

Use of Cyanoacrylate Glue in the Management of Troublesome Cardiovascular Events

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SIYANOAKRİLAT DOKU YAPIŞTIRICISININ KARDİYOVASKÜLER CERRAHİNİN GÜÇ ANLARINDA KULLANIMI

ÖZET

On hastada operasyon sırasında ortaya çıkan bazı cerrahi problemlerin çözümünde siyanoakrilat yapıştırıcı kullanıldı.

Tip II aort disseksiyonu olan bir olguda siyanoakrilat yapıştırıcı ile distal dikiş hattı güçlendirildi ve distal yalancı lümen oblitere edildi. İki olguda sağ ventrikül serbest duvar rüptürü bir perikard parçasının bu bölgeye siyanoakrilatla yapıştırılmasıyla onarıldı. Postoperatuar sternal kaynakma kusuru olan dört olguda siyanoakrilat kullanılarak stabilizasyon sağlandı. Bir başka olguda epidermoid karsinom invazyonuna uğramış olan femoral arter siyanoakrilat ile tamir edildi. Sol ventrikül apikal kist hidatik enükleasyonu yapılan bir olguda ventrikülotomi dikiş hattı kanaması, bölgeye siyanoakrilat yardımıyla teflon şeritler yapıştırılarak kontrol edildi. Son olarak, fragil aortlu bir vakada aort kapak replasmanı sonrası aortotomi hattı kanaması siyanoakrilatlı teflon şerit çepeçevre sarılarak durduruldu. Tüm olguların postoperatuar dönemleri sorunsuz seyretti ve periyodik kontrolleri sürmektedir.

Sonuç olarak, siyanoakrilat yapıştırıcı kardiyovasküler cerrahide ortaya çıkan bir takım ciddi sorunların çözümünde güvenle kullanılabilir, ucuz, hayat kurtarıcı neticeler verebilen yeni bir yardımcı araçtır.

Anahtar kelimeler: *Siyanoakrilat, aort disseksiyonu, sternum detaşmanı, ventrikül rüptürü, arter tamiri.*

Refixation of dissected aortic layers or reinforcement of the suture lines with biological or biocompatible synthetic tissue adhesives (1,2), and sutureless technics of repair of the postmyocardial infarction left ventricular free wall ruptures (3) are new adjuncts to cardiac surgery. We used commercially available cyanoacrylate (cyanacrylacidethylester, Lely Turbo Yapıştırma Tek. Ltd, İstanbul, Turkey) adhesive in ten patients for six different purposes.

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PATIENTS and METHODS

The first case was a 55 year-old man admitted in a preshock state. Chest roentgenography showed enlargement of the mediastinal shadow. Chest and abdominal computed tomography revealed dissection of the ascending aorta extending to the arcus. An intimal flap arising just above the aortic valve was seen. The patient's conditions deteriorated rapidly and urgent operation for Stanford type A-De Bakey type II ascending dissection was undertaken 8 hours after the admission, on September 29,1997. Median sternotomy was performed after the left femoral artery cannulation. Pericardial tamponade was present. Massive hematoma around the heart was relieved. There was no significant aneurysmal dilatation of the aorta. After the rapid cannulation of the right atrium, cardiopulmonary bypass was initiated. The patient was cooled down to 17-18° C, and circulation was arrested. No retrograde cerebral perfusion was used. An acute ruptured ascending dissection with an intimal tear a few centimeters above the aortic valve on the antero-lateral wall of the aorta was found. The false channel extended to the inner curvature of the proximal part of the aortic arcus. A 28 mm woven double velour vascular graft (Hemashield; Meadox Medicals, Inc, Oakland, NJ) was interposed above the coronary ostia to the aortic arch. Aortic hemi-arch anastomosis was performed under 16 minutes of hypothermic circulatory arrest without the use of teflon felt strips. But abundant bleeding from the posterior part of the distal anastomotic line occurred and we could not control it with standard suturing technics. As a last option, the anastomotic line was reinforced by commercially available cyanoacrylate adhesive, and peri-anastomotic tissues were reapproximated with cyanoacrylate glue by direct application over the suture line under 5 minutes of an additional total circulatory arrest period. The aortic valve was resuspended with pledget supported sutures. Total myocardial ischemic time was 67 minutes and the cardiopulmonary bypass time was 118 minutes. He was discharged on the 12th postoperative day. The patient is quite well 9 months after the operation without any false lumen on MRI control.

An iatrogenic right ventricular free wall perforation occurred in a 66 year-old female patient during dissection, for redo mitral valve replacement. A pericardial patch of 1.5x3 cm was prepared and pasted over the epicardial surface of the ruptured right ventricle with a thin layer of cyanoacrylate. The rest of the procedure was uneventful and the patient was discharged on the 12th postoperative day. In another case, oozing from the right ventricular epicardial surface after dissection for redo double valve replacement was controlled by the same way (Table 1).

Double valve replacement has performed in a 42 year-old male patient. On the 8th postoperative day, cardiac tamponade developed and the patient was revised urgently. During chest closure, multiple bilateral transverse, Hendrickson type III (4) sternal fractures were seen. Sternal wires were applied in a standard fashion, but before the wires were tightened, cyanoacrylate adhesive was applied to the sternal edges and then the sternal parts were strongly approximated. Sternum stabilized in a few minutes. Postoperative course was uneventful without any sign of infection or sternal detachment, and the patient was discharged on the 8th day. Three additional cases of sternal detachment were also treated by the same technic (Table 1).

A 37 year-old lady with an epidermoid carcinoma originated from a burn scar on the left groin was admitted to the hospital due to femoral bleeding. Femoral artery has invaded by the carcinoma. She was urgently taken to the operating room and bleeding from the left common femoral artery was controlled by direct sutures. Arterial wall was very fragile and for reinforcement, deep fascia and femoral sheath were prepared and pasted over the arterial wall by cyanoacrylate glue. This patient was followed up for 2 months. Femoral artery patency was good and, then she referred to the plastic surgery for further treatment.

A 46 year-old who has operated on for hepatic hydatid cysts 8 months ago. She was admitted to our center for left ventricular apico-lateral Echinococcal cyst. We performed left apical ventriculotomy under standard hypothermic (28° C) cardiopulmonary bypass and crystalloid cardioplegia and the cyst was extirpated with its germinal and fibro-

us membranes. Ventriculotomy edges were sutured with 2/0 polypropylene, but bleeding occurred from a tear over the suture line. This was controlled by cyanoacrylate glue pasted two teflon felts on the each side of the ventriculotomy. Postoperative course was uneventful with 250 cc total mediastinal drainage. Six months follow-up of this patient is without complication.

In the last case, abundant bleeding from the aortotomy suture line after aortic valve replacement on a fragile aorta was controlled by gluing a 3x15 cm teflon felt around the aorta at the level of the aortotomy. This was an easy and good alternative to the ascending aortic tube graft replacement for that patient (Table 1).

Bacteriological analyses: In all of the cases, a sample of cyanoacrylate glue was inoculated into soybean-casein digest broth (Bactec Plus Aerobic and Plus Anaerobic Culture Vials, Becton Dickinson Diagnostic Instrument Systems, Maryland, USA), Endo-agar (Dio-Media, Diomed AŞ, İstanbul, Turkey) and Sabouraud Dextrose Agar (Diomed AŞ, İstanbul, Turkey) for bacteriological control.

RESULTS

All the patients made an uneventful recovery and were followed up for 1 month to 9 months (mean 5 months). All are symptomless and in New York Heart Association functional class I.

Bacteriological studies showed no growth in any of the above-mentioned culture media. On the other

Table 1. General information on the patients.

CASE	AGE/SEX PATHOLOGY	PRIMARY	DATE	PROCEDURE	RESULT	HOSP.DAY	FOLLOW-UP month
1	55/M	Hemiarc replacement	Sep. 97	Distal anastomosis reinforcement	Successful	11	9
2	66/F	Redo MVR	Oct. 97	RV pericardial patch repair	Successful	12	8
3	42/M	AVR+MVR sternal detachment	Oct. 97	Sternal gluing	Successful	19	8
4	37/F	Femoral A. repair	Nov. 97	Arterial wall reinforcement	Successful	7	7
5	46/F	Apical hydatidosis	Dec. 97	Teflon felt gluing over the apex	Successful	8	6
6	64/M	CABG, sternal detachment	Jan. 98	Sternal gluing	Successful	42	5
7	67/M	CABG, sternal detachment	Jan. 98	Sternal gluing	Successful	37	5
8	70/M	CABG+CE, sternal detachment	March 98	Sternal gluing	Successful	16	3
9	38/M	Redo AVR+MVR	May 98	RV pericardial patch repair	Successful	18	1
10	60/F	AVR, fragile aorta	June 98	Teflon felt gluing to aortotomy	Successful	10	1

M: male, F: female, MVR: Mitral valve replacement, A.: arterial, CABG: Coronary artery by-pass graft, AVR: aortic valve replacement, RV: right ventricular, Hosp.: hospitalisation

hand, cyanoacrylate was tested against a piece of woven double velour graft and 2/0, 3/0 polypropylene sutures by direct application and no harmful effect was observed.

DISCUSSION

Cyanoacrylate derivatives and polymer solutions are successfully used in cardiovascular and pulmonary surgery. Also, they have been widely used in neurosurgical and ophthalmologic procedures, too (5-19). Horsley and Miller described the use of commercially available cyanoacrylate glue for managing air leaks in emphysematous lung (20). Robicsek et al. reported four cases in desperate clinical situations where cyanoacrylate was successfully used to control hemorrhage (21). Repair of subacute cardiac rupture complicating myocardial infarction with a sutureless method by means of pericardium or teflon patch glued over the myocardial tear has been reported by several authors (3,22,23). Jondeau and colleagues controlled Swan-Ganz catheter-induced massive pulmonary hemorrhage by immediate therapeutic embolization of the segmental artery by using cyanoacrylate (24).

According to an experimental study on the sutureless anastomosis of blood vessels, Takenake and colleagues reported that, because there were cases of patency even after 12 months with a very small pannus thickness, sutureless anastomosis using cyanoacrylate adhesive was considered to be a useful method of preventing anastomotic neointimal hyperplasia (25).

Quinn et al. showed that cyanoacrylate had in vitro antimicrobial effect when standard disc sensitivity tests were used (26), and bacteriological studies showed that commercially available cyanoacrylate adhesive is lack of bacterial contamination (21). Our trials had also indicated the same results.

Comparative studies of biological glues showed that cyanoacrylate glue had the strongest adhesive power, however this glue had the disadvantage of becoming very stiff without elastic properties and poor biocompatibility (27,28). Wound closure using cyanoacrylate alone has exhibited significantly less tensile strength than closure with tissue adhesive and subcutaneous suture or those closed by traditional suture methods (29). We have similar clinical observations.

We used cyanoacrylate for reinforcement of the distal suture line and obliteration of the distal false lumen in Type II aortic dissection, reestablishment of the ruptured right ventricular free wall integrity, reestablishment of the fractured sternum, reinforcement of a very fragile femoral artery invaded by carcinoma, to control bleeding from the left apical ventriculotomy, and aortotomy suture lines.

Especially in cases with uncontrollable bleeding by standard suturing techniques, the glue allows the patient and the surgeon to rescue from desperate surgical situations. To ensure a bloodless field, CPB may be stopped for 20 to 30 seconds which is sufficient for the hardness of the glue. On the other hand, in diabetic patients with osteoporosis, in mediastinitis and long-term mechanical support, sternal detachment prolongs the postoperative course and secondary rewiring may not be sufficient to stabilize the sternum. In these cases cyanoacrylate glue may be a useful adjunct to the standard rewiring in high-risk patients (30).

But care must be taken to avoid gluing of the under-sternal drains, epicardial surface of the heart to the sternum, gluing of the surgical gloves, cloths, and instruments to the biologic surfaces. At the same time, it is important not to aspirate glue debris into the cardiomy reservoir.

We can say that commercially available cyanoacrylate glue is the cheapest of current biological or biocompatible synthetic tissue adhesives and can be found easily in the market. It is a new adjunct for cardiac surgery with documented safety and occasionally life-saving results.

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