Papers of Annual International Inter-University Scientific and Practical Conference ``Innovations in the Field of Medical Science and Education`` October 17-19, 2019, Cholpon-Ata, International School of Medicine, Bishkek, Kyrgyzstan

DOI: 10.24969/hvt.2019.148

CONFERENCE PAPER

Heart, Vessels and Transplantation 2019; 3: 173-176.
DOI: 10.24969/hvt.2019.148

Morphology of intramural lymph vessels of the human heart

Tamara S. Abaeva[1], Masalbek A. Satybalbiev[2], Argen T. Alymkulov[3], Aida M. Ergesheva[4]

[1] Macro and Micro-Anatomy Department, International School of Medicine, Bishkek, Kyrgyzstan

[2] Normal and Topographic Anatomy Department, I.K. Akhunbaev Kyrgyz State Medical Academy, Bishkek, Kyrgyzstan.

[3] I.K. Akhunbaev Kyrgyz State Medical Academy, Bishkek, Kyrgyzstan.

[4] Anatomy Department, Osh State University, Osh, Kyrgyzstan

Abstract

The structure of intraorgan system of the lymphatic collectors of the heart, their size, structure and distribution in different parts of the wall of lymphangions are described. Generation and interposition of muscle fibers in the structure of the common vessel are shown. Visual description of the interaction of different structures of the lymphatic system for lymph passage, from subendocardial lymph capillaries to the main outflow vessels is described.

Key words: lymphangions, lymphatic vessel, collector, caliber, form

(Heart Vess Transplant 2019; 3: 173-6. doi: 10.24969/hvt.2019.148)

Introduction

Lymphangion is a structural-functional unit of a lymphatic vessel, which is a section of a lymphatic vessel between two valves (1-7). The peripheral valve of the lymphatic vessel belongs to one valve segment, the central one belongs to the next. According to the content of myocytes in the lymphangion, the muscular cuff, the wall of the valvular sinus and the region of attachment of the valve are distinguished (1-3,8,9). Myocytes are in close relationship with collagen and elastic fibers. To ensure the normal functioning of the heart, a significant role is played by the outflow of lymph from the heart. The subepicardial lymphatic vessels of the heart are a reservoir that collects lymph from all layers of the heart and are the lymphatic collector of the heart.

The concept of lymphangion as a structurally functional unit of a lymphatic vessel has been recognized by leading lymphologists of Russia (2,4).

The subepicardial lymphatic bed of the heart, which consists of the initial lymphatic networks, lymphatic vessels of the first order and larger lymphatic vessels of the second, third and fourth orders, has been studied. The latter, while merging, form the main or collector lymphatic vessels of the heart, heading to the regional lymph nodes. The outflow of lymph from the endocardium is carried out into the lymphatic channel of the myocardium and then into the "2-storied" subepicardial lymphatic network. The discharge lymphatic vessels are located subepicardially and accompany the branches of the coronary arteries along the anterior and posterior “longitudinal” grooves from the apex of the heart to the base. They form two main lymphatic “trunks” - the left and the right one, which flow into the regional lymph nodes of the mediastinum. The ventricular myocardium has lymphatic vessels that are connected on the one hand, with the subendocardial lymphatic network, and on the other hand with the subepicardial. All myocardial vessels flow into the plexus of the lymphatic vessels of the epicardium.

The lymphatic vessels of the atria and ventricles merge in the coronary sulcus, in the bifurcation node or in the nodes of the preaortocarotid lymphatic chain.

The shape of the lymphangions of the intraorgan vessels of the human heart is diverse, but most of them approach the shape of an ellipsoid.

Address for Correspondence: Tamara S. Abaeva, Macro and Micro-Anatomy Department, International School of Medicine, Bishkek, Kyrgyzstan

Lymphangions of intraorgan and extraorgan lymphatic vessels of the human heart have age and local features of the shape, size (length, width, volume), number and distribution of myocytes, bundles of collagen and elastic fibers (1,2,5).

It should be noted that vascular lymphangion in adulthood, elderly and senile ages is characterized by a significant variety of forms. The loops of the lymphatic capillaries of the myocardium in old age become diverse in shape and size. In connection with the problem of lymph transport from the heart, it is of considerable interest to study its lymphangions, the distribution of muscle elements in the area of the muscular cuff, valvular sinus and in the area of valve attachment. The decision was to study the quantitative parameters of lymphangion (length, width and volume), as well as the number, shape of lymphangions, the structure of its wall (myocytes, collagen and elastic fibers) of intraorgan and extraorgan lymphatic vessels of the heart in the postnatal period of ontogenesis.

The emphasizing of lymphangion as a structurally functional unit has made it possible to discover new aspects of the functioning of lymphatic vessels, first of all, to study their motor function. It is believed that the main factor in the lymphatic flow in the body is the contractile activity of the lymphatic vessels. Studying the structural foundations of the motor function of the lymphatic vessels of the human heart from a new perspective i.e. the theory of lymphangion is of undoubted interest to understand the lymph outflow from the wall of the human heart under normal and pathological conditions, therefore anatomical study of the human heart is not only of theoretical value, it is important for practical medicine, first of all cardiology. The ratio of the lymphatic bed of the heart to pathological developments has been proved by many authors. Therefore, their structural and functional state can be an integrating indicator of the lymph formation and lymph outflow from all the membranes of the heart (6,8).

The purpose of this study is to investigate the structure of intraorgan and extraorgan lymphatic vessels of the heart from the standpoint of the structural-functional unit of the lymphatic vessel, which is the lymphangion; to study the wall structure of lymphangions (myocytes, collagen and elastic fibers); to identify the dynamics of age-related changes in heart lymphangion; to identify partial atrophy of myocytes of the wall of the lymphangion, that reduces the motor function of lymphangion at the older age.

Methods

To solve the tasks, heart specimens taken from 15 corpses of people of both sexes who died from accidents and injuries were studied. Whenever possible, some specimens were taken in which there was less subepicardial fat that facilitated the accomplishment of subsequent study.

An injection technique revealed lymphatic capillaries, vessels of the left and right ventricles, as well as the atria. The wall structure was studied with morphometry of the subepicardial heart lymphangions.

In the study of architectonics of human heart lymphangions, complex methods of morphological studies were used. As a colored injection mass, a predominantly modified Herot mass was used. Herot's blue injection mass penetrates well into the lymphatic capillaries and lymphatic vessels. It quite easily reaches the regional lymph nodes, without diffusing from the lymphatic vessel into the surrounding tissue and, at the same time, contrasts well against the surrounding background, which is very valuable for the preparation (dissection) and microphotography of blood vessels.

The study of the lymphatic bed of the human heart through the method of interstitial injection and preparation made it possible to study in sufficient detail the formation and anatomical and topographic location of the left lymphatic collector of the heart and its regional lymph nodes.

In the study of the preparations made via the total drug technique, we can see all the structures of the lymphangion of the lymphatic vessel of the heart (valves, collagen and elastic fibers). Especially valuable color is gained in the treatment of the preparation with Heidengain azan, because at the same time, the cytoplasm of myocytes stains well in red or pink, and such dyes as gallocyanin, hematoxylin-eosin, picrofuxin, and Weiger resorcinol-fuchsin were also used.

The length and width of the lymphangions were determined after injection with a blue mass of Gerot. The length of the lymphangion on such preparations is the distance between the two constrictions of the lymphatic vessel. The width was determined in the middle part of the lymphangion.

Research methods were carried out in the following order:

1. The method of interstitial injection of colored mass (Herot mass).

2. The method of preparation.

3. The making of enlightened preparations according to the Shpaltegolts method as modified by D. A. Zhdanov, their conclusion in polystyrene according to the method of V. N. Nadezhdin

4. Production of histological sections and total preparations according to A.V., Borisov.

5. Methodology for the making of total preparations of the lymphatic vessels of the heart and hemomicrocirculation pathways.

6. Methodology for determining lymphangions per unit area of the epicardium.

7. The study of the ultrastructure of extraorgan lymphatic vessels of the heart of animals (10 white rats) by means of electron microscopy.

Results and Discussion

The lymphatic bed of the heart consists of lymphatic capillaries of the endocardium, myocardium and epicardium, lymphatic postcapillaries, intraorgan and extraorgan lymphatic vessels that flow into the regional lymph nodes. The main collector taking lymph from the endocardium and myocardium is the lymphatic bed of the epicardium, which consists of lymphatic capillaries, postcapillaries and blood vessels (Table 1).

Myocytes as the anatomical basis of the motor function of the lymphangion are determined in all the lymphangions of the vessels namely intraorgan, extraorgan "trunks" of the duct. In intraorgan lymphangions the number of myocytes is less than in extraorgan ones. In intraorgan lymphangions, myocytes are located in the middle part of the lymphangion (muscle cuff) and are usually absent in the wall of the valvular sinus (Table 2).

Table 1. Quantitative indicators of lymphangions (length, width, volume) of an intraorgan vessel in older people (75-90)

Lymphatic vessels of the 2nd order		
Length (mm)	Width (mm)	Volume (mm)
2.120(0.098)	0.650(0.068)	0.500(0.014)
Data are presented as Mean (SE)		

In extraorgan lymphangions, the number of myocytes in the muscle cuff is always greater than in the stack of valvular sinus. Myocytes are in close relationship with collagen and elastic fibers. Connective tissue fibers play a significant role in the motor function of the lymphangion. The elastic fibers of lymphangion in newborns and adults are thin. In the elderly, the elastic fibers of the wall of the lymphangion undergo profound changes: in some occasional areas, they get thicker, fragmented and disintegrated. In the elderly, varicose protrusions often formed in the wall of the valvular sinus of the lymphangion. Collagenization of the wall of the lymphangion and partial atrophy of the myocytes of the wall of the lymphangion in elderly people obviously reduce the motor function of the lymphangion at this age.

Table 2. The number of myocytes in the lymphangions of the left lymphatic collector of the human heart at the old age (75-90)

Object		minimum	maximum	M(SE)
Intraorgan	Muscular cuff	50	60	54.0(1.8)
	Valve sinus wall	0	0	0
	Valve attachment area	0	0	0
Extra-organ	Muscular cuff	100	130	121.0(5.5)
	Valve sinus wall	5	10	6.0(1.5)
		0	0	0

Conclusion

At the old age, significant changes occur in the shape, caliber and structure of the wall of the lymphangions of the intraorgan and extraorgan vessels of the left lymphatic collector of the heart. In this age group, “bay-shaped” and “mushroom-like” protrusions of the lymphangions of the intraorgan and extraorgan vessels are noted. Bulges are most often found in the wall of the valvular sinus of the lymphangions of the extraorgan vessel. The caliber of the lymphangions of the intraorgan and extraorgan vessels varies widely. The number of myocytes in the wall of the lymphangions of the intraorgan vessel is reduced. In parallel with the reduction (atrophy) of myocytes at this age, there occurs collagenization of the wall of the lymphangions i.e. an increase in the number of collagen fibers.

Conflict of interest: None to declare

Authorship: T.S.A., M.A.S., A.T.A., A.M.E. equally contributed to the study and preparation of manuscript

Acknowledgement and funding: None to declare

References

1. Alymkulov AT, Baktybekova MB, Abaeva TS. Structures of the thoracic duct lymphangions. Bulletin of the Kyrgyz-Russian Slavic University 2018; 18: 156-7.
2. Alymkulov AT, Satybaldiev M.A. About the human heart lymphangions. Bulletin of the International University of Kyrgyzstan 2018; 3: 39-43.
3. Borisov AV. The principles of the construction of the lymphatic vessel in the light. Structural and functional foundations of the

lymphatic system: theoretical and applied aspects. SPbGMA 1997; 1: 6-12.

4. Borisov AV. Anatomy of the lymphangion. Nalchik: Polygraphservice; 2007. 296p.
5. Konenkov VI, Borodin Yul, Lyubarsky MS. Lymphology. Novosibirsk: "Manuscript"; 2012. 1179 p.
6. Orlov RS. Evolution of lymph transport. In R.S. Orlov. Structural and functional foundations of the lymphatic system: theoretical and applied aspects. St. Petersburg: St. Petersburg State Medical Academy; 1997. p. 53-4.
7. Satybaldiev MA. About human heart lymphangions in old age. Architectonics of heart lymphangions - Bulletin-KSMA 2013; 3: 69-70.
8. Stolyarov VV. Morphological characteristics of subepicardial lymphangions, the conduction system and heart muscles in an age-related aspect and with myocardial infarction. In: Stolyarov VV. Structural and functional organization of the lymphatic vessels of the heart. Novosibirsk: RAMS Siberian Dept; 2005. p. 182.
9. Mislin H. The lymphangions. In: Lymphangiology. Eds. Földi M, Casley-Smith JR. Stuttgart: New York; 1983. p.165-75.

CONFERENCE PAPER

Heart, Vessels and Transplantation 2019; 3: 177-180
DOI: 10.24969/hvt.2019.148

Aorto-right ventricular tunnel originating from left coronary sinus: a case report

Bebezov I.H., Abdyldaev I.Z., Cholponbaev D. Ch., Chevgun S.D., Chukubaev M.A., Daniyarov B.S., Kaliev T.B., Nurbekov K.N.

International School of Medicine, Bishkek, Kyrgyzstan

Abstract

This report describes an extremely rare case of an aorto-right ventricular tunnel originating from the left coronary sinus with abnormality of left coronary artery in the 11-year-old child.

Key words: Aorto-right ventricular tunnel, coronary sinus

(Heart Vess Transplant 2019; 3: 177-80. doi: 10.24969/hvt.2019.148)

Introduction

Aorto-right ventricular tunnel is an extremely rare anomalous communication between aorta and the right ventricular cavity (1-18). This defect was first reported by K. Hart (1905) and J. Edwards (1961), and was given a term by Levi et al. as an aorto-ventricular tunnel in 1963 (13). To date, approximately 147 such cases have been reported (11). The cause of this defect is unknown. Incidence of its development is about 0.1% of all diagnosed congenital heart defects (16, 17).

This is a pathology in which there is an abnormal communication between ascending aorta and one of ventricles of human heart with a pathological retrograde blood flow from the aorta to the ventricle, followed by hypertrophy and dilatation of the ventricle, and severe heart failure, which leads to death in the first months of life. Also, it can cause severe aortic valve insufficiency, if child grows to an older age (2, 10).

Case report

An 11 years old boy was admitted with complaints of dyspnea. Complaints intensified for 2 months. Physical examination: Rhythmic heart sounds, heart rate at admission 90 beats per minute. Systolic and diastolic murmur at the apex. Blood pressure 90/60 mmHg. There was no hepatomegaly. ECG changes on admission: sinus rhythm, signs of concomitant hypertrophy of both ventricles.

Echocardiography findings

Diameter of the ascending aorta is 28 mm and in the sinus of Valsalva- 36 mm. Minimal tricuspid, aortic and mitral valves regurgitation. Left atrium cross dimension-29mm. Right atrium was moderately dilated. LV: end-diastolic dimension (EDD) -55 mm and end-systolic dimension (ESD)-33 mm. Ejection fraction (EF) - 69% by Teichholz formula. Right ventricle (RV) cross dimension - 27 mm. Systolic pulmonary artery pressure (PAP) - 40 mm Hg. A collector with the diameter of 6-7 mm is visualized at the ostium of the left coronary artery (LCA).

Angiography data

The left main coronary artery with the diameter of 11 mm. Left anterior descending (LAD) artery without stenosis. An extended collector (diameter-13 mm), is visualized instead of left circumflex artery (LCx) and opened in RV through interventricular septum. Right coronary artery (RCA) without stenosis.

CT –angiography data

Left pulmonary artery was moderately hypoplastic and signs of pulmonary hypertension and cardiomegaly (RV hypertrophy) were identified. Pulmonary veins drained in the left atrium. There are no data for atrial, ventricular septal defect and patent ductus arteriosus. A collector (tunnel) from the left coronary sinus along the posterior surface of the heart, 27 mm in diameter, was visualized. Tunnel opened in the inlet portion of the right ventricle cavity (Fig. 1).

Address for Correspondence: Danyar Cholponbaev, International School of Medicine, Bishkek, Kyrgyzstan
Email: danyarcholponbaev@gmail.com Phone No: +996 772 136 186

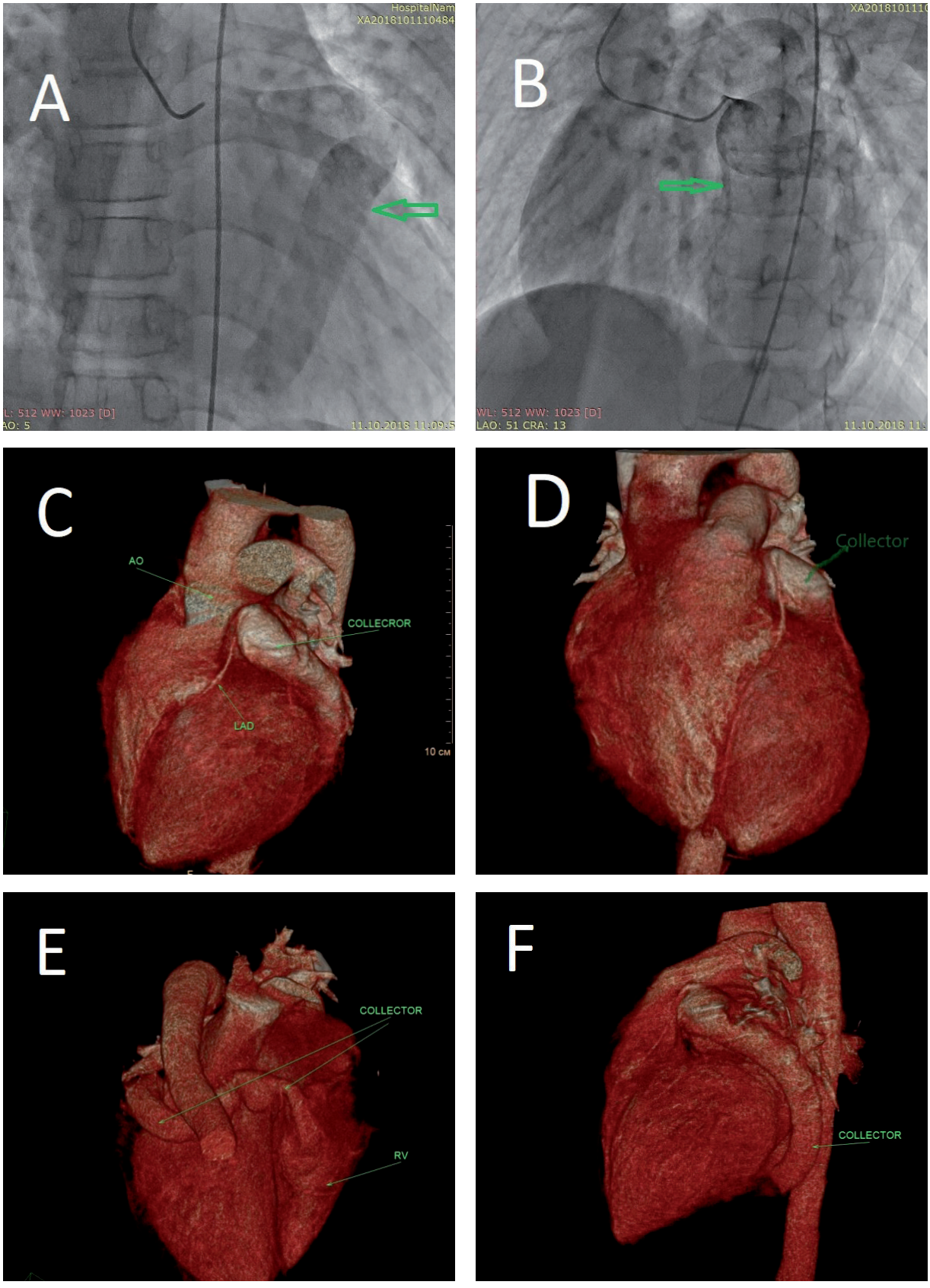


Figure 1. A (arrow – tunnel), B (arrow – LAD) - Angiography data. C,D,E,F - CT –angiography data. CT - computed tomography, LAD -left anterior descending artery

After the preparation and informed consent an open procedure has been performed: the distal portion of the aorto-right ventricular tunnel was sutured under cardiopulmonary bypass and normothermia. The ascending aorta was opened after aortic clamping. The tunnel orifice was detected at the left coronary artery normal disposition, about 25x30 mm in diameter. LCA originated 30-40 mm below the orifice; it was not possible to perform plastic surgery. It was decided to close the right ventricular end of the tunnel and access through RA. Tunnels orifice in RV was situated from the septal cusp papillary muscles of the RV, reached the fibrous annulus, and continued along to the commissure between the anterior and posterior cusps. Orifice was sutured with a continuous stitch and additional figure-of-eight plication on pledgets. There were no complications in postoperative period. After ten days, a repeated coronary angiography showed minimal residual flow along the posterior RV wall through an aorto-right ventricular tunnel.

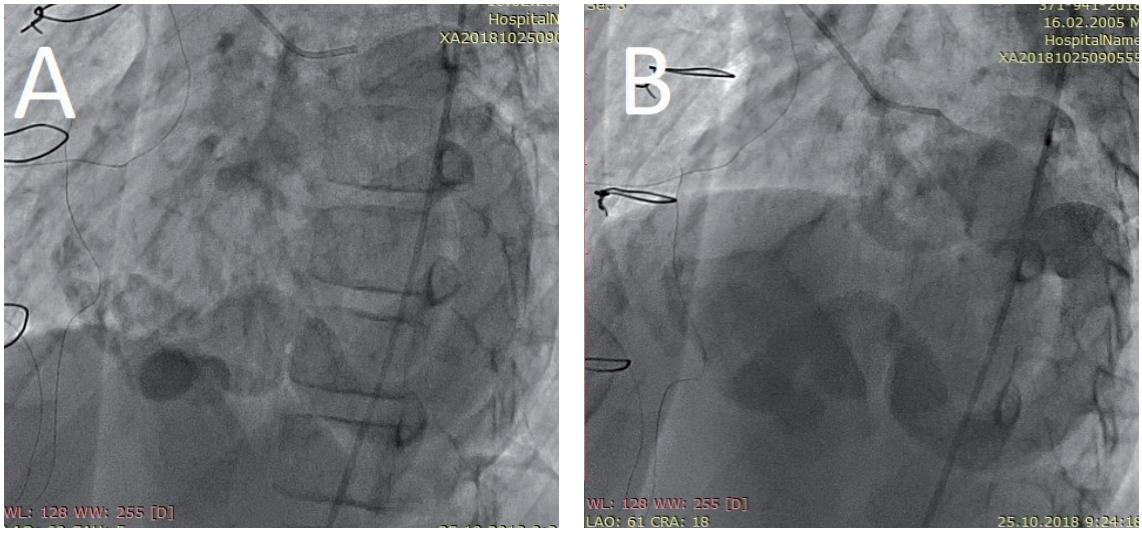


Figure 2. A, B - Angiography data 10 days after. There is functioning aorto-right ventricular tunnel, visualized accumulation of contrast agent in stitches area in the right ventricle and flow through the suture.

After 6 months of follow up CT, angiography showed a residual empty space about 5 mm at the site of postoperative sutures. However, according to echocardiography data, RV dimensions were unchanged and pulmonary hypertension slightly decreased (RV 27 mm, Syst. PAP 35 mm Hg). That was considered as a positive effect necessitating the continuation of long-term follow- up and no need for additional intervention.

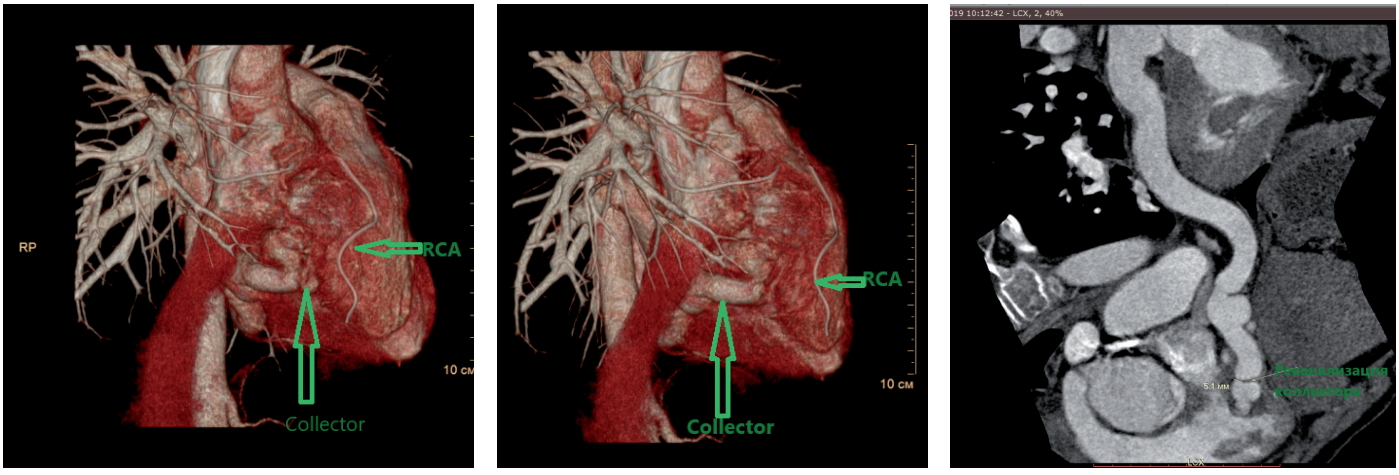


Figure 3. Six - month follow up CT –angiography.

CT - computed tomography

Discussion

According to the literature most common tunnel orifice originating from the right coronary sinus (about 80% of cases) (2-8). In this case, it is necessary to differentiate with fistulas. Depending on the terminating of tunnel, there are aortic left ventricular tunnel and aortic right ventricular tunnel. The most common aortic left ventricular tunnel, incidence of which is more than 90% (2-4). The aortic right ventricular tunnel is the rarest form of pathology in this group. Tunnels and fistulas most frequently are associated with aortic valve and CA abnormalities (45% of cases) (6-14).

Hovaguimian et al. in 1988 proposed the classification of aortic ventricular tunnels (10). This classification includes 4 types: a simple tunnel with a slit like opening at the aortic end; no aortic valve distortion; a large extracardiac aortic wall aneurysm of the tunnel with an oval opening at the aortic end, with or without valvular distortion; intracardiac aneurysm of the septal portion of the tunnel, with or without right ventricular outflow tract obstruction; types II and III combined.

There are two types of surgical treatment of such pathologies: open surgery and endovascular transcatheter closure of the tunnel with special closure devices (1). The open techniques for the tunnels can include closure of the aortic opening either by direct suture or with a patch; closure of the ventricular end of the tunnel; obliteration of the tunnel and closure of both orifices (aortic and ventricular) (18).

In our case an open procedure was performed: the tunnel distal orifice closure, which was subsequently recanalized.

Conclusion: The aorto-right ventricular tunnel with the associated LCA anomaly is a very rare abnormality that is found in clinical practice. In our case, open surgical intervention was performed under cardiopulmonary bypass. The RV orifice of tunnel was sutured through the right atrial access. There is also an opinion about the opportunity of the distal tunnel portion closure with occluder implantation, which can lead to complete occlusion.

Conflict of interest: None to declare

Authorship: B.I.H., A.I.Z., Ch. D. Ch., Ch. S. D., Ch.M. A., D. B.S., K.T.B., N. K.N. equally contributed to management of patient and preparation of case report, with fulfillment of all authorship criteria

Acknowledgement and funding: None to declare

References

1. Kathare P, Subramanyam RG, Dash TK, Muthuswamy KS, Raghu K, Koneti NR. Diagnosis and management of aorto-left ventricular tunnel. Ann Pediatr Card 2015; 8: 103-7.
2. Mueller C, Dave H, Prêtre R. Surgical repair of aorto-ventricular tunnel. Cardiothorac Surg. 2012; 2012 mms006.
3. Burkhardt BE. Aorto-right ventricular tunnel causing functional tricuspid atresia. Circulation 2012 ; 125: e591-4.
4. McKay R. Aorto-ventricular tunnel. Orphanet Journal of Rare Diseases. 2007; 2: 41-6.
5. Corno AF, Durairaj S, Anderson RH. Aorto-right ventricular tunnel in transposition of the great arteries. Front Pediatr 2018; 6: 30.
6. Yildirim A, Erek E, Uslu Z, Saygili A, Karaagac AT. Aorto-left ventricular tunnel originating from the left coronary sinus with aortic aneurysm in an 11-year-old boy. Tex Heart Inst J 2013; 40: 91–94.
7. Hruda J, Hazekamp MG, Sobotka-Plojhar MA, Ottenkamp J. Repair of aorto-right ventricular tunnel with pulmonary stenosis and an anomalous origin of the left coronary artery. Eur J Cardiothorac Surg 2002; 21: 1123-5.
8. Ono M, Goerler H, Boethig D, Breymann T. Surgical repair of aorticoleft ventricular tunnel arising from the left aortic sinus. Interact. Cardiovasc Thorac Surg 2008; 7: 510–2.
9. Nezafati MH, Maleki MH, Javan H, Zirak N. Repair of aorto-left ventricular tunnel arising from the left sinus of valsalva. J Card Surg 2010; 25: 345-6.
10. Hovaguimian H, Cobanoglu A, Starr A. Aortico-left ventricular tunnel: a clinical review and new surgical classification. Ann Thorac Surg 1988; 45:106-12.
11. Xie M. Clinical value of diagnosing aortico-left ventricular tunnel by echocardiography. Exp Therap Med 2016; 12: 3315-9.
12. Edwards J.E. An atlas of acquired disease of the heart and great vessels. 2nd. Ed, WB Saunders: Philadelphia; 1961: 1142p.
13. Levy MJ, Lillehei CW, Anderson RC, Amplatz K, Edwards JE. Aortico-left ventricular tunnel. Circulation 1963; 27: 841–53.
14. Martins JD, Sherwood MC, Mayer JE Jr, Keane JF. Aortico-left ventricular tunnel: 35-year experience. J Am Coll Cardiol 2004; 44: 446-50.
15. Jayaprakash K, Sebastian GB, George R. Aortico-left ventricular tunnel and bicuspid aortic valve with severe stenosis: a rare combination. Heart Asia 2015; 7: 41–3.
16. Perrier SL, Lang J, Jones B, Konstantinov IE. Right coronary artery arising within an aorta-to-left ventricle tunnel: surgical repair in a neonate. Interact Cardiovasc Thorac Surg 2018; 27: 467–8.
17. Rodriguez H, Figueroa J, Quibrera JA, Cordova L, Di Sessa T. Surgical repair of aorto-ventricular tunnel: a case report and review of methods. Int J Cardiovasc Dis Diagn 2018; 3: 001-003.
18. Fotios A, Hillel L, Meletios A, Daniel L. Aortoleft ventricular tunnel: an alternative surgical approach. Ann of Thorac Surg 2006; 82: 1113–5.

CONFERENCE PAPER

Heart, Vessels and Transplantation 2019; 3: 181-183
DOI: 10.24969/hvt.2019.148

Concentration of anti-Mullerian hormone in the blood as a result of electrical stimulation of polycystic ovaries in women with infertility

Arystanbek O. Atykanov[1], Nurgazy T. Dzhanuzakov[2]

[1] International School of Medicine, Bishkek, Kyrgyzstan

[2] Kyrgyz - Russian Slavonic University, Bishkek, Kyrgyzstan

Abstract

This paper presents data on the effect of unilateral and bilateral electrical stimulation of the ovaries in 36 women of reproductive age with polycystic ovary syndrome and infertility on follicular reserve, estimated by the concentration of anti-Mullerian hormone in the blood serum cauterization, it does not lead to a critical decrease in the follicular reserve compared with indicators of healthy women.

Key words: Women, polycystic ovary syndrome, follicular reserve, electrical stimulation, anti-Mullerian hormone

(Heart Vess Transplant 2019; 3: 181-3. doi: 10.24969/hvt.2019.148)

Introduction

Polycystic ovary syndrome (PCOS) is one of the common pathologies of the reproductive system of women and up to 94% of cases are accompanied by infertility (1). In case of polycystic ovary syndrome and infertility, there is an imbalance of hormones that regulate ovarian function, provoked by hyperandrogenism associated with the preserved follicular reserve (2, 3). In the treatment of PCOS, surgical (laparoscopic) methods are the main ones aimed at removing excess of androgen-secreting stromal tissue of the ovaries (4). However, by eliminating one of the factors of infertility by classical bilateral interventions on the ovaries, in the form of their wedge-shaped resection or cauterization, it is possible to provoke another, previously absent infertility factor, which consists in iatrogenic excessive reduction of the follicular reserve (4). A compromise option for surgical treatment for polycystic ovary syndrome is to perform surgery on only one ovary, while the prerequisites for an excessive reduction of the follicular reserve are not made available (5,7).

In PCOS, the production of anti-Mullerian hormone (AMH), which is a transforming factor in the growth of beta, increases several times. AMH characterizes follicles at the stage preceding hormone-dependent growth, and the cessation of its production is an important condition for the selection of a dominant follicle (8).

The aim of the study was to determine the state of the follicular reserve of the ovaries by the concentration of AMH as a result of the use of unilateral and bilateral electrical stimulation of polycystic ovaries in women with infertility in the treatment.

Methods

The study included 38 women with PCOS under the age of 35 (29 - 32) years, suffering from primary infertility, which made up the clinical group. In turn, the clinical group was divided into 2 groups: 18 women who underwent unilateral electrical stimulation of the ovary (clinical group I); 20 women who underwent bilateral electrical stimulation of the ovaries (clinical group II). The diagnosis was verified based on the criteria of the Rotterdam Conciliation Conference on Polycystic Ovary Syndrome (9). The indications for electrical stimulation of the ovaries were primary infertility and the lack of effect of conservative stimulation of the ovaries. To compare the AMH level in women with PCOS, 20 women without menstrual disorder and having a physiological birth in their past medical history were examined (control group).

For electrical stimulation, the laparoscopic method was used on a device produced by the company of "Richard Wolf Kuze Stors – Endoscope" (Germany) and a monitor made by the company of "Panasonic" (Japan). AMH in blood serum was determined by enzyme-linked immunosorbent assay using

Address for Correspondence: Arystanbek O. Atykanov Research and Analysis Department, International School of Medicine, Bishkek, Kyrgyzstan
E-mail: a.atykanov@gmail.com

test systems of the "Human" company (Germany).

Statistical processing of the results was carried out through the method of variation statistics on a personal computer with the use of the standard software package of applied statistical analysis (Statistic for Windows v.6.0).

Results and Discussion

As can be seen from the data in Figure 1, the AMH level in the blood serum of women (12.2 (1.9) ng/ml) in the clinical group upon admission to the clinic was actually 9 times higher than the relevant value in women of the control group (1.35 (0.21) ng/ml) ($p<0.001$). In 4 weeks after unilateral electrical stimulation (cauterization) of the ovary in women of clinical group I, the concentration of AMH in blood serum decreased significantly (3.1 (0.41) ng/ml) compared with the period before surgery ($p<0.001$) and slightly, but reliably, exceeded the indicator of the control group ($p<0.05$).

In women of clinical group II, an almost identical picture is observed during this period as in group I, in the concentration of AMH in the blood, namely, the hormone level was 2.4 (0.36) ng/ml, which is 5 times as less than in the period before treatment ($p<0.001$). Compared with the AMH indicator of the control group, a veracious difference is also observed ($p<0.05$).

To date, there is no consensus on regulated values of AMH in women. In the studies of D. Dewailly et al. (10), the optimal AMH threshold limit value of 5 ng / ml was characterized by high sensitivity (92%) and specificity (97%) in the diagnosis of polycystic ovary syndrome. In the studies by F. R. Tehrani et al. (11), the estimated age of menopause was calculated on the level of AMH<0.2 ng/ml. The level of AMH concentration in blood serum accurately reflects the number of antral follicles in the ovaries and is a diagnostic marker of polycystic ovary syndrome (12).

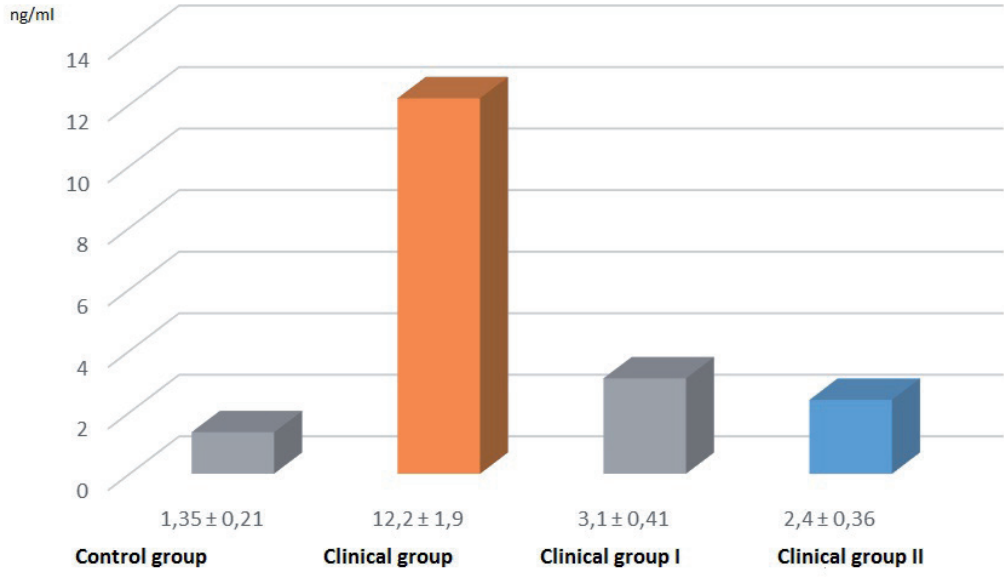


Figure 1. Value of the AMH level in blood serum after electrical stimulation of polycystic ovaries in women
Note: * - $p<0.05$ differences are significant compared to the control group
(*) –$p<0.05$ differences are significant compared with the period before surgery

Therefore, when conducting bilateral electrical stimulation of the ovaries in our studies, the critical level of the follicular reserve neither reached and nor did it go beyond the population fluctuations of 0.9-2.5 ng/ml, despite a slightly higher result relative to the value of the control group.

Conclusion

Use of bilateral electrical stimulation of the ovaries in polycystic ovary syndrome in the treatment of women is not accompanied by a pronounced reduction in the follicular reserve.

Conflict of interest: None to declare

Authorship: A.O.A., N.T.D. equally contributed to the study and preparation of manuscript

Acknowledgement and funding: None to declare

References

1. Manukhin IB, Nazarenko TA, Durinyan ER. Polycystic ovary syndrome. Russian Bulletin of the Obstetrician-Gynecologist 2010; 2: 52-5.
2. Nazarenko TA. Polycystic ovary syndrome: modern approaches to the diagnosis and treatment of infertility. Moscow: MEDpress-inform; 2005. 208p.

3. Nazarenko TA, Mishieva NG, Solovyeva IG. Inhibin B as a marker of ovarian reserve in women with various forms of infertility. Reproduction issues. 2005; 11: 3: 15-9.

4. Korsak BS, Parusov VN, Kirsanov AA. Effect of ovarian resection on their functional reserve. Reproduction issues. 1996; 4: 63-7.

5. Al-Mizyen E, Grudzinskas JC. Unilateral versus bilateral laparoscopic ovarian diathermy in the management of infertile woman with polycystic ovarian syndrome. Hu. Reprod 2000; 15: Abstract Book 1: 262: 199.

6. Al-Mizyen E, Grudzinskas JC. Unilateral versus bilateral laparoscopic ovarian diathermy in effective and long lasting in restoring spontaneous ovulation. Hum Reprod 2004; 19 Suppl 1: Abstract Book: 0-182: 64.

7. Inovay J, Csada A, Szendei G. Unilaterial ovarian electrocautery for the management polycystic ovarian disease (PCOD). Preliminary results. Fertil Steril 1998; 70 Suppl 1: 1224: 503.

8. Pelatt L, Rice S, Mason HD. Anti-Mullerian hormone and polycystic ovarian Syndrome: a mountain too high? Reproduction 2010; 135: 825-33.

9. Rotterdam ESRE/ASPM – Sponsored PCOS Consensus Work – Shop Group (2004) Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovary syndrome. Hum Reprod 2004; 19: 41-7.

10. Dewailly D, Gronier H, Poncelet E, Robin G, Leroy M, Pigny P, et al. Diagnosis of polycystic ovary syndrome (PCOS): revisiting the threshold values of follicle count on ultrasound and of the serum AMH level for the definition of polycystic ovaries. Hum Reprod 2011; 26: 131-9.

11. Tehrani FR, Solaymani-Dodaran M, Hedayati M, Azaz F. Is polycystic ovary syndrome an exception for reproductive aging? Hum Reprod 2010; 25: 1775-82.

12. Pighy P, Jonard S, Robert Y, Dewailly D. Serum anti-Mullerian hormone as a surrogate for antral follicle count for definition of the polycystic ovary syndrome. J Clin Endocrinol Metabol 2006; 91: 941-5.

CONFERENCE PAPER

Heart, Vessels and Transplantation 2019; 3: 184-187
doi: 10.24969/hvt.2019.148

Dissection of ascending aorta and left main coronary artery after routine percutaneous coronary intervention: a case report

Daniyarov B.S., Abdyldaev I.Z., Chevgun S.D., Nurbekov K.N., Cholponbaev D.C., Kaliev T.B., Borubaev EE, Chukubaev M.A.

International School of Medicine, Bishkek, Kyrgyz Republic

Abstract

We describe a case of guiding catheter-induced dissection of left main coronary artery and ascending aorta. A patient with unstable angina and two-vessel disease underwent drug eluting stents implantation in proximal left anterior descending artery and distal left circumflex artery. Six hours after the procedure of acute occlusive dissection of left main coronary artery with spreading to ascending aorta developed, it was required to do stenting of the left anterior descending and left main coronary arteries and balloon dilatation of left circumflex artery. Despite the initial success of the repeated intervention, total occlusion of left main coronary artery occurred with unsuccessful reopening in catheterization laboratory. Emergency coronary artery bypass surgery was carried out. However, despite the patent anastomosis from left mammary to left anterior descending artery, the patient died.

Key words: Percutaneous coronary intervention, complication, iatrogenic coronary dissection

(Heart Vess Transplant 2019; 3: 184-7. doi: 10.24969/hvt.2019.148)

Introduction

Since the year of 1977, when Andreas Gruentzig first successfully performed percutaneous coronary balloon angioplasty to a patient with left anterior descending artery (LAD) stenosis (1), percutaneous coronary interventions (PCI's) have come to a practice. However, major limitations of balloon angioplasty of coronary arteries were complications such as restenosis and abrupt vessel closure (2). Rate of complications was significantly reduced with the introduction of coronary stents (3). To date PCI's, when performed in experienced centers with proper indications, have become relatively safe and efficient procedures with high success rate. Coronary stents act as scaffolds to prevent elastic recoil and to prevent the spreading of intimal dissection (4), which frequently occurs after balloon inflation. Unfortunately major complications after contemporary PCI's still occur: death is about 0.7% and acute myocardial infarction (AMI) is 2%. In this report, we describe a case of dissection of left main coronary artery and aortic root after "routine" PCI.

Case report

Patient B., a 54-year old male, was admitted to hospital with frequent chest pain and shortness of breath, developing on light exertion. Angina symptoms started four months before. On admission, his physical examination was unremarkable, blood pressure 100/60 mm Hg, heart rate 60 per min. On patient's ECG, there was no sign of prior AMI, ST segment was isoelectric. Echocardiography showed preserved left ventricular (LV) function, LV ejection fraction 55%, normal cardiac dimensions. Coronary angiography revealed right dominant coronary circulation, two-vessel disease with subtotal stenosis of left circumflex artery (LCX) and long 75% lesion of mid portion of right coronary artery (RCA). There were no visible lesions in the left main coronary artery (LMCA). Thereafter stent Terumo Ultimaster 3.0x38 mm (Terumo Medical Products, Japan) was implanted in mid RCA (Fig. 1) and stent Terumo Ultimaster 2.75x15 mm was implanted in LCX (Fig. 2). Stenting LCX was difficult, due to problems in crossing the wire and balloon through the tight lesion. Suboptimal results were achieved with TIMI 2 distal flow in LCX.

Address for Correspondence: Bektur Daniyarov, International School of Medicine, Bishkek, Kyrgyzstan
Email: bektur_d@yahoo.com Phone: +996 554 091767

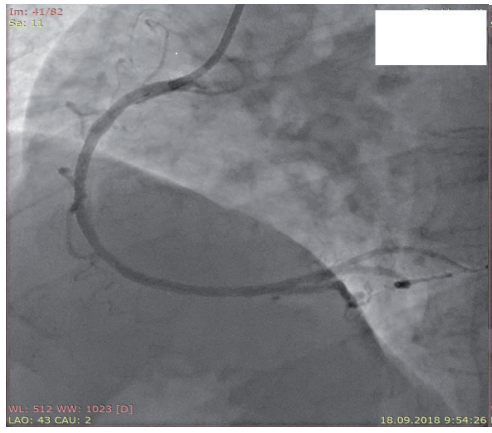


Figure 1. Stenting of right coronary artery

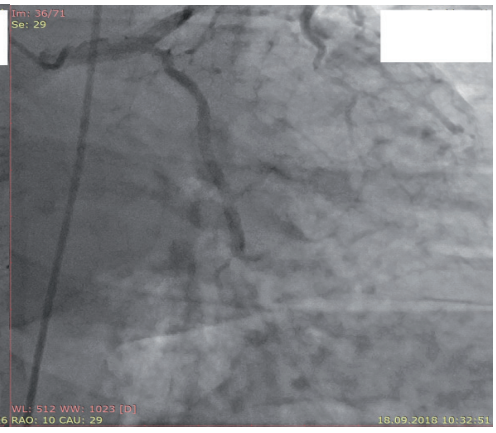


Figure 2. Stenting of left circumflex artery

Six hours after PCI patient suffered recurrent intensive chest pain. His ECG was unchanged. On control cineangiography (Fig. 3) there was a thrombus in the terminal part of LMCA with total occlusion of LAD and TIMI 1 flow in LCX. There was acute stent thrombosis in LCX. After crossing LAD occlusion with guidewire, a dissection flap in LMCA and left sinus of Valsalva became visible (Fig. 4). Balloon dilatation in LAD, LMCA, in stent in LCX and in LCX ostium. Bare metal stents (for socioeconomical reasons) were implanted: Rebel (Boston Scientific, USA) 3.0x28 mm in LAD and 4.0x32 mm in LMCA with overlap (Fig. 5). Recrossing the guidewire in LCX through the stent's struts and balloon dilatation. At the end of procedure, there was TIMI 3 flow in LAD and LCX, no signs of aortic root dissection. However, the control echocardiography showed the signs of double lumen in the ascending aorta. There was a minimal aortic regurgitation. Cardiac dimensions and LV ejection fraction were unchanged.

During two days, the patient was relatively symptom free, but the echocardiography still demonstrated signs of double lumen in the ascending aorta and then on the second day, a chest pain occurred again and it progressed. There was ST elevation in AVR and ST depression in inferior and precordial leads. In order to determine intervention tactics multiple detector computed tomography (MDCT)'s coronary angiography was performed (Fig. 6). MDCT angiography showed occluded LMCA stent and dissection of ascending aorta up to the truncus brachiocephalicus. There were signs of thrombus formation inside the false lumen of aorta. Patient was taken again in catheterization laboratory. Attempt of recanalization of LMCA was unsuccessful and the urgent coronary artery bypass graft surgery was performed on beating heart (off-pump) Anastomosis of left internal mammary artery – LAD was formed and thrombectomy from proximal and distal part of LAD was carried out. During surgical hemostasis sustained ventricular tachycardia developed, which transformed into bradycardia and asystole, despite resuscitation measures, cardiac pacing without capture and biological death was vindicated.

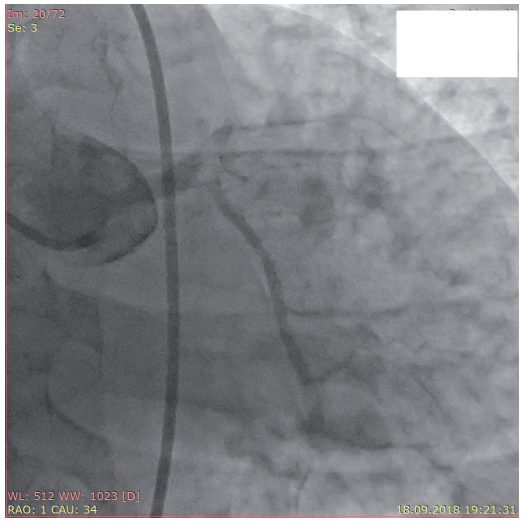


Figure 3. LMCA thrombus (arrow) LMCA-left main coronary artery

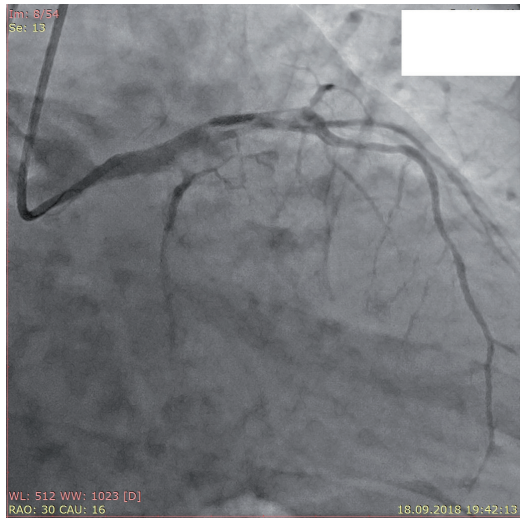


Figure 4. Dissection (arrow)

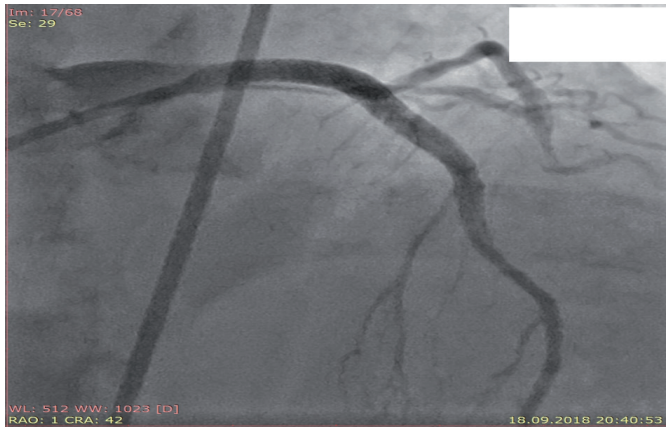


Figure 5. LAD and LMCA stents (arrows). LAD- left anterior descending artery, LMCA-left main coronary artery

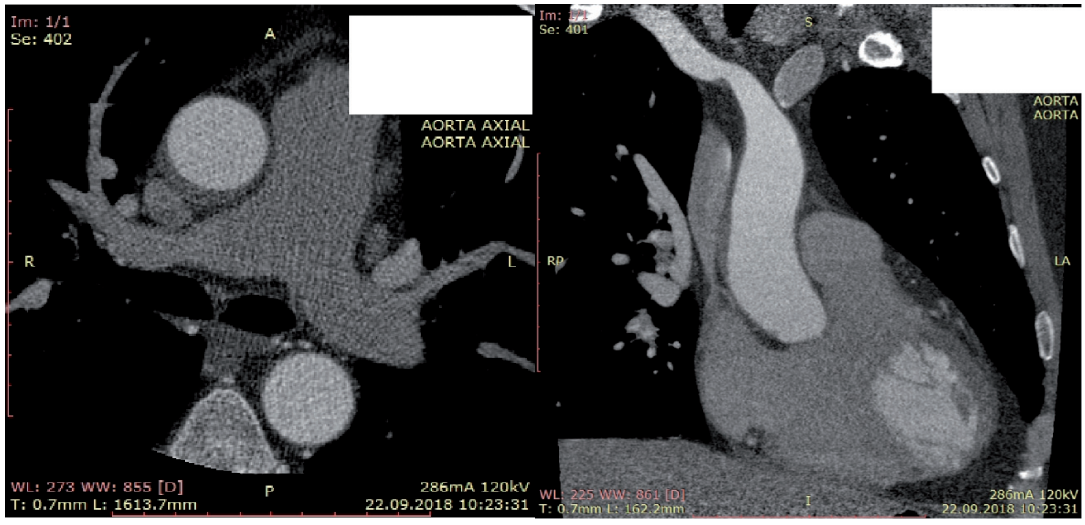


Figure 6. Aortic dissection on multidetector computed tomography

Discussion

As it has been mentioned above, the incidence of PCI related complications is rare nowadays. Coronary artery dissection is a condition in which there is a tear in a vessel's intima, sometimes leading to thrombosis and abrupt arterial closure. According to recently published Japanese study (5) the incidence of flow limiting coronary dissection occurred in 1.1% of PCI's. To date, with the use of stents, dissections can be caused by guidewire, stent edge or guide catheter. Risk factors for coronary artery dissections include aggressive catheter manipulations, stiff wires, guiding catheter of "Amplatz" type, calcified lesions and degenerative aortic disease (6). More frequently, they occur in PCI's in RCA and in women. Different classifications have been suggested, the most widely accepted are as shown in Table 1(7).

Table 1. Types of coronary artery dissections

Sr. No.	Type	
01	Type A	Minor radiolucency within the coronary lumen without dye persistence
02	Type B	Parallel tracks or double lumen separated by a radiolucent area during angiography without dye persistence
03	Type C	Extraluminal cap with dye persistence
04	Type D	Spiral luminal filling defects
04	Type E	New persistent filling defects
05	Type F	Dissection leading to total occlusion

According to this classification in our case, it was Type F dissection. There were difficulties in crossing the guide wire through the tight LCX lesion. Careful examination of cineangiograms revealed temporary dissection of type A at the terminal part of LMCA (Fig. 7), which disappeared at the end of procedure.

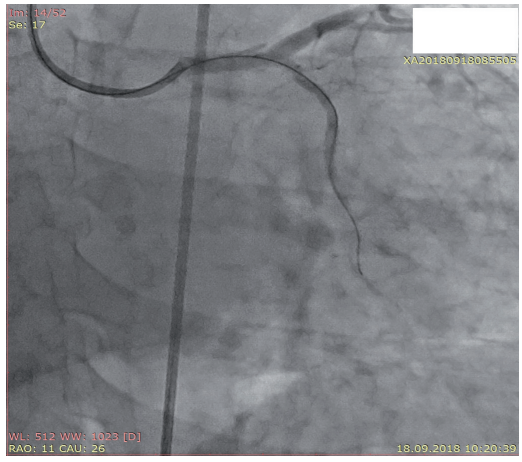


Figure 7. Temporary LMCA type A dissection (arrow) LMCA-left main coronary artery

Because of difficulties in passing wire through the lesion, there were manipulations with guiding catheter (Judkins left 4.0-6F). Thus, this was guiding catheter induced dissection of LMCA.

Eshtehardi et al. (8) suggested the following classification of LMCA dissection: Type I – localized dissection (55.3%), Type II dissection with extension into major branches (``zipper``) (42.1% - hemodynamic instability - 38%, cardiopulmonary resuscitation-25%, in-hospital death - 0%) and Type III – dissection with extension to aortic root (2.6% - hemodynamic instability - 100%, cardiopulmonary resuscitation - 100%, in-hospital death - 100%).

As it is mentioned in the same publication, type I dissections usually have excellent prognosis. In our case, there was initial spontaneous healing of the LMCA dissection, which later progressed into Type III dissection. In 2000, Dunning et al (9) suggested classification of iatrogenic aortic dissection, based on its spread: type 1 was determined when dissection was limited to a sinus of Valsalva, type 2 when it went to ascending aorta but less than 4 cm in length and type 3 exceeding 4 cm. Thus, the patient developed type 3 dissection. However, there were signs of thrombus formation in the false lumen on MDCT angiography and clinically acute myocardial infarction was the culprit for the patients' deterioration. Therefore, as well as because of the emergency of terminal condition "only" CABG was performed.

Conclusions: Iatrogenic coronary artery dissection can lead to lethal effect despite all medical efforts. In order to prevent such a serious complication during percutaneous coronary intervention a thorough choice of instruments, careful catheter manipulations are mandatory with auxiliary devices required for that.

Conflict of interest: None to declare

Authorship: D. B.S, A.I.Z., Ch. S. D., Ch. D. Ch., N. K.N, K.T.B., B.E.E., Ch.M. A. equally contributed to management of patient and preparation of case report

Acknowledgement and funding: None to declare

References

1. Gruentzig A. Transluminal dilatation of coronary artery stenosis. Lancet 1978; 1: 263.
2. Holmes DR Jr, Vlietstra RE, Smith HC, Vetrovec GW, Kent KM, Cowley MC, et al. Restenosis after percutaneous transluminal coronary angioplasty (PTCA): a report from the PTCA Registry of the National Heart, Lung, and Blood Institute. Am J Cardiol 1984; 53: 77C–81C.
3. Venkitachalam L, Kip KE, Selzer F, Wilensky RL, Slater J, Mulukutla SR, et al. Twenty-year evolution of percutaneous coronary intervention and its impact on clinical outcomes: a report from the National Heart, Lung, and Blood Institute-sponsored, multicenter 1985–1986 PTCA and 1997–2006 dynamic registries. Cathet Cardiovasc Interv 2009; 2: 6–13.
4. Serruys PW, Kutryk MJ, Ong AT. Coronary artery stents. N Engl J Med 2006; 354: 483–95.
5. Hiraide T, Sawano M, Shiraishi Y, Numasawa Y, Noma S. Impact of catheter-induced iatrogenic coronary artery dissection with or without postprocedural flow impairment: A report from a Japanese multicenter percutaneous coronary intervention registry. PLoS ONE 2018; 13: e0204333.
6. Rogers JH, Lasala JM. Coronary artery dissection and perforation complicating percutaneous coronary interventions. J Invasive Cardiol 2004; 16: 493-9.
7. Huber MS, Mooney JF, Madison J, Mooney MR. Use of a morphologic classification to predict clinical outcome after dissection from coronary angioplasty. Am J Cardiol 1991; 68: 467–71.
8. Eshtehardi P, Adorjan P, Togni M, Tevaearai H, Vogel R, Seiler C, et al. Iatrogenic left main coronary artery dissection: incidence, classification, management, and long-term follow-up. Am Heart J 2010; 159: 1147-53.
9. Dunning DW, Kahn JK, Hawkins ET, O'Neill WW. Iatrogenic coronary artery dissections extending into and involving the aortic root. Catheter Cardiovasc Interv 2000; 51: 387–93.

CONFERENCE PAPER

Heart, Vessels and Transplantation 2019; 3: 188-192
Doi: 10.24969/hvt.2019.148

Endovascular treatment of chronic lower limb ischemia - the first experience of consecutive patients in the Kyrgyz Republic

Chevgun S.D., Abdyldaev I.Z., Imankulova A. S., Bebezov I.H., Cholponbaev D. Ch., Nurbekov K.N., Daniyarov B.S., Raimkulov A.E., Alekseev D.N., Eginaliev A., Osmonov T.A.

International School of Medicine, Bishkek, Kyrgyzstan

Abstract

Objective: Pure atherosclerosis and diabetes mellitus are often responsible for the lesion of lower limb arteries. As a result, critical ischemia may develop. Endovascular treatment of lower extremities chronic ischemia in the modern world one of the most effective methods of limbs salvage. This report is an analysis of the first experience of endovascular treatment in consecutive patients with chronic lower limb ischemia in the Kyrgyz Republic.

Methods: In 2016-2018, there were 31 patients with chronic lower limb ischemia in IIb-IV Fontaine's stages that underwent endovascular treatment. The primary endpoint was 6-month painlessness or reduction of the Fontaine stage; freedom from amputation up to six months; active regenerative process or full recovery of ulcers/wounds up to six months. The secondary endpoints included 6-month all-cause mortality and reintervention rate.

Results: Overall, 27 (87.1%) patients reached painless form (stage I according to Fontaine (ABI ≥0.9)), with complete regeneration or active reparative process observed in 20 (64. 5%) patients. In general, major amputation was avoided in 29 (93.5%) patients (two patients underwent amputation by E. Burgess). Minor amputations were performed below the level of foot dorsum (Sharp) in 35.5% (11 patients). Simultaneous percutaneous coronary interventions and peripheral interventions were performed in 6 (19. 4%) cases. In total, within 6 months one death was registered (3.2%).

Conclusion: The first endovascular treatment of consecutive patients showed encouraging 6-month results. Simultaneous («Ad-hoc») or stepwise (at the current hospitalization) procedures on coronary and peripheral arteries ensure safety and can provide more chances of patient`s survival.

Key words: chronic lower limb ischemia, critical limb ischemia, percutaneous coronary interventions, limb salvage, freedom from amputation

(Heart Vess Transplant 2019; 3: 188-92. doi: 10.24969/hvt.2019.148)

Introduction

Critical limb ischemia (CLI) caused by infrainguinal atherosclerosis is a substantial source of death and disability. One-year mortality ranges from 10% to 40% and in case without revascularization somewhere, up to 40% will suffer limb loss within six months (1, 2).

For patients with CLI or severe progressive claudication, peripheral arterial revascularization is necessary to minimize the chance of losing a limb, neutralize the symptoms and improve quality of life. To date along with the bypass methods endovascular procedures (stenting and balloon angioplasty) are the most widespread measures (3). The main purpose of endovascular treatment - is to minimize the loss of tissue, complete recovery of the wounds and the preservation of a functioning limb. This report is an analysis of the first experience of endovascular treatment in consecutive patients with chronic lower limb ischemia.

Address for Correspondence: Semen Chevgun, International School of Medicine, Bishkek, Kyrgyzstan,
Email: schevgun@mail.ru Phone No: +996 550 177 377

Methods

The inclusion criteria were patients admitted with chronic lower limb ischemia at IIb-IV Fontaine's stages. In total for 2016-2018, there were 31 patients. Patients who were not subjected to endovascular revascularization with severe nephrological status (glomerular filtration rate (GFR) less than 30 ml/min) were excluded.

All patients underwent general clinical examination, constant monitoring of heart rate, blood pressure, laboratory tests. For control of cardiac activity dynamics, an echocardiogram (with a coronary artery disease history or significant lesions) and electrocardiogram (ECG) findings were analyzed. For visualizing the anatomy of the lower extremity arteries lesions, we conducted a dynamic analysis of ultrasound and Doppler sonography (all patients) and computed tomography-angiography (CT-angio) imaging (41.9%). The main baseline characteristics are presented in Table 1.

Patients at the time of hospitalization received recommended optimal medical therapy, which included drugs: acetylsalicylic acid, clopidogrel, anticoagulants, prostaglandin E1 drugs, L forms of arginine, and others. Before endovascular intervention, angiography of the coronary and lower limb arteries was performed sequentially. Drug therapy is presented in Table 2.

Table 1. Baseline characteristics

Characteristics	Number (n=31)	%
Mean age	67.7 (7.4) years	
Male sex	22	71
Ulcers/wounds presentation	24	77.4
Gangrene	13	41.9
Foot rest pain	24	77.4
Diabetes mellitus	25	80.6
Distal polyneuropathy	20	64.5
Insulin consumption	17	54.8
Hypertension	22	71
Hypercholesterolemia	18	58.1
Renal failure (GFR < 50 ml/min/1.73m^2)	11	35.5
Coronary artery disease anamnesis	15	48.4
Smoking status	14	45.2
Critical Limb Ischemia ankle –brachial index ≤ 0.5	27	87.1
Subcritical chronic limb ischemia (IIb)	4	12.9
GFR- glomerular filtration rate		

The average age of patients was over 65 years (mean 67.7(7.4) years), and males prevailed among the patients. Most of patients had the CLI with manifestation of pain at rest and non-healing ulcers and wounds in the distal part of extremities. The number of patients with diabetes mellitus was 80.6% (25). Of special note, the history of angina pectoris was present only in 48.4% (15) of patients.

Table 2. Drug therapy

Drugs	Number (n=31)	%
Dual antiplatelet therapy	31	100
Heparin	31	100
Statins	29	93.5
Alprostadil (PgE1)	23	74.2
L – arginine drugs	15	48.4
Ca++ channel blockers	24	77.4

Endpoints

The primary endpoint was 6-month painlessness or reduction of the Fontaine stage; freedom from amputation up to six months; active regenerative process or full recovery of ulcers / wounds up to six months. The secondary endpoints included 6-month all-cause mortality and reintervention rate.

Statistical analysis

The obtained data was processed on a computer by using the statistical program SPSS statistics 17v. Comparison of mean values was fulfilled by using standard methods of variation statistics of a medical-biological profile. Data is presented as the mean±SD for continuous variables and the number (percentage) for discrete variables. The distribution of variables was checked by using the Kolmogorov-Smirnov test. A p value of <0.05 was considered as statistically significant. Since there were no control groups, we did not use comparative intergroup characteristics.

Results

The mean time from the CLI symptoms manifestation to treatment was 1.2 (0.9) months. Angiographic success with direct blood flow to the ischemic region and indirect blood flow, with regard for angiosomes concept, was 90.3% (28 patients). The right limb (58%) was more often affected; however, bilateral intervention was also performed in 5 (16.1%) patients. Contralateral, ipsilateral and brachial approaches were used in 80.6%, 16.1%, and 12.9% of cases, respectively.

Nine (29.0%) patients underwent procedures "above the knee" (aorto-iliac segment, femoral, popliteal arteries) and 8 (25.8%) patients - stenting. The procedures "below the knee" (tibial arteries) were performed in 19 (61.3%) patients. Procedures were performed simultaneously above and below the knee in 3 (9.7%) patients (Table 3).

In 27 (87.1%) patients the painless form was reached (stages I according to Fontaine (ABI ≥0.9)), with complete regeneration or active reparative process was observed in 20 (64. 5%) patients. The systolic blood flow velocity according to ultrasound diagnosis was 9.97 (5.2) vs. 40.1 (17.9) cm/s (p <0.001). The general major amputation was avoided in 29 (93.5%) patients (two patients underwent amputation by E. Burgess). Minor amputations were performed not above than the level of foot dorsum (Sharp) in 35.5% (11 patients). Despite good results in freedom from amputation, the incidence of early thrombosis (30 days) with reintervention was 12.9% (4 patients).

Simultaneous percutaneous coronary interventions and peripheral interventions were performed in 6 (19.4%) cases. Previous coronary stenting at least 1 year was in 6.5% (2 patients).

In total, in the course of 6 months one death was registered (3.2%). The patient had a three-vessel coronary artery disease and renal insufficiency corresponding to C3b grades by KDIGO 2013 (GFR was 40 ml / min / 1.73m^2). The patient refused proposed simultaneous percutaneous coronary intervention.

Table 3. Angiographic findings and endovascular treatment

Segment	Angiographic findings		Endovascular treatment		
	Significant stenosis/ occlusions	%	Angioplasty only	Balloon angioplasty + stenting	%
Aorto – iliac segment	1	3.2	-	1	3.2
Superficial femoral artery	8	25.8	-	7	22.5
Popliteal artery	4	13	4	-	12.9
Anterior tibial artery	27	87.1	20	-	64.5
Posterior tibial artery	27	87.1	11	-	35.5
Peroneal artery	25	80.6	12	-	38.7

Discussion

CLI is defined as recurrent ischemic pain at rest requiring the analgesics for at least 14 days, ulceration or gangrene of the foot, or toes. Fontaine - Pokrovsky classifications, traditionally classify critical ischemia as that of III or IV stage (4).

It must be said that this article demonstrate the first endovascular treatment experience of chronic lower limb ischemia in subcritical and critical stages in consecutive patients in the Kyrgyz Republic. Also important is the creation of a logistics approach in the management of this pathology. It is obvious that in the treatment of patients with diabetes and chronic ischemia of the lower extremities is necessary to use the principle of multidisciplinarity.

Lower limb amputations in patients with diabetes are more common than in patients without diabetes, and five of six amputations occur in diabetes (5). Statistics show that 25% of hospitalizations among patients with diabetes are related to foot lesions, 40% require amputation (6). 50-70% of all non-

traumatic amputations occur in patients with diabetes (7).

From the study Imankulova A. S. et al. in 2018, performed on 820 patients with diabetic foot syndrome, the total frequency of various surgical procedures in these patients was 1072, of which minor surgical interventions were 85.1% (913). In addition, 140 patients underwent large amputations (17%) within 3 years. Staged major amputations of the lower limb after minor surgical interventions in patients with CLI were subsequently performed in 85 patients (10.4%). Reamputation was performed in 9 patients (1.0%) against the background of severe concomitant pathology (8).

The Lida et al., in a 3-year outcomes of the OLIVE registry study in 2015 showed, CLI patients with infrainguinal lesions, 3-year clinical results of endovascular treatment were reasonable despite high reintervention and moderate ulcer recurrence rate. In 3 years, overall survival rate was 63.0%, the major amputation-free rate was 87.9%, and avoidance of reintervention rate was 43.2%, however, diabetes accounted for 71% of the total number of patients. It should be noted that heart failure and wound infection only affected amputation-free survival within 6 months after endovascular treatment. Factors associated with ulcer healing were short-term predictors for amputation-free survival and presumably were linked to survival. After ulcer healing, these factors were no longer significant and other factors related to long-term prognosis tended to emerge. Six months also suggesting that this might be an appropriate duration when evaluating the usefulness of new methods of limb salvage (9).

It is not always possible to perform direct revascularization especially with lesions of the distal segment. However, with regard for the angiosomes concept, it is possible to achieve indirect optimal blood flow to the ischemic zone. It may allow to healing wounds and ulcers.

As a rule, these patients have comorbidities such as diabetes, dyslipidemia. In addition, the status of thrombogenicity is associated with endothelial dysfunction and elevated hypercoagulation. In the study by Rossi et al. in 2002, 34% of patients with symptomatic peripheral arteries atherosclerosis had a fatal or non-fatal myocardial infarction for 24 months (10). In 2005, the REACH study showed that 63% of patients with chronic lower limb ischemia had arterial multifocal lesions. These patients over the age of 50 have 68% and 42% cardiac and cerebrovascular adverse events, respectively (11). In addition to this, the study of Liistro et al. in 2013, demonstrated that aggressively endovascular treated CLI was not significantly associated with increased risk of long-term cardiac mortality in diabetic patients initially coming up with symptomatic coronary artery disease (12).

On the other hand a mortality rate of 20% within 6 months after the diagnosis and 50% ending up with fatal outcome in 5 years has been reported (13, 14). This excessive mortality may be related to the systemic cardiovascular diseases including coronary artery disease and cerebrovascular arterial disease (15, 16). Furthermore, CLI is associated with peripheral complications such as ulceration, gangrene, infection and a high risk of lower limb amputation estimated in 10%–40% of patients in 6 months after the established onset of the disease, especially in non-treatable patients (17, 18).

To date, increasingly more attempts become important as far as simultaneous («Ad-hoc») or stepwise (at the current hospitalization) procedures on coronary and peripheral arteries, which can improve the survival of patients presented initially with complications of diabetes.

Conclusion: Among patients with CLI, the majority were with distal lesions and diabetes mellitus. The first endovascular treatment of consecutive patients showed encouraging 6-month results of both endpoints, although there is a need for a more long-term analysis, and an increasing number of participants. Simultaneous («Ad-hoc») or stepwise (at the current hospitalization) procedures on coronary and peripheral arteries are safe and can provide the better patient survival.

Conflict of interest: None to declare

Authorship: Ch. S. D., A.I.Z., I. A. S., B. I.H., Ch. D. Ch., N. K.N, D. B.S., R. A.E., A. D.N., E. A., O.T.A. equally contributed to the study and preparation of manuscript

Acknowledgement and funding: None to declare

References

1. Norgren L, Hiatt WR, Dormandy JA, Nehler MR, Harris KA, Fowkes FG; TASC II Working Group. Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). J Vasc Surg 2007; 45 Suppl: 5-67.
2. Conte MS, Geraghty PJ, Bradbury AW, Hevelone ND, Lipsitz SR, Moneta GL, et al. Suggested objective performance goals and clinical trial design for evaluating catheter-based treatment of critical limb ischemia. J Vasc Surg 2009; 50: 1462 -72.
3. Shammas NW. Epidemiology, classification, and modifiable risk factors of peripheral arterial disease. Vascular Health and Risk Management 2007; 3: 229–34.
4. Nanjundappa A, Laird JR. Critical limb ischemia. Understanding the scope of the problem. Endovascular today. 2006.
5. Campbell WB., Ponette D, Sugiono M. Long-term results following operation for diabetic foot problems: arterial disease confers a poor prognosis. Eur J Vase Endovasc Surg 2000; 19: 174–7.
6. Cavallini M, Murante G, Caterino S, Volpini M, Montesi M, Fallucca F. The diabetic foot seen by the surgeon. Personal experience. Minerva Chir 2003; 55: 147–52.
7. Moulik PK, Mtonga R, Gill GV. Amputation and mortality in new onset diabetic foot ulcers stratified by etiology. Diabetes Care 2003; 26: 491–4.
8. Imankulova AS, Naraliev UT, Azimzhanova MN. Modern

approaches to surgical treatment of complicated forms of diabetic foot syndrome. Kyrgyzstan Medicine 2018, 3: 36-40.

9. Iida O, Nakamura M, Yamauchi Y, Fukunaga M, Yokoi Y, Yokoi H, et al. 3-year outcomes of the OLIVE registry, a prospective multicenter study of patients with critical limb ischemia: A prospective, multicenter, three-year follow-up study on endovascular treatment for infra-inguinal vessel in patients with critical limb ischemia. JACC Cardiovasc Interv 2015; 8: 1493-502.
10. Rossi E, Biasucci LM, Citterio F, Pelliconi S, Monaco C, Ginetti F, et al. Risk of myocardial infarction and angina in patients with severe peripheral vascular disease: predictive role of C-reactive protein. Circulation 2002; 105: 800–3.
11. Bhatt D. REACH (Reduction of Atherothrombosis for Continued Health) registry. American College of Cardiology Annual Scientific Session 2005.
12. Liistro F, Angioli P, Grotti S, Brandini R, Porto I, Ricci L. Impact of critical limb ischemia on longterm cardiac mortality in diabetic patients undergoing percutaneous coronary revascularization. Diabetes Care 2013; 36: 1495-500.
13. Murabito JM, Evans JC, Nieto K, Larson MG, Levy D, Wilson PW. Prevalence and clinical correlates of peripheral arterial disease in the Framingham Offspring Study. Am Heart J 2002; 143: 961–5.
14. Adam DJ, Beard JD, Cleveland T, Bell J, Bradbury AW, Forbes JF, et al. BASIL trial participants. Bypass versus angioplasty in severe ischaemia of the leg (BASIL): multicentre, randomised controlled trial. Lancet 2005; 366: 1925–34.
15. Steg PG, Bhatt DL, Wilson PW, D`Agostino R Sr, Ohman EM, Rother J, et al. REACH Registry Investigators. One-year cardiovascular event rates in outpatients with atherothrombosis. JAMA 2007; 297: 1197–206.
16. Caro J, Migliaccio-Walle K, Ishak KJ, Proskorovsky I. The morbidity and mortality following a diagnosis of peripheral arterial disease: long-term follow-up of a large database. BMC Cardiovasc Disord 2005; 5: 14.
17. Abu Dabrh AM, Steffen MW, Undavalli C, Asi N, Wang Z, Elamin MB, et al. The natural history of untreated severe or critical limb ischemia. J Vasc Surg 2015; 62: 1642–51.
18. Norgren L, Hiatt WR, Dormandy JA, Nehler MR, Harris KA, Fowkes FG. Intersociety consensus for the management of peripheral arterial disease (TASC II). J Vasc Surg 2007; 45 suppl : 5–67.

CONFERENCE PAPER

Heart, Vessels and Transplantation 2019; 3: 193-198.
Doi: : 10.24969/hvt.2019.148

Immediate clinical and angiographic outcomes after delayed percutaneous coronary interventions in patients with acute coronary syndrome

Chevgun S.D., Abdyldaev I.Z., Daniyarov B.S., Bebezov I.H., Badrakly E.F., Osmonov T.A.

International School of Medicine, Bishkek, Kyrgyzstan

Abstract

Objective: Coronary artery disease (CAD) remains the leading cause of premature death. Clinical management of patients with such disorders as acute coronary syndrome (ACS) is still one of the most important and debated issues in modern medicine. Some patients fail to come in the most relevant and recommended time for percutaneous coronary interventions (PCI) to receive an effective treatment. This study analyzed the results of the practical approach to the "compelled" delayed percutaneous coronary interventions (DPCI) in patients with acute coronary syndrome.

Methods: The study was performed retrospectively. From 2013 to 2016, there were 141 patients with CAD. The DPCI group with an average admission time when symptoms onset counts 89.4 (17.5) hours was compared with the groups with medical therapy only (MT) and PCI after stabilization (PPCI).

Results: The revascularization Index in DPCI was 0.90 (0.18) and in PPCI made 0.89 (0.2) ($p>0.05$). The percentage of ST segment recovery in the DPCI was 72.8% in patients with elevation, and 87% with ST segment depression. At the same time in comparison with the medical therapy group, a significant difference was found according to this criterion (45.2% and 67.2%, respectively) ($p<0.05$). There were marked changes in DPCI in the data of the echocardiogram due to the reduction in the size of the left ventricle after delayed PCI. The main role in increasing the ejection fraction in DPCI group was the contraction of the left ventricle cavity during the end of systolic phase. In DPCI, group 39 convalescents (92.9%) reached condition stabilization. All-cause mortality during hospitalization in the DPCI was noted for 3 patients (7.1%) and 9 patients (18%) in the MT ($p<0.05$). The PPCI group had no lethal cases.

Conclusion: Delayed PCI in patients with ACS is safe and effective procedure. The use of delayed PCI in combination with optimal drug therapy is the most appropriate non-surgical method of myocardial revascularization in the studied cohort of patients. Delayed PCI results showed greater efficacy in the dynamics of the clinical and functional patient's status compared to PCI performed after ACS stabilization.

Key words: delayed percutaneous coronary interventions, acute coronary syndrome, coronary artery disease

(Heart Vess Transplant 2019; 3: 193-8. doi: 10.24969/hvt.2019.148)

Abbreviations

ACS-Acute coronary syndrome, CAD-Coronary artery disease, CCS-Canadian Cardiovascular Society, EDD-end-diastolic dimension, EF-Ejection fraction, ESD-end-systolic dimension, LV-Left ventricle, NYHA- New York Heart Association, OMT-Optimal medical therapy, PCI-Percutaneous coronary intervention, RI-Revascularization index, TLT-Thrombolytic therapy

Introduction

Cardiovascular diseases caused by the progression of the atherosclerotic process such as coronary artery disease (CAD) remain the leading cause of premature death. Clinical

Address for Correspondence: Semen Chevgun, International School of Medicine, Bishkek, Kyrgyzstan,
Email: schevgun@mail.ru Phone No: +996 550 177 377

management of patients with such disorders as acute coronary syndrome (ACS) is still one of the most important and debated issues in modern medicine. There are several approaches in the treatment of patients with ACS such as optimal medical therapy (OMT), percutaneous coronary intervention (PCI), coronary artery bypass grafting. Each of these areas can be used to eliminate the root cause of an acute condition. Myocardial reperfusion attempts should be timely and optimal in terms of the volume. This study analyzed the results of the practical approach to the tactics of "compelled" delayed percutaneous coronary interventions (DPCI) in patients with ACS.

Methods

The study was performed retrospectively. It included 141 patients with ACS who were divided into three groups. The first group included 42 patients who, from 2013 to 2016, were exposed to DPCI. The second group (MT) consisted of 50 patients admitted urgently with ACS to the intensive care department in the clinic without the possibility of angiography and received optimal medical therapy. In 40% (20 patients) of cases thrombolytic therapy (TLT) was used in MT group. The third group consisted of 49 patients who underwent planned PCI at various periods after their stabilization (PPCI). The results obtained in the PPCI group were compared to determine the necessity of delayed PCI. Exclusion criteria were myocardial infarction (MI) with right ventricle involvement, patients with congenital heart disease, organic valvular lesions, severe concomitant diseases in the terminal stage (chronic kidney disease, and those of oncological nature).

Cases of achieving condition stabilization, dynamics of the heart failure class, all - cause mortality, dynamics of ST segment deviation on the ECG, recovery of left ventricular function according to echocardiography at the end of hospitalization were recorded and analyzed.

Patients of DPCI and PPCI groups had "Ad-hoc" PCI. PCI was performed after the consent was obtained. All patients received a loading dose of acetylsalicylic acid - 500 mg, clopidogrel - 600 mg and 5000 IU of heparin. The number of stents in stable patients depended on the affected arteries with hemodynamically significant stenosis / occlusion and the patient's physical condition. In patients with ACS, mainly stented artery was infarct-related artery (IRA). Whenever possible on part of the patient the stenting of the remaining hemodynamically significant stenosis of various localizations to increase the completeness of myocardial revascularization was carried out after stents implantation into IRA. Stenting of the arteries not connected with the infarction / ischemia zone was performed only with an adequate clinical picture available. The revascularization index (RI) was calculated.

Statistical analysis: The obtained data was processed on a computer using the statistical program SPSS statistics version 17. Comparison of mean findings was made using standard methods of variation statistics of a medical-biological profile. The distribution of variables was checked using the Kolmogorov-Smirnov test. In the case of a normal distribution of variables, Student's t-test and ANOVA tests were applied. For an out-of-standard distribution of variables, the U-criterion of Mann-Whitney, the criterion of the Wilcoxon signs and the criteria of Kruskal-Wallis, Friedman were calculated. Nominal variables were compared using criterion Chi-square.

Results

The majority of DPCI and MT groups' patients were in the II and III functional classes according to the Killip classification (92.7% and 78%, respectively). The groups differed significantly only in the number of IV class patients. All patients of the PPCI group were in II and III angina pectoris classes according to the Canadian Cardiovascular Society (CCS) classification and only one patient (2%) had New York Heart Association (NYHA) class IV heart failure. Patients were distributed depending on the diagnosis upon admission in the acute period (disease exacerbation), which is presented in Table 1.

In all three groups, the number of men was significantly higher ($p<0.05$). There were no significant differences in the three groups according to the age ($p>0.05$). In patients with ACS, the time from the symptoms onset to the types of treatment (MT and PCI) ranged from an hour to several days. The median time for DPCI patients was 89.4(17.5) hours. Patients admitted before 12 hours threshold prevailed in the MT group 35 (70%) ($p<0.05$). Most of PPCI patients 33 (67.3%) underwent PCI a month after medical treatment stabilization.

The basic characteristics are shown in Table 2.

Table 1. The distribution of patients depending on the diagnosis upon admission in the acute period

Diagnosis at admission	DPCI (N=42)	MT (N=50)	PPCI (N=49)
Refractory unstable angina, n(%)	10(23.8)	13(26)	27(55.1)*
Non Q-wave MI, n(%)	14(33.3)*	7(14)	8(16.3)
Q-wave MI, n(%)	18(42.9)	30(60)*	14(28.6)
*- $p<0.05$, Data are presented as n(%), DPCI- delayed percutaneous coronary intervention, MI –myocardial infraction, MT – medical treatment, PPCI- primary percutaneous coronary intervention			

Table 2. Baseline characteristics

Variables	DPCI (N= 42)	MT (N= 50)	PPCI (N= 49)
Age, years	55.6 (9.6)	61.5 (13.4)	56.3 (8.4)
Male sex, %	76.2	62.0	81.6
Mean delay time/ h/days	89.4 (17.5) *	5.3 (4.1)	>30 days
Killip class > 2, %	30.9	44.0	-
NYHA > 2/ CCS > 2, %	-	-	46.9 / 57.1
Anterior infarct/ischemia localization %	85.7	70.0	73.4
STEMI, %	61.9	68.0	44.9*
Affected arteries number (angiographically) > 1,%	59.5	-	49.0
GRACE score > 140, %	60.0	78.0	-
Euroscore II, %	7.8 (5.1)	9.0 (6.2)*	1.4 (0.8)
SYNTAX score (in points)	13.9 (6.0)	-	12.5 (7.6)
Cholesterol, mmol / l	5.2 (1.4)	5.0 (1.1)	5.2 (1.1)
GFR (MDRD) ml / min / 1.73 m^2	73.3 (16.7)	70.4 (33.2)	74.1 (19.3)
Creatinine, µmol / l	96.8 (21.6)	110.7 (48.1)	96.6 (20.9)
GFR (MDRD) < 70 ml / min / 1.73 m^2	33.3	56	42.8
EF < 50%,%	45.2	52.0	20.4*
Smoking, n(%)	15 (35.7)	20 (40)	11 (22.4)*
Diabetes mellitus, n(%)	14 (33.3)	18 (36)	16 (32.7)
Hypertension, n(%)	27 (64.3)	29 (58)	35 (71.4)
Lung disorders, n(%)	12 (28.6)	25 (50)*	2 (4.1)
Peripheral artery disease, n(%)	4 (9.5)*	14 (28)	14 (28.5)
Cardiogenic shock, n(%)	9 (21.4)	9 (18)	0
LV aneurysm, n(%)	11 (26.2)	14 (28)	7 (14.3)
AV blockade or BBB/atrial fibrillation , n(%)	9 (21.4) / 0	9 (18) / 4 (8)	2 (4.1) / 4 (8.2)
Previous MI, n(%)	11 (26.2)	6 (12)	22 (44.9)*
Previous GABG, n(%)	1 (2.4)	0	0
Previous PCI, n(%)	1 (2.4)	0	0

*- p<0.05, Continuous data are presented as Mean(SD), categorical variables as n(%)
AV-atrioventricular, BBB- bundle branch block, CABG-coronary bypass surgery, DPCI- delayed PCI, EF – ejection fraction, GFR-glomerular filtration rate, LV – left ventricle, MI –myocardial infraction, MT – medical treatment, PCI – percutaneous coronary intervention, PPCI- primary PCI, STEMI – ST-elevation myocardial infarction

It is worth noting that the number of patients with ST segment elevation in all groups was significantly higher compared with other forms of ACS. In the DPCI group, 34 (80.9%) patients had ST segment elevation and only 8 patients (19%) had depression. Among patients with ST-segment elevation, 24 (70.5%) patients had ischemia in the LV anteroseptal area, which was significantly higher than in other groups of patients (p<0.05), in 6 patients (17.6%) that was in the inferior wall of the LV, in three patients (9%) anterolateral LV area was ischemic. LVEF in patients of DPCI and MT groups did not statistically differ when admitted to hospital (49.3 (12.7) and 47.7 (13.1)mm, respectively) as well as the LV end-systolic dimension (ESD) (40.45(7.9) and 41.0(9.4) mm, respectively). The initial LVEF in the DPCI was significantly less than in PPCI (57.3 (9.8)) whereas the LVESD was significantly higher (p<0.05). LVESD in the PPCI group was 36.5 (6.1) mm. The mean values of the LV end-diastolic size (EDD) did not differ among the groups (55.1(5.6); 56 (6.7) and 53.3 (5.5) mm, respectively). Patient characteristics by the various risk assessment scales are presented in Table 3.

Table 3. Patient characteristics by risk stratification systems

	DPCI (N=42)	MT (N=50)	PPCI (N=49)
Euroscore в%	7.8 (5.1)	9.0 (6.2)*	1.4 (0.8)
GRACE в %	6.2 (3.2)	11.9 (5.6)*	-
SYNTAX score	13.9 (6.0)	-	12.5 (7.6)
BCIS-J Score before PCI	5.7 (2.7)	-	5.8 (2.2)
*- p<0.05, Data are presented as Mean (SD) DPCI- delayed percutaneous coronary intervention, MT – medical treatment, PPCI- primary percutaneous coronary intervention			

In accordance with the basic angiographic characteristics (Table 4) of the infarct / symptom-related artery (IRA) the left anterior descending artery (LAD) was affected in 71.4% of cases, in 8 patients (19%) it was the right coronary artery (RCA), and in 4 patients (9.5%) the circumflex artery (Cx) in DPCI group (p<0.05). The blood flow in IRA in most cases (54.8%) was at the TIMI 2 level (p<0.05). Blind occlusion was recorded in 10 (23.8%) patients, occlusion with recanalization elements in 7 (16.7%) patients. Blood flow TIMI 3 was observed in only 2 patients. The presence of collaterals to IRA, which were found in 12 (28.6%) patients, was also important. According to the American Heart Association classification, the type C of stenosis prevailed in both groups in the IRA (p<0.05).

In the PPCI group LAD was the most common lesion among 34 symptom-related cases (69.4%). The incidence rate of symptoms due to Cx in this group was 7 (14.3%) patients and 8 RCA (16.3%) patients. The most frequent was TIMI 2 blood flow through IRA during the period of stabilization in the PPCI group overall in 27 (55.1%) patients. Along with this, the number of blind occlusions with the TIMI 0 bloodstream was only 3 (6.1%), which proves the effectiveness of the optimal MT performed in these patients. The presence of collaterals to the IRA channel was detected in 13 (26.5%) patients.

After admission to the hospital, patients began to receive medical treatment for ACS and stable form of CAD. Almost all patients received antiplatelet and anticoagulant therapy, and according to these criteria, the groups were equal (p>0.05). There was also no difference in the percentage ratio in beta-blockers, nitrates, statins, angiotensin converting enzyme inhibitors / angiotensin receptor blockers (p>0.05). It is also important that inotropic drugs were used more often in the MT group (38.2%), which points to more unstable hemodynamic parameters (p<0.05). The use of Ca++ channel blockers and glycoprotein 2b / 3a inhibitor was also more frequent (p<0.05) in DPCI. It should be noted that the number of patients receiving TLT in the DPCI group was significantly less than in the MT group (4.8% and 40%, respectively) (p<0.05).

Table 4. Angiographic characteristics of IRA

IRA	DPCI	PPCI
	(N=42)	(N=49)
LAD, n(%)	30 (71.4)	34 (69.4)
Cx, n(%)	4 (9.5)	7 (14.3)
RCA, n(%)	8 (19)	8(16.3)
Blood flow by TIMI in IRA, n(%)		
0	10 (23.8)*	3 (6.1)
1	7 (16.7)	7 (14.3)
2	23 (54.8)	27 (55.1)
3	2 (4.8)	12 (24.5)
The presence of collaterals to the IRA, n(%)	12 (28.6)	13 (26.5)
Type of Stenosis in IRA by AHA, n(%)		
A	8 (19)	8 (16.3)
B	9 (21.4)	19 (38.8)
C	25 (59.5)	22 (44.9)
*- p<0.05, Data are presented as n(%) Cx- left circumflex artery, DPCI- delayed percutaneous coronary intervention, IRA – infract-related artery, PPCI- primary percutaneous coronary intervention, RCA – right coronary artery		

Characteristics of revascularization

One-vessel disease patients prevailed in the PPCI group (51%), while the number of patients with a two-vessel disease prevailed in the DPCI (52.4%). The BCIS-JS indicator can also specify the completeness of revascularization after PCI, which was 0.77 (1.4) in the DPCI group and 0.69 (0.3) in the PPCI group ($p>0.05$). RI in DPCI was 0.90 (0.18) and 0.89 (0.2) in PPCI ($p>0.05$).

Characteristics of ECG changes

The percentage of ST segment recovery in the DPCI was 72.8% in patients with elevation, and 87% with ST segment depression. At the same time in comparison with the MT group, a significant difference was found according to this criterion (45.2% and 67.2%, respectively) ($p<0.05$). PPCI group patients at the time of hospitalization and PCI were in stable condition and did not have a tendency to obvious ST segment deviation. As exceptions there were patients with LV aneurysms (7 patients) and rhythm disorders (blockade of the His bundle branch). However, there were no significant differences in ST deviation in this group ($p>0.05$). In the TLT subgroup (MT group), the percentage of ST segment recovery to baseline was 50%, which was also significantly different from the DPCI patients ($p<0.05$).

Characteristic of echocardiography data

After the treatment (3-5 days), DPCI LV EF was 54.4 (11.6)%, which was significantly different from the MT group 51.18 (10.2)% ($p<0.05$). There was also a significant difference before and after procedures in the DPCI group (49.3 (12.7) vs. 54.4 (11.6)%, respectively) ($p<0.05$). Despite the fact that the mean value of LVEF after stenting was the highest in the PPCI group (57.2 (8.9)%); there were no significant changes in intragroup comparison ($p>0.05$). There was also no difference in dynamics of EDD (53.88 (4.6) and 53.0 (5.5) mm, respectively) and ESD (37.75 (6.0) and 37.08 (5.5) mm, respectively) in the MT and PPCI groups after the treatment. On the contrary, in DPCI group a pronounced dynamics was observed in decreasing ventricular cavity size after delayed PCI (EDD- 53.55 (6.7) mm, ESD - 37.93 (7.2) mm). The main role in increasing the ejection fraction (EF) in DPCI group was about the contraction of the left ventricle (LV) cavity during the end systolic phase.

Hospitalization outcomes characteristics

In DPCI group, 39 convalescents (92.9%) reached condition stabilization. They moved from acute heart failure class by Killip to CCS I-II class and NYHA I-II. In the MT group, 41 (82%) patients gained the same results ($p>0.05$). In the PPCI group all stented patients move to CCS I class. In contrast, no reliable dynamics was found as far as NYHA heart failure after the procedure in PPCI group 21 (42.8%), which was combined with the lack of LV EF dynamics. All-cause mortality rate during hospitalization in the DPCI was 3 patients (7.1%) and 9 patients (18%) in the MT ($p<0.05$). In the PPCI group, there were no lethal cases.

Discussion

A very important factor in the effectiveness of revascularization in ACS is its timeliness. Numerous controlled studies showed the relationship of the total ischemia time, i.e. between the symptoms onset and reperfusion (thrombolysis, mechanical reperfusion or PCI) with a prediction of the revascularization success (1, 2). Reperfusion by primary PCI is to be administered to all patients with symptomatic duration <12 hours and persistent ST elevation or complete left bundle branch block (3-5). According to many authors, reperfusion by the method of primary PCI should be considered for patients and after 12-48 hours from the symptoms onset (6 -9).

In ACS without ST elevation, the time of angiography and revascularization is ambiguous. The choice of management is based on the patient risk profile. Very high-risk patients should undergo immediate angiography (within 2 hours). High-risk patients with at least one primary criterion (a regular increase or decrease in troponin, dynamic changes in ST and T, GRACE>140) should receive invasive care within 24 hours, which looks like an adequate time interval (10).

Obviously, in patients with ACS the timeliness of interventions has great importance. However, it is not always possible to meet the deadlines in accordance with the established international criteria and standards due the socio-economic and logistical difficulties.

The main result of this study is that PCI provides the best immediate results, even if they are performed late after the ACS symptoms onset. Primary PCI despite the delaying procedure proved to be most effective in restoring LV function, even compared with patients who received early thrombolytic therapy. Moreover, hospital mortality was significantly lower in the DPCI group, compared with the MT group.

Conclusion

Delayed PCI in patients with ACS are safe and effective procedures. The use of delayed PCI in combination with optimal drug therapy is the most appropriate non-surgical method of myocardial revascularization in the studied cohort of patients. Delayed PCI results showed greater efficacy in the dynamics of the clinical and functional patient's status compared to PCI performed after ACS stabilization.

Conflict of interest: None to declare

Authorship: Ch. S. D., A.I.Z., D. B. S., B. I.H., B.E.F., O.T.A. equally contributed to the study and preparation of manuscript

Acknowledgement and funding: None to declare

References

1. Steg PG, James SK, Atar D, Badano LP, Blomstrom-Lundqvist C, Borger MA, et al. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Eur Heart J 2012; 33: 2569–619.
2. Gershlick AH, Banning AP, Myat A, Verheugt FW, Gersh BJ. Reperfusion therapy for STEMI: is there still a role for thrombolysis in the era of primary percutaneous coronary intervention? Lancet 2013;382: 624–32.
3. Boersma E, Maas AC, Deckers JW, Simoons ML. Early thrombolytic treatment in acute myocardial infarction: reappraisal of the golden hour. Lancet 1996; 348: 771–5.
4. Boersma E. Does time matter? A pooled analysis of randomized clinical trials comparing primary percutaneous coronary intervention and in-hospital fibrinolysis in acute myocardial infarction patients. Eur Heart J 2006; 27: 779–88.
5. Keeley EC, Boura JA, Grines CL. Comparison of primary and facilitated percutaneous coronary interventions for ST-elevation myocardial infarction: quantitative review of randomised trials. Lancet 2006; 367: 579–88.
6. Mehilli J, Kastrati A, Schulz S, Frungel S,Nekolla SG, Moshage W, et al. Abciximab in patients with acute ST-segment-elevation myocardial infarction undergoing primary percutaneous coronary intervention after clopidogrel loading: a randomized double-blind trial. Circulation 2009; 119: 1933–40.
7. Busk M, Kaltoft A, Nielsen SS, Botcher M, Rehling M, Thuesen L, et al. Infarct size and myocardial salvage after primary angioplasty in patients presenting with symptoms for 12 h vs. 12–72 h. Eur Heart J 2009; 30: 1322–30.
8. Schomig A, Mehilli J, Antoniucci D, Ndrepepa G, Markwardt C, Di Pede F, et al. Mechanical reperfusion in patients with acute myocardial infarction presenting more than 12 hours from symptom onset: a randomized controlled trial. JAMA 2005; 293: 2865–72.
9. Vakili H, Sadeghi R, Rezapoor P, Gachkar L. In-hospital outcomes after primary percutaneous coronary intervention according to left ventricular ejection fraction. ARYA Atheroscler 2014; 10: 211-7.
10. Kolh P, Windecker S, Alfonso F, Collet JP, Cremer J, Falk V, et al. 2014 ESC/EACTS Guidelines on Myocardial Revascularization. Eur J Cardiothoracic Surg 2014; 46: 517-92.

CONFERENCE PAPER

Heart, Vessels and Transplantation 2019; 3: 199-202.
Doi: : 10.24969/hvt.2019.148

Individual-typological features of regulation of cardiorhythm in foreign students during education process

Ainura M. Satarkulova[1,2], Shadiya Yu. Aisaeva[1], Almaz S. Shanazarov[1]

[1] International School of Medicine, Bishkek, Kyrgyzstan

[2] Institute of Mountain Physiology and Medicine of the NAS KR, Bishkek, Kyrgyzstan

Abstract

Objective: In studies of the mechanisms of human adaptation to professional and educational activities, as well as in clinical practice, the method of mathematical analysis of heart rate variability (HRV) is widely used. Based on this, the aim of this paper is to determine the typology and characteristics of the vegetative regulation of the heart as a prenosological control of the functional state of the body of practically healthy foreign students.

Methods: In 2018, 389 male students from India and Pakistan, which are studying at the International higher school of medicine (ISM) aged 17-24, served as test subjects. For each student, the main HRV parameters were recorded in a sitting position for 5 minutes by means of "PSYCHOPHYSIOLOGIST" software and hardware company Medicom MTD (Russia).

Results: In total, 52% of young men had type I (with a moderate predominance of central regulation), 5% - type II (with a pronounced predominance of central regulation), 36% - type III (with a moderate predominance of autonomous regulation), and 7% - type IV (with a pronounced predominance of autonomous regulation). Students with a predominance of central regulation (types I and II) compared with types III and IV (predominance of autonomous regulation) have an excess of sympathetic influences on the heart, as indicated by reliably low values of the SDNN, Mo, TP and high level of SI, which leads to various dysfunctional disorders, especially with severe centralization. In the group of persons with type III, a balance is maintained between the tone of the sympathetic and parasympathetic nervous system, while type IV shows a significant prevalence of parasympathetic effects on the heart rhythm.

Conclusion: The results indicate a risk of developing disadaptation in the students' body during education process and the importance of systematic monitoring to detect early cardiac arrhythmias.

Key words: foreign students, heart rate variability, statistical and spectral characteristics, stress index, vegetative regulation

(Heart Vess Transplant 2019; 3: 199-202. doi: 10.24969/hvt.2019.148)

Introduction

Modern educational process in higher school is notable for progressive intensification. Currently, in the study of the mechanisms of adaptation to professional and educational activities in fundamental physiology, the method of mathematical analysis of heart rate variability (HRV) is actively used. It is very important that using this method you can obtain information not only about the state of regulatory systems, but also determine the type of vegetative regulation. The works of recent years have proved that using the principle of a two-circuit model of heart rate control it is possible to distinguish individuals with different levels of vegetative regulation. These individual typological features of regulatory systems can "serve as an objective criterion in assessing the functional state throughout the entire period of study at a university" (1).

Therefore, the aim of this work was to determine the typology and characteristics of vegetative regulation of the heart as a prenosological control of the functional state of the students' body.

Address for Correspondence: Ainura M. Satarkulova, International School of Medicine, Bishkek, Kyrgyzstan, e-mail: asat79@mail.ru,
Mobile: +996 772 67 25 28

Methods

The study was conducted in 2017, at the International higher school of medicine (ISM) in Bishkek, Kyrgyz Republic, among the male students from India and Pakistan. A total of 389 persons aged 17-24 were examined. The study was approved by the ethics committee at the International higher school of medicine (ISM) (Protocol No. 4 of November 9, 2016) and corresponds to the principles outlined in the Helsinki declaration. Prior to the study, informed consent was obtained from all participants for the examination.

Electrocardiogram (ECG) recording and calculation of heart rate variability (HRV) were carried out by means of "PSYCHOPHYSIOLOGIST" software and hardware company Medicom MTD (Russia) in siting position for 5 minutes. For recording of HRV, recommendation of the Task Force on HRV was followed (2).

The statistical characteristics of a dynamic line of cardio intervals include heart rate (HR), standard deviation of all RR intervals (SDNN), variation range (MxDMn), which are determined primarily by the influence of the parasympathetic part of the autonomous nervous system and is a reflection of sinus arrhythmia associated with breathing (3).

Mathematical analysis of heart rate according to R.M. Baevsky (4) was carried out to analyze the performance of Mode (Mo) and Mode amplitude (AMo), which reflect the measure of the mobilizing impact of sympathetic division. Besides, the stress index (SI) was used in the analysis, which reflects the degree of centralization of heart rhythm management.

To better quantify the periodic processes in heart rate a spectral analysis was involved, which allows evaluating the interaction of cardiac rhythm management levels. Spectral analysis consisted in measuring power of VLF-, LF-, HF-waves in the spectrum of heart rate variability, which was performed in percentage of the total power of the spectrum (TP), which shows the relative contribution of each component in the total power of heart rate fluctuations.

The surveyed contingent was divided into adaptive groups, with the classification of states according to the degree of regulatory stress index by Bayevsky and VLF waves. The contingent under analysis was divided into four types of vegetative regulation according to N.I. Shlyk (5): the type I with a moderate predominance of the central type of regulation (SI>100 c.u. and VLF>240 ms^2), the type II with a pronounced predominance of the central type of regulation (SI>100 c.u. and VLF<240 ms^2), the type III with a moderate predominance of self-contained regulation (SI =30-100 c.u. and VLF>240 ms^2), and the type IV with a pronounced predominance of self-contained regulation (SI<30 c.u. and VLF>240 ms^2).

Statistical analysis

The results of the study were subjected to statistical processing using the SPSS 16 version of the comparison of variables with the normal distribution.

One-way ANOVA analysis with the Posthoc-test Scheffe was used. Data are presented as mean (SD). Variables with a non-normal distribution were compared using the Kruskal-Wallis test. In this case, the data are presented as the median (Me), the first (Q1) and the third (Q3) quartiles (Me (Q1 - Q3)). The level of significance of differences at $p \leq 0.001$ was accepted as significant.

Results and discussion

Male students of type I (with a moderate predominance of central regulation) and type II (with a pronounced predominance of central regulation) amounted to 52% and 5% respectively of the total quantity of the examined. The analysis of statistical characteristics of HRV revealed that students with a predominance of central regulation (type I and type II) demonstrated significantly ($p \leq 0.001$) low values of SDNN (38ms and 20ms respectively), Mo (675ms and 575ms), MxDMn (191ms and 95ms), as compared to type III and IV, which evidences tension of adaptive and regulatory mechanisms (Table 1).

Table 1. Statistical HRV values of students with a different type of vegetative regulation

HRV Values	Type I	Type II	Type III	Type IV
HR, b/min	88 (80-96)	106 (94-112)	76 (72-84)	72 (64-76)
SDNN, ms	38 (31-44)	20 (17-25)	62 (54-72)	101 (77-108)
Mo, ms	675 (575-725)	575 (525-625)	775 (675-825)	832 (775-925)
AMo, %	47 (41-54)	65 (54-78)	30 (26-34)	19 (16-22)
MxDMn, ms	191 (154-223)	95 (82-131)	306 (271-357)	505 (402-624)
SI, c.u.	177 (134-266)	580 (386-805)	61 (47-80)	24 (19-29)

Data are presented as median (Q1 - Q3)
AMo - mode amplitude, HR- heart rate, HRV - heart rate variability, Mo-mode, MxDMn – variation range, SDNN- standard deviation of all RR intervals, SI - stress index

High values of AMo (47% and 65%) reflect influence of the sympathetic link of regulation of vegetative nervous system, and adverse condition of the cardiovascular system. The stress index (SI), which reflects the degree of tension of regulatory systems, is also "an important informative indicator of adaptive and regulatory condition of the body" (4). In the group of students with a pronounced predominance of central regulation (type II), stress index (SI) had highest values (580 c.u.), which is indicative of overstrain or unsatisfactory adaptation condition.

The spectral parameters demonstrated low total spectrum power (TP) and its wave structure; these changes are especially noticeable in the group with type II regulation (Table 2).

Table 2. Spectral HRV values of students with a different type of vegetative regulation

HRV Values	Type I	Type II	Type III	Type IV
TP, ms^2	2315 (1462-3121)	599 (432-897)	6688 (4980-9054)	17293 (11001-20360)
VLF, ms^2	741 (476-1140)	177 (152-208)	2537 (1728-3426)	5369 (3279-6874)
LF, ms^2	861 (510-1236)	259 (183-408)	2006 (1371-3045)	3910 (2739-5983)
HF, ms^2	497 (311-788)	130 (84-296)	1700 (1104-2618)	6153 (2949-8245)
VLF,%	37.4 (13.2)	27.9 (10.7)	39.0 (14.8)	35.9 (15.5)
LF, %	38.7 (12.1)	46.0 (11.6)	32.6 (11.4)	27.2 (8.5)
HF, %	23.9 (10.9)	25.9 (11.1)	28.4 (12.2)	39.9 (13.8)

Data are presented as median (Q1 - Q3) and mean (SD)
HF- high frequency power, HRV - heart rate variability, LF – low frequency power, TP – total power, VLF – very low frequency power

In particular, the TP indicator, which reflects the total effect on the heart rhythm of all levels of regulation, decreased to 599 ms^2 in the group of students with type II, which indirectly indicates a decrease in the adaptive capacity of the cardiovascular system and low stress resistance of the body. A decrease in TP, as mentioned above, entails changes in the structure of the HRV spectrum: HF values are 130 ms^2, LF-259 ms^2, VLF-177 ms^2. In addition, they are significantly ($p \leq 0.001$) lower as compared to type III and IV. The rate spectrum of this group demonstrated predominance of low frequency (LF% - 46) and very low frequency waves (VLF% - 27.9) with insignificant contribution to the rate spectrum of high frequency waves (HF% - 25.9).

The above data, together with high values of stress index (SI – 580 c.u.), evidence the condition of increased functional tension of the adaptation mechanisms. It also creates the danger of the adaptation breakdown and disruption of the intersystem and intrasystem functional links in the body and, as a result, occurrence of pathological processes. In some cases, for example, "excessive intellectual and psychoemotional stresses can lead to the development of myocardial electrical instability" (6).

The third group of male students (type III), with a moderate predominance of autonomous regulation (36% of the total quantity of examined) as compared to first group with a moderate predominance of central regulation (type I) had normal values of SDNN, Mo and MxDMn. The stress index within the third group of students had significantly ($p \leq 0.001$) lower values (61 c.u.) than the first group. Students of this group demonstrated high level of the total spectrum power (TP – 6688 ms^2, $p \leq 0.001$), which indicates a fairly high functional capabilities of the body and is a sign of sustainable adaptation to the effects of educational and psycho-emotional stress. In accordance with these shifts, the power of the high- and low-frequency components of the HRV spectrum (HF-1700 ms^2, LF-2006 ms^2, VLF-2537 ms^2) increases, while the moderate prevalence of respiratory waves (HF-28%) in the spectrum structure is consistent with "the ideas on the adaptive-trophic protective effect of the n. vagus on the heart" (6).

The fourth group of male students with a pronounced predominance of autonomous regulation (type IV) amounted to 7% of the total quantity of examined and demonstrated highest statistical values of HRV (SDNN-101ms; Mo-832 ms; MxDMn-505 ms; TP-17293 ms^2; HF-6153 ms^2). Increase of such values registered in this group gives evidence of significant predominance of the parasympathetic regulation link over the sympathetic link. Thus, predominance of the parasympathetic tone of the vegetative nervous system and high activity of autonomous control structures at rest evidence that the regulation systems of foreign students of this group are in "optimal condition and reflect high energy and reserve capabilities of bodies" (7).

Conclusion

The study findings indicate a balance between the tone of the sympathetic and parasympathetic nervous system in the students with moderate predominance of autonomous regulation (type III) and a significant prevalence of parasympathetic effects on heart rhythm in individuals with a pronounced predominance of autonomous regulation (type IV), which can be seen as the best condition of the adaptive and regulatory systems.

In students with a predominance of central regulation (types II and I) there was an excess of sympathetic influences on the heart, which may be the cause of the development of various dysfunctional disorders, especially with pronounced centralization. Therefore, there is an urgent need for monitoring of the functional state of students in order to identify early cardiac arrhythmias.

Conflict of interest: None to declare

Authorship: A.M.S., S.Yu.A., A.S.Sh. equally contributed to the study and preparation of manuscript

Acknowledgement and funding: None to declare

References

1. Lytvyn FB, Cyganowsky AM, Zbitny SN, Zabelina LN, Kalinnikova NG, Staniszewska TI. Heart rate variability among the students with different physical activity. Scientific notes of the P.F. Lesgafts' University 2015; 7: 123-9.
2. Heart rate variability: Standards of measurement, physiological interpretation, and clinical use. Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology. Eur Heart J 1996; 17: 354-81.
3. Mikhailov VM. Heart rate variability: the experience of practical application of the method. Ivanovo: Ivan State Med. Academy; 2002.
4. Bayevsky RM. The problem of estimation and forecasting of a functional state of an organism and its development in space medicine. Advances of Physiological Sciences 2006; 3: 42-57.
5. Shlyk NI. Heart rate and type of regulation in children, adolescents and athletes. Publishing house "Udmurtia University"; 2009. 259p.
6. Shlyk NI, Gavrilova EA. Heart rate variability in the rapid assessment to the functional state of the athlete. Applied Sports Science 2015; 2: 115-25.
7. Kiyono K, Bekki N. Intermittent characteristics of healthy heart rate variability. Pacific Science Review 2010; 12: 185-9.

CONFERENCE PAPER

Heart, Vessels and Transplantation 2019; 3: 203-207.
Doi: : 10.24969/hvt.2019.148

Results of controlled clinical examination of intraoperative reinfusion of blood, taken from pleural cavity in the slow and fast conditions

Jamilya A. Chyngysheva[1], Djuraboy M. Sabirov[2]

[1] Department of Anesthesiology and Reanimation, I.K. Akhunbayev Kyrgyz State Medical Academy, Bishkek, Kyrgyzstan

[2] Department of Anesthesiology and Reanimation, Institute of Doctors' Development of Tashkent, TashIDD, Tashkent, Uzbekistan

Abstract

The controlled clinical examination showed that the decay of erythrocytes and leucocytes under blood reinfusion in experimental control (EC) after intraoperative blood reinfusion (IO RIC) is 35% in slow blood reinfusion, and 48% in fast blood reinfusion. Osmotic resistance is decreased by three times. In fast technical exfusion the blood-hemolysis is more than 28%, what needs to be taken into account in carrying out technical IO RIC. According to CCI results, the faster the technical exfusion is done, the more significant is decrease of protein and bilirubin; besides, in both EC and clinical control. There is a higher concentration of K+, residual nitrogen and urea in blood collected during fast technical exfusion. According to CCI results, the number of thrombocytes is reliably decreased, especially due to the fast blood exfusion. The process of aggregation in these conditions is reliably slowing down; besides, in the fast blood exfusion mode it slows down twice in contrast to the controlled one. The period of plasma recalcification is decreased to 40% due to the high-speed mode of blood exfusion in comparison to the controlled indexes, which is 3 times higher than in the application of the slow blood aspiration.

Key words: controlled clinical examinations, technical intraoperative reinfusion of blood, pleural cavity

(Heart Vess Transplant 2019; 3: 203-7. doi: 10.24969/hvt.2019.148)

Introduction

According to some authors, decrease in fibrinogen concentration and number of blood plates is presumably tied up partially to their phagocytosis during the process of coagulation in cavity, and also in part to the destruction in the aspiration system (1-7). Meanwhile, increase of thromboplastic activity is seemingly the consequence of presence of tissue factors in blood resulted from tissues damaged during intervention. On the other hand, this can be the outcome of hemolysis (1, 8).

There is an extensive experience of use of technical IO RIC in domestic surgery practice. E.N. Kobzeva (2002) developed the differential tactics of intraoperative fractionation of abdominal and wound autologous blood (6). E.N. Kobzeva notes, that erythrocytes (Er.) used for intraoperative blood reinfusion (IO RIC) and extracted with the use of technical processing, have normal structural-functional properties, what makes them suitable for general functioning after IO RIC (6).

Research objectives: Comparative characteristic of the results of the examinations listed below, done in focus of controlled clinical examinations (CCE):

1. Experimental control (EC) is an examination of blood collected from pleural and abdominal cavities before and after technical intraoperative blood reinfusion (IO RIC) in conditions of modeling abdominal and chest wounds in animals with formation of hemothorax and hemoperitoneum;

2. Clinical control (CC) – examination of blood, taken from abdominal and chest cavities before and after technical IO RIC from patients with traumas of chest and abdomen with corresponding formation of hemothorax and hemoperitoneum.

Address for Correspondence: Jamilya A. Chyngysheva, Department of anesthesiology and reanimation, I.K. Akhunbayev Kyrgyz State Medical Academy, Bishkek, Kyrgyzstan, E-mail: amanova-j@mail.ru, Mobile: +996772504872

Methods

We have conducted series of examinations in 44 patients with abdominal blood losses, which makes 34.3% of the whole number of examined patients (n-128), in whom we used technical IO RIC. Some specimens have been examined during surgeries within first 2 hours as well. Distribution into clinical groups is presented in the Table 1.

The Table 1 shows, the fast blood collection is represented by samples from 18 (40.9%) patients (group A), and that done in the slow mode(Group B) by those from 26 (59.1%) patients. Besides, 18 patients were presenting the clinical group through the assessment of physical-chemical pleural blood condition, whereas 26 patients as regards the abdomen.

Table 1. Clinical groups by assessment of physical-chemical condition of blood collected from abdominal and pleural areas (A, B), also by assessment of effectiveness (C, D) IO RIC, in conditions of fast and slow blood collection modes for IO RIC (n-44)

Groups	CC	N (%)
A	Assessment of physical and chemical blood conditions, aspirated from pleural and abdominal cavities in slow mode.	18 (40.9)
B	Assessment of physical and chemical blood conditions, aspirated from pleural and abdominal cavities in fast mode.	26 (59.1)
Assessment of IO RIC effectiveness		
C	Assessment of IO RIC effectiveness under slow blood exfusion from cavity	26 (59.1)
D	Assessment of IO RIC effectiveness under fast blood exfusion from cavity	18 (40.9)

Effectiveness assessment of IO RIC is done to all 44 patients. Their blood is taken in different modes. In the fast mode (group C) the assessment is made in 18 (40.9%) patients, whereas in the slow mode (group D) – in 26 (59.1%) patients.

We have developed a simplest technique of technical IO RIC. The device consists of programmed time relay, connected to micro-vibro-compressor and suction-device. The compressor has adjustment knobs for regulation of vacuum-level. The compressor on its part is connected to a hermetic, sterile tube blood-collector with scale.

The device has the following modus of work: a free end of a trunk line is connected to a tip, with use of which a surgeon during surgery obtains the blood drawn out of abdominal or pleural cavity. The modification contains of silicon 1000ml tube with a scale connected to the vacuum-suction device.

The withdrawn blood is poured into a scaled reservoir with blood-stabilizer. We recommend using the traditional tube CIPK with COLIPK-7b for extensive practice. During the use of modern disposable systems for intravenous infusions, the blood is filtered well enough and by gravity comes into patient's vein.

Table 2. CC and EC parallels in hematological indexes subject to various speeds of blood aspiration for IO RIC

Control	Indexes	Initial	1st Group	2nd Group
CC	Er.	3.3(0.8)	2.8(0.2)*	2.3(0.3)*,**
	CP	0.7(0.02)	0.5(0.02)	0.5(0.04)*
	Hb	66.2(5.5)	54.4(2.8)*	51.0(2.2)*,**
	Ht	32.2(2.2)	31.5(2.2)*	29.5(2.1)*,**
	Leuc.	4.8(0.2)	4.2(0.1)*	4.2(0.2)*
EC	Er.	3.5(0.3)	2.8(0.1)*	2.2(0.2)*,**
	CP	0.8(0.01)	0.6(0.01)	0.5(0.02)*
	Hb	98.6(7.4)	80.1(3.6)*	56.3(5.5)*,**
	Ht	30.2(3.1)	20.2(2.0)*	14.8(2.2)*,**
	Leuc.	6.6(0.4)	3.4(0.2)*	2.5(0.1)*,**
	Note: * - p<0.05 is significant in contrast to the initial level; ** - p<0.05 is significant in contrast to the 1st group. CC- clinical control, EC- experimental control, Er. – erythrocyte, HB-hemoglobin, Ht – hematocrit, IO RIC – intraoperative blood reinfusion, Leuc. - leucocyte			

Results and discussion

Table 2 shows the dynamics of blood morphology, which is reproduced from the chest area under slow (1st group) and fast (2nd group) modes.

As it is shown in the Table 2, in both EC and CC, number of Er. in the 2nd group is more significantly decreased in comparison to the 1st group ($p<0.05$). In CC and EC, the same dynamic is observed in relation to CP, hemoglobin (Hb), and hematocrit (Ht). Values of all hemogram indexes in the 2nd group are decreased in contrast to the same of the 1st group. For instance, in EC the Ht index in the 4th group is 2 times lower, than in initial value ($p<0.05$). On the other hand, in CC, reduction gradient of this index is lower, but the tendency is maintained, as in EC. i.e. it is more salient in the 2nd group than in the 1st one.

Thus, reduction-level of form-elements of blood (Er., leucocytes), in both – EC and CC, is more salient in the 2nd group (48% for EC), (32% for CC).

According to EC leucocytes' number is decreased in the 1st group almost twice, and in the 2nd group almost three times as less ($p<0.05$ and $p<0.05$). According to CC, the reduction in leucocytes is in the 1st and the 2nd groups are by 0.8 times respectively.

Table 3 shows physical and blood colloid characteristics, collected from chest cavity in relation to speed of its technical exfusion (slow and fast modes).

Table 3. CC and EC parallels of physical and blood colloid indexes due to different speeds of blood aspiration for IO RIC

Control	Indexes	Initial	1st Group	2nd Group
CC	Osmotic Resistance Er., %	0.8(0.01)	0.7(0.01)*	0.3(0.02)*
	Hemolysis, % to com. Hb	3.1(0.4)	8.2(0.02)*	10.8(0.3)*,**
	Free Hb of plasma, mg%	1.0(0.01)	6.6(0.6)*	10.4(1.0)*,**
EC	Osmotic Resistance Er., %	0.8(0.003)	0.6(0.02)*	0.4(0.02)*
	Hemolysis, % to com. Hb	6.3(0.3)	8.8(0.07)*	12.3(1.2)*,**
	Free Hb of plasma, mg%	3.3(0.03)	7.7(1.1)*	31.2(2.5)*,**
	Note: * - $p<0.05$ significant in contrast to the initial level; ** - $p<0.05$ significant in contrast to the 1st group. CC- clinical control, EC- experimental control, Er. – erythrocyte, Hb-hemoglobin IO RIC – intraoperative blood reinfusion			

As it is shown in the Table 3, osmotic resistance of Er. in EC during technical exfusion is decreased: in the group 1 – by 1.5 times, in group 2 – by 2 times ($p<0.05$ and $p<0.05$). Specific weight of free Hb of plasma is reliably and sharply increased in both groups ($p<0.05$). Meanwhile, in comparative aspect, increase of free Hb in CC has lower salience, than in EC.

According to EC there is a 2 times increase of Hb in the 1st group, and almost 10 times increase in the 2nd group, containing 31.2(2.5) mg% ($p<0.05$). According to CC free Hb-level in the 1st group is 6.6(0.6) mg%, and in the 2nd group – 10.4(1.0) mg%. Thus, the gradient of concentration-increase of free Hb subject to the fast mode is more salient, in contrast to the slow one. Moreover, in CC this process is less salient, than in EC.

Therefore, blood-hemolysis in the slow mode of exfusion (1st group) is 8.8(0.07)%, and in the 2nd group – 12.3 (1.2)% ($p<0.05$ and $p<0.05$). In CC, respectively, 8.2 (0.02) and 10.8(0.3)% ($p<0.05$ and $p<0.05$).

Thus, the specific weight of formal blood elements' (Er., leucocytes) destruction in view of to the fast technical exfusion mode reaches 48% in EC and 35% in CC.

Table 4 shows the dynamics in values of protein and blood fractions, collected from pleural cavity for IO RIC during the slow (1st group) and fast (2nd group) modes.

Table 4. Parallels of CC and EC protein indexes in various speeds of blood aspiration for IO RIC

Control	Indexes	Initial	1st Group	2nd Group
CC	Protein	54.2(6.6)	50.2(2.2)*	43.2(2.0)*,**
	Albumin	30.2(6.2)	42.5(2.3)*	32.8(6.6)
	Globulin	42.5(2.2)	58.8(2.5)*	55.3(3.8)*
	Albumin/Globulin ratio	1.0(0.05)	0.7(0.01)*	0.6(0.05)*,**

EC	Protein	59.2(4.1)	53.4(3.3)*	41.6(5.1)*,**
	Albumin	41.4(3.9)	40.0(5.1)*	33.5(2.8)
	Globulin	59.2(8.1)	59.4(4.4)*	65.9(3.6)*,**
	Albumin/Globulin ratio	0.7(0.01)	0.6(0.01)*	0.5(0.05)*,**
	Note: * - p<0.05 significant in contrast to the initial level; ** - p<0.05 significant in contrast to the 1st group. CC- clinical control, EC- experimental control, IO RIC – intraoperative blood reinfusion			

As it is shown in the Table 4, in EC decrease of the total protein concentration, as well as its albumin fraction is more salient in the group 2 (p<0.05 and p<0.05). CC traces the same (p<0.05 and p<0.05). This dynamic is common for concentration of albumin too, in both EC and CC. Besides, the gradient of reduction of this protein fraction in plasma is more salient in the group 2, i.e. in the fast mode of blood aspiration (p<0.05 and p<0.05).

The only difference in comparing EC to CC data that the globulin fraction in the group 2 has tendency to increase, while in CC there is a decrease in contrast to the group 1. Thus, the more intensive mode of exfusion leads to more salient reduction of protein and its fractions.

Table 5 shows the dynamics of some biochemical blood indexes, when blood is collected from pleural cavity under the slow (1st group) and the fast (2nd group) modes of exfusion.

Table 5. Parallels of CC and EC biochemical indexes as for various speeds of blood aspiration for IO RIC

Control	Indexes	Initial	1st Group	2nd Group
CC	Bilirubin	15.3(2.4)	18.8(1.2)*	21.5(2.2)*,**
	Residual urea nitrogen	19.3(1.01)	28.2(1.5)*	33.4(2.1)*,**
	Urea	4.8(0.4)	25.8(2.6)*	36.2(2.0)*,**
	Na++	140.2(5.5)	142(2.2)	145(3.1)
	K+	4.1(0.2)	5.0(0.1)*	5.0(0.3)*
EC	Bilirubin, mmol/l	5.2(0.3)	5.6(0.4)	5.2(0.1)
	Residual urea nitrogen	31.4(9.2)	33.6(2.3)*	56.2(6.2)*,**
	Urea	8.2(0.9)	23.6(251)*	66.7(7.7)*,**
	Na++	144.4(3.8)	136(8.8)	144(5.9)
	K+	5.1(0.3)	5.3(0.1*	5.9(0.3)*,**
	Note: * - p<0.05 significant in contrast to the initial level; ** - p<0.05 significant in contrast to the 1st group. CC- clinical control, EC- experimental control, IO RIC – intraoperative blood reinfusion			

As it is shown in the Table 5, there is almost the same bilirubin concentration in compared groups, while residual nitrogen and blood-urea are grown by several times in contrast to initial indexes (p<0.05 and p<0.05). Besides, the tendency in the 2nd group is more obvious, than in the 1st one.

There is the tendency of increase in bilirubin concentration in CC. Particularly, 18.8(1.2) mmol/l (1st group) and 21.5(2.2) mmol/l (2nd group) (p<0.05 and p<0.05). This dynamic is typical for residual N, and urea. By the way, the tendency for hyperkaliemia is more perceptible for EC.

K+ concentration in EC of the group 1 is 5.3(0.1) mmol/l, and 5.9(0.3) mmol/l for the group 2 (p<0.05 and p<0.05). Contra wise, in CC there is the tendency for natriemia (p<0.05 and p<0.05).

Thus, there is a higher concentration of K+, urea, and residual N in blood collected during the fast technical exfusion, what needs to be considered at technical IO RIC.

On the basis of the extensive blood-hemostasiogram, collected from pleural cavity in dependence to technical exfusion speed (slow and fast modes of aspiration) in EC, we have found that thrombocytes' number is reliably decreased in both groups (p<0.05 and p<0.05). Besides, in the group 2 this process is more salient, than in the 1st one. Such dynamics and rule are common in aggregation and adhesion of thrombocytes (p<0.05 and p<0.05).

Thus, during the fast blood collection the process of coagulation is accelerated. It is supported by the fact that there is a fast pace of time shortening for Lee-White's coagulation in

EC, in both silicon and non-silicon tubes. One essential note: In the 2nd group, this fact is more salient.

In the 2nd group recalcification of plasma is decreased by almost 2 times in contrast to the initial level ($p<0.05$), and kaolin & kaolin-kefalin plasma-period is >2 times ($p<0.05$ and $p<0.05$), relatively consisting of 30.1(1.9) sec (in contrast to the initial meaning – 64.4(3.8) sec) and 25.5(1.0) sec (in contrast to the initial meaning – 62.4(8.8) sec).

There is synchronic (simultaneous) shortening of thrombin and prothrombin time in both groups ($p<0.05$ and $p<0.05$). Moreover, there is the same regularity, which took place in relation to blood-coagulation time. I.e. the dynamic of time shortening in the group 2 is more noticeable, than in the group 2. Besides, prothrombin time is shortening faster than thrombin time.

Due to this, substance of fibrinogen increases in both groups. Particularly, in group 1 – to 2.4(0.3) g/l and in group 2 – to 3.1(0.2) g/l in contrast to the controlled value – 1.9(0.2) g/l ($p<0.05$ and $p<0.05$). It is found that duration of euglobulin fibrinogen is increased ($p<0.05$). Meanwhile, during all the periods ACT-reactions (6,8 and 10 min) are, in contrary, shortening time wise, especially this process is salient in group 2 ($p<0.05$).

On the basis of the extensive blood-hemostasiogram, taken of pleural cavity in dependence to technical exfusion speed (slow and fast modes of aspiration) in CC, we have found that thrombocytes' number is synchronically decreased in both groups, as well as their adhesion and aggregation ($p<0.05$ and $p<0.05$). In both groups there is observed shortening of thrombin and prothrombin times. Typically, this synchrony and regularity are same in relation to blood-coagulation. Such synchrony is observed in both EC and CC.

Thus, it is obvious in CC and EC, that the dynamic of time shortening in the group 2 is more intensive, than in the 1st one. At the same time as far as both materials, (experimental and clinical) prothrombin time is shortening faster than thrombin time.

As for the fibrinogen concentration, it is definitely increased in the compared groups by data of both – EC and CC. In detail, fibrinogen is increased up to 2.4(0.3)g/l in EC of the 1st group, and to 3.1(0.2) g/l in the EC of the 2nd group, in contrast to the controlled meaning – 1.9(0.2) g/l ($p<0.05$ and $p<0.05$).

In CC indexes have, relatively, 2.6(0.2) g/l and 3.3(0.6) g/l ($p<0.05$ and $p<0.05$). Duration of euglobulin fibrinogen is increased synchronically with that process ($p<0.05$) in both examination materials. It is found that the periods of ACT-reactions (6,8 and 10 min) are shortening, especially in group 2, in average, by 2 times ($p<0.05$).

Conflict of interest: None to declare

Authorship: J.A. C., D. M. S. equally contributed to the study and preparation of manuscript

Acknowledgement and funding: None to declare

References

1. Barash PJ, Kullen BF, Stalting RK, eds. Clinical anesthesiology (text).Transl. from Eng. V.J. Rodionov. M.: Medical literature; 2004. 592p.
2. Bogomazova, I.V. Replenishment of intraoperative blood-loss in abdominal hysterectomy. Autoref. Dis. Cand. Of Med. Sc. M.: 2005. 23p.
3. Buidenok, Iu. V. Strategy of anesthesiology provision in extensive combined surgeries and massive blood-loss in oncologic-surgery. Autoref. Dis. Doct.Med.Sc. M.: 2005. 48p.
4. Vorobiev AI, Gorodetsky VM, Shulutko EM, Vasiliev SA, eds. Acute massive blood-loss. M.: GOETAR-MED; 2001. 176p.
5. Dutkevich IG. Pathogenic explanation of principles of transfusion therapy of acute blood-loss. Transfusiology 2001; 5: 30-40.
6. Kobzeva, EN. Technical reinfusion in emergency surgery. Autoref. Dis. Cand. of Med. Sc. M.: 2002. 27p.
7. Khvatov, VB. Clinical transfusiology under emergency conditions (modern concepts and prospectives). M.: SRI SP of N.V. Sklifosovsky; 2003. 27p.
8. Khvichia LO, Korshunov GV. Algorithm of express-diagnostics of functional conditions of the hemostasis systems. Clin. & Lab diagnostics 2000; 10: 18-9.

CONFERENCE PAPER

Heart, Vessels and Transplantation 2019; 3: 208-213.
Doi: : 10.24969/hvt.2019.148

Stent grafts implantation in patients with life-threatening aortic conditions – first experience in Kyrgyz Republic

Abdyldaev I.Z., Chevgun S.D., Aripov M.A., Bebezov I.H., Chukubaev M.A., Cholponbaev D. Ch., Nurbekov K.N., Daniyarov B.S., Toktosunova D.B.

International School of Medicine, Bishkek, Kyrgyzstan

Abstract

Objective: Aortic diseases remain an acute and debatable problem. Among all the aortic pathologies, the most dangerous are dynamic aneurysmal expansion, traumatic dissections and / or aneurysms, pure aortic intima dissections. Contemporary and less invasive treatment method is the stent graft implantation into aorta.

This report describes the first experience of thoracic endovascular aortic repair (TEVAR) and endovascular aneurysm repair (EVAR) in the Kyrgyz Republic in consecutive patients with life-threatening aortic conditions.

Methods: Nine patients, who underwent TEVAR and EVAR, were presented after all clinical examinations, echocardiography and computed tomography angiography with various life-threatening aortic diseases. Among the pathologies there were 2 (22.2%) dissections only, traumatic aneurysm 1 (11.1%), aneurysm without dissection 1 (11.1%), aneurysm with intimal dissection 5 (55.6%). Seven patients with dissection had type B (The Stanford classification).

Results: TEVAR was performed in eight cases EVAR just in one. All patients reached the 6-month endpoint. None of the following, such as aneurysm expansion, aneurysm thrombosis or a functioning of false lumen at the sites of the stent graft implantation has been recorded. In addition, no further progression of the false lumen below the implantation zones was visualized. Mean diameter of stent grafts was 31.4(4.8) mm and 188.9(34.6) mm in length.

Conclusion: This modest observation showed the effectiveness of stent grafts implantation procedures in various aortic life-threatening conditions, such as aneurysm and / or aortic intima dissection.

Key words: thoracic endovascular aortic repair (TEVAR), endovascular aneurysm repair (EVAR), life-threatening aortic conditions, aortic aneurysm, aortic dissection, stent graft

(Heart Vess Transplant 2019; 3: 208-13. doi: 10.24969/hvt.2019.148)

Introduction

Aortic diseases remain an acute and debatable problem. Among all the aortic pathologies, the most dangerous are dynamic aneurysmal expansion, traumatic dissections and/or aneurysms, pure aortic intima dissections.

Aortic aneurysms (AAs) are more common in men than in women. Abdominal AA prevalence rates are estimated at 1.3–8.9% in men and 1.0–2.2% in women and are more often located in the infrarenal segment. However, thoracic aortic aneurysms (TAAs) have an estimated incidence of at least 5-10 per 100.000 person-years. According to location, TAAs are classified into aortic root or ascending aortic aneurysms, which are most common (≈60%), followed by aneurysms of the descending aorta (≈35%) and aortic arch (<10%). Aneurysm over time may undergo dissection or rupture

Acute aortic syndrome (AAS) is the modern term that includes aortic dissection, intramural hematoma (IMH), and symptomatic aortic ulcer. In the classic sense, acute aortic dissection requires a tear in the aortic intima that is commonly preceded by medial wall degeneration or cystic media necrosis. Blood passes through the tear separating the

Address for Correspondence: Semen Schevgun, International School of Medicine, Bishkek, Kyrgyzstan, Email: schevgun@mail.ru
Phone No: +996 550 177 377

intima from the media or adventitia, creating a false lumen. Propagation of the dissection can proceed in anterograde or retrograde fashion from the initial tear involving side branches and causing complications such as malperfusion syndromes, tamponade, or aortic valve insufficiency. By convention, acute disease is distinguished from chronic disease at an arbitrary time point of two weeks from initial clinical presentation (hyperacute: <24 hours, acute: 1 to 14 days, subacute: >14 to 90 days, chronic: >90 days) and is typically manifested with symptoms (3-9).

Patients with AA and dissections undergo open aortic procedures, which often lead to complications and death. Contemporary and less invasive treatment method is the stent graft implantation into aorta. However, this requires certain skills. This report is focused on the first stents grafts implantation experience, in the nine consecutive patients, in Kyrgyzstan.

Methods

Patients were presented after all clinical examinations, echocardiography and computed tomography (CT) angiography with various life-threatening aortic diseases. Among the pathologies there were 2 (22.2%) dissections only, traumatic aneurysm 1 (11.1%), aneurysm without dissection 1 (11.1%), aneurysm with intimal dissection 5 (55.6%). Mean diameter of aneurysms was 6.8 (2.1) cm. Seven patients with dissection had type B (The Stanford classification). Five (55.6%) patients were females. One patient had Marfan syndrome and underwent the David procedure due to type A dissection. After that, type B dissection was detected (The Stanford classification). We reported about it earlier (10). Another patient previously had coronary artery stenting for a two-vessel lesion. We further noted this. The main basic characteristics are presented in Table 1. Also in one of the cases, according to CT angiography, there was the filling of the right renal artery from the aortic false lumen (case presentation).

Technique of procedures

After clinical preparation and received consent, patients were transferred to catheterization laboratory. General anesthesia and intubation were applied. After clinical manifestations of coronary heart disease and presence of the indirect indications (age, hypercholesterolemia) established, the angiography of the coronary arteries was performed (radial approach). Then, the bifurcation of the common femoral artery was separated (at the right side in TEVAR, on both sides in EVAR). The artery was approximated by tourniquets. Puncture and the introducer insertion were performed above the bifurcation site. A pigtail catheter was inserted with the guidewire to the aortic root. Then superstiff or extrastiff guidewire was installed. For angiography, a second catheter was placed simultaneously through the radial approach above the proximal tear or the neck of the aneurysm. We performed short images for better positioning of the stent graft.

Table 1. Baseline characteristics

Characteristics	Number (n=9)	%
Mean age	71.2 (5.8) years	
Female	5	55.6
Chest pain at presentation	7	77.8
Diabetes mellitus	1	11.1
Hypertension	8	88.9
Smoking	4	44.4
Hypercholesterolemia	6	66.7
Congestive heart disease presentation	7	77.8
Glomerular filtration rate (MDRD)	73.8 (21.4) ml/min/173 m^2	
Hemoglobin	138.7 (28.9) g/l	

After successful placement, the delivery system was removed. A post-dilatation was done to the aortic balloon in the presence of incomplete placement or endoleaks. The puncture site and the wound were sutured and control was carried out regularly.

Endpoints

Full and correct placement of stent graft during implantation; postoperative absence of endoleaks; all-cause mortality, neurological, organs and extremities deficits, further dissection, expansion and absence of aneurysm thrombosis were included in the 6-month follow-up. The patients were also followed-up with echocardiography, ultrasound with Doppler and CT angiography.

Statistical analysis: We used descriptive statistics to present data.

Results

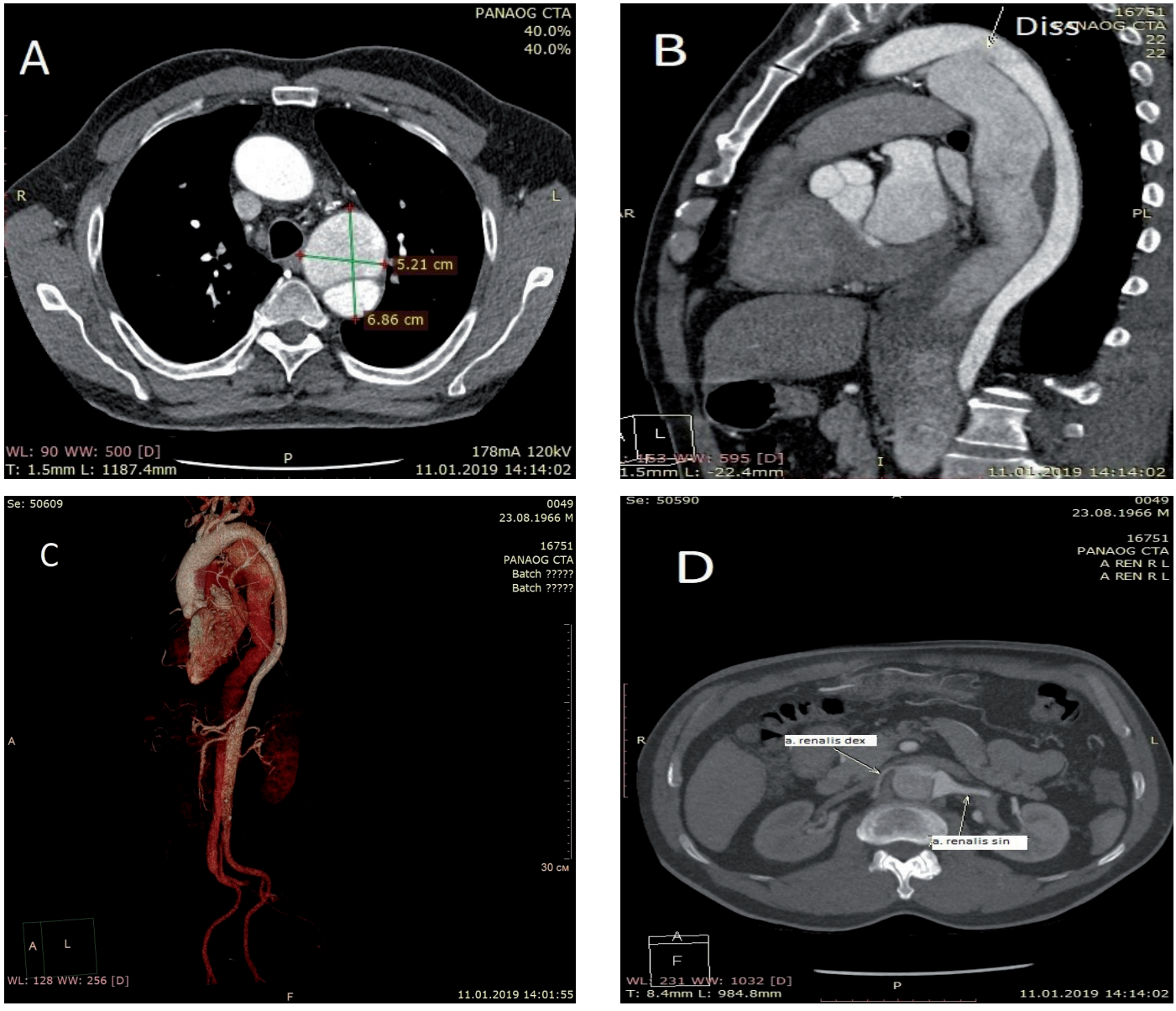
Thoracic endovascular aortic repair (TEVAR) was done in eight cases with one endovascular aneurysm repair (EVAR) performed. According to the angiography, two patients had significant lesions of the coronary arteries. Among patients who underwent TEVAR, 3 (33%) had a concomitant thrombosed infrarenal aneurysm.

As a result of the analysis, we obtained satisfactory outcomes. All patients reached the 6-month endpoint. We have not recorded any aneurysm expansion, lack of aneurysm thrombosis or a functioning false lumen at the sites of the stent graft implantation. In addition, no further progression of the false lumen below the implantation zones was visualized. Mean diameter of stent grafts was 31.4 (4.8) mm and is 188.9 (34.6) mm in length. Valiant Thoracic Stent Graft with the Captivia Delivery System/ Endurant II Stent Graft System (Medtronic, Ireland) and Seal Thoracic Stent Graft (S&G Biotech, South Korea) were used. All patients underwent full deployment of the stents graft. One patient underwent additional balloon adjustment due to the presence of endoleak III.

Two patients (22.2%) had the procedure with left subclavian arteries overlapping. One patient had a filling of the right renal artery from the false lumen before the procedure. There was no 6-month examination based evidence of neurological, organs and extremities deficits.

Case report

Patient U., 53 years old male was admitted with suspicion of acute coronary syndrome. After the necessary studies, coronary angiography, CT angiography revealed acute aortic syndrome (thoracic aortic aneurysm and dissection to the right common iliac artery: entrance tear at the left subclavian artery (LSA) orifice, secondary tears near renal and superior mesenteric arteries, and the right renal artery was filled from the false lumen. EF–33%; Hb–144g/l; serum creatinine-119mcm/l. The patient had longstanding hypertension (max. 300 mm Hg) and congestive heart failure. The patient was receiving therapy for controlled hypotension. After preparation, stent graft was implanted Valiant Thoracic Stent Graft with the Captivia Delivery System (Medtronic, Ireland) with overlapping of LSA. After 6 month, CT angiography was showing thrombosed false lumen (Fig. 1) in stent graft zone and functioning distal fenestra. Doppler showed satisfactory blood flow velocity on LSA and right renal artery.



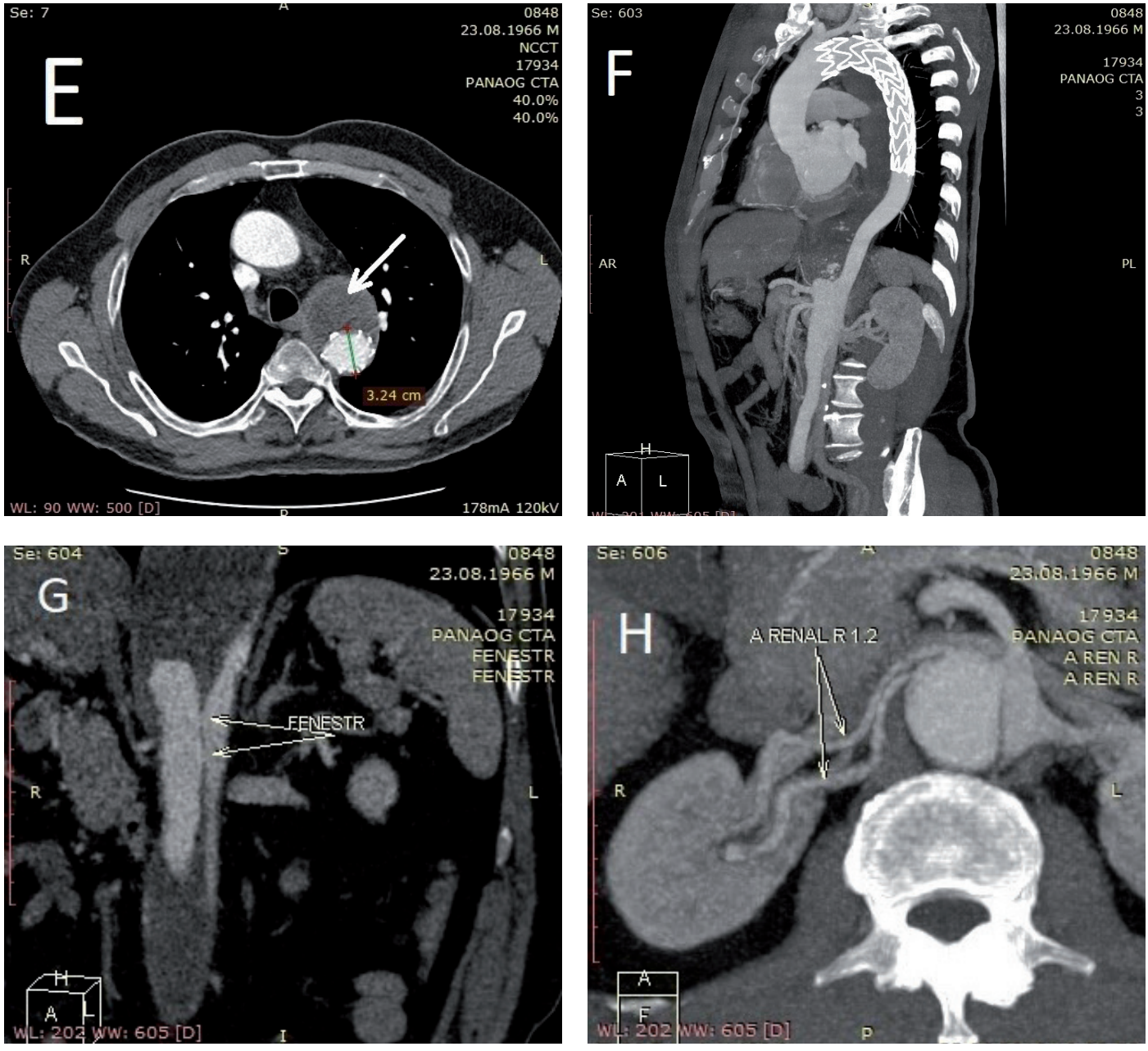


Figure 1. A, B - thoracic aortic aneurysm and dissection (arrow); C – common aortic 3D view; D – originate of renal arteries; E – implanted stent graft (arrow is pointing to thrombosed false lumen; F – implanted stent graft in section; G – lower tear (mesenteric zone); H - origination of renal arteries (right from false).

Discussion

Despite the lack of necessary circumstances for the development and implementation of stent grafts implantation procedures in Kyrgyzstan, it still can be done. In many ways, this procedure remains non - alternative method to prevent adverse events. Severe comorbidity, localization of aneurysms in the thoracic aorta, long distal dissection, and the hazard of the open intervention necessitate a greater consideration of the TEVAR and EVAR procedures.

Survival of patients with thoracic aorta aneurysm in the natural course of the disease (no surgery) can be represented as follows: 65% - within 1 year; 36% - for 3 years; 20% - for 5 years (11). AA dissection and its rupture with bleeding into the pericardial or pleural cavity are complications of an aortic aneurysm. The main reason for dissecting aortic aneurysms is arterial hypertension (12-14). Studies suggest an incidence of 2.6 to 3.5 cases per 100 000 person-years. In a review of 464 patients from the International Registry of Acute Aortic Dissection (IRAD), two thirds were male, with a mean age

of all patients as old as 63 years. Although less frequently affected by acute aortic dissection, women were significantly older than men, with a mean age of 67 years (15). There are many risk conditions for aortic dissection. The most common predisposing factor in IRAD is hypertension (72%). A history of atherosclerosis was present in 31% and a history of cardiac surgery in 18%. In the total registry, 5% and 4% of acute aortic dissections were thought to be related to Marfan's syndrome and iatrogenic causes, respectively. Traumatic aortic injury (TAI) also is a life-threatening condition that requires prompt diagnosis and management. It accounts for many cases. It is estimated that aortic injuries are lethal in 80-90% of cases (16). Thirty-two percent of patients with type A AAS were aged >70 years. Fewer elderly than younger patients were managed surgically (64 versus 86%; p<0.0001). In-hospital mortality was higher among older patients (43 versus 28%; p=0.0006). Logistic regression analysis identified age >70 years as an independent predictor of hospital death for acute type A dissection. In general, mortality from aortic dissection remains from 10.5% (type B) to 32.5% (Type A) (17-19). Analysis of the young patients with dissection (less 40 years of age) revealed that younger patients were less likely to have a history of hypertension (34%) or atherosclerosis (1%) but were more likely to have Marfan's syndrome, bicuspid aortic valve, and/ or prior to aortic surgery (20). Based on our observations the majority of patients also had high blood pressure. In addition no deaths were recorded, which can change with the further enrollment of patients.

The most significant rupture risk predictor is the size of the aneurysm. The critical diameter of the TAA, at which the risk of rupture and dissection sharply increases, is 6.0-cm. The risk factor for TAA rupture, related to its size, is the growth rate of the aneurysm. The average TAA progression rate is 0.1 cm per year, for TAA with chronic dissection varies from 0.24 cm per year for small aneurysms (4.0 cm) to 0.48 cm per year for large aneurysms (8.0 cm) (21).

As a rule, the identification of life-threatening conditions of the aorta at the stage of uncomplicated aneurysms, requiring a drug-based approach, is small and random. This represents a huge challenge. Most often, patients are hospitalized with complications, such as dissection. Obvious is the necessity to inform patients about successful stent grafts implantations experience, the creation of logistics and adding to national guidelines.

Conclusion

This modest observation showed the effectiveness of stent grafts implantation procedures in various aortic life-threatening conditions, such as aneurysm and / or aortic intima dissection. It is necessary to increase the number of patients, the follow - up period and the further development of this method in the Kyrgyz Republic.

Conflict of interest: None to declare

Authorship: A.I.Z., Ch. S. D., A.M.A., B. I.H., Ch.M. A., Ch. D. Ch., N. K.N, D. B.S. equally contributed to the study and preparation of manuscript

Acknowledgement and funding: None to declare

References

1. Lederle FA, Johnson GR, Wilson SE, Chute EP, Hye RJ, Makaroun MS. The aneurysm detection and management study screening program: validation cohort and final results. Arch Intern Med 2000; 160: 1425-30.
2. Kuzmik GA, Sang AX, Elefteriades JA. Natural history of thoracic aortic aneurysms. J Vasc Surg 2012; 56: 565.
3. Larson EW, Edwards WD. Risk factors for aortic dissection: a necropsy study of 161 cases. Am J Cardiol 1984; 53: 849-55.
4. Meszaros I, Morocz J, Szlavi J, Schmidt J, Tornoci L, Nagy L, et al. Epidemiology and clinicopathology of aortic dissection. Chest 2000; 117: 1271-8.
5. Roberts CS, Roberts WC. Aortic dissection with the entrance tear in the descending thoracic aorta: analysis of 40 necropsy patients. Ann Surg 1991; 213: 356 –68.
6. Masuda Y, Takanashi K, Takasu J, Watanabe S. Natural history and prognosis of medical treatment for the patients with aortic dissections. Nippon Geka Gakkai Zasshi 1996; 97: 890-3.
7. Bogaert J, Meyns B, Rademakers FE, Bosmans H, Verschakelen J, Flameng W, et al. Follow-up of aortic dissection: contribution of MR angiography for evaluation of the abdominal aorta and its branches. Eur Radiol 1997; 7: 695–702.
8. Thomas T, Christoph AN, Kim AE. Acute aortic syndromes. Circulation 2005; 112: 3802-13.
9. Corvera JS. Acute aortic syndrome. Ann Cardiothorac Surg 2016; 5: 188-93.
10. Aripov MA, Abdyldaev IZ, Chevgun SD, Daniyarov BS, Toktosunova DB, Sarbaev AM. Dissection of descending aorta treated by stent-graft implantation in a patient with Marfan syndrome. Heart Vessels Transplantation 2017: 1; 20-5.
11. Isselbacher EM. Diseases of the aorta. In: Braunwald E, Zipes DP, Libby P, Bonow RO., eds. Braunwald's heart disease: A textbook of cardiovascular medicine. 7th ed. Philadelphia: W.B. Saunders Co.; 2001. p.1422—56.
12. Belenkov YuN, Oganov RG. Cardiology: national guidelines. Abridged version. Moscow: GEOTAR-Media; 2012.
13. Pozdnyakov YuM, Volkov VS. Chest pain. Moscow: Sinergiya; 2006.
14. Savel'ev VS, Kirienko AI. Vascular surgery: national guidelines. Abridged version. Moscow: GEOTAR-Media; 2014.
15. Nienaber CA, Fattori R, Mehta RH, Richartz BM, Evangelista A, Petzsch M, et al. Gender-related differences in acute aortic dissection. Circulation 2004; 109: 3014 –21.

16. Cullen EL, Lantz EJ, Johnson CM, Young PhM. Traumatic aortic injury: CT findings, mimics, and therapeutic options. Cardiovasc Diagn Ther 2014; 4: 238–44.

17. Hagan PG, Nienaber CA, Isselbacher EM, Bruckman D, Karavite DJ, Russman PL, et al. The International Registry of Acute Aortic Dissection (IRAD): new insights into an old disease. JAMA 2000; 283: 897–903.

18. Mehta RH, Suzuki T, Bossone E. Predicting death in patients with acute type A aortic dissection. Circulation 2002; 105: 200–6.

19. Suzuki T, Metha R, Ince H. Clinical profiles and outcomes of acute type B aortic dissection in the current era: Lessons from the international registry of aortic dissection (IRAD). Circulation 2003; 108(Suppl. II):II-312–7.

20. Januzzi JL, Isselbacher EM, Fattori R, Cooper JV, Smith DE, Fang J, et al. Characterizing the young patient with aortic dissection: results from the International Registry of Aortic Dissection (IRAD). J Am Coll Cardiol 2004; 43: 665–9.

21. Podzoklov VI, Vargina TS. Acute aortic syndrome. Clinical medicine 2017; 95: 9.

CONFERENCE PAPER

Heart, Vessels and Transplantation 2019; 3: 214-216.
Doi: : 10.24969/hvt.2019.148

Circadian biorhythms of indicators of the cardio-respiratory system in children with bronchial asthma

Orozali Uzakov, Vladimir Alekseyev

International School of Medicine, Bishkek, Kyrgyzstan

Abstract

The paper presents the results of variability of indicators of the cardio-respiratory system in 24 children with bronchial asthma. Circadian recurrence of changes in bronchial obstruction, lung capacity, heart rate, beat and per-minute volume indicators have been established, which are necessary for the individualization of pharmacotherapy of bronchial asthma.

Key words: children, bronchial asthma, daily biorhythms, indicators of the cardio-respiratory system

(Heart Vess Transplant 2019; 3: 214-16. doi: 10.24969/hvt.2019.148)

Introduction

Cardio-respiratory system indicators may exhibit circadian variations in bronchial asthma (1-3). Chronopharmacology (4) has been widely developing. It make possible not only to detect occurring changes at different stages of the disease to determine regulatory mechanisms, but also to look for ways to correct these abnormalities, by means of influencing pathological mechanisms in vivo and in accordance with existing rhythms (1,5).

Currently, the circadian rhythms of a person are most well studied. A relatively short period of these rhythms allows them to be studied in a clinic. Insufficient data on the state of circadian rhythms in children with asthma in conditions of lowlands urged us to conduct a comparative analysis of the circadian rhythms of the cardio-respiratory system.

Purpose of research: To establish the daily variability of the indicators of the cardio-respiratory system in children with bronchial asthma.

Methods

We have studied the daily variability of the functional state of the cardio-respiratory system in 24 children with bronchial asthma, aged 14-15 years. Measurements of the integral parameters, including heart rate (HR), cardiac stroke volume (CSV), cardiac output (CO), vital lung capacity (VC), and forced expiratory volume for 1 second (FEV1) were performed 6 times a day at intervals of 4 hours each. The functioning parameters were determined by methods of tetrapolar thoracic rheography and spirometry.

Results and Discussion

The analysis of the obtained material by the method of Cosinor-Analysis 2.4 for Excel 2000 / XP (2) made it possible to establish a relatively well-defined near-daily periodicity of indicators of the cardio-respiratory system in children with bronchial asthma who were in in-patient condition. The analysis of the circadian rhythm of the pulse showed that its circadian acrophase occurs in the morning hours - 6.46, with a confidence interval from 5.31 to 7.67 hours and an amplitude of 16 beats per minute (Table 1).

Address for Correspondence: Orozali Uzakov, International School of Medicine, Bishkek, Kyrgyzstan,
Email: oroz7@mail.ru, Mobile: +996 555484950

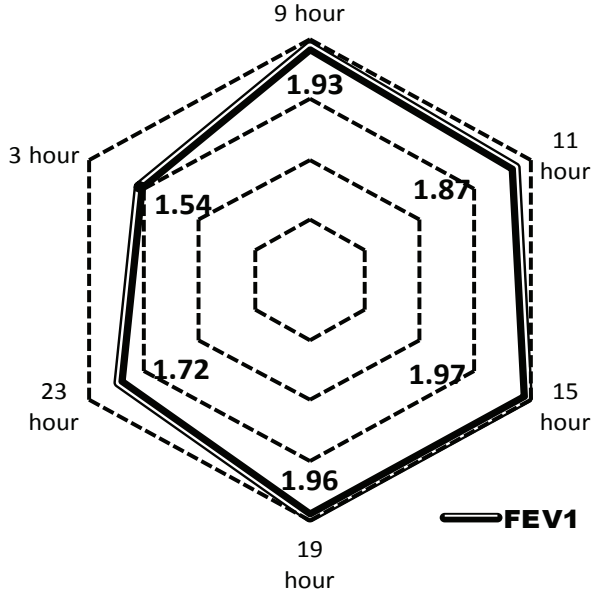
Table 1. Circadian rhythms of the cardio-respiratory system in children with bronchial asthma

Indicators	CPR*	CAI*	Level	Period	Amplitude	Acrophase
HR	0.99 0.97	-1.09 -1.49	78.3 78.04	21.3	16.65 15.75	6.4 7.47
CSV	0.94 0.95	-11.27 -8.27	75.2 78.7	21.3	16.53	15.41 17.3
CO	0.9 0.92	-15.16 -7.14	5.79 5.82	21.3	1.03	15.31 17.51
VC	0.92 0.95	-1.42 -5.37	2.39 2.37	24.00	1.07 0.80	13.46 16.09
FEV1	-0.9 0.91	-3.19 -9.83	1.84 1.82	24	0.18 0.15	14.35 14.42
*Circadian periodicity ratio (CPR), **Circadian adaptability indicator (CAI) CO - cardiac output, CSV - cardiac stroke volume, FEV1 - forced expiratory volume for 1 second, HR - heart rate, VC - vital lung capacity						

The acrophase shift in heart rate was more than 6 hours, compared to healthy ones. The indicators of CSV and CO are characterized by temporary synchronization, with their circadian acrophases occurring at 15-17 hours and are almost in the same time interval as indicators characteristic of healthy people. At the same time, a distinct phase shift and their circadian acrophases in relative antiphase were detected between the heart rate and the parameters of cardiac output) (heart rate - at 6 hours and 46 minutes, and CSV, CO - at 15-17 hours).

Analysis of indicators of the function of external respiration showed that the main ones of them (VC FEV1) change in phase, i.e. there is overlapping of confidence intervals for their acrophases, both among themselves and when compared with indicators characteristic of healthy people. However, the study of the circadian dynamics of the volume of forced output for 1 sec. revealed other patterns. So, in the daytime hours (7, 15, 19) the highest FEV1 values were noted, and in the night hours (23.3) FEV1decreased to its minimum value (1.54 l.), i.e. there was an inversion of the circadian periodicity ratio with a minus sign (CPR = -0.9).

Therefore, indicators characterizing bronchial patency in the daytime turned out to be relatively high, and at night it was minimal, which should be taken into account when determining the time of prescribing therapeutic measures for bronchial asthma in children.



Circadian amplitude = 1.81

Mesor = 1.83

Acrophase =16.43

Figure 1. The circadian variability of the characteristics of the average FEV1 indices in children with bronchial asthma

Taking into account the synchronization ratio of functions, a certain relationship was established between the individual parameters of cardio-hemodynamics and indicators characterizing bronchial patency.

A comparison of the results of these two groups of parameters made it possible to establish the following regularities. The main indicators of cardio-hemodynamic activity of the heart (CSV and CO), pulmonary volumes, airway conductance (FEV1) were interrelated, which was confirmed by the proximity of their circadian acrophases in one time sector (during the daytime in the time sector of 14-15.3 hours). At the same time, the maximum value of the heart rate and the volume of forced output in 1 sec. were in different circadian time sectors (for heart rate -7 hours, against 12-17 hours for FEV1).

The circadian dynamics of bronchial patency indicators was characterized by its deterioration at night with the minimum values being at 23 and 3 a.m., while the highest average values of this indicator were at 15 and 19 hours (Fig. 1).

It should be noted that, along with well-defined circadian biorhythms with periods equal to 18-28 hours, our studies revealed usually "hidden" cyclic components with periods relatively smoothly changing in at least the following four time ranges: 8,9,10 12 hours. These "hidden" cyclic components of various parameters for all four-time ranges are comparatively synchronized with similar circadian components.

Thus, the obtained research results testify to the presence in the body of children with bronchial asthma of a clear daily (circadian) biorhythm of the parameters of the cardio-respiratory system, which is consistent with previously established facts (3, 6). At the same time, a comparison of the dynamics of the circadian rhythms of the indicators of the cardio-respiratory system in children with bronchial asthma and healthy ones revealed their difference in acrophases, amplitudes, and average circadian level of parameters.

The main indicators of cardio-hemodynamics (CSV,CO) and airway conductance parameters are interconnected, which is confirmed by the close proximity of circadian acrophases in one time sector, as well as by overlapping of confidence intervals, while some indicators are in relative antiphases (heart rate and CV, FEV1), which may indicate some inconsistency in their functions.

Conclusion: When optimizing and choosing the time of pharmacotherapy, it is advisable to take into account information about the system most requiring relevant correction, the increase in activity of which is possible and necessary in the process of restoring impaired functions. As the main rhythm marker, we recommend considering the state of airway conductance, since the stimulation of bronchodilation mechanisms in children with bronchial asthma is pathogenetically substantiated.

Conflict of interest: None to declare

Authorship: O.U., V.A. equally contributed to the study and preparation of manuscript

Acknowledgement and funding: None to declare

References

1. Babak S.L., Chuchalin A.G. Nocturnal asthma. RMJ 1998; 17: 3-5.
2. Sheremetyev SN. Grass on the gradient of soil moisture: (water exchange and structural-functional Org.) In: VL Komarov VL, ed. Botanic garden - Moscow: Partnership of scientific editions KMK; 2005 (M.: Type. "Science") – p.270.
3. Ballard RD. Sleep, respiratory physiology, and nocturnal asthma. Chronobiol Int 1999; 16: 565-80.
4. Bairy LK. Chronotherapeutics: A Hype or future of chronopharmacology. Indian J Pharmacol 2013; 45: 545–6.
5. Baraldo M. The influence of circadian rhythms on the kinetics of drugs in humans. Exp Opin Drug Metab Toxicol 2008; 4: 175-92.
6. Gervais P, Reinberg A, Gervais C, Smolensky M, DeFRance O. Twenty-four-hour rhythm in the bronchial hyperreactivity to house dust in asthmatics. J Aller Clin Immun 1977; 59: 207–13.

CONFERENCE PAPER

Heart, Vessels and Transplantation 2019; 3: 217-225.
Doi: : 10.24969/hvt.2019.148

Possibilities of endobiliary stenting with complex choledocholithiasis

V.V.Yurchenko[1], O.J.Uzakov[2]

[1] FSBI "1409 VMKG MO", Kaliningrad, Russian Federation

[2] International School of Medicine, Bishkek, Kyrgyz Republic

Abstract

Objective: The aim of the study was to increase the effectiveness and safety of endosurgical treatment of choledocholithiasis.

Methods: The set goal is achieved by studying the causes of unsatisfactory results of lithoextractions, improving its tactics and technology. Patients with known predictors of the futility of lithoextraction were excluded from the study. Based on the study of other causes of inefficiency namely strangulation of calculi with a basket, progression of obstructive jaundice, the addition of purulent cholangitis or postpapillotomy bleeding some new tactical rules and endosurgical techniques were formulated. Their effectiveness was tested in group of patients.

Results: When comparing the research and control groups, a decrease in the frequency of endosurgical treatment of choledocholithiasis was revealed.

Conclusion: The effectiveness of the proposed tactical principles and technological techniques has been proved.

Key words: endoscopic papillosphinctertomy, endoscopic lithoextraction, obstructive jaundice, purulent cholangitis, postpapillotomy bleeding

(Heart Vess Transplant 2019; 3: 217-25. doi: 10.24969/hvt.2019.148)

Introduction

Currently, endosurgical treatment of bile duct calculi has become of significance in the treatment of this pathology (1, 2). The introduction into clinical practice of baskets of various sizes and configurations (3-5), various lithotripsy methods (6, 7) considerably increased the possibilities and the safety of their endoscopic debridement. Sufficient clinical material made it possible to significantly improve the "tactics of X-ray endoscopic treatment of choledocholithiasis" (8, 9), assessing its potential (10, 11).

Despite this, there are still clinical observations when it is necessary to perform an open laparotomy with choledocholithotomy sometimes against the background of not only high obstructive jaundice, but also purulent cholangitis, which does not always end in the patient's recovery (12, 13). In addition, while patients with a preserved gallbladder with a risk of open intervention can still be reconciled, then in patients with postcholecystectomy syndrome the need for laparotomy in the conditions of altered anatomical ratios against the background of adhesions in the subhepatic space can hardly inspire optimism.

Of course, the reasons for such unsatisfactory results can be both the lack of competence of both the attending physician and the endoscopist, as well as the lack of tactical principles and technological methods of the discussed treatment method that are scientifically substantiated by appropriate studies. Until now, generally accepted complex clinical observations (14, 15) are recognized as those occurring with high jaundice, complicated, in particular, by disorders in the hemostatic system or purulent cholangitis, relatively large calculi of hepaticocele, not amenable to passage through the distal section of the choledoch and even through the entire common bile duct (CBD). However, as practice has shown, this does not exhaust the list of criteria for "complexity" (16).

In some surgical treatment facilities, the department heads, the clinical management staff adhere to the following

Address for Correspondence: Orozali Uzakov, International School of Medicine, Bishkek, Kyrgyzstan,
Email: oroz7@mail.ru, Mobile: +996 555484950

algorithm: "the only attempt in endosurgical treatment, in case of failure or when coming across non-standard ratios is laparotomy, choledocholithotomy". According to the author, this tactic is somewhat simplified in modern conditions, since it does not take into account the possibilities of multi-stage endosurgical treatment of choledocholithiasis with inter-stage stenting, and in patients with high operational risk it needs correction and specification. Undoubtedly, the role of lithotripsy in the effectiveness of the treatment of choledocholithiasis is difficult to overestimate, however, even fragmented calculi must be extracted, before that, it is necessary to reliably capture them and pass through the lumen of the main bile ducts, and therefore the improvement of lithoextraction is relevant.

Methods

Under the supervision there were 562 patients who in the period 2001-2014 underwent hospital treatment at MBUZ "City Clinical Hospital №6 named after N.S. Karpovich ", city of Krasnoyarsk (2001-2009), Research Institute of the Ministry of Railways under the Russian Academy of Medical Sciences (2001-2013), KGBUZ" Krasnoyarsk Regional Clinical Oncology Center named after A.I. Kryzhanovsky (2001-2013), KGBUZ Krasnoyarsk Interdistrict Clinical Hospital No. 7 (2001-2013), Siberian Clinical Center FMBA of the Russian Federation (2001-2007), MBUZ GKB No. 1, Krasnoyarsk (2000-2005), GBUZ RH "Abakan City Clinical Hospital" (2008-2013), GBUZ RH "Clinical Oncology Dispensary" (2009-2013), MLPU "Sayanogorsk City Hospital No. 2" (2009) , GBUZ "Regional Clinical Hospital of the Kaliningrad Region" (2012-2014) and GBUZ Kaliningrad Region "The Central City Clinical Hospital" (2013), GBUZ Kaliningrad Region "Sovetskaya Central City Hospital "(2013), of the Osh City Hospital (Republic of Kyrgyzstan, Osh, 2012-2014.), Senior Naval Clinical Hospital of the Baltic Fleet (2014.), GBUZ Kaliningrad" City hospital №1 ".

The criterion for inclusion in the study was choledocholithiasis. Since the complex cases of lithoextraction are generally recognized, the authors did not study these patients nor did they study the patients with incomplete (generally or sufficiently) operative access (endoscopic papillosphincterectomy, EPST) to the supraterminal sections of the common bile duct. Thus, the exclusion criteria from the study were:

1) the impossibility of performing EPST;

2) inadequate implementation of EPST *;

3) complete obturation with hepatic choledochus calculus with the impossibility of retrograde contrasting of suprastenotic expansion;

4) obstructive jaundice above 300 μmol / l;

5) uncorrectable disorders in the hemostatic system;

6) purulent cholangitis (before the start of lithoextraction);

7) the development in the process of multi-stage lithoextraction of acute cholecystitis, requiring surgical treatment;

8) the impossibility of conducting the calculi through the retroduodenal or intrapancreatic portions of the bile ducts due to the apparent discrepancy between the size of the calculus and the diameter of the ducts.

Of 562 patients, 2 groups were formed. The first group consisted of patients with endoscopic lithoextraction performed according to the generally accepted methodology (404 observations - 71.9%) (the causes of unsatisfactory results were studied in this group), the second group (158 patients - 28.1%) - using advanced technology and tactics. These groups were compared by the incidence of acute cholangitis and the level of inefficiency of endoscopic debridement of the bile ducts. The first group was divided into 2 subgroups. The first subgroup consisted of 346 patients (85.6% of all patients of the first group) with successful uncomplicated lithoextraction, regardless of its single or multi-phases.

The second subgroup consisted of 58 patients (14.4% of all patients of the first group) in with unsuccessful (23 patients, of whom there was a strangulation in one observation, and 2 after unsuccessful lithoextraction were limited due to age and concomitant pathology to stenting of hepatic choledochus only for stopping obstructive jaundice; the laparotomy and choledocholithotomy were performed in the remaining 20 cases; moreover, 10 patients had anicteric choledocholithiasis, 7 patients had progressive jaundice and 3 cases had non-stopping form) or complicated lithoextraction (as far as purulent cholangitis there were 30 observations, of which 2 patients succeeded in going through lithoextraction against the background of this complication, the postpapillotomy bleeding was revealed in 2 observations and the perforation of the CBD with the development of phlegmon of hepatoduodenal ligament was in 3 observations). In these subgroups, the occurrence of the following morphological features was compared:

1) multiple calculi;

2) calculi that are poorly visualized against the background of CBD;

3) aerobilia;

4) atypical pathological (Mirizzi syndrome) anatomical ratios of the common bile and cystic ducts;

5) atypical forms of calculi;

6) deformations and stenosis of hepatic choledochus;

7) high strangulations (Fig.1) due to a peculiar "sludge" of calculi (and not due to the narrowness of the underlying sections of the CBD i.e. endoscopic lithoextraction was not performed in these patients).

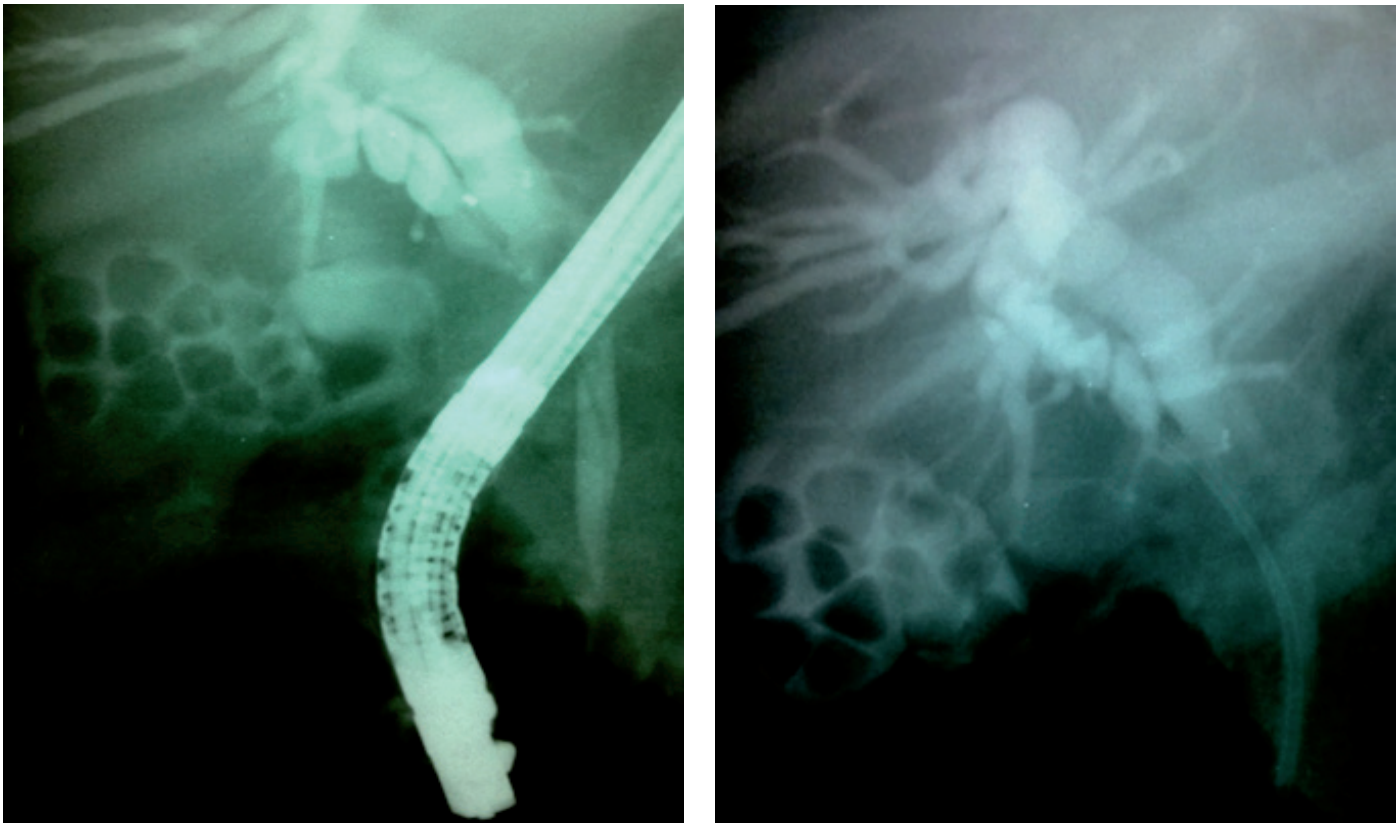


Figure 1. In the picture on the left, the strangulated conglomerate of calculi of the common bile duct is determined, in the picture on the right, it is drawn through the common bile duct, including suprastenotic expansion, into the cysticus stent, which ensures adequate bile flow, EPST was performed by duodenoscopes of Olympus and Pentax firms of the GIF-XQ30, IT-10 and FG-29F models.

We used standard Demling-type papillotomas and Olympus end-face models KD10Q-1, KD411Q, KD29Q. To create a diathermy effect, diathermocoagulators Olympus UES-10 were used. We used nitinol and steel baskets for lithoextraction Olympus, Endo-flex and KARLSTORZ.

Prior to the stent, all patients underwent ECST by cannulation (274 observations - 48.7%) and mixed procedures (pre-dissection, then selective cannulation of the CBD by an arc-shaped papillotome, followed by dissection before visualization of the choledochal lumen) (288 observations - 51.3%). Lithoextraction was carried out in the traditional way - under the control of X-ray, a basket was carried out for a calculus, it was opened, then it was removed with the capture of a calculus or it was opened directly when moving it to a calculus with its subsequent capture.

If it was impossible to remove (infringe) the captured calculus in the duodenum, the following technique was used: the maximally opened basket was moved in the proximal direction, the calculus in this case was partially released from the capture, after which the basket was closed with light traction.

Statistical analysis

Statistical processing of the material was carried out using the statistical software package Statistica 6.0. To compare the frequencies of qualitative characteristics in groups, nonparametric significance criteria were used (Fisher's F-test).

Results and discussion

A study (according to the second subgroup) showed that the reasons for the ineffectiveness of endosurgical treatment of choledocholithiasis were:

1) multiple small and medium (up to 0.8 cm.) calculi that do not leave free space for the basket to fully open (12 observations - 20.7% **);

2) calculi that are poorly visualized against the background of CBD, especially when combined with air that has got into the hepatocholedochus (5 observations - 8.6%);

3) calculi of CBD with atypical anatomical ratios of the common bile and cystic ducts (10 observations - 17.2%);

4) "irregular" *** (cylindrical), cubic, dumbbell shapes, etc. forms of calculi that impede their capture (8 observations - 13.8 %);

5) multiple calculi of "irregular" forms - 5 observations (8.6%);

6) a combination of choledocholithiasis with deformations and stenosis of hepatic choledochus (Fig. 2-4) - 6 observations (10.3%);

7) Mirizzi syndrome, which makes it difficult to determine the anatomical relationships and visualization (Fig. 5) - 7 observations (9.1%);

8) Mirizzi syndrome in combination with calculi of "irregular" form - 4 observations (6.9%);

9) high strangulations of the stone conglomerate (Fig. 1; 6) - 1 observation (1.8%).

A study with Mirizzi's syndrome, which complicates the determination of anatomical relationships and visualization, showed that lithoextraction is absolutely hopeless and very unsafe (of the seven failures, five were complicated by purulent cholangitis, and in one case, intrahepatic abscesses developed against its background). Based on the foregoing, this feature was considered by the authors as a contraindication to retrograde endosurgical treatment.

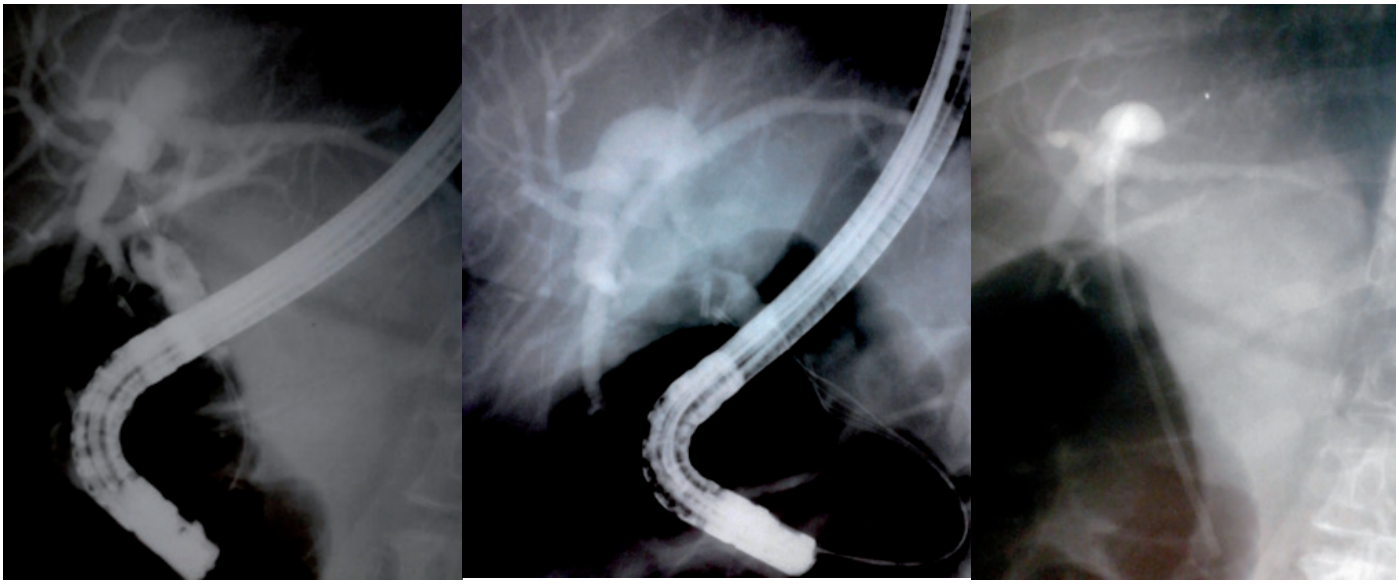


Figure 2. In the left picture, two stones of irregular shape of hepaticochocledoch combined with distal and proximal stenosis are determined; in the middle, the state after lithic extraction of the calculus is determined; in the right picture, the inter-stage stenting is determined with the stent passing through the distal and proximal stenosis into the intrahepatic ducts.

In order to overcome the above difficulties, the authors proposed the following set of technological and tactical rules.

In case of multiple calculi, especially of irregular shape, before capturing a distal calculus in order to prevent several stones (Fig. 6) from getting into the basket at once, it is advisable to free up space as much as possible via to the proximal dislocation of a higher lying (Fig. 7) calculus with a half-open basket.

The analysis showed that simultaneous attempts to completely resolve the bile duct with multiple calculi are accompanied by a decrease in safety due to iatrogenism (perforation of the common bile duct with the development of phlegmon of the hepatoduodenal ligament - 3 observations in the second subgroup (5.1%). In addition, its multi-stage implementation (Fig. 8) is characterized by higher efficiency and safety; however, the inter-stage intervals are complicated by the progression of obstructive jaundice and the addition of purulent cholangitis due to the dislocation of calculi into narrow distal CBD.

Prevention of this complication is achieved due to interstage **** stenting of the main bile ducts, and unlike interstep stenting (as a way to prevent postpapillotomy bleeding) with multi-stage EPST, there is no need for an endoprosthesis of the calculi proximally freely migrating along the choledochus, since the main purpose of this stenting is not only the preservation of the passage of bile, but also the obstruction of migration of calculus into the narrow distal sections of the common bile duct along with its strangulation. Therefore, the stent installed according to these indications should not rise above its retroduodenal part, except for cases of concomitant high stenosis (Fig. 2), and a stone conglomerate strangulated in the supraterminal departments (Fig. 1), when the stent should be conducted above, and it is allowed for it to be conducted into the cystic duct, if the strangulation occurred below its confluence with the hepaticochocledoch.

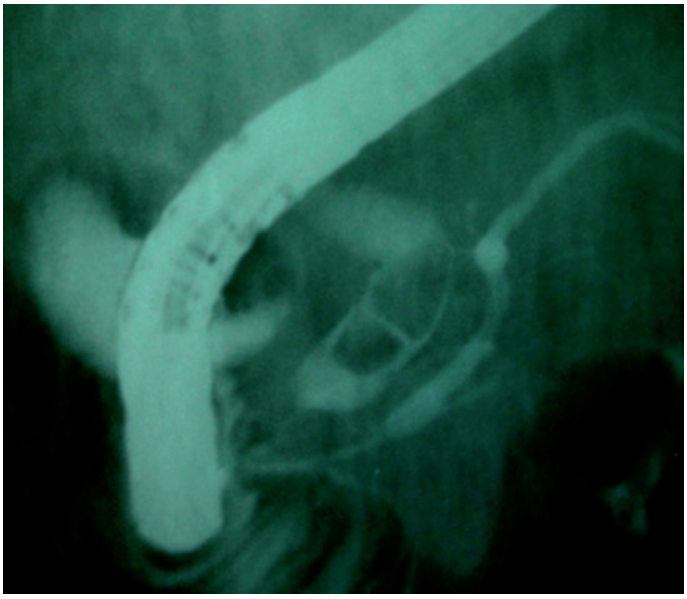
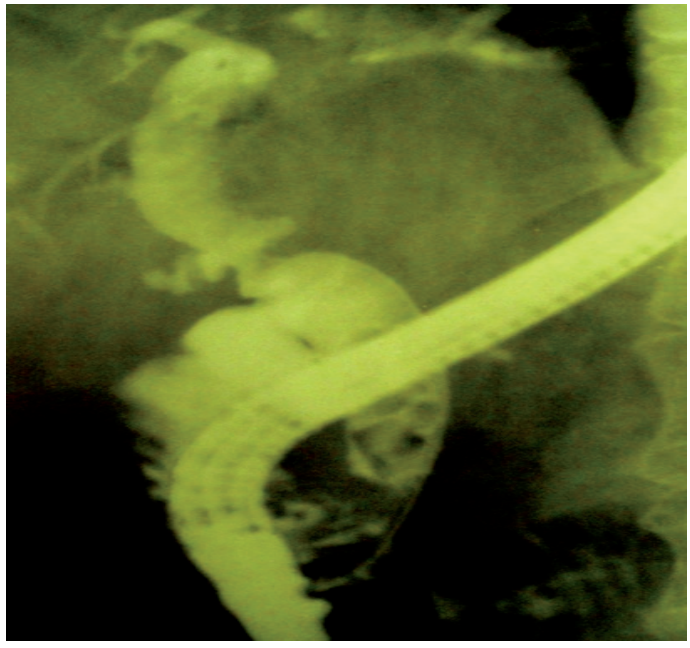


Figure 3. Irregular calculi with hepatic choledochus deformity are determined, limiting the free space for the basket to fully open

Figure 4.The calculus of the common hepatic duct with extended distal stenosis of hepaticohocledoch and its moderate deformity is determined



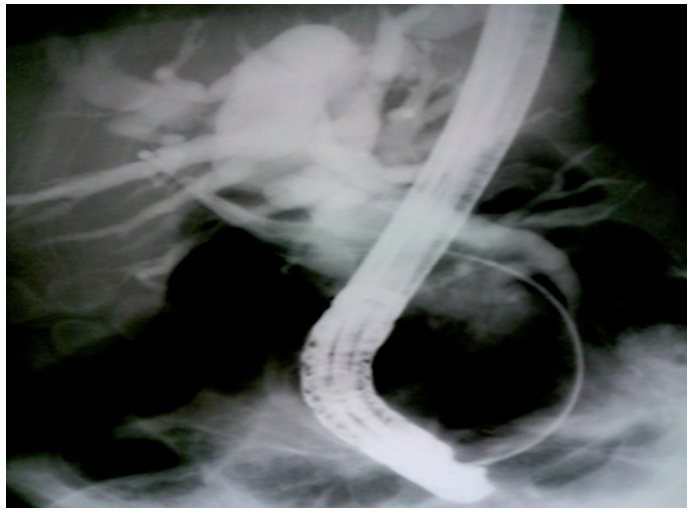


Figure 5. A sharp deletion of hepatic choledochus is determined with the "exit" of the basket beyond its boundaries and non-visualized calculi detected with type 2 Mirizzi syndrome only on laparotomy, choledocholithotomy

In case of an unintentional dislocation of the calculus in the common hepatic duct or in the area of high stenosis of the main bile ducts (Fig. 9) or when deliberately pushing in order to free up space to capture the "distal" calculus (Fig. 10) after its extraction, it is advisable to stop lithoextraction. Then offer the patient as much as possible his/her condition allows it, to stay in upright position (it's better to walk), and resume lithoextraction after 4 hours or the next day, when the calculus migrates on its own to more dilated distal areas.

When conducting a calculus through the retroduodenal and intrapancreatic departments of the common bile duct, it is advisable to change the direction of traction parallel to the bend of the choledochus.

Evaluating the effectiveness of each element of the proposed algorithm is an insoluble task (to obtain representative groups is hardly feasible even with multicenter research) and the meaning of this is very doubtful, since all elements are interconnected and consistently applicable, therefore they were evaluated in a complex (Table 1). The incidence of the above reasons for the inefficiency of endoscopic lithoextraction (according to the studied group) and their structure in the study and comparison groups is not statistically significant (Table 2).

Figure 6. The seizure of three calculi at once is determined by the basket, which prevents their passage along the common bile duct

As it is obvious, according to Table 1, the efficiency increased by 9.8% with an increase in safety by 5.5%, and on the condition of exclusion from both groups of patients with Mirizzi's syndrome, which complicates the determination the anatomical ratios and visualization (the authors consider this feature as a contraindication to endoscopic lithoextraction) by 9.4% and 4.4%, respectively. When comparing patients with identified reasons for the decrease in the efficiency of endoscopic lithoextraction of the first (the second subgroup with the exception of patients with Mirizzi's syndrome, which complicates the determination of the anatomical ratios and visualization - 51 patients) and the second group (also with the exception of patients with Mirizzi's syndrome, which makes it difficult to determine anatomical ratios and visualization - overall 19 patients) an even more pronounced advantage was revealed of the proposed tactics (Table 3): increased efficiency by 72.1%, safety - by 32.5%.

Conclusion

Mirizzi's syndrome, which complicates the determination of anatomical ratios and visualization, is an absolute contraindication to endosurgical retrograde treatment of choledocholithiasis. The maximum uncoupling of multiple calculi for the isolated capture of each with their multi-stage lithoextraction and inter-stenting, which does not prevent the migration of calculi into the most dilated sections of the main bile ducts in the inter-stage intervals, changing the direction of traction of the captured calculus in parallel to the bend of the choledochus makes it possible to increase the efficiency of the endoscopic retrograde lithoextraction by 9.4%, and security by 4.4%.

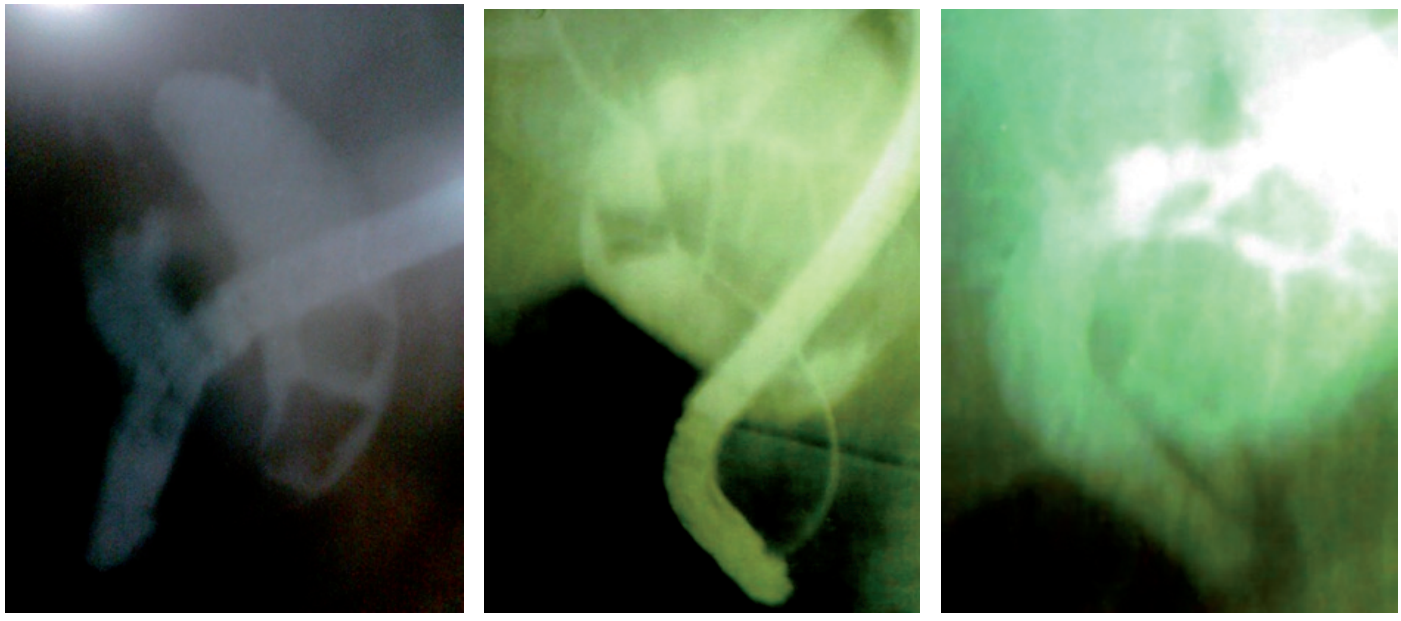


Figure 7. Due to the possibility of capturing two large calculi, the proximal calculus is located upwards, with the distal calculus extracted afterwards, and in the second stage, the proximal one as well.

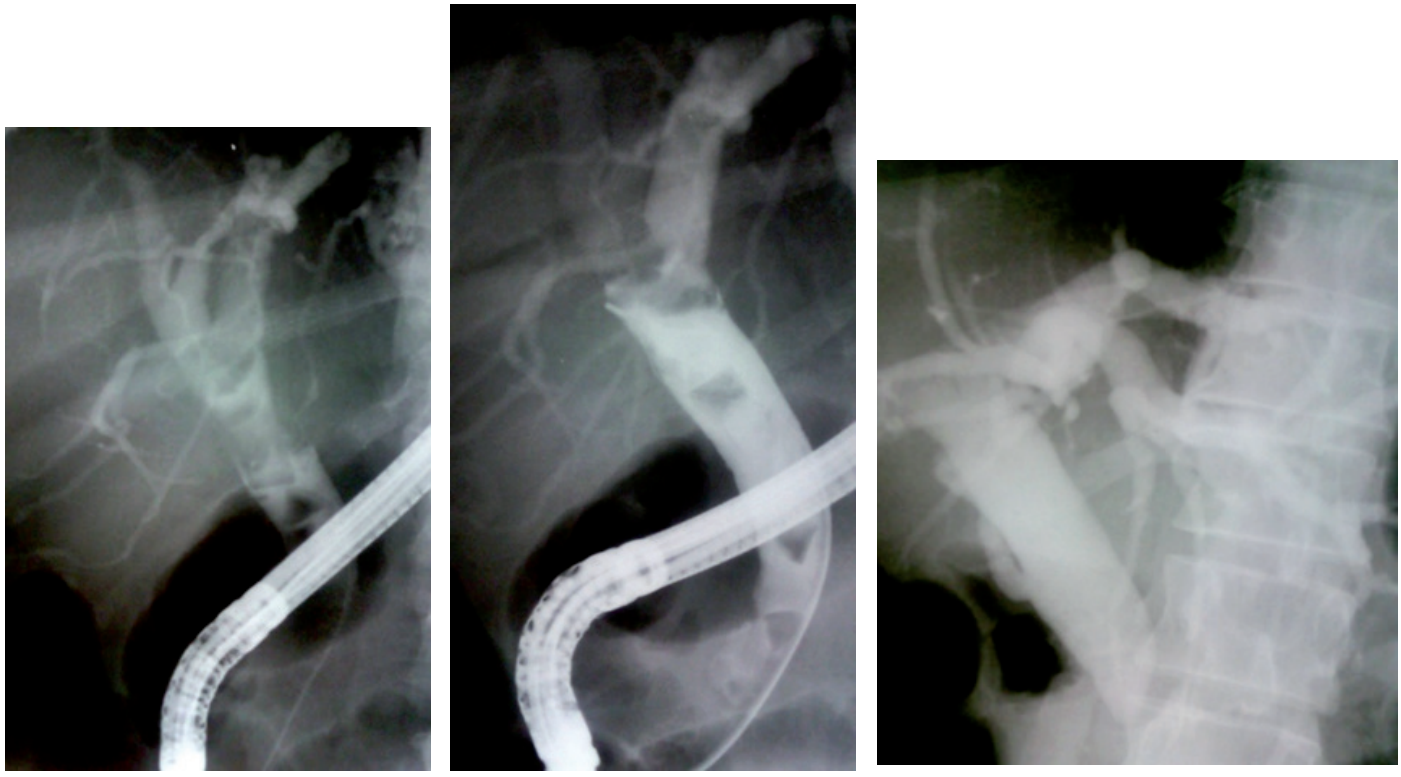


Figure 8. Multiple calculi of irregular shape are determined, extracted by stages (4 stages).

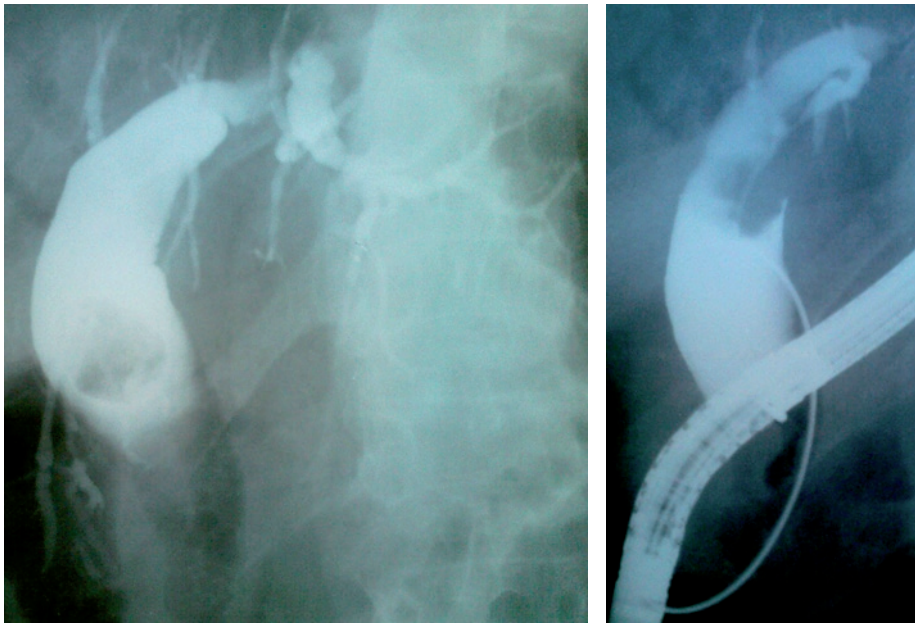


Figure 9. Unintentional dislocation of a single calculus into the common hepatic duct

Figure 10. Intentional dislocation of the proximal calculus into the common hepatic duct

Table 1. Comparison of the efficacy and safety of endoscopic lithoextraction of calculi of the main bile ducts according to traditional and advanced tactics

Groups	**Evaluation parameters**			
	Efficiency		Level of complications	
	Absolute number	%	Absolute number	%
Study group N=404	349	86.4	35	8.7
Comparison group N=158	151	95.6	5	3.2
Study group without patients with Mirizzi's syndrome, which complicates the determination of anatomical ratios and visualization, N = 397	342	86.1	30	7.6
Comparison group without patients with Mirizzi's syndrome, which complicates the determination of anatomical ratios and visualization, N = 155	148	95.5	5	3.2
Note. The significance of differences between the study and comparison groups, both with the inclusion of observations with Mirizzi's syndrome (p =0.0007 in efficiency, p =0.0007 in safety) and without inclusion (p = 0.014 in efficiency, p = 0.04) is statistically significant.				

Table 2. The occurrence and structure of the reasons for the decrease in the efficiency of endoscopic lithoextraction in the study and comparison groups

The reasons for the decrease in the effectiveness of endoscopic lithoextraction.	**Occurrence**			
	Study group, n=404		Comparison group, n=158	
	Absolute N	%	Absolute N	%
Multiple small and medium (up to 0.8 cm) calculi that do not leave free space for the basket to fully open	12	3.0	5	3.2
Stones that are poorly visualized against the background of CBD, especially with a combination of air trapped in the hepaticocholedochus	5	1.2	2	1.3
CBD calculi with atypical anatomical ratios of the common bile and cystic ducts	10	2.4	3	1.9
"Irregular" forms of calculi that make them difficult to capture	8	2.0	4	2.5
Multiple calculi of "irregular" forms	5	1.2	3	1.9
The combination of choledocholithiasis with deformations and stenosis of hepatic choledochus	6	1.5	2	1.3
Mirizzi's syndrome, which complicates the determination of anatomical ratios and visualization	7	1.7	3	1.9
Mirizzi's syndrome in combination with calculi of the "irregular" form	4	0.9	2	1.3
High strangulation of calculae conglomerate	1	0.2	1	0.7

Table 3. Comparison of the efficacy and safety of endoscopic lithoextraction of calculi in patients with various reasons for reducing its effectiveness

Patients with various causes of decrease in efficiency and safety of lithoextraction	**Evaluation parameters**			
	Efficiency		Level of complications	
	Absolute N	%	Absolute N	%
Patients from the second subgroup, N = 51 *****	3	5.8	30	58.8
Patients from the comparison group, N = 19 ******	12	78.9	5	26.3
Note. The significance of differences in efficiency of p=0.0001, and in safety of p=0.015 is statistically significant				

* The criterion for inadequate performance was the inability to visualize the lumen of the choledochus through the papillotomy fistula or enter at an angle close to the straight one into the choledopapillotomy
** The relative distribution is provided within the second subgroup
*** The correct form of calculus in the framework of this article was considered round and ovoid
**** It should not be confused with interstep stenting as a way of preventing postpapillotomy bleeding during two-stage EPST – endoscopic papillosphincterectomy
***** 7 patients from the comparison group with Mirizzi's syndrome, which complicates the determination of anatomical ratios and visualization, are not included
****** 3 patients from the study group with Mirizzi's syndrome, which complicates the determination of anatomical ratios and visualization, are not included

Conflict of interest: None to declare

Authorship: V.V. Y., O.J. U. equally contributed to the study and preparation of manuscript

Acknowledgement and funding: None to declare

References

1. Klimenko G.A. Choledocholithiasis, diagnosis and surgical treatment. M.: Medicine; 2000.223p.
2. Stain S, Cohen H, Tsuishoysha M, Donovan AJ. Choledocholithiasis. Endoscopic sphincterotomy or common bile duct exploration. Ann Surg 1991; 213: 627-33.
3. Strömberg C, Nilsson M. Nationwide study of the treatment of common bile duct stones in Sweden between 1965 and 2009. Br J Surg 2011; 98: 1766–74.
4. Lauri A, Horton RC, Davidson BR, Burroughs AK, Dooley JS. Endoscopic extraction of bile duct stones: management related to stone size. Gut 1993; 34: 1718-21.
5. Lee JE, Moon JH, Choi HJ, Song AR, Jung EK, Cheon YK, et al. Endoscopic treatment of difficult bile duct stones by using a double-lumen basket for laser lithotripsy - a case series. Endoscopy 2010; 42: 169-72.
6. Alexandrov SV. The possibilities of endoscopic laser lithotripsy in patients with cholangiolithiasis. Surgery News 2013; 21: 45-53.
7. Binmoeller KF, Brückner M, Thonke F, Soehendra N. Treatment of difficult bile duct stones using mechanical, electrohydraulic and extracorporeal shock wave lithotripsy. Endoscopy 1993; 25: 201-6.
8. Revyakin AND, Grinev SV, Prokushev VS. Tactics of X-ray endoscopic treatment of choledocholithiasis. Endoscopic surgery 2008; 2: 3-9.
9. Freitas ML, Bell RL, Duffy AJ. Choledocholithiasis: evolving standards for diagnosis and management. World J Gastroenterol 2006; 12: 3162–7.
10. Uskudar O, Parlak E, Disibeyaz S, Koksal AS, Cicek B, Kilic ZM, et al. Major predictors for difficult common bile duct stone. Turk J Gastroenterol 2013; 24: 423-9.
11. Ramírez García J. Factors related to therapeutic failure in the extraction of bile duct stones for endoscopic retrograde colangiopancreatography ERCP. Rev Gastroenterol Peru 2011; 31: 330-4.
12. Stolin AV, Nishnevich EV, Prudkov MI. The significance of the signs of a systemic inflammatory response in the diagnosis and treatment of purulent cholangitis. Ann Surg Hepatol 2009; 14: 16-21.
13. Trikudanathan G1, Navaneethan U, Parsi MA. Endoscopic management of difficult common bile duct stones. World J Gastroenterol 2013; 19: 165-73.
14. Samardzic J, Latic F, Kraljik D, Pitlovic V, Mrkovic H, Miskic D, et al. Treatment of common bile duct stones - is the role of ERCP changed in era of minimally invasive surgery? Med Arch 2010; 64: 187–8.
15. Kim HJ, Choi HS, Park JH, Park DI, Cho YK, Sohn CI, et al. Factors influencing the technical difficulty of endoscopic clearance of bile duct stones. Gastrointest Endosc 2007; 66: 1154–60.
16. Okhotnikov OI, Grigoriev SN, Yakovleva MV. X-ray surgical treatment of Mirizzi syndrome in patients with a high degree of operational and surgical risk. Ann Surg Hepatol 2009, 14: 2225.

CONFERENCE PAPER

Heart, Vessels and Transplantation 2019; 3: 226-228.
Doi: : 10.24969/hvt.2019.148

Intrauterine balloon tamponade in the management of postpartum hemorrhage

Saikal Osmonova[1,2], Saltanat Nazaralieva[1,2]

[1] National Center of Maternity and Childhood Care

[2] Department of Pediatrics, Obstetrics and Gynecology of International School of Medicine; Bishkek, Kyrgyzstan

Abstract

Objective: According to WHO, the maternal mortality ratio in Kyrgyz Republic is 76 cases per 100.000 live births and is the highest among the Central Asian and Eastern European countries. It is necessary to study and implement minimally invasive postpartum hemorrhage treatment methods to prevent massive obstetric hemorrhage.

Methods: A prospective study of 35 cases of the use of intrauterine balloon tamponade (UBT) for the treatment of hypotonic postpartum hemorrhage was conducted. The indicators were assessed to evaluate the effectiveness of UBT.

Results: Hemostatic effect after UBT was achieved in 30 cases (85.7%), the average total blood loss was 664.57 (117.83) ml; reduced need for blood products, high doses of prostaglandins, large volume of fluid maintenance was observed. Breastfeeding started within the first 30 – 60 minutes after birth in 88.6% of cases.

Conclusion: UBT fully complies with the strategy for preservation of the reproductive potential in women, allows to improve medical and economic indicators.

Key words: Uterine balloon tamponade, hypotonic postpartum hemorrhage

(Heart Vess Transplant 2019; 3: 226-8. doi: 10.24969/hvt.2019.148)

Introduction

The main obstetric problem around the world is, and remains, maternal mortality. According to an official report of World Health Organization (WHO) for the period from 1990 to 2015, the maternal mortality (MM) rate worldwide had been reduced by almost 44%, whereas the Kyrgyz Republic demonstrated only a 5% reduction, amounting to 76 cases per 100,000 live births. Thus, the MM ratio in the Kyrgyz Republic is the highest among the Central Asian and Eastern European countries (1, 2). The vast majority of maternal deaths could have been prevented with timely diagnosis and access to quality emergency obstetric care (2-4).

Postpartum hemorrhage (PPH) takes a leading position among the well-known "top five" causes of maternal mortality (5, 6). According to the first and second reports following the confidential investigation of MM cases in the Kyrgyz Republic, in relation to direct causes of MM, i.e., diseases that only occur as a result of pregnancy, the leading cause is obstetric hemorrhage - 15.8 cases per 100,000 live births; and in 49% of cases of obstetric hemorrhage, a woman's death occurred from the postpartum hemorrhage (7, 8).

Postpartum hemorrhage is defined as bleeding, more than 500.0 ml after a vaginal delivery or exceeding than 1000.0 ml after a cesarean section (4, 14). Uterine atony, or loss of myometrium contraction ability after childbirth, is a leading cause of postpartum hemorrhage, and is also one of the main causes of MM in developing countries (9). According to international recommendations, the treatment of uterine hypo- and atony begins with catheterization of the bladder,

Address for Correspondence: Saikal Osmonova Department of Pediatrics, Obstetrics and Gynecology of International School of Medicine; Bishkek, Kyrgyzstan, Email: saikal.osmonova@gmail.com, Mobile: +996550506650

uterine massage, manual examination of the uterine cavity and the prescription of uterotonic drugs (4).

If there is no effect from the first stage of therapy, aortic compression is performed, the intravenous administration of tranexamic acid (10) is recommended, a uterine balloon tamponade (UBT) is used, a uterine artery embolization procedure is performed, and infusion-transfusion therapy (4) is prescribed. Surgical treatment methods for uncontrolled postpartum hemorrhage include bilateral ligation of uterine arteries, internal iliac artery ligation, uterine compression sutures, as well as a hysterectomy (11). To date, according to various authors, the effectiveness of the uterine balloon tamponade ranges from 85% to 99.4% and compares favorably as the least invasive, safest, most effective, simplest and fastest procedure in cases where postpartum hemorrhage cannot be treated with uterotonic drugs (12 -19).

Therefore, all of the above suggests the need for further research and introduction of effective minimally invasive PPH treatment methods to prevent massive obstetric hemorrhage, to reduce the number of surgical methods of hemostasis, which ultimately will preserve the reproductive potential of women and increase patient satisfaction with the treatment they receive.

Methods

A prospective analysis of cases of the use of uterine balloon tamponade for the period from January 2015 to January 2017 was conducted at the National Center for Maternity and Childhood Care.

The study included 35 postpartum hemorrhage cases. Inclusion criteria: vaginal delivery, full term, singleton; early postpartum period complicated by hypotonic bleeding of 500 ml or more. Exclusion criteria: uterine ruptures, coagulation system pathology, cesarean section, operative delivery.

According to the law on the protection of the health of citizens in the Kyrgyz Republic, all patients gave written informed consent to the use of the UBT methodology.

For conducting UBT, the set registered in the Kyrgyz Republic was used, which consists of: a resilient axial conductor with an attached elastic silicone balloon at the end; fluid container with connecting tube, as well as a terminal for controlling fluid flow.

Method of use: after connecting all parts and preparing the set, the fluid container was suspended at a height of 45-50 cm from the perineum and filled with warm (38° C) solution of sodium chloride; the terminal on the connecting tube was closed. Then, holding the conductor behind the axial end, the balloon was inserted into the uterine cavity, the terminal on the connecting tube was opened and fluid from the container flowed freely into the silicone balloon. The terminal was left open. The principle of "interconnecting vessels" between the silicone balloon and the fluid container is a crucial and distinctive feature of this set. Because the terminal on the connecting tube does not close, as its contractility is restored, the uterus "squeezes" the liquid from the balloon back into the container. Thus, an increase in fluid level in the container is one of the first signs of myometrium tone restoration. As the level of the fluid in the container rose, the excess fluid merged and at the same time reduced the height of the container. After restoration of the myometrium tone and the bleeding stopped, the balloon is removed. The duration of the exposure of the balloon averaged from 2 to 2.5 hours.

The following indicators were assessed to evaluate the effectiveness of uterine balloon tamponade: blood loss, the need for transfusion of blood products, the use of large doses of prostaglandins, the use of antibiotic therapy, anesthetics, infusion therapy with a volume of more than 1,500.0 ml, the need for surgical hemostasis, breastfeeding start time, hemoglobin level at hospital discharge.

Results and Discussion

The average age of the patients was 24.7(3.9) years, anemia was diagnosed in 16 (46%) cases, primiparous amounted to 15 (43%), multiparous - 20 (57%). All 35 puerperas received active management of the third stage of labor: oxytocin 10 IU dose intramuscularly after the birth of a newborn, uterine massage, delayed contraction of the umbilical cord and controlled traction of the umbilical cord. This protocol of management of the third period of labor leads to a significant reduction in the number of PPH (20).

After the diagnosis of "Hypotonic Postpartum Hemorrhage", all 35 puerperas received emergency obstetric care according to the clinical protocol approved in the Kyrgyz Republic, which includes conservative treatment methods: prescribing uterotonic therapy, infusion therapy, uterine massage, bimanual compression of the uterus, uterine balloon tamponade, and also surgical methods of hemostasis.

Hemostatic effect after UBT was achieved in 30 cases (85.7%) and in 5 cases (14.3%) surgical hemostasis was performed - bilateral ligation of uterine arteries. The average total blood loss was 664.57 (117.83) ml, while blood loss equal to 500.0 to 1000.0 ml was in 33 cases (94.3%), in 2 cases (5.7%) the blood loss was more 1000.0 ml.

40 IU total dose of oxytocin was used in 100% of cases, and the need for misoprostol (PGE1) dose of 800-1000 μg amounted to 40% (14). Infusion-transfusion therapy was carried out in order to rapid recover capillary perfusion, which allowed the prevention of the breakdown of compensatory mechanisms leading to the development of shock changes. An indicator of the need for infusion therapy of more than 1,500.0 ml was 20% (7).

In order to recover the oxygen transport function of blood and achieve the minimum permissible RBC count (minimum of 70 g/L Hb, and minimum 30% hematocrit), transfusion of erythrocyte concentrates was carried out in 4 cases (11.4 %).

Manifestations of the hemostatic system disorders were in 4 cases (11.4%), which was an indication to perform a transfusion of fresh frozen plasma. According to WHO recommendations, the initiation of breastfeeding should be within the first 30 – 60 minutes after birth, 30 newborns (85.7%) were placed on the mother's breast in accordance with the recommendations. UBT allowed to prevent the development of a severe post-hemorrhagic anemia; the average hemoglobin level was 95.4 g/L at discharge from the hospital.

Conclusion

The uterine balloon tamponade is fully consistent with the strategy for maintaining the reproductive potential of women. Besides, it helps drastically improve medical and economic means, to increase the overall satisfaction and quality of women's lives.

Conflict of interests: None to declare

Authorship: S.O. and S.N. equally contributed to the study and preparation of manuscript

Acknowledgements and funding: This study was supported by the National Center of Maternity and Childhood Care, Kyrgyz Republic.

References

1. Black RE, Laxminarayan R, Temmerman M, Walker N. Reproductive, maternal, newborn and child health: disease control priorities, vol. 2. 3rd ed. Washington DC: The International Bank for Reconstruction and Development/The World Bank; 2016.
2. Trends in Maternal Mortality 1990–2015: Estimates by WHO, UNICEF, UNFPA, World Bank Group, and the United Nations Population Division. WHO, UNICEF, UNFPA, World Bank Group, United Nations. http://www.who.int/reproductivehealth/publications/monitoring/maternal-mortality-2015/en/. Published November 2015.
3. Royal College of Obstetricians and Gynecologists. Prevention and Management of Postpartum Hemorrhage, 1st ed. London: RCOG; 2009.
4. World Health Organization. WHO recommendations for the prevention and treatment of postpartum hemorrhage: evidence base. Geneva: World Health Organization; 2012. http://apps.who.int/iris/bitstream/10665/75411/1/9789241548502_eng.pdf.
5. Say L, Chou D, Gemmill A, Tuncalp O, Moller AB, Daniels J, et al. Global causes of maternal death: a WHO systematic analysis. Lancet Glob Health 2014; 2: e323-33. doi: 10.1016/S2214-109X(14)70227-X.
6. Kassebaum NJ, Bertozzi-Villa A, Coggeshall MS, Shackelford KA, Steiner C, Heuton KR. et al. Global, regional, and national levels and causes of maternal mortality during 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet 2014; 384: 980-1004.
7. Ministry of Health of the Kyrgyz Republic 2014. 'Inception Report on Confidential Enquiry into Maternal Deaths in the Kyrgyz Republic for 2011-2012.' National Committee on Confidential Enquiry into Maternal Deaths https://kyrgyzstan.unfpa.org/sites/default/files/pub-pdf/CEMD-report_-13_03.pdf
8. Ministry of Health of the Kyrgyz Republic 2017. 'Second Report on Confidential Enquiry into Maternal Deaths in the Kyrgyz Republic for 2014-2015.' National Committee on Confidential Enquiry into Maternal Deaths https://kyrgyzstan.unfpa.org/sites/default/files/pub-pdf/KRMS_RU_1.pdf
9. Lalonde A. FIGO Safe Motherhood and Newborn Health (SMNH) Committee. Prevention and treatment of postpartum hemorrhage in low-resource settings. Int J Gynecol Obstet 2012; 117: 108-18.
10. Effect of early tranexamic acid administration on mortality, hysterectomy, and other morbidities in woman with postpartum hemorrhage (WOMAN): an international, randomized, double-blind, placebo-controlled trial. WOMAN Trial Collaborators. Lancet 2017; 389: 2015-116.
11. El Senoun GA, Singh M, Mousa HA, Alfirevic Z. Update on the new modalities on the prevention and management of postpartum hemorrhage. Fetal Matern Med Rev 2011; 22: 247-64.
12. Tindell K, Garfinkel R, Abu-Haydar E, Ahn R, Burke TF, Conn K, et al. Uterine balloon tamponade for the treatment of postpartum hemorrhage in resource-poor settings: a systematic review. BJOG 2013; 120: 5–14. doi:10.1111/j.1471-0528.2012.03454.x.
13. Georgiou C. Balloon tamponade in the management of postpartum hemorrhage: a review. BJOG 2009; 116: 748–57. doi:10.1111/j.1471-0528.2009.02113.x.
14. Doumouchtsis SK, Papageorghiou AT, Arulkumaran S. Systematic review of conservative management of postpartum hemorrhage: what to do when medical treatment fails. Obstet Gynecol Surv 2007; 62: 540–7.
15. Martin E, Legendre G, Bouet PE, Cheve MT, Multon O, Sentilhes L. Maternal outcomes after uterine balloon tamponade for postpartum hemorrhage. Acta Obstet Gynecol Scand 2015; 94: 399–404.
16. Burke TF, Ahn R, Nelson BD, Hines R, Kamara J, Oguttu M, et al. A postpartum hemorrhage package with condom uterine balloon tamponade: a prospective multi-centre case series in Kenya, Sierra Leone, Senegal, and Nepal. BJOG 2015; https://doi.org/10.1111/1471-0528.13550.
17. Laas E, Bui C, Popowski T, Mbaku OM, Rozenberg P. Trends in the rate of invasive procedures after the addition of the intrauterine tamponade test to a protocol for management of severe postpartum hemorrhage. Am J Obstet Gynecol 2012; 207: 281–e1-7.
18. Burke TF, Danso-Bamfo S, Guha M, Oguttu M, Tarimo V, Nelson BD. Shock progression and survival after use of a condom uterine balloon tamponade package in women with uncontrolled postpartum hemorrhage. Int J Gynecol Obstet 2017; 139: 34–8.
19. Pendleton AA, Natarajan A, Ahn R, Nelson BD, Eckardt MJ, Burke TF. A qualitative assessment of the impact of a uterine balloon tamponade package on decisions regarding the role of emergency hysterectomy in women with uncontrolled postpartum hemorrhage in Kenya and Senegal. BMJ Open 2016; 6: e010083.
20. Begley CM, Gyte GM, Devane D, McGuire W, Weeks A. Active versus expectant management for women in the third stage of labor. Cochrane Database Syst Rev 2011; 11: CD007412.