

# Contenimento intraoperatorio delle perdite ematiche: tecnica chirurgica emostatici sistemici e topici

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MILANO, PALAZZO STELLINE

**ORTHOPEA 2022**



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Both optimists and pessimists contribute to society. The optimist invents the aeroplane, the pessimist the parachute.

George Bernard Shaw



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LITTERATURE REVIEW

02

GROUP EXPERIENCE

03

PERSONAL EXPERIENCE



# LITERATURE REVIEW

## ERAS vs (*complex?*) SPINE SURGERY

Enhanced Recovery After Surgery

*Multidisciplinary set of evidence-based interventions to reduce morbidity and accelerate postoperative recovery*



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# LITERATURE REVIEW

## ICU ADMISSION


Fluid overload

Postoperative vasopressor medications.

*Postoperative anemia*

### **Incorporation of Blood and Fluid Management Within an Enhanced Recovery after Surgery Protocol in Complex Spine Surgery**

Hana Yokoi, MD<sup>1,2</sup> , Vikram Chakravarthy, MD<sup>1</sup>, Robert Winkleman, MD<sup>1,2</sup>,  
Mariel Manlapaz, MD<sup>3</sup> , and Ajit Krishnaney, MD<sup>1</sup>

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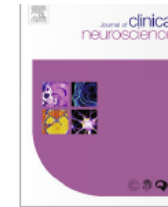
# LITERATURE REVIEW



Contents lists available at [ScienceDirect](#)

Journal of Clinical Neuroscience

journal homepage: [www.elsevier.com/locate/jocn](http://www.elsevier.com/locate/jocn)



Clinical Study

The effect of blood transfusion on short-term, perioperative outcomes in elective spine surgery

Andreea Seicean<sup>a,b</sup>, Nima Alan<sup>a,\*</sup>, Sinziana Seicean<sup>c,d</sup>, Duncan Neuhauser<sup>b</sup>, Robert I. Weil<sup>e</sup>

For elective spine surgeries, even one unit of packed red blood cells (RBC) or whole blood was associated with longer hospital length of stay (LOS) and morbidity when controlling for preoperative hematocrit and comorbidities<sup>5</sup>.

## BLOOD LOSS CONTROL



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# LITERATURE REVIEW

## Factors affecting blood loss

BMI ●

Underlying pathology / vascularity of the tissue ●●

Patient positioning (pressure on V. cava) ●

Type of procedure ●●

Surgical technique (?atraumatic → less traumatic) ●

Extent of approach ●●

Bone resection/harvesting/decortication ●

Duration of surgery ●



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# GROUP EXPERIENCE

	BLOOD LOSS	IDIOPATHIC DEFORMITY
0-500	290/709 (41%)	
500-1000	260/709 (36%)	
1000-2000	127/709 (19%)	
> 2000	32/709 (4%)	

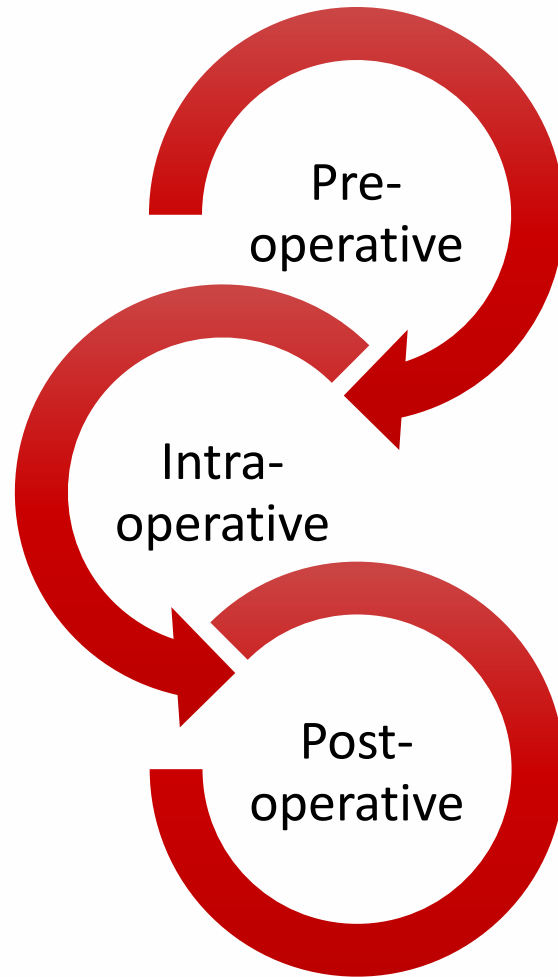
	BLOOD LOSS	IDIOPATHIC DEFORMITY
0-500	0/42	
500-1000	4/42 (9%)	
1000-2000	22/42 (52%) ●	
> 2000	16/42 (38%) ●	

	BLOOD LOSS	DEGENERATIVE DEFORMITY
0-500	240/507 (47%) ●	
500-1000	119/507 (23%)	
1000-2000	86/507 (17%)	
> 2000	62/507 (13%) ●	





# Peri-operative „Blood Saving“



- Stop platelet-aggregation inhibitors
- Pre-operative EPO / iron supplementation
- Autologous blood donation

- 
- Surgical technique
  - Hemostatic thrombin/gelatin matrix
  - Antifibrinolytics
  - Hypotension
  - Hemodilution
  - Intraop cell salvage

- 
- EPO
  - Iron supplementation

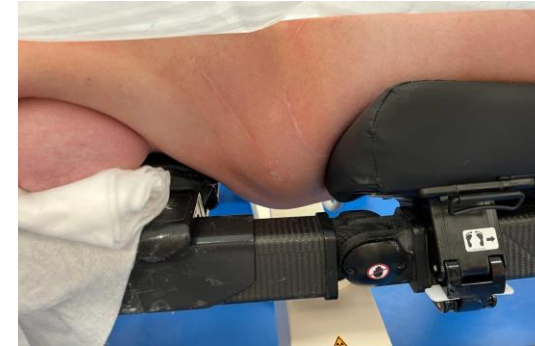


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# PERSONAL EXPERIENCE

## Surgical technique



# PERSONAL EXPERIENCE

## Surgical technique



- Less traumatic technique
- Meticulous hemostasis
- Decortication at the end
- Surgical time (more blood loss towards end of procedure)

Game changer:

- Surgical time
- Hypotension
- Bone scalpel
- FloSeal



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# Surgical technique

## The Volume–Cost Relationship: How Does Surgical Volume Affect Cost and Value in AIS Surgery

Vishal Sarwahi <sup>1</sup>, Elaine Tran <sup>1</sup>, Rushabh Vora <sup>1</sup>, Thomas J Dowling 3rd <sup>1</sup>, Jesse Galina <sup>1</sup>, Jordan Fakhoury <sup>1</sup>, Yungtai Lo <sup>2</sup>, Terry Amaral <sup>1</sup>, Jon-Paul DiMauro <sup>1</sup>, Sayyida Hasan <sup>1</sup>

**Conclusion:** HV surgeons had significantly lower operative times, lower estimated blood loss and transfusion rates and lower perioperative complications requiring readmission or return to emergency department resulting in lower health care costs.

> Spine Deform. 2020 Jun;8(3):447-453. doi: 10.1007/s43390-020-00049-w. Epub 2020 Feb 5.

## A dual-team approach benefits standard-volume surgeons, but has minimal impact on outcomes for a high-volume surgeon in AIS patients

Vishal Sarwahi <sup>1</sup>, Jesse Galina <sup>2</sup>, Stephen Wendolowski <sup>2</sup>, Jon-Paul Dimauro <sup>2</sup>, Marina Moguilevich <sup>3</sup>, Chhavi Katyal <sup>3</sup>, Beverly Thornhill <sup>3</sup>, Yungtai Lo <sup>4</sup>, Terry D Amaral <sup>2</sup>

0.05). Levels fused, fixation points, anesthesia and surgical times were similar ( $p > 0.05$ ). When the standard-volume surgeon operated with a second surgeon, radiographic parameters were similar ( $p > 0.05$ ), but anesthesia time, surgical time, and hospital length of stay were significantly shorter ( $p < 0.05$ ). Additionally, DJ had significantly shorter anesthesia and operative times ( $p < 0.001$ ) and length of stay ( $p < 0.001$ ) compared to S2.

**Conclusion:** Standard-volume surgeons have better outcomes with a dual surgeon approach. Junior surgeons benefit operating with an experienced surgeon. A high-volume surgeon, however, does not benefit from a dual surgeon approach.



# Hypotensive Anesthesia

Gardner 1946

Maintaining MABP at 50 – 65 mmHg

Effective in appropriate patients and in combination with other blood conservation modalities

Decreases blood transfusion by 45% and operating time by 10%

Good end-organ perfusion should be maintained

Relative contraindications:

(Peripheral) Vascular disease

Untreated hypertension

Renal or hepatic dysfunction

## Complications and contraindications

Hypertension

Ischemic disorders:

coronary, cerebral, peripheral.

Neurological damage

Compressed and compromised nerve roots,

Krengel WF Spine 18:306–309

Scoliosis surgery has also been questioned

Grundy BL Anesthesiology 54:249–253

Evoked potential monitoring may show temporary alterations, it does not appear that hypotensive anesthesia increases the risk of neurologic damage

Grundy BL Can Anaesth Soc J 29:452–462



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# Local agents

## Bone wax

Mixture of beeswax (70%) and petroleum jelly (30%).

Purely mechanical

Fusion!, neural compression!

## Thrombotic and antifibrinolytic agents

Gelfoam, absorbable gelatin sponge

Microfibrillar collagen

Oxidized regenerated cellulose hemostat (Surgicel)

Gelatin matrix hemostatic sealant (Proceed)

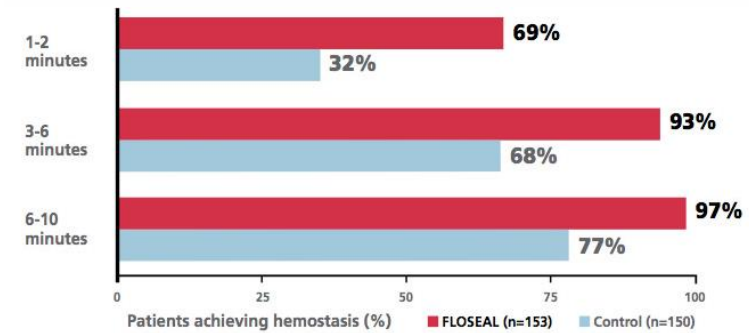
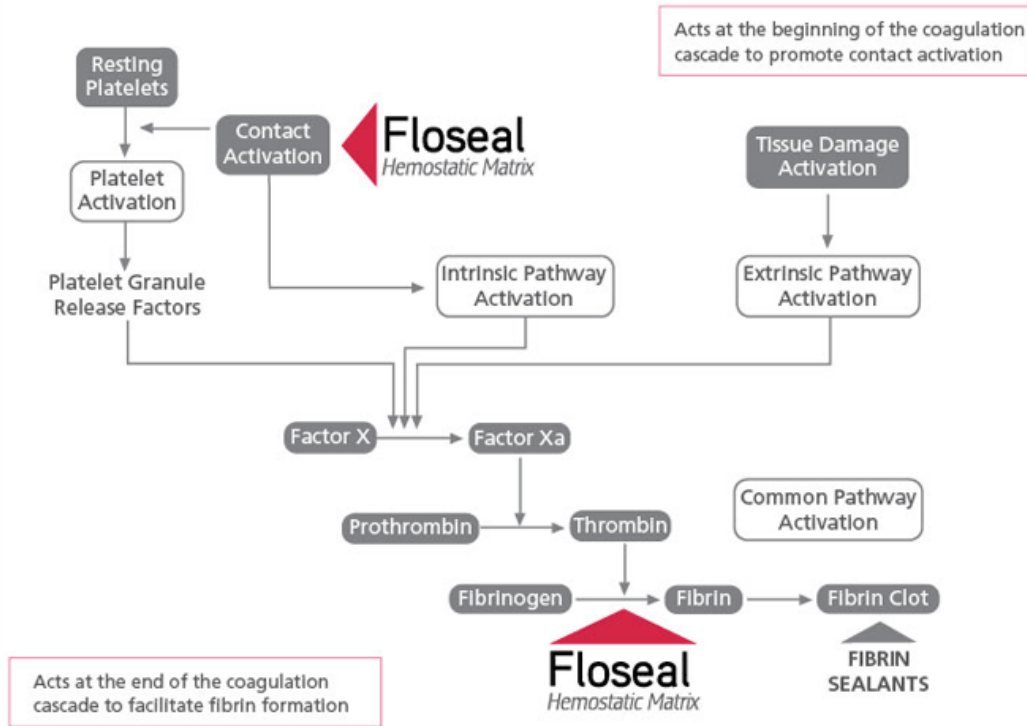
Fibrin glue



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# FloSeal / Surgiflo Hemostatic Matrix



First bleeding site treated per protocol analysis.

N=309; Cardiovascular/Vascular/Spine-Orthopedic Surgery

\*Six (6) patients, 3 in the FLOSEAL group and 3 in the Control group, were excluded because of protocol deviations in measuring hemostasis for the first treated bleeding site.



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# FloSeal / Surgiflo Hemostatic Matrix

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J Neurol Surg A Cent Eur Neurosurg. 2015 Sep 9. [Epub ahead of print]

## **Efficacy, Security, and Manageability of Gelified Hemostatic Matrix in Bleeding Control during Thoracic and Lumbar Spine Surgery: FloSeal versus Surgiflo.**

Landi A<sup>1</sup>, Gregori F<sup>1</sup>, Marotta N<sup>1</sup>, Delfini R<sup>1</sup>.

### **⊕ Author information**

radiological follow-up showed no evidence of postoperative hematoma. Conclusions: Comparative analysis of the two products did not show any relevant differences in terms of efficacy and ease of use or their effectiveness in bleeding control. Their use was valid even in patients who used antiaggregant/anticoagulant drugs preoperatively. **Both FloSeal and Surgiflo can be considered good choices for controlling bleeding in spinal surgery.**

Georg Thieme Verlag KG Stuttgart · New York.

Two reports of anaphylaxis:

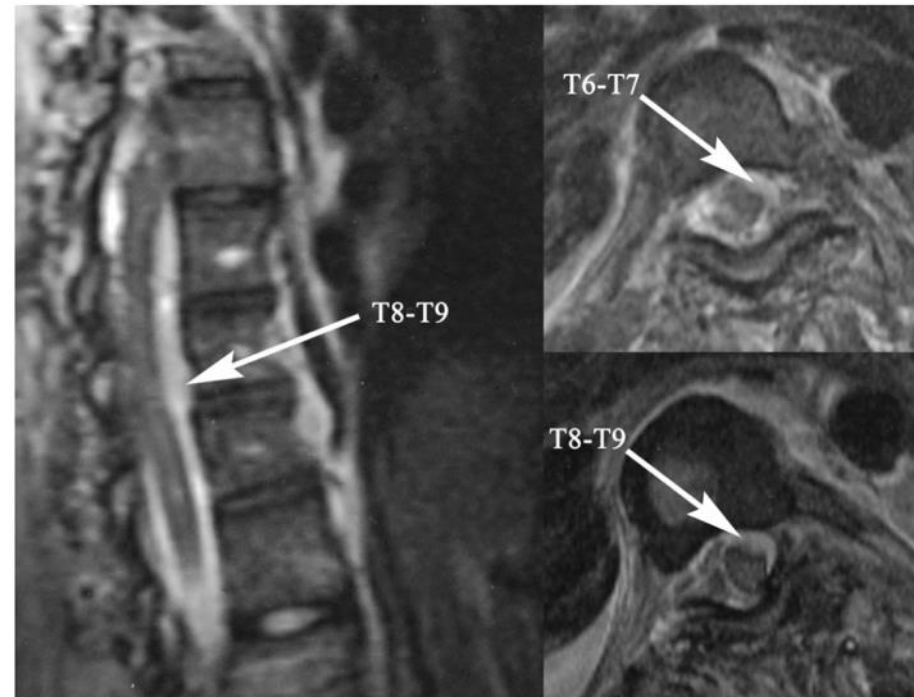
- Spencer et al. Spine J 2012
- Luhmann et al. J Paediatr Orthop 2013



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# FloSeal / Surgiflo Hemostatic Matrix



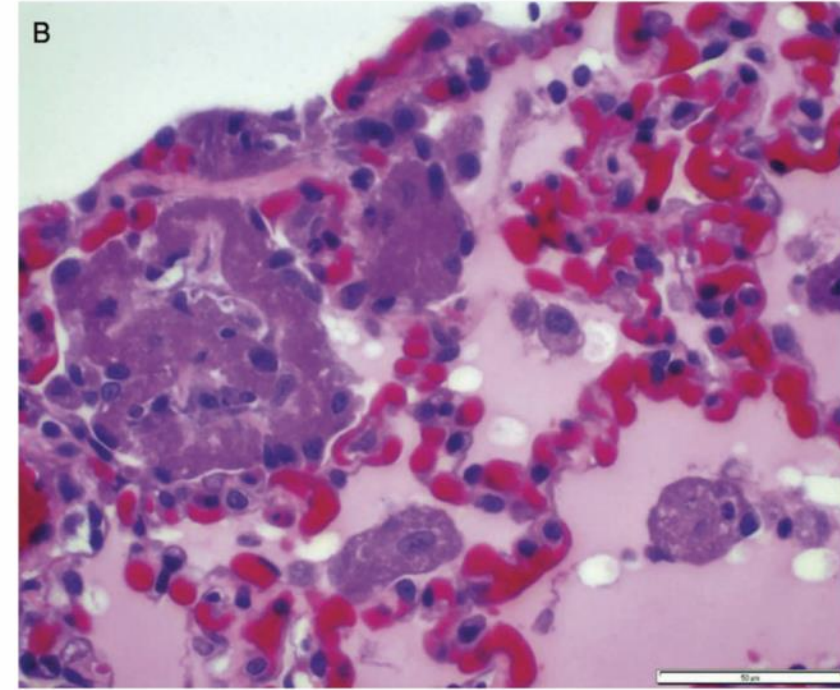
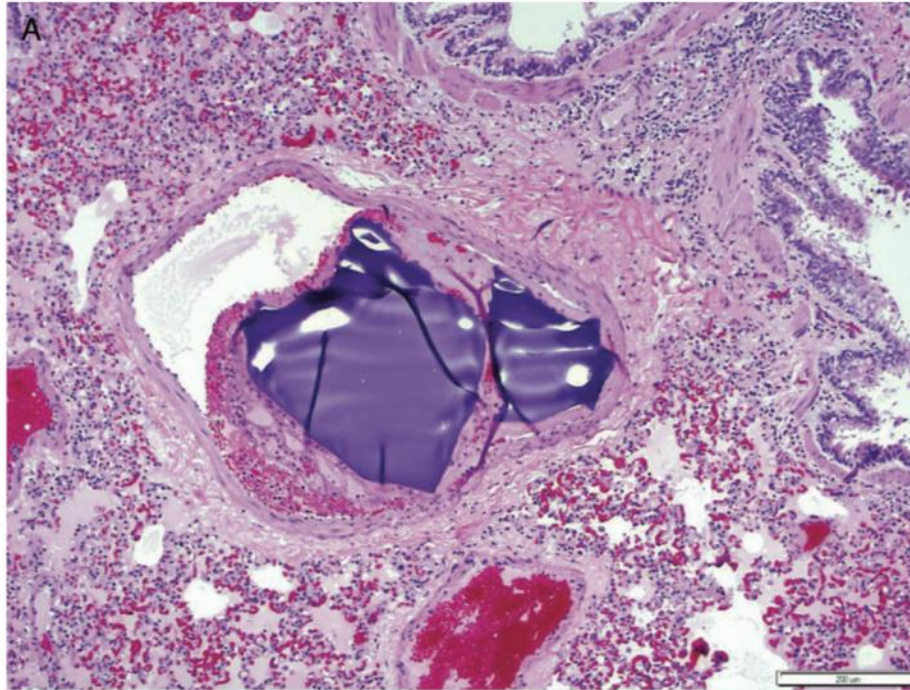
*Buchowski et al. Spine 2009;34:E473-7*



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# FloSeal / Surgiflo Hemostatic Matrix

Injectable hemostatic agents embolize to the lungs when injected into the pedicles for hemostasis during spinal surgery – porcine study



*Kuhns et al. Spine 2015;40:218-25*



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# Antifibrinolytics in scoliosis surgery

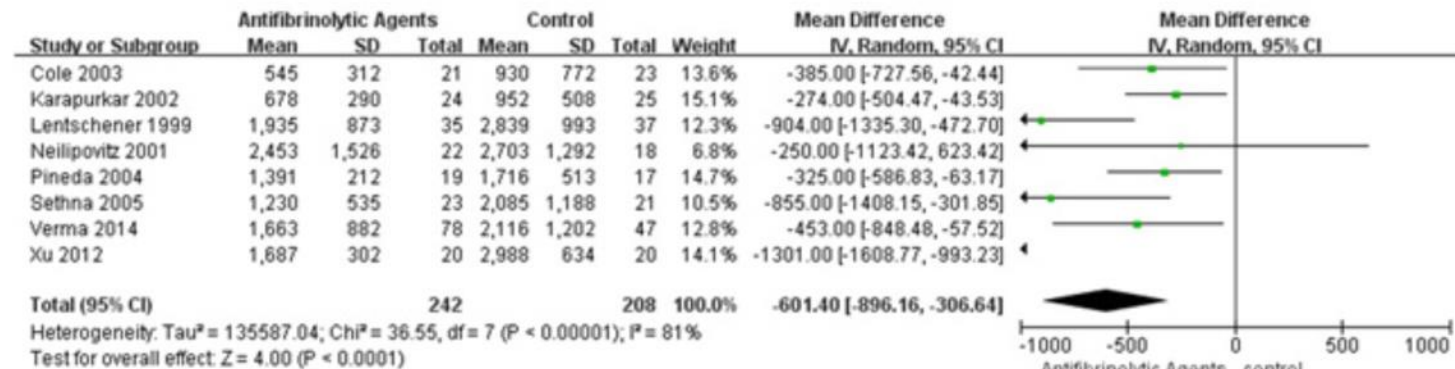
Tranexamic acid (TXA)

Epsilon aminocaproic acid (EACA)

Aprotinin

Meta-analysis

- 18 studies, 1158 patients
- 8 RCTs, 450 patients
- Reduction of blood loss intraop 409 ml
- Reduction of transfusion 474 ml
- Transfusion rate 44.6% vs. 68.3%
- No safety concerns



***Reduction of blood loss in favor of antifibrinolytics!***

Wang et al. PLOS One 2015; DOI 10.1371/journal.pone.0137886



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# Cell salvage: RCT for scoliosis surgery

- Advantages:
  - Lack of viral disease transmission
  - Reduced risk of alloimmunization
  - Normal potassium and lactate levels
- Drawbacks
  - Cost effectiveness vs predonated blood (Reitman et al. Spine 2004;29:1580-3)
- RCT:
  - **Reduction of transfusion rate from 32.7% to 14.5%**
  - Risk of bias due to randomisation concealment

**Table 4** Multivariate regression model predicting transfusion

Predictors	Odds ratio	95 % confidence interval		p values
		Lower limit	Upper limit	
No. of fused segments	1.472	1.125	1.927	0.005
Hemoglobin (pre)	0.901	0.849	0.957	0.001
Cell saver	0.133	0.035	0.498	0.003

# Cell salvage: Cochrane Review

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- 75 randomized trials from 1979 to 2008
- Reduction in allogenic RBC transfusion by 38%
- Orthopaedic surgery: reduction of 54% (cardiac 23%)
- Average saving of 0.68 units RBC per patient
- Majority of studies small with less than 60 patients, possibly publication bias



# Cell salvage: Risks and cost-benefit

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## Risks:

Bacterial contamination

Air embolism

Nephrotoxicity

Coagulation disorders

(Faught 1998, Huet 1999, Semmens 2000, Spahn 2000)

## Cost-effective?

Net benefit of £112-359 per patient

Could result in net reduction of 6500 to 320'000 units per year in th NHS

# TAKE HOME MESSAGES

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Intraoperative blood saving is a team approach!

Avoid allogenic blood transfusion

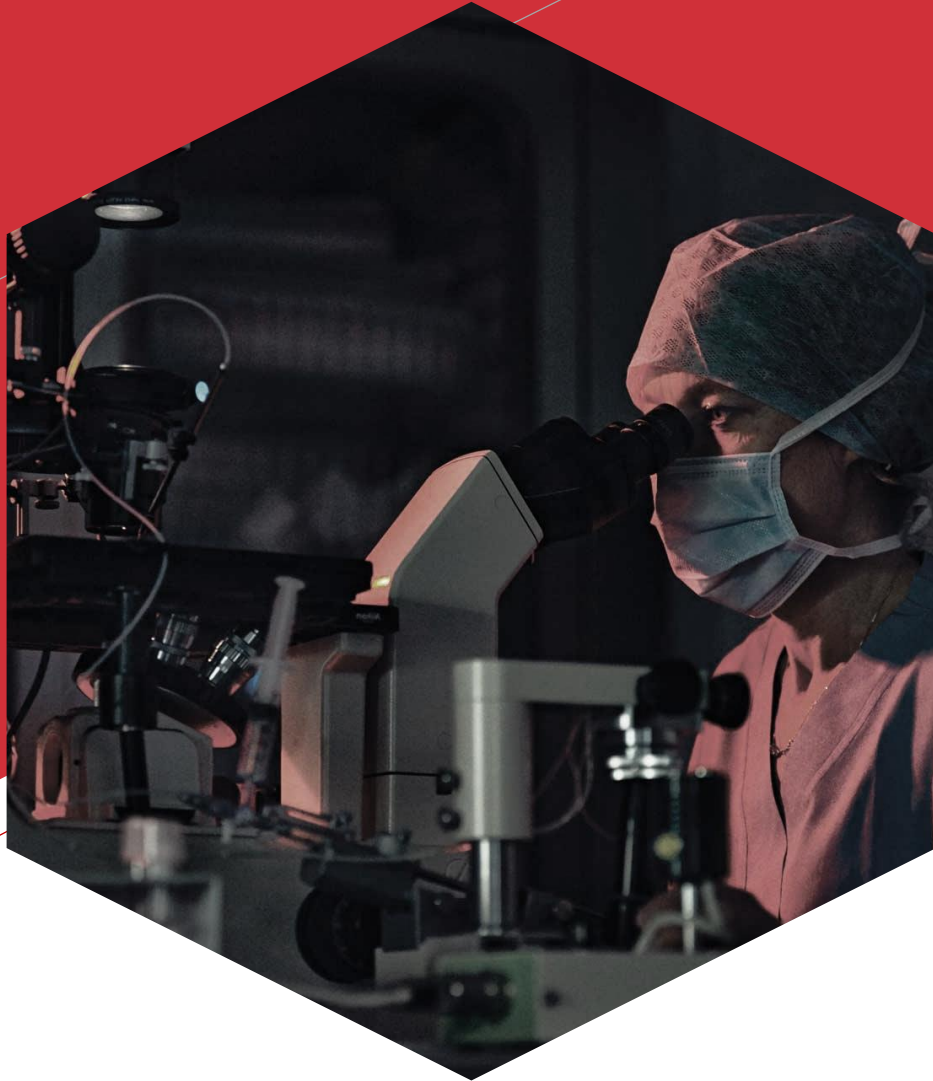
Bone scalpel and hemostatic agents help to reduce blood loss

Good evidence for antifibrinolytics and cell salvage in scoliosis surgery

Combination of mild hemodilution and hypotensive anaesthesia with above measures







**Thank You**



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## E PER FINIRE...

*Moderatori: Andrea Luca, Claudio Roscitano*

- 16.15 - 16.30      Contenimento intraoperatorio delle perdite ematiche; tecnica chirurgica emostatici sistemici e topici. *Andrea Luca*
- 16.30 - 16.45      Anemia postoperatoria e dimissione. *Paolo Perazzo*
- 16.45 - 17.00      Discussione

