THE USE OF “GLUES” FOR HERNIA REPAIR

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OPTIONS FOR MESH FIXATION IN HERNIA REPAIR

- Tackers/staples
- Stitches
- Fibrin glue/Fibrin sealant
- Self-sticking mesh (e.g. parietex progrip mesh)
- No Fixation

Mesh fixation prevents graft displacement with consequent hernia recurrence

COMPLICATIONS OF HERNIA REPAIR INCLUDE

- Hernia recurrence
- Bleeding and haematomas
- Chronic unexplained pain
- Sensory nerve entrapment with neuralgia
- Mesh sepsis

- **As a result of complications associated with mesh fixation with tackers, efforts have been directed at looking for an alternative method with less complications**

FIBRIN GLUE

- Also called fibrin sealant
- Commercial tissue adhesive
- Contains fibrinogen and thrombin
- It is a two component system from human plasma

FIRST COMPONENT

- Highly concentrated fibrinogen
- Fibronectin
- Traces of other proteins

SECOND COMPONENT

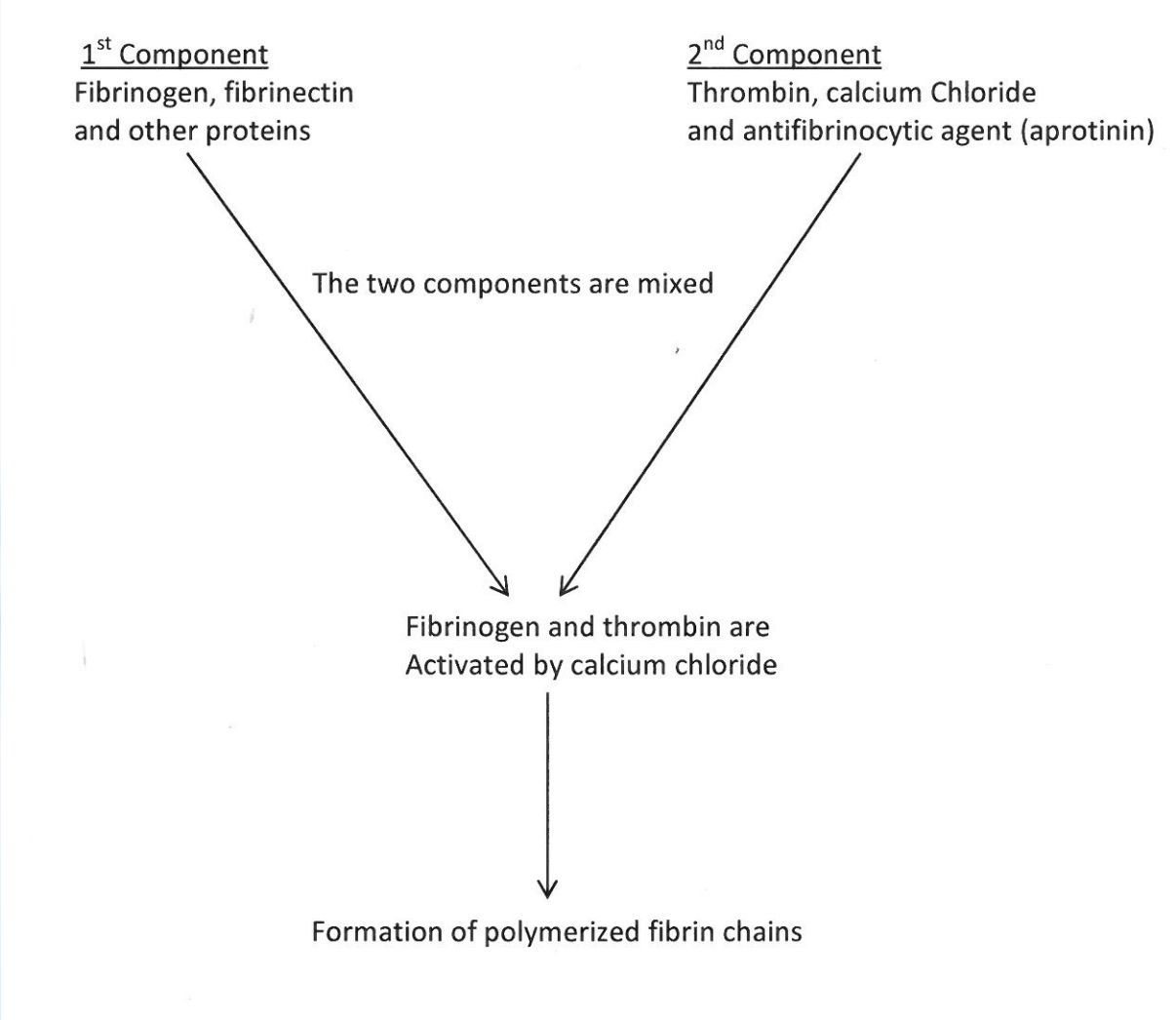
- Thrombin
- Calcium chloride
- An antifibrinolytic agent such as aprotinin

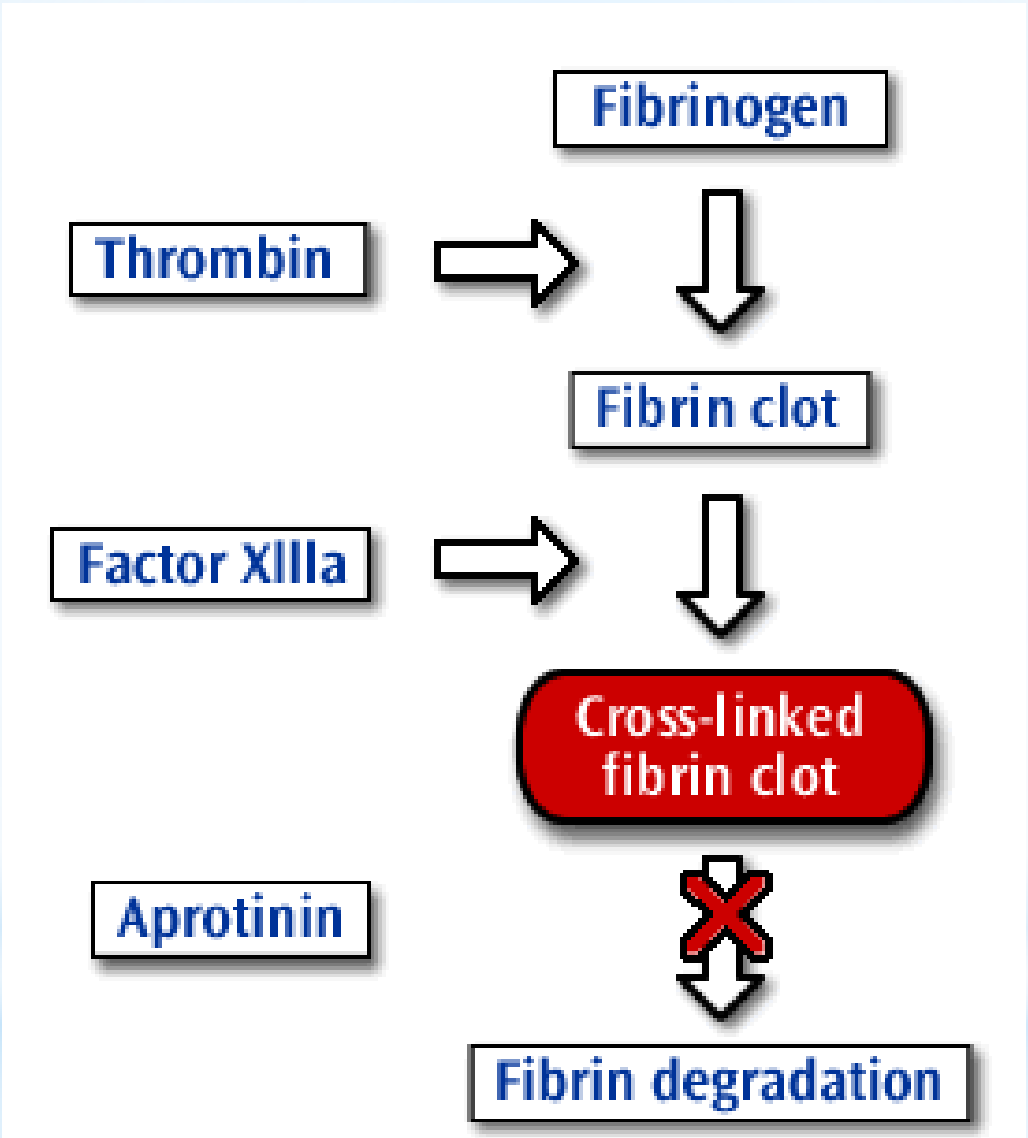
- **Fibrinogen is the most important component because the tensile or adhesive strength correlates directly with the fibrinogen content**
- **Thrombin is the second most critical component. The rapidity of clot formation and the tensile strength of fibrin seal is a function of concentration of thrombin used to initiate the process**

THROMBIN CONCENTRATIONS

- When rapid clot formation (5 to 10 seconds) is desired, thrombin concentrations of 500 to 1000 NIH units should be used (e.g. Tisseel, Evicel)
- If slower clot formation is desirable (e.g. plastic surgery procedures) thrombin concentrations of 4 to 10 NIH units should be used

HOW FIBRIN GLUE WORKS




Fibrinogen
Thrombin
Fibrin clot
Factor XIIIa
Cross-linked fibrin clot
Aprotinin
Fibrin degradation

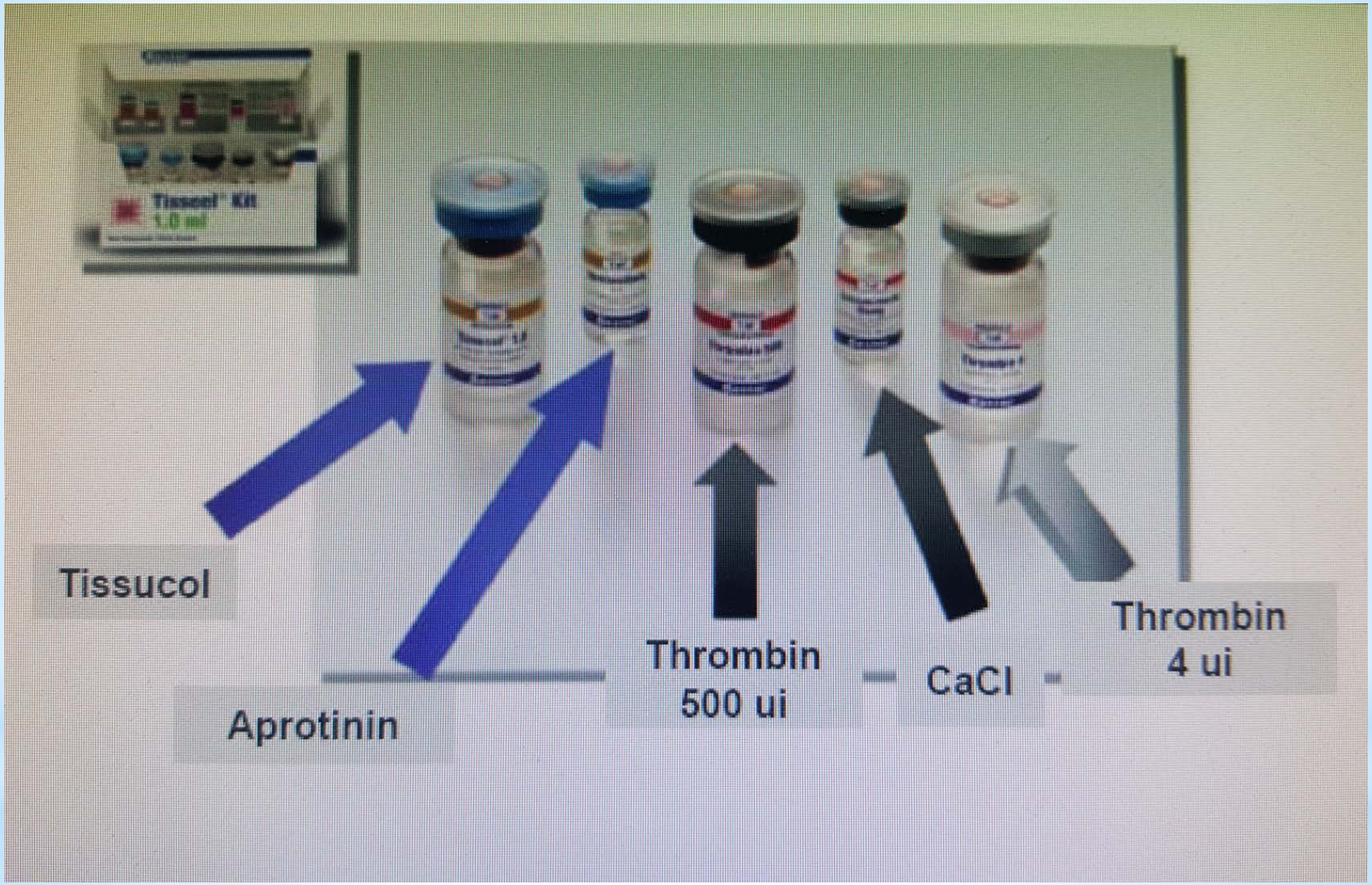
- Following its application, fibrin glue quickly sets to form a white , elastic mass which adheres to the tissue . Fibrinogen is converted to fibrin strands that join into net-like matrices. In the course of wound healing the solidified fibrin sealant is broken down by fibrinolysis and replaced by fibrotic layer
- The chemotactic effect of thrombin enhances fibroblast proliferation and incorporation in the mesh
- Fibrin glue has been found to incite a significantly stronger inflammatory response
- Through its haemostatic effect, it has the advantage of reducing the incidence of haematomas created during dissection and therefore preventing the lifting and displacement of mesh

TECHNICAL CONSIDERATION

- The fibrinogen and thrombin components are kept separate prior to application
- Fibrin sealant is applied using a two-syringe technique
- Some commercial products (e.g. Tisseel and Evicel) come fully mixed and assembled in dual syringe applications – require a brief period of thawing
- In the operating room, the fibrinogen/factor XIII is thawed if necessary → drawn into one syringe → the thrombin/calcium chloride drawn into the other syringe → needle tip or spray applicator used (depending on the clinical application)

PHYSICAL PROPERTIES OF FIBRIN GLUE

- Completely biodegradable within 6 weeks
- No foreign body reaction
- Adequate mechanical stretch properties
- Contains no toxic substances
- Underlying principle is that it mimics the natural stages of the coagulation process
- It is manufactured using stringent donar and blood donar screening protocols and validated production process, including viral inactivation procedures and quality control of each batch


Tissucol
Aprotinin
Thrombin
500 ui
CaCl
Thrombin
4 ui


TISSEEL
[Fibrin Sealant]
For Topical Use Only


Baxter
For Topical Use Only

Maximum size of the area to be sealed	*Required package sizes of fibrin sealant*
4 cm^2	0.5 ml
8 cm^2	1.0 ml
16 cm^2	2.0 ml
40 cm^2	5.0 ml

CONTRAINDICATONS TO ITS USE

- History of anaphylactic reactions to plasma products
- Patients with IgA deficiency
- Should never be injected intravenously (causes thrombosis)

- **The use of cyanoacrylate glue as an alternative for mesh fixation has been described**
- **However local toxicity and carcinogenic effect have been reported in some studies**
- **To date, no transmissible viral disease secondary to fibrin glue has been reported**

EVIDENCE SUPPORTING THE USE OF FIBRIN GLUE

- **N.Kathouda et al concluded that adequate mesh fixation in the extraperitoneal area can be accomplished using fibrin sealant. The method is mechanically equivalent to the fixation achieved by staplers (tackers) and superior to nonfixed grafts. Biologic soft fixation with fibrin sealant will prevent early graft migration and will avoid complications associated with use of staplers**

Table 1. GRAFT MOTION AND TENSILE STRENGTH MEASUREMENTS

	FS (n = 18)	Staples (n = 16)	No Fixation (n = 15)	*P* Value: FS vs. staples	*P* Value: FS vs. no fixation	*P* Value: Staples vs. no fixation
Graft motion (mm)	0 (0–2)	0	5 (0–10)	NS	<.01	<.001
Tensile strength (kg)	0.955 (0.25–3.2)	1.03 (0.09–4.5)	0.46 (0.16–2.64)	NS	<.01	<.01

FS, fibrin sealant.
Results are expressed as median (range).

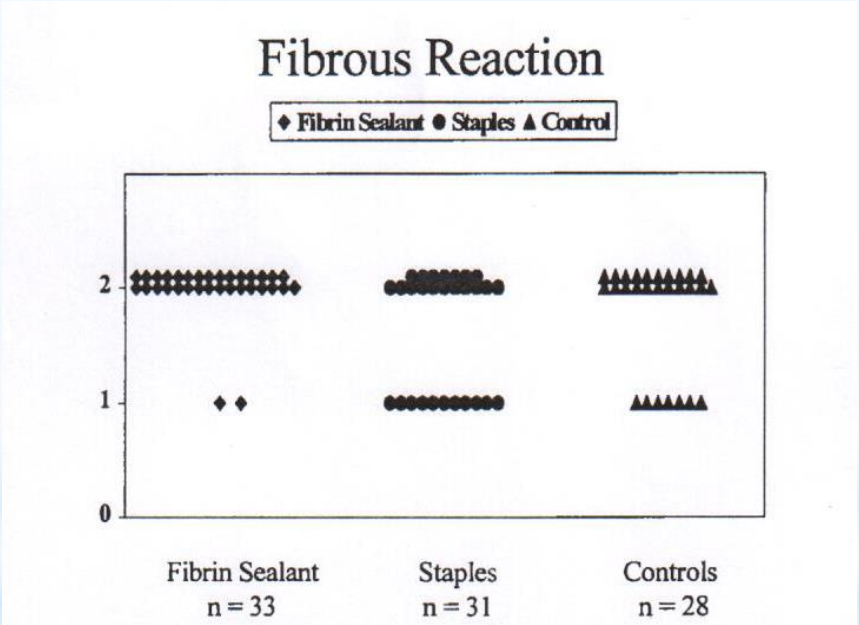


Figure 3. Distribution of the grades of fibrous reaction in the three study groups.

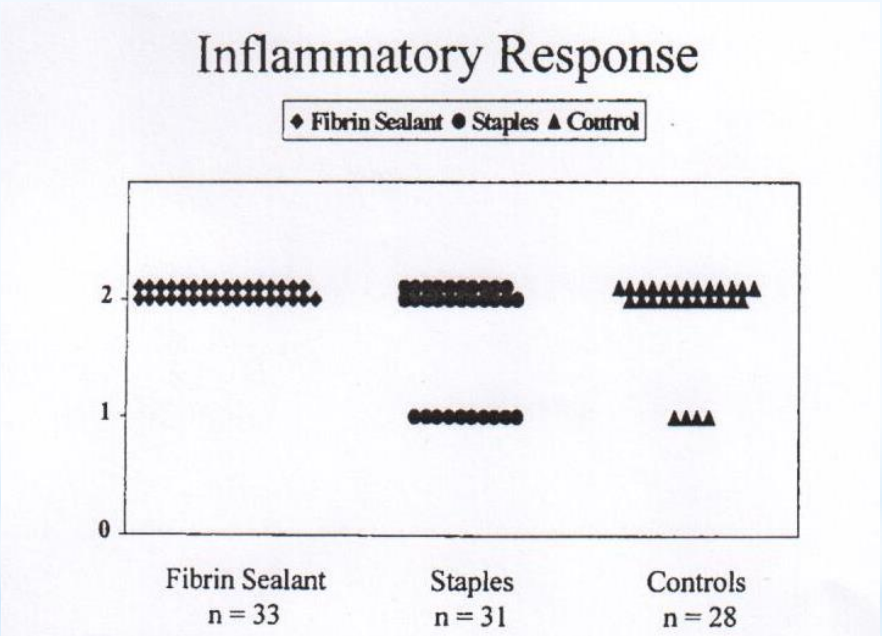


Figure 4. Distribution of the grades of inflammatory response in the three study groups.

Table 2. HISTOLOGIC EVALUATION

	FS (n = 33)	Staples (n = 31)	No Fixation (n = 28)	*P* Value: FS vs. staples	*P* Value: FS vs. no fixation	*P* Value: Staples vs. no fixation
Fibrous reaction*	1.94 ± 0.24	1.61 ± 0.49	1.75 ± 0.44	<.001	<.05	NS
Inflammatory response†	2	1.67 ± 0.47	1.85 ± 0.35	<.01	<.05	NS

FS, fibrin sealant.
Results expressed as the mean score ± SD.
* Grades of fibrous reaction: 1, mostly collagen aggregates, few fibroblasts; 2, mostly fibroblasts, little amount of collagen deposits.
† Grades of inflammatory response: 1, little or no inflammatory response; 2, significant inflammatory reaction (dense lymphoid aggregates).

- **B Novik et al in the first published study on the use of fibrin sealant for mesh fixation in laparoscopic hernia repair in humans concluded that fibrin glue seems to be a reasonable, feasible, and maybe even competitive alternative to the standard tissue penetrating mesh fixation. The results of the study justify launching larger trials**

- **A meta-analysis of 5 randomized controlled trials by Nehal S. Shah et al comparing tissue glue with tack fixation in laparoscopic inguinal hernia surgery depicts a significant reduction in chronic pain with no increase in recurrence rates. Early post operative outcome is similar after both methods of mesh fixation, although larger randomized controlled trials are required, with long-term pain as primary point.**

- **A study by Erwin Reider et al concluded that fibrin glue appears to be an appealing non-invasive option for mesh fixation in laparoscopic ventral hernia repair, but only if appropriate meshes are used. Glue can also serve as an adjunt to mechanical fixation to reduce the number of invasive tacks.**

Currently the TISTA trial is ongoing. It started recruiting on 01/02/2013. This is a prospective, randomized, controlled, single-center trial with two-by-two parallel design. TISTA stands for Tisseel **STA**ples.


THE FUTURE
IS HERE.

References

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Cyanoacrylate Surgical Glue for Mesh Fixation in Laparoscopic Total Extraperitoneal Hernia Repair