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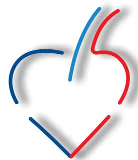

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Original Article | Open Access

Total percutaneous access versus surgical access in endovascular procedures: a retrospective analysis

Ünal Aydın, Ebru Bal Polat, Onur Şen, Ersin Kadiroğulları, Mehmet Kaya, Korhan Erkanlı, İhsan Bakır

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ABSTRACT

Objectives: This study aims to compare the outcomes of total percutaneous and surgical access methods in endovascular interventions.

Patients and methods: The results of endovascular aortic repair (EVAR) of abdominal aortic aneurysms were retrospectively analyzed. One hundred and four patients (76 males, 28 females; mean age 67.0±8.4 years; range 31 to 84 years) were operated for EVAR between October 2010 and June 2014. In 55 patients (52.9%), EVAR was performed percutaneously and access repair was made with vascular closure device. In 49 (47%), surgical cut-down was performed.

Results: There was a statistically significant difference in the frequency of chronic obstructive pulmonary disease between the groups, indicating a higher incidence in the percutaneous group (40.0% vs. 20.4%, p=0.031). Obese patients were shown to have a higher incidence of complications. A higher number of obese patients undergoing percutaneous closure developed hematoma (7.7% vs. 50.0%, p=0.0001). Vascular repair was also significantly more frequent in the percutaneous group with a more pronounced difference in obese patients (0 vs. 43.8%, p=0.005).

Conclusion: Pre-close technique is a successful way of performing EVAR procedures. Although wound infections are less common, obese patients may have higher rates of complications with percutaneous technique.

Keywords: Endovascular intervention; percutaneous approach; surgery.

Demand for transarterial catheterization has been increasing for the past decade for various procedures utilizing low (<10F) and high (10-25F) profile systems.[1] Manual compression may be used for lower profile systems (<8F) with drawbacks such as prolonged bed rest, patient discomfort, and cost.[2] The access closure for low profile system may be performed with various devices. However, large profile systems require a specified approach when percutaneous closure is preferred. In addition, the endovascular procedures for infrarenal abdominal aorta (endovascular aortic repair; EVAR), thoracic aorta (thoracic endovascular aneurysm repair; TEVAR), and aortic valve implantations (transcatheter aortic valve implantation; TAVI) conventionally require high profile systems (12-24F).[2] Any percutaneous closure system for this access closure purpose should avoid complications related to the femoral cut-down.

The pre-close technique was originally described by Haas et al. in 1999.[3] The Prostar XL closure device (Abbott Vascular, Santa Clara, CA, USA) has been designed for percutaneous closure of a wide range profile (8.5-24F) systems. Access site closure with Prostar device has also been used successfully in minimally invasive mitral valve surgery.[4] Herein, we aimed to compare the outcomes of total percutaneous and surgical access methods in endovascular interventions.

PATIENTS AND METHODS

The results of endovascular aortic repair (EVAR) of abdominal aortic aneurysm (AAA) were retrospectively analyzed to compare the surgical cut-down technique and percutaneous procedures. The study protocol was approved by the institutional ethics committee. One hundred and four patients (76 males, 28 females; mean age 67.0±8.4 years; range 31 to 84 years) were operated for EVAR from October 2010 to June 2014. Forty-nine (47.1%) patients were operated with surgical cut-down of bilateral femoral

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arteries (group S). In 55 (52.9%) patients, EVAR was performed percutaneously and access repair was made with vascular closure (Prostar XL, Abbott Vascular, Santa Clara, CA, USA) device (group P). All patients were included in the analysis.

Ultrasound-guided puncture was used for arterial access and imaging for all patients. Under this circumstance diameter, calcification and anatomic level of the femoral artery were evaluated. All patients in group S were operated under general anesthesia, while local anesthesia combined with sedation (n=19, 34%) or general anesthesia (n=36, 65%) methods were used in group P. Bilateral femoral access and Talent endovascular graft (Medtronic, Sunrise, FL, USA) were used in all EVAR procedures. The procedures were performed in the cardiac catheterization laboratory by cardiovascular surgeons and cardiologists.

The presence of chronic obstructive pulmonary disease (COPD) was defined as prolonged cough, shortness of breath, and extended use of pulmonary medications or compatible radiological changes.[5] The patients who were diagnosed before hospitalization or on any hypoglycemic medication were considered diabetic. The patients who had a previous diagnosis and whose baseline serum creatinine levels after hospitalization were >1.5 mg/dL were considered to have chronic renal disease (CRD). Obesity was defined as a body mass index of ≥30 kg/m^2.

During percutaneous procedures, a proctor was present to guide through the use of vascular closure device. Vascular access sites were repaired with the pre-close technique, as described previously.[6,7] Both femoral sheaths were placed percutaneously with Seldinger technique. Anticoagulation was made with unfractionated heparin (5000 IU) after the insertion of the sheath. Reversal of heparin with protamine was not routinely used. Deployment of the suture at the onset of the procedure ensures needle penetration into the arterial wall, before the dilatation of arteriotomy with the sheath. The procedure began with the introduction of an 8F sheath via an 18G needle. The sheath was exchanged for a Prostar XL over a non-hydrophilic guidewire of 0.035 inch. The Prostar catheter was removed before endograft introduction for a dilatation catheter of 12F or 14F size. After usual deployment of the endograft, 14F sheath was removed over the extra-stiff 0.035 inch guidewire, while manually compressing the access site.

Longitudinal femoral incisions were used in group S patients. Bilateral femoral arteries were explored surgically after sterile draping. Silastic loops were placed around common (CFA) deep (AFP) and superficial (SFA) femoral arteries. 14F or larger sizes of sheaths were placed under direct vision and patients were anticoagulated with unfractionated heparin. Reversal of heparin with protamine was not routinely used. Arteriotomies were primarily repaired with 6/0 continuous prolene sutures. Small drainage tubes were placed in both femoral sites.

The patients were transferred to the cardiovascular surgery intensive care unit (ICU) after the procedure. Those operated with general anesthesia were extubated during the ICU stay. Blood transfusions were made, when hemoglobin level decreased ≥2 g/dL or ≥100 mL/hour drainage was present from the femoral drainage tubes. Revision surgery was utilized in the presence of an enlarged hematoma, persistent decrease in the hemoglobin levels, or presence of an imaging evidence for a pseudoaneurysm. Renal function was evaluated according to the urea and creatinine levels. Postoperative renal dysfunction was classified according to the Acute Kidney Injury Network (AKIN) criteria.[8,9]

Statistical analysis

Statistical analysis was performed using the NCSS (Number Cruncher Statistical System) 2007 Statistical Software (Utah, USA). Continuous variables were expressed in mean ± standard deviation, while categorical variables were presented in percentage. For comparison of continuous and discrete data, independent t test and chi-square test were used, respectively. A p value of 0.05 was considered statistically significant.

RESULTS

Demographic and perioperative data are summarized in Table 1. There was a statistically significant difference in the frequency of chronic obstructive pulmonary disease (COPD) between the groups, indicating a higher incidence in the percutaneous group (40.0% vs. 20.4%, p=0.031) (Table 1). On the other hand, there was not a statistically significant difference in the amount of postoperative blood transfusions between the groups. The EVAR procedure success was 100% in this patient population.

Prostar deployment failed in three cases (5.5%). Vascular repair with open surgery was necessary in 11 patients. The surgical procedures performed included thrombectomy (n=3), primary repair (n=8),

Table 1
Perioperative parameters

	Group S (n=49)			Group P (n=55)			
	n	%	Mean±SD	n	%	Mean±SD	*p*
Age (year)			67.6±7.0			66.6±9.6	0.530
Gender							
Male	39	79.6		37	67.3		0.157
Female	10	20.4		18	32.7		
Hypertension	36	73.4		37	67.3		0.490
Diabetes mellitus	19	38.8		22	40.0		0.899
Chronic renal dysfunction	4	8.2		8	14.6		0.309
Obesity	13	26.5		16	29.1		0.771
Chronic obstructive pulmonary disease	10	20.4		22	40.0		0.031
Ejection fraction <50%	8	16.3		15	27.3		0.179
Blood transfusion (unit)							
None	31	63.3		44	80.0		0.285
1	11	22.5		6	10.9		
2	6	12.2		4	7.3		
3	1	2.0		1	1.8		
Average transfusion (mL)			288.9±123.1			309.1±137.5	0.222

SD: Standard deviation.

arterial bypass (n=2) in group P (Table 2). One Prostar device was used in each patient in group P. Arterial dissection and distal embolization were not observed in any patient. Access site infection was observed more frequently in group S (Table 2). Although the absolute frequency of infection was relatively higher in group S, it yielded a borderline significant trend. Tables 3a and 3b show postoperative complications in the risk groups in detail. Diabetes did not pose any extra risk on the occurrence of postoperative complications. However, obesity was shown to be a significant risk factor for occurrence of complications. Hematoma was more frequent in obese patients in group P. Vascular repair was also significantly more frequent in group P and the difference was more pronounced in obese patients. The requirement for blood transfusions was not significantly different between the two groups (Table 1).

DISCUSSION

Conventional EVAR procedures are performed through the cut-down of both femoral arteries. Postoperative patient discomfort and surgical site infections are critical predictors of postoperative morbidity. Given the fact that these patients are more likely to have repeated transfemoral interventions, groin site cut-down may be risky for the further procedures.[10] Novel vascular closure devices may solve this problem and decrease postoperative morbidity during EVAR procedures.

The success rates of vascular closure devices are highly dependent on patient volume and selection.[11] Primary suspects of failure are obesity, femoral artery calcification, groin scarring and iliac artery tortuosity. The success rate of utilization of the Prostar closure device has been closely associated with the learning

Table 2
Postoperative complications

	Group S		Group P				
	n	%	n	%	*p*	OR	%95 CI
Hematoma	7	14.3	8	14.6	0.970	1.28	0.43-3.82
Infection	10	20.4	4	7.3	**0.047**	0.3	0.09-1.04
Vascular repair	0	0	11	20.0	**0.001**	20.67	1.18-61-39

OR: Odds ratio; CI: Confidence interval.

curve. Pozzi et al.[4] reported that the success rate increased from 80% in the first 50 cases to 98.8% in the following cases. In our series, the success rate was 80% showing consistency with reported series due to high failure in the learning curve.[4] On the contrary, McDonnell et al.[12] reported a success rate of 71% regardless of the level of experience.

In addition, Thomas et al.[1] reported 93.6% primary success and 10.3% major complication rates with Prostar XL in their series of 50 patients who underwent endovascular aortic and iliac procedures. Pseudoaneurysms were detected in 6.4% of the operated groins (five patients) in the first three months after the procedure and two of them healed conservatively. Manual compression for continuing bleeding was necessary in six patients (12.0%) and five patients (10.0%) required immediate surgical cut-down. The authors found that the difference of complication rates were not statistically significant in small and large profile systems. Inconsistent with these findings, Starnes et al.[13] reported higher complication rates using sheaths larger than 20F. However, we did not use such high profile systems in our patient population.

Furthermore, Eisenack et al.[14] analyzed the risk factors of procedure failure in 500 patients. They demonstrated that anterior calcification of femoral artery and fibrosis at the access site were possible predictors of failure and operator experience was a predictor for success. They found no correlation of obesity or sheath size with the success rate. In another study, although Starnes et al.[13] reported higher complication rates in morbid obese patients, they did not show any correlation of obesity with conversion to open repair. However, Teh et al.[15] reported a significant association between obesity and groin fibrosis and device failure. Similarly, in our series, obese patients had higher rates of complications and the difference was strongly marked for hematoma formation (Table 3b).

In general, the rate of general anesthesia is high in our EVAR experiences; however, surgical conversion is a serious complication for aortic procedures. To avoid possible complications, general anesthesia was preferred for primary cases. Of note, as the EVAR experience increased, the use of general anesthesia decreased.

Table 3
Postoperative complications according to the patient groups

(a)	DM (–)		DM (+)		
Diabetes	n	%	n	%	*p*
Hematoma					
Group S	5	16.7	2	10.5	0.550
Group P	4	12.1	4	18.2	0.532
Infection					
Group S	7	23.3	3	15.8	0.523
Group P	2	6.1	2	9.1	0.672
Vascular repair					
Group S	0	0	0	0	-
Group P	6	18.2	5	22.7	0.680

(b)	Obesity (–)		Obesity (+)		
Obesity	n	%	n	%	*p*
Hematoma					
Group S	6	16.7	1	7.7	0.428
Group P	0	0	8	50.0	0.0001
Infection					
Group S	8	22.2	2	15.4	0.600
Group P	1	2.6	3	18.8	0.036
Vascular repair					
Group S	0	0	0	0	-
Group P	4	10.3	7	43.8	0.005

DM: Diabetes mellitus.

To the best of our knowledge, only one study on the use of percutaneous systems which included seven patients is available in Turkey.[16] Although the authors reported their initial experience in the published paper; they failed to address the technique and device of vascular closure. Therefore, our report is the largest series of percutaneous experience in Turkey for the time being.

On the other hand, there are some limitations to our study. The primary limitation is the retrospective design of the study. The conclusions, therefore, were drawn more hesitantly. Second, the patients were not randomized in both groups; however, the preoperative data comparison did not show significant differences between the two groups. Third, anatomical analysis was not made in detail. However, the primary goal was to evaluate the outcomes in patients with various risk factors reported in the literature such as diabetes and obesity.

In conclusion, pre-close technique is a successful way of performing EVAR procedures. Inherent limitations such as open repairs may be challenging which can be solved with increasing experience. In addition, although wound infections are less common, obese patients show higher rates of complications with percutaneous technique. We believe that further studies are required to identify the optimal access technique in this patient population.

Declaration of conflicting interests

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Cardiovascular Surgery and Interventions

Original Article Open Access

Surgery for patent ductus arteriosus in infants with very low birth weight

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ABSTRACT

Objectives: We aimed to present our institutional experience on the surgical management of low birth weight infants with patent ductus arteriosus.

Patients and methods: In this retrospective study, 14 low birth-weight infants with a mean birth weight of 1201±252 g (range, 640 to 1500 g), mean age of 19.71±9.55 days (4 to 38 days), mean gestational age of 29.14±2.07 weeks (25 to 34 weeks) operated for isolated patent ductus arteriosus (mean weight on operation of 1377 g) between January 2008 and November 2012 were included. At baseline, all patients received indomethacin and three were also given ibuprofen. None achieved closure of the duct. Standard surgical protocol consisting of suture closure of patent ductus arteriosus through posterolateral thoracotomy approach was performed in all patients.

Results: The mean operation time was 70.4±18.8 min, the mean mechanical ventilation time was 10.6±7.4 h, the mean intensive care unit stay was 7.4 days (range, 1 to 38 days), and the mean hospital stay was 12.8±11.5 days (range, 4 to 44 days). There was no complication, mortality or morbidity related to surgery. Reintubation rate was 14.28% and this complication resolved with surfactant therapy.

Conclusion: Early intervention for closure of isolated patent ductus arteriosus is acceptable in very low birth weight infants who are unresponsive to medical treatment provided that no other abnormality is present and the surgical protocol is well standardized.

Keywords: Cardiac surgery; infant; patent ductus arteriosus; prematurity; very low birth weight.

Patent ductus arteriosus (PDA) is abnormal persistence of the communication between the descending aorta and the pulmonary artery.[1] It is more common in premature infants (about 8 of every 1,000 births) compared to those in full-term (2 of every 1,000 births) and is also more common in girls.[2] Genetic factors seem to play a role in persistence of ductus arteriosus.[1] The disease is characterized by a substantial decrease in peripheral blood circulation and oxygen delivery in small neonates, particularly, if the shunt of blood from systemic to pulmonary circulation is extremely high. If left uncorrected, PDA may cause systemic disturbances including feeding intolerance, necrotizing enterocolitis, intracranial hemorrhage, decreased glomerular filtration rate, and bronchopulmonary dysplasia.[1,2]

Very low birth weight infants (500 to 1500 g) comprise about 1% of all live births; however, more than 60% of all neonatal deaths are very low birth weighted ones.[3] The incidence of PDA was reported to be as high as 30% in premature neonates.[2] The main reason of high incidence in preterm infants is likely reduced sensitivity for oxygen and increased sensitivity to prostaglandin E2 (PGE2), nitric oxide (NO), and endothelin.[4] Clinical severity of symptoms depends on the degree of the left-to-right shunting and the level of increase in the pulmonary blood flow. Treatment approach for the PDA, either medical or surgical, may also be influenced by coexistence of other congenital abnormalities requiring further diagnostic effort and also implementation of an individual approach for selected patients.[5]

Surgery may be delayed in asymptomatic patients and in those whose symptoms are able to be controlled by medical treatment. However, surgical closure is usually indicated in infants with congestive heart failure unresponsive to medical therapy. In asymptomatic patients, elective closure of the duct may be done at any age or when the patient becomes symptomatic.[6,7]

Although surgery for isolated PDA is often easy to perform, the operation may be more challenging when performed on a low birth weight infant due

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to the comorbidites which mainly arise from the immaturity of organs and systems. Depending on the patients' overall clinical or hemodynamic status and also morphological features of the lesion, there have been several options for closure of a patent ductus arteriosus including conventional surgical banding or ligation and catheter-based interventions using various devices. Recently, a number of minimally invasive procedures have also been successful.[8,9]

In this study, we present our institutional experience on the surgical management of low birth weight infants operated for isolated patent ductus arteriosus.

PATIENTS AND METHODS

A parental informed consent was obtained for each patient. This was a retrospective cohort study performed in a tertiary university hospital and consisted of infants operated for isolated PDA between January 2008 and November 2012. Very low birth weight infants (birth weight of lower than 1500 g) with a PDA were considered to be eligible. Exclusion criteria were as follows: concomitant congenital cardiac abnormalities including atrial septal defect, ventricular septal defect, tetralogy of Fallot, atrioventricular septal defect, transposition of great arteries or interruption of the aorta. Between the dates given, a total of 36 infants underwent surgical closure of isolated PDA in our facility. Among them, 14 infants (8 boys, 6 girls; mean age 19.7±9.6 days; range, 4 to 38 days) with a mean birth weight of 1201±252 g (640 to 1500 g), and a mean gestational age of 29.14±2.07 weeks (range, 25 to 34 weeks) were considered to be eligible for the present study (Table 1).

Preoperative echocardiographic findings included a mean LA/Ao ratio of 1.37±0.16 and a mean PDA size of 2.12±0.35 mm. In patients with severe symptoms and contraindications to medical treatment or in those in whom medical therapy failed, surgical closure was performed. Prophylactic closure was also another indication which we used for one patient.

All of the operations were performed under general anesthesia (inhaled sevoflurane and intravenous fentanyl protocol with neuromuscular blockade) by a single surgical team with the participation of an experienced senior pediatric cardiac surgeon. The infant was placed in right lateral decubitus position. Surgical anti-sepsis and appropriate dressing were performed. A left posterolateral thoracotomy was performed and the left lung was retracted. Patent ductus arteriosus was easily able to be visualized in all cases and closed by double ligation by using thick ligature of plaited silk in nine patients by Ligaclip (Ethicon Endo-Surgery, Cincinnati, OH, USA) in two and by division of the duct with double ligation in three (Table 2). A single chest tube of 12 or 16 Fr was placed before skin closure. Patients were transferred to pediatric cardiac surgery intensive care after the operation. There was no specific medication after surgery except antibiotherapy.

The primary outcome measure was in-hospital death from any cause and included procedural failure (i.e. unsuccessful closure), bleeding, hemothorax, pneuomothorax, respiratory distress, need for prolonged mechanical ventilation, revision surgery, low cardiac output syndrome, acute renal failure (serum creatinin >35 µmol/L or urine output <1 mL/kg/h), chylothorax, phrenic nerve paralysis and neurological complications. All patients underwent echocardiographic examination following the operation and the outcome data were collected by an independent pediatric cardiologist.

Continuous parameters were expressed in the mean (min.-max. values) and categorical variables were represented in number/total number.

RESULTS

The mean operation time was 70.4±18.8 min, the mean mechanical ventilation time was 10.6±7.4 h, the

Table 1
Demographic data of the patients (n=14)

	Mean±SD	Range
Birth weight (g)	1201±252	640 to 1500
Gestational age (weeks)	29.1±2.1	25 to 34
Operation day after birth (days)	19.7±9.6	4 to 38

SD: Standard deviation.

Table 2
Surgical procedures

Procedure	n	%
Double ligation	9	64.28
Ligaclip	2	14.28
Division + double ligation	3	21.42

Table 3
Pre- and posttreatment complications

	n	%
Pretreatment complication		
Acute renal failure	3	21.42
Necrotizing enterocolitis	3	21.42
Thrombocytopenia	2	14.28
Intraventricular hemorrhage	1	7.14
Posttreatment complication		
Surgical complication	0	0
Reintubation	2	14.28

mean intensive care unit stay was 7.4 (range, 1 to 38) days, and the mean hospital stay was 12.8±11.5 days.

At baseline, all patients received indomethacin as a standard three dose regimen (0.2 mg/kg in 12 h intervals during 48 h period) by intravenous route and three were also given ibuprofen (10 mg/kg in 12 h intervals during 48 h period) by peroral route; however, none achieved closure of the duct. Before the operation, three patients had acute renal impairment, one patient had intracranial hemorrhage, and two patients had thrombocytopenia (Table 3).

There was no in-hospital death. Secondary outcome measures were those related to surgery. Reintubation rate was 14.28% (n=2) and these two patients were extubated after one and seven days of reintubation, respectively. This complication was likely resulted from the immature respiratory system of the patients. The mean amount of 24 h bleeding was 12.5±7.5 mL and the mean blood transfusion amount was 0.048±0.014 units. Postoperative echocardiography revealed no residual flow of PDA.

DISCUSSION

We achieved satisfactory surgical outcomes in low birth weight infants operated for isolated PDA. Fragility of the tissues and also duct is a challenge on a low birth weight infant compared to a normal weight one. We paid attention to this severe complication, although we did not use ligation technique when the duct appeared fragile and hard to ligate.

In preterm infants, PDA can be challenging to manage and definitive treatment is either achieved by pharmacological means or surgery. Traditionally, intravenous indomethacin has been considered and a variety of dosing regimens have been proposed.[5] Additionally, ibuprofen, another cyclo-oxygenase inhibitor, can be as effective as indomethacin with fewer side effects.[10,11] In our institution, we used indomethacin preoperatively. As intravenous form of ibuprofen was not easily accessible, peroral administration was applied in three patients. When medical therapy fails or congestive heart failure occurs, surgical closure of PDA may be necessary.

If hemodynamically significant PDA is unable to be closed or becomes significantly smaller despite medical therapy, surgical closure is often considered.[12,13] Surgery is also performed, if there are contraindications to pharmacological treatment.[14]

Patent ductus arteriosus can be closed via thoracotomy, sternotomy or minimally invasive techniques.[15] Minimally invasive procedures may be feasible in even premature babies[16] which seems to be equally safe, although it is more time-consuming. However, left thoracotomy, if applicable, is the most common approach for isolated PDA in particular. We perform posterolateral thoracotomy in all our patients with isolated PDA.

Surgical closure of PDA can be achieved through left posterolateral thoracotomy, left anterolateral thoracotomy or midline sternotomy. Closure technique of PDA includes ligation, division, closure from inside the pulmonary artery or patch closure under cardiopulmonary bypass, ligaclip occlusion, transcatheter closure or video-assisted thoracoscopic surgery.[8]

Prophylactic surgical ligation is a method particularly in extremely low birth weight infants for the prevention of mortality and morbidity; however, this procedure remains an area of controversy. We used this technique for only one patient who was on fourth day of birth.

Furthermore, minimally dissection is recommended to preserve intact tissues. After careful evaluation we preferred double ligation in our institution. On the other hand, surgical complications including bleeding, recanalization, recurrent laryngeal nerve injury, chylothorax, and pneumothorax are uncommon.

In conclusion, despite the shortcomings of retrospective design, we suggest that surgery may be well-tolerated for isolated PDA in very low birth weight infants with good results if the first-line treatment by indomethacin or ibuprofen fails.

Declaration of conflicting interests

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Cardiovascular Surgery and Interventions

Case Report Open Access

Adjuvant platelet-rich plasma after lower extremity revascularization for treatment of foot ulcer: a case report

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ABSTRACT

In patients with plantar ulcers, both diabetes and peripheral occlusive disease are implicated in the disease process, resulting in diminished blood flow to the extremity and, thereby, interrupting or delaying the wound healing process. The risk of amputation is extremely high in diabetic patients with plantar foot ulcers-related limb ischemia. Herein, we report a diabetic case in whom adjuvant platelet-rich plasma therapy was applied following surgical revascularization of the plantar foot ulcer.

Keywords: Healing; peripheral artery disease; platelet-rich plasma; wound.

Severe chronic wound ulcers of the lower extremity may cause serious disability when located in the plantar surface of the foot, particularly.[1] In patients with plantar ulcers, both diabetes and peripheral occlusive disease are implicated in the disease process, resulting in diminished blood flow to the extremity and, thereby, interrupting or delaying the wound healing process.[1] Diabetic plantar foot ulcers has also distinct pathological features such as fat pad atrophy due to irregular arrangement of collagen fibrils and distal fat pad migration which renders the metatarsal heads susceptible to pressure and eventually leads foot ulceration.[1]

Platelet-rich plasma (PRP) has been in use for promoting healing of surgical wounds for nearly two decades.[1] Application of PRP to chronic wounds has recently gained popularity and several reports have appeared in the literature regarding its effectiveness in diminishing the wound area.[1] There is also a growing evidence showing its benefits in patients with diabetic foot ulcers.[2]

Herein, we report a diabetic case in whom adjuvant PRP therapy was applied following surgical revascularization for plantar foot ulcer.

CASE REPORT

A 71-year-old diabetic male patient presented with critical limb ischemia and deep foot ulcer located at the plantar surface of the left foot lasting for about six months. The patient suffered from chronic hypertension, renal failure (i.e. serum creatinine: 2.18 mg/dL), chronic ischemic heart disease and had a 15-year-history of diabetes receiving long-acting insulin. He had a long-standing history of reduced walking distance before ulceration of the wound and received only pharmacological therapy without being operated on for peripheral arterial occlusive disease. He had also lower extremity numbness and pain in toes for more than five years. He had no history of major or minor extremity amputation and underwent multi-vessel coronary artery bypass grafting three years ago alone and also had a recent transient ischemic attack. Systolic heart functions were normal. The patient was consulted for the decision on the level of amputation.

On physical examination, there were severe trophic changes and desquamation on toes which suggested severely diminished blood flow and the presence of an untreated chronic fungal infection. The extremity was cyanotic and cold; however, motor neuron functions were intact. The wound was 10 cm^2 in surface area and was approximately 8 mm in depth (Figure 1a). There was excessive fibrosis around the inner surface of the wound. The loss of fat pad tissue was so severe that even metatarsal heads were visible. Ankle systolic pressure was below 35 mmHg, indicating severe critical limb

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ischemia. The patient was admitted to the department of cardiovascular surgery to achieve limb salvage and initiated on standard therapy including intravenous fluids, broad spectrum antibiotics (ciprofloxacin 500 mg per day), subcutaneous low-molecular-weight heparin, and peroral pentoxifylline.

Wound swab cultures were taken and the wound was debrided under sterile conditions for removal of necrotic tissues. The wound swab cultures were contaminated and no specific microbial agents were able to be isolated. Antibiotic treatment was continued and local anti-fungal spraying was added to the treatment. Contrasted computed tomography showed an interrupted contrast enhancement along a 10 cm segment within the left superficial femoral artery and distal bed (tibial arteries) poorly filled with contrast agent due to multi-segmental atherosclerotic lesions of tibial arteries.

Under spinal anesthesia, we performed a left femoropopliteal artery bypass using 7 mm diameter ringed expanded-polytetrafluoroethylene graft with the distal anastomosis being located on the popliteal artery as distal as possible - just distal to the Hunter's canal. After the operation, tibialis anterior artery was not palpable; however, a stronger biphasic flow was achieved on the artery and the ankle systolic pressure increased up to 50 mmHg.

The patient received two sessions of PRP therapy beginning on the day after the operation and the therapy was repeated one week after the beginning. During this therapy, surface of the wound was washed with physiologic saline and hypochlorous acid was used to clean the healthy tissue around the wound. Platelet-rich plasma was prepared using Easy PRP KIT system (Neotec Biotechnology, Istanbul, Turkey). Twenty milliliter of venous blood was taken from

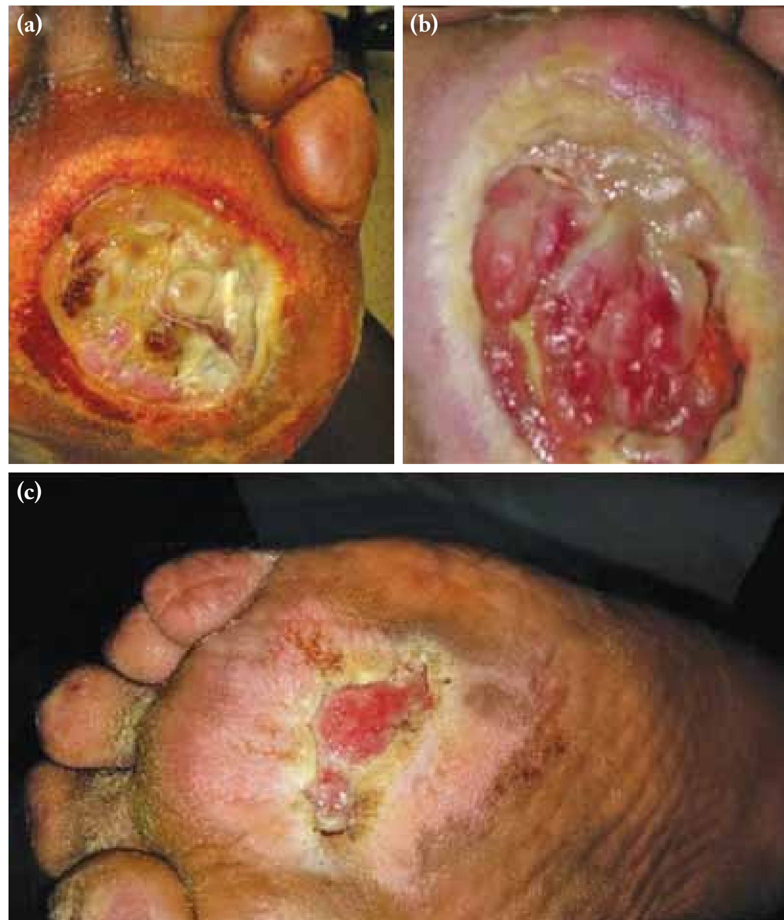

Figure 1. **(a)** Wound at plantar surface of the foot on admission. **(b)** Healing process. **(c)** About 70% reduction was achieved at five weeks after surgery with platelet-rich plasma treatment.

antecubital vein and added into a 9/1 acid citrate dextrose containing test tube under aseptic conditions. The tube was centrifuged at a rate of 5000 rpm for 15 minutes to separate red blood cells from platelets and plasma. Platelet containing plasma was harvested by collecting platelet and plasma containing supernatant and thin white layer and it was centrifuged at a rate of 2000 rpm for five to 10 minutes. The 2 to 3 mL bottom layer was collected and added to 0.3 mL of 10% calcium chloride for each 1 mL of PRP. A 10 mL of PRP substance was administered into the wound with half of the amount being injected 1 to 2 mm deep into the wound and then the wound surface being covered with the remaining half. The lesion was covered with soft silicone polyurethane foam dressing (Mepilex®, Göteborg, Sweden) which was used in the treatment of diabetic foot ulcers previously. The wound dressing was changed every other day and the wound was only rinsed with physiological saline.

The patient did not receive any other type of wound care or therapy. After discharge, he was invited for weekly follow-up (Figure 1b). The patient had around 70% reduction in the wound area within five weeks after the operation (Figure 1c). As he was living in a distant rural town, he did not attend to follow-up any longer and reported that his wound completely healed during phone interview.

DISCUSSION

Our patient benefited from adjuvant PRP following surgical revascularization for the treatment of severe foot ulcer. Given the patient's poor limb status on admission and various risk factors, both treatment modalities seems to prevent an otherwise unavoidable major amputation. The procedure was safe, as it did not result in any deterioration in the wound status. The preparation and application of the substance was also simple and cost-effective. Although surgical or endovascular revascularization is still the mainstay in the treatment of critical limb ischemia regardless of the presence of wound lesions, limb prognosis is still poor in patients with diabetes and infection. Therapeutic angiogenesis with stem cells, growth factors, and autologous progenitor cells have been used to treat critical limb ischemia patients to achieve improvement in wound healing; however, all these therapies had their own limitations and research continues for adjuvant therapies which would promote wound healing after revascularization.[3]

In recent years, the importance of a multidisciplinary approach in the treatment of diabetic foot ulcers has increasingly become recognized. A recent Spanish registry study showed that the introduction of a multidisciplinary team coordinated by an endocrinologist and a podiatrist for managing diabetic foot ulcers yielded a significant reduction in the incidence of major lower extremity amputations in diabetic patients.[4]

In an experimental model, platelet-rich fibrin matrix, a variant preparation with similar properties, induced endothelial cell proliferation, suggesting an explanation of wound healing effect of PRP.[5] In a clinical study including 17 patients with chronic wounds of different etiologies receiving PRP therapy, Roubelakis et al.[6] reported that the majority of wounds were of diabetes and ischemic etiology and also were infected or necrotic. The mean volume reduction was 34.1% in all types of ulcers within eight weeks through a mean separate PRP session of 9.5. This study provided evidence that PRP regulated wound healing by acting on cell migration and proliferation.

The use of PRP in the treatment of non-healing diabetic foot ulcers has not been studied widely. There have been only a small number of case reports or case series in the literature. Mehrannia et al.[7] reported a 71-year-old male case with severe diabetic wounds in both soles of his foot which showed improvement after application of PRP. In consistent with our findings, the authors performed deep injection through the wound, although the peripheral arterial status of the patient was not mentioned.

In another 57-year-old diabetic male case with non-healing wound on his left foot for four years, Suresh et al.[8] also used PRP in a similar way to our application. The wound was the stump of the amputated left toe. The patient received six sessions of PRP and achieved complete healing.

In another recent study including diabetic patients with concomitant peripheral artery disease, Kontopodis et al.[9] investigated whether PRP improved healing of diabetic foot ulcers. In this study, 30 of 72 patients had critical limb ischemia and a total of 52 patients had ulcer reduction after receiving PRP treatment. Based on their findings, the authors concluded that PRP might serve as a useful adjunct during the management of diabetic foot ulcers even in diabetic patients with severe non-reconstructable peripheral artery disease.

In conclusion, the adjuvant use of PRP to promote wound healing after revascularization for critical limb ischemia seems promising in terms of preventing future amputations. As our patient had a marked increase in ankle systolic pressure and apparently benefited from surgical revascularization, we cannot draw a conclusion suggesting the role of PRP in achieving complete healing. Nevertheless, given the depth of the ulcer and various comorbidities our patient had, PRP might at least accelerated the wound healing process, eliminated the need of additional attempts for wound care, and possibly prevented the dissemination of the infection which might further lead amputation of the extremity.

Declaration of conflicting interests

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Cardiovascular Surgery and Interventions

Case Report Open Access

Mitral valve replacement in dextrocardia with situs inversus totalis: a good exposure

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ABSTRACT

Situs inversus totalis with dextrocardia is a rare congenital anomaly. This is a reverse isomeric form of the thoracic and abdominal viscera or the complete mirror image. Left atrial approach for mitral valve surgery is required particularity in the treatment. Herein, we present a case of situs inversus, dextrocardia, and rheumatic mitral regurgitation. Standing in the left side of the patient, biatrial cannulation and left atrial approach for mitral valve replacement were performed. We described a new technique for biatrial cannulation and decannulation without lifting the heart.

Keywords: Dextrocardia; mitral valve replacement; situs inversus totalis.

The incidence of situs inversus totalis with dextrocardia is 1/10,000 to 50,000 births.[1] There is only one mitral valve surgery case with isolated dextrocardia without situs inversus totalis in the literatures in Turkey.[2] Dextrocardia situs inversus totalis is defined as the heart and all visceral organs being the mirror image of one another.[3] In most cases, the diagnosis is made incidentally on imaging studies in adults.

Herein, we present a case of situs inversus totalis and dextrocardia and rheumatic mitral regurgitation, in which mitral valve replacement was done under cardiopulmonary bypass (bicaval cannulation) through left atriotomy.

CASE REPORT

A 61-year-old woman presented to our clinic with palpitation and dyspnea. She was in Class III New York Heart Association. On physical examination, grade 3/6 pansystolic murmur was heard all over the precordium. The patient had diabetes mellitus, chronic obstructive lung disease, and hypertension. She was in normal sinus rhythm on electrocardiography (ECG). Chest X-ray revealed dextrocardia. Carotid Doppler ultrasonography and blood test results were normal. The patient was diagnosed with severe mitral regurgitation with mild stenosis by transthoracic and transesophageal echocardiography. She had a left ventricular end-systolic diameter of 42 mm, an end-diastolic diameter of 55 mm, a left atrial anteroposterior diameter of 40 mm, and an ejection fraction of 60% by echocardiography. The coronary arteries were normal in the preoperative coronary angiography (Figure 1). During the preoperative period, abdominal tomography was performed to discover any pathology in the inferior vena cava and abdominal organs. She was found to have abdominal situs inversus totalis. The continuity of the inferior vena cava was normal (Figure 2).

Surgical technique

Following a median sternotomy and pericardiotomy, superior vena cava and inferior vena cava were widely separated from the pericardium for cannulation and decannulation without lifting the heart. Arterial cannulation was performed on ascending aorta and venous cannulation was done through bicaval cannulation of the superior and inferior vena cava (Figure 3). Moderate hypothermia was induced. The surgeon switched his position from the right to the left side of the patient after establishment of cardiopulmonary bypass. Cardioplegic arrest was achieved using antegrade blood cardioplegia. There

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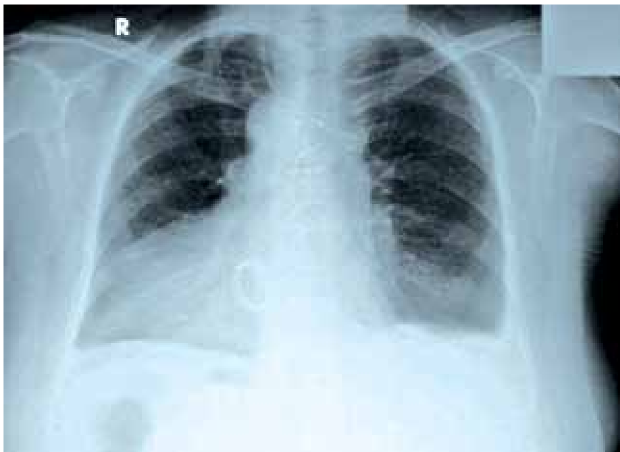

Figure 1. A postoperative chest X-ray image showing dextrocardia and prosthesis mechanical mitral valve shadow.

was no major problem on the tricuspid valve. Then, we decided to approach to mitral valve through the left atriotomy. Atrium was vertically opened from the superior part in front of the right pulmonary veins. We achieved the excellent mitral valve exposure by using the left atrial retractor. Intraoperative findings revealed that the repair of the mitral valve was not feasible, as the valve structure was severely calcified and degenerated. Chordal thickening and chordal fusion were also present. In addition, the anterior leaflet was calcified, making it unsuitable for valve repair. Additionally, the mitral annulus was dilated. Therefore, the native valve was excised, preserving the posterior leaflet, and replaced with a 29 mm mechanical valve prosthesis (Figure 4). The postoperative course was uneventful and the patient was discharged on the postoperative fifth day. She was followed for three months without any complaints.

DISCUSSION

Although dextrocardia can be associated with situs solitus, situs inversus or situs ambiguous, situs solitus is the most common form.[4] Situs inversus totalis, as in our case, is a reverse isomeric form of the thoracic and abdominal viscera or complete mirror image. Such patients may have an interrupted inferior vena cava in the intrahepatic segment. These abnormalities may cause problems during the inferior venous cannulation. Therefore, inferior vena cava abnormalities should be definitely examined by computed tomography or magnetic resonance imaging.

To date, several approaches for mitral valve surgery in dextrocardiac patients have been published. As in our case, almost all surgeons prefer to stand on the left side of the patient. St. Rammos et al.[5] established cardiopulmonary bypass by cannulating the aorta and left common femoral vein. The superior vena cava was cannulated after emptying the heart. Okamura et al.[6] lifted the heart by using a heart positioner and then made bicaval venous cannulation and the aorta was cannulated in the routine manner. The mitral valve was exposed via left-sided left atriotomy with an incision made at the base of the left atrial appendage similar to our approach, with the surgeon standing on the left side. However, lifting the heart for inferior vena cava decannulation while a mitral valve

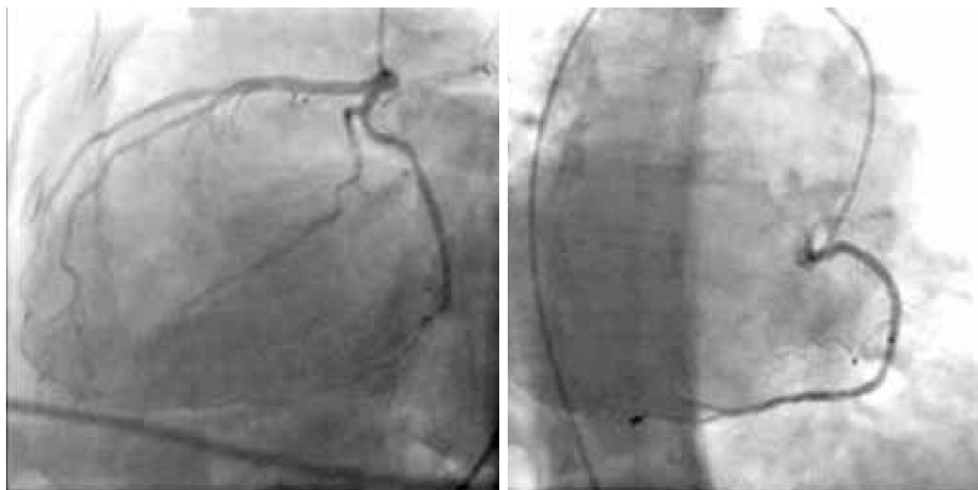

Figure 2. Preoperative normal coronary angiography image.

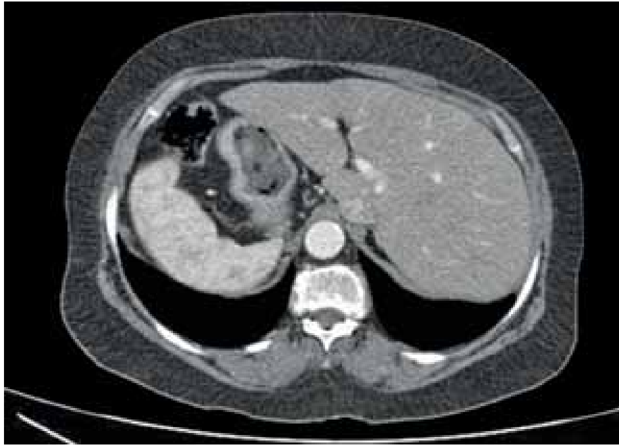

Figure 3. Contrast-enhanced abdominal computed tomography indicating the presence of situs inversus totalis.

prosthesis is *in situ* is fraught with danger of the left ventricular rupture.[7] In another study, Kikon et al.[8] used a two-stage single venous cannula and performed left atriotomy. This method may lead to obstruction of the superior vena cava during the traction to the left atrium.

Furthermore, we established cardiopulmonary bypass by cannulating the aorta and superior and inferior vena cava separately without using any heart positioner for lifting the heart, since we performed cannulation by widely separating vena cava superior and inferior from the pericardium. This may be a technical trick for safe bicaval cannulation in dextrocardiac patients. We approached the mitral valve via left atriotomy. We provided excellent exposure with a little traction. Of note, although there are few bleeding complications with the transseptal approach, the extension of the septal incision to the anterior of the coronary sinus may lead to nodal rhythm.[9] The other concern is probability of damaging the sinus node artery in the superior septal approach. Therefore, we avoided risk of groove tear during decannulation in mitral valve replacement by not lifting the heart. We also abstained superior venous obstruction and rhythm problems by bicaval venous cannulation and left atriotomy.

In conclusion, we suggest that standing on the left side of the patient and widely separating the vena cava inferior and superior from the pericardium for cannulation and decannulation without lifting the heart through bicaval venous cannulation and left atriotomy is more useful approach for the treatment of dextrocardiac mitral valve.

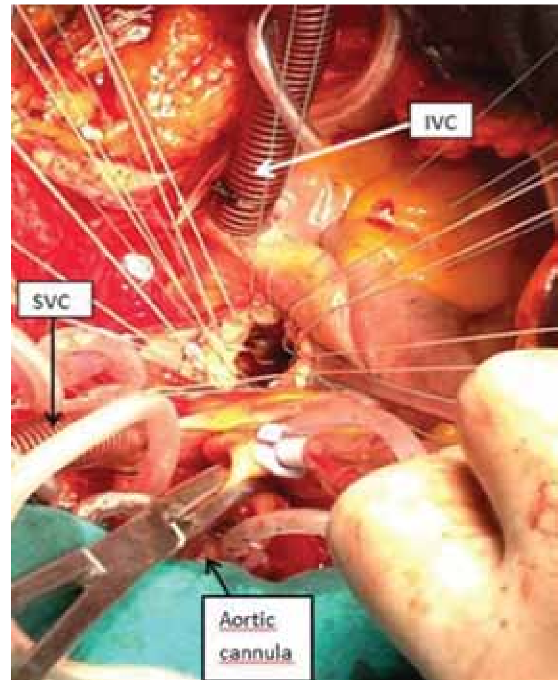

Figure 4. Intraoperative view showing the left atriotomic approach to the mitral valve and ascending aortic and bicaval venous cannulation. IVC: Inferior vena cava; SVC: Superior vena cava.

Declaration of conflicting interests

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Cardiovascular Surgery and Interventions

Case Report Open Access

A rare case of iatrogenic retrograde coronary dissection spreading antegradely during coronary angiography: emergency revascularization

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ABSTRACT

Herein, we report a 66-year-old male case with critical stenosis due to catheter-induced dissection during percutaneous coronary intervention. During the insertion of a stent to the critical stenosis in the circumflex branch, a retrograde dissection was detected in the circumflex branch proceeding to the left main coronary artery.

Keywords: Coronary dissection; emergency revascularization; percutaneous coronary intervention.

The incidence of iatrogenic aortocoronary dissection during percutaneous coronary intervention (PCI) has been reported approximately 0.1%.[1] Although rare, it may have catastrophic consequences due to rapidly impaired antegrade coronary blood flow as a result of unpredictable nature of the dissection flap.[2] Therefore, an urgent revascularization strategy should be considered as the appropriate approach in such cases. Herein, we report a case of cardiogenic shock caused by iatrogenic coronary dissection and treated by urgent revascularization. We present this case due to its rarity in the literature.

CASE REPORT

A 66-year-old man (70 kg, 165 cm, body surface area: 1.77 cm^2) was admitted to our hospital's emergency department for sudden-onset chest pain and nausea. His medical history was specific for an appendectomy operation and bronchitis. He had several risk factors for coronary artery disease including smoking, untreated hypertension, and hyperlipidemia. On admission electrocardiography (ECG) demonstrated signs of acute inferior myocardial infarction (MI) changes and his troponin level was 0.14 ng/lt. He was diagnosed with acute coronary syndrome and brought to angiography laboratory for coronary angiography using a 7F diagnostic catheter via transfemoral approach. The angiogram showed a normal left main coronary artery, a 30-40% stenosis at the ostium of the left anterior descending artery (LAD), a 60-70% stenosis in the first diagonal branch (D1) of LAD, a 50% LAD stenosis after D1, and diffuse luminal irregularities in LAD, a 70% stenosis in obtuse marginal 2 (OM2) branch, complete occlusion of circumflex artery (Cx) after OM2 branch; and a 30-40% stenosis in the right coronary artery (RCA) after its right ventricular (RV) branch (Figure 1). During stent placement to the critical stenosis of the circumflex artery via transfemoral approach using a Judkins catheter (Launcher, Medronic, Minneapolis, USA), a circumflex artery dissection occurred and progressed retrogradely to the left main coronary artery from where it extended antegradely to the mid-portions of the left anterior descending artery (Figure 2). The patient's chest pain was intensified and he rapidly developed cardiogenic shock. An urgent coronary artery bypass grafting (CABG) was performed via standard median sternotomy. Intraoperatively, the patient's heart was globally edematous with depressed ventricular functions. Following intravenous heparinization and rapid cannulation, cardiopulmonary bypass (CPB) was initiated to bypass OM artery, first diagonal artery (D1), second diagonal artery (D2), and LAD artery with a saphenous vein. The patient was only able to be removed from the CPB under dopamine, epinephrine, and intra-aortic balloon pump (IABP-intra-aortic balloon pump, Maquet, USA) support. Pump time and cross-clamp time were 159 and 69 min, respectively.

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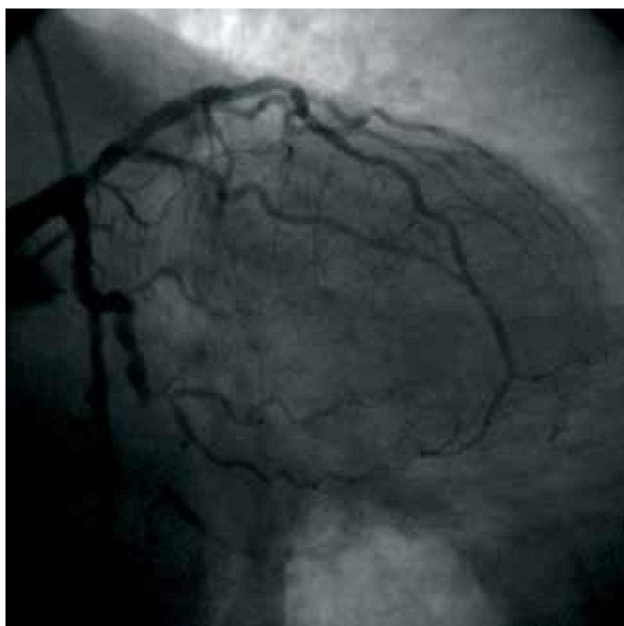

Figure 1. The angiographic view of the circumflex artery.

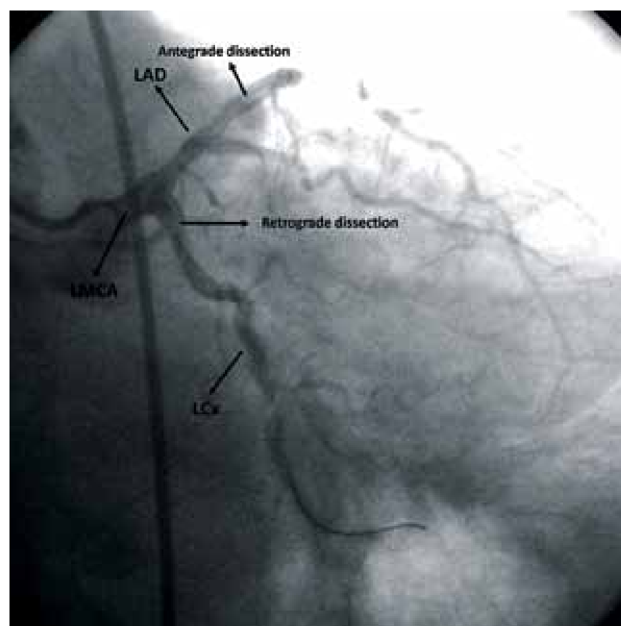

Figure 2. The view of the retrograde dissection of the circumflex artery during percutaneous coronary intervention of the artery, which from there extended to left main coronary artery and, then, antegradely to left anterior descending artery.

The patient was hemodynamically stable and was admitted to the surgical intensive care unit. He was extubated on postoperative second day and discharged on postoperative seventh day.

DISCUSSION

The incidence of iatrogenic aortocoronary dissection during percutaneous coronary intervention (PCI) has been reported close to 0.1%.[1] According to the classification scheme developed by Eshtehardi et al.,[3] type 1 dissection is defined as a localized dissection in left main coronary artery (LMCA) without involvement of the LAD and Cx; type 2 dissection refers to a dissection flap extending well into the LAD and Cx; and type 3 dissection is defined as the presence of a dissection involving the aortic root. In the same study, type 1 dissections were associated with excellent outcomes without hemodynamic instability or in-hospital mortality, while type 3 dissections had an in-hospital mortality rate of 100%.

Despite not fully understood, the etiology of iatrogenic LMCA dissection during PCI reportedly involves LMCA atherosclerosis (i.e., a type C, calcified stenosis), an unusual LMCA anatomy and location, operator experience, forceful manual injection of contrast agent, catheter selection (size and type differences; i.e., left Amplatz catheters are associated with a greater dissection risk), failure to align guidewire and guiding catheter co-axially with LMCA and subintimal canal (particularly with hard and less maneuverable guidewires), deep catheter intubation, and manipulations during seating the guiding catheter to coronary ostium, as well as all mechanical injuries to arterial wall during balloon dilatation and stenting.[1,2,4-9]

It has also been reported that LMCA stenosis, hypertension, Marfan syndrome, congenital uni- or bicuspid aortic valve, and cystic medial necrosis may increase the risk.[1] Fortunately, our case had no risk factor other than hypertension.

We suggest that in our patient a Cx dissection occurred due to the mechanical injury of arterial wall during stenting (Integrity, Medtronic; Medtronic, Inc., Santa Rosa, CA, USA) or intimal tear during pre-dilatation procedure, which retrogradely progressed to LMCA due possibly to forceful dye injection or medial degeneration.

Furthermore, LMCA dissection is a rare, albeit fatal complication of coronary interventional procedures. To date, several strategies have been proposed for the management of LMCA dissection. A rapid, successful

management requires a full cooperation between cardiologists and cardiovascular surgeons. Emergent stent implantation, emergent CABG or conservative therapy are the available treatment options for an iatrogenic LMCA dissection.

The presence of hemodynamic instability constitutes the major incentive for coronary intervention. Currently, percutaneous stenting of the entry point of coronary dissection is the primary treatment of choice in patients with limited aortic involvement.[10] Surgical therapy is recommended, when a dissection involves beyond coronary ostium or 40 mm into ascending aorta.[10] In patients with a distal 'Thrombolysis In Myocardial Infarction: TIMI' III flow and hemodynamic stability, conservative therapy of iatrogenic non-occluding LMCA dissection has been shown to be associated with quite favorable long-term outcomes.[4]

In a large observational study including 38 patients with iatrogenic LMCA dissection,[3] 17 patients were treated with CABG and 14 patients were treated with bailout stenting. The authors reported no in-hospital mortality and the number of stable patients with multivessel disease was higher in the CABG group.

In conclusion, hemodynamic status, technical feasibility, availability of therapy, and surgical expertise are the major factors to be considered in the management for LMCA and coronary artery dissections. Based on our experiences, we suggest that emergency aortocoronary bypass surgery before hemodynamical status becomes worse is a life-saving procedure in patients with coronary arterial dissection.

Declaration of conflicting interests

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Cardiovascular Surgery and Interventions

Case Report Open Access

An extensive Morel-Lavallée lesion mimicking deep vein thrombosis

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ABSTRACT

Morel-Lavallée lesions are post-traumatic hemolymphatic collections related to shearing injury and disruption of interfascial planes between the subcutaneous soft tissue and muscle. In this report, we present a 24-year-old male with atypically Morel-Lavallée lesions localized in the thigh, knee and calf regions, mimicking deep vein thrombosis.

Keywords: Deep vein thrombosis; degloving; Morel-Lavallée.

Morel-Lavallée lesions (MLL) are post-traumatic hemolymphatic fluid collections related to shearing injury and disruption of interfascial planes between the subcutaneous soft tissue and muscle. Morel-Lavallée lesions are most commonly found in the trochanter/hip (36%), followed by thigh (24%) and pelvis (19%).[1] Its occurrence of the whole leg is rare. Herein, we report an unusual presentation of MLL.

CASE REPORT

A 24-year-old male was admitted to the emergency service following amoderate-velocity bicycle accident 15 days ago. He had a right tibial fracture and intramedullary instrumentation history. The patient suffered from serious leg pain and swelling. Physical examination revealed large abrasion on the anterolateral site of the thigh, significant increase in left leg diameter and positive Homan's sign; however, venous structures were patent and functional on Doppler ultrasonographic evaluation. Ultrasound revealed an extensive collection between the skin and fascia. Hematoma was initially considered. The tension on the leg started to resolve on the second day of admission and generalized fluctuation occurred through the lateral aspect of left leg. Magnetic resonance imaging (MRI) demonstrated complete degloving over the entire lateral aspect of his left thigh extending from the lower lateral abdomen to the middle of tibia (Figures 1, 2). The liquid collection was aspirated through a small incision in combination with systemic antibiotic therapy and leaved to negative pressure drainage with external bandaging. The patient was discharged on postoperative 10th day and his overall condition is well in the outpatient follow-up visits.

DISCUSSION

The MLL first described by a French physician Maurice Morel Lavallée in 1853 is a closed degloving injury involving separation of the skin and subcutaneous fat from the underlying fascia.[2,3] The acute trauma, typically due to a blunt shearing force applied across the surface of the skin, creates a potential space between the subcutaneous fat and fascia which fills with a mixture of hemorrhage, fat, and lymphatic fluid due to disruption of bridging vessels and lymphatic channels.[3] Vanhegan et al.[1] and Hak et al.[3] reported trochanteric, pelvic, flank and knee regions as the most common locations for these lesions. On the other hand, MLLs are rarely seen in multiple regions.[4]

Morel-Lavallée lesions present within a few hours to 13 years.[5] They are usually with underlying fractures and mostly unilateral. Patients may suffer from pain, swelling and stiffness. Physical examination reveals a fluctuant boggy mass under skin causing contour deformity with or without discoloration.

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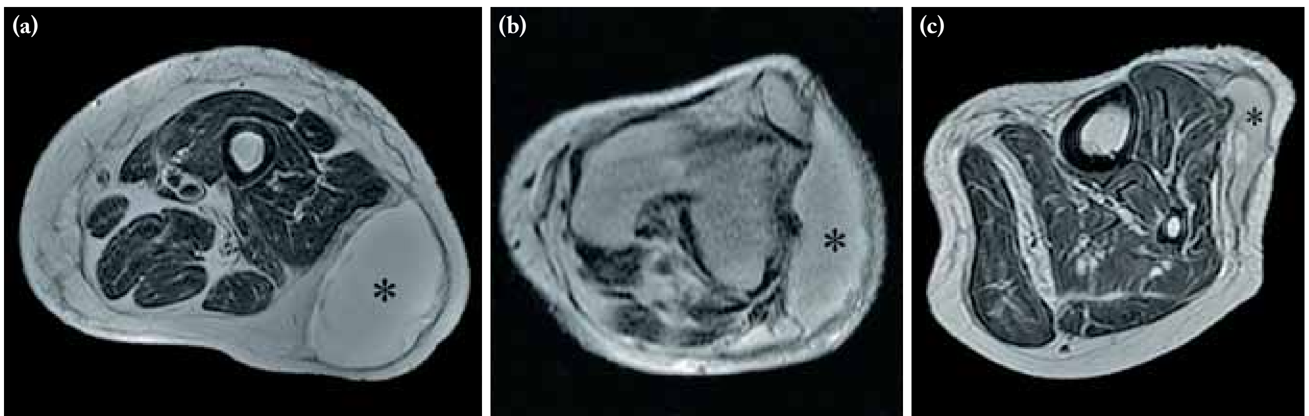

Figure 1. Axial T_2-weighted magnetic resonance imaging of the **(a)** left thigh, **(b)** left knee, **(c)** left calf. Asterisk show fluid collection.

Unresolved hematomas may also become persistent with encapsulation.

Morel-Lavallée lesions can be detected by ultrasonography. However, MRI is the best choice to determine the lesion type and chronicity.[6] On MRI, acute or subacute fluid collections containing a large amount of methemoglobin may be hyperintense on T_1- and T_2-weighted imaging. In this case, MRI showed acute fluid collection-related hyperintense lesions.

The differential diagnoses for acute lesions include hematomas, abscesses, fat necrosis, and soft tissue neoplasms, whereas the differential diagnosis is expanded in chronic collections which are better marginated and more homogeneous including seromas, bursitis, and lymphoceles.[7]

The skin receives its blood supply from the underlying fascia, whereas perfusion is dependent on the dermal and subcutaneous vascular plexus after the separation from the fascia. In cases of such injuries,

Figure 2. Coronal T_2-weighted magnetic resonance imaging of the **(a)** left thigh, **(b)** left calf. Asterisk show fluid collection.

expanding hematoma may lead to skin necrosis acutely or in a delayed fashion, if not promptly drained. Treatment options include application of compression banding, percutaneous or open surgical drainage with debridement, and irrigation and suction drainage with or without injection of sclerosing agents followed by pressure therapy.[5]

In conclusion, in our case, the lesion was atypically located including both thigh, knee and calf regions, and the initial symptoms and findings were similar with deep vein thrombosis. The diagnosis of Morel-Lavallée lesions should be particularly kept in mind by the cardiovascular surgeons and orthopedists, when venous Doppler ultrasonography reveals normal findings.

Declaration of conflicting interests

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Cardiovascular Surgery and Interventions

Case Report Open Access

Neck ecchymosis: a rare symptom in a ruptured thoracic aorta dissection

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ABSTRACT

A 73-year-old woman was admitted to the emergency room with sudden onset of neck swelling, ecchymosis, and chest pain. Computed tomography revealed a ruptured type B dissection and mediastinal hematoma extending towards the neck. The patient underwent emergent endovascular repair and the procedure was accomplished without any signs of endoleak. She was discharged on the fourth postoperative day and has been followed for 50 months without any complaints.

Keywords: Neck ecchymosis; ruptured thoracic aortic dissection; thoracic endovascular aortic aneurysm repair.

Acute type B aortic dissection is a life-threatening condition associated with high morbidity and mortality in the current era.[1] Medical therapy is the first treatment of choice for uncomplicated type B acute aortic dissection, while complicated acute type B dissections require an urgent approach by an open surgical or endovascular intervention. Sudden-onset chest or back pain without any evidence of myocardial ischemia is the most common symptom.[1,2] Other signs and symptoms such as syncope, cerebrovascular accidents, altered mental status, numbness and tingling, pain or weakness in the extremities, the pressure difference between the extremities or pulseless, Horner syndrome, dyspnea, hemoptysis, dysphagia, flank pain abdominal pain, anxiety and premonitions of death are also well-described.[1,2] In very rare cases, ecchymosis on the skin of the neck and upper chest wall caused by a rupture into the mediastinum has been also reported.[3-5]

Herein, we report an unusual case of a patient who presented to the emergency department with complaints of sudden neck swelling and ecchymosis. The patient was diagnosed with a ruptured type B dissection and treated by endovascular technique. This case is presented due to its rarity and discussed in the light of treatment options based on the literature data.

CASE REPORT

A 73-year-old woman presented to the emergency department with sudden onset of chest pain, neck swelling and ecchymoses (Figure 1). Her medical history revealed no head or neck trauma. She was on treatment for ischemic heart disease, hypertension, chronic obstructive pulmonary disease, and type 2 diabetes mellitus. She also had a previous history of thyroid surgery.

Physical examination revealed a large neck ecchymosis extending onto the upper chest wall. All peripheral pulses were symmetrically palpable and there was no pressure difference between the upper extremities. Neurological examination was unremarkable. Her blood pressure was 160/90 mmHg, heart rate was 112 bpm, respiratory rate was 25 bpm, temperature was 36.5 °C, and oxygen saturation by pulse oximetry was 90% on room air. The hemoglobin level was 9.8 g/dL. A complete blood count demonstrated white blood cell count of 14,300/mm^3, hemoglobin level of 9.8 g/dL, and platelet count of 231,000/mm^3. Coagulation studies revealed an international normalized ratio (INR) of 1.2.

Computed tomography (CT) examination demonstrated a ruptured type B dissection causing mediastinal and neck hematomas without hemothorax

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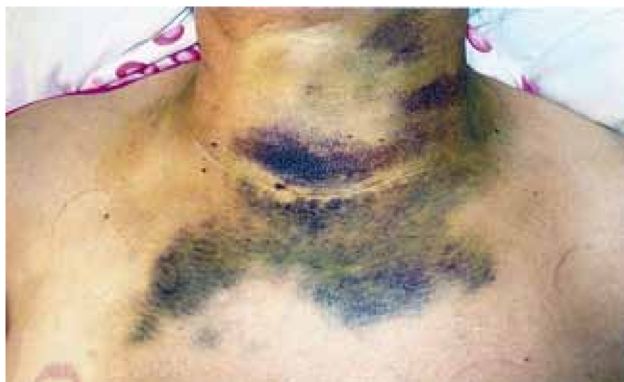

Figure 1. Large neck ecchymosis extending onto the upper chest wall.

(Figure 2). She was immediately brought to the angiography suite for endovascular treatment. Through left femoral artery, two thoracic endografts (Medtronic Valiant, Medtronic AVE, Santa Rosa, CA) were deployed from just beyond the origin of the left subclavian artery to the mid-descending thoracic aorta. Repeated angiogram did not show any evidence of endoleak at the end of the procedure. She was discharged on the fourth postoperative day. The follow-up CT at one month showed total exclusion of dissection without endoleak and size reduction of the mediastinal hematoma (Figure 3).

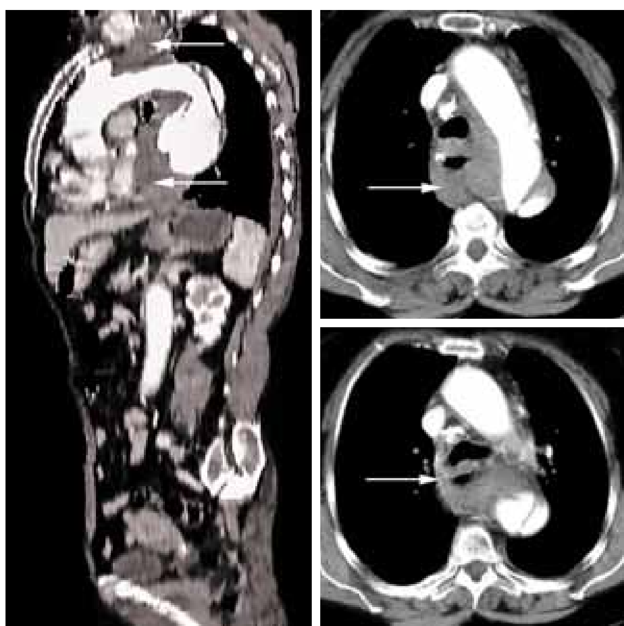

Figure 2. Preoperative computed tomography scan showing thoracic aortic dissection and mediastinal hematoma. Arrows highlight mediastinal hematoma and its extension through the thoracic outlet.

DISCUSSION

Ruptured aorta dissection is a fatal disorder, if left undiagnosed and untreated timely. It presentation may be nonspecific. Sudden-onset chest or back pain without any evidence of myocardial ischemia is the most common symptom, which accounts for approximately 90% of cases.[3,4] Paraplegia, hemiplegia, peripheral ischemia, and syncope are among the other well-described symptoms.[1,2] Our case presented with sudden onset neck ecchymosis, which is uncommon and unexpected.[3-5] The mechanism of the neck ecchymosis can be explained as follows: the posterior mediastinum extends into the retropharyngeal space, providing a communication between the chest and neck. Therefore, bleeding into the mediastinum may be seen subcutaneously in the anterior neck due to connections between retropharynx and parapharyngeal spaces. Hypertension is the most important risk factor presenting in up to 75% of patients with Stanford type B aortic dissection.[1,2] Computed tomography aortography is the gold standard for the diagnosis of aortic dissections due to its high sensitivity (98-100%) and specificity (95-98%).[2] Although magnetic resonance angiography, transesophageal echocardiography, and aortography are alternative diagnostic imaging modalities, all require institutional availability and patient stability.

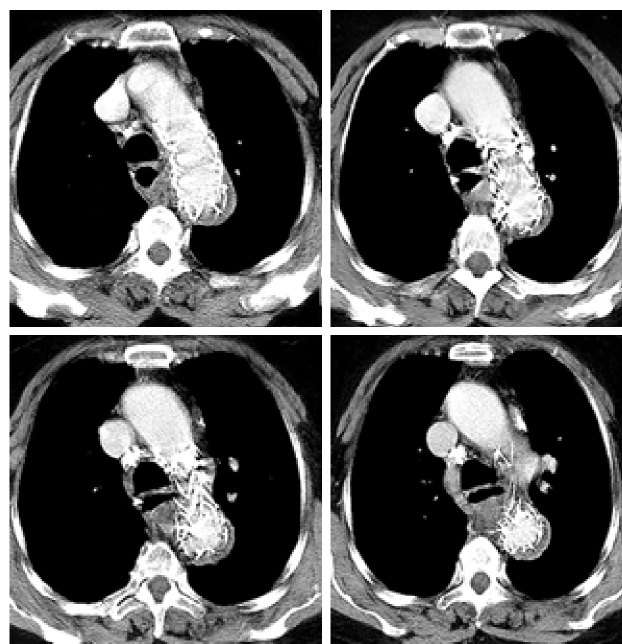

Figure 3. Postoperative computed tomography scan showing no evidence of endoleak and size reduction of the mediastinal hematoma.

Acute type B aortic dissection is treated medically, unless complicated by malperfusion, rupture, intractable pain, early false lumen expansion or uncontrolled hypertension. All complicated acute type B dissections require an urgent approach by an open surgical or endovascular intervention. The aim of endovascular repair of complicated aortic dissections is to prevent death from rupture, correction of malperfusion syndromes, and cease diameter expansion of the aneurysm. In a meta-analysis, Parker and Golledge[6] reported an in-hospital mortality incidence of 9%, an emergency surgical conversion rate of 0.6%, a periprocedural stroke rate of 3.1%, a mean 20-month survival of 88%, an endovascular re-intervention rate of 7.6% and a surgical re-intervention rate of 2.8% following endovascular repair of type B aortic dissections. On the other hand, open surgery for acute type B aortic dissection carries a 18 to 22% risk of in-hospital mortality even at experienced centers.[7] Therefore, surgery has been replaced by endovascular repair with a grade 1A recommendation.[7,8]

In conclusion, a ruptured acute type B aortic dissection may present with neck ecchymosis. This unusual presentation should always be kept in mind when managing patients with acute chest pain without any evidence of myocardial ischemia. Endovascular treatment, if applicable, should be considered the first-line treatment in complicated acute type B dissection with favorable initial and long-term outcomes.

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Cardiovascular Surgery and Interventions

Case Report Open Access

Surgery of mitral valve disease and coarctation of the aorta in Williams syndrome

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ABSTRACT
Although coarctation of the aorta is frequently diagnosed and treated in childhood, some cases are unable to be diagnosed until adulthood. Rarely, additional cardiovascular problems may accompany coarctation of the aorta in patients with genetic disturbances such as Williams syndrome. Herein, we report a case who presented to emergency service with symptoms of congestive heart failure and atrial fibrillation and underwent early, one-step surgery for severe mitral valve regurgitation and coarctation of the aorta after cardiac compensation. Genetic study confirmed the diagnosis of Williams syndrome.

Keywords: Coarctation of aorta; mitral valve regurgitation; one stage operation; Williams syndrome.

Williams syndrome is a hereditary, progressive, multi-system disease characterized by peripheral vascular disorders, mostly supravalvular aortic stenosis (SVAS) and peripheral pulmonary stenosis (PPS), dysmorphic "elfin facies", a characteristic cognitive profile, mild to moderate mental retardation and developmental disabilities.[1] Although supravalvular aortic stenosis (SVAS) tend to progress with age, PPS usually becomes milder.[1,2] We, herein report an interesting case demonstrating that cardiac abnormalities of Williams syndrome may not be solely confined to peripheral vascular stenosis and very rarely atypical presentations may also occur including tetralogy of Fallot, coarctation of the aorta (CoA), and severe mitral valve prolapse (MVP), as in our case.

Coarctation of the aorta constitutes 6 to 8% of congenital cardiac malformations.[1] Additional cardiac pathologies may accompany CoA, necessitating open cardiac surgery.[1] In patients with additional cardiac malformations and clinically unstable condition, two-step surgery may increase mortality and morbidity. Therefore, one-step procedure seems preferable and may decrease risk.

We, herein report a case who presented to emergency service with severe cardiac symptoms and was diagnosed with severe mitral valve regurgitation due to MVP. The patient underwent one-step successful surgery for accompanying CoA.

CASE REPORT

A 22-year-old male patient was admitted to the emergency service department with complaints of dyspnea, orthopnea, tachycardia, and syncope. The patient was hospitalized with the diagnosis of New York Heart Association (NYHA) Class III-IV acute decompensated congestive heart failure. His previous history included rheumatic heart disease, heart failure, and infective endocarditis. Blood pressure was 140/70 mmHg in both arms, the mean pulse rate was 160 bpm and in tachycardia. Physical examination revealed 4-5/6 systolic ejection murmur, bilateral rales up to the mid-lung fields and mild pretibial edema. Femoral pulses were not palpable and ankle-brachial index was 0.7. Electrocardiography was notable for atrial fibrillation with high ventricular response. Chest radiograph demonstrated pulmonary congestion and left atrial enlargement. Echocardiography showed severe mitral and tricuspid regurgitation, MVP, gigantic left atrium (10 cm), and a maximum systolic pulmonary artery pressure of 40 mmHg.

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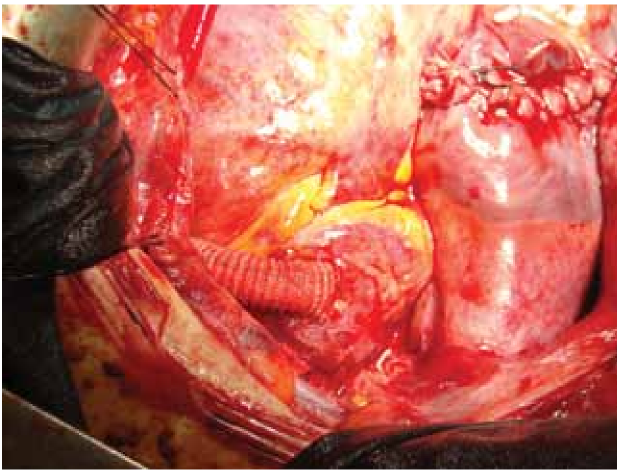

Figure 1. Graft placement during operation.

Suprajugular examination demonstrated systolic gradient in descending aorta with a peak value of 60-100 mmHg. Meanwhile, intravenous diuretics for congestion and digoxin and carvedilol for rate control of atrial fibrillation was initiated. The patient experienced polymorphic ventricular tachycardia and subsequent ventricular fibrillation. Defibrillation and brief cardiovascular resuscitation were performed. Amiodarone infusion converted rhythm to sinus and prevented ventricular tachycardia. Due to frequent ventricular premature beats and bradycardia, digoxin was withheld. Cardiac catheterization revealed normal coronary arteries, Grade 3 mitral regurgitation and coarctation of the aorta with a peak-to-peak systolic gradient of 60 mmHg, just distal of the left subclavian artery. A one-step surgery for correction of both pathologies was planned.

The patient was monitored with arterial tracings in both radial and femoral arteries under general anesthesia. Simultaneous radial artery pressure was observed as 130/80 mmHg, when femoral artery tracings demonstrated 60/30 mmHg. After aortic and bicaval cannulation, cardiopulmonary bypass was started. The apex was lifted and pericardium was dissected to expose the coarctated segment of the descending aorta. Hypoplastic descending aorta (1 cm in diameter in a 10 cm segment) was seen. The distal end of the coarctation was anastomosed with an 8 mm Dacron graft and this segment was cannulated to perfuse the descending aorta after bleeding control. Following cross-clamping and cardioplegia, mitral valve was evaluated by the left atrial dissection. As mitral valve was degenerated and ineligible for repair, it was replaced with a 31 mm Carbomedics prosthetic valve (CarboMedics Inc., Austin, TX). Then, tricuspid De Vega annuloplasty was performed for functional tricuspid regurgitation and cross-clamp was removed. The proximal end of the graft was anastomosed to ascending aorta with a sided-clamp (Figure 1) and cardiopulmonary bypass was stopped. After the operation, simultaneous blood pressure readings were 110/70 mmHg in radial artery and 100/65 mmHg in femoral artery. Postoperative ankle/brachial index increased from 0.7 to 1. The patient remained asymptomatic and was discharged at the 10th postoperative day. Postoperative control

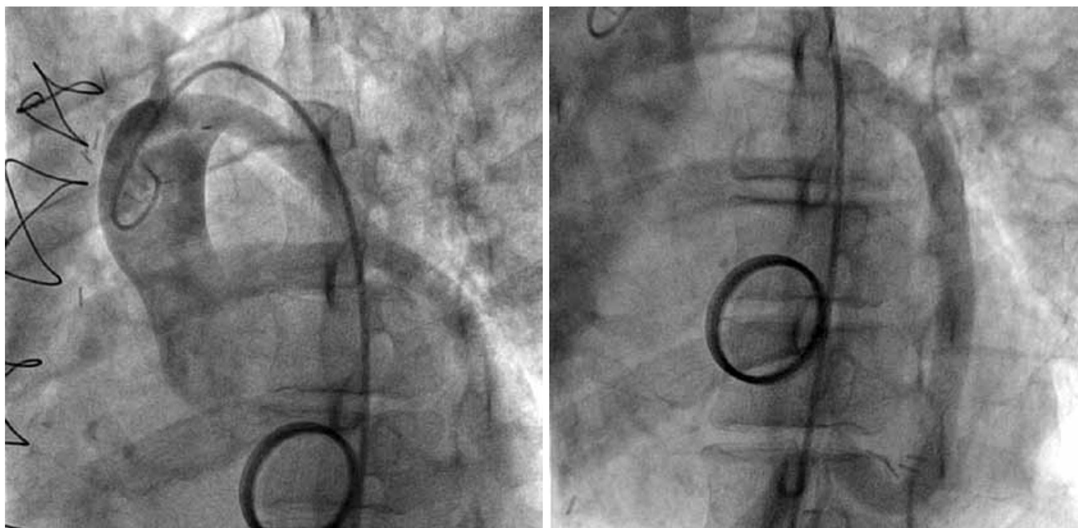

Figure 2. View of the graft in postoperative aortography.

aortography was normal (Figure 2a, b). His functional class was assessed as Class I in his first outpatient follow-up visit.

DISCUSSION

Williams syndrome is characterized with morphological facial features including curly hair, wide forehead, periorbital fullness, short nose with a bulbous tip, long philtrum, wide mouth, full cheeks and small, spaced teeth.[1] Our case also demonstrated same morphological characteristics signs since his toddler age.

Cardiovascular system is most frequently (80%) involved in patients with WS. Several published data reported the incidence of SVAS between 38-100%, and PPS between 16-100%. Moreover, MVP is also observed in patients with WS due to alterations in elastin gene.[2] Bruno et al.[3] reported the incidence of MVP as 27% in their series, the third most common anomaly following SVAS (71%) and PPS (38%), and these incidences were more frequent than previous reports. Our patient had severe mitral regurgitation due to MVP.

As another important pathology in WS, arteriopathy is a systemic disease caused by alterations of the elastin gene.[2] Coarctation of the aorta and renal artery stenosis apart from SVAS and PPS may also be seen. A thorough review reported stenosis of great arteries in 20% of patients without concomitant CoA.[2] On the contrary, Yau et al.[4] reported CoA in only 6% of cases and no arterial stenosis in other territories. Coarctation of the aorta in adulthood is usually an isolated condition. Surgical options include resection and end-to-end anastomosis, subclavian flap technique, reverse subclavian flap, patch-graft aortoplasty and graft interposition. Any of these techniques may be utilized in one-step or two-step surgeries in stabilized patients either with isolated CoA or co-existing anomalies. However, in patients with unstable cardiovascular condition, as in our patient, a one-step procedure correcting both anomalies may decrease associated morbidity and mortality.

Heinemann et al.[5] reported several surgical techniques to repair co-existing cardiac anomalies. Yilik et al.[6] and Bardakci et al.[7] used abdominal aorta as the distal site of anastomosis in a similar case with mitral valve disease and CoA. However, we did not prefer this method due to hypoplastic descending aorta and possible risk of intraperitoneal hemorrhage.

In conclusion, in the event of serious hemodynamic derangement in patients with coarctation of the aorta and coexisting cardiac anomalies, one-step surgery seems successful and feasible.

Declaration of conflicting interests

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