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Intravenous and Oral Tranexamic Acid are Equivalent at Reducing Blood Loss in Thoracolumbar Spinal Fusion: A Prospective Randomized Trial Phase 2

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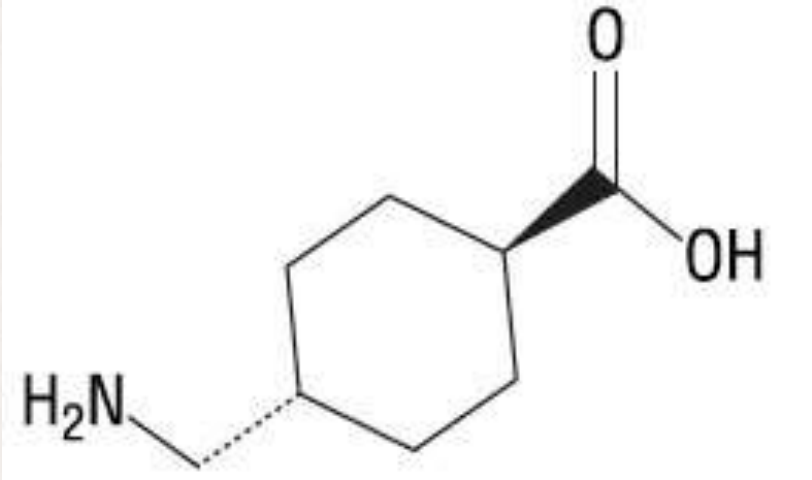
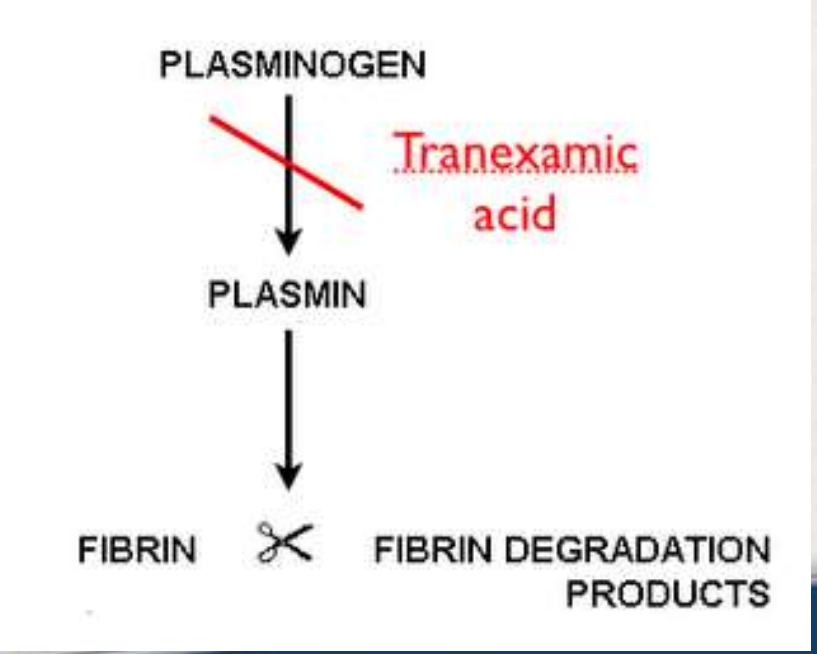
Background

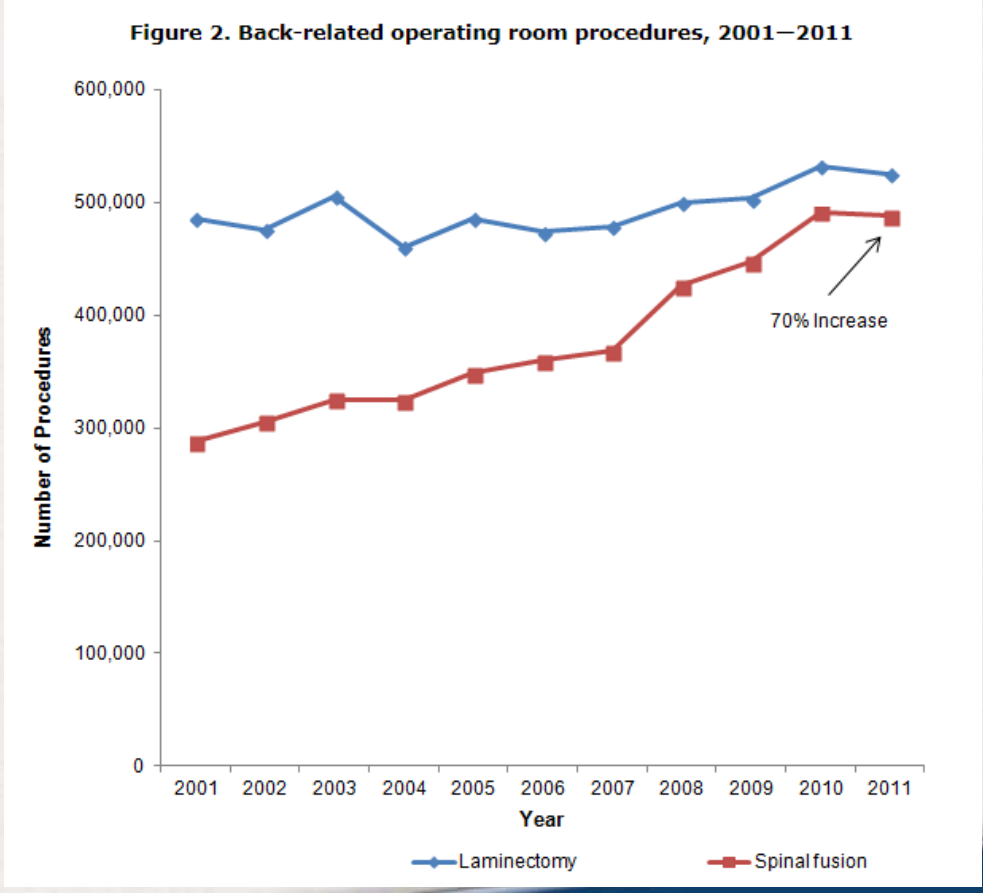
- Tranexamic acid (TXA) is a synthetic antifibrinolytic that prevents fibrin breakdown by binding to plasminogen, thus stabilizing the fibrin clot.[1]
- Intraoperative use of TXA has proven to be effective in reducing transfusion requirements after spinal fusion.[2,3]





Background

- TXA can be administered orally, topically, or IV.
- IV TXA costs $47-$108 per dose depending on formulation.[10]
- Oral TXA is both cheaper and easier to administer than IV.
- There are currently no prospective studies investigating equivalence between IV and PO TXA in spinal fusion surgery.



Methods

- PO TXA: 1950mg (3 tablets) 2 hrs before incision
- IV TXA: 1g (in 100mL NS) bolus before incision and 1g before closure
- 2 surgeons: G.G. performed majority of surgeries (95%)
- Revision cases: 63% of total
- Exclusion criteria: known allergy to TXA, history of renal failure or kidney transplant, history of arterial thromboembolic event (eg. myocardial infarction, stroke) within the past year, placement of an arterial stent within the past year, a history of thromboembolic event, coagulopathy, or refusal toreceive blood products.

A randomized, controlled trial

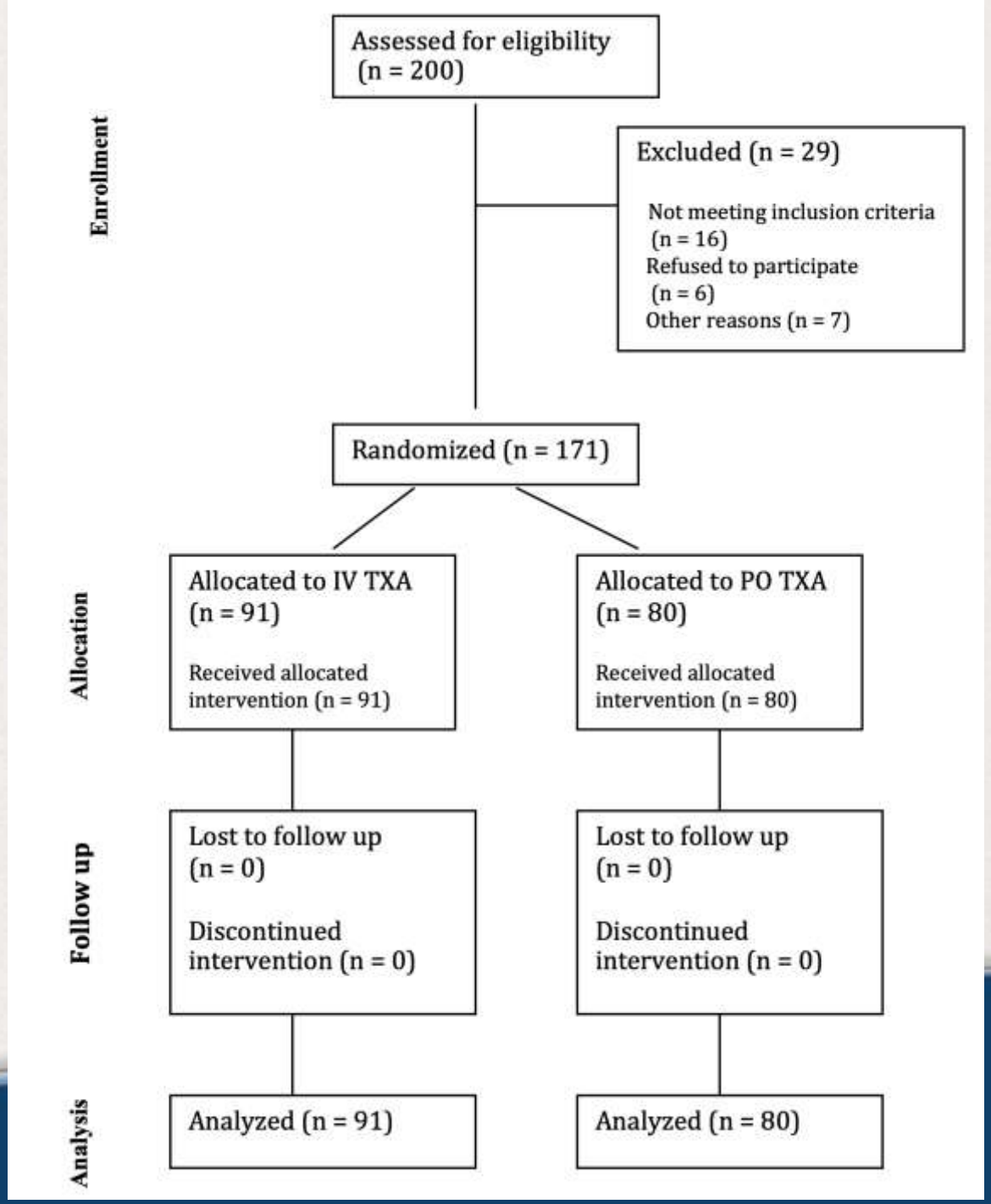


Table 1. Patient characteristics

	IV	PO	P*
Number of patients	91	80	
Mean age (yr)	64 (13)	60 (13)	0.02
Sex (M/F)	40/51	34/46	0.85[a]
Weight (kg)	85 (20)	92 (21)	0.02
Height (m)	1.69 (0.10)	1.69 (0.11)	0.7
Body mass index	29.4 (6.0)	32.1 (5.8)	0.003
Estimated blood volume (mL)	4903 (941)	5107 (1035)	0.18
ASA	2.7 (0.5)	2.8 (0.5)	0.67
Class I (n)	0	1	
Class II (n)	24	19	
Class III (n)	64	60	
Class IV (n)	3	0	
Number of fused levels	3.8 (3.0)	3.6 (2.9)	0.82
1-2 levels	42	42	
3-5 levels	27	21	
>5 levels	22	17	
Number (%) of revisions	59 (65%)	49 (61%)	0.63[a]
Number (%) of interbody fusions	9 (10%)	19 (24%)	0.01[a]
Number (%) of osteotomies	13 (14%)	12 (15%)	0.90[a]
Number (%) of anticoagulant use	11 (12%)	2 (5%)	0.19[a]
Preoperative Hgb (g/dL)	13.2 (1.5)	13.3 (1.7)	0.54
Preoperative Hct (%)	39.4 (4.5)	39.9 (5.1)	0.48
Preoperative platelet count ($x10^3/mm^3$)	208 (58)	254 (72)	<0.001
Preoperative INR	1.09 (0.14)	1.06 (0.19)	0.39
Preoperative creatinine (mg/dL)	0.99 (0.82)	0.94 (0.87)	0.7

Mean (SD)

*Statistical analysis for comparison between groups: $P < 0.05$, statistical significance

[a]x^2 test or Fisher exact test.

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Results

Table 2. Intraoperative measures

	IV (N=91)	PO (N=80)	P*
Anesthesia time (min)	360 (109)	357 (109)	0.86
Surgical time (min)	261 (106)	265 (106)	0.79
Estimated blood loss (mL)	350 (50, 3000)	325 (40, 2300)	0.83[b]
Intravenous fluid (mL)	3198 (1589)	3387 (1610)	0.44
Number (%) receiving cell saver	29 (32%)	29 (36%)	0.55[a]
Number (%) receiving blood transfusion	8 (9%)	3 (4%)	0.18[a]

Mean (SD)

EBL presented as median (min, max) due to nonparametric distribution.

*Statistical analysis for comparison between groups: $P < 0.05$, statistical significance.

[a]x^2 test or Fisher exact test.

[b]Wilcoxon sum run test.

Results

Table 3. Outcome measurements

	IV (N=91)	PO (N=80)	P*
Hgb drop (g/dL)	3.48 (1.85)	3.19 (1.54)	0.004[c]
Calculated blood loss (mL)	1274 (688)	1206 (622)	0.001[c]
Hct drop (%)	10.3 (5.6)	9.7 (5.7)	0.003[c]
Drain output (mL)	637 (459)	641 (491)	0.95
Rate of postop transfusion	23%	13%	0.07[a]
Rate of DVT/PE	2%	3%	0.90[a]
Rate of infections	3%	4%	0.41[a]
Length of hospital stay (days)	4.5 (3.2)	3.8 (2.7)	0.11

Mean (SD)

*Statistical analysis for comparison between groups: $P < 0.05$, statistical significance.

[a] x^2 test or Fisher exact test.

[c] Welch two one-sided test: $P < 0.05$ demonstrates equivalence between treatments.

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Discussion

- PO TXA has been shown to be equivalent to IV in total joints literature
- First study comparing PO and IV TXA in thoracolumbar fusions
- Use of oral TXA in spinal fusion surgery could provide substantial savings to the healthcare system
- At least $20 million per year of saving

Limitations

- Heterogeneity in patient diagnosis and surgical technique/approach
- Hgb change was based on lowest recorded post-operative hgb, which could be affected by hemodilution
- No placebo group and assumed PO TXA was superior than placebo

Summary

- Oral TXA is equivalent to IV TXA in preventing blood loss and hemoglobin drop in spinal fusion surgery.
- There is no significant difference in drain output, post-op transfusions, DVT/PE, or infections when using IV or PO TXA.
- Oral TXA is a viable, more cost-effective alternative to IV TXA to prevent blood loss in spine surgery.

Future Directions

- Ongoing trial to collect a larger cohort to perform adequately powered sub-group analysis

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Thank you

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