

Il punto sulla 'tip location': il metodo dell'ECG intracavitario vs. i metodi radiologici in termini di costo efficacia e accuratezza

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GENOVA 5 DICEMBRE 2014

Tip location e tip navigation sono due diversi aspetti del posizionamento dei cateteri venosi centrali

Tip location

- Metodo per verificare che la punta del catetere sia nella posizione desiderata (in genere questa corrisponde alla giunzione atrio cavale)
- Il metodo deve essere sufficientemente preciso da permettere un uso sicuro della via centrale

Importanza della posizione della punta

malposizione

=

Aumentato rischio di complicanze

Importanza della posizione della punta

Catetere corto:

- Trombosi venosa
- Cattivo funzionamento
- Fibrin sleeve
- Lesioni della cava
- Persistent Withdrawal Occlusion (PWO)
- Tip migration

Catetere lungo:

- Aritmie
- Lesioni atriali
- Tamponamento cardiaco
- Lesioni della tricuspide
- Trombosi atriale

La giunzione atrio-cavale è la posizione migliore per ridurre

- trombosi
- Malfunzionamenti
- migrazione del catetere
- Aritmie

Verifica della posizione della punta

Metodi postprocedurali

RX torace

ecocardiografia
CT scan , RMN

Metodi intraprocedurali

fluoroscopia

metodo dell'ECG intracavitario (IC-EKG)

ecocardiografia (TTE o TEE)

Metodi postprocedurali

- Necessità di riposizionamento
 - PERDITA DI TEMPO
 - RITARDO NEL TRATTAMENTO
 - AUMENTO DEI COSTI

Metodi intraprocedurali

- Radiologici: fluoroscopia
- Metodo dell'ECG intracavitario (IC-EKG)
- Ecocardiografia (TTE o TEE)

- Applicabili
- Fattibili
- Accurati
- Sicuri
- Semplici
- Costo efficaci

Applicabilità

In quale gruppo di pazienti o con quale dispositivo si può utilizzare il metodo?

Fattibilità

Se il metodo è applicabile in quanti casi è possibile dimostrare che la punta del catetere è nella giusta sede?

Precisione

Qual'è il grado di errore
connesso al metodo?

Sicurezza

Quali rischi per l'operatore e per il paziente
sono associati al metodo?

Facilità

Facile da usare , imparare ed
insegnare

Metodi radiologici

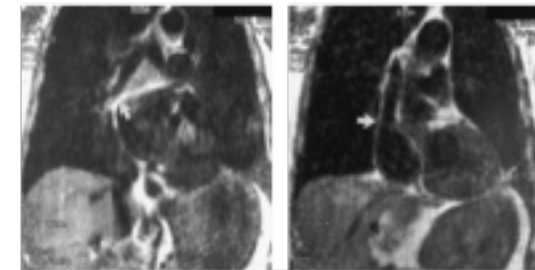
LIMITI della radiologia

- Limiti clinici
 - Reperi radiologici ambigui:
 - Movimenti respiratori
 - Artefatti proiettivi (proiezione antero-posteriore)
 - sproiettamenti (PARALLASSE) da reperi non complanari all'asse vascolare
 - ingresso posteriore della cava in atrio
 - mancanza di prospettiva nella proiezione singola antero-posteriore
 - anomalie anatomiche

LIMITI della radiologia convenzionale

Il profilo cardiaco destro include in alto l'atrio sin. nel 38% dei pazienti

L'ingresso della VCS in atrio dx è posterocraniale e non direttamente craniale



clinical investigations in critical care

MRI of Central Venous Anatomy*

Implications for Central Venous Catheter Insertion

Baki Adiguzel, MD; Christian L. Decull, MD; and John E. Heffner, MD, FCCP

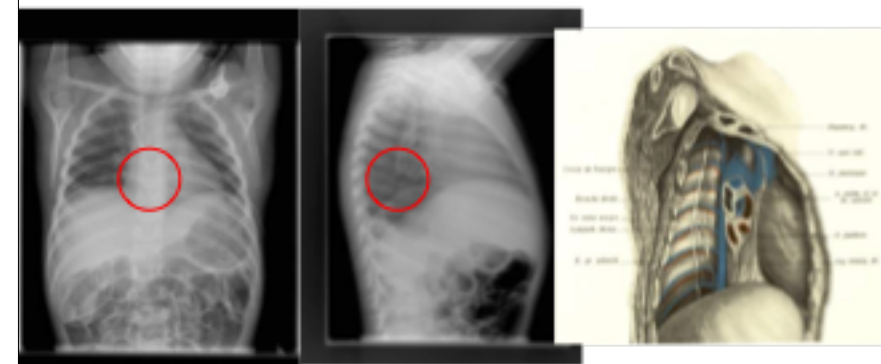
Punta proiettivamente in atrio dx ma in realtà più craniale

LIMITI della radiologia

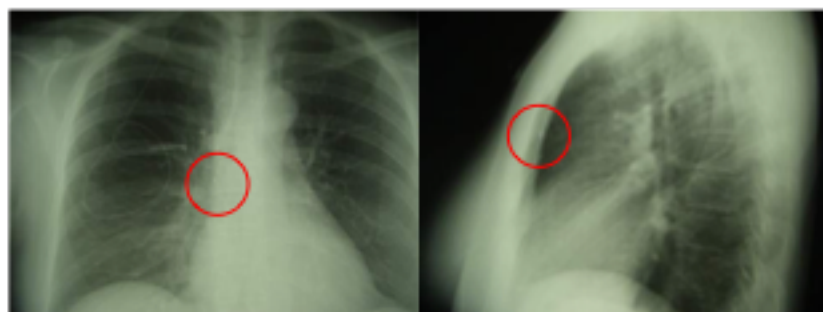
La sola proiezione AP può ingannare

PARALLASSE

Le strutture ossee usate come reperi nella proiezione AP sono anteriori o posteriori all'asse vascolare e la loro proiezione sul profilo cardiaco non corrisponde ai reali rapporti anatomici



...punta in azigos



Punta nella vena mammaria interna

Comunque tutti limitati dalla
soggettività
dell'interpretazione.

Accuracy of radiological landmarks

Comparison of radiographic landmarks and the echocardiographic SVC/RA junction in the positioning of long-term central venous catheters

*Acta Anaesthesiol Scand 2006; 50: 731-735
Printed in Singapore. All rights reserved*

J-H. Hu¹, C-K. Wong², K-S. Guo³, K-A. Ooi³, H-Y. Chen³, T-S. Jow² and J-R. Wu¹
Departments of ¹Pediatrics, ²Medical Imaging, ³Anesthesiology and ⁴Clinical Research, Kaohsiung Medical University Hospital, Kaohsiung, Taiwan

Conclusion: Both the radiographic SVC/RA junction and the thoracic vertebral bodies are not reliable landmarks for the SVC/RA junction defined by TEE. Physicians should be aware that using the radiographic SVC/RA junction to confirm proper positioning of permanent central venous catheters risks placing the catheter tip in the upper SVC, with subsequent potential long-term complications. More reliable radiographic landmarks for the SVC/RA junction should be investigated.

Parallax

Anatomical variations

Antero-posterior view

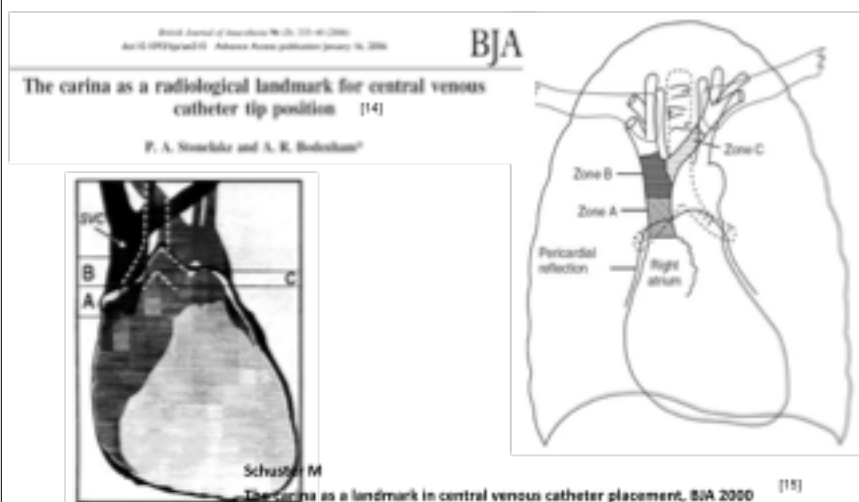
Per ridurre il rischio legato alla soggettività dell'interpretazione ci sono due possibili approcci radiologici

- Sweet Spot
- carina landmark

A European multicenter study is currently comparing the two approaches

Both of them, though, will have limited accuracy if compared to ECG or US

The Carina = best x-ray landmark for CAJ



Best position(s) – F&B's zone A

Il terzo inferiore della VCS

Rx torace : da 1 a 3 cm sotto la carina

LA giunzione cavo-atriale

Rx torace: circa 3 cm sotto la carina

La parte superiore dell'atrio dx

Area sicura dell'atrio dx

Rx torace: 3 – 5 cm sotto la carina

	IC-DIG	Fluoro	Chest X-ray	TTE	TEE
applicability	93%	99%	99%	100%	100%
feasibility	+++	++	++	+	+
accuracy	+++	+	++	+++	+++
precision	++	+	+	+++	+++
safety	+++	+	++	+++	++
easiness	+++	+	++	+	+
cost effectiveness	+++	+	+	++	+

Fluoro and chest x-ray are almost always applicable, but they may not be feasible and/or accurate (*poor diagnostic criteria; poor imaging due to obesity, abnormal anatomy, enlarged heart, artefacts,, etc.*). They are not 100% safe and they are expensive.

Fluoroscopia

- * Può darci indicazioni sia sulla direzione del catetere sia sulla posizione della punta

MA

- * Costo elevato
- * Necessità di luogo dedicato ed appropriato
- * Esposizione ai raggi X sia per l'operatore che per il paziente
- * Non utilizzabile bedside
- * L'interpretazione delle immagini richiede *training*
- * Interpretazione difficile per problemi tecnici
- * Variabilità con la posizione del paziente
- * Non precisione dei reperti radiologici
- * Necessità di proiezioni antero-posteriori e laterali

Ultrasuoni per la tip location

Ecocardiografia Trans Toracica o transaddominale TTE



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Accurata e precisa

Può essere difficile o non fattibile in
alcuni pazienti adulti
(BPCO, obesi, chirurgia
addominale, etc.)

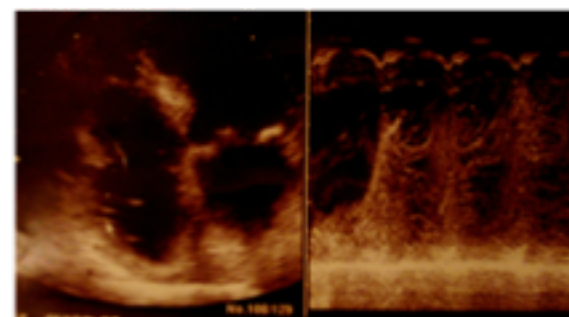


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CEUS Contrast-enhanced Ultrasonography

(M-Mode)

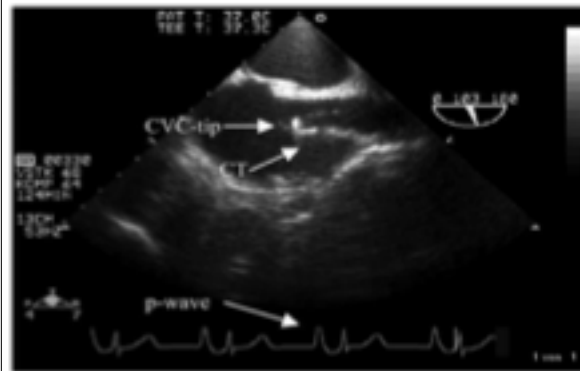
- Molto accurata
- Ma necessita di un training molto specifico



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Ecocardiografia Trans Esofagea- TEE

E' il metodo più accurato ma costoso ed invasivo e sostanzialmente inutilizzabile negli impianti routinari di PICC/CICC (bedside e outpatients)



Tip at CAJ

24

Ancora più preciso nei neonati

J Perinatol. 2013 Oct;33(10):791-4

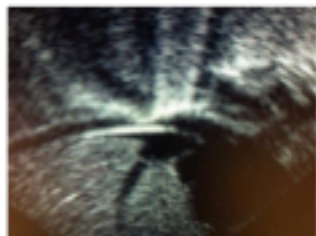
Epub 2013 Jun 13.

A randomized controlled trial of ultrasound-guided peripherally inserted central catheters compared with standard radiograph in neonates.

Katheria AC(1), Fleming SE, Kim JH.

(1)Division of Neonatology, Department of Pediatrics, University of California, San Diego, CA, USA.

TTE = scelta migliore nel neonato



	IC-DIG	Fluoro	Chest X-ray	TTE	TEE
applicability	92%	99%	99%	100%	100%
feasibility	+++	++	++	+	+
accuracy	+++	+	++	+++	+++
precision	++	+	+	+++	+++
safety	+++	+	++	+++	++
easiness	+++	+	++	+	+
cost effectiveness	+++	+	+	++	+

TTE è molto accurato(specialmente con CEUS); è sicuro and cost-efficace, ma (a) richiede training e (b) può non essere facilmente utilizzabile in tutti i pazienti adulti

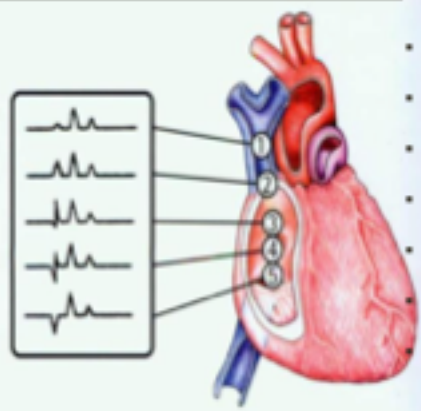
	IC-DIG	Fluoro	Chest X-ray	TTE	TEE
applicability	93%	99%	99%	100%	100%
feasibility	+++	++	++	+	+
accuracy	+++	+	++	+++	+++
precision	++	+	+	+++	+++
safety	+++	+	++	+++	++
easiness	+++	+	++	+	+
cost effectiveness	+++	+	+	++	+

TEE è quasi sempre applicabile, è estremamente accurato e preciso, ma è poco fattibile e poco costo-efficace (troppo invasivo, troppo costoso, etc.).
(idem per CT, MR, Angio, etc.)

• METODO DELL'ECG INTRACAVITARIO

METODO DELL'ECG INTRACAVITARIO

ECG intracavitario ottenuto tramite un elettrodo (rappresentato dal catetere) che si muove all'interno del sistema venoso



- If an electrode runs within the venous system from the periphery to the heart, the P wave will change on the trace
- Getting near to the heart, the P wave:
 - increases in size
 - reaches a maximum at the entrance in the RA
 - decreases, becomes biphasic and then negative while leaving the atrium
- Endocavitary peripheral p wave = surface p wave
- SVC (medium-distal segment): endocavitary P = 1/3 - 1/2 of the maximal P
- Distal SVC close the RA: endocavitary P = 2/3 of the maximal
- Atrio-caval junction = first maximal P wave (Yeon, Schummer, Pittiruti-La Greca)
- RA: endocavitary P = maximal P (visible for 1-3 cm of the intravenous track)
- Deep atrium = P wave decreases and the becomes biphasic
- IVC = negative endocavitary P wave

- E' STATO RICONOSCIUTO ESSERE AFFIDABILE E PUO' ESSERE ATTUATO CON QUALSIASI MONITOR



Tecnologia

1) Monitor

- Derivazione DII
- Marchio CE
- Assenza di artefatti
- Modalità diagnosi

2) Cavetti di connessione

Applicability

- E' applicabile ad ogni accesso venoso centrale , valvolato o meno, inserito per via periferica o centrale, indipendentemente dalla tecnica di impianto utilizzata
- Necessità di evidenza dell'onda P sull'ECG di superficie

Feasibility

- In quale percentuale possiamo identificare un'onda P atriale all'ECG intracavitario?
- **GAVeCeLT multicenter study 2012:**
 - 1440 pazienti, vari tipi di VAD
 - P evidente all' ECG basale
 - Tecnica con colonna liquida o guida metallica
 - Fattibilità totale **99.3 %**
 - Feasibility with the saline technique **99.9 %**
 - Feasibility with the guidewire technique **98.6 %**

Feasibility

0.7 % di insuccessi legati a:

- Problemi tecnici di connessione
- Problemi del monitor
- Abilità dell'operatore a riconoscere l'onda P)
- Segnale insufficiente(catetere < 3Fr)

Precisione

In quasi il 99% dei casi la P atriale
corrisponde alla giunzione atrio-
cavale

PRECISIONE

Negli ultimi anni molti lavori dimostrano la
precisione del metodo ECG:

- Paragonato ai metodi radiologici
- Paragonato al gold standard rappresentato dalla TEE
- Per tutti i tipi di catetere

Metodo più preciso = TEE

Accurate Central Venous Port-A Catheter Placement: Intravenous Electrocardiography and Surface Landmark Techniques Compared by Using Transesophageal Echocardiography

Kuang-Shing Chu, MD, Jong-Hsu Hsu, MD, Shie-Shan Wang, MD, Chao-Shun Tang, MD,
Kuang-I Cheng, MD, Chien-Kuo Wang, MD, and Jiunn-Ren Wu, MD

^aDepartment of Anesthesiology, Kuo General Hospital, Taiwan, Taiwan; and Departments of ^bPediatrics, ^cSurgery,
^dAnesthesiology, and ^eMedical Imaging, Kaohsiung Medical University, Kaohsiung City, Taiwan

2004

Cavoatrial junction = maximal P wave (EKG)
Cavoatrial junction = crista terminalis (TEE)

In 30 patients, EKG = TEE

TEE vs. EKG

Transesophageal echocardiographic evaluation of ECG-guided central venous catheter placement

*[Évaluation échocardiographique transœsophagienne de la mise en place d'un
cathéter veineux central guidé par ECG]*

Yunseok Jeon MD,* Ho-Geeul Ryu MD,* Seung-Zhao Yoon MD,* Jin-Hyeon Kim MD,† Jae-Hyeon Buhk MD‡

54 patients

Cavoatrial junction = crista terminalis

2006

Conclusions: During ECG-guided central venous catheteriza-
tion, the tallest peaked P wave may be used to place the CVC
tip at the SVC/RA junction, the normally-shaped P wave identi-
fies the mid to upper SVC, and biphasic P waves identify RA
localization.

EKG – E' preciso?

The Accuracy of Electrocardiogram-Controlled Central Line Placement

Ralf E. Gebhard, MD*

Peter Szczuk, MD†

Evan G. Pivalizza, MBSM,
FFASA‡

Vladimir Melnikov, MD§

Christiane Vogt, MD§

Robert D. Wartens, MD§

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

METHODS: Patients in group ECG ($n = 147$) had a CVC placed using right-atrial ECG to guide catheter tip positioning. CVCs in group NO-ECG ($n = 143$) were positioned without this technique.

RESULTS: Overall, guidewire-ECG control resulted in more correctly positioned CVCs (96% vs 36%, $P < 0.001$) without increasing placement time. Significantly more CVCs were placed in the middle of the superior vena cava in group ECG ($P < 0.001$), although placement into the right atrium or right ventricle and into other vessels occurred significantly more often in group NO-ECG ($P < 0.001$). Twenty patients in group NO-ECG required repositioning of their CVC after surgery, whereas this maneuver was necessary only in three patients in group ECG ($P < 0.001$).

CONCLUSIONS: ECG guidance allows for more accurate CVC placement, and should be considered to increase patient safety and reduce costs associated with repositioning procedures.

(*Ann Surg* 2007;245:45–50)

2007

147 pts – correct tip positioning in 96 %

TEE vs. EKG vs. X-Ray

Transesophageal Echocardiography for Verification of the Position of the Electrocardiographically-Placed Central Venous Catheter

Joerg Ender, MD, Gabor Erdos, MD, Eugen Krohmer, MD, Dirk Othoff, MD, PhD, and Chiranjit Mukherjee, MD

Objective: Compare changes in P-wave amplitude of the intra-atrial electrocardiogram (ECG) and its corresponding transesophageal echocardiography (TEE)-controlled position to verify the exact localization of a central venous catheter (CVC) tip.

Design: A prospective study.

Setting: University, single-institution setting.

Participants: Two hundred patients undergoing elective cardiac surgery.

Interventions: CVC placement via the right internal jugular vein with ECG control using the guidewire technique and TEE control in 4 different phases: phase 1: CVC placement with normalized P wave and measurement of distance from the crista terminalis to the CVC tip; phase 2: TEE-controlled placement of the CVC tip; parallel to the superior vena cava (SVC) and measurements of P-wave amplitude; phase 3: influence of head positioning on CVC migration; and phase 4: evaluation of positioning of the CVC postoperatively using a chest x-ray.

Measurements and Main Results: The CVC tip could only be visualized in 87 patients on TEE with a normalized P wave. In 198 patients with the CVC parallel to the SVC wall controlled by TEE (phase 2), an elevated P wave was observed. Different head movements led to no significant migration of the CVC (phase 3). On a postoperative chest x-ray, the CVC position was correct in 87.8% (phase 4).

Conclusion: The study suggests that the position of the CVC tip is located parallel to the SVC and 1.5 cm above the crista terminalis if the P wave starts to decrease during withdrawal of the catheter. The authors recommend that ECG control as per their study should be routinely used for placement of central venous catheters via the right internal jugular vein.

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KEY WORDS: intra-atrial electrocardiogram, central venous catheter, TEE, positioning

2009

200 patients - accuracy 99% for EKG, 88% for X-Ray

(*Ann Surg* 2011;253:248–253)
DOI: 10.1097/ASA.2011.00000

ORIGINAL ARTICLE

Endovascular electrocardiography to guide placement of totally implantable central venous catheters in oncologic patients

Cecilia Pelagatti, Gianluca Villa, Andrea Casini, Cosimo Chelazzi, Angelo Raffaele De Gaudio

Department of Critical Care, Section of Anesthesiology and Intensive Care, University of Florence, Florence - Italy

ABSTRACT

Purpose: Appropriate tip position of totally implantable central venous catheters is essential in order to prevent catheter-related complications, in particular thrombosis. Endovascular electrocardiography is an economic and safe method to guide placement of catheters into the central veins. Although widely utilized, there is still lack of conclusive evidence about its efficacy. The aim of the study was to assess the efficacy and safety of endovascular electrocardiographic guided placement compared to the anesthesiometric method.

Methods: Endovascular ECG was employed to guide electrocardiographic placement of a central venous catheter in a cohort of oncologic patients. The rate of correct placement and the incidence of catheter-related thrombosis were considered. Patients in which central venous catheters were inserted with the anesthesiometric technique were considered as control group.

Results: The rate of correct placement was 91% and 38% for ECG-guided and anesthesiometric catheters ($p < 0.0001$) respectively. None of the patients suffered from early insertion-related complications. The rate of catheter-related vascular thrombosis was lower for ECG-guided catheters (3.6% vs. 8.6%, n.s.), in particular for left-inserted catheters (0% vs. 33.3%, $p < 0.02$).

Conclusion: Endovascular electrocardiography was more effective than the anesthesiometric technique in placement of implantable central venous catheters and was associated with a lower incidence of catheter-related thrombosis, in particular for those inserted from the left side.

Accuracy = 91 %

2011

(*Ann Surg* 2012;255:380–385)
DOI: 10.1097/ASA.0b0000000000000000

TECHNIQUES IN VASCULAR ACCESS

Intra-cavitary ECG is an effective method for correct positioning the tip of tunneled Groshong catheters

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Anesthesia and Intensive Care Unit, Bolzano Central Hospital - Italy

ABSTRACT

Background: Intra-cavitary electrocardiography (ECG) is a well-known method for correct positioning of the tip of central venous catheters (CVC). A significant increase in the P wave, as registered by the intra-cavitary electrode, signals the entrance of the catheter into the right atrium.

Methods: In this prospective observational study, 135 consecutive oncologic patients were enrolled for cannulation of the right or left internal jugular vein for insertion of a tunneled Groshong catheter. In 130 patients the tip was positioned by means of intra-cavitary ECG. Five patients with atrial fibrillation (N=4) or pacemaker in place (N=1) were excluded from the study. As the P-wave amplitude began to increase, the catheter was secured in that position and the insertion depth was registered.

Results: Intra-cavitary ECG was always apt to detect the increase in the P wave. On the post-operative chest x-ray all Groshong catheters except two were in the correct position.

Conclusions: The need for chest x-ray or fluoroscopy may be virtually eliminated by using the ECG technique.

Accuracy = 99 %

2012

The intracavitary ECG method for positioning the tip of central venous catheters: results of an Italian multicenter study

Mauro Pittiruti¹, Daniele Bertollo¹, Ermanno Briglia², Massimo Buononato³, Giuseppe Capozzoli⁴, Luigi De Simone⁵, Antonio La Greca⁶, Cecilia Pelagatti⁷, Pier Sandro Sette⁸

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2012

GAVeCeLT Multicenter Study

8 ospedali, 1440 pazienti

2012

Ogni tipo di catetere centrale

IC- EKG intra-procedurale vs. RX post-procedural

Criteri radiologici

CAJ = 3 cm sotto la carina

1/3 inferiore SVC = 1-3 cm sotto la carina

1/3 superiore RA = 3-5 cm sotto la carina

GAVeCeLT Multicenter Study

IC-EKG (intra-op.) vs. Chest X-Ray (postop.)

Total Match (Accuracy): 95,4 %

Mismatch EKG/RX = 3,8 % (55 casi)

in 44/55 casi, la punta era più alta all'RX

* ma in molti di questi pazienti la radiografia era stata fatta in ortostatismo

SICUREZZA

Nessuna esposizione a radiazioni

Nessun rischio di aritmia

Procedura effettuata sotto controllo ECG

Se si usa la tecnica della colonna di liquido
la guida non entra mai in atrio

In ogni momento l'operatore sa a che livello
è il catetere

Nessun rischio di scendere troppo
profondamente in atrio

FACILE

- Da eseguire
- Da insegnare
- Da imparare

- Ancora più semplice se si usano monitor specializzati

Nautilus, Romedex
Nautilus/delta, Romedex
Sapiens/3CG, Bard
Celerity, Medcomp
Vasonova, Teleflex

- N.B Aumentano i costi!!

costo-efficacia

Basso costo utilizzando monitors non dedicati

Training semplice

Applicabile anche quando l'RX è controindicato,
difficile o costoso –(gravidanza, obesità
patologica, hospice, domicilio, etc.)

Controllo in tempo realeeee

- Ulteriore risparmio
- evitando l'utilizzo di apparecchiature costose
(fluoroscopia ,TEE)
- Evitando la radiografia post-impianto
- Evitando il ritardo nell'inizio della terapia
- Evitando eventuali riposizionamenti

	IC-DIG	Fluoro	Chest X-ray	TTE	TEE
applicability	93%	99%	99%	100%	100%
feasibility	+++	++	++	+	+
accuracy	+++	+	++	+++	+++
precision	++	+	+	+++	+++
safety	+++	+	++	+++	++
easiness	+++	+	++	+	+
cost effectiveness	+++	+	+	++	+

ECG intracavitario è accurato (almeno come TTE/TEE), sicuro al 100%, altamente costo-efficace, facile e fattibile. L'unico limite è che non può essere utilizzato in pazienti che non abbiano una P evidente

Recent FDA statement (2010)

Indications for Use: The Sapiens™ Tip Location System (TLS) is indicated for guidance and positioning of central venous catheters such as PICCs, CVCs, implantable ports, and hemodialysis catheters. The Sapiens™ TLS provides real-time catheter tip location information by using the patient's cardiac electrical activity. Sapiens™ TLS is indicated for use as an alternative method to chest X-ray and fluoroscopy for central venous catheter tip placement confirmation in adult patients.

Il metodo ECG realizzato con il monitor Sapiens TLS è un metodo alternativo all'RX torace

Recent FDA statement (2011)

Teleflex Incorporated, a leading global provider of medical technology products, today announced that its VasoNova Inc. subsidiary has received 510(k) clearance from the U.S. Food and Drug Administration (FDA) to market the company's VPS™ peripherally inserted central catheter tip location technology as an alternative to chest x-ray or fluoroscopy in adult patients when the guidance indicator shows a blue bulls-eye.

Raccomandazioni AHRQ



2013



Annals of Internal Medicine

SUPPLEMENT

The Top Patient Safety Strategies That Can Be Encouraged for Adoption Now

Paul G. Shekelle, MD, PhD; Peter J. Pronovost, MD, PhD; Robert M. Wachter, MD; Kathryn M. McDonald, MM; Karen Schoelles, MD, SM; Sydney M. Dy, MD, MSc; Kavitha Shojania, MD; James T. Reardon, PhD, MPH; Alyce S. Adams, PhD; Peter B. Angood, MD; David W. Bates, MD, MSc; Leonard Brackman, PhD; Pascale Carayon, PhD; Sir Liam Donaldson, AM, CM, MSc; Nafiseh Duan, PhD; Donna O. Farley, PhD, MPH; Trisha Greenhalgh, BM BCh; John L. Haughton, MD; Ellen Lake, PhD; R. Richard Loford, PhD; Kathleen N. Lohr, PhD, MA, MPH; Gregg S. Meyer, MD, MSc; Marlene R. Miller, MD, MSc; Duncan V. Noufauer, PhD, MBA, MHA; Gary Ryan, PhD; Nancy Saint, MD, MPH; Stephen M. Shortell, PhD, MPH, MBA; David P. Stevens, MD; and Kevin W. Welch, PhD

Encouraged

- Multicomponent interventions to reduce falls
- Use of clinical pharmacists to reduce adverse drug events
- Documentation of patient preferences for life-sustaining treatment
- Obtaining informed consent to improve patients' understanding of the potential risks of procedures
- Team training
- Medication reconciliation
- Practices to reduce radiation exposure from fluoroscopy and CT
- The use of surgical outcome measurements and report cards, such as those from ACS NSQIP
- Rapid-response systems
- Use of complementary methods for detecting adverse events or medical errors to monitor for patient safety problems
- Computerized provider order entry
- Use of simulation exercises in patient safety efforts

Conclusioni

Un metodo attendibile di tip location ,
preferibilmente intraprocedurale, è obbligatorio
per ogni impianto di cateteri centrali

Conclusioni

Negli adulti l'ECG intracavitario dovrebbe essere
il metodo preferenziale di tip location essendo
accurato , sicuro, facile , molto costo-efficace e
potendo essere applicato a gran parte dei
pazienti

Conclusioni

Ciò non esclude che alcuni pazienti in cui ci sono dei
dubbi o nei quali non si è potuto realizzare un IC-ECG
necessitino di una fluoroscopia intraprocedurale e/o di
un controllo post-procedurale con una radiografia o con
TTE

Problemi

E se l'onda P non è evidente all'ECG di superficie?

Varie possibilità

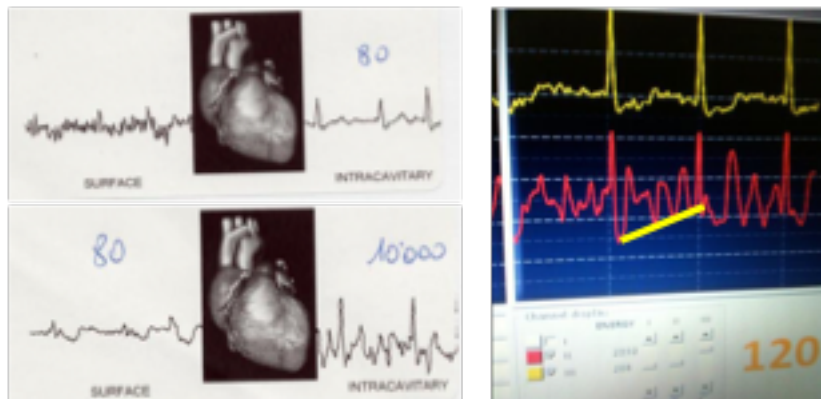


Nei pazienti con FA si può valutare l'aumento di ampiezza dei voltaggi al del catetere elettrodo dalla VCS all'atrio dx

(Engelhardt; Pittiruti et al.)

Seconda possibilità

Utilizzando monitor dedicati si può valutare la variazione di energia atriale, rappresentata dall'area sotto il segmento T-Q



"EKG-controlled placement of central venous catheters in patients with atrial fibrillation"
(Pittiruti, La Greca, Scoppettuolo et al. - INS 2011)

Cavo-atrial junction was detected by two criteria:

- (a) abrupt appearance of high-voltage waves when entering the right atrium and their brisk disappearance when pulling the catheter back into the vena cava superior;
- (b) sudden increase (4-fold, 10fold) of the amount of energy recorded by the intracavitary electrode

Post-op. chest x-ray in all patients

Cavo-atrial junction correctly identified in 25 pts. out of 27

Conclusion: the EKG method for verifying the position of the tip of central venous access devices can be applied in most patients with atrial fibrillation, with high accuracy (no false positives; few false negatives).



Terza possibilità

Aggiungere un sistema di navigazione per indirizzare il catetere così da ottenere le attese variazioni di voltaggio e di energia

Costo-efficacia!?