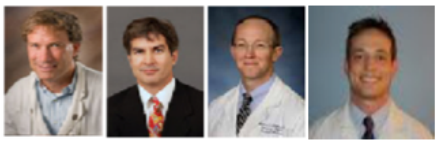
critical care perspectives in emergency medicine



IV or IO for Vascular Access in OHCA?

Key Article

- *Ko YC, Lin HY, Huang EPC, et al. Intraosseous versus intravenous vascular access in upper extremity among adults with out-of-hospital cardiac arrest: cluster randomized clinical trial (VICTOR trial). BMJ. 2024;386 :e079878.*

Background

- Approximately 4 million OHCA events occur worldwide each year.
- As international guidelines recommend the administration of epinephrine with OHCA and a nonshockable rhythm, it is necessary to establish vascular access during resuscitation.
- Both IV and IO vascular access is routinely attempted for this purpose during OHCA resuscitation.
- At present, international guidelines recommend IV access for initial attempts at vascular access in OHCA, but this is based on very low certainty of evidence.

Objective

- To compare the effectiveness of intraosseous versus intravenous vascular access in the treatment of adult patients with OHCA.

Methods

- Multicenter, clustered, pragmatic, randomized controlled trial
- 4 advanced life support ambulance service teams in Taipei City
- Patients
    - Included
        - Adults $\geq$ 20 years
        - OHCA
        - Treated by participating EMS agencies
    - Excluded
        - Obvious signs of death
        - DNR order at scene
        - Contraindications for IV or IO access (infection, burns, AV fistula, extremity fracture, prosthesis, etc.)
        - ROSC achieved before intervention
        - Traumatic OHCA
        - Known or suspected pregnancy
- Interventions
    - Randomized 1:2 allocation
        - IO Group (EZ-IO); IO felt to be twice as likely to be successful than IV; limited to humeral location
        - IV Group; limited to IV access in upper extremity
- Primary outcome

    - Survival to hospital discharge
- Secondary outcomes
    - ROSC
    - Survival to admission
    - Favorable neurologic outcome at hospital DC

Results

- A total of 1,732 patients were included in the final analysis
    - IO Group: 741 patients
    - IV Group: 991 patients
    - Mean age of 65 years, 71% male, 71% at home, 44% witnessed, 71% bystander CPR, and 71% nonshockable rhythm
    - Mean time between EMS arrival on scene and first drug administration: 15.6 min
- Primary Outcome – survival to hospital discharge
    - IO Group: 10.7%
    - IV Group: 10.3%
    - Not statistically different
- Secondary Outcomes
    - Pre-hospital ROSC, survival to admission, and favorable neurologic outcome were not significantly different between the 2 groups

Limitations Identified by Authors

- Study ultimately underpowered given the authors overly optimistic improvement in primary outcome with IO
- Time to IO insertion exceeded expectations
- Despite a 1:2 randomization ratio, the ultimate number of patients in each group was similar
- Post-cardiac arrest management in hospital was not available in the trial

Take Home Point

- The IO route for vascular access in adults with OHCA did not improve survival to hospital DC, pre-hospital ROSC, and favorable neurologic outcome when compared to the IV route for vascular access.

Key Article

- *Vallentin MF, Granfeldt A, Klitgaard TL, et al. Intraosseous or intravenous vascular access for out-of-hospital cardiac arrest. N Engl J Med. 2025; 392:349-60. The IVIO Trial*

Objective

- To determine whether the effectiveness of initial attempts at IO vascular access or IV vascular access during OHCA would differ with respect to ROSC.

Methods

- Investigator-initiated, randomized, parallel-group superiority trial
- EMS agencies in all 5 regions of Denmark

    - In Denmark, cardiac arrests are attended by a primary ambulance unit and a physician-manned unit.
- Patients
    - Included
        - Adults ≥ 18 years
        - If vascular access was indicated during OHCA
    - Excluded
        - Suspected traumatic cardiac arrest
        - Vascular access already in place
- Interventions
    - Randomized 1:1 by the on-site clinician
        - IO Group (EZ-IO)
            - Further randomized 1:1 between humeral and tibial locations
        - IV Group
    - After 2 failed attempts at either access, further attempts were at the clinician's discretion
- Primary outcome
    - Sustained ROSC – defined as a palpable pulse or other signs of circulation with no further chest compressions for at least 20 minutes
- Secondary outcomes
    - 30-day survival
    - 30-day survival with favorable neurologic outcome (mRS of 0-3)

Results

- A total of 1,479 patients were included in the final analysis
    - IO Group: 731 patients
    - IV Group: 748 patients
    - Mean age of 69 years, 70% male, 81% of cardiac arrests were at home, 77% with nonshockable rhythm, 84% with bystander CPR
- Procedural Outcomes
    - Successful establishment of vascular access on 1st or 2nd attempt
        - IO: 92%
        - IV: 80%
    - Time to first successful vascular access similar in both groups
    - Time to first epinephrine dose also similar in both groups (15 min)
- Primary Outcome – sustained ROSC
    - IO Group: 30%
    - IV Group: 29%
    - Not statistically different
- Secondary Outcomes
    - 30-day survival
        - IO Group: 12%
        - IV Group: 10%
    - 30-day survival with favorable neurologic outcome
        - IO Group: 9%
        - IV Group: 8%
- Humeral vs. Tibial IO

- Humeral: 361 patients
- Tibial: 370 patients
- Successful first or second attempt success:
  - Humeral: 90%
  - Tibial: 93%
- ROSC
  - Humeral: 30%
  - Tibial: 31%

Limitations Identified by Authors

- Trial powered for ROSC and not a patient-centered outcome measure
- Unblinded
- Some crossover occurred
- Trial not powered to compare humeral vs. tibial IO

Take Home Point

- No significant difference in sustained ROSC between IO and IV access in adults with OHCA.

Key Article

- *Couper K, Ji C, Deakin CD, et al. A randomized trial of drug route in out-of-hospital cardiac arrest. N Engl J Med. 2025; 392:336-38.*

Objective

- To determine the clinical effectiveness of an IO-first strategy, as compared with an IV-first strategy in adults with OHCA.

Methods

- Pragmatic, open-label, randomized trial
- 11 EMS services in the UK
- Patients
  - Included
    - Adults $\geq$ 18 years
    - OHCA
    - Required vascular access for drug administration during ongoing CPR
  - Excluded
    - Known or suspected pregnancy
- Interventions
  - Paramedics from participating EMS agencies performed resuscitation according to current guidelines.
  - Randomized 1:1 ratio
    - IO-First Group
    - IV-First Group
  - If the paramedic could not obtain vascular access by the assigned route within 2 attempts, the route of subsequent attempts was determined by the paramedic.
  - Location of IO and IV was determined by the paramedic.

- Primary outcome
    - 30-day survival
- Secondary outcomes
    - ROSC
    - Survival to hospital DC, at 3 months, and 6 months
    - Time to ROSC
    - Hospital and ICU LOS
    - Neurologic function at hospital DC, 3 months, and at 6 months
- Statistical analysis – planned to recruit 15,000 patients to achieve a sample size of 14,972 patients to detect a 1% difference in 30-day survival.

Results

- Recruitment was slower than anticipated and the trial stopped prematurely at the end of the funding period.
- A total of 6,082 patients were included in the final analysis
    - IO-First Group: 3,040 patients
    - IV-First Group: 3,042 patients
    - Mean age of 68 years, 64% male, 79% home location of the arrest, 78% nonshockable rhythm, 61% witnessed, and 69% bystander CPR
    - Mean time between EMS arrival on scene and first drug administration: 15.6 min
- Time from EMS arrival to vascular access
    - IO-First Group: 12 min
    - IV-First Group: 12 min
- Time from EMS arrival to drug administration
    - IO-First Group: 14 min
    - IV-First Group: 15 min
- Time from emergency call to drug administration
    - IO-First Group: 24 min
    - IV-First Group: 24 min
- Primary Outcome – 30-day survival
    - IO-First Group: 4.5%
    - IV-First Group: 5.1%
    - Not statistically different
- Secondary Outcomes
    - Favorable neurologic outcome
        - IO-First Group: 2.7%
        - IV-First Group: 2.8%

Limitations Identified by Authors

- Trial terminated mined before the planned sample size reached – underpowered to detect a 1% difference.
- Did not collect information on resuscitation quality.
- Did not collect information on hospital-based post-arrest care

Take Home Point

- The use of an IO-first strategy did not improve 30-day survival compared with an IV-first strategy in adult patients with OHCA.