



Contrast media administration - Alternatives to the cubital vein

Radiologists must be prepared for
administration of contrast media via the
intraosseous route & CVC

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When is bending the rule advantageous for the patient?

Off-label use is defined as use of a medical device for an indication it is not specifically approved or cleared.

Physicians (or qualified prescribers) may prescribe, order or use drugs and devices for indications not approved or cleared by the FDA according to their best medical judgment.





Intraosseous Vascular Access in Radiology: Review of Clinical Status

Am J Roentgenol. 2016 Aug. Baadh et al

In the critically ill
patient

- Reduce time to
imaging
- Minor risks
- Not MRI
compatible

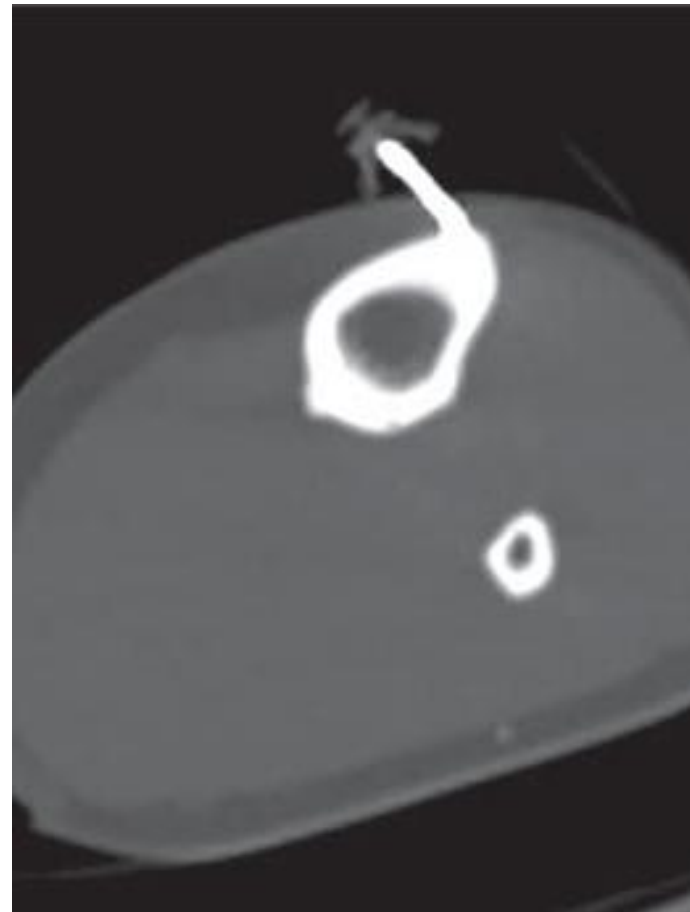
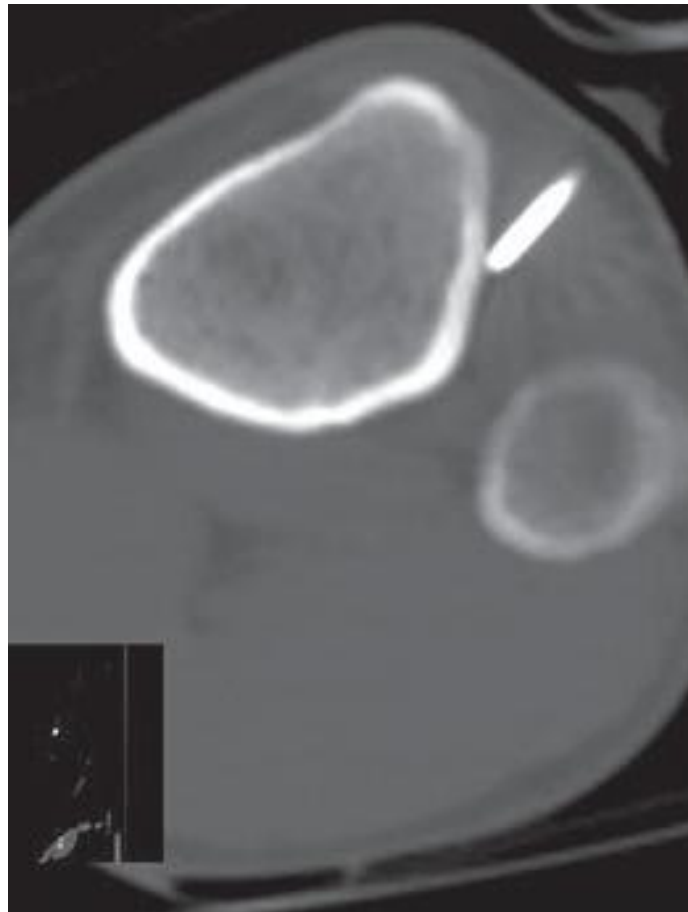
•<https://www.youtube.com/watch?v=KHXSfh2ZRDM>





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Before injection of CM in IO - Flush & confirm location

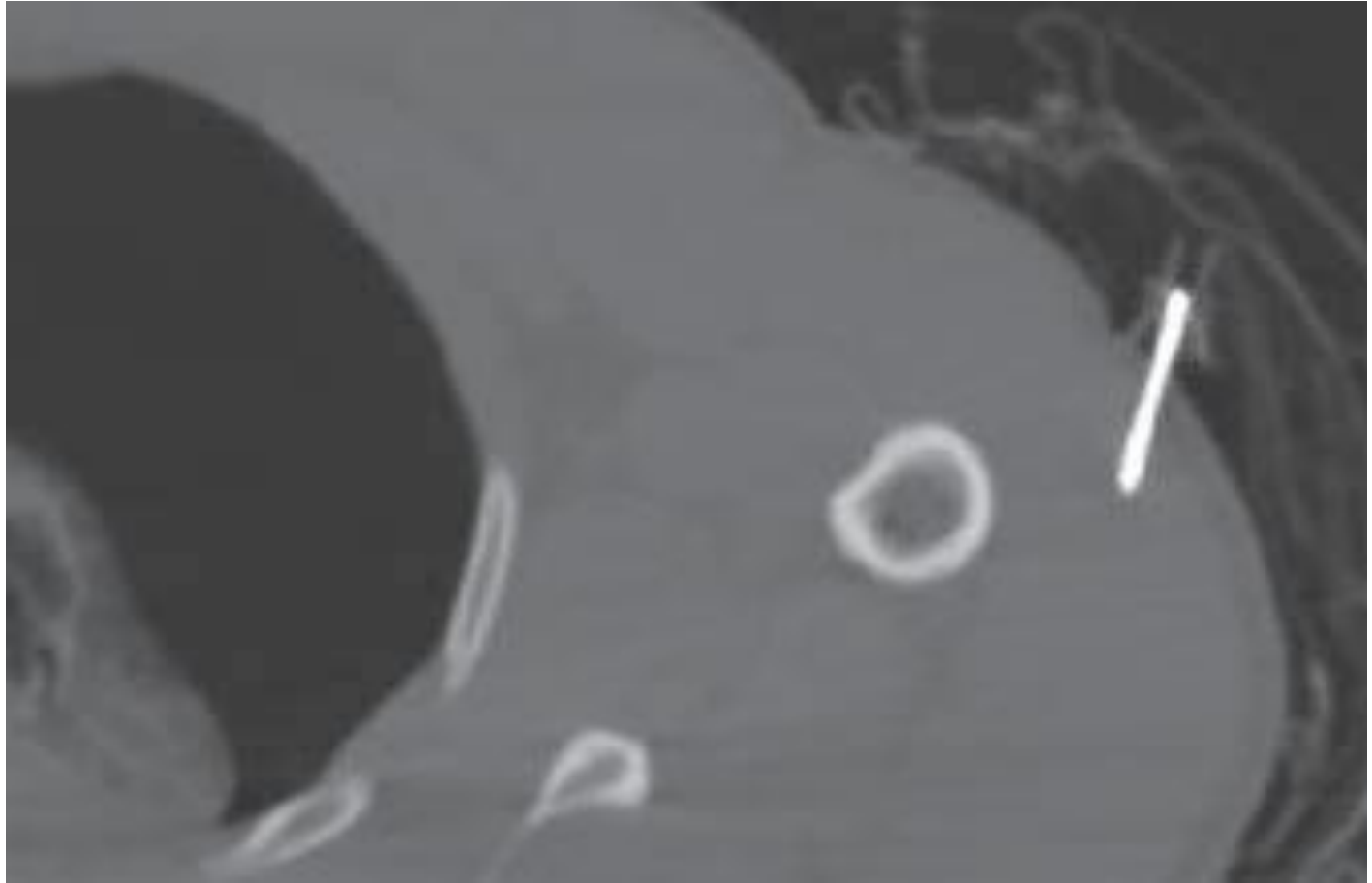


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IO before injection of CM - confirm location

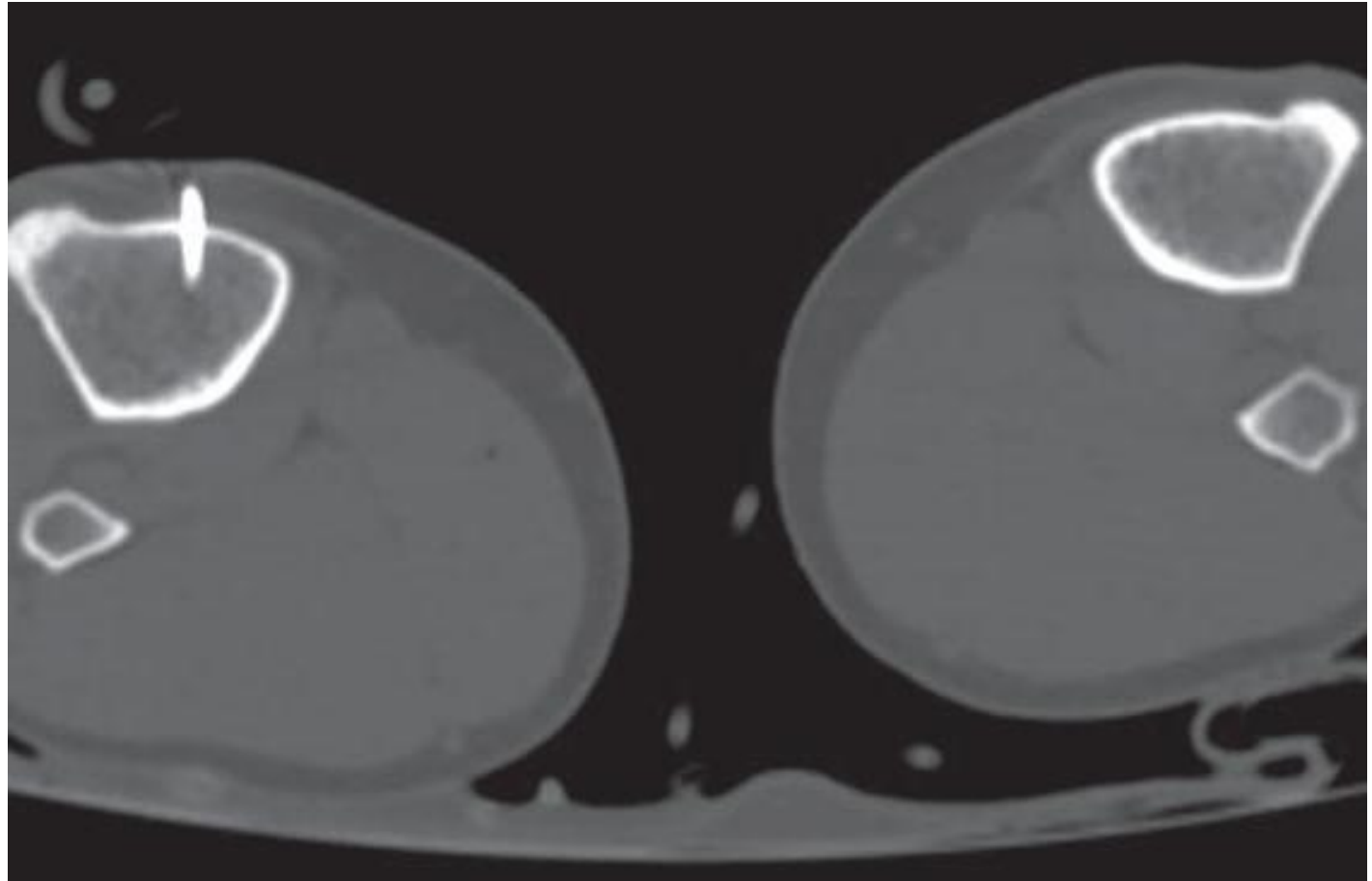


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Tip of intraosseous device positioned in intramedullary cavity



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Complications

Extravasation of fluid into soft tissues,
frequency of 12%. No serious sequelae

*Intraosseous access in the setting of pediatric critical care transport.
Pediatr Crit Care Med 2005*

Compartment syndrome requiring
emergency fasciotomy. Rare.

Intraosseous extravasation complication reports. Ann Emerg Med 1994

Osteomyelitis, fewer than 1% of patients

*Intraosseous infusion: an alternative route of pediatric intravascular
access. Ann Emerg Med 1985*



Intraosseous administration of Iodinated Contrast Media

Only 4 reports where intraosseous devices were used to administer iv CM

- No complications noted
- All imaging examinations were adequate

Intraosseous injection of iodinated computed tomography contrast agent in an adult blunt trauma patient. Ann Emerg Med 2011

Intraosseous contrast infusion: efficacy and associated findings.

Pediatr Radiol 1997

Intraosseous infusion of iodinated contrast in an abused child.

Pediatr Emerg Care 1999

Successful computer tomography angiogram through tibial intraosseous access: a case report. J Emerg Med 2013



Tibial intraosseous access & Power injector

Suspected pulmonary embolism

- 150 ml of prewarmed (38° C) iopamidol
- Injection rate 5 ml/s
- Timing of the bolus by fluoro-triggering

Successful computer tomography angiogram through tibial intraosseous access: a case report. J Emerg Med 2013



Guideline Baadh: intraosseous injection of contrast media

1. Flush intraosseous line with 20 ml of normal saline. If line does not flush easily, do not use!
2. Low-radiation-dose CT scan through intraosseous device to confirm placement and positioning. If incorrect position, do not use!
3. If patient is unconscious, no analgesia is required. If patient is conscious and responsive to pain, 2% preservative- and epinephrine-free lidocaine should be administered just before contrast medium



Guideline Baadh: intraosseous injection of contrast media

4. Hand-inject contrast agent directly into intraosseous line hub using same volume as would be used with power injector. Contrast agent is injected over 1 minute as tolerated.
5. Flush intraosseous line with 20 mL of normal saline and then immediately perform scan.



Central venous catheters

1. High pressure catheters are available
2. Most CVC's/PICC's are NOT tested for high pressure injection
3. Finding warnings can be a problem



Your experience?

Do you ever use CVC for injection of cm with powerinjector?

Do you have local guidelines for "off-label use" CVC-Powerinjection of cm?

Do you know who is responsible in case of adverse event?



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Central venous line for injection with powerinjector



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Risks & benefit analysis

Modest risk of CVC damage

VS

Failing to obtain a diagnosis



The use of central venous catheters for intravenous contrast injection for CT examinations.
Plumb, Br J Radiol 2011

”...summarises the available evidence for the safe and effective use of these devices...”

”The use of CV lines for power injection of CM is feasible and safe as long as certain precautions are taken. The 1% adverse events... lead to no patient harm and only require catheter replacement to rectify.



”Following a strict safety protocol there were no complications associated with power injections of contrast material containing 400mg iodine/ml with preset flow rates up to 5ml/s ...”

”104 examinations with the Arrow CVC were evaluated”



Responsibility in case of adverse event

- **Manufacturerer**
 - if CVC is used as CE-approved
- **Deptm of Rad**
 - if "off label use" is in line with local Guideline.
- **Dr/nurse**
 - personal responsibility if not following local or central guidelines



When is the powerinjector needed?

CTA

- Pulmonary embolism
- Dissection of aorta
- Aneurysm intracranially or elsewhere



Local test Uppsala

Can CVC handle the pressure in vitro?

Xenetix / Omnipaque 350 mg Iodine/ml

Room temperature (25° C)

60 ml/injection

Powerinjector Medrad IPX1

Max pressure: 325 PSI

Injection rate: 2-4-6-8-10 ml/s

Angio-powerinjector

1200 psi

20 ml/s



Test setup

- Powerinjector
- Standard lines from injector
- CVC
- Paper around CVC
- Tip of CVC in bottle





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CVC tested straight and bent

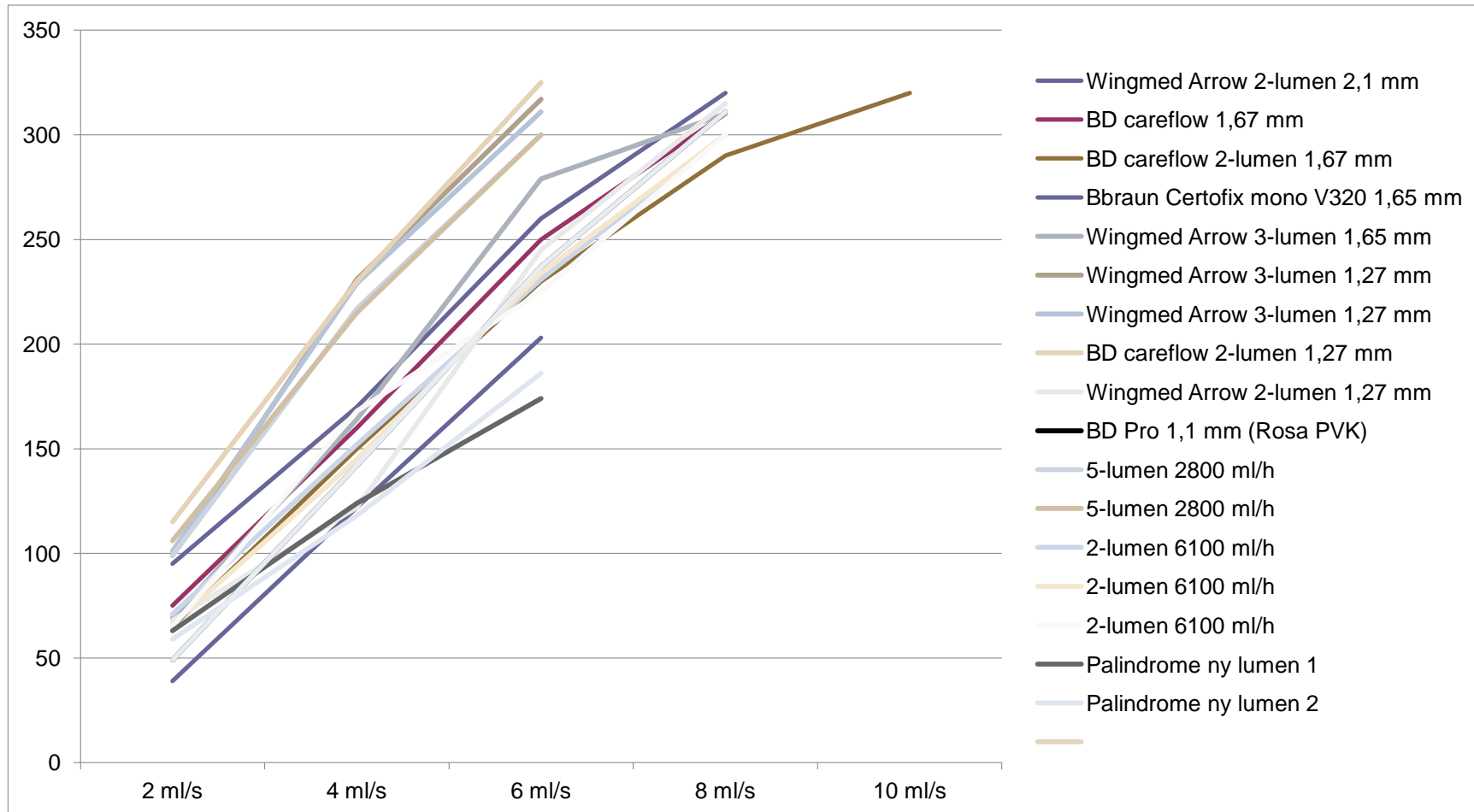


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Results

Pressure vs speed of flow





Results

- One type of CVC ruptured repeatedly
 - (Bard Hickman/Baroviak)
- All other tested CVC - no sign of ruptur
- Pressure in Powerinjector <325 psi for injections of ≥ 6 ml/s



Guidelines Uppsala for "off label use" (CVC-powerinjector)

Off-label use may be done with the following CVC's:

- Arrow 3-lumen (Wingmed)
- Arrow 2-lumen (Wingmed)
- Bbraun Certofix mono V320
- BD careflow 7Fr 2-lumen



Guidelines Uppsala for "off label use" (CVC-powerinjector)

Precautions:

- Speed of injection ≤ 6 ml/s
- CVC not older than 2 weeks
- Injection and aspiration through CVC can be done without resistance
- Correct position of CVC verified recently
- Temperature of cm $\geq 30^{\circ}$ C



Recommendations to you

- ❑ Use CVC tested by manufacturer for use with powerinjector!!!

- ❑ Write local guidelines for "off label use"
 - ❑ Test the CVC's used at your hospital
 - ❑ Use relevant tests from other institutions
- ❑ Information to CT-staff and referring units



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Look where it ruptures!



Thank you!
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