmacokinetic analysis over 4 min. Defibrillation and epinephrine administration proceeded according to ACLS guidelines continuing for 20 min or until ROSC. Seven HIO swine, 6 PIV swine, and no control swine had ROSC. There were no significant differences in ROSC, maximum concentration, except at 30 s, and time-to-concentration-maximum between the HIO and IV groups. Significant differences existed between the experimental groups and the control. The HIO delivers a higher concentration of epinephrine than the IV route at 30 s which may be a survival advantage. Clinicians may consider using the IO route to administer epinephrine during CA when there is no preexisting IV access or when IV access is unavailable.

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1. Introduction

Incidence of death attributable to cardiovascular disease has declined over the past 15 years but still accounts for 1 of every 3

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http://dx.doi.org/10.1016/j.amssurg.2015.08.010

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Avantages de la voie IO humérale

Table 2
Cross-tabulation of group members by status.

		Groups			Total
		CPR with defib	HIO	IV	
Survive?	Yes	0	7	4	11
	No	7	0	3	10
Total		7	7	7	21

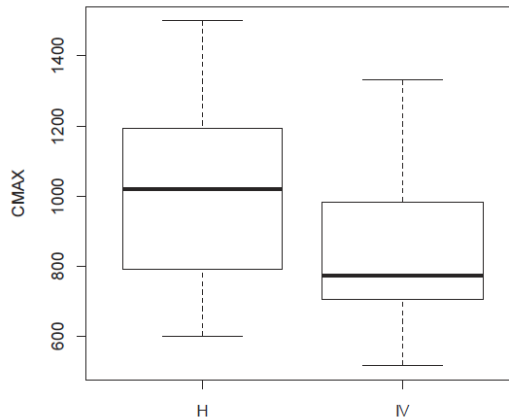


Fig. 1. Boxplots of Cmax by treatment group.

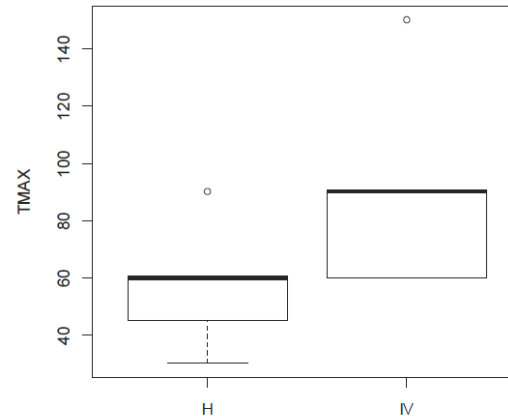


Fig. 2. Boxplots of Tmax by treatment group.

Résultats:

- RACS : $IO_{HP} = 100\%$ vs $IV = 57\%$
- Pas de différence statistiquement significative pour C_{max}
- Pas de différence statistiquement significative pour T_{max}

Avantages de la voie IO humérale

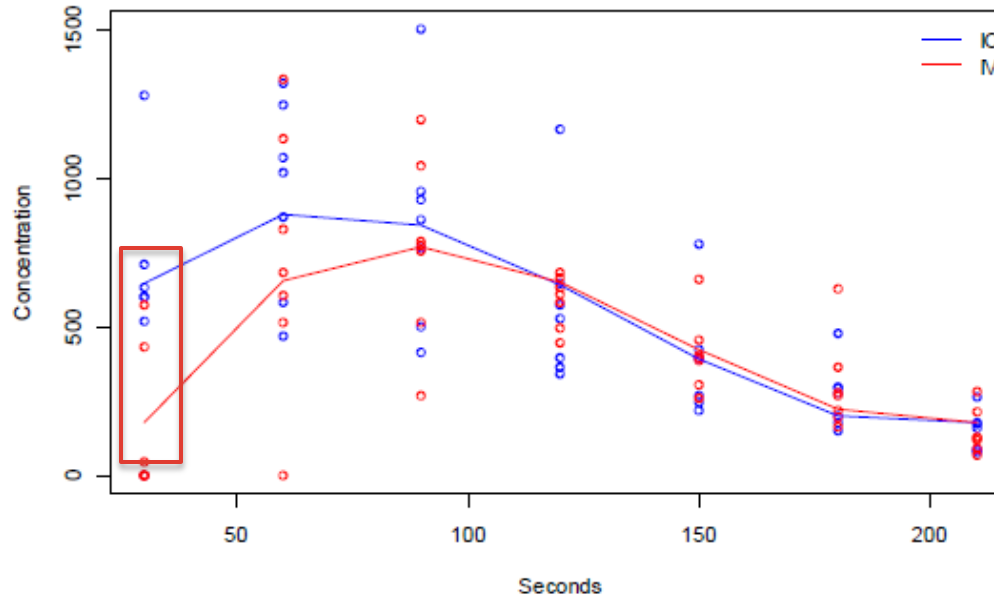


Fig. 3. Epinephrine concentration over time.

Résultats:

- Différence significative entre IO et IV: C_{max} à t_{30s} : 620,91 vs 150,06 ng/ml ($p=,017$)

Avantages de la voie IO humérale

Discussion:

- Modèle animal expérimental
- C_{max} plus élevé à 30s via l'IO cliniquement significatif chez l'humain ?
- Effectif faible

Conclusion:

- Rejoint les travaux de Zuercher¹: l'administration précoce IO d'adrénaline améliore les résultats de la réanimation comparé à une administration IV retardée
- Nécessite des plus amples investigations chez l'homme
- La voie IO doit être envisagée pour une administration rapide d'épinephrine s'il n'existe pas d'accès veineux préexistant ou si l'abord veineux est difficile

1. M. Zuercher, K.B. Kern, J.H. Indik, M. Loedl, R.W. Hilwig, W. Ummenhofer, et al., Epinephrine improves 24-hour survival in a swine model of prolonged ventricular fibrillation demonstrating that early intraosseous is superior to delayed intravenous administration, *Anesth. Analg.* 112 (4) (2011) 884e890.

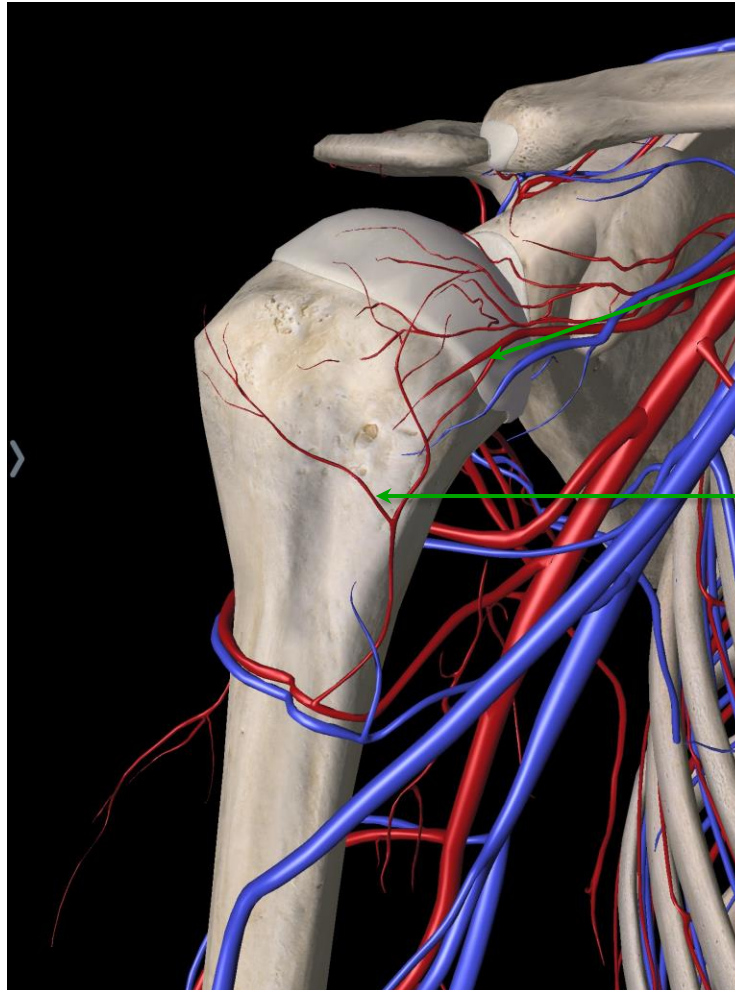
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Structures anatomiques de la tête humérale

Anatomie de la tête humérale

- Structures vasculaires

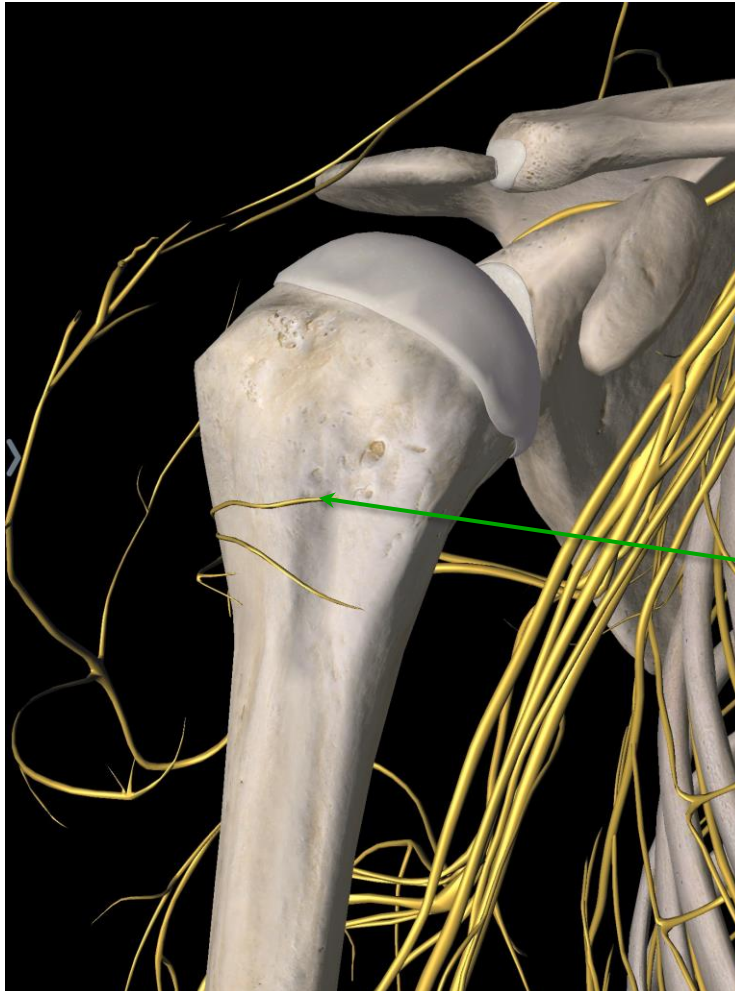


Branche de l'artère acromio-thoracique

Branche de l'artère humérale circonflexe antérieure

Anatomie de la tête humérale

- Structures nerveuses



Branche du nerf axillaire

Anatomie de la tête humérale

- Structures musculo tendineuse



Tendon bicipital

Anatomie de la tête humérale



Proximal Humerus Positioning / Anatomy Dissected (Cadaveric)

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Repérage du site d'insertion humérale

Repérage du site d'insertion humérale

IO plus difficile à placer sur l'humérus proximal?

- Etude de 2011 de Wampler D. et al. sur la pose IO_{HP} par des paramedics¹
- 405 arrêts cardiaques dont 61% avec une pose IO_{HP} (n=244)
- Réussite à la première tentative: 91% (vs 95% pour le tibia)

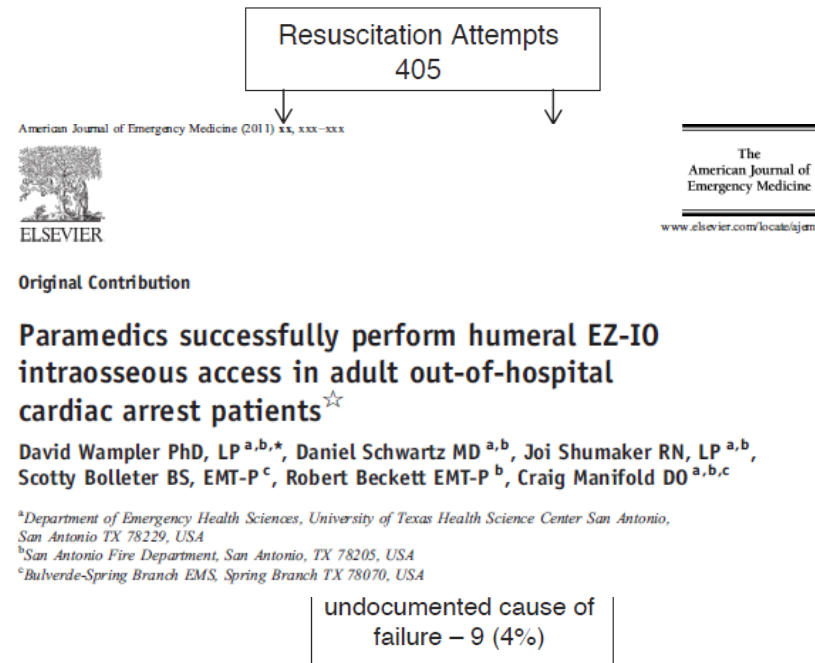
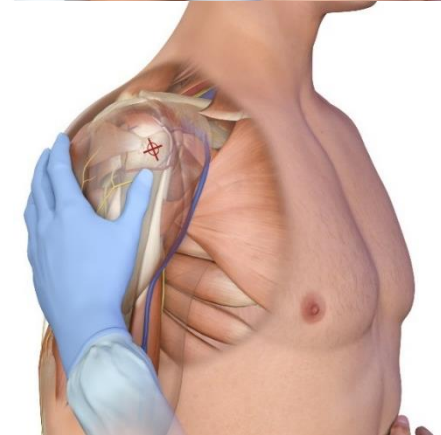


Fig. 1 Descriptive analysis of humeral IO success data.

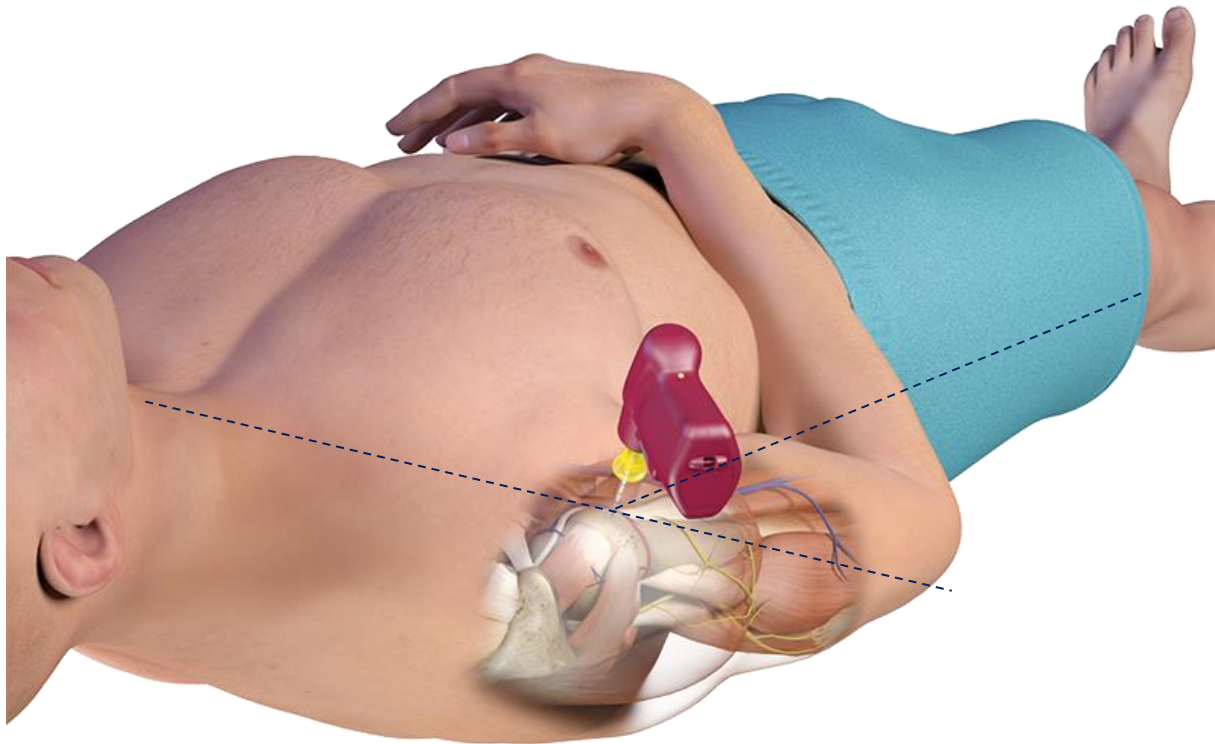
1. D. Wampler, D. Schwartz, J Shumaker, S. Bolleter, R. Beckett, C. Manifold. Paramedics successfully perform humeral EZ-IO intraosseous access in adult out-of-hospital cardiac arrest patients, American Journal of Emergency Medicine (2011)

Repérage du site d'insertion humérale

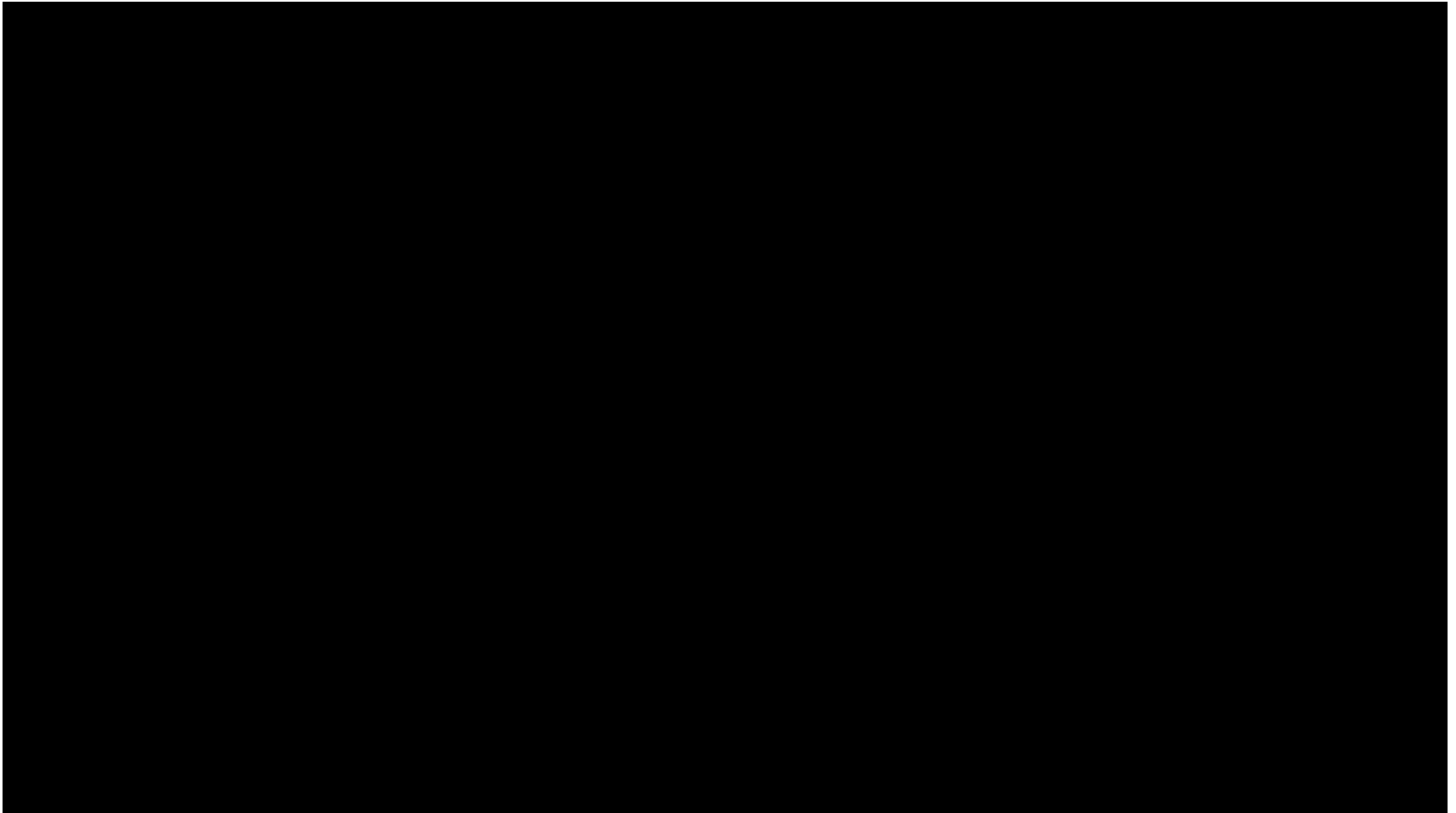


Repérage du site d'insertion humérale

- **Angle d'insertion:**
 - Insérer l'aiguille avec un angle de 45° par rapport au plan horizontal et au plan sagittal



Repérage du site d'insertion humérale



Conclusion:

- *Meilleures caractéristiques pharmacocinétiques*
- *Meilleurs débits*
- *Moins douloureux*
- *Moins de risque de transfixion*
- *Pas de risque de syndrome des loges*
- *Faible risque de lésions vasculaires ou nerveuses*
- *Taux de succès élevé à la première tentative*

Des questions?

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