Total proximal anastomosis detachment after classical bentall procedure

Aref Rashed *, Karoly Gombocz, Andras Vigh, Nasri Alotti

Department of Cardiac Surgery, Zala St. Raphael County Hospital, Zalaegerszeg, Hungary

Abstract

INTRODUCTION: Since its introduction in 1968, the Bentall procedure has been the primary surgical solution for aneurysms of the aortic root. However, many surgeons have reported serious procedural complications such as detachment of coronary ostia and pseudoaneurysm formation at anastomosis sites. Therefore, the Bentall procedure has undergone several modifications to eliminate those complications. Partial or total detachment of the proximal anastomosis is rarely reported.

PRESENTATION OF CASE: We report a total detachment of the proximal anastomosis after a Bentall operation with emphasis on the possible practical mechanisms, which might have led to the development of this very rare complication. The diagnosis was confirmed at a routine follow up examination and urgent surgery was performed. We also report our operative solution and review other possible surgical solutions that might be considered in this setting.

DISCUSSION: The Bentall procedure and its modifications continue to be considered the gold standard for treating aneurysms involving the aortic root. Various modifications can serve as optimal solutions for procedure-related complications.

CONCLUSION: Surgeons performing the Bentall procedure must be familiar with all existing modifications because they are complementary to the original surgical procedure. In the absence of endocarditis left ventricle outflow tract elongation may be an acceptable surgical solution to deal with total detachment of the proximal anastomosis.

© 2017 The Author(s). Published by Elsevier Ltd on behalf of IJS Publishing Group Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

1. Introduction

Since its introduction in 1968, the Bentall procedure has been the primary surgical solution for aneurysms of the aortic root [1]. Due to procedural complications such as bleeding, detachment of coronary ostia and pseudoaneurysm formation at anastomosis sites, the Bentall procedure has undergone several modifications [2–4]. Today surgeons typically perform modified Bentall operations instead of the classic Bentall operation, which involves direct coronary anastomosis and wrapping the aneurysmal aortic wall around the valve conduit. Detachment of the proximal suture line after the Bentall procedure is a rarely reported [9,10]. Here, we report a total detachment of the proximal anastomosis after a Bentall operation induced stress on the possible mechanisms, which might have led to development of this very rare complication. We also report our surgical solution in dealing with this frightening situation. This work has been reported in line with the SCARE criteria [5].

2. Presentation of the case

A 42-year-old man with Marfan syndrome underwent a Bentall procedure due to a 6 cm aortic root aneurysm and severe bicuspid aortic valve regurgitation. In his past history aortic coarctation and hypertension were highlighted. Due to aortic coarctation he underwent a left thoracotomy with excision of the coarctic segment and end-to-end anastomosis when he was 7 months old. At the age of 17, a bypass with prosthetic graft was anastomosed between the left subclavian artery and the ascending aorta due to recoarctaion. During routine follow up, echocardiography revealed a dilated aortic root and significant aortic valve regurgitation. Computer tomography (CT) images showed a root aneurysm 6 cm in diameter and minimal hypoplasia of the aortic arch. Coronarography revealed a normal coronogram. Surgery was performed via midline sternotomy and extracorporeal circulation with cannulation of the proximal aortic arch and right atrium. The Bentall procedure was performed using a home-made mechanical valve-graft conduit (a 27-mm Sorin bileaflet mechanical valve sutured to the end of a 34-mm Polythene ICT vascular prosthesis using continuous 2/0 prolene suture), which was sewn to the aortic ring using supra annular interrupted 2-0 mattress pledgeted sutures. The coronary ostia were reimplanted applying the button technique, and

* Corresponding author at: Department of Cardiac Surgery, Zala St. Raphael County Hospital, Zrínyi M. str. 1., Zalaegerszeg 8900, Hungary.
E-mail address: aref.rashed.szv@zmkorhaz.hu (A. Rashed).
the aneurysmal wall was wrapped over the vascular prosthesis. The postoperative period was uneventful except for early excessive bleeding (1st h: 250 ml, 2nd h: 180 ml and 1050 ml over 24 h), which was treated successfully using a conservative correction of the coagulation parameters.

As a follow-up measure, transthoracic echocardiography (TTE) was performed every 6 months by his cardiologist; according to the available documents, no abnormalities were detected. At the patient’s last follow up, 26 months after the operation, he visited his cardiologist and complained of exertional dyspnea. Transthoracic, transesophageal echocardiography and CT scan revealed a pseudoaneurysm around the graft and the mechanical valve was totally detached from the aortic annulus. The distance between the original aortic annulus and the detached mechanical valved composite was approximately 20 mm (Fig. 1).

In an urgent operation, cardiopulmonary bypass was initiated prior to re sternotomy with cannulation of the femoral vessels. After re sternotomy and careful adhesiolysis, the ascending aorta was clamped directly below the origin of the innominate artery and the wall of the pseudoaneurysm sac was opened. The heart was arrested by direct administration of cold crystalloid cardioplegia into the valved conduit. The valved conduit was found to be hanging above the aortic ring, fully detached and suspended in place by the main coronary arteries. No tension or traction was observed on the coronary arteries. The aortic annulus was empty (Fig. 2). As no signs of endocarditis were observed, we decided to elongate the left ventricle outflow tract (LVOT) using a vascular prosthesis between the original aortic ring and the sewing ring of the valved conduit. A vascular graft with 30-mm in diameter and 2.5-cm in length was selected. The proximal anastomosis, at the level of the original aortic annulus, was prepared using running 3-0 polypropylene sutures with external reinforcement incorporating a strip of Teflon. After removing all the disrupted pledgeted sutures from the ring of the mechanical valve, the other end of the vascular graft was sewn to the ring of the mechanical valve using running 3-0 polypropy-
ring early or later after surgery [6,7], and thrombotic events can be reduced if a biological Bentall procedure is adopted [8]. Procedure-related complications include bleeding, anastomosis dehiscence, and pseudoaneurysm formation at the anastomotic sites. Although pseudoaneurysm formation is rare after a Bentall procedure, it is typically reported at the coronary ostial sites, particularly prior to the introduction of the button technique [2].

Total detachment of the proximal anastomosis after the Bentall procedure is a rarely reported complication. Without the formation of a pseudoaneurysma, this complication can be fatal due to massive bleeding. Among 37 cases at Chulalongkorn University, only one case with sternal infection developed proximal suture line dehiscence with consequent massive bleeding into the mediastinum within 3 months [9]. In our case, a pseudoaneurysm was observed after complete detachment of the proximal anastomosis from the original aortic ring, and a lifesaving huge pseudoaneurysm developed.

Endocarditis has been reported as a cause of paravalvular dehiscence when perivalvular extension occurs [10,11]. In our case, an endocarditis diagnosis was rejected based on clinical symptoms, echocardiographic images and intraoperative findings. Hemocultures were negative. Traumatic injury could be considered in this situation, particularly considering the existing connective tissue disorder. However, our patient had no history of trauma.

Postoperative bleeding from the anastomosis sites and suture tension has reportedly played causative roles in pseudoaneurysm formation. This complication is typically reported at coronary ostial anastomosis sites [12,13]. In our patient, intraoperative findings showed completely competent and tension-free coronary ostial anastomosis with normal anatomical morphology. The wrapping technique originally described by Bentall can lead to increased pressure around the valved composite conduit, particularly at anatomic sites. Some surgeons still use the wrapping technique despite the zero-porosity collagen and gel-impregnated grafts [14].

In some instances where coagulopathy coexists, it can be difficult to distinguish between surgical and nonsurgical sources of postoperative bleeding after aortic surgery [15–17]. With our home-made graft, the anular sutures were passed through the ring of the valve and the edge of the vascular prosthesis. The thickness of the sewing ring engaged with the anular sutures can vary, rendering some sutures more secure than others. With commercially available conduits, the ring of the prothesis valve is prominent, and sutures are typically passed only through the ring of the valve in the same manner as in traditional valve implantation. We hypothesized that total or partial tearing of one or more of the interrupted sutures used to secure the home-made valve graft might have led to postoperative bleeding, which was controlled by the wrapped aortic tissue and therapeutic corrective measures of the coagulative state. In our Marfan patient, we assume that both postoperative bleeding and the wrapping technique led to increased pressure in the aneurysmal sac, which resulted in increased tension on the proximal suture line with subsequent gradual dehiscence of the interrupted sutures of the proximal anastomosis.

Repeating a Bentall procedure can necessitate excessive adhesiolysis around the conduit and the coronary ostia as well as use of a new composite valved-graft conduit [18]. This solution could be time-consuming. A Cabrol modification of the Bentall procedure might be necessary to solve this issue [3]. At the time of surgery, elongation of the LVOT seemed to be the less time-consuming procedure because no excessive adhesiolysis around the vascular graft or the intact coronary ostia anastomosis was necessary. This solution was copied after our experience in the Urbansky modification of the Bentall operation, where the valve was implanted within the vascular prosthesis leaving a 3–5-mm skirt proximally [4]. This skirt was sewn to the aortic ring.

4. Conclusion

Surgeons performing the Bentall procedure must be familiar with all existing modifications because they are complementary to the original surgical procedure. Where home-made valved grafts are used, we believe suturing the valve inside the vascular prosthesis is more beneficial than doing so at the end of the vascular tube. Elongation of the LVOT with a vascular graft can serve as an acceptable solution for dehiscence of the proximal anastomosis after a Bentall operation.

Conflicts of interest

Authors have no conflicts of interest.

Funding

Authors have no sponsor or any other external funding to declare.

Ethical approval

Due to extreme anonymity, no ethical approval was approved.

Consent

Written informed consent was obtained from the patient for publication of this case and accompanying images. A copy of the written consent is enclosed.

Authors contribution

Aref Rashed: He performed the reoperative procedure, summarized the clinical course in a case report for publication.

Karoly Gomboz: He prepared the figures and contributed in editing.

Andras Vigh: He edited the surgical part in the report.

Nasi Alotti: He assisted in designing the study, revised the report and contributed in editing.

Guarantor

Aref Rashed.

References

[1] H. Bentall, A. De Bono, A technique for complete replacement of the ascending aorta. Thorax 23 (1968) 338–339.
[2] N.T. Kououchouk, T.H. Wareing, S.F. Murphy, J.B. Perrillo, Sixteen-year experience with aortic root replacement. Results of 172 operations. Ann. Surg. 214 (3) (1991) 308–320.
[3] C. Cabrol, A. Pavie, P. Mesnil, L. Gajdábék, L. Laughlin, V. Bors, et al., Long-term results with total replacement of the ascending aorta and reimplantation of the coronary arteries. J. Thorac. Cardiovasc. Surg. 91 (1986) 17–25.
[4] P.P. Urbansky, A. Diegeler, A. Siebel, M. Zacher, R.W. Hacker, Valved stentless composite graft: outcomes and hemodynamic characteristics. Ann. Thorac. Surg. 75 (2003) 467–471.
[5] R.A. Agha, A.J. Fowler, A. Saeta, I. Barai, S. Rajmohan, D.P. Orgill, SCARE group, The SCARE statement: consensus-based surgical case report guidelines, Int. J. Surg. 34 (2016) 180–186.
[6] H.-C. Joo, B.-C. Chang, Y.-N. Yoon, K.-J. Yoo, S. Lee, Clinical experience with the Bentall procedure: 28 years. J. Yonsei Med. 53 (5) (2012) 915–923.
[7] N.C. Radu, E.W.M. Kirsch, M.-L. Hillion, F. Lagnaou, L. Drouet, D. Loisance, Embolic and bleeding events after modified Bentall procedure in selected patients, Heart 93 (1) (2007) 107–112.
[8] J.D. Gall, S.L. Lamsan, D. Spielvogel, O.P. Minanov, A. Ergin, C.A. Bodian, et al., Bioprosthetic valved conduit aortic root reconstruction: the Mount Sinai experience, Ann. Thorac. Surg. 74 (2002) 1769–1772.
[9] L. Kittichai, Modified Bentall’s Operation, Chulalongkorn’s Experience, 2010, http://thaists.org/download/aorti_root_surgery_kittichai.pdf. (Accessed 16 January 2010).

[10] R.K. Krishna, P. Casanova, M. Larrauri-Reyes, O. Santana, Complete dehiscence and unseated prosthetic aortic valve causing severe aortic insufficiency: an unusual complication of prosthetic valve endocarditis, BMJ Case Rep. (2014), http://dx.doi.org/10.1136/bcr-2014-206925.

[11] C. Graupner, I. Vilacosta, J. SanRoman, R. Roneros, C. Sarria, C. Fernandez, et al., Periannular extension of infective endocarditis, J. Am. Coll. Cardiol. 39 (7) (2002) 1204–1211.

[12] V. Hanak, M. Troubil, P. Santavy, V. Lonsky, Pseudoaneurysm of the ascending aorta following bentall procedure, J. Cardiovasc. Dis. Diagn. 4 (2016) 254, http://dx.doi.org/10.4172/2329-9517.1000254.

[13] A.D. Milano, S. Pratali, G. Mecozzi, P. Boraschi, G. Braccini, E. Magagnini, U. Bortolotti, Fate of coronary ostial anastomoses after the modified Bentall procedure, Ann. Thorac. Surg. 75 (6) (2003) 1797–1801, discussion 1802.

[14] M.A. Mingija, A. Mohamed, L. Yang, W. Xiang, A modified wrapping-internal shunt method for hemostasis in Bentall procedure, Med. Arch. 70 (4) (2016) 321–323.

[15] T.S. Hall, G.R. Brevetti, A.J. Skoultchi, J.C. Sines, P. Gregory, A.J. Spotnitz, Reexploration for hemorrhage following open heart surgery differentiation on the causes of bleeding and the impact on patient outcomes, Ann. Thorac. Cardiovasc. Surg. 7 (2001) 352–357.

[16] M. Gwozdziewicz, P. Olsak, V. Lonsky, Re-operations for bleeding in cardiac surgery: treatment strategy, Biomed. Pap. Med. Fac. Univ. Palacky Olomouc Czech Repub. 152 (2008) 159–162.

[17] K.L. Kristensen, I.J. Rauer, P.E. Mortensen, B.J. Kjeldsen, Reoperation for bleeding in cardiac surgery, Interact. Cardiovasc. Thorac. Surg. 14 (2012) 70913.

[18] S. Mohammadi, N. Bonnet, P. Leprince, M. Kolsi, A. Rama, A. Pavie, et al., Reoperation for false aneurysm of the ascending aorta after its prosthetic replacement: surgical strategy, Ann. Thorac. Surg. 79 (1) (2005) 147–152.

Open Access
This article is published Open Access at scienvedirect.com. It is distributed under the IJSCR Supplemental terms and conditions, which permits unrestricted non commercial use, distribution, and reproduction in any medium, provided the original authors and source are credited.