

FIBRIN SEALANT FOR THE MANAGEMENT OF GENITOURINARY INJURIES, FISTULAS AND SURGICAL COMPLICATIONS

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ABSTRACT

Purpose: We report our preliminary experience with the use of fibrin sealant to manage iatrogenic urinary tract injuries, complex urinary fistulas, and urological surgical complications.

Materials and Methods: Topical fibrin sealant was used in 19 patients for iatrogenic urinary tract injury during gynecological or general surgical procedures (7), complex urinary fistulas (5) or urological surgical complications (7).

Results: Successful resolution of the injury, fistula or complication was attained after a single application of fibrin sealant in the 18 patients (94.7%) in whom a direct injection technique was used. The only failure (formation of a vesicovaginal fistula) occurred with the air driven sprayed sealant delivery technique after sutured closure of iatrogenic cystotomy during vaginal hysterectomy.

Conclusions: Liquid fibrin sealant appears to be safe and prudent for use in urological “damage control” from trauma, fistulas or surgical complications. Direct injection over a sutured urinary anastomosis appears to be highly effective in preventing urinary drainage. Additional study is needed to define further the role and best use of tissue adhesives in urology.

KEY WORDS: urogenital surgical procedures, tissue adhesives, hemostatic techniques

Fibrin sealant has been gaining popularity as an adjunct for a plethora of surgical applications since Food and Drug Administration (FDA) approval in 1998. Its unique properties as a hemostatic agent, tissue adhesive and urinary tract sealant make it an attractive adjunct for managing complex surgical problems of the genitourinary tract effectively. We previously reported the successful use of fibrin sealant in the management of Fournier’s gangrene sequelae, open prostatectomy and splenic injury.^{1–3} We now present our experience with the use of fibrin sealant in the management of iatrogenic urinary tract injuries, complex urinary fistulas and urological surgical complications.

MATERIALS AND METHODS

From 2000 to 2002, 19 patients received fibrin sealant as an adjunct to urological care for iatrogenic urinary tract injury sustained during gynecological surgical procedures or trauma (group 1), complex urinary fistulas (group 2) or urological surgical complications (group 3). All patients received the commercially available fibrin sealant HEMASEEL APR (Haemacure Corp, Sarasota, Florida), which was prepared according to manufacturer instructions. A successful outcome was defined as resolution of the underlying urological problem without further surgical intervention.

Group 1 comprised 6 gynecological bladder injuries that occurred during transvaginal hysterectomy and 1 traumatic ureteral injury (gunshot wound), all of which resulted in urgent intraoperative urological consultation. For bladder

repair 2 ml. fibrin sealant were applied transvaginally as a bolster over the absorbable bladder suture line to seal the anastomosis before closure of the vaginal mucosa. In 1 patient the air driven spray technique was used and all others received straightforward injection. The traumatic ureteral injury was repaired via a stented ureteroureterostomy and then sealed with 2 ml. fibrin sealant.

Patients in group 2 included 5 men and 1 woman. Of the men, 1 had inflammatory urethrocutaneous fistula, 2 had traumatic bladder fistula and 1 had prostatic fistula owing to combined external beam radiation/brachytherapy. The woman had persistent vesicovaginal fistula after attempted transvaginal and abdominal repair. For the inflammatory fistula repair 5 ml. fibrin sealant were injected along the fistulous tract after accessing and fulgurating the fistula endoscopically (fig. 1). The 2 traumatic fistulas were amputated from the bladder via a retropubic approach and sealed with direct injection of 5 ml. fibrin sealant into the fistulous tract (fig. 2). The prostatic fistula was repaired via a single stage salvage prostatectomy, rectal repair, bladder neck closure and ileocystoplasty with omental interposition. Bladder neck and rectal anastomoses were each sealed with direct injection of 2 ml. fibrin sealant before omental interposition. The vesicovaginal fistula was treated with transvaginal sealant instillation as monotherapy.

All patients in group 3 had complications of urological surgical procedures and were treated with direct injection of 2 ml. fibrin sealant. Of the 7 patients 2 experienced life threatening hemorrhage owing to coagulopathy after minor genital surgery (radical orchiectomy in 1 patient who then required warfarin sodium for vena caval thrombus, and incision and drainage of a urinoma in 1 with thrombocytopenic purpura). The patient who sustained extraperitoneal dehiscence of the abdominal wound after radical prostatectomy was not an operative candidate because of a recent myocardial infarction (see table).

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Editor’s Note: This article is the fourth of 5 published in this issue for which category 1 CME credits can be earned. Instructions for obtaining credits are given with the questions on pages 1516 and 1517.

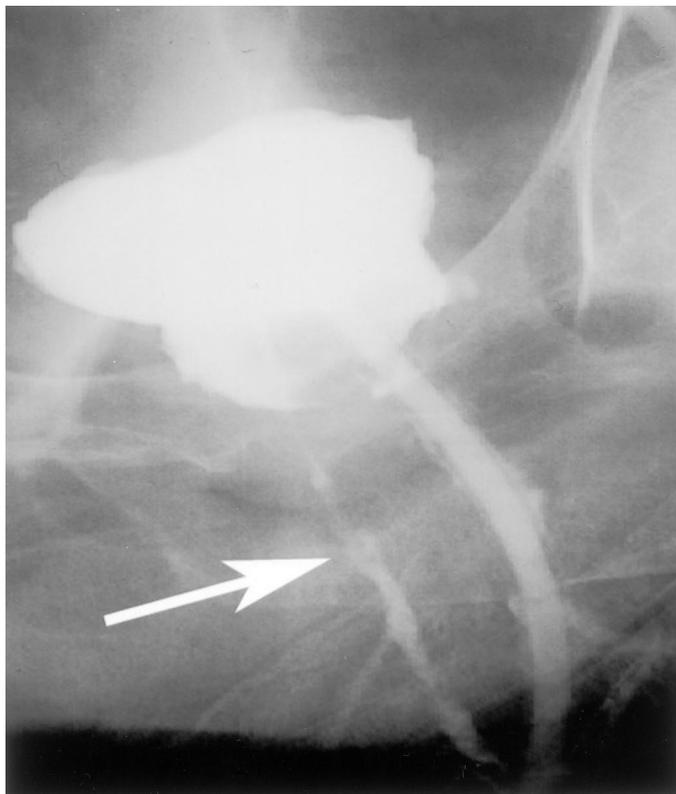


FIG. 1. Long urethrocutaneous fistula in quadriplegic patient resolved with instillation of 5 ml. fibrin sealant into tract.

RESULTS

Overall, use of fibrin sealant as a surgical adjunct was associated with an outstanding long-term clinical outcome in 94.7% (18 of 19) of the patients. Only 1 patient (5.3%) required additional surgery for the same clinical problem at long-term followup (range 3 to 25 months, mean 13). The failure in our series occurred when the air driven spray application method was used in lieu of direct injection. A vesicovaginal fistula developed in this group 1 patient after attempted transvaginal closure of a cystotomy sustained during vaginal hysterectomy.

Repair was successful in 100% of patients with complex bladder/urethral fistulas (group 2) and urological surgical complications (group 3). All patients with sealed rectal injuries healed well with no adverse clinical sequelae. The patient who had sustained bulbous urethral perforation during penile prosthesis implantation did well after sutured, sealed repair followed immediately by an inflatable penile prosthesis in the same setting. The 2 patients with life threatening bleeding from postoperative coagulopathy attained complete hemostasis after a single application of sealant.

DISCUSSION

Although all surgical fields have now reported great success with fibrin sealant for a plethora of clinical purposes,⁴⁻⁶ urological experience has largely been limited to animal studies and small case reports involving nonFDA approved sealant.⁷ To our knowledge, this series represents the first comprehensive report of the use of contemporary FDA approved fibrin sealant to manage urological trauma, fistulas and surgical complications.

Fibrin sealant appears to be advantageous for urological surgery as a hemostatic agent, tissue adhesive and urinary tract sealant. Unlike synthetic tissue adhesive agents, it is biocompatible and biodegradable through natural fibrinolytic mechanisms, thereby preventing inflammation, foreign body



FIG. 2. Traumatic 12 cm. bladder pseudodiverticulum resolved with amputation of neck from bladder and instillation of 5 ml. fibrin sealant into diverticulum cavity.

Indications for fibrin sealant

	No. Pts.
Group 1:	
Cystotomy (during transvaginal hysterectomy)	6
Ureterotomy (traumatic)	1
Group 2:	
Male bladder fistula (traumatic)	2
Male urethral fistula (inflammatory)	1
Rectoprostatic fistula (radiation)	1
Vesicovaginal fistula (postoperative)	1
Group 3:	
Rectal injury (during radical prostatectomy)	3
Uncontrollable hemorrhage (coagulopathy)	2
Extraperitoneal wound dehiscence	1
Urethrotomy (during penile prosthesis placement)	1
Total	19

reactions and fibrosis while promoting healing.⁸ As a hemostatic agent, fibrin sealant is effective because it provides supraphysiological concentrations of fibrinogen directly to the point of injury, overcoming concomitant deficiencies in intrinsic and extrinsic coagulation pathways and, thus, amplifying the common final pathway of hemostasis.⁹

Fibrin sealant appears to promote healing by enhancing local proliferation of fibroblasts and subsequent replacement by connective tissue.⁸ It has been shown to prevent formation of bronchopleural fistulas after pulmonary resection,^{10,11} secure skin grafts in reconstructive and burn surgery,¹² and occlude chronic anorectal¹³ and enterocutaneous¹⁴ fistulous tracts. Endoscopic injection of fibrin sealant into a vesicovaginal fistulous tract in combination with bovine collagen has been used to achieve continence,¹⁵ and serial injections of sealant have resulted in occlusion of a ureterocutaneous fistula.¹⁶ To our knowledge, this is the first report demonstrating successful long-term treatment of vesicocutaneous and urethrocutaneous fistulas with commercial fibrin sealant.

One of the most promising urological applications lies in the potential of fibrin sealant to provide an effective urinary tract seal by reinforcing sutures in high risk urinary tract anastomoses. Fibrin sealant has been used effectively to support approximating sutures in pyeloplasty,¹⁷ ureteral anastomoses,¹⁸ vasovasostomy¹⁹ and vasoepididymostomy.²⁰ This application has also been demonstrated in an experimental rat model in which skin sutures supported by fibrin sealant provided watertight anastomosis immediately after surgery and withstood significantly higher hydrostatic pressures than did nonsealed anastomoses.²¹ We effectively reinforced closure of the urinary tract in our patients with iatrogenic injury (cystotomy, ureterotomy, urethrotomy). Watertight closure with fibrin sealant support should prevent urinary extravasation and reduce the risk of postoperative infection or fistula formation.

Fibrin sealant promotes the simplified, successful transvaginal management of gynecological cystotomy (fig. 3). Its effectiveness appears equivalent to that of conventional tissue transfer methods for bolstering bladder repair, such as Martius, peritoneal or omental flaps, but superior in that the time and morbidity of additional tissue transfer are avoided. Peritoneal and omental flaps may not be readily available when the urologist is called for intraoperative consultation during a transvaginal procedure, and a Martius flap risks postoperative disfigurement.

The only failure we experienced in these 19 patients was with the air driven spray technique over urinary tract closure. Although this method enhances mixing of the aerosolized fibrinogen and thrombin, a thinner coat of sealant is delivered to the wound. We hypothesize that standard direct dual-barrel syringe application provides a thicker layer of sealant, which prevents urinary extravasation from surgical wounds more effectively.

CONCLUSIONS

Fibrin sealant appears to offer a rapid and secure adjunct to the management of genitourinary fistulas and injuries through its hemostatic, tissue adhesive and urinary tract sealant properties. Direct injection over a sutured anastomosis appears to prevent urinary leakage and promote definitive repair effectively. Although fibrin sealant use appears to reduce risk and enhance clinical outcome in a variety of

challenging urological surgical problems, further study is needed to define better the role and optimal delivery methods for tissue adhesives in urology.

Drs. Edward Mueller and Edith Canby contributed to this manuscript.

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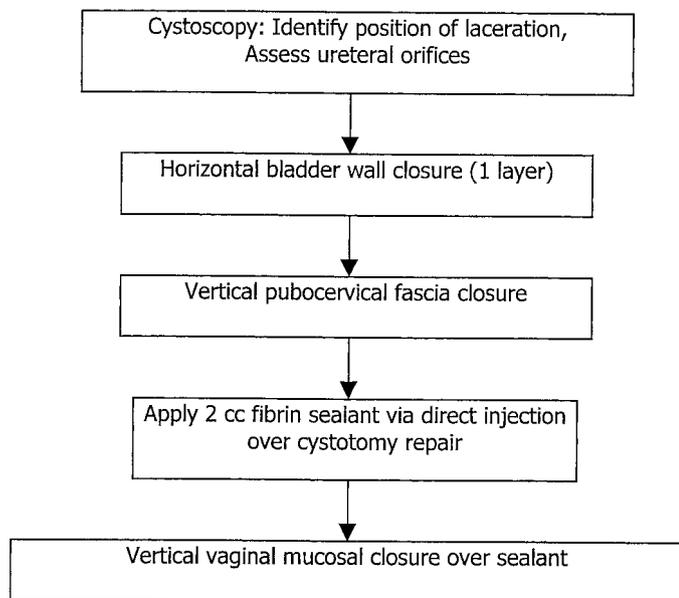


FIG. 3. Management algorithm for intraoperative consultation for bladder injury during transvaginal hysterectomy.