Intra-osseous drills: the ups and downs of a new device

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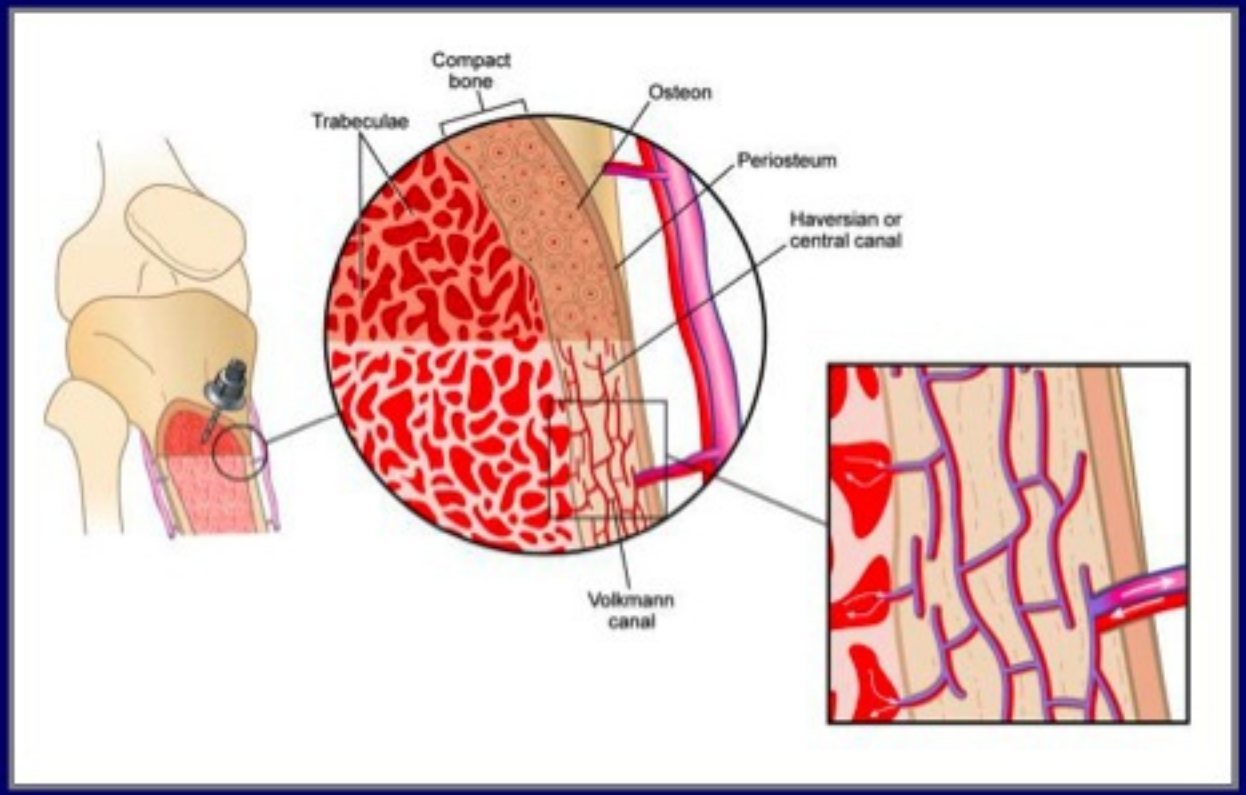
Intra-osseous needle and trauma

- Gaining vascular access can be difficult in trauma
  - Patients may be hypovolaemic and vasoconstricted
  - Not all limbs and sites may be suitable for access

Intra-osseous needle and trauma

- Bone marrow remains ‘wide open’ despite hypovolaemia
- Fluids and medicines are rapidly absorbed from marrow
  - Almost as rapidly as intravenous administration
  - Intra-osseous access just another form of vascular access
- Significant interest in the role of intra-osseous access in trauma



Intra-osseous needle (ION) and trauma

- Discuss the history of ION
- Briefly summarise the literature
- Discuss the evolution of ION within our own service
- Discuss why we have moved to a powered drill device
- Discuss the potential role of the ION in trauma
- Present a few cases
- Questions and discussion

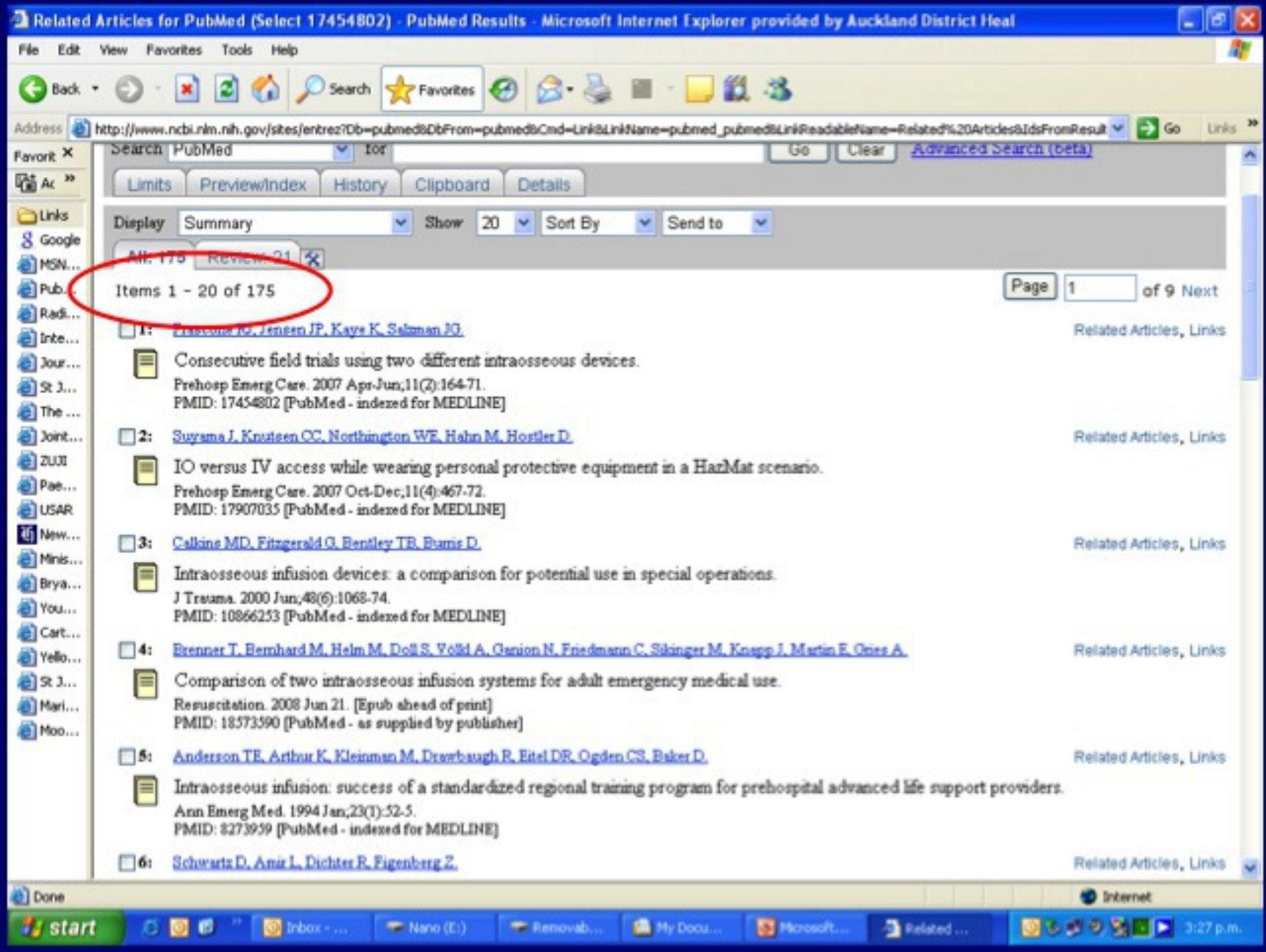
Conflict of interest

- I do not have a financial interest in any of the products
  - I wish I did
- I have not received money from any of the companies
  - I have gratefully received coffee
  - I have gratefully received training

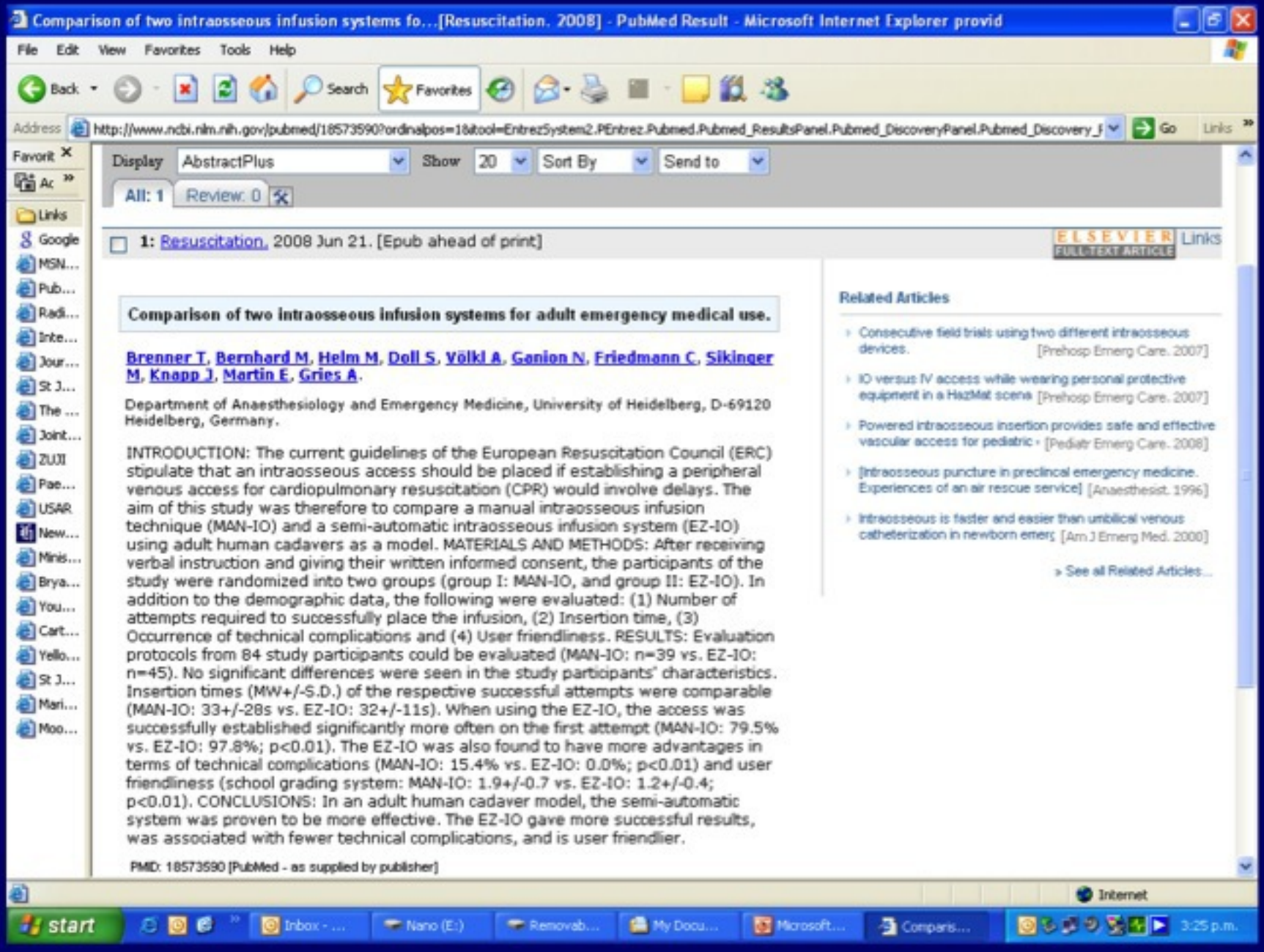
History

- ION have long been used as an alternative to veinous access
- Common in the 1930s and 1940s
- Originally in both adults and children
- Became less common in adults over time
- Resurgence recently

Resurgence recently



The literature



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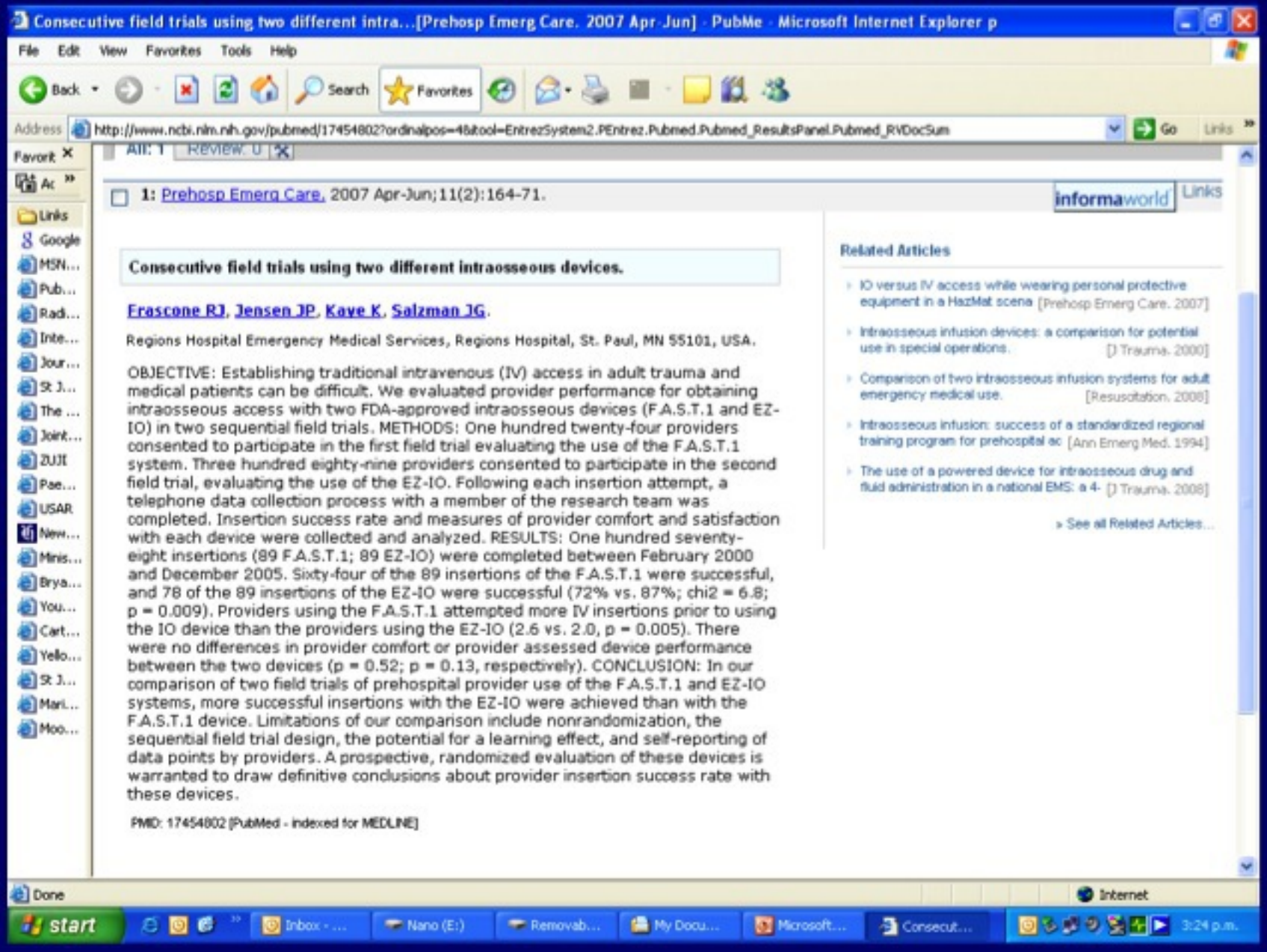

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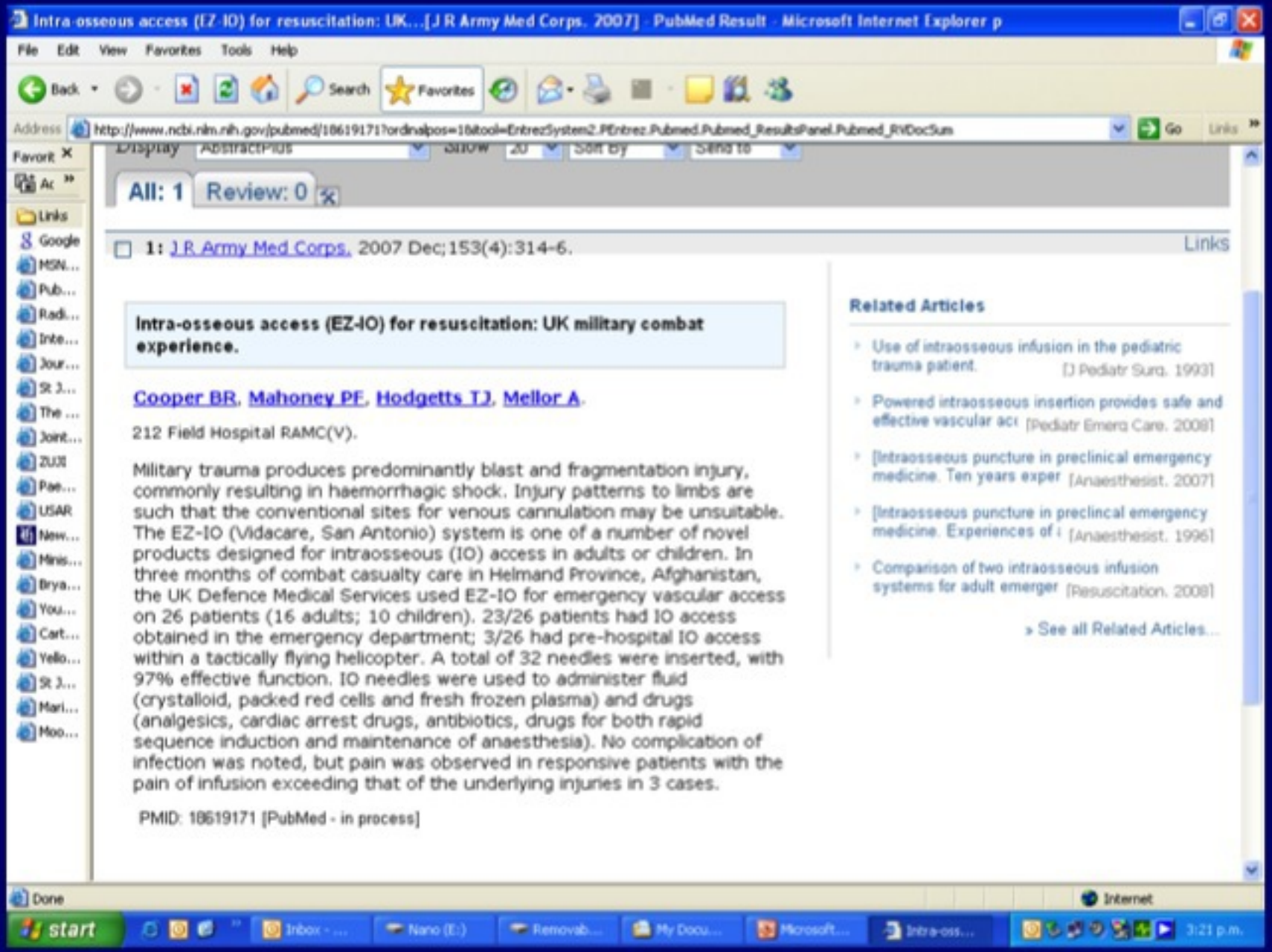


A summary of the literature

- Not a systematic review
- Dominated by pre-hospital use
- Use in adults is increasing
  - Particularly in military setting
- Some randomised trials
  - Comparing ease of placement of one type vs another
  - In general powered devices appear easier and quicker
  - Differences are statistically significant but not always clinically significant
- No meaningful outcome data

ION in St John

- We used a manual screw in ION for many years
- Only used in children, tibial site only
  - Required child to be fairly moribund
  - Used relatively infrequently
  - Took time and force to place
  - Approximate 30% failure rate
  - Tendency to be easy to dislodge

ION in St John

- Moved away from the manual screw in device to a spring loaded device (bone injection gun or BIG)
  - Easier and quicker to insert, more stable in the bone
  - Able to be placed in ‘less moribund’ patients
  - We carried the paediatric size only
  - All or nothing (unable to be altered)
  - A much higher failure rate than expected
  - We decided to move back to the manual

ION in St John

- We have also looked at the FAST ION
  - Sternal access only
  - Adults only
  - All or nothing
  - Originally required a separate device for removal
- We decided against introducing it

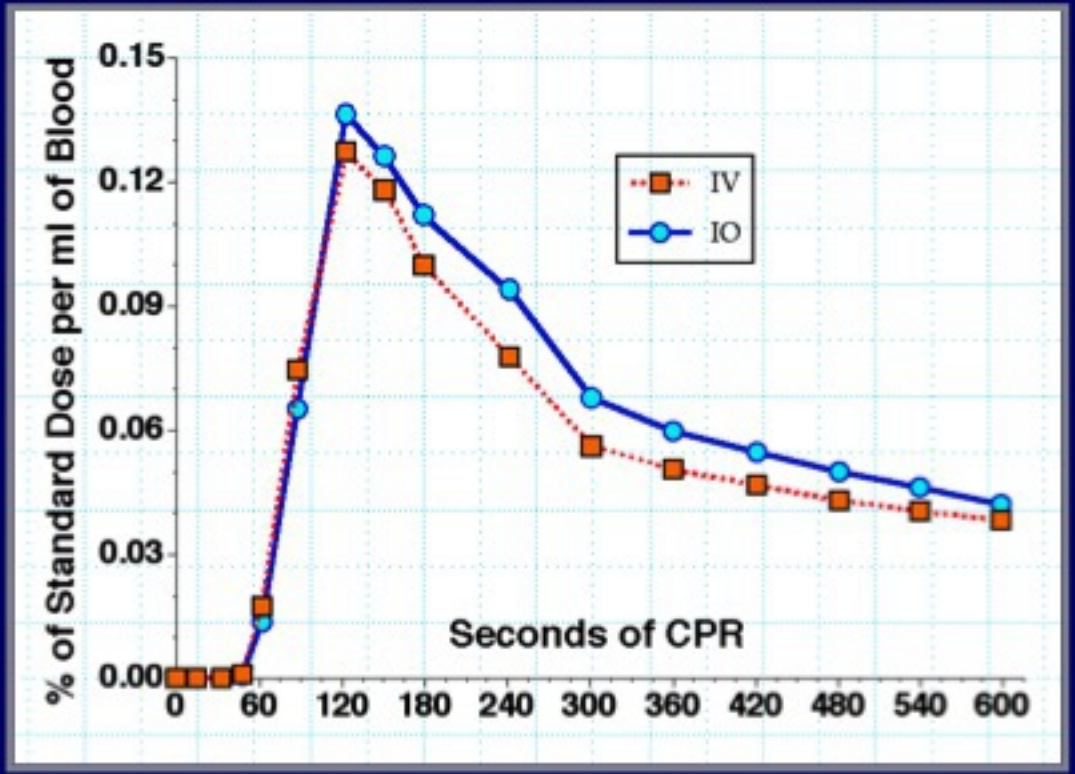
ION in St John

- We then evaluated drill powered devices
  - Relatively expensive
  - Very quick, easy, relatively painless
  - Adults and children
  - Multiple sites
  - Can be altered (not all or nothing)
- We have chosen to introduce the the EZ IO

Absorption

How good are they really?

- Medicines and fluids are very quickly absorbed
- Large volumes of fluid require pressure
  - 1 litre crystalloid or one bag of blood crystalloid in 10-15 minutes
  - This may be sore if the patient is awake
  - 1% lignocaine IO for pain



IO drill in St John

- Advanced paramedics (ALS)
- Two sites
  - Anterior tibial (adults and children)
  - Humeral head (adults only)
- Immediate requirement for time critical medicine or fluid and IV access cannot be obtained
- Contraindicated if:
  - Fracture of that bone
  - Known (or strongly suspected) metal in that bone
  - Soft tissue infection at that site

IO drill in St John

- Procedure
  - Identify site
  - Swab with iodine or alcohol and chlorhexidine
  - Drill until loss of resistance (usually into hilt)
  - Remove stylet
  - Aspirate for bone marrow
  - Secure (not crucial immediately)
  - Flush (important for flow)
  - Administer fluid and medicines
- Discourage use in cardiac arrest

IO drill in St John

- What we have learned
  - Awake patients tolerate it remarkably well
  - Not all patients experience pain with fluid under pressure
  - There is an initial level of enthusiasm which then settles down
  - They are remarkably stable
  - We may need to carry a longer needle
  - Don’t replace large bore veinous access
  - Bridge to large bore veinous access when this cannot be achieved quickly

Case example – trauma

- RTC, Truck vs van, van driver trapped
  - A and B OK, tachycardic and constricted, GCS 9 (M5), agitated
  - Trapped by legs, multiple compound limb fractures
  - Several attempts at IV access in one available limb
  - ION placed in humerus
  - Volume loaded via ION during extrication
  - GCS fell to 7 (M5)
  - Intubated and ventilated using RSI via ION following extrication
  - Large bore access gained via EJV

Case example – bleeding

- Woman in her fifties
  - Elective hysterectomy
  - Heparinised post operatively for prosthetic mitral valve
  - Code red for hypotension (clinically bleeding)
  - Restless and agitated, pulled peripheral IVs out
  - Taken rapidly to OR
  - No IV access could be obtained
  - Borrowed ION drill from paediatric ED
  - ION placed in anterior tibia
  - 5 units of blood via ION
  - Anaesthetised via ION
  - Large bore IV access gained in IJ
  - Laparotomy and repair of bleeding vessels

Summary

- The IO drill means that IO access can be gained in both adults and children
  - Quickly and easily
  - In patients who are not moribund
  - In multiple potential sites
  - Ability to rapidly administer medicines and fluids, rapidly absorbed
- Not a panacea
  - Another option for vascular access when it is difficult
- Do not replace large bore veinous access
  - They are a bridge to it
- In my view – they definitely have a role