

Heparinization

Epicardial Tachosil Patch Repair of Ventricular Rupture in a 90-Year-Old after Mitral Valve Replacement.

Authors: Feng W., Coady M.

Publication Date: 2016

Abstract:

We report our experience with emergent treatment of ventricular rupture following a mitral valve replacement in a 90 year-old male. The repair was performed using a Tachosil patch (Baxter Health Care Corporation, Westlake Village, California), a fibrin sealant coated on an equine collagen sponge, and BioGlue (Cryolife, Kenneson, GA) and bovine pericardium (Edwards Lifesciences, Irvine, CA). Aside from early ventricular dysfunction requiring a low-dose dopamine infusion, this patient's recovery was uneventful. Follow-up echocardiograms demonstrated no gross anatomic abnormality at the repair site, and steady improvement in his ventricular function.

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Bleeding from the sternal marrow can be stopped using vivostat patient- derived fibrin sealant.

Authors: Kjaergard H.K., Trumbull H.R.

Publication Date: 2000

Abstract:

Background. Median sternotomy is the most important method of access to the heart. Bleeding from the sternal marrow may become significant, especially in elderly patients. Vivostat (ConvaTec, a Bristol-Myers Squibb Company, Skillman, NJ) patient-derived fibrin sealant is biocompatible and easily applied to the sternal marrow using the Vivostat Spraypen applicator. Methods. Thirty patients undergoing elective cardiac operation were randomized to receive Vivostat fibrin sealant applied to either the right or left side of the sternum immediately after median sternotomy, with the untreated side serving as control. Results. The average time to hemostasis was 43 seconds after treatment with Vivostat and 180 seconds on the control sides ($p < 0.001$). At the end of the operation, complete hemostasis was observed on 24 of 30 sides treated with Vivostat compared with on 4 of 30 of the control sides ($p < 0.001$). The average volume of sealant used to cover one side of the sternum was 0.9 mL. Conclusions. Vivostat patient-derived fibrin sealant is a biocompatible alternative to bone wax, with the results of this study showing that it provides effective control of bleeding after median sternotomy. (C) 2000 by The Society of Thoracic Surgeons.

Hemostatic efficacy of EVARRESTTM, fibrin sealant patch vs. TachoSil in a heparinized swine spleen incision model.

Authors: Matonick J.P., Hammond J.

Publication Date: 2014

Abstract:

Background: First-generation single-component hemostats such as oxidized regenerated cellulose (ORC), fibrin, collagen, and gelatin have evolved into second and third generations of combination hemostats. **Objective:** This study compares two FDA approved products, EVARRESTTM, Fibrin Sealant Patch, a hemostat comprised of a matrix of nonwoven polyglactin 910 embedded in ORC coated with human fibrinogen and thrombin to TachoSil medicated sponge, an equine collagen pad coated with human fibrinogen and thrombin.

Materials and Methods: Swine were anticoagulated with heparin to 3X their baseline activated clotting time and a 15 mm long x 3 mm deep incision was made to create a consistent moderate bleeding pattern. Test material was then applied to the wound site and compressed manually for 3 min with just enough pressure to prevent continued bleeding. Hemostatic effectiveness was evaluated at 3 min and 10 min.

Results: At 3 min, the hemostasis success rate was 86% in the EVARRESTTM group and 0% in the TachoSil group, $p < .0001$. The overall success rate at 10 min was 100% with EVARRESTTM and 4% with TachoSil, $p < .0001$. Adhesive failure, in which the test material did not stick to the tissue, occurred in 96% of TachoSil sites. In contrast, 100% of the EVARRESTTM applications adhered to the test site.

Conclusions: EVARRESTTM, Fibrin Sealant Patch demonstrated greater wound adhesion and more effective hemostasis than TachoSil. Adhesive failure was the primary failure mode for TachoSil in this model.

Comparative evaluation of absorbable hemostats: Advantages of fibrin-based sheets.

Authors: Krishnan L.K., Mohanty M., Umashankar P.R., Vijayan Lal A.

Publication Date: 2004

Abstract:

Bioactive hemostats and wound dressings consist of either inherently active materials or act as delivery vehicles which contain such materials. Fibrin is a natural hemostat and scaffold, guiding the direction of wound contraction and closure. In order to improve the ease of application of liquid fibrin glue, we have made a freeze-dried form of polymerized fibrin that supports hemostasis and wound healing. The bleeding from the middle ear artery of rabbits was found to be arrested instantaneously on application of fibrin sheets, even when the animal was heparinized systemically. As the fibrin sheet was found to be fragile, gelatin was incorporated to the sheet and thus the mechanical stability was improved without compromising the hemostatic effect. The efficacy of the fabricated fibrin and fibrin-gelatin sheets to seal traumatized rat liver was compared with commercially available hemostats, Abgel (cross-linked gelatin) and Surgicel (cross-linked cellulose). Tissue compatibility of all the hemostats was studied by analyzing the liver tissue 15 days after application. While the hemostatic effect was best with fibrin and fibrin-gelatin sheets, both Surgicel and Abgel were not capable of arresting the bleeding quickly. Gross analysis of tissue on the 15th day of application, visibly, Abgel was not only degraded but resulted in severe adhesions of internal organs and histologically capsule formation around the implant was evident. Though Surgicel was also seen as cream soft material on the site of application that joined two pieces of liver, there was no adhesion of other internal organs and histologically, immune reaction and foreign-body-type giant cells were present in large amounts. Fibrin was not found grossly on application site whereas fibrin-gelatin was seen as a small white spot. Granulation tissue formation and cell migration into the

fibrin-based sheets were evident, and therefore, fibrin-based sheets are not only efficient hemostats but showed optimum degradation and wound healing. © 2004 Elsevier Ltd. All rights reserved.

New application method of fibrin glue for more effective hemostasis in cardiovascular surgery: Rub-and-spray method.

Authors: Minato N., Shimokawa T., Katayama Y., Yamada N., Sakaguchi M., Itoh M.

Publication Date: 2004

Abstract:

Objective: This study was performed to determine the most effective application method of fibrin glue as a hemostatic sealant in cardiovascular surgery. **Methods:** The effectiveness of fibrin glue as a hemostatic sealant was compared between 4 methods of application; dripping, spray, spray-and-rub, and rub-and-spray methods. I. In vitro 'burst pressure' was measured in fibrin glue-sealed needle holes of polytetrafluoroethylene (PTFE) graft in each method. II. Fibrin glue-sealed needle holes of PTFE grafts implanted between an abdominal aorta and iliac arteries of a pig was microscopically examined to determine the effectiveness of fibrin glue sealing in each method. **Results:** I. Burst pressures were 24.1 \pm 7.9 mmHg in dripping, 98.1 \pm 35.4 mmHg in spray, 140.8 \pm 34.8 mmHg in spray-and-rub and 206.7 \pm 26.1 mmHg in rub-and-spray method (statistically significant, $p < 0.01$, between each method). H. Microscopically, no fibrin glue remained on the external surface of the PTFE graft in the dripping method. Fibrin glue plugged 1/3 or 2/3 of the depth of the needle hole in the spray method and spray-and-rub methods respectively. In the rub-and-spray method, fibrin glue covered the needle hole over the external surface of the graft, completely plugged the needle hole to its whole depth, leaving no spaces where blood came into the needle hole. **Conclusion:** The rub-and-spray method of fibrin glue application revealed the strongest sealing and hemostatic effects, and can be safely and effectively used for hemostasis in cardiovascular surgery that requires systemic heparinization or prolonged extracorporeal circulation.

Fibrin glue containing fibroblast growth factor type 1 and heparin decreases platelet deposition.

Authors: Zarge J.I., Husak V., Huang P., Greisler H.P.

Publication Date: 1997

Abstract:

BACKGROUND: The early success rates of endarterectomy and angioplasty are influenced by the thrombogenicity of the deendothelialized surface. We previously reported decreased platelet deposition after 30 and 120 minutes and after 28 days on expanded polytetrafluoroethylene (ePTFE) grafts coated with fibrin glue (FG) containing fibroblast growth factor type 1 (FGF-1) and heparin in canine aortoiliac bypass grafts when compared with control uncoated grafts. The FG/FGF-1/heparin coating has been shown to enhance spontaneous endothelialization at 28 days in canine ePTFE bypass grafts. The current study evaluates the thrombogenicity of this FG/FGF-1/heparin suspension applied to a balloon de-endothelialization model of endarterectomy in canine carotid arteries. **METHODS:** Nine dogs underwent bilateral, deendothelialization balloon injury to 6-cm segments of their carotid arteries. Fibrin glue (fibrinogen 32.1 mg/mL + thrombin 0.32 U/mL) containing FGF-1 (11 ng/mL) and heparin (250 U/mL) was applied to the luminal surface of one carotid artery in each dog. Both femoral arteries were circumferentially dissected but not balloon injured; one femoral artery was clamped for the same period as the carotid arteries. In the 6 acute dogs, 10 minutes prior to the restitution of flow in both carotid arteries and one femoral artery, $4 \text{ to } 8 \times 10^9$ ^{111}In -labelled autologous platelets were injected intravenously. Four-cm segments of both carotid and femoral arteries were excised after 15 or 120 minutes of circulation ($n = 3/\text{time}/\text{artery}$, 24 arteries). In the 3 chronic dogs, the radiolabelled platelets were injected 30 days after carotid injury. The carotid and femoral vessels were then excised after 120 minutes of perfusion. Radioactive platelet deposition was quantitated by gamma counting.

RESULTS: After 2 hours, the injured carotid arteries demonstrated significantly more platelet deposition than either uninjured femoral artery controls ($P < 0.001$). There was also a significant 45.2% decrease ($P = 0.008$) in platelet deposition on the balloon injured carotid arteries treated with FG/FGF-1/heparin when compared with balloon injured carotid arteries alone. At 30 days there was an insignificant trend toward decreased thrombogenicity in the FG/FGF-1/heparin treated injured carotids. CONCLUSION: Surface coating with FG/FGF-1/heparin significantly decreases platelet deposition on balloon injured canine carotid arteries after 2 hours of perfusion and may be clinically applicable in endarterectomy and angioplasty procedures. The long-term induction of reendothelialization of arterial surfaces by this technique is under investigation.