ECG and CVC Tip location

2015
Dr ROSAY
Vascular Access Team
DAR CLB Lyon
Who are we? Legitimity.

The CLB is a medical center totally dedicated to cancerology.
All the steps of the medical care.
The anesthesiology Department: All CVC exclusive implanter: Implanted ports, tunneled CVC, PICC.
13 physicians, 4 half-time nurses

3000 CVC/year
Ultimately, what is the best tip location?
Zone A (low SVC/upper right atrium). This is a suitable tip site from any access point in the upper body. We believe catheter tips can be sited safely within the upper right atrium provided they do not abut the atrial wall end-on or pass through the tricuspid valve or into the coronary sinus.\textsuperscript{6,13,20,25,26}

Zone B (upper SVC). This is a suitable site for tips of catheters placed via the right internal jugular route.\textsuperscript{9,10}

Zone C (mid-point, left innominate vein). This is a suitable site for the tip when the catheter is introduced from the left internal jugular or subclavian vein, and reduces the risk of SVC perforation.\textsuperscript{11}
CVC’s Tip Location: thrombosis

- Retrospective study, 334 tunnelled catheters
- Average duration 72 days (1–720)

Centrales venous Thrombosis

<table>
<thead>
<tr>
<th>Location</th>
<th>Incidence</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>20/48</td>
<td></td>
<td>42%*</td>
</tr>
<tr>
<td>5/95</td>
<td></td>
<td>5%</td>
</tr>
<tr>
<td>5/191</td>
<td></td>
<td>2.5%</td>
</tr>
</tbody>
</table>

* p < 0.0005

Cadman, Clin Radiol 2004, 59, 349-355
## CVC’s Tip Location: functional consequences

<table>
<thead>
<tr>
<th>Tip location</th>
<th>#</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inominate vein/ VCI</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Above 1/3 lower SVC</td>
<td>133</td>
<td>66.5</td>
</tr>
<tr>
<td>1/3 lower SVC</td>
<td>48</td>
<td>24</td>
</tr>
<tr>
<td>Right atrium</td>
<td>17</td>
<td>8.5</td>
</tr>
</tbody>
</table>

Dysfunction of blood return from CVC in 200 consecutive patients

*STAS - Equipe de référence des cathéters - UZLeuven*
Optimal location: CVC’s Tip

Atrio-cava junction (SVC-RA)

2 vertebrae under the carena

Way of IV line // spine

In supine position

For all the devices

From any access in upper body
Upper SVC: Thrombosis Risk!

Insidious, poorly treatable, late sequelae

ACJ

Below RA/SVC Junction: Cardiac complications!

Rare, readily correctable
What is the real risk of upper right atrium tip location?

- ...whose tip is in the lower third of the superior vena cava, at the atrio-caval junction, or in the upper portion of the right atrium (Grade A).

ESPEN Guidelines on Parenteral Nutrition: Central Venous Catheters (access, care, diagnosis and therapy of complications)

Mauro Pittiruti \(^a\), Helen Hamilton \(^b\), Roberto Biffi \(^c\), John MacFie \(^d\), Marek Pertkiewicz \(^e\)

- Image-guided percutaneous central venous access is defined as the placement of a catheter with its tip in the cavoatrial region or right atrium with the assistance of real-time imaging
Limitations of chest X-Ray and fluoroscopy
Fluoroscopic landmarks?
(From sweet spot – Dr Key Symington)
When do we have to verify?
Chest x-ray after placement?

Too late!
During the placement
A randomized, controlled trial evaluating postinsertion neck ultrasound in peripherally inserted central catheter procedures

William D. Schweickert, MD; Jean Herlitz, RN; Anne S. Pohlman, RN, MSN; Brian K. Gehlbach, MD; Jesse B. Hall, MD; John P. Kress, MD

Crit Care Med 2009 Vol. 37, No. 4
We are lucky!
Sinus node is on atrio-cava junction!

Fig. 3 Diagram of a heart viewed from the right side of the chest showing the location of the sinus node in 22 of the 25 hearts studied.

Human heart anatomy

Location and vascular supply of sinus node in human heart

KENNETH R. ANDERSON, S. YEN HO, AND ROBERT H. ANDERSON
No doubt: ECG method is the best

Central venous port implantations via the cephalic vein applying an intravascular electrographic control of the catheter tip position: a single-center experience of 316 cases

Marcus Schenck, Tim Schneider, Herbert Rübben, Andreas Eisenhardt

Transesophageal echocardiographic evaluation of ECG-guided central venous catheter placement

Yunseok Jeon MD,* Ho-Geol Ryu MD,* Seung-Zhoo Yoon MD,* Jin Hec Kim MD,† Jae Hyon Bakh MD‡

CAN J ANESTH 2006 / 53: 10 / pp 978-983

The Accuracy of Electrocardiogram-Controlled Central Line Placement

BACKGROUND: Electrocardiographic (ECG) guidance to confirm accurate position of central venous catheters (CVC) placed before surgery in the operating room is commonly used in the United States. We designed this randomized, controlled trial to investigate whether the use of this technique impacts the accuracy of catheter placement.

METHODS: Patients in group ECG (n = 117) had a CVC placed using right-side ECG guidance at the catheter tip positioning. Patients in group NO-ECG (n = 117) were placed without this technique.

RESULTS: Overall, guidewire ECG control resulted in a significantly higher rate of correct positioning (96% vs 76%, P < 0.001) and a shorter mean time to correct positioning (30 ± 15 vs 21 ± 15 min, P < 0.05). The CVC was placed into the right atrium or right ventricle in 16% of patients (n = 18) in group ECG (P < 0.001) vs 8% (n = 9) in group NO-ECG.

CONCLUSION: ECG guidance allows for a more accurate CVC placement, as well as to increase patient safety and reduce costs associated with the CVC placement procedures.

REVIEW

The electrocardiographic method for positioning the tip of central venous catheters

Mauro Pittiruti1, Antonis La Greca2, Giancarlo Scoppettuolo2
1Department of Surgery, Catholic University, Rome - Italy
2Department of Infectious Diseases, Catholic University, Rome - Italy

ABSTRACT

Tip position of a central venous access is of paramount importance and should be verified before starting infusion. Several methods for verifying the location of the tip are to be preferred, since they avoid the risks, delays in repositioning the tip. Among the procedural methods, the electrocardiographic (ECG) method has advantages since it is an accurate and harmless, but simpler, more readily available, less expensive, safer and more effective than the others. The only contraindication to using the ECG method is the difficulty in identifying the standard on a surface ECG. This method - usually because of severe arrhythmias, such as atrial fibrillation - in only about 7% of cases, although such patients are easily identified before the procedure, and are referred to other diagnostic tip positioning. When dealing with the insertion of peripherally inserted central catheters (PICC), the ECG using the columns of saline technology virtually has no risk of false positives. The ECG method removes the need for further supplemental chest x-rays, as long as it is not expected risk of pneumothorax in the study population. The ECG guided central venous access positioning is not limited to any kind of PICC insertion. Indeed, evidence is mounting that the ECG method may be a valid and cost-effective alternative to the standard method of the location of the tip of any central venous access device (CVC), and that will rapidly become the standard method for confirming the tip position during PICC insertion.

d: February 12, 2011

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During the procedure

Advantages to patients
Reduced delays
Reduced exposure to radiation
Recognition of malposition during procedure

Advantages to the organisation
Reduced exposure to radiation
Increased efficiency
Cost saving
Practices
We need machine(s)
We need P wave: sinus rhythm
Endocavitary ECG: Maximal P wave
sinus node = atrio-cava junction
Optimal location with ECG method

During the placement: where the P wave is maximum, push it **+ 2 cm** to correct the move in supine position without causing malposition.

_Schutz, J Vasc Interv Radiol 2004_
Electrodes' placement
Maximal P wave
What are the problems?
P-wave does not increase!
P-wave does not increase!
you are not on the right way!
There is no false negative
Is there false positive?

- Yes:
  - Azygos vein

- Probably yes:
  - Sinusal vein
Azygos position
How to avoid this location?

- Push the catheter in the right atrium and then pull back it in the maximal P wave position
Interference movement - Beathing
Remember Maximal P wave
Bad P wave
Left vena cava
P wave from inferior vena cava

- Go in right atrium, obtain biphasic wave,
- Pull back slowly and stop when become back normal
Sometimes, P wave don’t want to grow up!

The KT don’t want to go forward
We need sometime Terumo guid or contrast injection via catheter and ....

fluoroscopy!

Stenosis, occlusion, thrombosis
Faisability- Acceptability-Relevance
Reduction of radiation rate PICC

Radiation level (mGray/cm²) for PICC placement 2012-2014
Reduction of radiation rate TI-LTCVCs

Radiation level (mGray/cm²) for PORT placement 2012-2014
PICC placement with ECG

Evolution of using ECG exclusively for port and PICC placements
TI-LTCVCs placement with ECG

Evolution of using ECG exclusively for port and PORT placements
How do you want to work?