Infusione intraossea

…un piccolo salto nel passato…

B-29 Crewmen Save a Life in the Air by New Method

THE LIFE of Sergt. Romeo Rendina, 18-year-old Detroiter, was saved recently when comrades gave him blood plasma through a new type of needle as his Superfortress sped homeward high over Japan.

The successful injection showed that the new intra-sternal method of administering plasma can be used safely by airmen, even though their medical ward is a crowded radio room of a shell-punctured B-29, according to a United Press account.

R. Rendina

Before Rendina's injuries put the method to an emergency test, medical men believed it could be used only by physicians.

A shell from a Jap fighter plane exploded in Rendina's lap a few seconds after his B-29, "Draggin' Lady," dropped its bombs over Nagoya, Feb. 18.

* * *

FOUND UNCONSCIOUS

RENDINA WAS found by the pilot, Lieut. Robert E. Engle, Price Utah, and a gunner, Sergt. Lester E. Johnston, Logan, Kan. They said he had at least 100 shell fragments in his hand, right arm and left leg.

"We took him into the radio room," another crew member, Sergt. Nicholas Gladke, Yonkers, N. Y., said.

The trio splinted and dressed Rendina's hand and gave him morphine.

* * *

USUAL METHOD FAILS

BUT WHEN THEY tried to give him plasma intravenously, they found he was suffering from shock and that his veins had collapsed, making it impossible to inject the intravenous needle.

"We had been instructed on use of the intra-sternal needle," Gladke said, "but we'd never seen it used before. Johnston and Engle read over the instructions.

"Then they measured the required three-finger breadth down from Rendina's collarbone — and jammed the needle in through the cartilage."

In an hour, Rendina received 150 cubic centimeters of plasma through his breast bone. Then he rallied enough to be given 300 more by the conventional intravenous method.

* * *

PARENTS GET NEWS

RENDINA IS HOSPITALIZED in Hawaii now and expects "to get back to the States in three months," according to a letter he wrote his parents, Mr. and Mrs. Henry Rendina, 4245 Grand avenue west.

A Cooley High graduate, he entered service in Nov., 1943, and went overseas last December.

COURTESY OF THE DETROIT NEWS

TUESDAY, MARCH 13, 1945

…the successful injection showed that the new intra-sternal method of administering plasma can be used safely…

12 marzo 1945

…un po’ di storia…

L’accesso intraosseo è stato proposto da Drinker e Lund nel 1922

L’infusione nel compartimento intraosseo è stata utilizzata frequentemente negli anni 30 e 40

Negli anni 80 viene proposta per i pazienti pediatrici quando non è possibile ottenere un accesso vascolare tradizionale

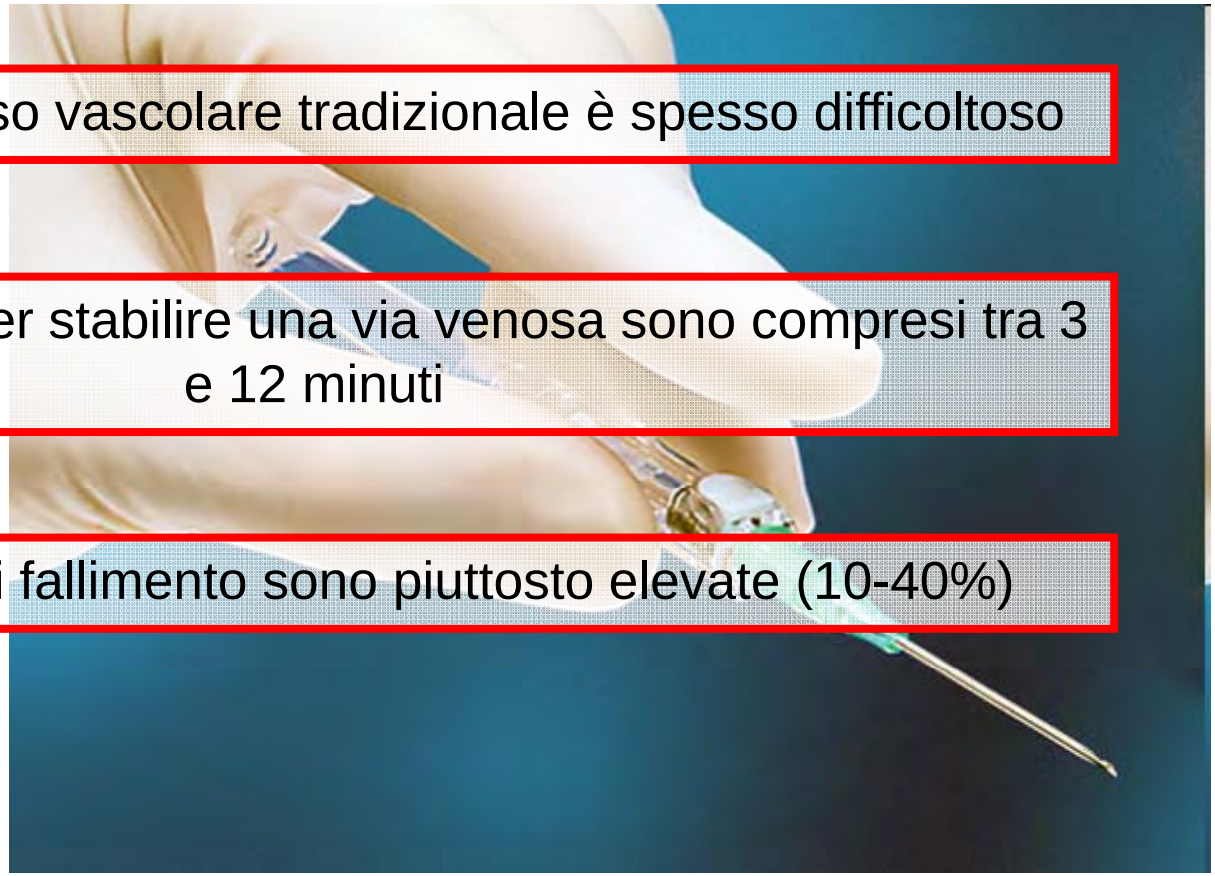
Nel 1986 American Heart Association approva l’utilizzo dell’IO nella rianimazione cardiopolmonare pediatrica nelle proprie linee guida

Problemi con gli accessi vascolari…

Stabilire un accesso vascolare tradizionale è spesso difficoltoso

I tempi necessari per stabilire una via venosa sono compresi tra 3 e 12 minuti

Le percentuali di fallimento sono piuttosto elevate (10-40%)



"If intravenous access is difficult or impossible, consider the IO route. Although normally considered as an alternative route for vascular access in children, it is now established as an effective route in adults.

Intraosseous injection of drugs achieves adequate plasma concentrations in a time comparable with injection through a central venous catheter.

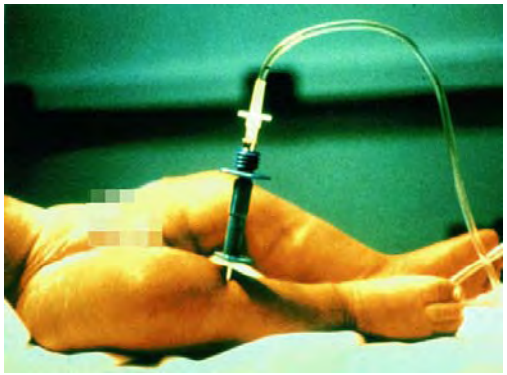
The recent availability of mechanical IO devices has increased the ease of performing this technique.

JP. Nolan et al
European Resuscitation Council Guidelines for Resuscitation 2010
Section 4. Adult advanced life support
Resuscitation 81 (2010) 1219–1276

"Vascular access is essential to enable drugs and fluids to be given, and blood samples obtained. Venous access can be difficult to establish during resuscitation of an infant or child. In critically ill children, whenever venous access is not readily attainable intraosseous access should be considered early, especially if the child is in cardiac arrest or decompensated circulatory failure.

In any case, in critically ill children, if attempts at establishing intravenous (IV) access are unsuccessful ***after 1min****, insert an intraosseous (IO) needle instead*

D. Biarent et al
European Resuscitation Council Guidelines for Resuscitation 2010
Section 6. Paediatric life support
Resuscitation 81 (2010) 1364–1388



Bone marrow samples can be used to cross match for blood type or group, for chemical analysis and for blood gas measurement (the values are comparable to central venous blood gases if no drug has been injected in the cavity). However samples can damage autoanalysers and should be used preferably in cartridge analyser.

***Flush each drug with a bolus of normal saline** to ensure dispersal beyond the marrow cavity, and to achieve faster distribution to the central circulation. Inject large boluses of fluid using manual pressure.*

Intraosseous access can be maintained until definitive IV access has been established.

D. Biarent et al
European Resuscitation Council Guidelines for Resuscitation 2010
Section 6. Paediatric life support
Resuscitation 81 (2010) 1364–1388

THE ANNALS OF PHARMACOTHERAPY

IO administration is a fast, reliable method to deliver fluids and drugs during cardiopulmonary resuscitation…
…When used by trained healthcare providers, the IO route can be a valuable tool during cardiopulmonary resuscitation.

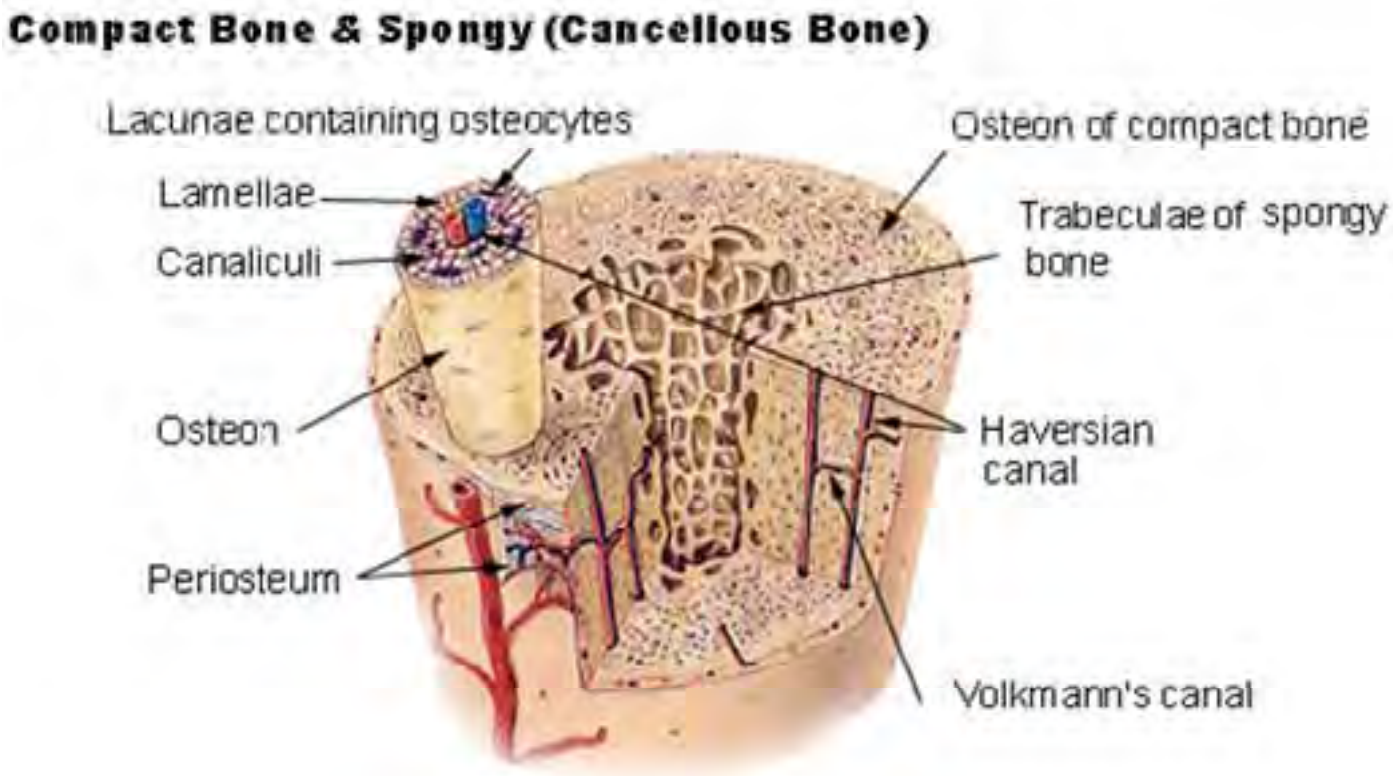
Marcia L Buck, Barbara S Wiggins, Jefferson M Sesler
Intraosseous Drug Administration in Children and Adults During Cardiopulmonary Resuscitation
The Annals of Pharmacotherapy, 2007 october,volume 41 (1679-86)

Quando?

The paper "*Recommendations for the Use of Intraosseous Access for Emergent and Nonemergent Situations in Various Healthcare Settings: A Consensus Paper*" recommends that IO be considered as an alternative to peripheral or central IV access in the intensive care unit, high-acuity/progressive care floors, general medical floor and chronic care and long-term care settings.

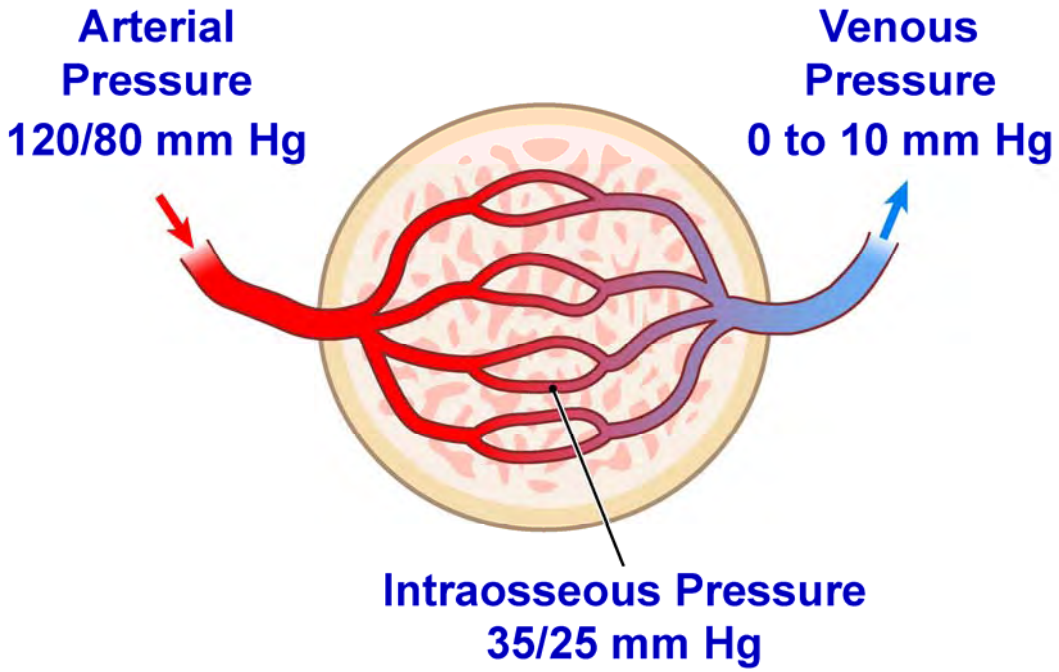
Phillips L, Brown L, Campbell T, Miller J, Proehl J, Youngberg B; Consortium on Intraosseous Vascular Access in Healthcare Practice.
Recommendations for the use of intraosseous vascular access for emergent and nonemergent situations in various healthcare settings: a consensus paper.
J Emerg Nurs. 2010 Nov;36(6):551-6.

Infusione di liquidi



il compartimento intraosseo rappresenta una rete vascolare estremamente estesa nella porzione spongiosa delle ossa lunghe e piatte rimane immodificato in corso di shock

Infusione di liquidi



L'utilizzo di una sacca a pressione consente di "vincere" la pressione del compartimento intraosseo e di somministrare un notevole volume di fluidi

Ogni somministrazione di farmaci DEVE essere seguita da un bolo per garantire una migliore diffusione: 5 ml nel bambino, 10 ml nell'adulto

Quando?

- Cardiac arrest
- Profound hypovolemia (clinical signs of shock) with altered mental status

Denise M. Langley and Melina Moran
Intraosseous needles: they're not just for kids anymore
Journal of Emergency Nursing, 2008 august (34:4)

Quando?

Identified need for intravenous fluid or medications and a peripheral intravenous line cannot be established in 2 attempts or 90 seconds

+

- Altered mental status (Glasgow Coma Scale <8)
- Severe respiratory distress or compromise (not responsive to oxygen or other therapies)
- Hemodynamically unstable (blood pressure <90 with clinical signs of shock)
- Status epilepticus with prolonged seizure activity greater than 10 minutes
- Toxic ingestions/conditions requiring immediate intravenous access for antidote administration

Denise M. Langley and Melina Moran
Intraosseous needles: they're not just for kids anymore
Journal of Emergency Nursing, 2008 august (34:4)

Quando?

Criteri clinici

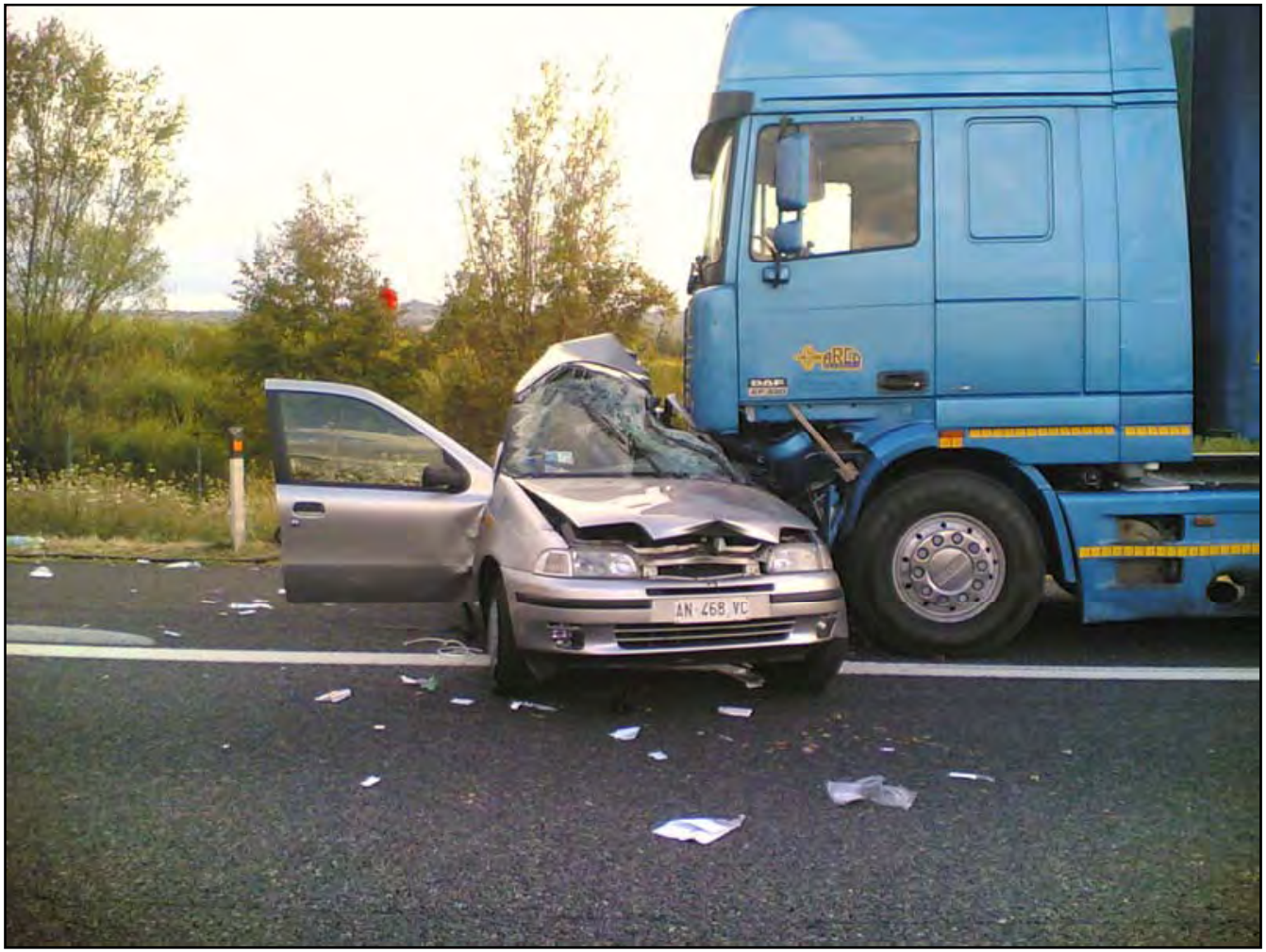
Traumi maggiori

Open book
Frattura 2 ossa lunghe
RTS ≤ 11
GCS<12
Trauma spinale
Ustioni: BSA ≥ 30%adulto
≥ 20%bambino

Arresto cardiocircolatorio

Criteri situazionali/ ambientali

- Ambiente ostile (ambiente impervio, strade elevato scorrimento)
- Exposure limitata (pz. Incastrato, vestiario tecnico, attrezzature)
- Scarsa / nulla visibilità
- Ipotermia ambientale severa



Criteri dinamici

- Precipitazione > 5mt
- Altri pazienti deceduti sulla scena
- Previsione / necessità estricazione prolungata
- Proiezione / sbalzamento

Criteri clinici

Traumi maggiori
Open book
Frattura 2 ossa lunghe
RTS ≤ 11
GCS<14
Trauma spinale
Ustioni: BSA ≥ 30%adulto ≥ 20%bambino

Arresto cardiocircolatorio

+

Criteri situazionali/ ambientali

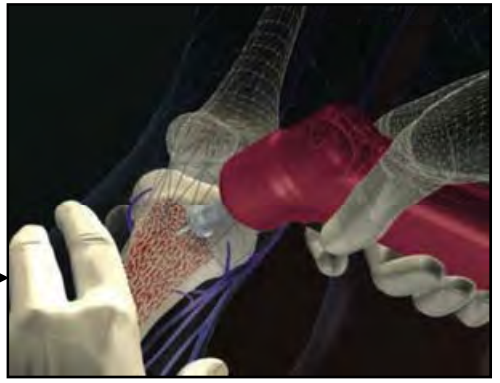
Ambiente ostile (ambiente impervio, strade elevato scorrimento)
Exposure limitata (pz. Incastrato, vestiario tecnico, attrezzature)
Scarsa / nulla visibilità
Ipotermia ambientale severa

+

Criteri dinamici

Precipitazione > 5mt
Altri pazienti deceduti sulla scena
Previsione / necessità estricazione prolungata
Proiezione / sbalzamento

Accesso venoso non reperito



Riflessioni…

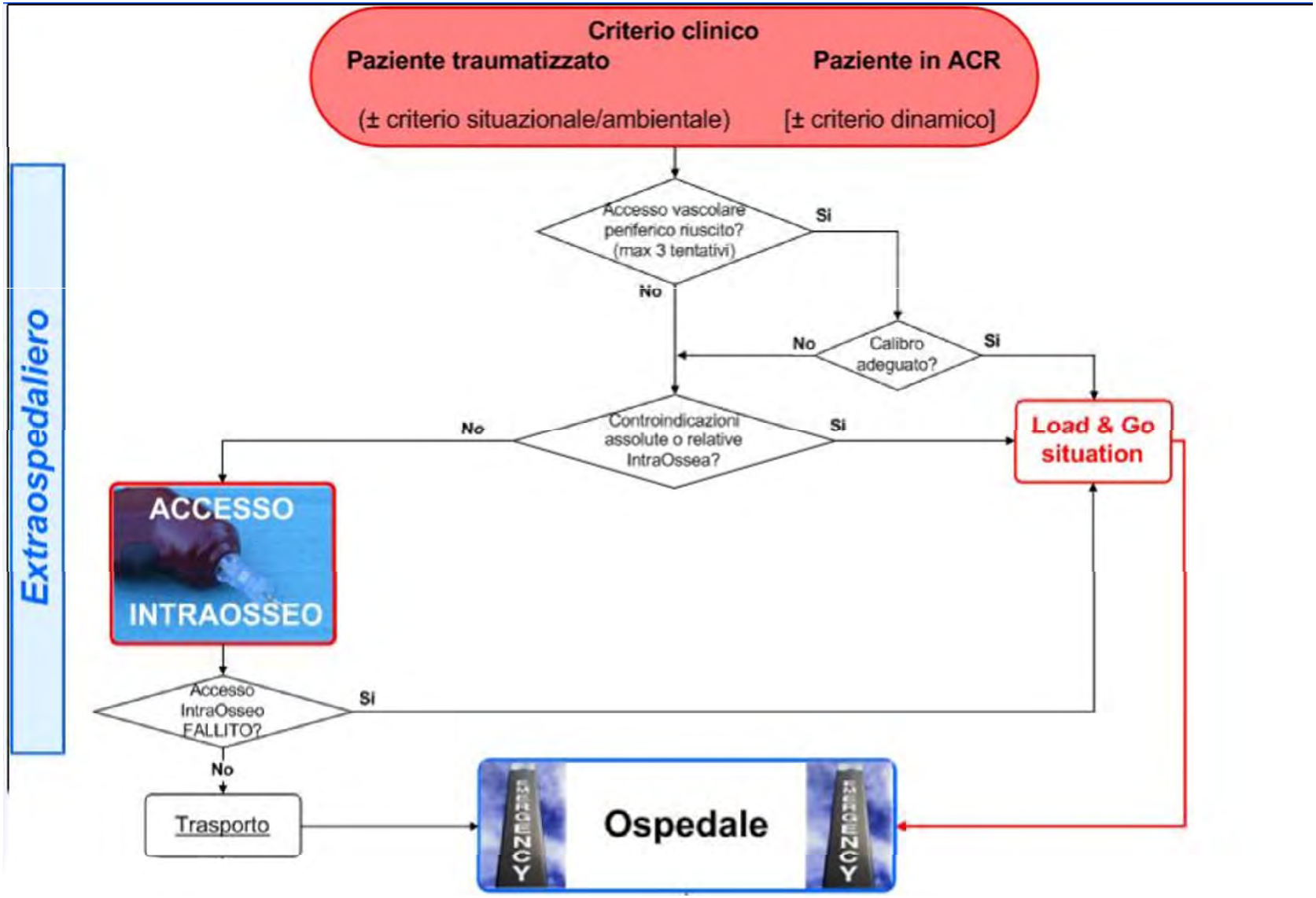
In this case report, a 19 year-old male soldier was severely wounded by a roadside bomb in Iraq. Given the heavy initial blood loss, anatomic location of the injuries and gross wound contamination, peripheral IV access could not be established.

Instead, multiple IO catheters were used to initiate fluid resuscitation prior to transfer to a combat support hospital.

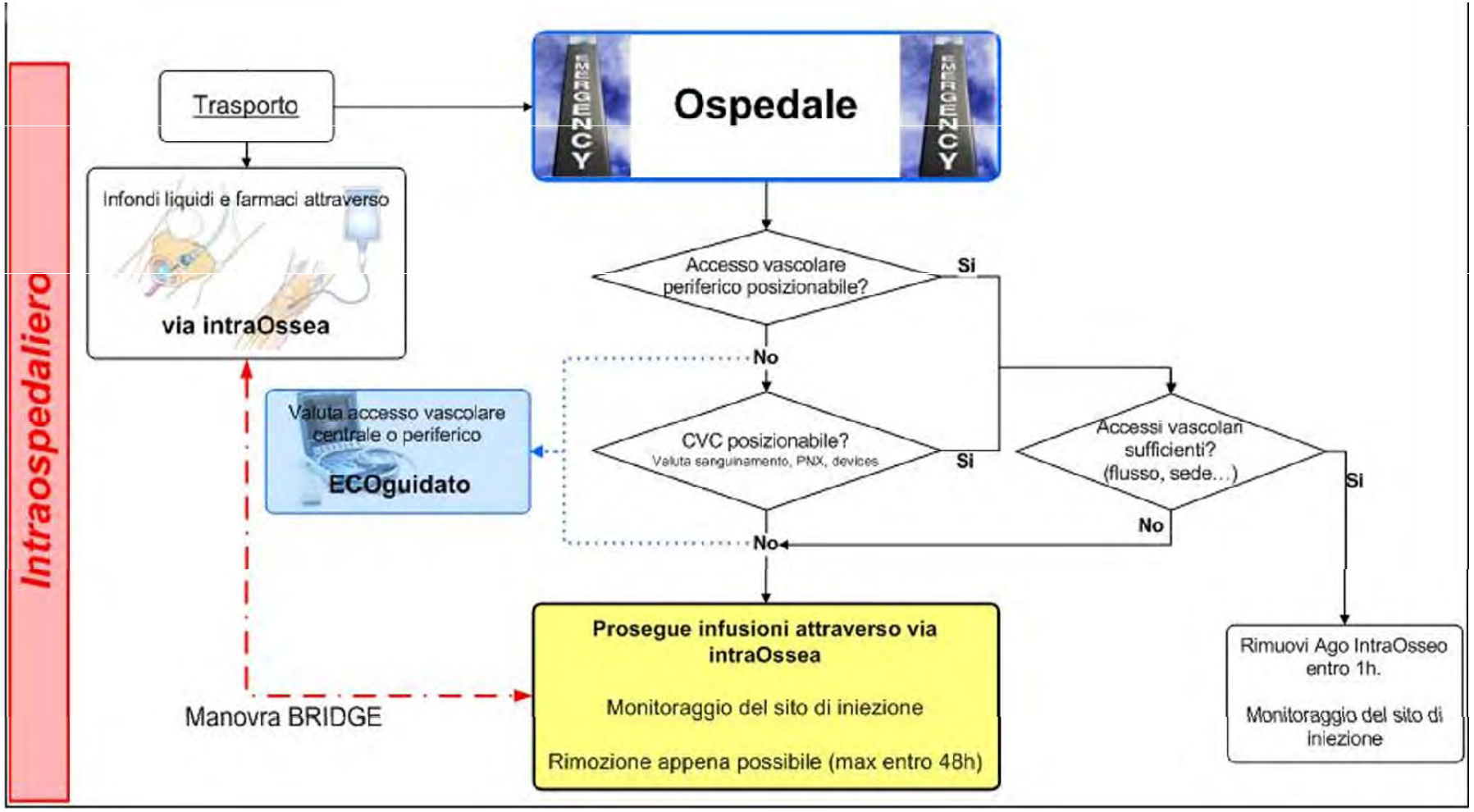
Multiple IO catheters can be placed rapidly and safely and may help solve the challenge of establishing vascular access for resuscitation of critically injured casualties.

Sarkar D, Philbeck T.
The use of multiple intraosseous catheters in combat casualty resuscitation
Mil Med. 2009 Feb;174(2):106-8.

ALGORITMO Extra Ospedaliero



ALGORITMO Intra Ospedaliero



A. Piacentini, G. Imbrìaco, G. Gamberini, L. Giovannini, G.Gordini
Accesso venoso intraosseo (IO): proposta di algoritmo sperimentale per mezzi di soccorso avanzati
Poster presentato a Trauma Update and Organization, Bologna, 13 e 14 febbraio 2009

Cosa Infondere…

Cristalloidi
Colloidi
Emazie
Plasma
Soluzioni ipertoniche (HTS)

Principi attivi somministrabili per via IO

Adenosina	Destrosio	**Naloxone**
Adrenalina	**Diazepam**	**Noradrenalina**
Amikacina	**Dobutamina**	Fenitoina
Aminofillina	**Dopamina**	Fenobarbitale
Amiodarone	Etomidate	**Rocuronio**
Ampicillina	**Fentanyl**	Sodio bicarbonato
Atropina	Furosemide	Succinilcolina
Calcio cloruro	Gentamicina	Tiopentone
Calcio gluconato	**Insulina**	Tobramicina
Cefotaxime	Lidocaina	Vancomicina
Ceftriaxone	Mannitolo	Vasopressina
Cloramfenicolo	**Midazolam**	**Vecuronio**
Desametasone	**Morfina**	

Marcia L Buck, Barbara S Wiggins, Jefferson M Sesler
Intraosseous Drug Administration in Children and Adults During Cardiopulmonary Resuscitation
The Annals of Pharmacotherapy, 2007 october,volume 41 (1679-86)

Cosa Infondere…

Intraosseous Injection of Iodinated Computed Tomography Contrast Agent in an Adult Blunt Trauma Patient

Thomas E. Knuth, MD, MPH, James H. Paxton, MD, MBA, Daniel Myers, MD

From the Department of Acute Care Surgery (Knuth), the Department of Emergency Medicine (Paxton), and the Department of Radiology (Myers), Henry Ford Hospital, Detroit, MI.

48y/o male
Pedestrian struck by car
Arrived in ED without IV access

In ED:
Proximal homerus IO access
with EZ-IO

Contrast agent was administered through the IO catheter during the TC examination (head, thorax, abdomen, pelvis)

CT scans were considered equivalent of studies using traditional central venous access.

Cosa Infondere…

Cristalloidi
Colloidi
Emazie
Plasma
Emoderivati
Soluzioni di contrasto

Cosa infondere…

Intraosseous delivery of factor VIIa during hemorraghic shock

…there was no evidence of significant local or systemic toxicity following infusion and that the systemic blood concentration of rFVIIa peaks immediately after the end of infusion.

…administration of rFVIIa via IO infusion is a reasonable safe method and is likely to produce blood levels required for improved hemostasis during shock.

Wright JK, Christy RJ, Tharp RV, Kalns JE.
Evaluation of intraosseous delivery of factor VIIa during hemorraghic shock in the pig
Mil Med. 2009 Feb;174(2):119-23.

Cosa Infondere…

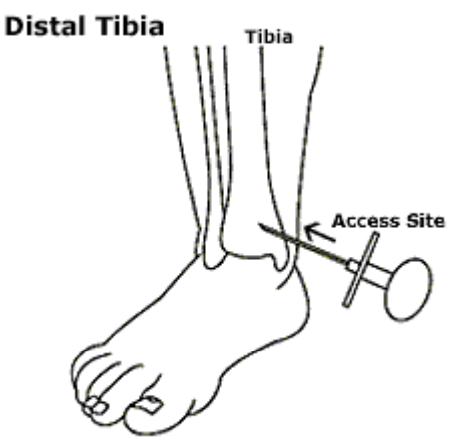
Cristalloidi
Colloidi
Emazie
Plasma
Emoderivati
Soluzioni di contrasto
Soluzioni ipertoniche (HTS)

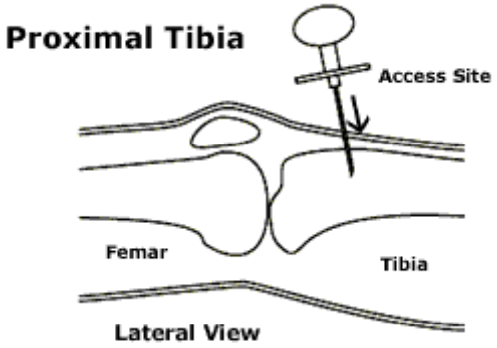
Sedi di inserzione

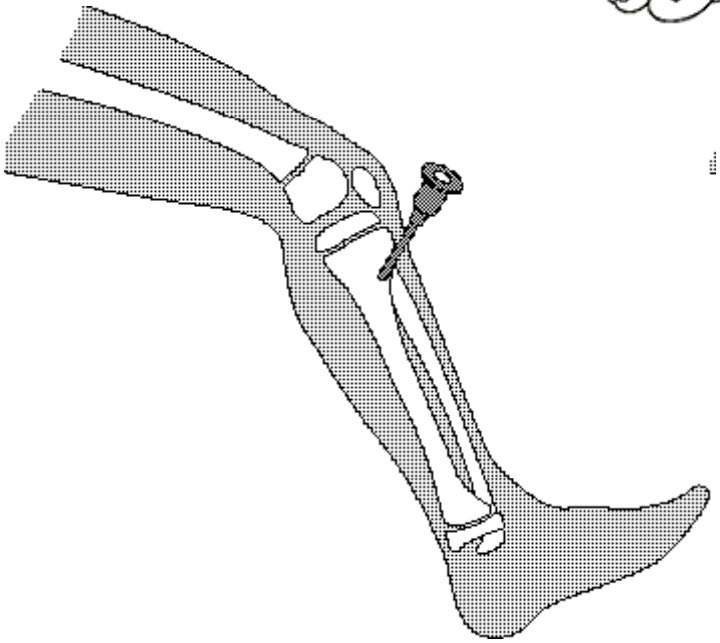
Pazienti pediatrici:

Tibia prossimale o distale

Femore distale



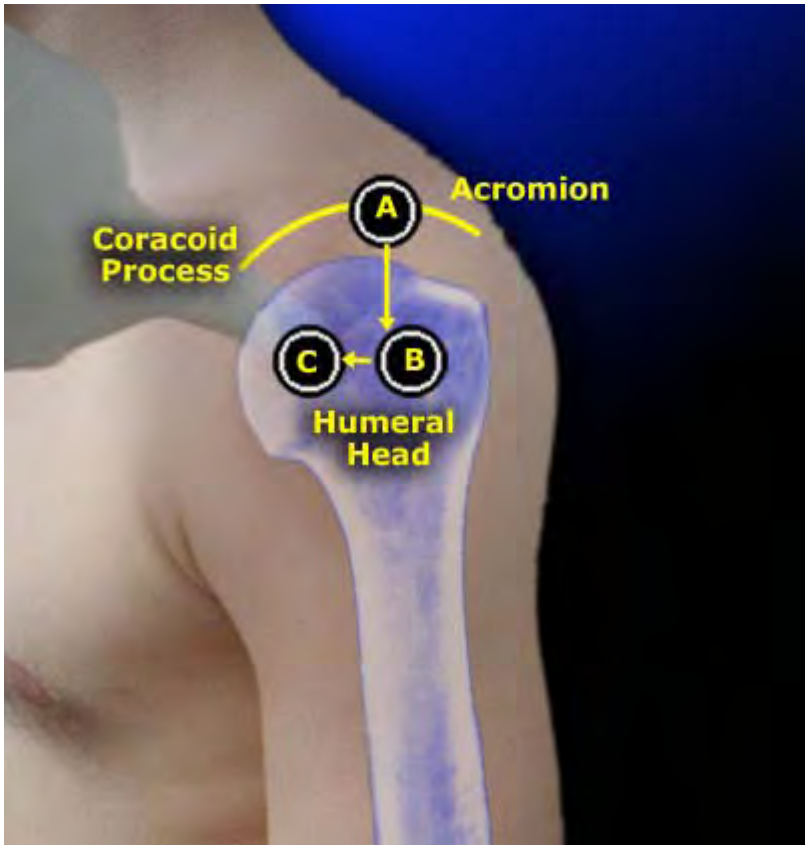




Localizzare la tuberosità tibiale
Scorrere 2 cm medialmente
Scorrere 1 cm verso il basso

Pazienti adulti:
omero

Il sito di inserzione è sul grande tubercolo della testa dell'omero

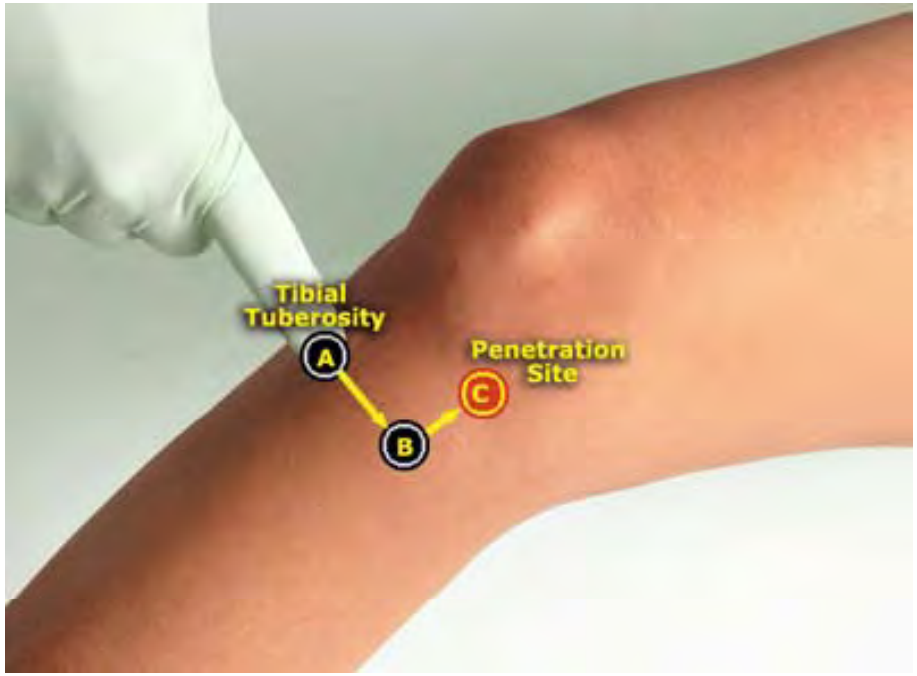


Flusso:
- 84 ml/min
- 153 ml/min (con sacca a pressione)

Ong ME, Chan YH, Oh JJ, Ngo AS
An observational, prospective study comparing tibial and humeral intraosseous access using the EZ-IO
American Journal of Emergency Medicine, 2009 Jan;27(1):8-15

Pazienti adulti:
Tibia prossimale

Localizzare la tuberosità tibiale
Scorrere 2 cm medialmente
Scorrere 1 cm verso l'alto



Flusso
- 73 ml/min
- 165 ml/min (con sacca a pressione)

Ong ME, Chan YH, Oh JJ, Ngo AS
An observational, prospective study comparing tibial and humeral intraosseous access using the EZ-IO
American Journal of Emergency Medicine, 2009 Jan;27(1):8-15

NECESSITÀ DI UN SITO ALTERNATIVO PER L'ACCESSO INTRAOSSEO

Paziente obesa
Pa 80/50
FC 130
FR 35
SpO_2 55%

IMPOSSIBILI
ACCESSO PERIFERICO
ACCESSO GIUGULARE e FEMORALE

Accesso intraosseo in clavicola destra


Accesso I.O. clavicolare. – Fonte 118 "Genova soccorso"

Somministrati:

Midazolam e Atracurio per IOT

Dopamina e Dobutamina

Patrone F et al
Necessità di un sito alternativo per l'accesso intraosseo
N&A mensile italiano del soccorso, 2010 Ago; 19(214):8-9

controindicazioni

Frattura del segmento osseo in cui si vuole inserire l'ago

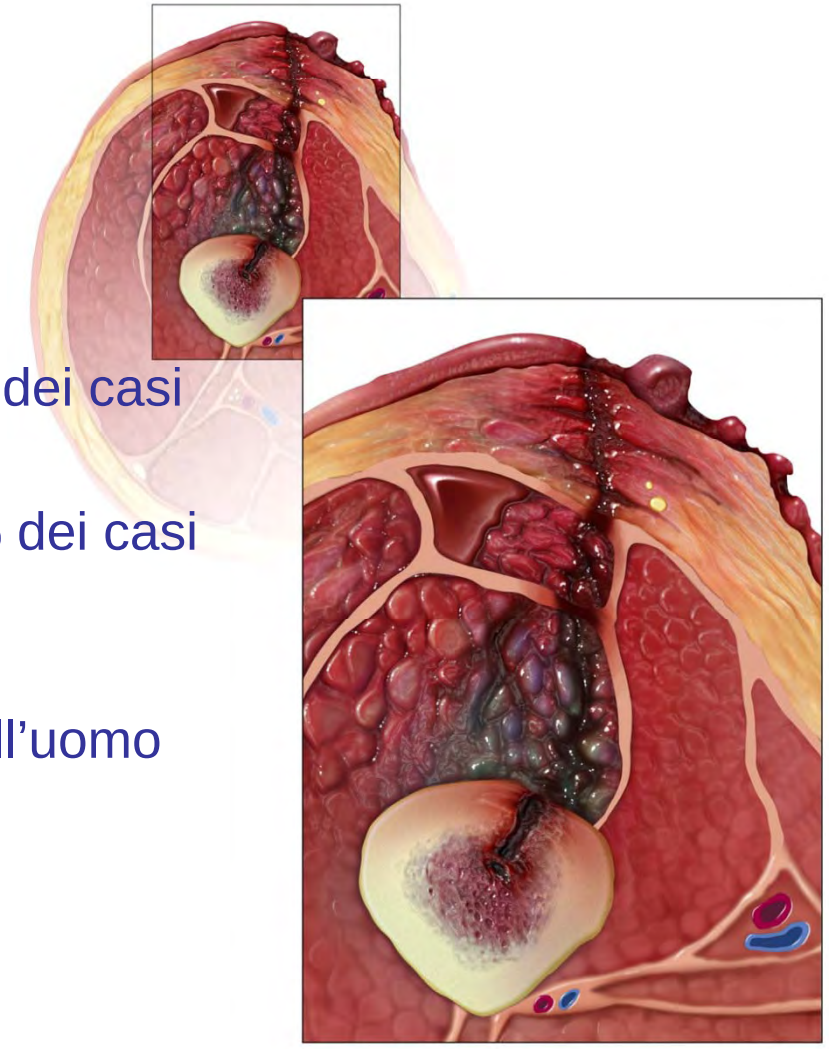
Severa osteoporosi

Osteogenesi imperfecta

Infezione del sito di inserzione

Pregresso tentativo di inserzione IO nello stesso segmento osseo

complicanze



Stravaso di liquidi: 12% dei casi

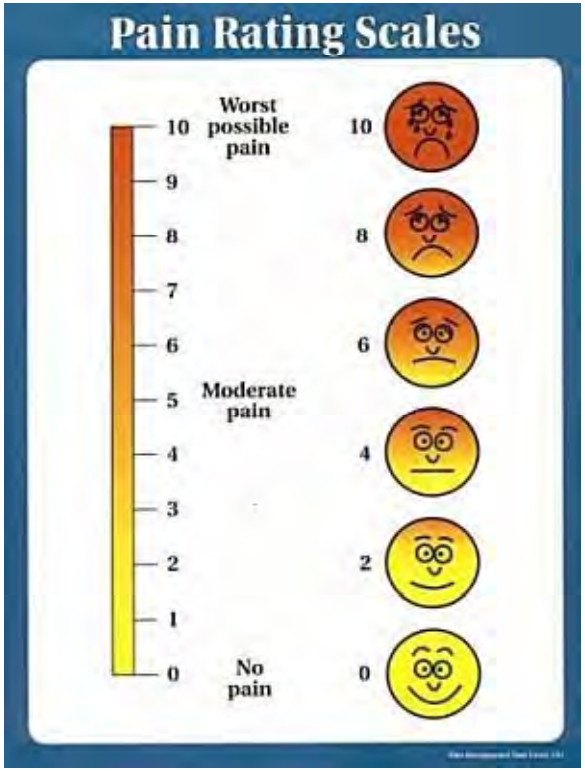
Osteomielite: 0,6% dei casi

Embolia grassosa:
riportata in modelli animali ma mai sull'uomo

Marcia L Buck, Barbara S Wiggins, Jefferson M Sesler
Intraosseous Drug Administration in Children and Adults During Cardiopulmonary Resuscitation
The Annals of Pharmacotherapy, 2007 october,volume 41 (1679-86)

dolore

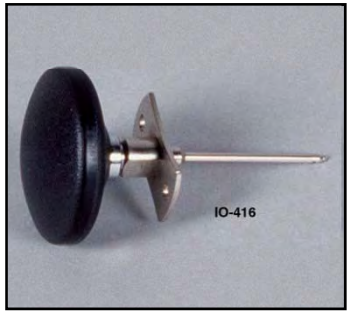
Il dolore medio riportato da adulti svegli, senza anestesia locale, è stato di 2,5 su 10
Il dolore è paragonabile all'inserzione di un catetere venoso di grosso calibro (16-14G)

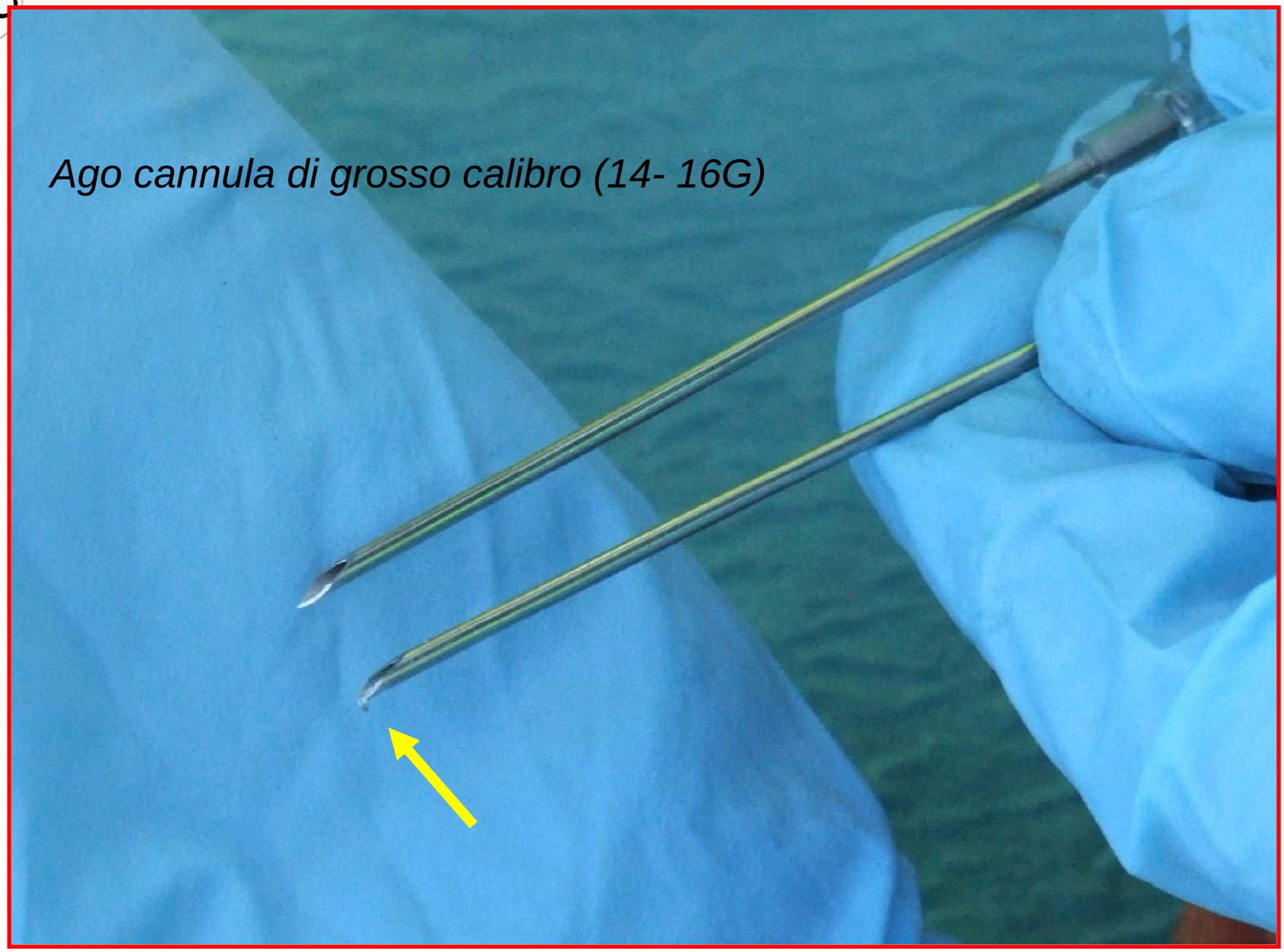


- Una volta posizionato il catetere IO non causa dolore
- Il dolore è causato dall'infusione a pressione nel compartimento intraosseo

- Un bolo iniziale di 20-40mg lidocaina al 2% blocca efficacemente i recettori presenti nel compartimento IO
- Il dosaggio di Lidocaina per pazienti pediatrici coscienti è 0.5 mg/kg somministrati con bolo lento
- Dopo l'infusione di Lidocaina infondere un bolo di 5-10 ml di soluzione fisiologica per garantire un miglior flusso

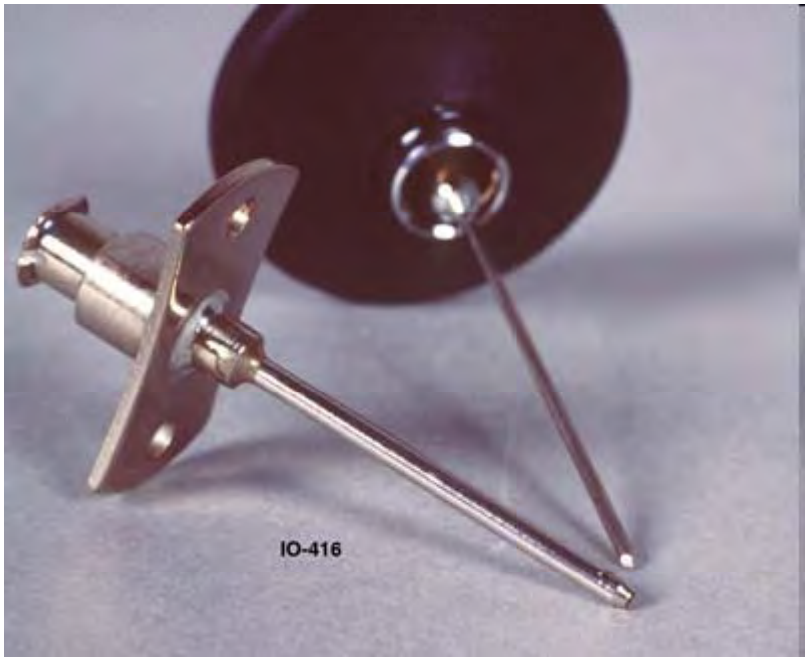
Dispositivi per accesso intraosseo

Manuali	Assistiti/automatici	Meccanici
Ago per intraossea	**BIG** Bone Injection Gun	**EZ-IO**
		
	FAST1 – FAST-X 	


Ago cannula di grosso calibro (14- 16G)

Dispositivi per accesso intraosseo

Ago COOK



Misure disponibili:

14-16-18 gauges x 2,5 – 3 – 4 cm

Dispositivi per accesso intraosseo

Bone Injection Gun (BIG)

Misure disponibili:

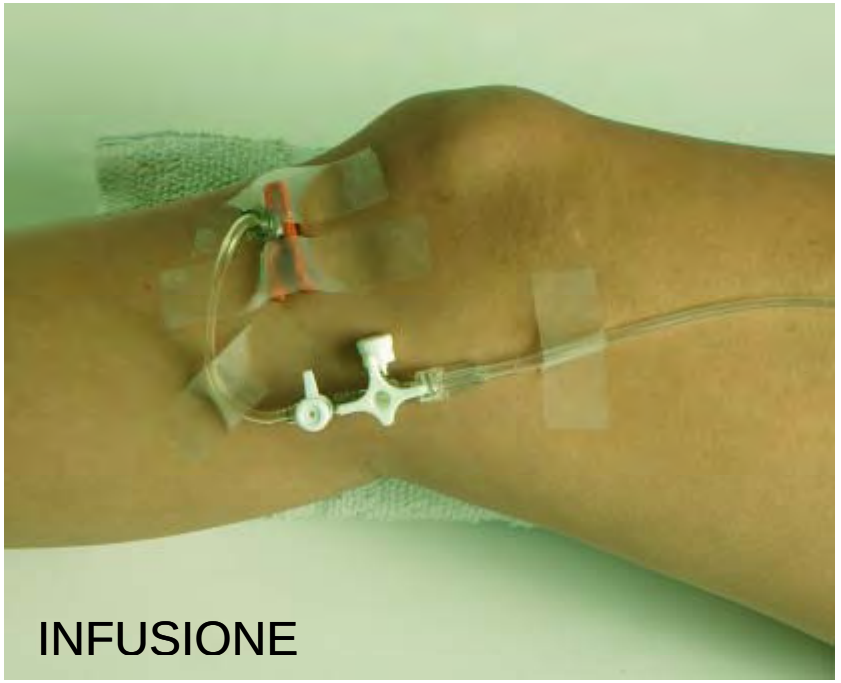
Adulti 15G

Pediatrico 18G (regolabile in base all'età)

INSERZIONE

Dispositivi per accesso intraosseo

Bone Injection Gun



Dispositivi per accesso intraosseo

FAST-1
First Access for Shock and Trauma

Dispositivo per l'infusione intraossea sternale, utilizzabile su pazienti di età superiore ai 12 anni

Dispositivi per accesso intraosseo

FAST-X

Inserisce un ago del diametro di 16G per 6mm nel manubrio sternale

EZ-IO® *Dispositivi per accesso intraosseo*

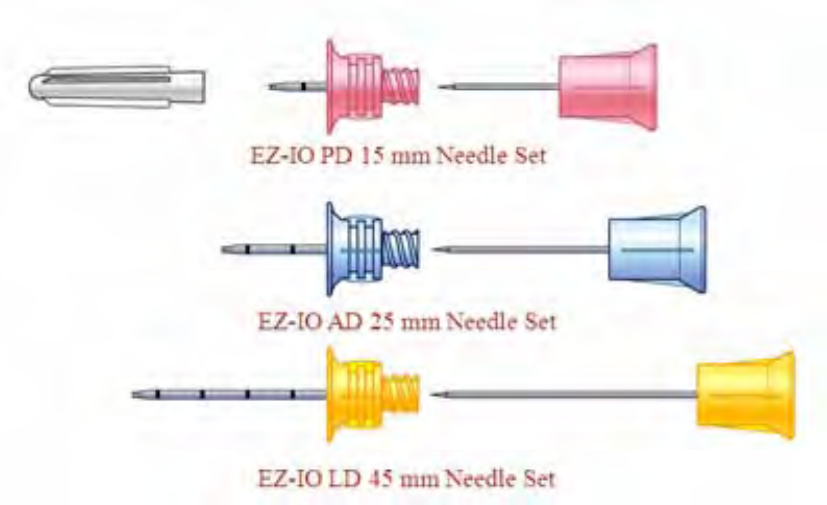
EZ-IO G3 Power Driver

Trapano riutilizzabile

- batteria al litio sigillata
- garantisce circa 500 inserzioni

Peso 455 grammi

EZ-IO needles



Adulto 25mm x 15G (>40 Kg)

Pediatrico 15mm x 15G (3-39 Kg)

Large 45mm x 15G

(pazienti obesi o edematosi o
inserzione omerale in pazienti adulti)

Fissaggio e rimozione del catetere

Per rimuovere il catetere IO utilizzare una siringa Luer Lock ed esercitare contemporaneamente trazione verso l'esterno e rotazione in senso orario

…perchè l'EZ-IO

A multicenter trial of the EZ IO device showed a 97% success rate of placement with fluid administration

Davidoff J, Fowler R, Gordon D, Klein G, Kovar J, et al.
Clinical evaluation of a novel intraosseous device for adults: prospective, 250-patient, multi-center trial
JEMS 2005;30(10):suppl 20–23.

MAN-IO Vs EZ-IO
Insertion times were comparable (MAN-IO: 33+/-28s vs. EZ-IO: 32+/-11s)
Success at first attempt (MAN-IO: 79.5% vs. EZ-IO: 97.8%)
technical complications (MAN-IO: 15.4% vs. EZ-IO: 0.0%)

Brenner T et al.
Comparison of two intraosseous infusion systems for adult emergency medical use
Resuscitation. 2008 Sep;78(3):314-9.

B.I.G. Vs EZ-IO
Participants had a significantly higher one-attempt success rate with the EZ-IO than with the BIG (28/29 vs 19/29)

Shavit I, Hoffmann Y, Galbraith R, Waisman Y.
Comparison of two mechanical intraosseous infusion devices: a pilot, randomized crossover trial
Resuscitation. 2009 Sep;80(9):1029-33.

Raccogliere dati?

Numero di utilizzi

Farmaci somministrati

Sedi di inserzione

Tempo di permanenza in situ

Sorveglianza di eventuali complicanze

*Video disponibile su **www.rossoemergenza.it***

Guglielmo Imbrìaco

Infermiere, specialista in emergenza e urgenza sanitaria

Terapia Intensiva – Rianimazione - 118, Ospedale Maggiore Bologna

Con l’insostituibile collaborazione di:

Giovanni Gamberini

Infermiere, specialista in emergenza e urgenza sanitaria

Croce Rossa Italiana, Bologna

Matteo Erbacci

Infermiere, specialista in emergenza e urgenza sanitaria

118 Modena Soccorso, Modena

Alberto Piacentini

medico, specialista in anestesia e rianimazione

118 Bologna Soccorso, Ospedale Maggiore Bologna

gu.imbriaco@inwind.it