Devastating late complication for repair of type A acute aortic dissection with usage of gelatin-resorcinol-formalin glue

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Abstract

Objectives: We review cases of pseudoaneurysm formation of the graft anastomosis sites following repair of type A acute aortic dissection by our original leak-proof technique for dissected aortic wall reinforcement with xenopericardium and gelatin-resorcinol-formalin (GRF) glue. Cases: A 47-year-old male presented inferior acute myocardial infarction with bradycardia and cardiogenic shock 34 months after the initial total arch replacement for acute aortic dissection. The patient underwent reoperation with total arch replacement and coronary artery bypass grafting to the right coronary artery. There was rupture of the proximal anastomosis with clotted pseudoaneurysm formation extending over the right ventricle. The right coronary artery was compressed by the pseudoaneurysm. The distal anastomosis also ruptured with localized pseudoaneurysm formation. Twenty-two patients with type A acute aortic dissection underwent aortic repair by our original leak-proof technique for dissected aortic wall reinforcement with xenopericardium and gelatin-resorcinol-formalin glue between 1997–2003. Four patients developed redissection of the anastomosis sites, which required reoperation, including the current case. Discussion: The cause of redissection was unclear, however, use of GRF glue itself might develop tissue damage and redissection of the aorta, and also glued xenopericardium strip reinforcement in our original technique might accelerate damage to the aortic wall. Conclusion: Follow-up examination is mandatory for the patient of aortic repair with the use of GRF glue.

Keywords: Aortic dissection; Aortic operation; Reoperation

1. Introduction

Gelatin-resorcinol-formalin (GRF) glue (Cardial, Technopele, Sainte-Etienne, France) has been commonly used for repair of Stanford type A acute aortic dissection to obliterate the false lumen and reinforce the aortic wall by applying it into the false lumen [1]. Incidence of postoperative redissection of the aortic wall at the anastomosis site has been reported as early and midterm complication. The causes remain controversial but some investigators reported that GRF glue might lead to aortic wall necrosis and cause aortic redissection [2–4]. We experienced a critical complication with pseudoaneurysm formation of the graft anastomosis site causing acute myocardial infarction.

A 47-year-old male underwent total arch replacement for acute aortic dissection (Stanford type A) in 2003. The false lumens of the aortic root and the distal aortic arch were fixed with GRF glue. The proximal and distal aortic stumps were reinforced with a 1-cm wide glued Xenomedica strip (Baxter Healthcare Co, Deerfield, IL) outside, and a 0.5-cm wide polytetrafluoroethylene sheet (Gore-Tex; W.L. Gore & Associates, Inc, Flagstaff, AZ) inside with mattress sutures from inside to outside, and a 28-mm straight Hemashield graft (Meadox Medicals, Oakland, NJ) was anastomosed. The detail technique was previously described [1]. The patient’s hospital course was unremarkable and he was discharged home. He visited the emergency department presenting with chest pain 34 months postoperatively. He developed cardiogenic shock and bradycardia during examinations. His cardiac enzymes elevated and he developed inferior acute myocardial infarction. His echocardiogram showed mild aortic insufficiency and inferior wall akinesia with reduced left ventricular function. His chest computed tomography scans revealed a huge pseudoaneurysm of the aortic root extending anteriorly to the right ventricle and a saccular aneurysm of the distal anastomosis at the distal aortic arch (Fig. 1). He underwent reoperation with total arch replacement and coronary artery bypass grafting to the right coronary artery. Operative findings revealed that the previous artificial graft was partially detached at the proximal anastomosis. There was rupture of the proximal anastomosis with clotted pseudoaneurysm formation extending over the right ventricle. The right coronary artery was compressed by the pseudoaneurysm. The distal anastomosis also ruptured with localized pseudoaneurysm formation (Fig. 2). The patient recovered from the critical medical condition postoperatively.

2. Comment

An original leak-proof technique for dissected aortic wall reinforcement with xenopericardium and GRF glue per-
formed in 14 patients at our institution from 1997 to 2000 was reported [1]. Although the surgical outcomes including shorter time for operation and hemostasis were satisfactory, we experienced a case with redissection and pseudoaneurysm formation of the aorta requiring reoperation 3 months following the initial aortic repair in 2002. We reported the case and the pathological findings of aortic redissection after repair of proximal aorta with usage of GRF glue [4]. The pathological findings of the aortic wall at the site of GRF glue application were necrosis and inflammation. There was almost disappearance of the intima and media in the aortic wall. There were elastic fiber and aggregation of macrophages in the necrotic aortic tissue. We thought that high formalin concentration might lead to tissue damage causing aortic redissection and pseudoaneurysm formation. Then we had reduced concentration of formalin by decreasing the amount of formalin when applying it to the false lumen and a xenopericardial strip since 2002. Following this new strategy to avoid complications of GRF glue usage by reducing formalin dosage, eight patients underwent aortic repair by our original technique for acute aortic dissection with xenopericardial reinforcement. However, three cases out of eight developed redissection of the anastomosis sites, which required reoperation including the current case. One patient underwent aortic root repair 44 months after graft replacement of the ascending aorta. Another case underwent total arch replacement 46 months after the initial surgery. Both cases presented severe aortic regurgitation. The present case underwent reoperation 34 months after the initial total arch replacement. His primary clinical presentation was inferior acute myocardial infarction with cardiogenic shock. Currently we have discontinued the use of GRF glue for cardiovascular surgery because of unfavorable complications since 2004. There was a report in which the development of redissection of the aorta examined by computed tomography was not prevented by applying a lesser amount of formalin in the use of GRF glue [5]. The cause of redissection was not entirely the result of too much formalin. Use of GRF glue itself might develop tissue damage and redissection of the aorta regardless of the formalin dosage. Moreover, glued xenopericardium strip reinforcement in our original technique might accelerate damage to the aortic wall. The sandwiched GRF glue between the xenopericardium strip and the aortic wall could remain locally and strongly damage the aortic wall without being absorbed. Follow-up examination is mandatory for the patient of aortic repair with the use of GRF glue, especially for our patient with the original technique using xenopericardial reinforcement and GRF glue.

References

ICVTS on-line discussion A

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eComment: In their article entitled ‘Devastating late complication for repair of type A acute aortic dissection with usage of Gelatin-Resorcinol-Formalin glue’ Izutani and co-workers [1] report on a single case of false aneurysms on the proximal and distal anastomoses in a patient who had undergone emergency surgery for acute type A dissection 34 months earlier with the aid of GRF glue. The authors consider that this adjunct was responsible for the occurrence of the late false aneurysms. Is it so?

In the present report, the authors seem to have used the glue appropriately. In particular, being aware of the potential toxicity of the polymerizing agent, they have reduced its quantity according to the manufacturer’s recommendations.

However, it is somewhat intriguing that, whereas the GRF glue has been used liberally for several decades worldwide (except in the US), most of the few reported cases of late complication (mainly aortic necrosis and false aneurysms) have been observed in Japan. One may wonder whether this is not related to the fact that the surgeons, in their legitimate desire to obtain a safe, reliable and stable result, do not trust the GRF glue alone as being a safe adjunct and use concomitantly other adjuncts to reinforce the aortic anastomoses. This includes Teflon felt bands, autologous or heterologous pericardium, put outside and/or inside the true and false channels in various modes of ‘sandwiches’. In addition, those adjuncts are often glued again after completion of the anastomosis to enhance local haemostasis. Could it be that, ‘better being the enemy of good’, those complicated and somewhat overcautious methods induce some necrosis at the site of the anastomosis and subsequent occurrence of false aneurysms?

This hypothesis is strengthened by the very high and unusual rate of false aneurysms reported by the authors. Despite the reduction in the quantity of Formalin and Glutaraldehyde, 3 out of 8 patients (40%) experienced a postoperative false aneurysm. In the largest series of acute dissections operated on with the aid of GRF glue appearing in the literature, such a high rate of late false aneurysms has never been reported. Indeed, in many groups, and particularly in Europe, the glue is the only adjunct used to stick together the dissected layers and to reinforce the anastomoses. For instance, in our experience extending over exactly three decades and including 242 patients, only glue was used in most patients and Teflon felt was very seldom required. Reoperation on the proximal aorta was necessary in 17 patients out of the 196 survivors (9%) and in only 4 patients (2%) for occurrence of a false aneurysm. Even if we consider that some patients have been lost to follow-up and might have been re-operated on elsewhere, the rate of false aneurysm possibly related to the use of GRF glue is quite different from the one reported in the present article.

Izutani and co-workers allude to this problem in their discussion but state that they have decided to discard the use of GRF glue albeit keeping their technique of aortic sandwiching. They could have chosen to keep the glue and discard the ‘sandwich’ procedure. The improvement in the results could be similar. Future will tell.

Reference