Gelatin

Sutureless technique for oozing type postinfarction left ventricular free wall rupture. [Japanese]

Authors: Hayashi H., Nishimura Y., Mori H., Komori S., Hiramatsu T., Okamura Y.

Publication Date: 2005

Abstract:

We report our experience using a sutureless technique for oozing type postinfarction left ventricular free wall rupture. Several materials such as fibrin seat, autologous or heterologous pericardial patch, fibrin glue, and geratin-resorcin-formaldehyde (GRF) glue have been used. Nine patients, who developed postinfarction left ventricular free wall rupture, underwent surgical repair using a sutureless technique between 1999 and 2004. All patients survived and discharged our hospital without any postoperative complications. And all are alive an exellent condition in 5 to 44 months. A sutureless technique for the treatment of oozing type postinfarction left ventricular free wall rupture is simple, effective, and associated with a favorable outcome.

Pharmacological strategies to decrease transfusion requirements in patients undergoing surgery.

Authors: Porte R.J., Leebeek F.W.G.

Publication Date: 2002

Abstract:

Surgical procedures are inevitably associated with bleeding. The amount of blood loss may vary widely between different surgical procedures and depends on surgical as well as non-surgical factors. Whereas adequate surgical haemostasis may suffice in most patients, pro-haemostatic pharmacological agents may be of additional benefit in patients with (diffuse) surgical bleeding or in patients with a specific underlying haemostatic defect. In general, surgical haemostasis and pharmacological therapies can be complementary in controlling blood loss. The use of pharmacological therapies to reduce blood loss and blood transfusions in surgery has historically been restricted to a few drugs. Antifibrinolytic agents (aprotinin, tranexamic acid and aminocaproic acid) have the best evidence supporting their use, especially in cardiac surgery, liver transplantation and some orthopaedic surgical procedures. Meta-analyses of randomised, controlled trials in cardiac patients have suggested a slight benefit of aprotinin, compared with the other antifibrinolytics. Desmopressin is the treatment of choice in patients with mild haemophilia A and von Willebrand disease. It has also been shown to be effective in patients undergoing cardiac surgery who received aspirin up to the time of operation. However, overall evidence does not support a beneficial effect of desmopressin in patients without pre-existing coagulopathy undergoing elective surgical procedures. Topical agents, such as fibrin sealants have been successfully used in a variety of surgical procedures. However, only very few controlled clinical trials have been performed and scientific evidence supporting their use is still limited. Novel drugs, like recombinant factor VIIa (eptacog alfa), are currently under clinical investigation. Recombinant factor VIIa has been introduced for the

treatment of haemophilia patients with inhibitors, either in surgical or non-surgical situations. Preliminary data indicate that it may also be effective in surgical patients without pre-existing coagulation abnormalities. More clinical trials are warranted before definitive conclusions can be drawn about the safety and the exact role of this new drug in surgical patients. Only adequately powered and properly designed randomised, clinical trials will allow us to define the most effective and the safest pharmacological therapies for reducing blood loss and transfusion requirements in surgical patients. Future trials should also consider cost-effectiveness because of considerable differences in the costs of the available pro-haemostatic pharmacological agents.

Sutureless repair for left ventricular free wall rupture after acute myocardial infarction.

Authors: Aoyagi S, Tayama K, Otsuka H, Okazaki T, Shintani Y, Wada K, Kosuga K

Publication Date: 2014

Abstract:

We report three cases of left ventricular free wall rupture (LVFWR) after acute myocardial infarction, which were repaired using a sutureless technique without cardiopulmonary bypass. At operation, a sheet of fibrin tissue-adhesive collagen fleece (TachoComb) was secured to the hematoma surrounding the tear and the infarcted area under compression by the surgeon's fingers. After complete hemostasis, several sheets of an absorbable gelatin sponge (Gelfoam) were glued onto the collagen fleece in layers. Intra-aortic balloon pumping was electively performed. Concomitant coronary artery bypass grafting was not carried out. All patients survived the operation but recurrence of the rupture occurred on postoperative day 10 in one patient and an LV aneurysm was found four months after repair in another patient. The sutureless technique may be a simple and fast option for treatment of an oozing type LVFWR; however, careful follow-up is mandatory.

Comparative study of biological glues: cryoprecipitate glue, two-component fibrin sealant, and "French" glue.

Authors: Basu S, Marini CP, Bauman FG, Shirazian D, Damiani P, Robertazzi R, Jacobowitz IJ, Acinapura A, Cunningham JN Jr

Publication Date: 1995

Abstract:

BACKGROUND: Although biological glues have been used clinically in cardiovascular operations, there are no comprehensive comparative studies to help clinicians select one glue over another. In this study we determined the efficacy in controlling suture line and surface bleeding and the biophysical properties of cryoprecipitate glue, two-component fibrin sealant, and "French" glue containing gelatin-resorcinol-formaldehyde-glutaraldehyde (GRFG).

METHODS: Twenty-four dogs underwent a standardized atriotomy and aortotomy; the incisions were closed with interrupted 3-0 polypropylene sutures placed 3 mm apart. All dogs had a 3- by 3-cm area of the anterior wall of the right ventricle abraded until bleeding occurred. The animals were randomly allocated into four groups: in group 1 (n = 6) bleeding from the suture lines and from the epicardium was treated with cryoprecipitate glue; in group 2 (n = 6) bleeding was treated with two-component fibrin sealant; group 3 (n = 6) was treated with GRFG glue; group 4 (n = 6) was the untreated control group. The glues were also evaluated with regard to histomorphology, tensile strength, and virology.

RESULTS: The cryoprecipitate glue and the two-component fibrin sealant glue were equally effective in controlling bleeding from the aortic and atrial suture lines. Although the GRFG glue slowed bleeding significantly at both sites compared to baseline, it did not provide total control. The

control group required additional sutures to control bleeding. The cryoprecipitate glue and the two-component fibrin sealant provided a satisfactory clot in 3 to 4 seconds on the epicardium, whereas the GRFG glue generated a poor clot. There were minimal adhesions in the subpericardial space in the cryoprecipitate and the two-component fibrin sealant groups, whereas moderate-to-dense adhesions were present in the GRFG glue group at 6 weeks. The two-component fibrin sealant was completely reabsorbed by 10 days, but cryoprecipitate and GRFG glues were still present. On histologic examination, both fibrin glues exhibited minimal tissue reaction; in contrast, extensive fibroblastic proliferation was caused by the GRFG glue. The two-component and GRFG glues had outstanding adhesive property; in contrast, the cryoprecipitate glue did not show any adhesive power. The GRFG glue had a significantly greater tensile strength than the two-component fibrin sealant. Random samples from both cryoprecipitate and the two-component fibrin glue were free of hepatitis and retrovirus.

CONCLUSIONS: The GRFG glue should be used as a tissue reinforcer; the two-component fibrin sealer is preferable when hemostatic action must be accompanied with mechanical barrier; and finally, the cryoprecipitate glue can be used when hemostatic action is the only requirement.

The use of TachoSil associated to fibrin glue as dural sealant in spinal intradural tumors surgery.

Authors: Montano N., Papacci F., Fernandez E.

Publication Date: 2017

Abstract:

Not Available

The use of fibrin and gelatin fixation to repair a kinked internal carotid artery in carotid endarterectomy.

Authors: Kubota H., Sanada Y., Tanikawa R., Kato A.

Publication Date: 2016

Abstract:

Background: The kinking of the internal carotid artery (ICA) after final closure in carotid endarterectomy (CEA) is thought to be uncommon. When it occurs, it is mandatory to reconstruct ICA to preserve normal blood flow. We herein present a case in which a fixation technique was applied to repair an ICA that became kinked during CEA. Case Description: A 68-year-old man presented with cerebral infarction due to an artery-to-artery embolism from the right cervical ICA stenosis. CEA was performed 12 days after admission. After final closure, a distal portion of ICA was found to have been kinked following plaque resection in CEA procedure. Fixation with fibrin glue and gelatin was used to reinforce the arterial wall and repair the kink. Postoperative magnetic resonance angiography demonstrated the release of the kink in ICA. Conclusion: Fixation with fibrin and gelatin is a salvage armamentarium that can be considered in CEA for the repair of kinked or tortuous ICA.

The FINISH-3 trial: A phase 3, international, randomized, single-blind, controlled trial of topical fibrocaps in intraoperative surgical hemostasis.

Authors: Bochicchio G.V., Gupta N., Porte R.J., Renkens K.L., Pattyn P., Topal B., Troisi R.I., Muir W., Chetter I., Gillen D.L., Zuckerman L.A., Frohna P.A.

Publication Date: 2015

Abstract:

Background This Phase 3, international, randomized, single-blind, controlled trial (FINISH-3) compared the efficacy and safety of Fibrocaps, a ready-to-use, dry-powder fibrin sealant containing human plasma-derived thrombin and fibrinogen, vs gelatin sponge alone for use as a hemostat for surgical bleeding in 4 indications (ie, spinal, hepatic, vascular, soft tissue dissection).

Study Design Adults with mild to moderate surgical bleeding (randomized 2:1; Fibrocaps vs gelatin sponge) were treated at a single bleeding site (day 1). Time to hemostasis (TTH) during 5 minutes was compared (log-rank statistic) within each indication. Safety follow-up continued to day 29.

Results Patients were treated (Fibrocaps, n = 480; gelatin sponge, n = 239) when undergoing spinal (n = 183), vascular (n = 175), hepatic (n = 180), or soft-tissue (n = 181) procedures. Fibrocaps was applied by spray device in 53% of all procedures (94% of hepatic and soft-tissue procedures). Fibrocaps significantly reduced TTH compared with gelatin sponge; estimated hazard ratios were 3.3, 2.1, 2.3, and 3.4 for the 4 surgical indications, respectively (each $p < 0.001$; primary end point). Fibrocaps significantly reduced median TTH for each indication ($p < 0.001$) and was superior for secondary efficacy end points of restricted mean TTH ($p < 0.001$) and probability of hemostasis at 3 ($p < 0.001$) and 5 ($p <= 0.002$) minutes. Adverse event incidences were generally similar between treatment arms. Non-neutralizing, anti-thrombin antibodies developed in 2% of Fibrocaps-treated and 3% of gelatin sponge-treated patients.

Conclusions Fibrocaps was well tolerated and significantly reduced TTH relative to gelatin sponge alone in all 4 surgical indications. These findings demonstrate the broad utility of Fibrocaps as a hemostatic agent for mild to moderate surgical bleeding.

Hemostasis and other benefits of fibrin sealants/glues in spine surgery beyond cerebrospinal fluid leak repairs.

Authors: Epstein N.E.

Publication Date: 2014

Abstract:

Background: Fibrin sealants (FS)/glues (FG) are primarily utilized in spinal surgery to either strengthen repairs of elective (e.g., intradural tumors/pathology) or traumatic cerebrospinal fluid (CSF) fistulas. Here, additional roles/benefits of FS/FG in spine surgery are explored; these include increased hemostasis, reduction of scar, reduction of the risk of infection if impregnated with antibiotics, and its application to restrict diffusion and limit some of the major complications attributed to the controversial "off-label" use of bone morphogeneitc protein (rhBMP-2/INFUSE). Methods: We reviewed multiple studies, focusing not just on the utility of FS/FG in the treatment of CSF fistulas, but on its other applications. Results: FS/FG have been primarily used to supplement elective/traumatic dural closure in spinal surgery. However, FS/FG also contribute to; hemostasis, reducing intraoperative/postoperative bleeding/transfusion requirements, length of stay (LOS)/costs, reduced postoperative scar/radiculitis, and infection when impregnated with antibiotics. Nevertheless, one should seriously question whether FS/FG should be applied to prevent diffusion and limit major complications attributed to the "off-label" use of BMP/INFUSE (e.g., limit/prevent heterotopic ossification, dysphagia/respiratory decompensation, and new neurological deficits). Conclusions: FS/FG successfully supplement watertight dural closure following elective (e.g., intradural tumor) or traumatic CSF fistulas occurring during spinal surgery. Additional benefits include: intraoperative hemostasis with reduced postoperative drainage, reduced transfusion requirements, reduced LOS, cost, scar, and prophylaxis against infection (e.g., impregnated with antibiotics). However, one should seriously question whether FS/FG should be used to contain the

diffusion of BMP/INFUSE and limit its complications when utilized "off-label". Copyright:

Sellar reconstruction using biomaterials after transsphenoidal surgery in 449 cases of pituitary adenomas.

Authors: Du J., Qiu B., Tao J., Ou S., Wang Y.

Publication Date: 2014

Abstract:

BACKGROUND: We report the methods and effects of sellar reconstruction using biomaterials in 449 cases of pituitary adenoma undergoing transsphenoidal surgery from August 2009 to August 2010. METHODS: During transsphenoidal surgery (including 15 cases assisted with endoscope), diaphragma sellae damage and cerebrospinal fluid (CSF) leakage occurred in 52 cases intraoperatively. The resection cavity was packed with absorbable hemostatic cotton and gelatin sponge, and then artificial dura mater and fibrin glue were used to seal and reconstruct the sellar floor. Postoperative and delayed CSF leakage occurred in 6 and 2 cases, respectively. To manage the CSF leakage, the removal of intranasal vaseline gauze was postponed; and meanwhile, continuous lumbar CSF drainage and/or mannitol were used to decrease the intracranial pressure. RESULTS: The incidence of CSF leakage was 12% (52 cases) intraoperatively, 1.3% (6 cases) postoperatively, and incidence of delayed CSF leakage was 0.45% (2 cases). For cases of postoperative CSF leakage, postponed removal of intranasal vaseline gauze and reducing intracranial pressure were effective methods. Most cases were cured in 1 week. CONCLUSION: In transsphenoidal surgery of pituitary adenoma, an exact intrasellar packing and sellar floor reconstruction with artificial dura mater and fibrin glue are effective and affirmative to prevent postoperative CSF leakage.

An international, multicenter, randomized, single-blind, controlled trial of a dry-powder, fibrin sealant for mild to moderate perioperative surgical bleeding.

Authors: Bochicchio G., Singla N., Gupta N.Y., Porter R., Renkens K.L., Pattyn P., Topal B., Chetter I., Frohna P.

Publication Date: 2014

Abstract:

INTRODUCTION: Topical hemostatic agents are important adjuncts for controlling surgical bleeding. The objective of this study was to evaluate the safety and efficacy of a dry-powder, fibrin sealant containing human plasma-derived thrombin and fibrinogen in reducing time to hemostasis (TTH). METHODS: Multicenter, randomised control trial (RCT) (clinicaltrials. gov: NCT01527357) comparing fibrin sealant plus gelatin sponge vs. gelatin sponge alone in 4 surgical indications (spinal, hepatic, vascular, soft tissue), run in parallel as independently-powered trials for efficacy and pooled across indications for safety. Adult patients with mild/moderate surgical bleeding were randomized 2:1 to fibrin sealant or gelatin sponge during surgery. The primary efficacy endpoint was a comparison of the time to hemostasis (TTH) survival curves over 5 minutes. Subjects were followed for 28 days for safety. RESULTS: 719 patients provided informed consent, were randomized, and treated (fibrin sealant: 480; gelatin sponge: 239) while undergoing spinal (n=183), vascular (n=175), hepatic (n=180), or soft tissue (n=181) procedures. Fibrin sealant was applied by proprietary spray device in 53% of procedures and significantly reduced TTH compared to gelatin sponge, with hazard ratios of 3.3, 2.1, 2.3, and 3.4 for the 4 surgical indications, respectively (each $p<0.0001$). Adverse event incidences were generally similar between treatment groups and none were related to the spray device. Non-neutralizing, anti thrombin antibodies developed in 2% of fibrin sealant and 3% of gelatin sponge-treated patients. CONCLUSIONS: A ready to use, dry-powder,

fibrin sealant was well tolerated and significantly reduced TTH across a wide variety of surgical procedures, strongly supporting its safety and broad utility as a hemostatic agent.

Reconstruction of the sellar floor following transsphenoidal surgery using gelatin foam and fibrin glue.

Authors: Yin J., Su C.-B., Xu Z.-Q., Xia X.-W., Song F.

Publication Date: 2005

Abstract:

Objective: To introduce a new principle of sellar reconstruction and to evaluate the effectiveness of absorbable gelatin foam and fibrin glue for sellar reconstruction. Methods: A total of 176 consecutive patients who underwent surgery for pituitary adenomas, cysts, chordomas, or subdiaphragmatic craniopharyngiomas in the sella turcica between January 2001 and April 2003 at Peking Union Medical College Hospital were enrolled. Different techniques of sellar closure and indications for each specific condition were retrospectively reviewed. Results: Seventy-seven (43.7%) patients developed a visible cerebrospinal fluid (CSF) leakage during surgery. Intraoperative CSF leakage were repaired simply with gelatin foam and fibrin glue in 62 (35.2%) patients, and with autologous fat graft and sellar floor reconstruction in 15 (8.5%) patients. Postoperative CSF rhinorrhea occurred only in 1 case. There were no visual deterioration, allergic rhinitis, meningitis, pneumocranium, granulomas, or other complications associated with the reconstruction procedure. Conclusion: The procedure of using gelatin foam and fibrin glue and principle of cranial base reconstruction is safe and effective in preventing postoperative complications following transsphenoidal surgery.

Fibrocaps for surgical hemostasis: two randomized, controlled phase II trials.

Authors: Verhoef C, Singla N, Moneta G, Muir W, Rijken A, Lockstadt H, de Wilt JH, O-Yurvati A, Zuckerman LA, Frohna P, Porte RJ

Publication Date: 2015

Abstract:

BACKGROUND: Fibrocaps, a ready-to-use, dry-powder fibrin sealant containing human plasma-derived thrombin and fibrinogen, is being developed as an adjunct for surgical hemostasis.

MATERIALS AND METHODS: Safety and efficacy of Fibrocaps applied directly or by spray device, in combination with gelatin sponge, was compared with that of gelatin sponge-alone in two randomized, single-blind controlled trials: FC-002 US (United States) and FC-002 NL (the Netherlands). A total of 126 adult patients were randomized (Fibrocaps: n = 47 [FC-002 US], n = 39 [FC-002 NL]; gelatin sponge alone: n = 23 [FC-002 US], n = 17 [FC-002 NL). One bleeding site was treated during a surgical procedure (n = 125). Time to hemostasis (primary end point) was measured, with a 28-d safety follow-up. Four surgical indications included hepatic resection (n = 58), spinal procedures (n = 37), peripheral vascular procedures (n = 30), and soft tissue dissection (n = 1).

RESULTS: Mean (standard deviation) time to hemostasis was significantly shorter after Fibrocaps treatment than after gelatin sponge alone (FC-002 US: 1.9 [1.3] versus 4.8 min [3.1], P < 0.001; FC-002 NL: 2.2 [1.3] versus 4.4 min [3.1], P = 0.004). The incidence of hemostasis was greater after Fibrocaps compared with that of gelatin sponge alone within 3 min (FC-002 US: 83% versus 35%, P < 0.001; FC-002 NL: 77% versus 53%, P = 0.11), 5 min (94% versus 61%, P = 0.001; 95% versus

71%, P = 0.022), and 10 min (100% versus 78%, P = 0.003; 100% versus 82%, P = 0.025). Adverse events were consistent with surgical procedures performed and patients' underlying diseases and generally similar between treatment arms; most were mild or moderate in severity. Non-neutralizing antithrombin antibodies were detected in 5% of Fibrocaps-treated patients on day 29.

CONCLUSIONS: Fibrocaps had good safety and efficacy profiles, supporting continuing clinical development as a novel fibrin sealant.

Usefulness of a new gelatin glue sealant system for dural closure in a rat durotomy model.

Authors: Kawai H, Nakagawa I, Nishimura F, Motoyama Y, Park YS, Nakamura M, Nakase H, Suzuki S, Ikada Y

Publication Date: 2014

Abstract:

Watertight dural closure is imperative after neurosurgical procedures, because inadequately treated leakage of cerebrospinal fluid (CSF) can have serious consequences. We used a rat durotomy model to test the usefulness of a new gelatin glue as a dural sealant in a rat model of transdural CSF leakage. All rats were randomly divided into one of the following three treatment groups: no application (control group: N = 18), application of fibrin glue (fibrin glue group: N = 18), and application of the new gelatin glue (new gelatin glue group: N = 18). The craniotomy side was re-opened, and CSF leakage was checked and recorded at 1, 7, and 28 days postoperatively. The new gelatin glue was adequate for stopping CSF leakage; no leakage was observed at postoperative days 1 or 7, and leakage was observed in only one rat at postoperative day 28. This result was statistically significant when compared to the control group (P = 0.002, P = 0.015, P = 0.015, respectively). The pathologic score of the new gelatin group was not different from that of the control or fibrin glue groups. We conclude that our new gelatin glue provides effective watertight closure 1, 7, and 28 days after operation in the rat durotomy model.

Enhanced Sealing by Hydrophobic Modification of Alaska Pollock-Derived Gelatin-Based Surgical Sealants for the Treatment of Pulmonary Air Leaks.

Authors: Mizuta R., Taguchi T.

Publication Date: 2017

Abstract:

Pulmonary air leaks are medical complications of thoracic surgery for which fibrin sealant is the main treatment. In this study, innovative sealants based on hydrophobically modified Alaska pollock-derived gelatin (hm-ApGltn) and a poly(ethylene)glycol-based 4-armed cross-linker (4S-PEG) have been developed and their burst strengths have been evaluated using fresh rat lung. The developed sealants show higher lung burst strength compared with the nonmodified original ApGltn (Org-ApGltn)-based sealant and a commercial fibrin sealant. The maximum burst strength of the hm-ApGltn-based sealant is 1.6-fold higher than the Org-ApGltn-based sealant ($n = 5$, $p < 0.05$), and 2.1-fold higher than the commercial fibrin sealant ($n = 5$, $p < 0.05$). Cell culture experiments show that modification of ApGltn with cholesteryl or stearoyl groups effectively enhances anchoring to the cell surface. In addition, binding constants between hm-ApGltn and extracellular matrix proteins such as fibronectin and fibrillin are increased. Therefore, the new hm-ApGltn/4S-PEG-based sealant has the potential for applications in thoracic surgery. (Figure presented.).

Improved techniques of applying fibrin glue in lung surgery.

Authors: Morikawa T., Katoh H.

Publication Date: 1999

Abstract:

To enhance the adhesive property of fibrin glue, two techniques were developed. The first is an improvement of the conventional layer method, and the second is a further improvement of the first technique. Their adhesive properties were tested in canine lungs in two phases. In phase 1 of the experiment, two new techniques were compared with the conventional methods in the retrieved lung. In phase 2 of the experiment, the second technique examined how its adhesive properties changed after treatment comparing them with gelatin-resorcinol-formaldehyde-glutaraldehyde (GRFG) glue. In phase 1, the first technique showed a 3-fold enhancement of the adhesive properties as compared with the conventional methods, and with the second technique the adhesive properties were further improved by more than 2-fold in the retrieved canine lung, In phase 2, it was revealed that the bursting pressure of both the second new technique and GRFG glue was eventually equal, and enough to close the cut surface of the lung. In the clinical setting, two techniques showed a safe and satisfactory performance in closing the cut surface of the lung. Due to the low toxicity of fibrin glue and absorbable material, these two techniques, especially the second technique, provide better circumstances for the healing of lung injury.

Comparison of the wound healing efficacy of polyglycolic acid sheets with fibrin glue and gelatin sponge dressings in a rat cranial periosteal defect model.

Authors: Koshinuma S., Murakami S., Noi M., Murakami T., Mukaisho K.-I., Sugihara H., Yamamoto G.

Publication Date: 2016

Abstract:

Oral surgical procedures occasionally require removal of the periosteum due to lesions, and these raw bone surfaces are prone not only to infection but also to scar formation during secondary healing. The objective of this study was to identify successful methods for reconstruction using periosteal defect dressings. We created 1-cm² defects in the skin and cranial periosteum of 10-weekold male Wistar rats under isoflurane anesthesia. The animals were assigned to three defect treatment groups: (1) polyglycolic acid sheets with fibrin glue dressing (PGA-FG), (2) Spongel gelatin sponge dressing (GS), and (3) open wound (control). Postoperative wound healing was histologically evaluated at 2, 4, and 6 weeks. The moist conditions maintained by the GS and PGA-FG treatments protected the bone surface from the destructive effects of drying and infection. Complete wound healing was observed in the GS group but not for all animals in the PGA-FG and control groups. Histologically, osteoblast proliferation on bone surfaces and complete epithelialization with adnexa were observed in the GS group at 6 weeks after surgery. In contrast, PGA sheets that had not been absorbed inhibited osteoblast proliferation and delayed wound healing in the PGA-FG group. Wound surface dressings maintain a moist environment that promotes wound healing, but PGA materials may not be suitable for cases involving exposed periosteum or bone surfaces due to the observed scar formation and foreign-body reaction.

Experimental use of crosslinked gelatin glue for arterial hemostasis in cardiovascular surgery.

Authors: Yamashita K., Suzuki S., Tabayashi N., Abe T., Hayata Y., Hirose T., Hiraga S., Niwa K., Fukuba R., Takeda M., Ikada Y., Taniguchi S.

Publication Date: 2015

Abstract:

BACKGROUND: Anastomotic needle hole bleeding is a frequently encountered problem in cardiovascular surgeries. OBJECTIVE: To examine the feasibility of crosslinked gelatin glue as an anastomotic needle hole sealant in comparison with fibrin glue. METHODS: The in vitro burst water pressures were measured for gelatin and fibrin glue sealed needle holes of expanded polytetrafluoroethylene (ePTFE) or collagen coated woven polyester grafts. For in vivo investigations, abdominal aorta-ePTFE graft anastomoses of heparinized beagle dogs were sealed by gelatin or fibrin glue and hemostatic efficacy was judged. The implanted sites were re-examined 4 weeks postoperatively. RESULTS: The in vitro burst water pressures of gelatin glue sealed needle holes of both grafts were higher than those sealed by fibrin glue. For in vivo canine studies, hemostasis was successful for all gelatin glue applied suture lines, but not two out of three fibrin glue treated sites when 3-0 polypropylene suture was employed. Although adhesions of surrounding tissues were intense for all sites 4 weeks postoperatively, inflammation was more severe for the fibrin glue group compared to those of gelatin glue. CONCLUSIONS: Gelatin glue was found to be an effective and safe sealant for accomplishing hemostasis of anastomotic needle holes of vascular grafts.

Hemostatic plug: Novel technique for closure of percutaneous nephrostomy tract.

Authors: Abbott J.E., Cicic A., Jump R.W., Davalos J.G.

Publication Date: 2015

Abstract:

Percutaneous nephrolithotomy (PCNL) is a standard treatment for patients with large or complex kidney stones. The procedure has traditionally included postoperative placement of a nephrostomy tube to allow for drainage and possible reentry. This practice was first implemented after complications incurred after tubeless PCNL in a small patient population. Recently, tubeless PCNL has reemerged as a viable option for selected patients, resulting in decreased pain and analgesic use, shorter hospitalization, quicker return to normal activity, and decreased urine extravasation. Gelatin matrix sealants are occasionally used in nephrostomy tract closure. Techniques for delivery of these agents have been ill described, and placement may be performed with varying results. We present a literature review comparing tubeless PCNL to its traditional variant with indications for use of each, as well as a comparison of agents used in closure. Finally, we outline a novel, reproducible technique for closure of the dilated percutaneous renal access tract.

Re: The role of FISH and cytology in upper urinary tract surveillance after radical cystectomy for bladder cancer.

Authors: Wood D.P.

Publication Date: 2014

Abstract:

Not Available

Basic animal experiment on the utility of fibrin sealant in combination with various hemostatic agents for use in laparoscopic partial nephrectomy.

Authors: Ishii K., Kawashima H., Sugimoto T.

Publication Date: 2012

Abstract:

OBJECTIVE: In this study, we investigated the adhesiveness to the renal tissue of some sheet-type hemostatic agents used with a liquid fibrin sealant using animal kidneys. (Figure Presented) METHODS: In Experiment A, component solutions of liquid fibrin sealant were dripped onto a kite string placed on a removed porcine kidney slice. No hemostat, or one of the sheettype hemostats, such as collagen, gelatin, or oxidized-cellulose, was placed on a kite string, and a string scale was used to measure the force needed to pull the string apart vertically from the slice. The weight data were analyzed statistically. In Experiment B, liquid fibrin sealant alone, or in combination with the same kind of sheet-type hemostat was applied to the cut surface of the hilus clumping kidney of anesthetized living rabbits, and after declamping, the severity of bleeding was checked. The evaluated parameters included the number of times the process was needed to secure hemostasis. Histological analyses were also performed to compare the degree of adherence of the aforementioned hemostats to kidney tissue. RESULTS: The combination of fibrin sealant plus a collagen hemostat was clearly superior in Experiment A. In Experiment B, fibrin sealant plus the collagen or gelatin hemostat was found to have a stronger hemostatic effect (Table 1). The histological investigation only with these hemostats showed a continuous layer of fibrin adhering to the renal tissue (Fig 1). CONCLUSIONS: Fibrin sealant used in combination with the a collagen hemostat was considered the most suitable for obtaining reinforced hemostatic effect at the suture site in partial nephrectomy.

FibrocapsTM, a novel fibrin sealant, for bleeding during hepatic resection: Results of a phase 2, randomized, controlled study.

Authors: Porte R.J., Verhoef C., De Wilt J.H.W., Rijken A.M., Klaase J.M., Ayez N., Van Rij M., Frohna P.A.

Publication Date: 2012

Abstract:

Introduction: Fibrin sealants mimic the final stage of the clotting cascade and are used when control of bleeding by surgical technique is difficult. Diffuse bleeding of the hepatic resection surface can be a problem due to the vascularity of the liver, for which fibrin sealants have been used. FibrocapsTM (ProFibrix, Leiden, The Netherlands) is a ready-to-use, premixed powder blend of human plasma-derived fibrinogen and thrombin. We conducted a study of the efficacy and safety of Fibrocaps in liver surgery. Methods: Study FC-002 NL was a Phase 2, randomized, single-blind, controlled, comparative efficacy and safety study of Fibrocaps in subjects with diffuse bleeding during hepatic resection at 5 centers in The Netherlands. 56 subjects were randomized (2 : 1) during surgery to Fibrocaps (n = 39) or gelatin sponge (n = 17). Treatment was followed by a 10-min observation period where hemostasis was evaluated every minute, with failure defined as lack of hemostasis by 10 min. The primary efficacy endpoint was the mean time to hemostasis (TTH), and the secondary was the incidence of hemostasis at 10, 5 and 3 min. Overall safety was determined by treatment-emergent adverse events, clinical labs and antithrombin antibodies monitored for 4 weeks after treatment. Results: Subject demographics were similar across both treatment groups (64% male, mean age of 61 yrs). The mean +/- SD dose of Fibrocaps was 1.4 +/- 0.5 g used for a mean +/- SD bleeding surface area of 58 +/- 29 cm². There was a statistically significant reduction on the intent-to-treat analysis of the mean TTH of Fibrocaps 2.2 +/- 1.2 min vs. gelatin sponge 4.4 +/- 3.1 (p = 0.004). There were no treatment failures in the Fibrocaps arm and 3

in the control arm (p = 0.025). The incidence of hemostasis at 5 min was also statistically significant for Fibrocaps (p = 0.022). The safety was comparable across both treatments, with most AEs gastrointestinal, and classified mild or moderate and unrelated to treatment. No neutralizing anti-thrombin antibodies were detected. Conclusion: These efficacy results with Fibrocaps in liver surgery demonstrate a significant reduction in mean bleeding time across patients and in the incidence of treatment failure. The safety profile of Fibrocaps in this study was very good and consistent with events expected in subjects with multiple diseases undergoing major hepatic resection under general anesthesia. The observed benefit: risk profile strongly supports the conduct of a Phase 3 study in surgical hemostasis.

Pathologic evaluation of hemostatic agents in percutaneous nephrolithotomy tracts in a porcine model.

Authors: Lipkin M.E., Mancini J.G., Simmons W.N., Raymundo M.E., Yong D.Z., Wang A.J., Ferrandino M.N., Albala D.M., Preminger G.M.

Publication Date: 2011

Abstract:

Background and Purpose: Hemostatic agents have been suggested as an adjunct for tubeless percutaneous nephrolithotomy (PCNL). We pathologically evaluated the percutaneous tracts injected with the fibrin sealant (FS) Evicel and hemostatic gelatin matrix (HGM) Surgiflo at various time intervals to determine their absorption and tract closure rates. We also evaluated whether these agents reduced urine leak rates in a porcine model. Materials and Methods: Percutaneous access was obtained in 19 kidneys in 10 domestic swine. The tracts were dilated to 30F using a balloon dilating catheter. Ten kidneys served as controls. Surgiflo was injected into the tract of four kidneys, and Evicel was injected into the tract of five kidneys. Intravenous urography (IVU) was performed on postoperative days (POD) 1 and 10 to 14. IVU was performed on two pigs at POD 30. The pigs were sacrificed and kidneys were harvested for pathologic evaluation. Results: Two (20%) control kidneys had a urine leak on IVU on POD 1. None of the kidneys treated with HGM or FS had a urine leak on POD 1. None of the kidneys had a leak on POD 10 to 14 or POD 30. On pathologic inspection, the tracts of all the control kidneys and HGM kidneys had closed completely at POD 14. Two kidneys treated with FS had fistula at POD 6 and POD 14. At POD 30, the tracts in the control kidneys and kidney treated with HGM had completely healed. Fibrin sealant remained in the tract at POD 30. Conclusion: Fibrin sealant should be used with caution because it can persist in the tract for up to 30 days and may inhibit wound healing. Hemostatic gelatin matrix is the preferable agent because the tract closed by POD 10 to 14, similar to the findings in the control animals. The use of hemostatic

agents in a nephroscopy tract may reduce the risk of early urine leak after tubeless PCNL.

Combination of a liquid fibrin sealant with sheet-type hemostatic agents: Experimental evaluation in partial nephrectomy animal model.

Authors: Ishii K., Kawashima H., Hayama T., Asai T., Kamikawa S., Sakamoto W., Miyabashira S., Oka S., Sugimoto T.

Publication Date: 2011

Abstract:

Liquid fibrin sealants, together with sheet-type hemostatic agents, have been used during partial nephrectomies to secure effective hemostasis at the suture site. Using animal kidneys, we investigated which hemostatic agent might adhere most effectively to the renal tissue and serve best as a bolster. Liquid fibrin sealant alone, or in combination with a sheet-type hemostat, such as collagen, gelatin or oxidized-cellulose hemostat, was applied to the cut surface of the kidney of anesthetized rabbits, and the differences in the degree of adherence to the kidney and resultant hemostatic efficacy were evaluated. Histological analyses were also carried out to compare the degree of adherence of each of the aforementioned hemostats to the kidney tissue. Fibrin sealant plus the collagen or gelatin hemostat was found to have a stronger hemostatic effect than fibrin sealant applied alone or fibrin sealant plus oxidized-cellulose hemostat. The histological investigation showed that the fibrin sealant adhered well to kidney tissue when it was applied with the collagen or gelatin hemostat, showing the advantage of combining these two materials for achieving effective hemostasis. Fibrin sealant used in combination with the collagen or gelatin hemostat was the most suitable for obtaining a reinforced hemostatic effect at the suture site in a partial nephrectomy animal model.

The differences in combining fibrin glue with various hemostasis agents for laparoscopic partial nephrectomies.

Authors: Ishii K., Hayama T., Sugimoto T., Kawashima H.

Publication Date: 2010

Abstract:

Introduction: It is being reported now that more doctors are, in laparoscopic partial nephrectomies, doing surgeries to remove larger tumors using a combination of fibrin glue and one of the various hemostasis agents available. Purpose: This experiment was performed to document which combination of fibrin glue and one of three commonly used agents is most effective in hemostasis. Materials and Methods: 14 female rabbits were divided into 4 groups. Group1 (N=6) used only fibrin glue. Collagen material was added in Group 2 (N=8), gelatin material in Group 3 (N=8) and oxidized cellulose in Group 4 (N=6). After transecting the kidney and confirming bleeding, we clamped renal vessels. We put fibrin glue on the area and in Groups 2-4, we also pressed there for (Table presented) 1 minute with agents. After removing clamping, we observed for 3 minutes. If there was bleeding, we repeated procedure. We determined which method was most effective from the number of procedures needed. After fixing removed kidney, we made several thin sections and observed them microscopically. Results: The number of repetitions needed was significantly lower in Group 2 than Groups 1 and 4. Histologically, in Group 2, fibrin glue spread most uniformly into the area between the tissue and agent and also into agent fibers. In Group 4, little fibrin glue remained between tissue and the agent. Conclusions: Collagen materials are significantly more effective than oxidized cellulose. We suggest this is due to mild acid in oxidized cellulose reducing activity of thrombin. In laparoscopic partial nephrectomies, we should avoid using oxidized cellulose with fibrin glue.

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.

Introduction: Does the evidence justify the routine use of fibrin sealants in cardiovascular surgery?.

Authors: Taylor Jr. L.M.

Publication Date: 2003

Abstract:

Not Available

Prospective randomized multicenter trial of fibrin sealant versus thrombin-soaked gelatin sponge for suture- or needle-hole bleeding from polytetrafluoroethylene femoral artery grafts.

Authors: Taylor Jr. L.M., Mueller-Velten G., Koslow A., Hunter G., Naslund T., Kline R.

Publication Date: 2003

Abstract:

Objective: We evaluated the safety and efficacy of the fibrin sealant Beriplast P (FSBP; Aventis-Behring) for hemostasis in anastomosis of polytetrafluoroethylene (PTFE) grafts to the femoral artery. Methods: In a single-blinded randomized prospective multicenter clinical trial, FSBP was compared with thrombin-soaked gelatin sponge (TSG) for efficacy in stopping bleeding from needle or suture holes in PTFE grafts after anastomosis to the femoral artery. Patients were randomized to FSBP application, which requires a 3-minute period of arterial clamping to enable the fibrin clot to adhere, or to TSG application, which requires pressure from gauze sponges, after completion of the femoral artery anastomosis. The primary end point was hemostasis, defined as absence of any detectable bleeding as judged by the operating surgeon, by 4 minutes after randomization. Secondary end points included actual time from randomization to hemostasis, time to beginning of wound closure, measured blood loss (weighed sponges), incidence of recurrent bleeding, stay in the intensive care unit, and hospital length of stay. Data were analyzed with the intention-to-treat method. Results: Two hundred thirty-five subjects were enrolled at 26 medical centers; 34 were subsequently excluded from the study. Of the 201 randomized subjects, 100 received FSBP and 99 received TSG. Hemostasis was achieved by 4 minutes in 64 subjects (63%) in the FSBP group and 40 subjects (40%) in the TSG group (P = .0018). In the FSBP group, compared with the TSG group, time to hemostasis was shorter (median, 4.0 minutes; 95% confidence interval [CI], 3.8-4.18 minutes vs median, 5.6 minutes, 95% CI, 4.5-7.0; P = .008), blood

loss was less (mean, 4.0 +/- 29.7 g vs mean, 15. 6 +/- 28.4 g; P < .0001), and time to wound closure was shorter (median, 15 minutes; 95% CI, 10.47-18.67 minutes vs median, 22.8 minutes; 95% CI, 18.67-30.67; P = .005). There were no differences in recurrent bleeding or any other adverse events. There was no significant difference in ICU stay, but hospital length of stay was shorter in the FSBP group compared with the TSG group, and the difference approached significance (median, 6.5 days; 95% CI, 5.00-7.00 days vs median, 7.0 days; 95% CI, 6.00-8.00 days; P = .0565). Conclusion: FSBP is more effective than TSG for achieving hemostasis of needle or suture hole bleeding from PTFE femoral artery grafts.

The use of biological glue in aortic surgery.

Authors: Bachet J., Guilmet D.

Publication Date: 1999

Abstract:

The biologic sealants presently available on the market that are used in cardiovascular surgery and particularly during surgery of the aorta are described in this article. Two of these biological sealants, the gelatin- resorcinol-formaldehyde (GRF) glue and two-component fibrin sealant have been in use for two decades. Their respective properties are described and compared, and the authors' experience with the GRT glue in 212 cases of acute type A aortic dissection is briefly reported.

Assessment of alternative tissue approximation techniques for laparoscopy.

Authors: Eden C.G., Coptcoat M.J.

Publication Date: 1996

Abstract:

Objective: To investigate the feasibility and results of applying alternative techniques of tissue approximation for experimental urothelial re-anastomosis in an open and laparoscopic setting. Materials and methods: The study was carried out in two phases; in phase 1, an open porcine ureteric re-anastomosis was performed using gelatin/resorcin/formaldehyde (GRF) glue, fibrin glue or potassium-titanyl-phosphate laser tissue-welding with a fluorescein-doped human albumin solder. The anastomoses were assessed both immediately, by leak pressure, and by the operating time, upper tract urodynamic studies and light and scanning electron microscopy, 6 weeks after surgery. In phase 2, the best technique from phase 1 was compared with sutured controls for porcine retroperitoneoscopic dismembered pyeloplasty, using the same assessment criteria. Results: In phase 1, GRF glue produced adhesion which was insufficiently flexible to withstand rotation of the anastomosis and this technique was therefore abandoned. Fibrin-glued anastomoses withstood leak pressures equal to those from laser-welding (P=0.91) and gave similar changes in maximum pressure with a Whitaker test at 6 weeks (P=0.30), but were superior in requiring a shorter operating time (P=0.02) and in their electron and light microscopic appearances. In phase 2, fibrin glue gave similar changes in maximum pressure with a Whitaker test to those from polyglactin 910 sutures (P=0.51) but withstood higher leak pressures (P=0.01), had a shorter operating time (P=0.01) and had superior electron and light microscopic appearances. Conclusion: Fibrin glue produced effective experimental laparoscopic pelvi-ureteric anastomoses within less operating time than did sutured controls. Such anastomoses withstood supra- physiological pressures, with no evidence of

functional obstruction and with a more favourable histological result after 6 weeks. Laparoscopic evaluation of this modality in a clinical setting is now justified.

Experimental evaluation of gelatin adhesive. [Japanese]

Authors: Kiyotani T., Teramachi M., Takimoto Y., Okumura N., Nakamura T., Shimizu Y.

Publication Date: 1994

Abstract:

We examined the effectiveness of gelatin glue (GRF glue, E.H.S., France) for wound-healing in rats. On each rat, two or three 2-cm incisions were made with a scalpel in the back skin. Each wound was closed with GRF glue, fibrin glue or 3-0 nylon sutures. The tensile strength of each wound was measured and histological examination was conducted sequentially. Three days after surgery, the wounds treated with GRF glue had a higher tensile strength than those in the other two groups. From seven days of surgery, however, the tensile strength of wounds in the GRF group was not markedly greater than that of wounds in the other two groups. On histological examination, the GRF-treated wounds showed greater infiltration of inflammatory cells than the fibrin glue-treated wounds, but the GRF group showed no necrotic change in the surrounding tissue. At three weeks after surgery, the GRF glue remained in three out of six wounds, whereas the fibrin glue had disappeared by seven days in all wounds. We also examined the efficacy of GRF glue for sealing air leakage from lung tissue and for hematostasis of the liver and kidney in rabbits. GRF glue was effective for sealing air leakage from the lung tissue. It also had a hemostatic effect on oozing from parenchymal organs, but its hemostatic effect seemed insufficient for continuous arterial bleeding.

Fibrin glue in tympanoplasty.

Authors: Fujino K., Ito J., Ota K., Tokuda Y.

Publication Date: 1992

Abstract:

Not Available

Tissue sealing by local application of coagulation factors. [German]

Authors: Stemberger A., Blumel G.

Publication Date: 1983

Abstract:

Not Available

Haemostasis on the liver by fibrin glue and GRF glue; A comparative study. [German]

Authors: Stenzl W., Hofler H., Tscheliessnigg K.H.

Publication Date: 1982

Abstract:

After experimental hepatic resection in rabbits and piglets, haemostasis was achieved by using two types of tissue glue - fibrin glue and gelatin-resorcin-formaldehyde glue (GRF-glue). With both glues, an elastic adhesive film could be produced. Fibrin glue was completely absorbed by granulation tissue at the 11th postoperative day. After using GRF-glue a toxic necrosis and a subsequent demarcation of necrotic tissue could be observed, with the adhesive substance being not absorbed after 11 days. When used together with a collagen fleece, fibrin glue was not spilled away by tissue haemorrhage. Therefore it seems to be especially suited for haemostasis on the liver. With both glues, no leakage was observed after raising the portal vein pressure to 300 mm Hg during in vitro experiments.

Randomized trial of a dry-powder, fibrin sealant in vascular procedures.

Authors: Gupta N, Chetter I, Hayes P, O-Yurvati AH, Moneta GL, Shenoy S, Pribble JP, Zuckerman LA

Publication Date: 2015

Abstract:

OBJECTIVE: Topical hemostats are important adjuncts for stopping surgical bleeding. The safety and efficacy of Fibrocaps, a dry-powder, fibrin sealant containing human plasma-derived thrombin and fibrinogen, was evaluated in patients undergoing vascular surgical procedures.

METHODS: In this single-blind trial (clinicaltrials.gov: NCT01527357), adult patients were randomized 2:1 to Fibrocaps plus gelatin sponge (Fibrocaps) vs gelatin sponge alone. Results are presented for the patient subset undergoing vascular procedures with suture hole bleeding. The primary efficacy endpoint compared time to hemostasis (TTH) over 5 minutes. Safety follow-up continued to day 29.

RESULTS: A total of 175 patients were randomized and treated (Fibrocaps, 117; gelatin sponge, 58). Patients were predominately male (69%) and underwent arterial bypass (81%), arteriovenous graft formation (9%), or carotid endarterectomy (9%). Fibrocaps significantly reduced TTH compared with gelatin sponge (hazard ratio [HR], 2.1; 95% confidence interval [CI], 1.5-3.1; median TTH, 2 minutes; 95% CI, 1.5-2.5 vs 4 minutes; 95% CI, 3.0-5.0; P < .002). Significant reductions were also observed in patients receiving concomitant antiplatelet agents alone (HR, 2.8; 95% CI, 1.0-7.4; P = .03; n = 33), anticoagulants alone (HR, 2.0; 95% CI, 1.0-4.0; P = .04; n = 43), or both antiplatelet agents and anticoagulants (Fibrocaps vs gelatin sponge, HR, 2.3; 95% CI, 1.2-4.3; P = .008; n =

65). Incidences of common adverse events (procedural pain, nausea, constipation) were generally comparable between treatment arms. Anti-thrombin antibodies developed in 2% of Fibrocaps-treated patients and no-gelatin-sponge patients.

CONCLUSIONS: Fibrocaps, a ready-to-use, dry-powder fibrin sealant, was well-tolerated and reduced TTH in patients undergoing vascular procedures, including those receiving antiplatelet agents and/or anticoagulants, demonstrating its safety and usefulness as an adjunct to hemostasis.

A combination of hemostatic agents may safely replace deep medullary suture during laparoscopic partial nephrectomy in a pig model.

Authors: Ploussard G, Haddad R, Loutochin O, Bera R, Cabrera T, Malibari N, Scarlata E, Derbekyan V, Bladou F, Anidjar M

Publication Date: 2015

Abstract:

PURPOSE: We assessed whether a combination of the fibrin tissue adhesive Tisseel (human fibrinogen and thrombin) plus the hemostatic matrix FloSeal (bovine derived gelatin matrix/human thrombin) could safely replace the conventional deep medullary suture without compromising outcomes.

MATERIALS AND METHODS: Laparoscopic mid pole and one-third partial nephrectomy was performed on the right kidney of 12 female pigs. The only difference between the 2 groups of 6 pigs each was the use of a fibrin tissue adhesive plus hemostatic matrix combination in group 2 instead of the deep medullary running suture in control group 1. Renal scans and angiograms were performed at baseline and before sacrifice at 5-week followup. Retrograde in vivo pyelogram was also done.

RESULTS: No significant difference was seen in operative parameters or postoperative course between the groups. Renal scans revealed a statistically insignificant trend toward greater uptake loss in group 1 and angiograms showed 3 major vessel occlusions in that group. No active bleeding was detected. Those 3 kidneys had significantly poorer postoperative uptake on renal scan than that of other kidneys (18.6% vs 39.4%, p = 0.013). Only 1 small asymptomatic pseudoaneurysm was

noted in group 1. No urine leakage was found in either group. No major vessel occlusion, pseudoaneurysm or urinary complications developed in group 2.

CONCLUSIONS: Even after deep one-third partial nephrectomy FloSeal with concurrent Tisseel appeared sufficient to control major medullary vascular injuries and replace the deep medullary conventional suture without compromising operative outcomes. The potential advantages seen during functional and vascular examinations by decreasing the risk of unnecessary segmental vessel occlusion need further clinical evaluation.

The use of surgical glue in acute type A aortic dissection. [Review][Erratum appears in Gen Thorac Cardiovasc Surg. 2014 Apr;62(4):214]

Authors: Suzuki S, Masuda M, Imoto K

Publication Date: 2014

Abstract:

Acute type A aortic dissection (AAAD) remains a lethal disease. With advances in operative methods and perioperative management, surgical outcomes continue to improve, but in-hospital mortality still ranges from 10 to 30% in most series. The surgical technique of choice for aortic root repair remains controversial. Surgical glue created a breakthrough in surgery for acute aortic dissection. We review the surgical techniques with the use of surgical glue for AAAD.

Suture or hemostatic agent during laparoscopic partial nephrectomy? A randomized study using a hypertensive porcine model.

Authors: Rouach Y, Delongchamps NB, Patey N, Fontaine E, Timsit MO, Thiounn N, Mejean A

Publication Date: 2009

Abstract:

OBJECTIVES: To compare the efficacy of 3 biologic hemostatic devices with that of conventional suture during laparoscopic partial nephrectomy (LPN) in a hypertensive porcine model. Improving hemostasis, urinary tract closure, and the warm ischemia (WI) time are important in the development of LPN.

METHODS: A total of 40 pigs were randomized prospectively into 4 groups before bilateral LPN. Right LPN involved 30% of the renal parenchyma without a urinary tract opening, and left LPN involved 40% of the renal parenchyma with a urinary tract opening. The renal section was treated with fibrin/thrombin sealant, fibrin glue, thrombin/gelatin granules, and conventional suture in groups 1, 2, 3, and 4, respectively. At 10 days postoperatively, left retrograde pyelography was performed. The pigs were then killed and the kidneys sent for pathologic analysis. The main criteria were the estimated blood loss, perioperative WI time, leaking pressure during retrograde pyelography, and parenchyma necrotic-induced lesions.

RESULTS: The estimated blood loss was lower in the pigs treated with either thrombin/gelatin granules or suture ($P < .001$). The use of thrombin/gelatin granules decreased the WI time compared with the use of suture ($P < .001$). However, the leaking pressure was greater in the pigs treated with suture ($P < .01$). The mean area of necrosis around the renal section was shorter when no suturing was performed ($P < .01$).

CONCLUSIONS: The use of thrombin/gelatin granules alone controlled hemostasis as effectively as suture and significantly decreased the WI time. However, conventional suture of the urinary tract, when opened, should be considered. Additional evaluation in humans is required before any clinical recommendation can be made.

The use of hemostatic agents and sealants in urology. [Review] [50 refs]

Authors: Hong YM, Loughlin KR

Publication Date: 2006

Abstract:

PURPOSE: While hemostatic agents and sealants have long been used in the fields of surgery and urology, confusion persists about their indications for use and the optimal agent choice. We comprehensively defined and evaluated the scientific basis for hemostatic agent and sealant use in urology, and provide a conceptual framework for future research and discussion.

MATERIALS AND METHODS: A MEDLINE search of all available literature concerning hemostatic agents in urology was performed, including topical hemostats, anti-fibrinolytics, fibrin sealants and matrix hemostats. Select references were also chosen from the broader surgical literature. Animal studies, case reports, retrospective and prospective studies, and opinion articles were reviewed.

RESULTS: Hemostatic agents include a wide range of components. Recent literature has focused on fibrin sealants and matrix agents. Two main indications exist for hemostatic agents, including 1) hemostasis and 2) sealant. The best evidence for efficacy and safety exists for hemostasis, especially for nephrectomy and trauma. Newer data highlight urinary tract reconstruction, fistula and percutaneous tract closure, suture line strengthening and infertility as potential uses. Novel drug delivery and tissue engineering are areas with large clinical potential.

CONCLUSIONS: Hemostatic agent use is promising and yet unproven for most conditions currently treated in urology. Hemostasis continues to be the main indication, which is well established. Few

trials have examined comparative efficacy among hemostatic agents and further prospective studies are needed to justify additional indications as well as determine the optimal mode of use. Minimally invasive surgery will further drive the use of hemostatic agents and sealants. Cost-effective, evidence based hemostatic agent use will continue to challenge all urologists. [References: 50]

An in vitro and in vivo analysis of fibrin glue use to control bone morphogenetic protein diffusion and bone morphogenetic protein-stimulated bone growth.

Authors: Patel VV, Zhao L, Wong P, Pradhan BB, Bae HW, Kanim L, Delamarter RB

Publication Date: 2006

Abstract:

BACKGROUND CONTEXT: Recombinant human bone morphogenetic protein-2 (rh-BMP2) has become popular for augmenting spine fusion in the lumbar and cervical spine. Concerns exist, however, over bone morphogenetic protein (BMP)-stimulated soft-tissue swelling and bone growth stimulation in areas where bone is not desired, especially as the material "leaks" into such spaces. The most detrimental effects of such leakage might be airway compromise, while heterotopic bone formation into the spinal canal has been reported in animal and human studies. Fibrin glue has been used as a carrier of many osteoinductive materials; however, its efficacy at modulating the clinical effects of BMP are not known. The amorphous nature of fibrin glue makes it a candidate to control diffusion of BMP and possibly limit bone formation by limiting BMP diffusion to areas where such bone is not desired.

PURPOSE: To evaluate the use of fibrin glue to limit BMP diffusion and BMP-stimulated bone growth.

STUDY DESIGN/SETTING: This is an in vitro basic science study and an in vivo prospective randomized animal study.

STUDY SAMPLE: Eighteen Lewis rats.

OUTCOME MEASURES: In vitro study: Enzyme-linked immunosorbent assay measurement of rh-BMP2 concentration in saline. In vivo study: At day 60, rats were evaluated for neurologic deficits before sacrifice. Spines were harvested, and the following studies were performed: 1) manual testing for fusion and bone growth; 2) X-ray evaluation; 3) Micro-computed tomography (micro-CT) scans.

METHODS: In vitro study: Collagen sponges soaked with BMP at two different concentrations were incubated in saline solution with and without encapsulation by fibrin glue. Saline BMP concentrations were measured at consecutive time points. In vivo study: A rat fusion model using rh-BMP2 for fusion has been developed and tested with resultant100% fusion in over 100 rats. Lewis rats were divided into two groups and treated as follows: I: Exposure of L4-L5 transverse processes, decortication, and placement of BMP sponge in the lateral intertransverse space. II: Exposure and decortication as above and placement of fibrin glue before BMP sponge placement.

RESULTS: In vitro study: Peak rh-BMP2 concentrations in saline were 20% and 45% of the maximum possible for fibrin glue encapsulated sponges and controls, respectively, with a more gradual increase to peak concentration in samples encapsulated in fibrin glue. In vivo study: No rats exhibited any neurologic deficits. X-rays revealed at least partial bone formation in all rats. Manual testing of intertransverse fusion spines revealed 100% fusion in rats treated with BMP only, whereas rats treated with fibrin glue before placement of BMP sponges revealed only one possible fusion. Posterior-lateral bone formation was present on X-ray in both groups, and micro-CT imaging revealed bridging bone from transverse processes to the BMP-stimulated bone in the control groups. In spines treated with fibrin glue before rh-BMP2 placement, bone formation could still be seen within the soft tissues; however, bridging bone connecting to the transverse processes was either significantly decreased or not present.

CONCLUSIONS: Fibrin glue can limit rh-BMP2 diffusion. Also, because it limited bone formation at the transverse processes, it can be inferred that fibrin glue can limit bone formation when used to separate areas of desired bone formation from areas where bone formation is not desired.

Controlled survival study of the effects of Tisseel or a combination of FloSeal and Tisseel on major vascular injury and major collecting-system injury during partial nephrectomy in a porcine model.

Authors: L'Esperance JO, Sung JC, Marguet CG, Maloney ME, Springhart WP, Preminger GM, Albala DM

Publication Date: 2005

Abstract:

PURPOSE: We report the results of a controlled survival study in a porcine model investigating Tisseel or a combination of FloSeal and Tisseel in dealing with vascular and collecting-system injury during partial nephrectomy.

MATERIALS AND METHODS: We performed an open right lower-pole partial nephrectomy on 15 large female pigs. The defect was repaired using standard open techniques (N = 5; controls), Tisseel only (N = 6; group I), or FloSeal followed by Tisseel (N = 4; group II). A Jackson-Pratt drain was placed. Nephrectomy and retrograde pyelography were performed at 1 week.

RESULTS: Operative times were shorter in both study groups, achieving statistical significance in group I (P = 0.008). Warm-ischemia times were significantly improved in both study groups (P = 0.029 and P = 0.00005 in groups I and II, respectively). Time to hemostasis was significantly shorter in group II only (P = 0.002) but approached significance in Group I as well (P = 0.09). Estimated blood loss was not significantly different from the controls in either group. When Tisseel was placed alone after hilar control, hematoma formation under the Tisseel was noted on release of the hilar clamp. After 1 week, there was one urinoma and three urine leaks in the control group. In group I,

there was one urinoma and four urine leaks, and there was only one urine leak and no urinomas in group II. There were no hematomas in any of the groups.

CONCLUSIONS: Tisseel alone is not adequate for either hemostasis or management of major collecting-system injury. FloSeal capped with Tisseel appears sufficient to control major vascular and collecting-system injuries without adjunctive surgical measures. A proposed technique for laparoscopic partial nephrectomy without reconstructive techniques is presented that warrants clinical study.

Hemostatic efficacy of fibrin sealant (human) on expanded poly-tetrafluoroethylene carotid patch angioplasty: a randomized clinical trial.

Authors: Jackson MR, Gillespie DL, Longenecker EG, Goff JM, Fiala LA, O'Donnell SD, Gomperts ED, Navalta LA, Hestlow T, Alving BM

Publication Date: 1999

Abstract:

PURPOSE: The efficacy of solvent-detergent-treated fibrin sealant (human [FSH]) for controlling anastomotic bleeding from expanded polytetrafluoroethylene (ePTFE) patch angioplasty during carotid endarterectomy was evaluated, and FSH was compared with thrombin-soaked gelatin sponge (Gelfoam; TSG).

METHODS: The study was of a randomized, open-label, single-site, single-treatment, parallel design that took place in a referral center with hospitalized patients. Forty-seven adult patients (33 men, 14 women) underwent elective carotid endarterectomy. Patients were randomized to receive either FSH (N = 24) or TSG (N = 23). FSH was obtained as an investigational new drug. FSH was applied as a liquid by means of a dual-syringe technique. Heparin anticoagulation, patch thickness, and suture type were standardized. Two different needle sizes were used (CV-6, PT-13: N = 21 [FSH: N = 10, TSG: N = 11]; CV-6, PT-9: N = 26 [FSH: N = 14, TSG: N = 13]). The FSH or TSG was applied to the ePTFE patch, and then blood flow was restored through the carotid artery. Degree of anticoagulation was assessed by anti-factor Xa activity. The time from restoration of carotid blood flow until achieving hemostasis was recorded. The blood loss from patch suture hole bleeding was measured. Completion intraoperative duplex ultrasound scanning was performed in all cases. Heparin was reversed with protamine sulfate. The primary end point was successful hemostasis

within 15 minutes of restoration of carotid blood flow. The secondary end points were the amount of blood loss caused by suture line bleeding and the time to achieve hemostasis.

RESULTS: There was no difference in the number of patients with complete hemostasis at 15 minutes (TSG, 13 of 23; FSH, 12 of 24; P =.77). The measured blood loss was 99.0 +/- 119.9 (SD) mL for TSG, and 105.0 +/- 107.9 mL for FSH (P =.86). The time to hemostasis was the same for both groups (TSG, 16.5 +/- 16.5 minutes; FSH, 16.6 +/- 14.2 minutes; P =.97). Within both treatment groups, the use of larger needles (PT-13) was associated with greater blood loss (FSH, 169.7 +/- 124.2 mL; TSG, 172.7 +/- 151.5 mL) than was the use of smaller needles (PT-9; FSH, 58.8 +/- 66.3 mL; TSG, 34.1 +/- 25.6 mL; P =.036, P =.001, respectively). There were no postoperative strokes or bleeding complications in either group. No abnormalities were shown in either group by means of completion carotid duplex ultrasound scanning.

CONCLUSION: FSH was equivalent, but not superior to, TSG in achieving hemostasis during carotid endarterectomy performed with ePTFE patch angioplasty. Adhesion properties of FSH to ePTFE are possibly different than those to native tissue and warrant additional investigation.

[Changes in the vascular wall induced by surgical glues. Experimental study]. [French]

Authors: Portoghese M, Acar C, Jebara V, Chachques JC, Fontaliran F, Deloche A, Carpentier A

Publication Date: 1992

Abstract:

The effects on vascular tissues of two different types of surgical glue, gelatin-resorcinol-formaldehyde (GRF) and fibrin (Tissucol) were tested on the rat abdominal aorta. The GRF glue induced destruction of the vascular wall: multiple inclusions of the glue were noted in the media. Conversely, the fibrin glue preserved the normal architecture of the three arterial layers. The use of GRF glue therefore should be avoided on particularly fragile tissues (e.g. coronary arteries), and it seems preferable in such cases to use the fibrin glue.

The use of TachoSil associated to fibrin glue as dural sealant in spinal intradural tumors surgery.

Authors: Montano N., Papacci F., Fernandez E.

Publication Date: 2017

Abstract:

Not Available

Sellar reconstruction using biomaterials after transsphenoidal surgery in 449 cases of pituitary adenomas.

Authors: Du J., Qiu B., Tao J., Ou S., Wang Y.

Publication Date: 2014

Abstract:

BACKGROUND: We report the methods and effects of sellar reconstruction using biomaterials in 449 cases of pituitary adenoma undergoing transsphenoidal surgery from August 2009 to August 2010. METHODS: During transsphenoidal surgery (including 15 cases assisted with endoscope), diaphragma sellae damage and cerebrospinal fluid (CSF) leakage occurred in 52 cases intraoperatively. The resection cavity was packed with absorbable hemostatic cotton and gelatin sponge, and then artificial dura mater and fibrin glue were used to seal and reconstruct the sellar floor. Postoperative and delayed CSF leakage occurred in 6 and 2 cases, respectively. To manage the CSF leakage, the removal of intranasal vaseline gauze was postponed; and meanwhile, continuous lumbar CSF drainage and/or mannitol were used to decrease the intracranial pressure. RESULTS: The incidence of CSF leakage was 12% (52 cases) intraoperatively, 1.3% (6 cases) postoperatively, and incidence of delayed CSF leakage was 0.45% (2 cases). For cases of postoperative CSF leakage, postponed removal of intranasal vaseline gauze and reducing intracranial pressure were effective methods. Most cases were cured in 1 week. CONCLUSION: In transsphenoidal surgery of pituitary adenoma, an exact intrasellar packing and sellar floor reconstruction with artificial dura mater and fibrin glue are effective and affirmative to prevent postoperative CSF leakage.

Effect of hemostatics used during operations for digestive organ on cancer cells present in the peritoneal cavity.

Authors: Kubota N., Kojima T., Naruse T.

Publication Date: 2000

Abstract:

We investigated effects of hemostatics used during operations for digestive organ on cancer cells present in the peritoneal cavity using BALB/c mice inoculated with Meth A tumor cells (fibrosarcoma) intraperitoneally (i.p.) and C3H/He mice inoculated with MH134 tumor cell (hepatic cell carcinoma) i.p. Microfibrillar collagen hemostat (Avitene) or fibrinogen preparation (Beriplast P) did not affect survivals of those tumor-bearing mice. Gelatin sponge (Spongel) prolonged survivals of MH134 tumor-bearing mice. Liquid form gelatin used instead of Spongel displayed in vitro antitumor effect on MH134 tumor cells at the concentration of 15 mg/ml. Radioactive sodium chromate-labeled MH134 and Meth A tumor cells were not lysed when they were incubated with 15 mg/ml of liquid form gelatin for 24 hours. On the other hand, the tritium thymidine (³H-TdR) uptake by MH134 or RL 1 tumor cells was suppressed when they were incubated with 15 mg/ml of liquid form gelatin for 24 hours. Proliferation of Meth A tumor cells were not affected by the treatment. Effect of liquid form gelatin on phytohemagglutinin (PHA)-stimulated spleen cells as a benign counter-part of RL 1 tumor cells (T cell lymphoma) was examined Liquid form gelatin (15 mg/ml) did not suppress ³H-TdR uptake by PHA-stimulated spleen cells.

Effects of Tisseel and FloSeal on primary ischemic time in a rat fasciocutaneous free flap model.

Authors: Partsafas AW, Bascom DA, Jorgensen SA, Wax MK

Publication Date: 2004

Abstract:

OBJECTIVES: Free flaps are the technique of choice for reconstruction of defects resulting from extirpation of tumors of the head and neck. Advances in microsurgical technique have resulted in success rates of greater than 95%. Numerous intraoperative factors, ranging from technical issues to topically applied agents, can complicate the outcome of microsurgical free tissue transfer. Synthetic tissue adhesives and hemostatic agents are playing an ever-increasing role in reconstructive surgery. The safety of these factors in free flap surgery has not been ascertained.

STUDY DESIGN: Animal Care Committee live rat model.

METHODS: Male Sprague-Dawley rats were divided into three groups: group I, Control; group 2, FloSeal; group 3, Tisseel. In each group, a 3 x 6 cm ventral fasciocutaneous groin flap based on the left superficial epigastric artery was elevated and the experimental material applied beneath the flap and around the flap pedicle prior to suturing of the flap back to the wound bed. The experimental materials consisted of 0.2 mL saline in the control group, 0.5 mL FloSeal, and 0.2 mL Tisseel. In phase I of this study, the effect of each treatment on flap survival was assessed by survival at postoperative day 4. In phase II of the study, the effects of these agents on ischemic tolerance was investigated. Five rats in each treatment group were exposed to ischemic times of 6, 8, 10, and 12 hours. Survival of the flap was assessed 7 days after reversal of the ischemia. Probit curves and the critical ischemic time (CIT50) were calculated.

RESULTS: All flaps survived the 2-hour period of ischemia and were viable at postoperative day 4. Flap survival from group 1 (Control), group 2 (FloSeal), and group 3 (Tisseel) at the various ischemic times was as follows: at 6 hours, 80%, 80%, and 80%, respectively; at 8 hours, 80%, 80%, 60%; at 10 hours, 60%, 33%, 40%; at 12 hours, 20%, 20%, 0%. The CIT50 for the Control, FloSeal, and Tisseel groups was 9.4, 9.0, and 7.0 hours, respectively.CONCLUSIONS FloSeal, a thrombin-based hemostatic agent, and Tisseel, a fibrin glue, displayed no adverse effect on flap survival in this model.

Hemostasis and other benefits of fibrin sealants/glues in spine surgery beyond cerebrospinal fluid leak repairs.

Authors: Epstein N.E.

Publication Date: 2014

Abstract:

Background: Fibrin sealants (FS)/glues (FG) are primarily utilized in spinal surgery to either strengthen repairs of elective (e.g., intradural tumors/pathology) or traumatic cerebrospinal fluid (CSF) fistulas. Here, additional roles/benefits of FS/FG in spine surgery are explored; these include increased hemostasis, reduction of scar, reduction of the risk of infection if impregnated with antibiotics, and its application to restrict diffusion and limit some of the major complications attributed to the controversial "off-label" use of bone morphogeneitc protein (rhBMP-2/INFUSE). Methods: We reviewed multiple studies, focusing not just on the utility of FS/FG in the treatment of CSF fistulas, but on its other applications. Results: FS/FG have been primarily used to supplement elective/traumatic dural closure in spinal surgery. However, FS/FG also contribute to; hemostasis, reducing intraoperative/postoperative bleeding/transfusion requirements, length of stay (LOS)/costs, reduced postoperative scar/radiculitis, and infection when impregnated with antibiotics. Nevertheless, one should seriously question whether FS/FG should be applied to prevent diffusion and limit major complications attributed to the "off-label" use of BMP/INFUSE (e.g., limit/prevent heterotopic ossification, dysphagia/respiratory decompensation, and new neurological deficits). Conclusions: FS/FG successfully supplement watertight dural closure following elective (e.g., intradural tumor) or traumatic CSF fistulas occurring during spinal surgery. Additional benefits include: intraoperative hemostasis with reduced postoperative drainage, reduced transfusion requirements, reduced LOS, cost, scar, and prophylaxis against infection (e.g., impregnated with antibiotics). However, one should seriously question whether FS/FG should be used to contain the

diffusion of BMP/INFUSE and limit its complications when utilized "off-label". Copyright:

Efficacy of fibrin sealant in patients on various levels of oral anticoagulant undergoing oral surgery.

Authors: Bodner L., Weinstein J.M., Baumgarten A.K.

Publication Date: 1998

Abstract:

OBJECTIVE: The purpose of this study was to investigate the efficacy of fibrin sealant in patients on oral anticoagulant therapy undergoing oral surgery with varying degrees of surgical trauma and various intensities of anticoagulation. STUDY DESIGN: A consecutive series of 69 subjects on oral anticoagulant therapy undergoing oral surgery without changing anticoagulation intensity is presented. For each subject, indication for anticoagulation, international normalized ratio on day of treatment (low, 1.0-2.0; medium, 2.1-3.0; high, 3.1-5.0), degree of surgical trauma (on a scale of 1-12), and complications were recorded and correlated. RESULTS: There were 32 (46.4%) patients with prosthetic valves, 23 (33.3%) with atrial fibrillation and rheumatic or ischemic heart disease, and 14 (20.3%) with previous thromboembolism. Twenty (29%) patients were on low-intensity anticoagulation (international normalized ratio, 1.0-2.0), 26 (37.7%) were on medium-intensity anticoagulation (international normalized ratio, 2.1-3.0), and 23 (33.3%) were on high-intensity anticoagulation (international normalized ratio, 3.1-5.0). Each of 39 (56.5%) patients was in surgical trauma category 1, 2, or 3; the remaining 30 (43.5%) patients were in surgical trauma categories 4 through 12. Complications occurred in 3 (4.3%) patients and took the form of minor postoperative bleeding. No correlation was found between complications and international normalized ratio or degree of surgical trauma. CONCLUSIONS: The use of fibrin sealant in oral surgery for patients on oral anticoagulant therapy is safe, and it can be provided in an international normalized ratio range of 1.0 through 5.0 and in a surgical trauma scale range of 1 through 12.