# *Managing Traumatic Brain Injuries without a Neurosurgeon*

*Jeff D Disney MD, FAAEM*
*PVAMC-OHSU Dept of Emergency Medicine*

# Not this!

# Rather This!

Prevent Secondary Injury !

ACS TQIP
BEST PRACTICES IN THE MANAGEMENT OF TRAUMATIC BRAIN INJURY

1. Avoi
2. Avoi

e Prophylaxis

se Coagulopathy

Vali... ain Injury Guidelines: Result... tion for the Surgery of Trau...

| | | |
|---|---|---|
| ...% | ICP 20 - 25 mmHg | Serum sodium 135-145 |
| ...mmHg | $PbtO_2$ ≥ 15 mmHg | INR ≤ 1.4 |
| $Pa..._2$ 35-45 mmHg | CPP ≥ 60 mmHg * | Platelets ≥ 75 x $10^3$ / $mm^3$ |
| SBP ≥ 100 mmHg | Temperature 36.0-38°C | Hemoglobin ≥ 7 g/dl |
| PH 7.35-7.45 | Glucose 80-180 mg/dL | |

# "BIG"

*Brain Injury Guidelines (2014)*

| Brain Injury Guidelines | | | |
|---|---|---|---|
| **Variables** | **BIG 1** | **BIG 2** | **BIG 3** |
| LOC | Yes/No | Yes/No | Yes/No |
| Neurologic examination | Normal | Normal | Abnormal |
| Intoxication | No | No/Yes | No/Yes |
| CAMP | No | No | Yes |
| Skull Fracture | No | Non-displaced | Displaced |
| SDH | $\leq$ 4mm | 5 - 7 mm | $\geq$ 8 mm |
| EDH | $\leq$ 4mm | 5 - 7 mm | $\geq$ 8 mm |
| IPH | $\leq$ 4mm, 1 location | 3 – 7 mm, 2 locations | $\geq$ 8 mm, multiple locations |
| SAH | Trace | Localized | Scattered |
| IVH | No | No | Yes |
| **THERAPEUTIC PLAN** | | | |
| Hospitalization | No Observation (6hrs) | Yes | Yes |
| RHCT | No | No | Yes |
| NSC | No | No | Yes |

BIG, brain injury guidelines; CAMP, Coumadin, Aspirin, Plavix; EDH, epidural [illegible] IVH, intraventricular hemorrhage; IPH, intraparenchymal hemorrhage; LOC, loss of consciousness; NSC, neurosurgical consultation; RHCT, repeat head computed tomography; SAH, subarachnoid hemorrhage; SDH, subdural hemorrhage

**Abnormal Neuro Exam: GCS<12; Abnl Pupils or Focal Exam**

# BIG 2021

- Validation study!  2000 patients.  *Added in:  Any re-admits or ED visits?*
    - BIG 3 - Contained ALL the pts that required acute NSx intervention.
    - BIG 1 - No patients worsened. No re-admits or ED visits.
    - BIG 2 - 7% had progression on CT, *none requiring NSx*.
      No re-admits or ED visits.
- Conclusion:  “BIG” works, keeps patients safe, and saves resources.
- Lake Havasu Level 3 Trauma Center Study….

# But there are questions…

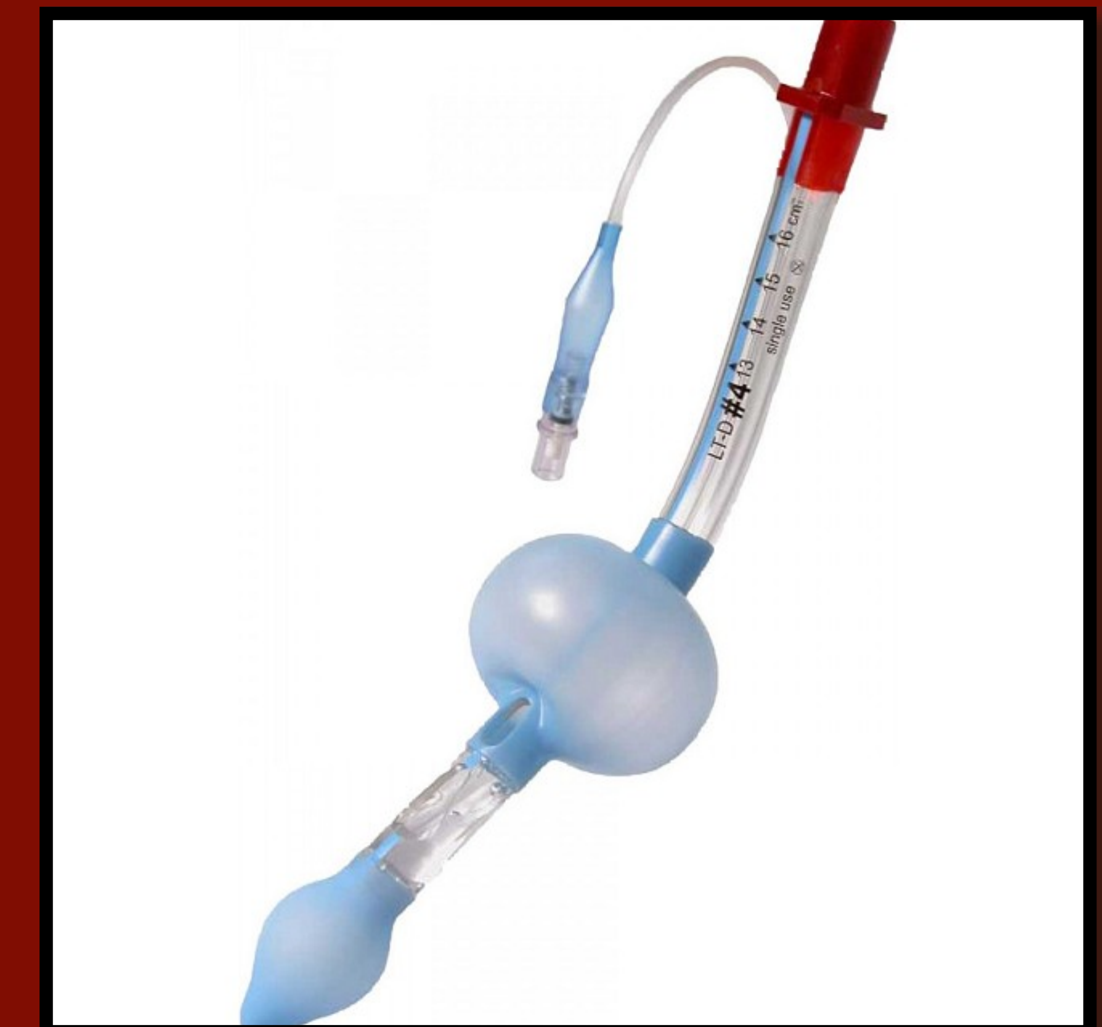
- *How does this apply to our cirrhotic and dialysis patients*…..it doesn't.
- *Haven't there been some reported small epidurals in BIG 1 that went on to get worse?*
    - Yes. In Colorado: Epidurals and some deep intra-parenchymal
    - Yes. In Atlanta: Epidurals - so they now exclude EDH from Big 1.
- So be cautious! I'll admit pts who are cirrhotic, DD-ESRD, and epidurals - with plans to re-CT them in 6-10 hours.

# Prevent Secondary Injury

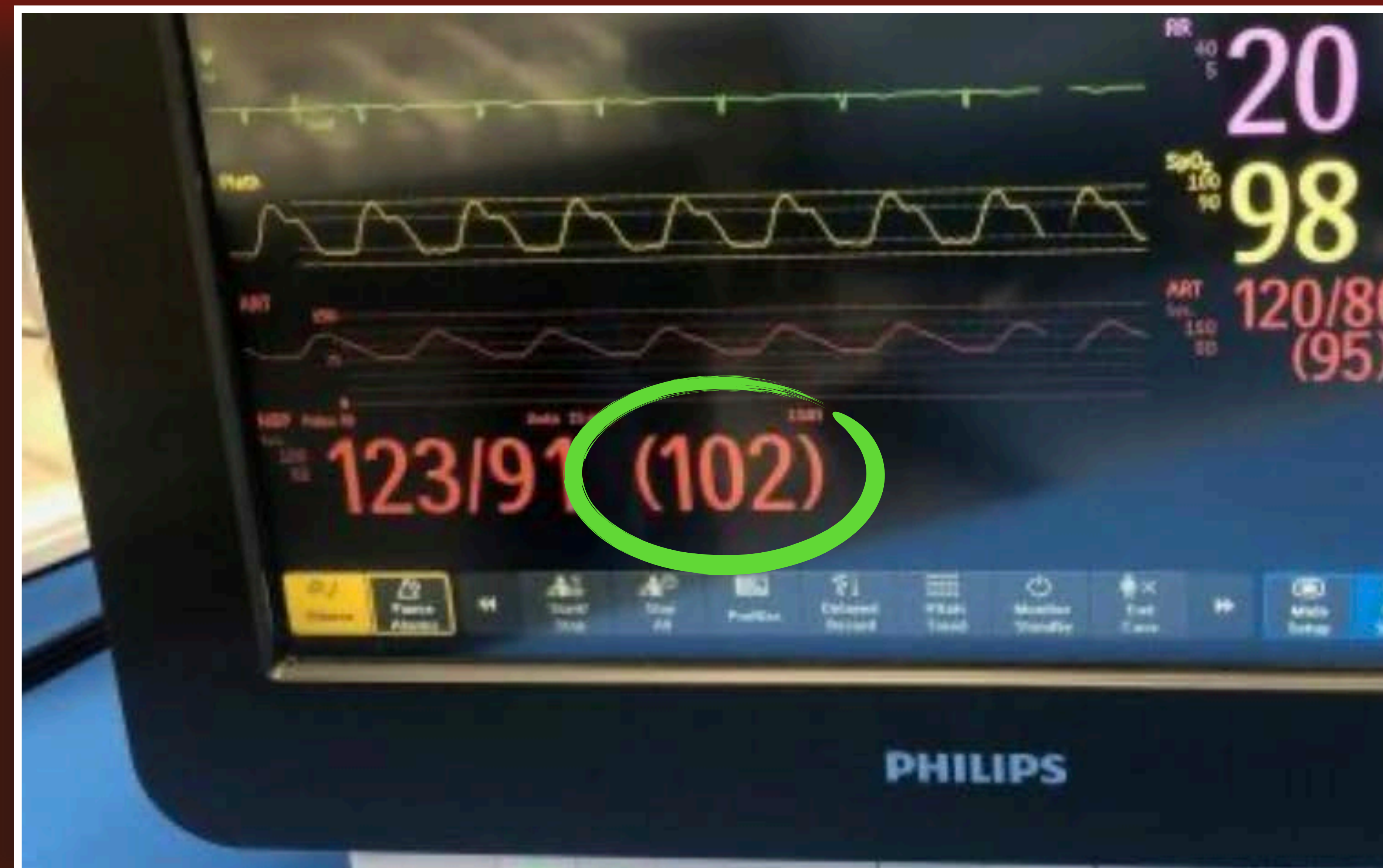
1. Avoid Hypoxia
2. Avoid Hypotension
3. Keep the ICP Low
4. Seizure Prophylaxis
5. Reverse Coagulopathy

# Avoid Hypoxia

- Pre-Hospital Intubation ?   Literature is mixed…
- Supra-Glottic Device ?  Yes!
- RSI - 2 fold increase in mortality w/ inexperienced provider
    - Elevate the HOB at least 30 degrees
    - Poly-Trauma:  Ketamine / Rocuronium
    - Isolated CHI:  Fent / Etomidate / Rocuronium
- **Goal:  O2 Sat > 92%**
- **Goal:  EtCO2: 35-45**



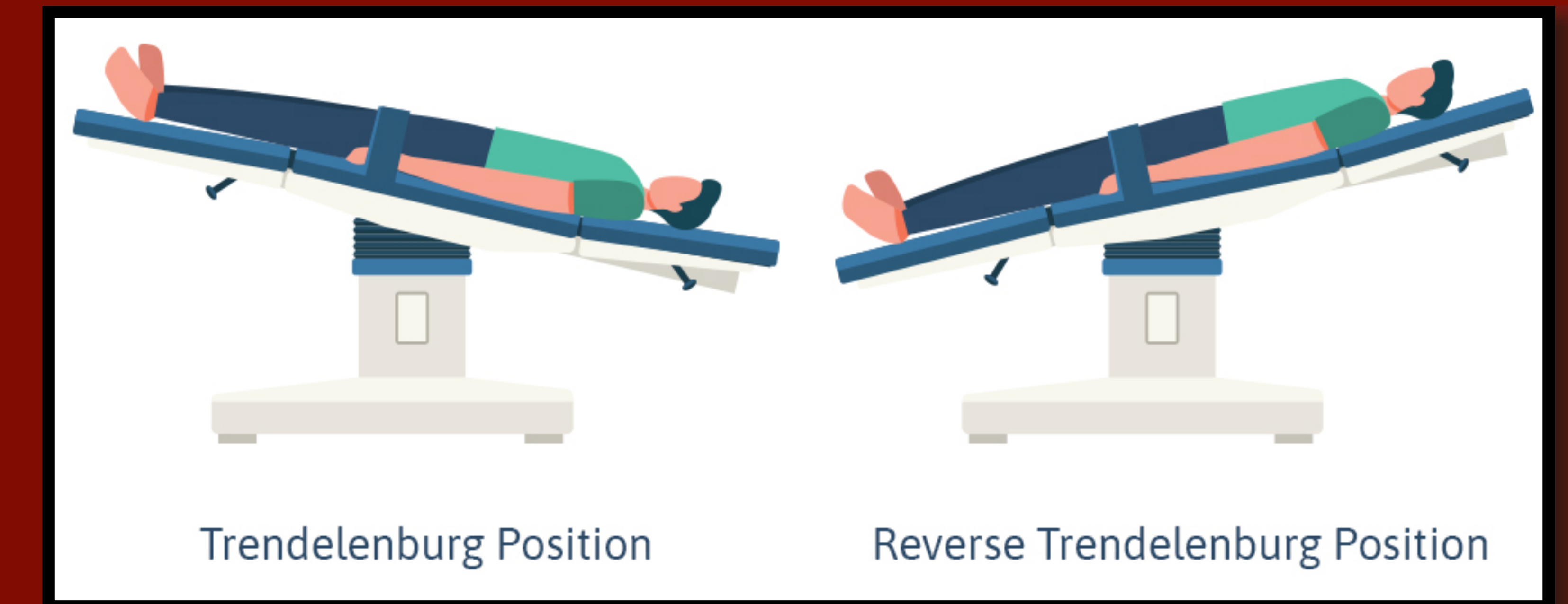
# Maintain MAP (~CPP)




- Goal: SBP > 100 (>120 for age over 70). ***MAP > 80***
- NS > LR small boluses of 250-500ml
- Nor-Epi ? Paucity of literature.
- PRBC's:
  - Current recommendation: Hgb < 7.0
  - Two ongoing studies. Stay tuned!
- Hypertonic NS for MAP? ROC Meta-analysis: no difference
- What to do with the Poly-Trauma patient? ***SBP > 100***.

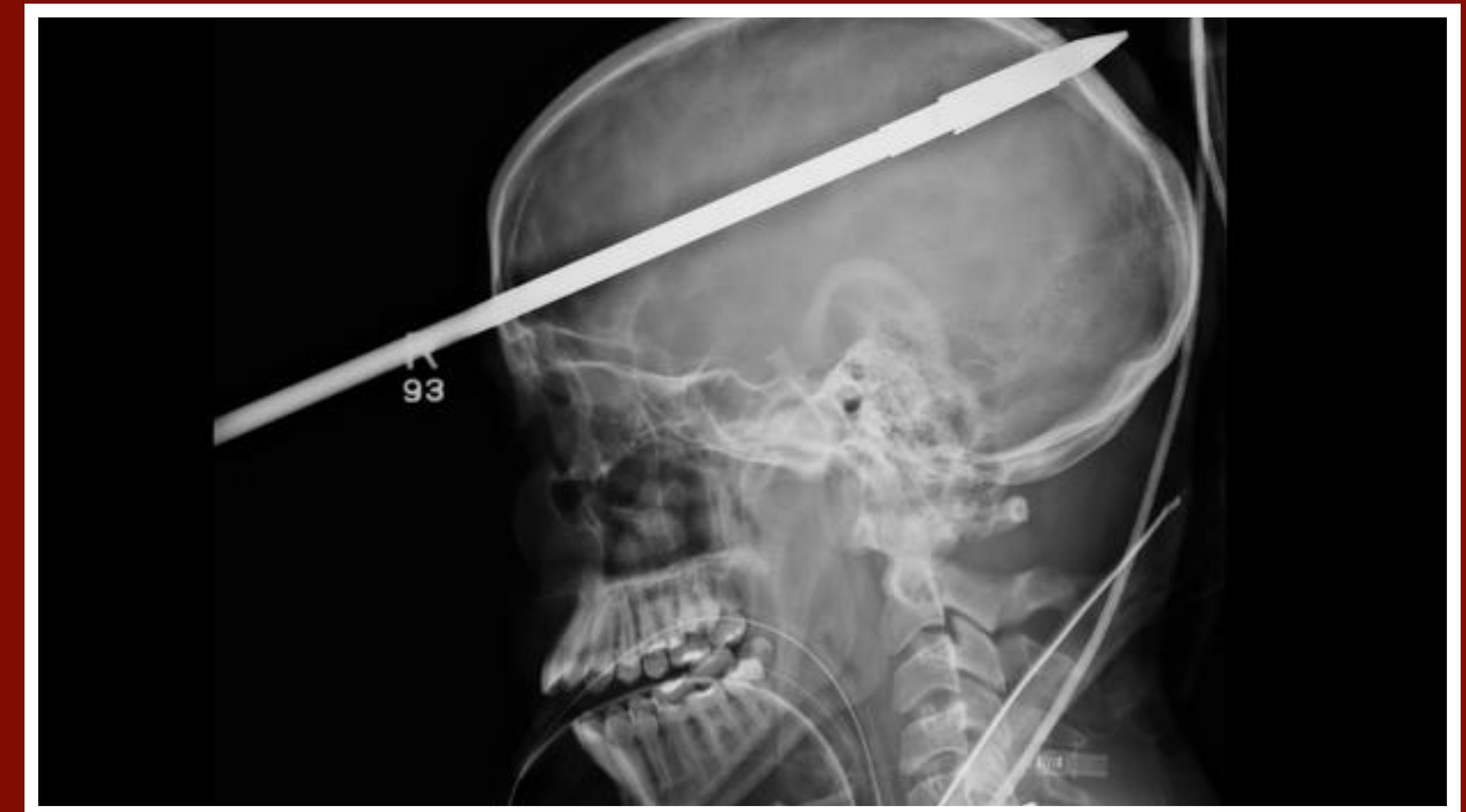
# Keep the ICP Low

- Use Gravity - Reverse Trendelenburg
- Adequate Sedation
- Adequate Pain Control
- Number 1 issue observed by Flight Teams:
    - *Not enough sedation and pain control*
- Role of Hypertonic Saline/Mannitol in RURAL facilities….
    - Maybe: For the pupil that blows in front of you.
    - Talk to your Recv'ing Surgeon



# Seizure Prophylaxis

- ICB’s with GCS < 10
- Penetrating TBI’s
- Depressed Skull Fractures



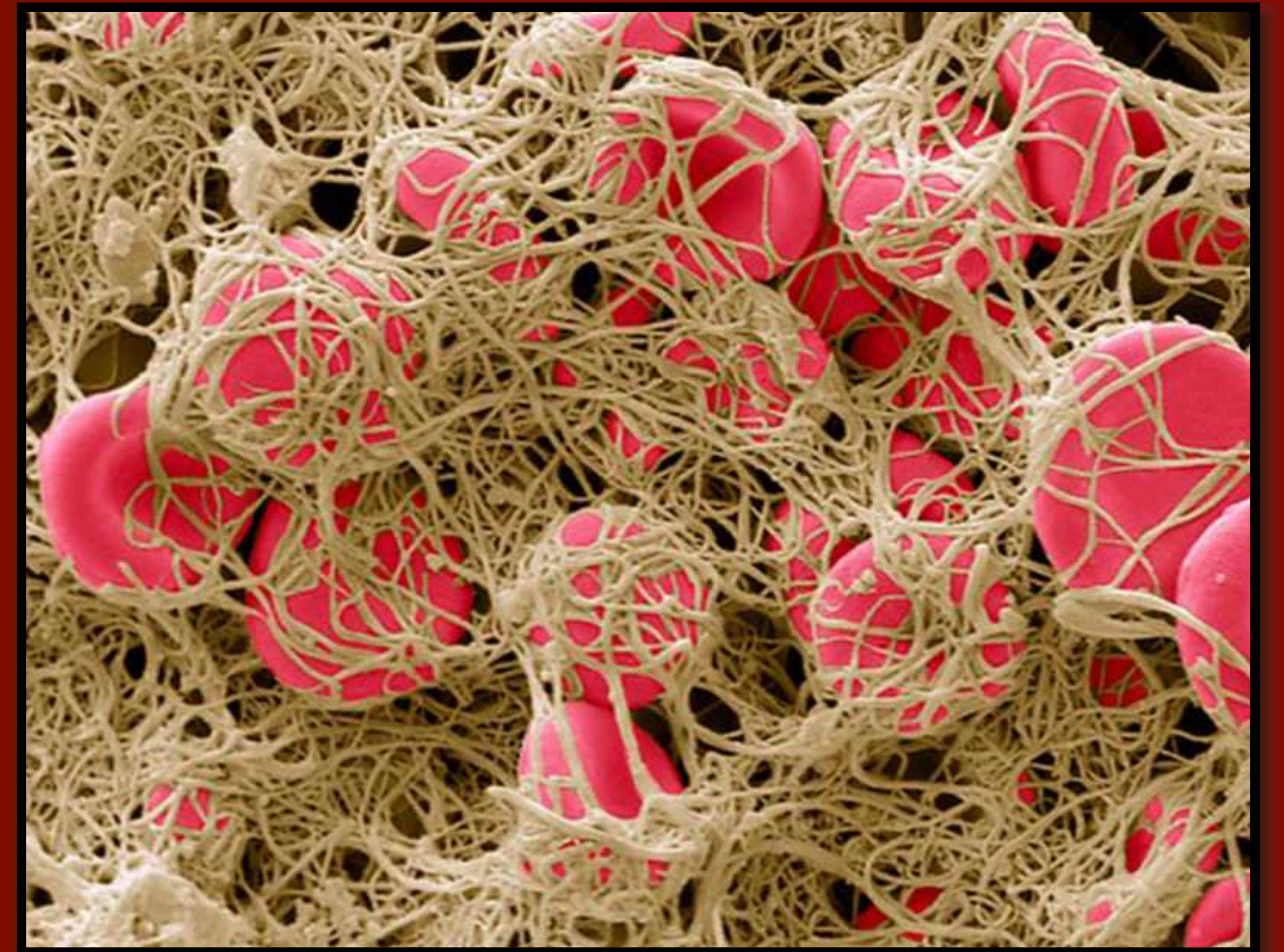

**Levetiracetam (Keppra) 20mg/kg (2 Gram load)**

# Reverse Coagulopathy

- What about Aspirin and Clopidogrel (Plavix)?
    - Give DDAVP
- What about Coumadin and 10-a Inhibitors?
    - 4 Factor PCC - KCentra
    - For Coumadin, give Vitamin K 10mg slow IV also
- *Well, what about TXA?  It's good for hemorrhagic shock, right?!*

# TXA, the wonder drug!

- Fibrin forms a mesh to hold clot together
- Tissue hypo-perfusion releases tissue plasminogen activator
- TXA inhibits plasminogen —> Maintains clot integrity.
- Must be given WITHIN 3 hours of injury
- TISH-2 Trial: *NON*-traumatic ICH.  No benefit in hematoma expansion. Some benefit in early 7 day mortality.

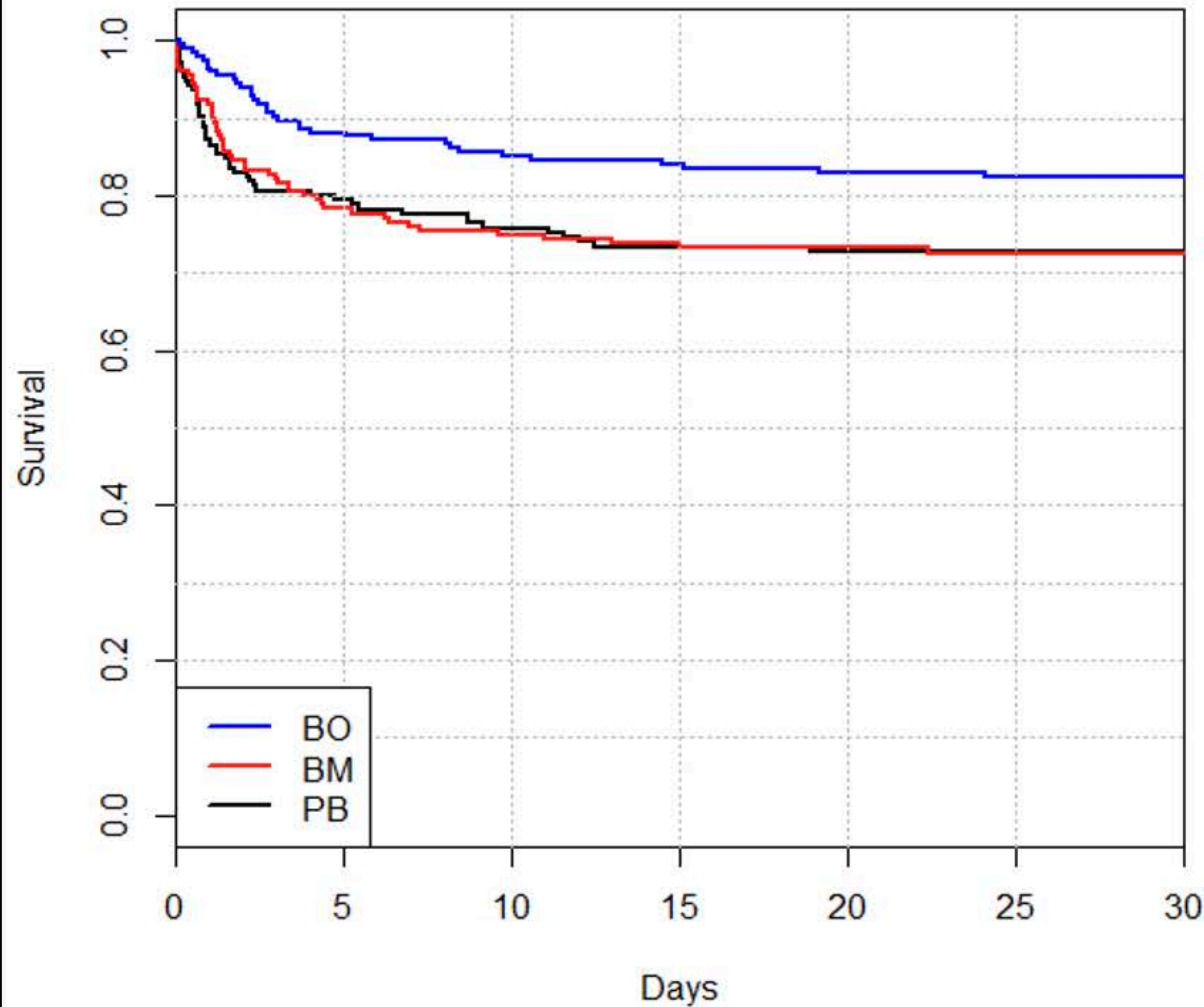


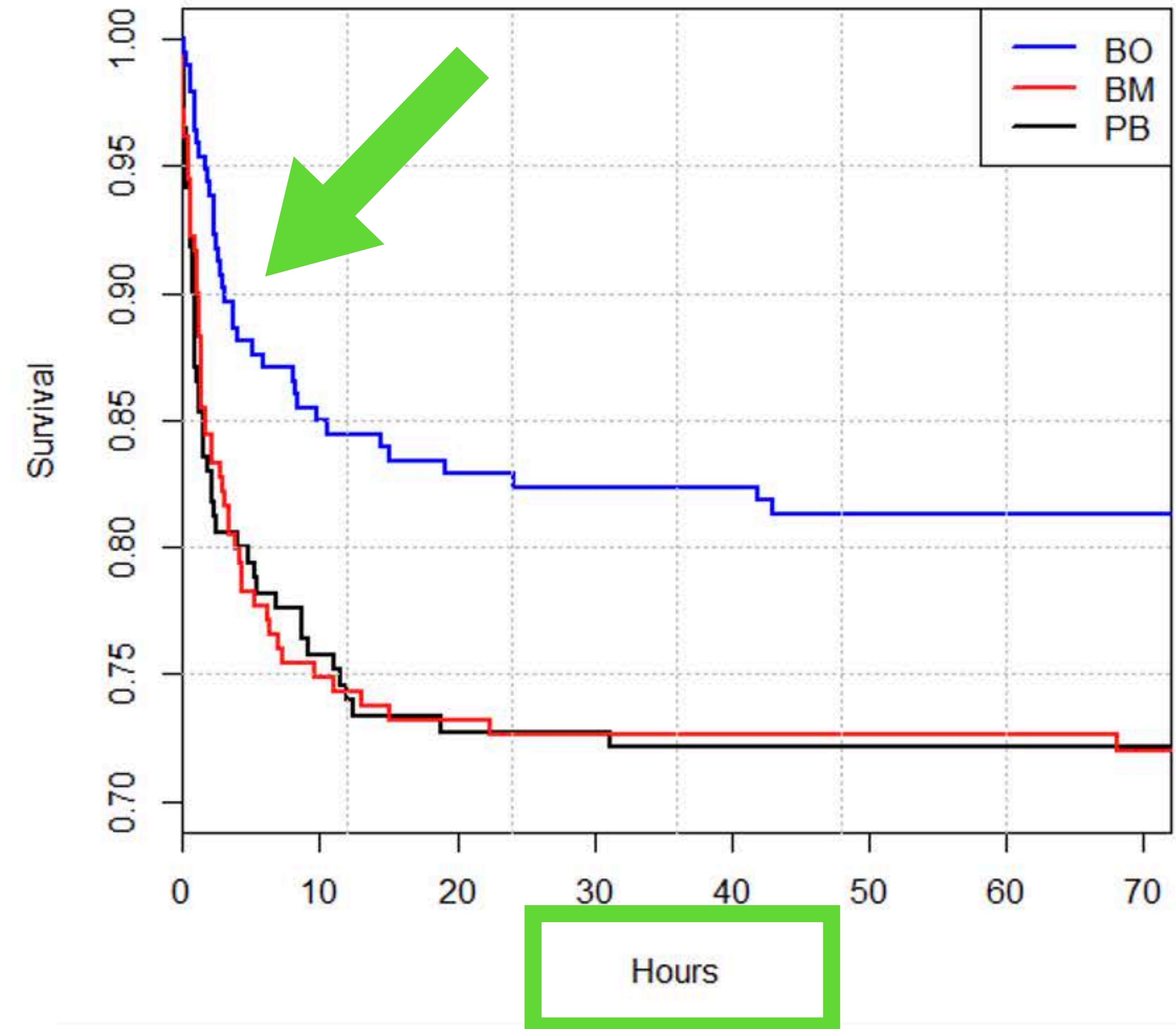
# TXA - the wonder drug!

- *"CRASH 3"* — Published 2019; 175 hospitals; 29 countries; 12,737 pts.
  - Trend to benefit in ISOLATED mild-mod CHI pts with GCS 9-15.
- Rowell, et.al. 2020. *Pre-Hospital use of TXA in Moderate CHI*.
  - Bolus + Maintenance (1gm+1gm/8) vs. Bolus Only (2gm)
  - Odds Ratio for 28 day survival better - Bolus ONLY group

**Rowell, S et.al.; JAMA 2020; 324 (10) 961-974**

# TXA - the wonder drug!



# TXA - the wonder drug!

- TXA can be given with little harm
- TXA can be given as a 2 gram bolus
- TXA is more beneficial if given early within 1 hour of injury
- 2 gms prehospital TXA results in improved 28 day survival in pts with Traumatic ICH.
- RURAL APPLICATION:
  - EMS Administration (long transport times)
  - ED Administration (2gm - no drip is easy!)

# Take Home

- Appreciate the challenge our RURAL colleagues face on a daily basis!
- Appreciate BIG and how it affects TBI Transfers
- Prevent Secondary Injury!
- Get out and visit Rural Oregon!

Questions ?