



**Cardiovascular
Surgery and
Interventions**

E-ISSN 2148-9211

CARDIOVASCULAR SURGERY *and* INTERVENTIONS

*Official Electronic Journal of the
Turkish Society of Cardiovascular Surgery*



Volume: 1 / Number: 3 / November 2014



CARDIOVASCULAR SURGERY AND INTERVENTIONS

Volume 1 - Number 3 - November 2014

Owner on behalf of the Turkish Society of Cardiovascular Surgery
Ali Gürbüz, MD.

Editor

Anıl Z. Apaydın, MD., *İzmir*

Managing Editor

Şahin Şenay, MD., *İstanbul*

Associate Editors

Tankut Akay, MD., *Ankara*
Numan Ali Aydemir, MD., *İstanbul*
Serkan Durdu, MD., *Ankara*
İbrahim Gökşin, MD., *Denizli*
Serdar Günaydın, MD., *Eskişehir*
Ali Can Hatemi, MD., *İstanbul*
Ece Salihoğlu, MD., *İstanbul*

Cardiovascular Surgery and Interventions is the official and periodical journal of the Turkish Society of Cardiovascular Surgery. It is published three times a year.

Material published in the Journal is covered by copyright ©2014 Turkish Society of Cardiovascular Surgery. All rights reserved.

Executive office:

Türk Kalp ve Damar Cerrahisi Derneği
Ataşehir Mah., Ataşehir Bulvarı, 48 Ada,
Mimoza 2/2, K: 2, D: 6,
34758 Ataşehir, İstanbul, Turkey
Tel: +90 216 - 456 14 54
Fax: +90 216 - 456 14 54
e-mail: info@tkdcd.org
URL: <http://www.tkdcd.org>

Editorial Contact Person

Anıl Z. Apaydın, MD.
e-mail: anil.apaydin@ege.edu.tr

Publisher

Bayçınar Tıbbi Yayıncılık ve Reklam Hiz. Tic. Ltd. Şti.
Örnek Mah., Dr. Süphi Ezgi Sok., Saray Apt.,
No: 11, D: 6, 34704 Ataşehir, İstanbul, Turkey
Tel: +90 216 - 317 41 14
Fax: +90 216 - 317 63 68
e-mail: info@baycinartibbiyayincilik.com

Type of publication: Periodical
Publication date: February 10, 2015

The control of conformity with the journal standards and the typesetting of the articles in this journal, the control of the English abstracts and references and the preparation of the journal for publishing were performed by Bayçınar Medical Publishing.

CONTENTS

CASE REPORTS

- Discrete subpulmonic membrane in transposition of great arteries with an intact ventricular septum**
Trushar Gajjar, Nageswar Rao, Neelam Desai61
- Acute massive pulmonary embolism without deep venous thrombosis**
Özge Korkmaz, M. Birhan Yılmaz, Sabahattin Göksel, Müslim Gül, Öcal Berkan64
- Cardiac tamponade after pulmonary valvuloplasty for presumed pulmonary valvular stenosis in a patient with double-chambered right ventricle: An unexpected diagnosis during emergency surgery**
Gökhan İlhan, Şahin Bozok, Şaban Ergene, Sedat Ozan Karakişi, Hakan Karamustafa, Nebiye Tüfekçi.....67
- A rare cause of hematuria and abdominal pain: our clinical experiences with Nutcracker Syndrome**
Mehmet Tort, Ümit Arslan, Ziya Yıldız, Eyüp Serhat Çalık, Mehmet Ali Kaygın71

INTERESTING IMAGE

- Left ventricular apical diverticulum associated with double outlet right ventricle**
Onur Işık, Muhammet Akyüz, Mahir Balakishiev, Mehmet Fatih Ayık, Yüksel Atay74

HOW TO DO IT?

- Retrograde passage of radiofrequency catheter for the endovenous ablation of the great saphenous vein: a modified technique and report of two cases**
Cemal Kemalöglü.....76

- Index**79

THE TITLES OF ARTICLES PUBLISHED IN THE JOURNAL IN 2014

| Page | Titles of the Articles | Authors | Publication Type |
|---------------------------|---|-----------------------------|----------------------|
| Volume (1) Issue 1 | | | |
| 1-2 | Ruptured spontaneous coronary artery dissection in a postmenopausal woman | Tekeli Kunt A <i>et al.</i> | Care Report |
| 3-5 | A rare location for cardiac hydatid cyst in the interventricular septum | Yıldırım F <i>et al.</i> | Care Report |
| 6-8 | Surgical treatment of two different interventional cardiological complications at the same patient | Seren M <i>et al.</i> | Care Report |
| 9-11 | Ross procedure after aortic balloon valvuloplasty: the youngest case in Turkey | Sarioğlu T <i>et al.</i> | Care Report |
| 12-14 | Partial endocardial cushion defect with Raghیب's syndrome: a rare case report | Akyüz M <i>et al.</i> | Care Report |
| 15-18 | Aortic coarctation and descending aortic aneurysm involving the subclavian artery: Hybrid approach to treatment | Özsöyler İ <i>et al.</i> | Care Report |
| 19-22 | Aortic coarctation treated with a self-expandable stent graft | Yıldırım F <i>et al.</i> | Care Report |
| 23-25 | Open abdominal surgery for migration of patent ductus arteriosus occluder device | Gümüş F <i>et al.</i> | Care Report |
| 26-28 | Removal of a missed guide wire in central vein with endovascular intervention: a case report | Çalık E <i>et al.</i> | Care Report |
| 29-31 | Histopathological findings of an excised varicose vein complicated with chemical phlebitis | Yılmaz S <i>et al.</i> | Care Report |
| 32-34 | Iatrogenic arteriovenous fistula of tibialis posterior artery following surgery of inserting plates and screws on a broken ankle: a case report | Temur B <i>et al.</i> | Care Report |
| 35-37 | Giant external iliac artery pseudoaneurysm following percutaneous coronary intervention: a rare case | Sürer S <i>et al.</i> | Care Report |
| 38-40 | Surgical treatment of an isolated left jugular vein aneurysm: a case report | Alur İ <i>et al.</i> | Care Report |
| Volume (1) Issue 2 | | | |
| 41-44 | Comparison of the sternal wires and sternal cable in closure of the sternum during cardiac surgery | Özen Y <i>et al.</i> | Original Article |
| 44-48 | Simultaneous nephrectomy, intracaval and right atrial tumor excision, caval patchplasty and coronary artery bypass grafting in patient with renal cell carcinoma | Alur İ <i>et al.</i> | Case Report |
| 49-52 | Upper extremity deep vein thrombosis after in vitro fertilization treated with ultrasound accelerated catheter directed thrombolysis | Dumantepe M <i>et al.</i> | Case Report |
| 53-55 | Coronary artery bypass graft surgery in a pediatric patient with a giant coronary aneurysm | Gürsoy M <i>et al.</i> | Case Report |
| 56-58 | Urgent carotid endarterectomy in carotid artery stenosis with a pedunculated thrombus: a case report | Akyüz M <i>et al.</i> | Case Report |
| 59-60 | Removal of an embolized transcatheter occluder device: the contradictory surgical treatment of a percutaneous complication | Başbuğ HS and Özışık K | Letter to the Editor |
| Volume (1) Issue 3 | | | |
| 61-63 | Discrete subpulmonic membrane in transposition of great arteries with an intact ventricular septum | Gajjar T <i>et al.</i> | Case Report |
| 64-66 | Acute massive pulmonary embolism without deep venous thrombosis | Korkmaz Ö <i>et al.</i> | Case Report |
| 67-70 | Cardiac tamponade after pulmonary valvuloplasty for presumed pulmonary valvular stenosis in a patient with double-chambered right ventricle: An unexpected diagnosis during emergency surgery | İlhan G <i>et al.</i> | Case Report |
| 71-73 | A rare cause of hematuria and abdominal pain: our clinical experiences with Nutcracker Syndrome | Tort M <i>et al.</i> | Case Report |
| 74-75 | Left ventricular apical diverticulum associated with double outlet right ventricle | Işık O <i>et al.</i> | Interesting Image |
| 76-78 | Retrograde passage of radiofrequency catheter for the endovenous ablation of the great saphenous vein: a modified technique and report of two cases | Kemaloğlu C | How to do it? |

Subject Index

- Abdominal pain** *see* 2014;1(3):71-73
- Aneurysm**
see 2014;1(1):38-40
see 2014;1(2):53-55
- Aortic coarctation** *see* 2014;1(1):15-18
- Atrial septal defect** *see* 2014;1(1):6-8
- Balloon valvuloplasty** *see* 2014;1(1):9-11
- Cable** *see* 2014;1(2):41-44
- Cardiac hydatid cyst** *see* 2014;1(1):3-5
- Cardiac tamponade** *see* 2014;1(3):67-70
- Cardiopulmonary bypass** *see* 2014;1(2):44-48
- Carotid endarterectomy** *see* 2014;1(2):56-58
- Catheter directed thrombolysis** *see* 2014;1(2):49-52
- Child** *see* 2014;1(1):38-40
- Complication** *see* 2014;1(1):6-8
- Compression of the left renal vein** *see* 2014;1(3):71-73
- Computed tomography** *see* 2014;1(3):64-66
- Congenital heart disease** *see* 2014;1(1):9-11
- Coronary artery bypass grafting**
see 2014;1(2):53-55
see 2014;1(3):64-66
- Coronary artery** *see* 2014;1(1):1-2
- Coronary bypass** *see* 2014;1(2):44-48
- Coronary sinus** *see* 2014;1(1):12-14
- Deep vein thrombosis** *see* 2014;1(2):49-52
- Deep venous thrombosis** *see* 2014;1(3):64-66
- Descending aorta aneurysm** *see* 2014;1(1):15-18
- Dissection** *see* 2014;1(1):1-2
- Double-chambered right ventricle** *see* 2014;1(3):67-70
- Endarterectomy** *see* 2014;1(2):56-58
- Endocardial cushion defect** *see* 2014;1(1):12-14
- Endovenous radiofrequency ablation** *see* 2014;1(3):76-78
- Great saphenous vein** *see* 2014;1(3):76-78
- Hematuria** *see* 2014;1(3):71-73
- Hybrid procedure** *see* 2014;1(1):15-18
- Iliac artery** *see* 2014;1(1):32-34
- In vitro fertilization** *see* 2014;1(2):49-52
- Interventricular septum** *see* 2014;1(1):3-5
- Jugular vein** *see* 2014;1(1):38-40
- Kawasaki disease** *see* 2014;1(2):53-55
- Left ventricular outflow tract obstruction**
see 2014;1(1):9-11
see 2014;1(3):61-63
- Neosinus** *see* 2014;1(1):19-22
- Nephrectomy** *see* 2014;1(2):44-48
- Nutcracker syndrome** *see* 2014;1(3):71-73
- Obesity** *see* 2014;1(2):41-44
- Occluder** *see* 2014;1(1):6-8
- Operative view** *see* 2014;1(1):3-5
- Pedunculated thrombus** *see* 2014;1(2):56-58
- Percutaneous intervention** *see* 2014;1(1):32-34
- Pericardial patching** *see* 2014;1(1):19-22
- Pseudoaneurysm** *see* 2014;1(1):32-34
- Pulmonary embolism** *see* 2014;1(3):64-66
- Pulmonary valvuloplasty** *see* 2014;1(3):67-70
- Renal cell carcinoma** *see* 2014;1(2):44-48
- Retrograde catheterization** *see* 2014;1(3):76-78
- Right atrial mass** *see* 2014;1(2):44-48
- Right ventricular outflow tract stenosis** *see* 2014;1(1):19-22
- Ross procedure** *see* 2014;1(1):9-11
- Rupture** *see* 2014;1(1):1-2
- Spontaneous** *see* 2014;1(1):1-2
- Sternal dehiscence** *see* 2014;1(2):41-44
- Subpulmonic membrane** *see* 2014;1(3):61-63
- Superior** *see* 2014;1(1):12-14
- Surgery** *see* 2014;1(1):38-40
- Thoracic endovascular aortic repair** *see* 2014;1(1):15-18
- Transposition of great arteries** *see* 2014;1(3):61-63
- Tumor** *see* 2014;1(2):44-48
- Ultrasound** *see* 2014;1(2):49-52
- Vena cava** *see* 2014;1(1):12-14

Author Index

- Acıpayam M** (see Özsoyler İ *et al.*) 2014;1(1):15-18
- Ada F** (see Gümüş F *et al.*) 2014;1(1):23-25
- Ak K** (see Tekeli Kunt A *et al.*) 2014;1(1):1-2
- Akgün S** (see Tekeli Kunt A *et al.*) 2014;1(1):1-2
- Aksoy E** (see Özen Y *et al.*) 2014;1(2):41-44
- Aksoy E** (see Yılmaz S *et al.*) 2014;1(1):29-31
- Akyüz M** (see Işık O *et al.*) 2014;1(3):74-75
- Akyüz M, Işık O, Ayık MF, Atay Y.** Partial endocardial cushion defect with Raghbir's syndrome: a rare case report. 2014;1(1):12-14 (Care Report)
- Akyüz M, Işık O, Ayık MF, Atay Y.** Urgent carotid endarterectomy in carotid artery stenosis with a pedunculated thrombus: a case report. 2014;1(2):56-58 (Case Report)
- Aldağ M** (see Temur B *et al.*) 2014;1(1):32-34
- Alihanoğlu Yİ** (see Alur İ *et al.*) 2014;1(2):44-48
- Alur İ, Girgin S, Emreçan B, Özcan AV.** Surgical treatment of an isolated left jugular vein aneurysm: a case report. 2014;1(1):38-40 (Care Report)
- Alur İ, Gökşin İ, Alihanoğlu Yİ, Durna F, Tuncay L.** Simultaneous nephrectomy, intracaval and right atrial tumor excision, caval patchplasty and coronary artery bypass grafting in patient with renal cell carcinoma. 2014;1(2):44-48 (Case Report)
- Arnaz A** (see Sarıoğlu T *et al.*) 2014;1(1):9-11
- Arsan S** (see Tekeli Kunt A *et al.*) 2014;1(1):1-2
- Arsan Ü** (see Tort M *et al.*) 2014;1(3):71-73
- Atay Y** (see Akyüz M *et al.*) 2014;1(1):12-14
- Atay Y** (see Akyüz M *et al.*) 2014;1(2):56-58
- Atay Y** (see Işık O *et al.*) 2014;1(3):74-75
- Aydın P** (see Çalık E *et al.*) 2014;1(1):26-28
- Ayık MF** (see Akyüz M *et al.*) 2014;1(1):12-14
- Ayık MF** (see Akyüz M *et al.*) 2014;1(2):56-58
- Ayık MF** (see Işık O *et al.*) 2014;1(3):74-75
- Balakishiev M** (see Işık O *et al.*) 2014;1(3):74-75
- Başbuğ HS, Özışık K.** Removal of an embolized transcatheter occluder device: the contradictory surgical treatment of a percutaneous complication. 2014;1(2):59-60 (Letter to the Editor)
- Berkan Ö** (see Korkmaz Ö *et al.*) 2014;1(3):64-66
- Beşir Y** (see Sürer S *et al.*) 2014;1(1):32-34
- Bozok Ş** (see İlhan G *et al.*) 2014;1(3):67-70
- Can T** (see Temur B *et al.*) 2014;1(1):32-34
- Çalık E, Tort M, Aydın P, Yıldız Z, Kaygın MA.** Removal of a missed guide wire in central vein with endovascular intervention: a case report. 2014;1(1):26-28 (Care Report)
- Çalık ES** (see Tort M *et al.*) 2014;1(3):71-73
- Çiçek ÖF** (see Seren M *et al.*) 2014;1(1):6-8
- Dedemoğlu M** (see Özen Y *et al.*) 2014;1(2):41-44
- Desai N** (see Gajjar T *et al.*) 2014;1(3):61-63
- Dumantepe M, Teymen B, Fazlıoğulları O, Uyar İ.** Upper extremity deep vein thrombosis after in vitro fertilization treated with ultrasound accelerated catheter directed thrombolysis. 2014;1(2):49-52 (Case Report)
- Durna F** (see Alur İ *et al.*) 2014;1(2):44-48
- Düzgün AC** (see Seren M *et al.*) 2014;1(1):6-8
- Emreçan B** (see Alur İ *et al.*) 2014;1(1):38-40
- Erek E** (see Sarıoğlu T *et al.*) 2014;1(1):9-11
- Ergene Ş** (see İlhan G *et al.*) 2014;1(3):67-70
- Eyileten Z** (see Gümüş F *et al.*) 2014;1(1):23-25
- Fazlıoğulları O** (see Dumantepe M *et al.*) 2014;1(2):49-52
- Gajjar T, Rao N, Desai N.** Discrete subpulmonic membrane in transposition of great arteries with an intact ventricular septum. 2014;1(3):61-63 (Case Report)
- Girgin S** (see Alur İ *et al.*) 2014;1(1):38-40
- Göksel S** (see Korkmaz Ö *et al.*) 2014;1(3):64-66
- Gökşin İ** (see Alur İ *et al.*) 2014;1(2):44-48
- Gül M** (see Korkmaz Ö *et al.*) 2014;1(3):64-66
- Gümüş F, Taşar M, Ada F, Eyileten Z, Yazıcıoğlu L, Kaya B, Uysalel A.** Open abdominal surgery for migration of patent ductus arteriosus occluder device. 2014;1(1):23-25 (Care Report)
- Günay D** (see Özen Y *et al.*) 2014;1(2):41-44
- Güney G** (see Yılmaz S *et al.*) 2014;1(1):29-31
- Gürsoy M, Salihoğlu E, Özçobanoğlu S, Özkan S.** Coronary artery bypass graft surgery in a pediatric patient with a giant coronary aneurysm. 2014;1(2):53-55 (Case Report)
- Işık O** (see Akyüz M *et al.*) 2014;1(1):12-14
- Işık O** (see Akyüz M *et al.*) 2014;1(2):56-58
- Işık O, Akyüz M, Balakishiev M, Ayık MF, Atay Y.** Left ventricular apical diverticulum associated with double outlet right ventricle. 2014;1(3):74-75 (Interesting Image)
- İlhan G, Bozok Ş, Ergene Ş, Karakişi SO, Karamustafa H, Tüfekçi N.** Cardiac tamponade after pulmonary valvuloplasty for presumed pulmonary valvular stenosis in a patient with double-chambered right ventricle: An unexpected diagnosis during emergency surgery. 2014;1(3):67-70 (Case Report)
- İsbir S** (see Tekeli Kunt A *et al.*) 2014;1(1):1-2
- İşkesen İ** (see Yıldırım F *et al.*) 2014;1(1):19-22
- İşkesen İ** (see Yıldırım F *et al.*) 2014;1(1):3-5
- Kaplan M** (see Temur B *et al.*) 2014;1(1):32-34
- Karakişi SO** (see İlhan G *et al.*) 2014;1(3):67-70
- Karamustafa H** (see İlhan G *et al.*) 2014;1(3):67-70
- Katırcıoğlu SF** (see Seren M *et al.*) 2014;1(1):6-8
- Kaya B** (see Gümüş F *et al.*) 2014;1(1):23-25
- Kaygın MA** (see Çalık E *et al.*) 2014;1(1):26-28
- Kaygın MA** (see Tort M *et al.*) 2014;1(3):71-73
- Kemaloğlu C.** Retrograde passage of radiofrequency catheter for the endovenous ablation of the great saphenous vein: a modified technique and report of two cases. 2014;1(3):76-78 (How to do it?)
- Kıralı K** (see Özen Y *et al.*) 2014;1(2):41-44
- Korkmaz Ö, Yılmaz MB, Göksel S, Gül M, Berkan Ö.** Acute massive pulmonary embolism without deep venous thrombosis. 2014;1(3):64-66 (Case Report)

- Kurdal AT** (see Yıldırım F *et al.*) 2014;1(1):19-22
- Kurdal AT** (see Yıldırım F *et al.*) 2014;1(1):3-5
- Olsun A** (see Temur B *et al.*) 2014;1(1):32-34
- Özbakkaloğlu A** (see Yıldırım F *et al.*) 2014;1(1):19-22
- Özcan AV** (see Alur İ *et al.*) 2014;1(1):38-40
- Özçobanoğlu S** (see Gürsoy M *et al.*) 2014;1(2):53-55
- Özen Y**, Sarıkaya S, Rabuş MB, Günay D, Aksoy E, Dedemoğlu M, Kıralı K. Comparison of the sternal wires and sternal cable in closure of the sternum during cardiac surgery. 2014;1(2):41-44 (Original Article)
- Özışık K** (see Başbuğ HS *et al.*) 2014;1(2):59-60
- Özkan S** (see Gürsoy M *et al.*) 2014;1(2):53-55
- Özsöyler İ**, Uncu H, Uçak HA, Acipayam M, Uçak D. Aortic coarctation and descending aortic aneurysm involving the subclavian artery: Hybrid approach to treatment. 2014;1(1):15-18 (Care Report)
- Öztürk T** (see Yıldırım F *et al.*) 2014;1(1):19-22
- Öztürk T** (see Yıldırım F *et al.*) 2014;1(1):3-5
- Rabuş MB** (see Özen Y *et al.*) 2014;1(2):41-44
- Rao N** (see Gajjar T *et al.*) 2014;1(3):61-63
- Rodoplu O** (see Sürer S *et al.*) 2014;1(1):32-34
- Salihoğlu E** (see Gürsoy M *et al.*) 2014;1(2):53-55
- Sarıkaya S** (see Özen Y *et al.*) 2014;1(2):41-44
- Sarioğlu T**, Arnaz A, Ereğ E, Yalçınbaş Y. Ross procedure after aortic balloon valvuloplasty: the youngest case in Turkey. 2014;1(1):9-11 (Care Report)
- Seren M**, Çiçek ÖF, Düzgün AC, Katircioğlu SF. Surgical treatment of two different interventional cardiological complications at the same patient. 2014;1(1):6-8 (Care Report)
- Sürer S**, Beşir Y, Rodoplu O, Tetik Ö. Giant external iliac artery pseudoaneurysm following percutaneous coronary intervention: a rare case. 2014;1(1):32-34 (Care Report)
- Taşar M** (see Gümüş F *et al.*) 2014;1(1):23-25
- Tekeli Kunt A**, Akgün S, Ak K, İsbir S, Arsan S. Ruptured spontaneous coronary artery dissection in a postmenopausal woman. 2014;1(1):1-2 (Care Report)
- Temur B**, Aldağ M, Can T, Olsun A, Kaplan M. Iatrogenic arteriovenous fistula of tibialis posterior artery following surgery of inserting plates and screws on a broken ankle: a case report. 2014;1(1):32-34 (Care Report)
- Tetik Ö** (see Sürer S *et al.*) 2014;1(1):32-34
- Teymen B** (see Dumantepe M *et al.*) 2014;1(2):49-52
- Tort M** (see Çalık E *et al.*) 2014;1(1):26-28
- Tort M**, Arslan Ü, Yıldız Z, Çalık ES, Kaygın MA. A rare cause of hematuria and abdominal pain: our clinical experiences with Nutcracker Syndrome. 2014;1(3):71-73 (Case Report)
- Tuncay L** (see Alur İ *et al.*) 2014;1(2):44-48
- Tuncer B** (see Yıldırım F *et al.*) 2014;1(1):3-5
- Tüfekçi N** (see İlhan G *et al.*) 2014;1(3):67-70
- Uçak D** (see Özsöyler İ *et al.*) 2014;1(1):15-18
- Uçak HA** (see Özsöyler İ *et al.*) 2014;1(1):15-18
- Uncu H** (see Özsöyler İ *et al.*) 2014;1(1):15-18
- Uyar İ** (see Dumantepe M *et al.*) 2014;1(2):49-52
- Uysalel A** (see Gümüş F *et al.*) 2014;1(1):23-25
- Yalçınbaş Y** (see Sarioğlu T *et al.*) 2014;1(1):9-11
- Yazıcıoğlu L** (see Gümüş F *et al.*) 2014;1(1):23-25
- Yıldırım F**, Kurdal AT, Özbakkaloğlu A, Öztürk T, İşkesen İ. Aortic coarctation treated with a self-expandable stent graft. 2014;1(1):19-22 (Care Report)
- Yıldırım F**, Tuncer B, Kurdal AT, Öztürk T, İşkesen İ. A rare location for cardiac hydatid cyst in the interventricular septum. 2014;1(1):3-5 (Care Report)
- Yıldız Z** (see Çalık E *et al.*) 2014;1(1):26-28
- Yıldız Z** (see Tort M *et al.*) 2014;1(3):71-73
- Yılmaz MB** (see Korkmaz Ö *et al.*) 2014;1(3):64-66
- Yılmaz S**, Aksoy E, Güney G. Histopathological findings of an excised varicose vein complicated with chemical phlebitis. 2014;1(1):29-31 (Care Report)

Discrete subpulmonic membrane in transposition of great arteries with an intact ventricular septum

Trushar Gajjar, Nageswar Rao, Neelam Desai

Received: November 23, 2014 Accepted: January 06, 2015 Published online: February 10, 2015

The left ventricular outflow tract obstruction is rare in transposition of the great arteries with an intact ventricular septum. The obstruction may be dynamic or anatomic. Herein, we present a four-year-old boy who was diagnosed with dextro-transposition of the great arteries, patent ductus arteriosus with an intact ventricular septum, and left ventricular outflow tract obstruction due to a discrete subpulmonic membrane.

Keywords: Left ventricular outflow tract obstruction; subpulmonic membrane; transposition of great arteries.

The left ventricular outflow tract (LVOT) obstruction is rare in transposition of the great arteries with an intact ventricular septum (TGA/IVS). Only in 0.7% of cases this combination is reported.^[1] The obstruction may be dynamic or fixed.^[1] Herein, we present a case report of this rare anomaly with various treatment options.

CASE REPORT

A four-year-old child presented with cyanosis since birth. On physical examination, uniform central cyanosis and clubbing were present. The heart rate was 90/min on a regular basis and blood pressure was 120/70 mmHg. Electrocardiogram showed sinus rhythm with right axis deviation. Chest X-ray revealed situs solitus, left ventricular type of apex, biatrial enlargement and pulmonary plethora. Two dimensional echocardiography showed (Figure 1a) dextro-transposition of the great arteries (d-TGA), an intact interventricular septum, subpulmonic membrane (subcostal view), LVOT gradient of 43/26 mmHg, an aneurysm of interatrial septum, patent ductus arteriosus (PDA), morphologically regressed left ventricle and good ventricular function. Left ventriculogram showed a discrete subpulmonic membrane with 46 mmHg gradient (Figure 1b), an intact ventricular septum with good-size main and branch pulmonary arteries and a small PDA. In view of morphologically regressed left ventricle and significant gradient across the LVOT, we decided to perform Sennings operation with excision of subpulmonic membrane.

The patient was taken for surgery and a conventional median sternotomy approach was used. Preoperative findings revealed d-TGA, and the aorta to the right and anterior to the pulmonary artery. The coronary arteries were normal for d-TGA with sinus-1 giving the left coronary artery and the sinus-2 giving the right coronary artery. Both the atria were of good size with an absent atrial isomerism. There was a large secundum type of atrial septal defect and a complete diaphragm like subpulmonic membrane with a central opening (Figure 2a). Pulmonary valve was tricuspid with thickened leaflets and a small PDA. The subpulmonic membrane was excised, the PDA was ligated and a physiological correction was done by a modified Sennings operation. The weaning from cardiopulmonary bypass was done in a usual way.

The postoperative course was uneventful and an immediate postoperative echocardiography revealed nonobstructed systemic and pulmonary venous return, no residual shunt, mild tricuspid regurgitation, trivial pulmonary regurgitation; gradient across the LVOT was 6 mmHg with mild right ventricular dysfunction and a normal left ventricular function. A three month and two year follow-up showed asymptomatic patient and echocardiography revealed normal systemic and

Department of Cardiothoracic and Vascular Surgery, Sri Sathya Sai Institute of Higher Medical Sciences, Prasanthigram, Andhra Pradesh, India

Corresponding author: Trushar Gajjar, M.D. Department of Cardiothoracic and Vascular Surgery, Sri Sathya Sai Institute of Higher Medical Sciences, Prashanthigram 515134, District Anantapur, Andhra Pradesh, India.
Tel: +91 970 035 54 11 e-mail: trushargajjar@gmail.com

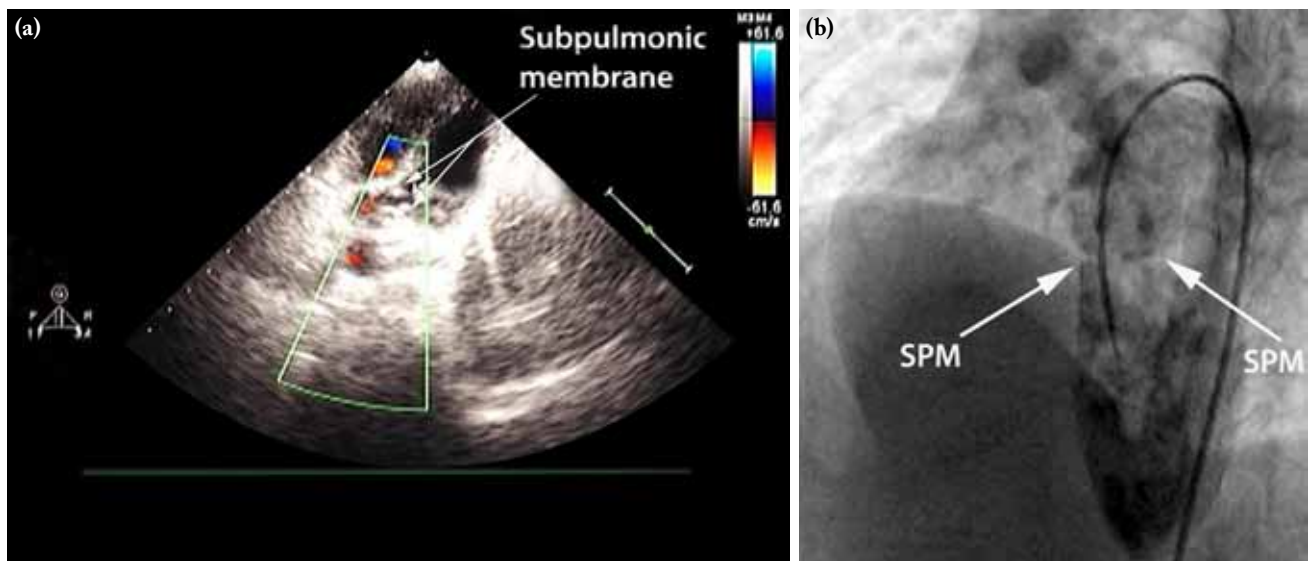


Figure 1. (a) Transthoracic echocardiogram in a subcostal view showing a discrete subpulmonic membrane. (b) A left ventriculogram through the femoral artery to descending aorta to patent ductus arteriosus to main pulmonary artery to left ventricle showing intact interventricular septum and discrete subpulmonic membrane. SPM: Subpulmonic membrane.

pulmonary venous drainage, insignificant gradient across the LVOT and a good ventricular function.

DISCUSSION

Left ventricular outflow tract obstruction is well-known in overall 30-35% of patients in association with TGA.^[1] However, only 0.7% of patients with TGA and intact ventricular septum develop a critical LVOT obstruction.^[1] Very few cases of discrete subpulmonic membrane have been reported in d-TGA/IVS in the literature.^[1] The obstruction may be dynamic or anatomic with anatomic causes ranging from the subvalvar fibrous ridge to fibrous tags, hypertrophied bands and valvar stenosis.^[1] A discrete subpulmonic membrane causing LVOT obstruction in patients with d-TGA is rare, although it has been reported with doubly committed ventricular septal defect in association with subpulmonary fibrous ridge.^[2-5] Ozkutlu et al.^[2] reported a discrete subaortic and subpulmonic stenosis with doubly committed ventricular septal defect in a series of nine patients. Raff et al.^[3] reported a subpulmonic membrane in association with a ventricular septal defect and aortic insufficiency. Duggal et al.^[4] showed a subpulmonic membrane in association with a suprasternal ventricular septal defect. Tomar et al.^[5] recommend a careful echocardiography of all similar presentations which may enable us to learn more of this rare lesion. The

pathophysiology of LVOT obstruction in TGA/IVS shows that a dynamic type of obstruction is common.^[1] A fixed type of obstruction is very rare and of two

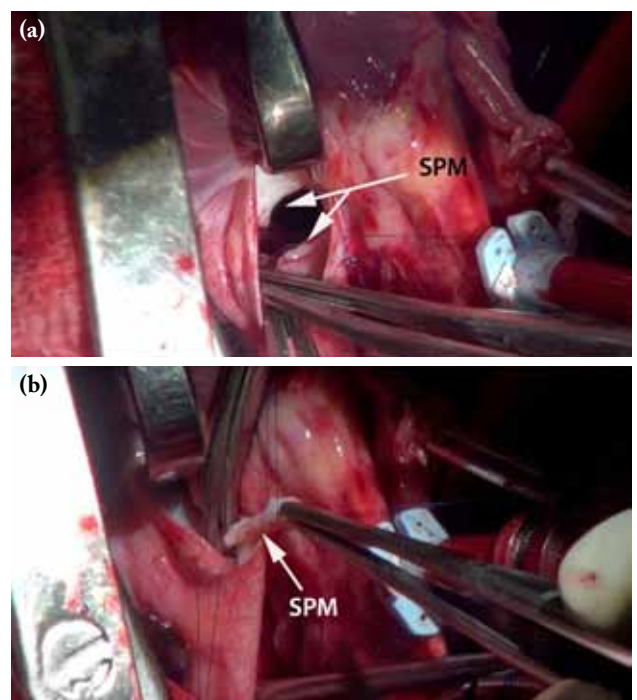


Figure 2. Intraoperative pictures taken from the head end of the table showing, (a) a complete fibrous ring just below the pulmonary valve, (b) excised subpulmonic ring. SPM: Subpulmonic membrane.

types, discrete or tunnel type.^[1] The discrete variety initially appears as a patch of endocardial thickening on the septal bulge, but later may evolve into sharp fibrous ridge or a discrete membrane which is analogous to the subaortic membrane.^[1] The less common type of fixed subpulmonary obstruction is caused by a tunnel like subpulmonary fibromuscular ridge that extends across the outflow tract.^[1] A careful transthoracic echocardiography in subcostal and apical five-chamber view can be useful in the diagnosis of this rare anomaly. Although percutaneous dilatation of subpulmonic membrane has been reported in the literature,^[5] the surgical excision is the treatment of choice along with the definitive surgical procedure. If this patient would have presented early with normal, non-regressed left ventricle Arterial switch would be the preferred operation. Unfortunately, our patient presented late with regressed left ventricle. In case of a significant and borderline left ventricle, the left ventricle can be trained in the late arterial switch operation. On the other hand, in case of a significantly preferably gradient less than 40 mmHg and morphologically regressed membrane excision of the left ventricle can be avoided to keep slightly higher left ventricular pressure which in long-term helps to improved right ventricular function. In case that corrected transposition (Corrected TGA) subpulmonic membrane can produce pulmonary insufficiency like subaortic membrane, but with lower pulmonary artery pressure, the chances of pulmonary insufficiency are rare. In the absence of a non-significant obstruction, probably gradient less than 40 mmHg without associated with cardiac anomaly requiring surgical correction, the subpulmonic membrane can be left alone, however, there is a possibility of progression of gradient later in life due to the development of fibrosis secondary to turbulence. However, if the gradient is more than 40 mmHg without associated with cardiac anomaly

or associated cardiac anomaly is present in spite of gradient less than 40 mmHg in, corrected TGA resection of subpulmonic membrane is advisable.

In conclusion, a discrete subpulmonic membrane in d-TGA with IVS is a rare anomaly, careful transthoracic echocardiography is able to diagnose this rare entity and surgical excision is the treatment of choice along with the definitive surgical procedure.

Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The authors received no financial support for the research and/or authorship of this article.

REFERENCES

1. Wernovsky G. Transposition of the great arteries. In: Allen HD, Driscoll DJ, Shaddy RE, Feltes TF, editors. *Moss and Adams' Heart Disease in Infants, Children, and Adolescents: Including the Fetus and Young Adults*. 7th ed. New York: Lippincott Williams & Wilkins; 2008; 1045-47.
2. Ozkutlu S, Saraçlar M, Alehan D, Yurdakul Y, Firat P, Tokel K. Subpulmonary and subaortic ridges in doubly committed subarterial ventricular septal defect: an echocardiographic study. *Eur Heart J* 1996;17:935-9.
3. Raff GW, Gaynor JW, Weinberg PM, Spray TL, Gleason M. Membranous subpulmonic stenosis associated with ventricular septal defect and aortic insufficiency. *J Am Soc Echocardiogr* 2000;13:58-60.
4. Duggal B, Bajaj M, Bansal NO. Subpulmonic membrane associated with a supracristal VSD: a rare cause of right ventricular outflow obstruction. *Echocardiography* 2011;28:E89-90.
5. Tomar M, Radhakrishnan S, Sharma R. Isolated subpulmonary membrane causing critical neonatal pulmonary stenosis with concordant atrioventricular and ventriculoarterial connections. *Images Paediatr Cardiol* 2009;11:5-9.

Acute massive pulmonary embolism without deep venous thrombosis

Özge Korkmaz,¹ M. Birhan Yılmaz,² Sabahattin Göksele,¹ Müslim Gül,³ Öcal Berkan¹

Received: July 08, 2014 Accepted: December 29, 2014 Published online: February 10, 2015

Acute pulmonary embolism is rarely encountered following coronary artery bypass graft (CABG) surgery. Herein, we present a 75-year-old woman who developed an acute massive pulmonary embolism without deep venous thrombosis 20 days after four-vessel CABG surgery. She was diagnosed using a thoracic computed tomography scan, yielding subtotal occlusion of the right and left pulmonary arteries. She was administered successful thrombolytic therapy and discharged uneventfully without problems during the follow-up period.

Keywords: Computed tomography; coronary artery bypass grafting; deep venous thrombosis; pulmonary embolism.

Acute pulmonary embolism (PE) following cardiac bypass surgery is an uncommon complication, yet leads to potentially fatal complications. It is known to increase morbidity and mortality. The estimated incidence of acute PE ranges between 0.5% and 4%.^[1] The diagnosis is often challenging as symptoms such as shortness of breath, chest pain, hypoxia, and leg swelling are often attributed to pre-procedural changes. Therefore, the diagnosis of PE or deep vein thrombosis (DVT) may be challenging. Furthermore, on occasion, DVT may not accompany acute PE after coronary artery bypass graft (CABG). In the light of the current literature data, we present a case who developed acute PE after CABG in the absence of detectable DVT along with successful recovery after thrombolytic therapy.

CASE REPORT

A 75-year-old woman (body mass index <20) who did not have accompanying diabetes mellitus or hyperlipidemia, underwent coronary angiography which showed serious lesions of the left anterior descending artery, right coronary artery, and circumflex coronary artery after presenting with unstable angina pectoris. According her medical story, she was on a beta blocker for hypertension. She underwent a four-vessel CABG with the use left internal mammary artery for grafting the left anterior descending artery, and saphenous vein graft which was harvested using a classic method for grafting first branch of obtuse marginal, first branch of diagonal and right coronary artery. The surgical

procedure was not complicated with a cross-clamp time of 79 minutes and with a cardiopulmonary bypass time of 116 minutes. During the first operative night, all vital parameters were steady and there were no complications. On the first postoperative day, she was transferred to the ward. She was administered a daily dose of 8000 IU low molecular weight heparin in addition to 100 mg of acetyl salicylic acid and 75 mg of clopidogrel. She was discharged on the 10th postoperative day. Prior to discharge, she was prescribed acetyl salicylic acid, clopidogrel, metoprolol, atorvastatin and ramipril. Twenty days postoperatively, the patient was admitted to the emergency department with shortness of breath and chest pain, which started four hours earlier. On admission, vital parameters were as follows: respiratory rate 35/minute, heart rate 135/minute, and blood pressure 85/45 mmHg with moderate oxygen desaturation (85%), and cold sweats. Echocardiography showed sinus tachycardia along with negative T waves on the anterior leads. Transthoracic echocardiography was performed immediately and revealed mild right ventricular (RV) dilatation with hypocontractility in the interventricular septum. A differential diagnosis of

¹Department of Cardiovascular Surgery, Medical Faculty of Cumhuriyet University, Sivas, Turkey

²Department of Cardiology, Medical Faculty of Cumhuriyet University, Sivas, Turkey

³Department of Cardiovascular Surgery, Sivas Numune Hospital, Sivas, Turkey

Corresponding author: Özge Korkmaz, M.D. Cumhuriyet Üniversitesi Tıp Fakültesi, Kalp ve Damar Cerrahisi Anabilim Dalı, 58140 Sivas, Turkey.
Tel: +90 532 - 592 20 91 e-mail: ozgekorkmaz73@hotmail.com



Figure 1. Contrast-enhanced transaxial spiral computed tomographic scan at the level of contain the both left and right main pulmonary. Scan acquired during late arterial phase of contrast enhancement.

acute coronary syndrome (ACS) versus acute PE was considered. Therefore, cardiac enzymes and D-dimer were studied. Troponin level was 0.19 ng/mL and D-dimer level was 17.48 ng/mL. In the light of these findings, an emergent thoracic computed tomography (CT) scan was sought and it confirmed subtotal occlusion of the right and left pulmonary arteries (Figure 1). In the meantime, she had similar ECG and echocardiographic abnormalities in the previous records, postoperatively; hence, the diagnosis of ACS was eliminated. In addition, her deep venous system was investigated using Doppler ultrasonography which produced negative results. Since her hemodynamic condition was not improving, she was referred for thrombolytic therapy of 0.6 mg/kg tissue plasminogen activator (tPA). No complications were detected during this protocol. During in-hospital follow-up, troponin levels slightly increased, then decreased sharply within 24 hours, while the level of D-dimer declined slowly within four days. She was hospitalized for 10 days and no complication was seen. She was discharged with warfarin, acetyl salicylic acid, metoprolol, atorvastatin, and ramipril. She was scheduled for visit two weeks later after discharge.

DISCUSSION

Previous retrospective studies reported that acute PE was an uncommon complication with a maximum incidence of 0.6%.^[2] On the other hand, most of recent studies introduced an incidence of acute PE that is higher than the previous reports with a range between 2.7% and 3.9%.^[2] Acute PE is

a life-threatening condition. Unfortunately, the presentation after CABG may be deceptive. Most patients, as in our case, suffer from ambiguous symptoms which are not helpful in the tentative diagnosis of acute PE after CABG. Moreover, these findings do not help the differential diagnosis of acute myocardial infarction or congestive heart failure. Even measuring D-dimer level and the cardiac enzyme profile may not be helpful for a definitive diagnosis. In addition, echocardiography is not useful in the differential diagnosis due to preexisting wall motion abnormalities, either due to CABG itself or due to previous infarctions, which may cause some confusion, though, severe right ventricular dilatation may help in case of hemodynamically significant PE.^[3] In this present case, the diagnosis was confirmed with a CT scan due to the fact that multi-slice CT, which was able to accurately make the differential diagnosis, was not available in the emergency department setting.

Recent guidelines recommend thrombolytic therapy in patients having acute massive acute PE with a high risk for early death.^[4] A number of controlled clinical trials confirm streptokinase, urokinase or alteplase therapy for patients suffering from significant acute PE. Currently, there is a consensus that patients with massive acute PE presenting with serious right ventricular failure with or without clinical instability and cardiogenic shock should be treated with thrombolytic agents expeditiously.^[5] Hence, in our case, as soon as the definitive diagnosis was made, thrombolytic therapy of 0.6 mg/kg tPA was dispensed within one hour in the intensive care unit. After therapy, she was administered warfarin and low-molecular weight heparin. Symptoms and hemodynamic status recovered remarkably in 48 hours.

In conclusion, although acute PE is an uncommon complication after cardiac surgery, the rate of incidence is higher than expected. Early diagnosis and rapidly tailored medical therapy is crucial. For the differential diagnosis of acute PE accurately, the gold standard remains to be thoracic CT scanning, particularly if a triple scan is available with multi-slice CT.

Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The authors received no financial support for the research and/or authorship of this article.

REFERENCES

1. Close V, Purohit M, Tanos M, Hunter S. Should patients post-cardiac surgery be given low molecular weight heparin for deep vein thrombosis prophylaxis? *Interact Cardiovasc Thorac Surg* 2006;5:624-9.
2. Protopapas AD, Baig K, Mukherjee D, Athanasiou T. Pulmonary embolism following coronary artery bypass grafting. *J Card Surg* 2011;26:181-8.
3. Wood KE. Major pulmonary embolism: review of a pathophysiologic approach to the golden hour of hemodynamically significant pulmonary embolism. *Chest* 2002;121:877-905.
4. Lankeit M, Konstantinides S. Thrombolytic therapy for submassive pulmonary embolism. *Best Pract Res Clin Haematol* 2012;25:379-89.
5. Konstantinides S. Should thrombolytic therapy be used in patients with pulmonary embolism? *Am J Cardiovasc Drugs* 2004;4:69-74.

Cardiac tamponade after pulmonary valvuloplasty for presumed pulmonary valvular stenosis in a patient with double-chambered right ventricle: An unexpected diagnosis during emergency surgery

Gökhan İlhan, Şahin Bozok, Şaban Ergene, Sedat Ozan Karakişi, Hakan Karamustafa, Nebiye Tüfekçi

Received: July 03, 2014 Accepted: December 27, 2014 Published online: February 10, 2015

Double-chambered right ventricle (DCRV) is a rare cardiac congenital anomaly characterized by an obstruction of subinfundibular region by abnormal muscle bands. Herein, we report a case with DCRV and cardiac tamponade requiring urgent surgery following pulmonary valvuloplasty due to presumed pulmonary valvular stenosis. A 42-year-old female patient was admitted to cardiology department with a complaint of dyspnea. The patient was diagnosed with pulmonary valvular stenosis by echocardiography and cardiac catheterization. A maximum hemodynamic gradient of 110 mmHg was detected in the right ventricular outflow tract (RVOT). The patient required emergency surgery due to the right atrial laceration and cardiac tamponade following an attempt for pulmonary valvuloplasty. Right atrial injury was repaired by primary suturing and a longitudinal incision was made to the RVOT. A fibrotic, circular muscular ring in the subinfundibular region was resected. Pressure tracings from the right ventricle and pulmonary arteries revealed resolution of pressure gradient. Preoperative correct diagnosis of DCRV and associated pathologies increase the success of surgical procedures and may prevent unexpected complications for both the surgeon and the patient.

Keywords: Cardiac tamponade; double-chambered right ventricle; pulmonary valvuloplasty.

Double-chambered right ventricle (DCRV) is a rare congenital anomaly causing the right ventricular outflow obstruction with a prevalence of 1-1.5% among all congenital cardiac anomalies.^[1,2] It is characterized by abnormal muscular bands in the subinfundibular region which obstructs the outflow and separates the right ventricle into two cavities, namely inflow and outflow chambers. The abnormal muscular tissue produces a pressure gradient between these chambers. The majority of patients are diagnosed in childhood and early adulthood with a preponderance below the age 20.^[2,3]

Although the natural history is still not clarified, DCRV frequently accompanies ventricular septal defect (VSD), causing the long-standing right ventricular outflow obstruction.^[1] Although other cardiac malformations often coexist with DCRV, an isolated DCRV is an extremely rare pathology. Approximately 80% of the patients have membranous VSD. Aneurysmatic pouching of the membranous septum, known as membranous septum aneurysm (MSA), may also develop. Hypertrophic muscular bands within the right ventricle impede flow, producing a pressure gradient. Thus, differential diagnosis includes other causes of the right ventricular outflow tract (RVOT) obstruction.

If DCRV is not ruled out in a patient with RVOT obstruction, the area between two chambers surrounded by muscular bands may be mistakenly identified as VSD during surgery and closure of this area may prove fatal.

Herein, we report an adult case with DCRV and RVOT obstruction, who underwent pulmonary valvuloplasty due to presumed pulmonary valvular stenosis and required emergency surgery due to cardiac tamponade.

CASE REPORT

A 42-year-old female patient was admitted to cardiology department with the complaints of dyspnea, fatigue and chest pain. Physical examination revealed a 4/6 systolic murmur in the mesocardiac area. Electrocardiography demonstrated the right ventricular hypertrophy voltage criteria. The patient was diagnosed with pulmonary valvular stenosis by

Department of Cardiovascular Surgery, Medical Faculty of Recep Tayyip Erdoğan University, Rize, Turkey

Corresponding author: Şahin Bozok, M.D. Recep Tayyip Erdoğan Üniversitesi Tıp Fakültesi Kalp ve Damar Cerrahisi Anabilim Dalı, 53200 Rize, Turkey.
Tel: +90 464 - 217 03 65 e-mail: sahinboz@yahoo.com

echocardiography and cardiac catheterization which showed a maximum pulmonary artery pressure of 15 mmHg, right ventricular pressure of 125 mmHg and a gradient of 110 mmHg between these chambers (Figures 1a, b). The patient underwent pulmonary valvuloplasty and cardiac tamponade ensued due to the right atrial injury requiring emergency surgery.

Surgical procedure

Since the patient was hypotensive due to cardiac tamponade, urgent median sternotomy was performed under general anesthesia. A large hematoma was observed around the heart within the pericardial cavity. After debridement of hematoma, the source of bleeding in the right atrial free wall was repaired primarily using 4/0 prolene sutures. After aortic and bicaval cannulation, cardiopulmonary bypass was initiated under moderate hypothermia (28 °C). As we obtained no information related to DCRV and due to emergent nature of the procedure, we did not measure the right atrial, right ventricle inlet, and pulmonary artery pressures. Following cross-clamping, diastolic arrest was achieved by cardioplegia. Right atriotomy and a longitudinal incision of RVOT were performed. No evidence of stenosis in the pulmonary valve was observed. However, an abnormal muscular tissue which divided the right ventricle into two chambers was noticed. The right ventricle was inspected using right atriotomy and right ventriculotomy (Figure 2a).

With the diagnosis of double-chambered right ventricle, abnormal hypertrophic and fibrotic bands which aligned circularly were resected. Septum, moderator band, papillary muscle of the tricuspid valve were spared during resection. No additional abnormalities including VSD were present. Right atrium was closed primarily, whereas right ventriculotomy was repaired with a pericardial patch (Figure 2b). Cardiopulmonary bypass was ceased. Pressure readings from the right ventricle dropped to 30 mmHg in the proximal right ventricle from 125 mmHg and the gradient dropped to 12 mmHg from 110 mmHg. Systemic arterial pressure was 110/70 mmHg at the end of the procedure.

The patient remained stable in the postoperative period without any complications and was discharged at the 10th postoperative day.

DISCUSSION

Lesions causing the right ventricular outflow obstruction may be at valvular, supraventricular or infundibular level. Infundibular obstructions are further classified as high, medium and low. Moreover, abnormal muscular bands of the right ventricle, membranous septum aneurysm, accessory tricuspid leaflet, Ebstein's anomaly type C and D, hydatid cyst of the infundibular septum, and neoplasms may cause RVOT obstruction.



Figure 1. (a) Right anterior oblique right ventriculography showing a muscular band dividing the right ventricle into two cavities and (b) typical double cavity view.

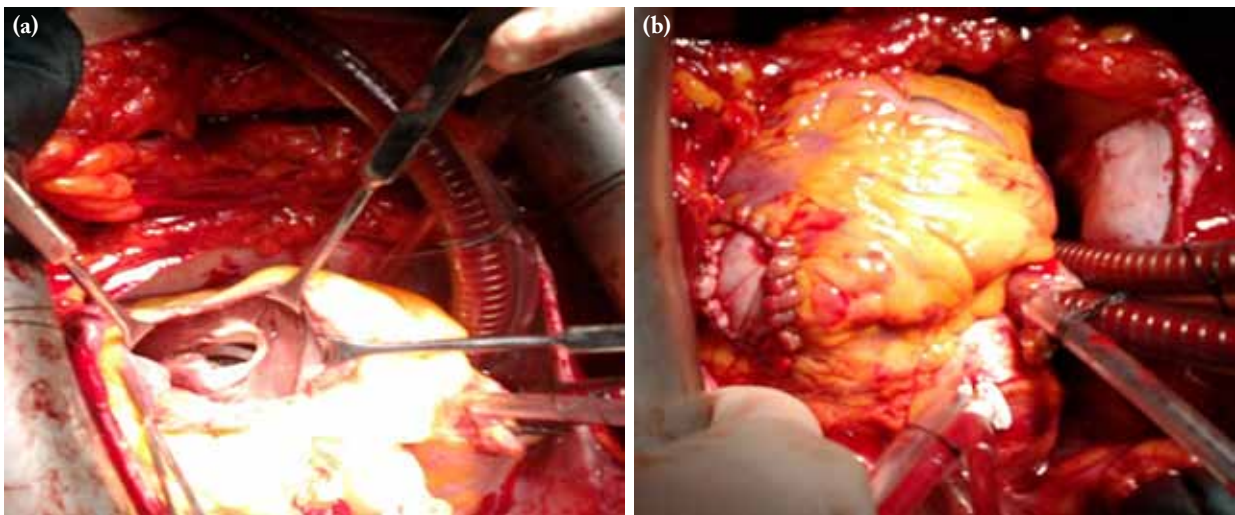


Figure 2. After right ventricular incision, (a) muscular band dividing the right ventricle into two cavities is seen. (b) Right ventriculotomy repaired with a pericardial patch.

Formerly, DCRV, a rare cause of RVOT obstruction, was first described by Lucas et al.^[4] as a pathology resulting from abnormal muscular bands in the subinfundibular region. Moreover, they reported that two patients were deceased after closure of the defect with the suspicion of VSD.

This pathology includes two chambers: proximal chamber has high pressure, whereas distal chamber is below normal or normal. Pulmonary valve and infundibulum are usually normal. Also, DCRV should be differentiated from other forms of RVOT obstructions: infundibular fibromuscular stenosis, reactive crystal hypertrophy and tetralogy of Fallot (TOF) may also cause subpulmonary pressure gradient. These pathologies can be differentiated by decreased trabeculations of the right ventricle. In addition, Goor and Lillehei^[5] reported the following points in differentiating DCRV and TOF: In TOF aorta is dextropositioned and VSD is always below obstruction. High septoparietal muscular bands, unlike abnormal muscular bands, are in the infundibulum and these bands do not cross the right ventricular cavity.^[4] Moreover, the conus is usually higher. In patients with DCRV and VSD, aorta is normally placed, VSD may not be below the level of obstruction, and it may also be supracristal. Additionally, VSD in DCRV is accompanied with abnormal muscular bands, and these bands cross the right ventricular cavity. The conus septum is normally placed.^[5]

Furthermore, DCRV is usually accompanied with several anomalies, the most common of which is

VSD.^[1] However, an isolated DCRV is an extremely rare pathology. In a series of 24 patients, Fellows et al.^[6] demonstrated 85% VSD and 8% membranous septum aneurysm (MSA). In addition to VSD (80–95%), pulmonary valve stenosis (33%), discrete subaortic stenosis, coronary artery anomalies (single coronary artery), double outlet right ventricle, and TOF may be also seen in patients with DCRV.^[6] In a study including patients undergoing surgery for VSD, Simpson et al.^[7] found the frequency of DCRV to be 10–11%.

McElhinney et al.^[3] reported that RVOT obstruction may be progressive and symptomatic in patients with DCRV. Thus, they suggested surgical treatment in adult patients, in the event of symptoms, coexisting pathologies, and patients with severe obstruction, even if they were asymptomatic. Similarly, our patient remained asymptomatic following surgery.

The main diagnostic tool for DCRV is echocardiography. Cardiac catheterization is the gold standard to measure the proximal and distal chamber pressures and calculate the gradient. Hachiro et al.^[1] suggested four criteria for the diagnosis of DCRV: systolic pressure gradient between the right ventricle inflow and outflow tracts, subinfundibular high/low obstruction and abnormal muscular bands in the right ventriculography, lack of infundibular hypoplasia, and direct visualization of intracardiac muscle bands during surgery. Right ventriculography may not be

diagnostic in every patient. However, during surgical exploration, DCRV is easily diagnosed. We believe that misdiagnosis of pulmonary stenosis in our case is due to an inexperience, and lack of information about DCRV, an extremely rare cause of RVOT obstruction. As a result, we could diagnose the patient correctly at surgery.

In a series of 40 patients, Hachiro et al.^[1] reported that they performed right atriotomy, combined pulmonary arteriotomy, and most commonly right ventriculotomy. During surgery, care must be given to evaluate the tricuspid papillary muscles. Similarly, we performed right atriotomy and a longitudinal incision to RVOT. These two combined incisions gave us an excellent view to excise abnormal muscular tissues.

In long standing pulmonary stenosis, infundibular hypertrophy usually develops. Therefore, even the pulmonic valvular stenosis is certain both before and after valvuloplasty procedure, gradient from multiple places should be obtained routinely. If the right ventricle, infundibular and pulmonary artery pressures are measured, it can be seen that there is no transvalvular gradient. On the other hand, this type of measurement is essential, since the procedure is sometimes successful, but the right ventricle pressure can be high due to the infundibular gradient. Furthermore, it should be emphasized that routine right ventricular angiography is advised before the valvuloplasty procedure. Angiographic appearance of the lateral view of the right ventricle may help to detect the exact location of stenosis. It may also give information not only where you put the balloon, but also function of the pulmonary valve.

In conclusion, correctly diagnosis of DCRV in the preoperative stage and excluding other causes of RVOT obstruction are of utmost importance. As DCRV may cause difficulties in the evaluation and surgery, special care on perioperative exploration

and systematic direct pressure recording from each chamber may be helpful in patients with VSD and pulmonary valve stenosis. Successful detection of DCRV and associated pathologies may increase safety, the success of the surgical procedure, and prevent unexpected complications for both the patient and the surgeon.

Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The authors received no financial support for the research and/or authorship of this article.

REFERENCES

1. Hachiro Y, Takagi N, Koyanagi T, Morikawa M, Abe T. Repair of double-chambered right ventricle: surgical results and long-term follow-up. *Ann Thorac Surg* 2001;72:1520-2.
2. Ozsoyler I, Bozok S, Yilik L, Kestelli M, Ilhan G, Gurbuz A. Double-chambered right ventricle: a case report. *Turk Gogus Kalp Dama* 2005;13:356-8.
3. McElhinney DB, Chatterjee KM, Reddy VM. Double-chambered right ventricle presenting in adulthood. *Ann Thorac Surg* 2000;70:124-7.
4. Lucas RV Jr, Varco RL, Lillehei CW, Adams P Jr, Anderson RC, Edwards JE. Anomalous muscle bundle of the right ventricle. Hemodynamic consequences and surgical considerations. *Circulation* 1962;25:443-55.
5. Goor DA, Lillehei CW. Congenital malformations of the heart. In: Goor DA, Lillehei CW, editors. *Congenital Malformations of the Heart: Embryology, Anatomy, and Operative Considerations*. 1st ed. New York: Grune & Stratton; 1975. p. 1-37.
6. Fellows KE, Martin EC, Rosenthal A. Angiocardiography of obstructing muscular bands of the right ventricle. *AJR Am J Roentgenol* 1977;128:249-56.
7. Simpson WF Jr, Sade RM, Crawford FA, Taylor AB, Fyfe DA. Double-chambered right ventricle. *Ann Thorac Surg* 1987;44:7-10.

A rare cause of hematuria and abdominal pain: our clinical experiences with Nutcracker Syndrome

Mehmet Tort, Ümit Arslan, Ziya Yıldız, Eyüp Serhat Çalhık, Mehmet Ali Kaygın

Received: January 11, 2014 Accepted: January 15, 2014 Published online: February 10, 2015

Compression of the left renal vein between the abdominal aorta and the superior mesenteric artery is named as Nutcracker syndrome (NCS). It is an extremely rare pathology which usually manifests with hematuria, pain, or proteinuria. The diagnosis of the disease is primarily based on clinical suspicion. Various treatment models such as observation, conservative therapies, and surgery are available. In this article, we discuss a rare condition of NCS in three patients with left renal vein compression in the light of radiological findings.

Keywords: Abdominal pain; compression of the left renal vein; hematuria; Nutcracker syndrome.

Nutcracker syndrome (NCS) or renal entrapment syndrome was firstly reported by El-Sadr and Mina^[1] in 1950; however, the first definition was made by Schepper in 1972, who described the disease as compression of the left renal vein between the aorta and the superior mesenteric artery.^[2] Nutcracker syndrome is characterized by an external compression of the outflow from the left renal vein into the inferior vena cava. Nutcracker phenomenon (NCP) is typically described as the compression of the left renal vein between the aorta and the superior mesenteric artery, restriction in left renal vein due to external compression, and dilation of the segment proximal to the stenotic renal vein due to an increased pressure. By some authors, this definition of NCP is called as anterior-type NCP. As in posterior NCS, it is defined as the external compression of the retroaortic renal vein by vertebral column.^[3] Wilkie syndrome which is characterized by compression of third part of duodenum (in a similar way with anterior NCS) can be simultaneously seen with anterior NCS.^[4]

CASE REPORT

Case 1– A 22-year-old male patient was admitted to the emergency department of our hospital with abdominal pain. On physical examination, the patient had remarkable pain attacks radiating to the right inguinal region. Blood and urinalysis revealed no pathology except microscopic hematuria. Ultrasonography (USG) which was performed to exclude acute abdomen showed a dilated left renal vein. These findings suspected us NCS. Abdominal computed tomography

(CT) demonstrated a large caliber left renal vein compressed between the abdominal aorta and superior mesenteric artery. The patient was hospitalized with the initial diagnosis of NCS (Figure 1). Medical work-ups were done preoperatively. Comorbid familial Mediterranean fever was diagnosed. Surgery was performed with a median abdominal incision. The superior mesenteric artery and the renal vein were mobilized (Figure 2). Saphenous vein bypass graft was placed between vena cava inferior and left renal vein at the anterior aorta level. The patient was then taken to the postoperative intensive care unit. The patient was given oral nutrition on the second postoperative day. In a stable condition, the patient was transferred to the hospital service on the third postoperative day. No complications were observed during follow-up visits and he was discharged from the hospital with full recovery on the seventh postoperative day.

Case 2– A 28-year-old woman was admitted to the internal medicine department of our hospital with recurrent hematuria attacks and abdominal pain. Using CT, the patient was diagnosed with NCS and was hospitalized in our service. Urinalysis detected 2+ blood. Preoperative procedures were completed and the patient underwent surgery. The left renal vein was fully incised and mobilized

Department of Cardiovascular Surgery, Erzurum Regional Training and Research Hospital, Erzurum, Turkey

Corresponding author: Mehmet Tort, M.D. Erzurum Bölge Eğitim ve Araştırma Hastanesi, Kalp ve Damar Cerrahisi Kliniği, 25240 Erzurum, Turkey.
Tel: +90 442 - 316 57 63 e-mail: dr_tort@hotmail.com

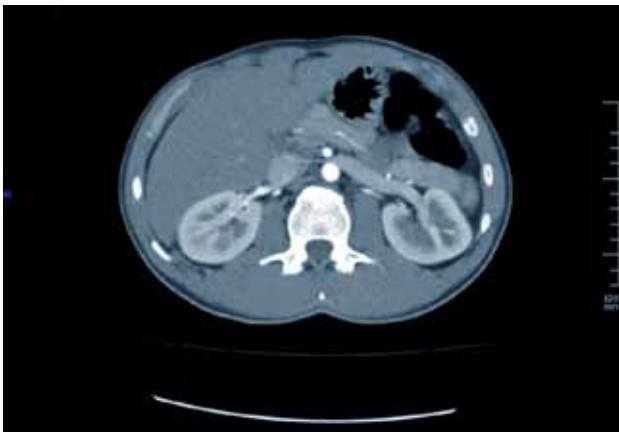


Figure 1. Computed tomography angiographic view of the patient with Nutcracker syndrome.

through the superior mesenteric artery and the aorta. End-to-end anastomosis was unable to be done due to far distance, and therefore a vascular hemostasis was able to be obtained by the insertion of saphenous vein interposition graft (2 cm). The patient was stabilized and transferred to the hospital service on the second postoperative day. The patient was discharged from the hospital with full recovery on the sixth postoperative day.

Case 3– A six-year-old female patient who received medical treatment and was under follow-up in the pediatric service due to recurrent urinary infections was diagnosed with NCS by abdominal USG. The patient was consulted to our clinic. Blood and urinalysis revealed no significant pathology. Abdominal CT angiography revealed the compression of the left renal vein between the aorta and superior mesenteric artery. Compression was not severe and a dilatation was not detected in the left renal vein. The patient was diagnosed with NCP and a medical follow-up was scheduled for the patient. The patient did not present with hematuria and a remarkable sign of compression was not observed during two-year follow-up. The follow-ups were sustained.

DISCUSSION

The NCP refers to the compression of the left renal vein between the aorta and the superior mesenteric artery.^[5] Nutcracker syndrome refers to the NCP together with complicated symptoms.^[5] As there are a limited number of experiential case reports and case series on NCS, the definite incidence of the syndrome remains unknown.



Figure 2. Perioperative view of the patient. A: Left renal vein B: Superior mesenteric artery.

Since NCS is a rare disease, the diagnosis is often delayed due to its non-specific diagnostic criteria. Most patients, children, in particular, are asymptomatic.^[5] This pathology is more commonly seen in young women. The disease can be clinically silent or can give symptoms such as hematuria in 66% of the patients, pelvic pain, flank pain, varicocele, dysmenorrhea, and dysuria.^[6] Hematuria which is the most commonly seen symptom is attributed to the rupture of thin-walled varices at the level of renal calyces due to elevated venous pressures. Orthostatic proteinuria which is defined as protein leakage from calyceal system due to an elevated venous pressure is seen in %0.6-10.7 of the Nutcracker cases and it is a less common laboratory finding, compared to hematuria.^[7]

Color Doppler USG is an initially preferred non-invasive method with a rough %78 sensitivity and %100 specificity. Contrast CT, magnetic resonance imaging, inferior vena cava manometry are used in the first step to establish the final diagnosis, retrograde flebografia, an invasive screening method, follows these methods. Renocaval pressure gradient less than 1 mmHg is classified as normal and 1-3 mmHg as borderline, while more than 3 mmHg indicates potential NCS.^[8]

Various treatment models such as observation, conservative treatment and surgery are suggested in adult patients. Different concepts and methods are available for the treatment (Table 1). Conservative approach is recommended in children due to

Table 1
Treatment strategies are divided into four groups

- 1) Medical observation
- 2) Open surgery
 - Medial nephropexy (excision of varicose veins)
 - Renal vein bypass
 - Transposition of the left renal vein
 - Autotransplantation of left kidney
 - Superior mesenteric artery transposition
 - Gonadocaval bypass
- 3) Stent implantation
 - Intravascular stent implantation
 - Extravascular stent implantation
- 4) Intrapelvic chemical cauterization

spontaneous remissions. Medication including medroxy progesteron acetate, goserelin acetate, and antiinflammatory drugs is administered to the patients with isolated pelvic congestion.^[9] Severe hematuria-related anemia is the most common indication for the treatment. Surgery or endovascular treatment is recommended for the patients with tense flank pain. Observation and conservative treatment are also recommended for other patients with NCS.^[7]

Anterior transposition of the left renal vein is a prominent method for the patients with recurrent hematuria attacks, massive proteinuria, severe flank pain, and posterior NCS accompanied by elevated renal vein pressures. Left renocaval bypass technique is preferred due to low surgery complication risk and maintained lower venous hypertension.^[10]

Endovascular stent insertion requires long-term anticoagulant prophylaxis. Potential stent complications include obstruction caused by neointimal hyperplasia development, embolization, and proximal migration of the stent. Although stenting has effective short-term results, long-term results remain unknown due to inadequate data in the literature.

In conclusion, NCS which is a rare disease should be kept in mind in the differential diagnosis among the

patients with recurrent hematuria attacks and flank pain. Although endovascular or laparoscopic stenting appear to be an appealing option, open surgical repair still remains reliable.

Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The authors received no financial support for the research and/or authorship of this article.

REFERENCES

1. EL-Sadr AR, Mina E. Anatomical and surgical aspects in the operative management of varicocele. *Urol Cutaneous Rev* 1950;54:257-62.
2. de Schepper A. "Nutcracker" phenomenon of the renal vein and venous pathology of the left kidney. *J Belge Radiol* 1972;55:507-11. [Abstract]
3. Urban BA, Ratner LE, Fishman EK. Three-dimensional volume-rendered CT angiography of the renal arteries and veins: normal anatomy, variants, and clinical applications. *Radiographics* 2001;21:373-86.
4. Barsoum MK, Shepherd RF, Welch TJ. Patient with both Wilkie syndrome and nutcracker syndrome. *Vasc Med* 2008;13:247-50.
5. Kurklinsky AK, Rooke TW. Nutcracker phenomenon and nutcracker syndrome. *Mayo Clin Proc* 2010;85:552-9.
6. Santos Arrontes D, Salgado Salinas R, Chiva Robles V, Gómez de Vicente JM, Fernández González I, Costa Subias J, et al. Nutcracker syndrome. Report of a case and review of the literature. *Actas Urol Esp* 2003;27:726-31. [Abstract]
7. Ekim M, Ozçakar ZB, Fitoz S, Soygür T, Yüksel S, Acar B, et al. The "nutcracker phenomenon" with orthostatic proteinuria: case reports. *Clin Nephrol* 2006;65:280-3.
8. Dellavedova T, Racca L, Ponzano RM, Minuzzi S, Olmedo JJ, Minuzzi G. Nutcracker syndrome: a case report. *Rev Mex Urol* 2010;70:51-4.
9. Sezik Ş, Duman Atilla Ö. Makroskobik hematürinin nadir bir nedeni. *Tr J Emerg Med* 2013;13:7.
10. Liu Y, Sun Y, Jin X. Left renocaval venous bypass with autologous great saphenous vein for nutcracker syndrome. *J Vasc Surg* 2012;55:1482-4.

Left ventricular apical diverticulum associated with double outlet right ventricle

Onur Işık, Muhammet Akyüz, Mahir Balakishiev, Mehmet Fatih Ayık, Yüksel Atay

Received: July 18, 2014 Accepted: December 20, 2014 Published online: February 10, 2015

A six-year-old boy was admitted to our hospital for surgery for cardiac anomaly. The patient's medical history included a right 5 mm sided modified Blalock-Taussig shunt through median sternotomy incision. Physical examination was normal, except a pulsatile mass localized in the epigastric area starting near inferior portion of the xiphoid process. Transthoracic echocardiography revealed double outlet right ventricle, subaortic ventricular septal defect, pulmonary stenosis, and patent right-sided shunt. An outpouching in the left ventricle apex which freely communicated with the left ventricle cavity through a narrow neck was observed. The diverticulum showed characteristics synchronous contractility with the left ventricle. The patient had normal left ventricular function without any evidence of thrombus in the left ventricular cavity or diverticulum. Cardiac computed tomography images revealed focal outpouching in the apical wall of the left ventricle, consistent with a congenital muscular diverticulum of the left ventricle apex (Figure 1). The patient was operated through re-median sternotomy incision and the apical diverticulum was visualized (Figure 2). After initiating cardiopulmonary bypass, Rastelli procedure was performed. At the end of the procedure, the left ventricular diverticulum was resected and primarily closed.

CASE REPORT

Although congenital diverticulum of the left ventricle (LV) is a rare cardiac malformation, comorbid disorders may frequently coexist.^[1] The incidence of LV diverticulum has been reported to be 0.05% of all congenital heart malformations.^[2] A diverticulum is typically characterized by a morphologically narrow neck and synchronous contractility.^[3] Both LV aneurysm and pseudoaneurysm which are characterized by a wide neck and paradoxical contraction.^[3] Most of the left ventricular diverticula are located at the apex of the LV, however, they may also be found in

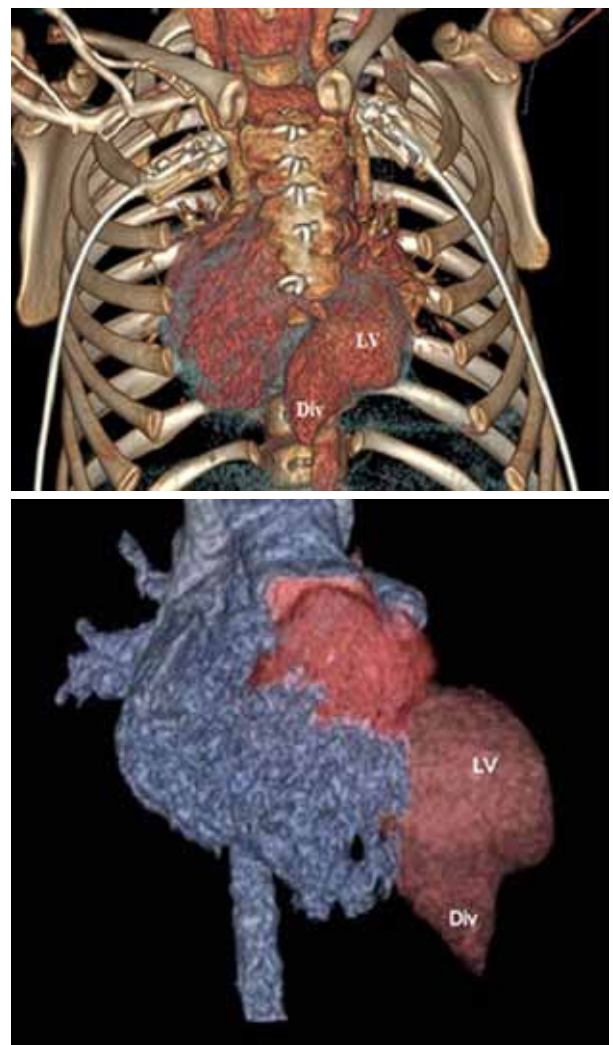


Figure 1. Three-dimensional computed tomography reconstruction of the heart showing diverticulum in the apical wall of the left ventricle. LV: Left ventricle; Div: Diverticulum.

Department of Cardiovascular Surgery, Medical Faculty of Ege University, İzmir, Turkey

Corresponding author: Muhammet Akyüz, M.D. Ege Üniversitesi Tıp Fakültesi Kalp ve Damar Cerrahisi Anabilim Dalı, 35100 Bornova, İzmir, Turkey.
Tel: +90 232 - 388 11 15 e-mail: drmak100@gmail.com

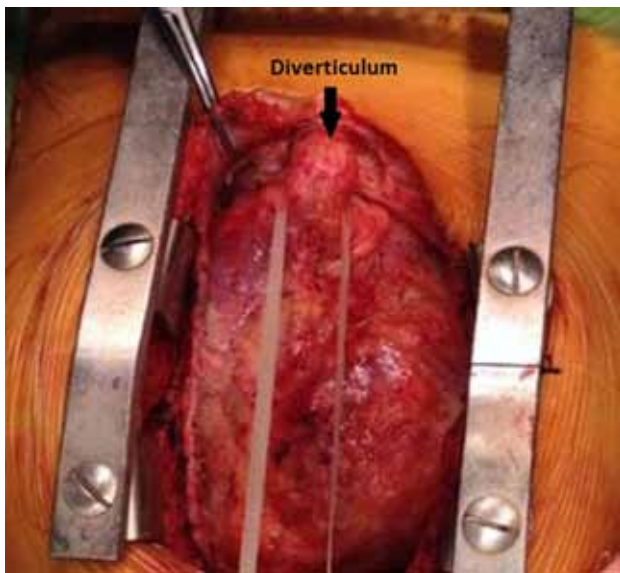


Figure 2. Operative picture of the diverticulum (arrow) at the apex of the heart.

any other location and may occur in association with cardiac heart disease, and/or extra-cardiac defects (Cantrell's syndrome).^[3,4] Congenital LV diverticula may cause serious complications including systemic thromboembolism, endocarditis, cardiac rupture,

heart failure, arrhythmia, and sudden cardiac death.^[4] Asymptomatic isolated diverticulum can be followed up, but symptomatic cases or patients for whom surgical intervention is necessary, diverticulum must be repaired.

Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The authors received no financial support for the research and/or authorship of this article.

REFERENCES

1. Saedi S, Salehi A, Saedi T, Hashemi MJ. Association of left ventricular diverticula and sinus venosus atrial septal defect. *Congenit Heart Dis* 2013;8:145-8.
2. Shauq A, Agarwal V, Crawley C. Congenital left ventricular diverticulum. *Heart Lung Circ* 2006;15:272-4.
3. Tullu MS, Vaideeswar P, Deshmukh CT. Congenital left ventricular diverticula. *International Journal of Cardiology* 2000;73:293-5.
4. Oylumlu M, Yüksel M, Yıldız A, Bilik MZ. Case images: A giant congenital left ventricular diverticulum. *Türk Kardiyol Dern Ars* 2014;42:585.

Retrograde passage of radiofrequency catheter for the endovenous ablation of the great saphenous vein: a modified technique and report of two cases

Cemal Kemalöglü

Received: January 21, 2014 Accepted: January 14, 2015 Published online: February 10, 2015

This is the report of two cases who underwent a modified great saphenous vein (GSV) ablation for venous insufficiency. For two patients with venous insufficiency and GSV reflux, radiofrequency (RF) ablation was scheduled. Both patients were obese and they had a reflux time more than four seconds in erect position with Valsalva's maneuver during color duplex ultrasound (US). Puncture for the GSV below or above the knee was unable to be performed. For both patients, a successful approach to GSV was made from the saphenofemoral junction (SFJ) at the groin level and GSV was ablated from below the knee level to the SFJ by RF.

Keywords: Endovenous radiofrequency ablation; great saphenous vein; retrograde catheterization.

Radiofrequency (RF) ablation of the incompetent great saphenous vein (GSV) is an effective and widely performed method for the treatment of varicose veins.^[1,2] Surgeons perform this method usually by similar ways: puncture to GSV usually below the knee, place the introducer, push the RF catheter upwards through the introducer, and position the tip of RF catheter 1-2 cm distally from the saphenofemoral junction (SFJ). What if the puncture of the GSV is unable to be performed due to various reasons such as obesity, thin GSV diameter, multiple punctures, and bleeding from the GSV or serious venospasm? This is a report of a solution for failures to enter the distal part of the GSV.

CASE REPORT

Case 1– A 42-year-old female patient was admitted due to visible varicose veins, night cramps, edema, and pain on the right leg for six months. Physical examination was remarkable for palpable varicosities on cruris and venous congestion. The patient was morbid obese with a body mass index of 40.4 kg/m². Duplex examination showed a five-second reflux of the right SFJ in erect position during Valsalva's maneuver and the GSV diameter was 7 mm at the junction level. The GSV was divided into two branches approximately 4-5 cm distal of the SFJ. The anterolateral branch of GSV, which was 2 mm, showed no significant reflux. However, posteromedial branch was 5.5 mm with a significant reflux. Radiofrequency ablation (VNUS

ClosureFAST) for GSV and posteromedial branch was scheduled.

After initial preparation, under local anesthesia and ultrasound guidance, GSV puncture was tried below the knee level (at this level GSV diameter was 4 mm). Due to thick subcutaneous adipose tissue, it was not feasible to enter GSV, despite multi-level attempts up to 10-12 cm above the knee. Then, we decided to make a puncture from the groin level to the GSV downwards. Under ultrasound guidance, the guide-wire was placed (Figures 1, 2). The access point for the GSV was about 3 cm distal of the SFJ (Figure 3). After placing the introducer, RF catheter was pushed downwards through the introducer. However, at 13-15 cm distally from the junction, the RF catheter was unable to be advanced forward due to the vein valve resistance. The patient was taken to reverse Trendelenburg position, and was told to make a long Valsalva's maneuver. The RF catheter was pulled back a little and pushed down simultaneously. The catheter, then, passed downwards to below the knee level without any difficulty. Tumescence anesthetic solution was given routinely (starting from below the knee level where the tip of RF catheter was to the SFJ). The procedure was completed following ablation. The GSV was

Department of Cardiovascular Surgery, Turgutlu State Hospital, Manisa, Turkey

Corresponding author: Cemal Kemalöglü, M.D. Turgutlu Devlet Hastanesi Kalp ve Damar Cerrahisi Kliniği, 45400 Turgutlu, Manisa, Turkey.
Tel: +90 505 - 899 07 39 e-mail: cemalkemaloglu@hotmail.com



Figure 1. The retrograde puncture of the great saphenous vein on the groin level (Case 1).



Figure 2. B-mode ultrasound view: common femoral vein, great saphenous vein, common femoral artery and guide-wire.

completely ablated from below the knee level to the 3 cm distal of SFJ.

Case 2– A 51-year-old female with a weight of 88 kg and height of 1.59 cm was admitted. She was obese with a body mass index of 34.8 kg/m². She was admitted due to visible varicose veins and edema on left

leg. Physical examination findings were remarkable for palpable varicosities on cruris and venous congestion. Duplex examination showed a four-second reflux of the left SFJ in erect position during Valsalva's maneuver and the GSV diameter was 6 mm at the junction level. Radiofrequency ablation for GSV was scheduled.



Figure 3. B-mode ultrasound view: radiofrequency catheter in great saphenous vein 3 cm distal of saphenofemoral junction.

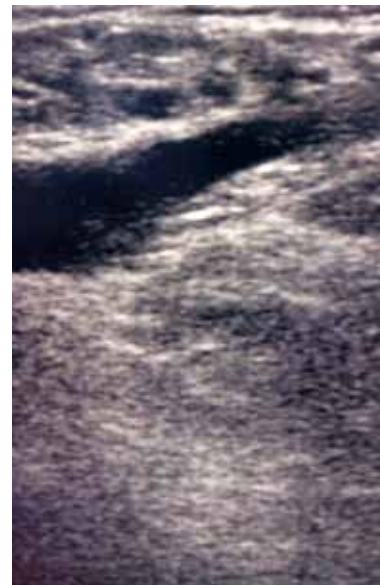


Figure 4. B-mode ultrasound view: great saphenous vein is occluded without complication, the first week control visit.

In this case, the GSV puncture was not also feasible below the knee level, where its diameter was 3.5 mm. The GSV was also easily cannulated downwards from the groin. The access point for the GSV was about 2 cm distal from the SFJ. Without any difficulty, the RF catheter was advanced downwards below the knee and was stuck there (15 cm from the knee). After tumescent anesthetic solution was given, ablation was made and the procedure was completed.

In the first week, repeated ultrasound showed an occluded GSV without any complication (Figure 4).

DISCUSSION

Endovenous access for thermal ablation of GSV is routinely performed from below the knee level commonly.^[3] Occasionally, the puncture for GSV at this level may not be feasible due to various reasons such as obesity, thin GSV diameter, bleeding to subcutaneous tissue, and venoconstriction. All these factors may complicate the operation and force the physician for an alternative access point to GSV.

In addition, it brings several questions together when retrograde junction puncture for GSV firstly come to mind, i.e. injury of femoral vein or artery or attachment of the catheter to vein valves. In one of our cases, valve resistance occurred during the retrograde passage of the catheter, however the catheter was advanced downwards very easily with saphenous filling (reverse Trendelenburg position and Valsalva's maneuver). Puncture of GSV at the groin level was made initially under ultrasound

in both patients without any arterial or venous complication.

There is a limited number of data in the literature regarding modified accesses for the GSV for thermal ablation.

In conclusion, retrograde puncture to GSV and retrograde passage of radiofrequency catheter from the groin to below the knee may be an alternative access to GSV for thermal ablation treatment.

Declaration of conflicting interests

The author declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The author received no financial support for the research and/or authorship of this article.

REFERENCES

1. García-Madrid C, Pastor Manrique JO, Gómez-Blasco F, Sala Planell E. Update on endovenous radio-frequency closure ablation of varicose veins. *Ann Vasc Surg* 2012;26:281-91.
2. Rasmussen LH, Lawaetz M, Bjoern L, Vennits B, Blemings A, Eklof B. Randomized clinical trial comparing endovenous laser ablation, radiofrequency ablation, foam sclerotherapy and surgical stripping for great saphenous varicose veins. *Br J Surg* 2011;98:1079-87.
3. Golbasi I, Turkay C, Erbasan O, Kemaloglu C, Sanli S, Turkay M, et al. Endovenous laser with miniphlebectomy for treatment of varicose veins and effect of different levels of laser energy on recanalization. A single center experience. *Lasers Med Sci* 2015;30:103-8.