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Increased risk of cardiovascular disease may be starting in childhood: 25 OH vitamin D levels in Turkish Children

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Abstract

Background: Vitamin D deficiency has become global health problem and it is associated with metabolic syndrome, type 2 diabetes mellitus, cancer, cardiovascular diseases and increased mortality. The aim of this study is to shed light on the 25 OH vitamin D status in different age groups of Turkish children.

Materials and Method: 1597 children (753 boys (47.2 %) and 844 girls (52.8 %)) admitted to Pediatry Outpatient Clinic were enrolled in this study. 25 OH vitamin D analysis was performed from venous blood samples using Cobas e411 auto-analyzer (Roche Diagnostics, USA).

Results: The children were between 0 and 18 years old, mean of age was 6.90 ± 5.1 years (median: 6 year). 25 OH vitamin D levels were between 3 and 70 ng / mL, mean value was 32.4 ± 16.9 ng / mL (median: 29.1 ng / mL). Age and vitamin D levels were inversely correlated and a statistically significant difference was observed between these two parameters ($r=-0.450$; $p=0.0001$). Very low vitamin D levels (<10 ng / mL) differed significantly according to gender. It was found significantly higher in girls ($p<0.05$).

Conclusion: Vitamin D deficiency is not rare in Turkish children, especially in adolescent period and girls. Vitamin D levels decrease with increasing age throughout childhood. Because of its association with metabolic syndrome, type 2 diabetes mellitus, hypertension and cardiovascular diseases, vitamin D deficiency in childhood may play a role in the development of these diseases in future. Large scale cohort studies are needed to reveal whether there is such an association.

Key Words: Vitamin D, Turkish children, cardiovascular disease, adolescent period

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Introduction

Recent years, it has been revealed that 25-hydroxyvitamin D [25(OH)D] deficiency is associated with metabolic syndrome, type 2 diabetes mellitus, cancer, cardiovascular diseases and increased mortality.[1] It has been also reported that vitamin D deficiency is a global public health problem in all age groups, especially in the Middle East populations.[2] 25(OH)D plays an important role in metabolic regulation such as calcium and phosphate homeostasis, cell differentiation, parathyroid hormone suppression, T-cell suppression, cancer pathogenesis and erythropoiesis.[3, 4] Vitamin D is a fat-soluble vitamin that is naturally present in few foods, added to others, and available as a dietary supplement. It is also produced endogenously when ultraviolet rays from sunlight strike to skin.

Since vitamin D is biologically inactive, it undergoes two hydroxylations in body for activation. The first occurs in the liver and converts vitamin D to 25-hydroxy vitamin D [25(OH)D, calcidiol]. The second occurs primarily in the kidney and forms physiologically active 1,25-dihydroxy vitamin D [1,25(OH)2D, calcitriol].[5] Serum concentration of 25(OH)D is the best indicator of vitamin D status.[5] It reflects vitamin D produced by skin and obtained from foods and supplements.[5] Vitamin D has a fairly long circulation half-life about 15 days but may change according to racial differences and seasonal changes.[6] Afro-Americans and Hispanics have been reported to have lower vitamin D levels than Caucasians.[7]

Vitamin D deficiency is based on various reasons such as nutrition, atmospheric deterioration, religious clothing, geographical latitude and altitude and seasons affecting daylight. Its deficiency causes rickets in children.[8] Following the observation in 1920 that vitamin D is effective in treating rickets, western countries started to provide this vitamin as a supplement to infants and children and fortified foods such as milk and bread with vitamin D, which led to eradication of vitamin D deficiency as a public health problem in these countries.[9, 10] It is recommended that all infants, children, and adolescents provide a minimum daily intake of 400 IU (10 µg) of vitamin D since the vitamin D status of the newborn is highly related to maternal vitamin D levels.[11] The purposes of this study are to examine 25(OH)D levels and to reveal whether or not there are vitamin D deficiency, differences according to age and gender in Turkish children.

Material and Method

Study population

1597 children [753 boy (47.2%) and 844 girl (52.8%)] admitted to pediatry outpatient clinics of our tertiary training and research hospitals between 2013 and 2014 were enrolled in this study. All of the blood samples were collected during this period. An approval was obtained from the Ethics Committee. 25(OH)D measurements were performed from venous blood samples using Cobas e411 autoanalyzer (*Roche Diagnostics, USA*). ELECSYS® Vitamin D Assay was used to measure serum 25(OH)D levels of the subjects.

Statistical analysis

Statistical analyzes were performed via MedCalc Statistical Software Program (*MedCalc Software version 12.7.7, bvba, Ostend, Belgium; http://www.medcalc.org; 2013*). Descriptive statistical methods (mean, standard deviation, minimum, median and maximum) were used for the definition of continuous variables. For the comparison of more than two independent and normally distributed variables, One-way ANOVA test was used. The comparison of more than two independent and abnormally distributed variables was made with Kruskal Wallis test. For the comparison of two independent and normally distributed variables, Student t test was used.

Mann Whitney U test was used in comparison of two independent and abnormally distributed variables. In the analysis of the associations among categorical variables, Chi Square test and Fisher's Exact test in convenient circumstances were used. P values of <0.05 were considered as significant.

Results

Distributions of participants according to descriptive features, age groups and vitamin D levels have been shown in **Table 1**. A total of 1597 participants aged between 0 and 18 years were enrolled in the analysis. Participants were divided three age groups as 0-2, 3-11, 12-18 years. They also divided four groups according to their vitamin D results as ≤ 10, 11-29, 30-39 and ≥ 40 ng / mL. Vitamin D levels were measured between 3 to 70 ng / mL, mean 32.4 ± 16.9 ng / mL and median

29.04 ng / mL. 844 (52.8%) of 1597 participants were female and 753 (47.2%) were male. The average age of the participants is 6.9 ± 5.1 years.

According to age groups, there is a statistically significant difference in 25OH vitamin D distribution ($p<0.05$). Distributions of Vitamin D levels according to age and gender are shown in **Table 2** and **Table 3**. According to post-hoc binary comparison results; there is a statistically significant difference in terms of distribution of 25OH Vitamin D according to all age groups (Mann-Whitney U test, Bonferroni correction, $p<0.016$, **Table 3**). According to sex, it was determined that there was a significant difference between the rates of the cases in the vitamin D groups (Chi-Square $p<0.05$). It was determined that 65.2% of the cases with vitamin D level ≤10 ng / mL were female.

In the other vitamin D groups, it was determined that the ratios are close to each other. It can be said that this significant difference according to sex is the ones with vitamin D level ≤10 ng / mL. This significant difference has no significant effect on the cumulative (**Table 2**, $p>0.05$). There was a significant relationship between age and vitamin D levels in this study. There is a statistically significant difference in terms of 25OH vitamin D groups according to age groups ($p<0.05$). 91.3% of cases with vitamin D levels of 10 or less were in the 3-18 age group, 54.6% of the cases with vitamin D level 11-29 were in the 3-11 age group, 56.1% of cases with vitamin D level 30-39 were in the 3-11 age group, and 59.42% of the cases with vitamin D level 40 and above were in the 0-2 age group.

There was a statistically significant (r:-0.452, p=0.0001) negative relationship between vitamin D levels and age of all children participating in the study. Vitamin D levels decrease with increasing age. This negative relationship was seen both girls (r: -0.434, p=0.001) and boys (r: -0.463, p=0.001, **Table 4** and **Figure 1**).

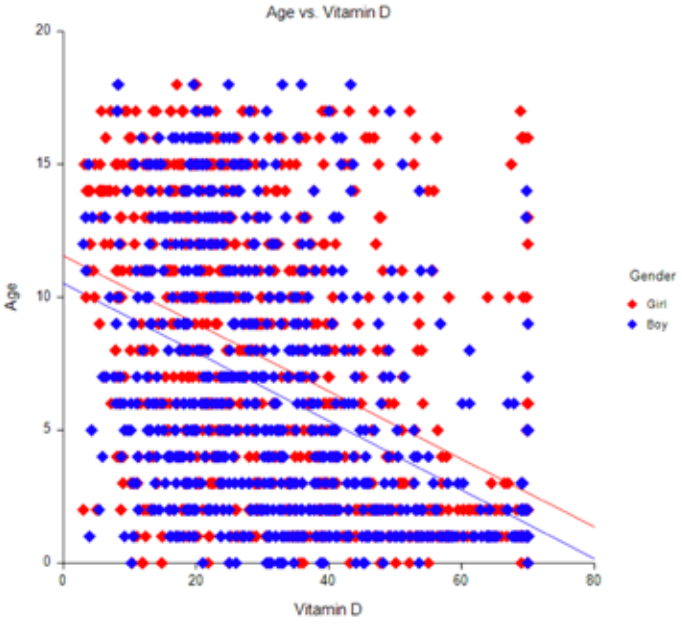
Table 1. Distributions of participants according to descriptive features, age groups and vitamin D levels

		Min - Max (Median)	Mean ± SD
Age (years)		0-18 (6)	6.9 ± 5.1
25OH Vitamin D (ng / mL)		3-70 (29.04)	32.4 ± 16.9
		n	%
Gender	Girls	844	52.8
	Boys	753	47.2
Age (years)	0-2	471	29.5
	3-11	753	47.2
	12-18	373	23.4
25OH Vitamin D (ng / mL)	≤10	115	7.2
	11-29	705	44.3
	30-39	301	18.9
	≥40	471	29.6

Discussion

This study demonstrated that age and vitamin D levels were inversely correlated. Vitamin D levels decrease with increasing age in Turkish children (r=-0.450; p=0.0001). Very low vitamin D levels (≤10 ng / mL) also known as vitamin D deficiency were found significantly higher in girls than boys ($p<0.05$). The best and only natural source of vitamin D is sunlight. Unlike dietary or supplementary vitamin D, when one get vitamin D from sunshine, body takes what it needs, and metabolizes. The care of the physician and mother

Figure 1. Graphical representation of inverse relationship between vitamin D and Age



may protect the children until preadolescence period from vitamin D deficiency, but the low levels of vitamin D in children older than 10 years may be due to dietary behavior characteristics and sedentary lifestyle.

In consistent with this, our findings show that vitamin D levels appear to decrease with increasing age from zero to eighteen. The normal level of serum vitamin D in children and adolescents as well as in adults is still a topic of debate. Studies have shown that over half of infants, children, and adolescents are inadequately supplemented. In 2008, the American Academy of Pediatrics published a review article with recommended target vitamin D concentrations for healthy infants, children, and adolescents.[12] Vitamin D has important roles in body metabolism. Parathormon (PTH) levels rises in low vitamin D concentrations, and increases blood pressure, and exerts several negative effects on heart such as myocardial hypertrophy and arrhythmias.[5]

Suppression of PTH via vitamin D supplementation reduces cardiovascular risk and high blood pressure.[5] Vitamin D suppresses renin transcription and reduces renin angiotensin aldosterone system activity, and has also anti-diabetic, anti-inflammatory and anti-auto immunological properties.[5] The immunologic effects of vitamin D have stimulated great interest, but studies in these areas are currently limited in pediatric patients.[12] Vitamin D has been shown to suppress pro-inflammatory cytokines and promote anti-inflammatory ones in children and adults with congestive heart failure.[13] In murine cardio-myocytes, vitamin D appears to have rapid effects on contractility and relaxation, which improve cardiovascular function.[15]

Moreover, vitamin D up regulates insulin receptors and reduces insulin resistance and development of diabetes mellitus type 1.[5] Vitamin D has anti-infectious and anti-inflammatory actions; it reduces inflammation marker tumor necrosis factor-α and increases anti-in-

Table 2. Score comparisons of vitamin D levels with age and gender

		25OH Vitamin D (ng/mL)	
		Mean ± SD (Med.) Min-Max	p
Gender	girls	31.79 + 17.2 28.52 (3-70)	0.062[1]
	boys	33.16 + 16.6 30.59 (3-70)	
Age (years)	0-2	44.48 + 17.3 45.2 (3-70)	<0.001[2]
	3-11	29.13 + 13.8 27.07 (3.41-70)	
	12-18	23.82 + 13.5 21.46 (3-69.99)	
Post Hoc binary comparisons		0-2 vs. 3-11	<0.001[1]
		0-2 vs. 12-18	<0.001[1]
		3-11 vs. 12-18	<0.001[1]
[1]Mann Whitney U test,		*[2]Kruskal Wallis test*	

Table 3. Categorical comparison of vitamin D levels with age and gender

		25OH Vitamin D (ng/mL)				p
		≤10	11-29	30-39	≥40	
Gender	Girls (n, %)	75 (65.2)	381 (54.0)	146 (48.5)	241 (51.2)	0.016[1]
	Boys (n, %)	40 (34,8)	324 (46,0)	155 (51,5)	230 (48,8)	
Age (years)	0-2 (n, %)	10 (8.7)	92 (13.0)	89 (29.6)	280 (59.4)	
	3-11 (n, %)	49 (42.6)	385 (54.6)	169 (56.1)	146 (31.0)	<0.001[1]
	12-18 (n, %)	56 (48.7)	228 (32.3)	43 (14.3)	45 (9.6)	
[1]Chi square test						

flammatory cytokine interleukin-10.[5] Vitamin D has also anti-hypertrophic and anti-proliferative effects; it reduces matrix metalloproteinase-9 levels.[5] Vitamin D possesses protective effects against atherosclerosis, vascular calcification and endothelial dysfunction; it inhibits macrophage cholesterol uptake and foam cell formation, vascular smooth muscle cell proliferation and migration, and suppresses inflammation triggered endothelial activation and expression of endothelial adhesion molecules.[5]

Several epidemiologic and clinical studies take an attention the association between low vitamin D levels and increased risk of metabolic syndrome, obesity, diabetes mellitus, hypertension and cardiovascular disease risk factors.[16, 17] Pacifico et showed that low levels of vitamin D has associated with metabolic syndrome components such as insulin resistance, central obesity, hypertension, low high density lipoprotein and high triglyceride levels in children and adolescents, but they found that no correlation between vitamin D and impaired flow mediated vasodilatation and increased carotid intima- media thickness which are two markers of subclinical atherosclerosis.[17]

On the other hand, Juonala et al, have reported that there is an association between low childhood vitamin D levels and increased carotid intima-media thickness in adulthood after thirty years observation.[18] Epidemiological studies showed low vitamin D levels in patients with cardiovascular and cerebrovascular diseases, and significant associations between low vitamin D levels and risk of fatal cardiovascular and cerebrovascular events such as sudden cardiac death and fatal strokes.[5] It has also been reported that, beyond cardiovascular disease, there is an association between vitamin D deficiency and all-cause mortality.[5] All of these reports prompted our interest a potential role of vitamin D deficiency on future cardiovascular disease in Turkish children. Similar to findings reported from Europe,[19] we exposed that a large proportion of adolescents in our country has low vitamin D levels. We have also demonstrated that very low vitamin D levels were higher in girls compared to boys, therefore possibly contributing to their lower peak bone mass and also may be increasing trend to CHD.

This difference may be explained by gender differences in body size, muscle mass, as well as possibly in bone remodeling during a critical period for bone mass increment, that is, puberty. And also, in Turkey, nearly half of girls of adolescent age wear sun-resistant clothing and spend most of their times in closed places. Hag et al reported similar result from Abu Dhabi, United Arab Emirates.[20] Science et al have also reported low levels of vitamin D levels in Canadian adolescents.[21] All children, particularly girls, should spend more time outside for the vitamin D synthesis. In summary, our findings showed that even in sunny environments, vitamin D deficiency is quite common. Although Turkey is a Mediterranean country, Turkish people should have checked their levels of 25 (OH)D at periodic intervals throughout their lives including childhood period. Furthermore, proper supplementation should be considered to avoid a secondary serious disorders such as diabetes mellitus, hypertension and coronary artery disease that may arise from 25-(OH)D deficiency.

On the other hand, there are some limitations in this study. Firstly, the seasonal changes of vitamin D levels were ignored. Secondly, we had no knowledge of the paticipants's body mass index, degree of sun exposure. A high body mass index is proportional to lower 25(OH)D values, and this is possibly due to the lipid-soluble vitamin D stored in fat tissues, which causes a reduction in serum levels.[22, 23] Given the important role

Table 4. Assessment of the relationship between Vitamin D levels and age of children

		Vitamin D vs Age		
		Total	Girls	Boys
All participants (n=1592)	n	1592	843	749
	r	-0.450	-0.434	-0.463
	p	0.0001**	0.001	0.001**

r: *Spearman's correlation co-efficient*

of vitamin D in childhood health, more time spent in outdoor activity for sunlight exposure and vitamin D supplementation may be necessary for optimal health in infants, children, and adolescents. And also, optimal vitamin D levels in the mother during pregnancy should be maintained. Moreover, with the onset of puberty, there is acceleration in rate of growth and bone mass, which leads to an increase in requirements for vitamin D and calcium.[24] A program consisting of measurement and replacement of vitamin D to adolescents in healthcare system may be initiated.

Conclusion

Vitamin D deficiency is not rare in Turkish children, especially in adolescent period and girls. Vitamin D levels decrease with increasing age throughout childhood. Because of its association with metabolic syndrome, hypertension, type 2 diabetes mellitus and cardiovascular diseases, vitamin D deficiency in childhood may play a role in development of these hazardous diseases in future. Large scale cohort studies are needed to reveal whether there is such an association.

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Outcomes of with open and Seldinger-Guided Peripheral Cannulation Techniques in open heart surgery

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Abstract

Objective: In this study, we evaluated the results of open access and seldinger guided peripheral cannulation techniques in patients which underwent open heart surgery.

Materials and Method: The results of heart surgery cases with peripheral artery and vein open access technique and seldinger guide technique between November 2010 and October 2017 were evaluated retrospectively. Edwards® Fem-Flex II and Medtronic Bio-Medicus™ NextGen percutaneous femoral artery and venous Cannulas were chosen. Peripheric cannulations were performed percutaneously with doppler ultrasonography via guided seldinger technique. Seldinger technique for peripheric cannulation was preferred even open exploration of the groin vessels were needed.

Results: 65 patients (32 male, 33 female; mean age 43±37 years; range 3-81 years) were taken into the study that peripheral cannulation performed. In 18 (27.6%) patients minimally invasive technique was applied and 34 (52.3%) patients were redo cases. A mean flow of 4,108±0.6 m2 l/m2/m was achieved with vacuum application in only 6 patients (9.2%) for venous drainage. No hemothorax, pneumothorax or hematoma had occured in cannulation sites due to internal jugular vein or femoral cannulations. Surgical embolectomy was performed due to distal thrombus only in 4 patients (6.15%) to whom had conventional cannulation. In 4 patients (6.15%) femoral venous cannula couldn't reached up to the right atrium.

Conclusion: In our opinion, seldinger technique either performed percutaneously or surgically is a faster, easier and superior technique in protecting distal limb perfusion when compared with open vasculotomy with proximal/distal clamping technique. Moreover, it can be safely applied in high risk redo cases as well as routine minimally invasive surgery.

Key Words: Cannulation; extracorporeal circulation; seldinger guide; minimally invasive; percutaneous.

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Introduction

Recently peripheral artery and vein cannulation technique has become popular since the numbers of minimally invasive heart surgeries and redo cases are increasing. After a limited learning curve for the peripheric cannulation and application of vacuum to venous lines when is needed, efficient cardiopulmonary bypass can always be achieved. Implication of cannulation with percutaneous cannulas in peripheric veins and arteries is an innovation that eases the workload of surgeon in minimally invasive and redo cases. By means of percutaneous peripheric cannulation, extracorporeal circulation (CPB) can be even applied before the sternotomy to reduce the tension of massively adhered heart tissues underneath the sternum in order to overcome the possible perforation problems during the resternotomy if occures.

Peripheric cannulation provides an advantage in cases with minimally invasive heart surgery, heart transplant, high risk redo cases, robotic heart surgery and cardiopulmonary resuscitation (CPR) that requires extracorporeal membrane oxigenator (ECMO).[4-6] Additionaly It is known that femoral artery cannulation and retrograd perfusion is safe and doesn't increase stroke rate.[1-3] Femoral artery cannulation is preferred in emergency cases, redo cases and minimally invasive heart surgeries. Axillary artery cannulation with antegrad perfusion is preferred especially in thoracic aort and redo surgeries.[4-6]

Besides, small diameter of axillary artery can complicate the placement of antegrad perfusion cannule. Jugular vein cannulation can provide venous return in minimally invasive heart surgeries and redo cases. Internal jugular vein (İJV), femoral, axillary, subclavian and iliac vessels can be used for peripheric cannulation.[1-37] Seldinger guide technique provides ease of implantation in both arterial and venous cannulation in comparison to concervative surgical procedure.

Decannulation can be performed more quickly. In redo cases, implication of CPB before sternotomy can decrase mortality and morbidity. In this study, the results of percutan and open peripheric cannulation techniques in open heart surgery were evaluated.

Material and Method

The results of heart surgery cases with peripheral artery-vein open surgery technique and seldinger guide technique between November 2010 and June 2017 were evaluated retrospectively.

Dokuz Eylul University ethics comitee permission (date: 04.08.2016, protocol: 2841-GOA) and necessary permissions to get and use archieve datas (anesthesia and perfusion records, electronic records) were obtained.

The cases that include use of central cannulation because of changing strategy, urgent patients, infective endocarditis cases and the patients that had performed CPR and ECMO were excluded from the study. The outcomes of open surgery technique and seldinger guide technique for peripheric cannulation were evaluated as well as patients demographic datas.

Technique

All patients were operated under general anesthesia and endotracheal entubation. For patients that had been planned right jugular venous cannulation, 7F three way central venous cathether (Certofix Trio V720) using left IJV and 20G (Becton Dickinson insyte cannula, Swindon, UK) artery cathether using left radial artery were placed before extracorporeal circulation. For right IJV cannulation, patients were positioned as right arm closed and shoulder elevated approximately 5cm. Patients were prepared properly and covered with sterile clothes.

Anaesthesiologist had also scrubbed and involved the operation site. Pump lines were taken into the surgery region. IJV and femoral artery and vein were evaluated for atherosclerosis, mobile thrombus, occlusion and diameter via doppler ultrasonography. For percutanous jugular vein cannulation, ponction site was marked preoperatively. For patients whom had percutanous right IJV cannulation plan, IJV ponction was maden in trendelenburg position and guidewire was placed into vein via seldinger technique (**Figure 1**). 1.5 mg/kg heparin was administered for partial anticoagulation. After dilatation, Edwards® Lifesciences Fem Flex II or Medtronic Bio-Medicus™ NextGen percu-

tanous femoral cannule was placed into right IJV. 16 Fr cannules were used for patients to whom body surface area is under 1.7 m2, 18 Fr cannules were used for patients whom body surface area is above 1.7 m2. Cannules advanced approximately to right atrium entrance (10-15 cm) and fixed to skin. Following the flow rate was checked with aspiration, cannules were clamped. According to surgical plan, clamps were removed and providing a full return, 4/l/min flow rate was maintained during CPB.

For femoral artery and vein cannulation, vessels were explored with 2 cm vertical incision, 1 cm blow to the inguinal ligament. Main femoral artery and vein surrounded and taped for bleeding control. Vessels were fixed with a silk suture to the skin.

In standart surgical cannulation planned cases, cannulation was made with arteriotomy after heparinization. Patients were taken into temporary CPB in order to check perfusion and cannulas were fixed (**Figure 2**). We chose right femoral cannulation because of its nearest position to the surgeon and easy to manupilate.

For patients whom planned minimally invasive surgery, aortic cross clamp was placed to ascending aorta using standard X clamps. Cardioplegia was administered through aortic root using standard cannulas. For de-airing, patient turned around to right side and trendelenburg position, ventricule and aortic root was punctured trans-septally with a 16G branule. Vent catheter was placed to right upper pulmonary vein. In case of defibrillation, external defibrilation pads were placed to the shoulder.

In seldinger guide technique chosen cases, after femoral artery and vein exploration, tapes were placed before punction for bleeding control. Descending thoracic aorta cannulation was made with inserting 0.038 guidewire (or hydrophilic guidewires in high fragil vessels) through 18 G puncture needle (**Figure 3**). The venous cannula was sized and advanced externally as well as the right atrium. 16-18-20F artery cannulas were used according to patients Body Mass Index (BSA). In cannulation seldinger guide supported Femflex II (Edwards Lifesciences, Irvina, CA) or Medtronic Bio-Medicus™ NextGen percutanous femoral artery cannulas and venous Edwards® V Fem/Femoral (Edwards Lifesciences LLC, USA) cannulas were used. Tapes were removed for providing distal vascular perfusion. We evaluated the results retrospectively for cannulation techniques.

Results

65 patients (32 male, 33 female; mean age 43±37 years; range 3-81 years) were taken into the study that peripheric femoral artery, vein and IJV cannulation performed for elective heart surgery between Novem-

Table 1.

Number of Patients	Number	Mean+SS	Min-Max
Sex	46		
Male	24		
Female	22		
Age		43±37	3-81
Body surface area		1.9 ±0.6	1.2-4
Body weight (Kg)		65 ±15.6	35-100
Ejection Fraction (%)		54.629	20-70
Aortic cros clamp time (Min)		90.47	28-187
Bypass time (Min)		180.51	58-900

ber 2010- October 2017. For extracorporeal circulation sufficient perfusion was maintained through cannulas that were compatible with patients body surface area and vein diameter. Patients mean weight was 65±15.6 kg (range 35-100 kg) and mean body surface area was 1.9±0.6 m2 (range 1.2-4 m2). Patients demographics are shown in **Table 1**.

For 18 patients, minimally invazive technique was applied and 34 patients were redo cases. The operations are shown in **Table 2**. No pneumothorax or hemothorax were observed related to cannulation. Cannulas were placed successfully and sufficient venous drainage was maintained. In 4 patients(%6.15), femorale venous cannulas couldn't advance to right atrium.

For these patients after sternotomy, two stage venous cannulas were placed into right atrium due to insufficient flow. All patients were operated with mean 4.108±0.6 m2 l/m2/dk flow rate. In 6 patients (9.2%) vacuum (max:60 mmHg) was applied for sufficient venous drainage. 70% of patients double peripheric venous cannulas were used.

Limb ischemia occured in 4 patients (6.15%) who had open surgical peripheric cannulation performed. Therefore, due to distal thrombus, embolectomy was performed to those. No limb ischemia had occured in open seldinger and percutanous cannulation group.

Minimally invasive surgeries were performed via 13 ministernotomy and 5 minithoracotomy. In redo cases, neither signs of cardiac injury was observed nor hospital mortality. In postoperative follow-up, no hematoma was occured at IJV cannulation site. On the other hand, wound site complications at femoral cannulation site

Table 2.

	Operation		Redo operation		Minimal invasive	
	Number	Per. (%)	Number	Per. (%)	Number	Per. (%)
Total count	65	100	34	52.3	18	27.6
Redo aortic valve replacement					-	
Redo tricuspid valve replacement					-	
Redo mitral valve replacement					-	
Aortic valve replacement	9		6		3	
Atrial septal defect repair	5		-		5	
Mitral valve replacement	23		8		8	
Rastelli	1		-		-	
Heart transplant	2		2		-	
Pulmonart valve replacement	3		3		-	
Benthall	6		5		1	
Assendan aort tubular greft	5		4		1	
Thoracoabdominal aortic aneursym repair	2		-		-	
Tricuspid valve replacement	9		7		2	
Ventricular septal defect repair	1		-		1	

had occured in 4 patients (6.15%) therefore revision operations were performed (hematoma in 2 patient, seroma in 2 patient). IVC repairment surgery was performed in 1 patient due to İVC injury during femoral vein cannulation.

The datas from this research were evaluated with database created with "Statistical Package for Social Sciences" (SPSS-Chicago, IL, USA) 16 and Software Excel (Microsoft-USA) programmes. Statistical analyses were made with same programmes. Measured values were evaluated with Mann Whitney U test, cathegorical values were evaluated with Fisher exact test. $p \leq 0.05$ values were excepted as significant.

Discussion

Nowadays minimally invasive approaches in cardiovascular surgery have become more popular by the means of increased quality of equipment. In cardiovascular surgery, percutanous cannulations frequently performed to ensure safer approach to redo cases, robotic and minimally invasive surgery. Optimal cannulation strategy for cardiovascular surgery has not determined yet. The decision varies from patients' clinical state and experience of surgery team. In this research, the results of open heart surgery cases with peripheric cannulation between November 2010 and June 2017 were evaluated retrospectively.

While peripheric cannulation performing, the cannulas stay out of surgical site thus, giving extra field for surgeon.[1-5] By this means, smaller incisions can be made. It enables both endoscopic view and port entry. It also provides CPB support before surgery so that surgical team can perform safely and faster. In the cases of thoracic surgeons who have a total circulatory arrest plan, the surgical team does not have to wait for cooling the patient by entering the pump in advance. Redo cases have high risk because of diffuse sternal attachment.

In these cases, performing peripheric cannulation before sternotomy provides reduction of ventricule tension by accumulating the blood partially into pump resevoir and decrase the risk of surgical bleeding. Cardiac dissection can be made comfortably.[1-7] In case of high risk complications or abundant bleeding during exploration in redo cases, periferic cannulation also provides cerebral perfusion.[7-10]

Periferic cannulation can be performed easily with advanced technology.[11-12] It can be made with seldinger technique, open or percutanous way as well as open arteriotomy, venotomy, proximal snaring and distal clamping. We recommend that the surgical seldinger method should also facilitates the bleeding control as well as maintaining of distal vascular perfusion can be also achieved by avoiding concervative distal clamping.

Standard surgical peripheral cannulation can also be achieved with minimally incision like in 1 or 2 cm lenght. When single peripheric venous cannulation is not enough, CPB vacuum support or double peripheric venous cannulation can be added. In these cases, CPB up to 60 mmHg vacuum can be applied to the venous

Figure 1.



Figure 2.



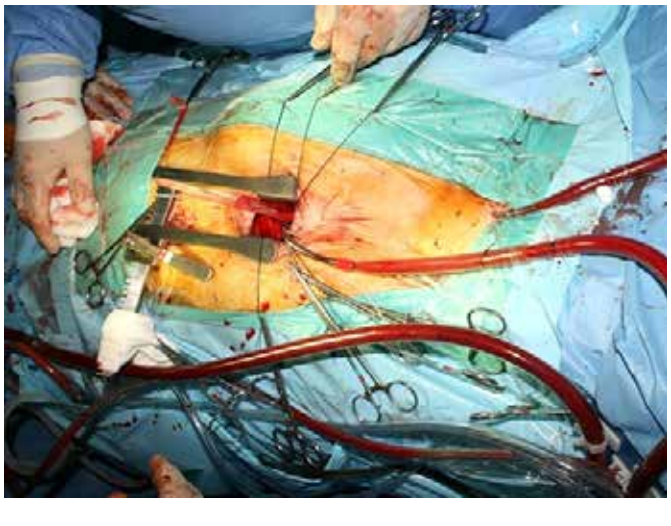
lines, thus the venous return can be increased.

In our study, 9.2% of patients were needed vacuum support while 70% of patients were needed double peripheric venous cannulas. Double venous cannulation enables short line and provides advantage in venous return for patients that have high BSA. In a research of Luciani and collegues, 20% of patients needed vacuum after percutanous cannulation.[15] Since we applied a percutaneous jugular vein cannulation when is needed our vacuum application has reduced by the time (9.2%).

IJV percutanous cannulation and snaring enables to perform cases via right atrium like atrial septal defect (ASD), ventricular septal defect, tricuspid valve replacement (TVR), atrial mass, atrial tumor-myxoma with only peripheric cannulation. Kitahara and col. evaluated ASD closing with right minithoracotomy for perfusion strategy in 91 patients, and determine that femoral artery cannulation is safer.[18] It is advantageous to place cannulas percutanously using doppler usg before surgery.[11-12] In our cases, IJV cannulations were performed by anesthesiologists without any complications. In literature it is implicated that anesthesiologists must take part in cannulation.[1-5]

In liver transplant cases IJV cannulation complication rate is reported in 0.32-0.7% mortality rate while we had no canulation related morbidity and mortality. By taking this into considiration we perform 20-22F cannulation carefully. We can perform more comfortably in open surgery with seldinger method.

Figure 3.



Keeping optimum and adequate venous return, a blood free and comfortable surgical site can be obtained.[1] For femoral and IJV cannulations we try not to exagerate the size of cannulae by not exceeding optimal sizes. Accordingly in patients with fragile veins, we choose to use one size smaller cannulae and apply vacuum when is needed. Guidewires can cause temporary arrhythmia due to myocardial irritation.

Retracting guidewires 1-2 cm will prevent arrhythmias. We use Edwards® Lifesciences Fem Flex II and Medtronic Bio-Medicus™ NextGen percutanous femoral canulas for peripheric cannulation.[1-2] Side hole and flexible structure are advantages of the cannulas. They are compatible for venous drainage. We choose cannulas according to patients neck and body length. For patients with short neck we use one size smaller cannulas. During cannulation, the neck is deviated to the counter side, sholders closed with trendelenburg position.

Axillar cannulation method in complicated cases with aortic surgery; Neurocognitive outcomes are better reported. Antegrade provides perfusion convenience. It is preferred today.[2-4] Axillary artery is recommended not to be preferred in cases of small arterial diameter because of diminished limb perfusion.[2-8] Central arterial monitoring is also not recommended in cases of distress.[1-3] Brachial plexus injury has been reported in the literature recently.[2-6]

Femoral cannulation is a perfect choice for open heart surgeries and CPB. We evaluated cases with İJV seldinger cannulation, femoral artery-vein both open and seldinger cannulations. Recently, due to innovations in cannulation and perfusion technologies, seldinger guide technique is used in peripheric cannulation for heart surgery. Minimal dissection is usually sufficient. In seldinger guide femoral cannulation, there is no need for arteriotomy after exploration, by this way distal extremity perfusion is maintained. Besides this method is easy to apply percutanously and also by surgical exploration.

Moreover, decannulation can be also performed fastly and safely. In percutan decannulation, about 10 min compression after protamine neutralization is usually enough. Cosmetic results are satisfying for patient.

After open surgery seldinger cannulation, entry hole can be closed with primer sutures. Our study with 65 patients supports these results.

Extremity ischemia occured in 4 patients (6.15%) that open surgery peripheric cannulation performed, and due to distal thrombus, embolectomy was performed. No limb ischemia had occured in seldinger open and percutanous cannulation group. In addition to these study remarks, limb perfusion can be provided in seldinger technique that stabilized with only hanger tape without need of clamp or snare.

Perioperative evaluation with doppler usg and positioning cannulas that allows optimal CPB perfusion flow are the most important matters. Patients must be evaluated for severe atherosclerosis, unstable plaque, mobile thrombus, vascular occlusion with lung X rays, echocardiography, tomography and angiograms preoperatively. Minimally vascular surgical manipulation and exploration can prevent trauma and perivascular lymph leakage. By this means risks of seroma formation and wound site infections can be minimized.

Suitable size and type of cannulas must be chosen in compliance to vessel quality. For fragile vessels Edwards® Fem-Flex II percutan femoral artery cannulas can be used safely. Guidewires must be checked whether it advances intavascularly, in case of hesitation, vascular positioninig must be performed with the help of X ray-scopy intraoperatively. Placement of venous cannulas must be checked with palpation after sternotomy and exploration.

Vida and col. suggests that right jugular vein cannulation and femoral artery open surgery cannulation is the optimal choice for patients above 15 kg.[16] The same study suggests that peripheric cannulation decreases the amount of surgical stress. Reeb and col. suggests that peripheric cannulation is practical for elective or emergency ECMO applications.[17]

Vallabhajosyula and col. report that superficial femoral artery percutanous cannulation doesn't increase the rate of extremity ischemia with a 92 patient study.[18]

They also suggest that distal perfusion must be checked with angiogram. Von Segesser and col. evaluated results of 407 patients that had been performed venoatrieal ECMO.[20] Ischemic complication rate is reported as 11-52%, need for surgical repair rate is 9-22%, leg amputation rate is reported as 2-10%. This study higlighted to watch out peripheral ischemia in arterial cannulation and to choose smaller diameter cannulas. And use of double way artery cannulas are suggested for maintaining the reperfusion.

There is no limitation in our randomized study because of retrospective evaluation. Our evaluation is unbiased because operations had been performed with same surgical and anesthesiologist team.

Conclusion

In the light of our study; we suggest that peripheric or percutaous cannulation provides a specific advantage in 'redo cases' besides the well known indications in minimally invasive heart surgery, aortic dissection and robotic heart surgery. Low morbidity and mortality can be achieved especially in even most difficult redo cases when peripheral cannulation performed prior to sternotomy. On pump sternotomy also brings the advantage of empting of right ventricule and atrium that reduces wall tension and risk of accidential rupture during the sternotomy. In emergency CPB and ECMO cases, femoral artery-vein and IJV peripheric cannulation with seldinger guide can also be performed rapidly and safely.

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An useful complication of emergent pericardiocentesis procedure in cardiac tamponade: Case report

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Abstract

We present a case of 19 years old patient whom was admitted to emergency service with abdominal pain and dyspnea and had prodromal symptoms for about ten days. He was hypotensive, tachycardic and dyspneic. CT scan showed large amount of free peritoneal, pericardial and bilateral pleural fluid. With the diagnosis of cardiac tamponade; emergent pericardiocentesis was done with apical approach and quick hemodynamic relief was observed. It was understood that rapid haemodynamic response was a result of complication, characterized by increasing of left pleural effusion.

Key Words: Complication, abdominal pain, cardiac tamponade, pleural effusion.

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Case Report

A 19 years old man with a history of migraine and smoking, was admitted to emergency service with abdominal pain, nausea, dyspnea and loss of appetite for one week. The abdominal pain was worsening by standing and relieving by lying down. He had prodromal symptoms for ten days. Patient was consulted to our department due to detection of minimal cardiac silhouette enlargement in chest X-ray and sinus tachycardia in electrocardiogram. Computerized tomographic (CT) scan of abdomen and thorax revealed large amount of free peritoneal, 30 mm of pericardial, 30 mm of pleural effusion in left lung as well as 20 mm of effusion in right lung. Transthoracic echocardiography (TTE) showed large circumferential pericardial effusion (PE) with right atrial (RA) systolic and right ventricular (RV) diastolic collapse and >30% variation in mitral inflow pattern suggesting cardiac tamponade **(Figure 1)**.

Hypotension, tachycardia and pulsus paradoxus was observed at physical examination. After echocardiographic examination, it was concluded that the most convenient way for pericardiocentesis (PC) was apical approach. However collecting very small amount of pericardial fluid (15 cc), his hemodynamic profile was rapidly improved. A thoracal CT scan was taken immediately, although 15 mm residual pericardial effusion was implemented; 20 mm effusion at right and 45 mm at left lung was identified **(Figure 2)**.

Thoracal drainage tube was inserted left pleural cavity and 500 cc of hemorrhagic pleural fluid was collected. Tube was removed 2 days after, and no residual or recurrent effusion existed in the control imaging. Increase in acute phase reactants like, CRP:93 (0-5mg/l) fibrinogen:744 (200-400mg/dl), ESR: 53mm/h and neutrophilic leucocytosis was established in blood tests. However pericardial effusion was exudative quality; aerob- anaerob blood, urine and fluid culture was negative and no acid fast bacilli was seen in fluid; ANA, Anti-CCP, Anti-DNA and ENA profile were also normal. Colchicum 2*5 mg and brufen 3*600 mg without antibiotic regimen applied as the treatment strategy. 10 days after beginning of the treatment, only 10 mm pericardial effusion at posterior wall and 8 mm at RV neighbouring was found in TTE **(Figure 3)**. He was on treatment for two months without any symptoms; rheumatologic and genetic tests are still having been done.

Discussion

Cardiac tamponade is the hemodynamic result of increase in pericardial fluid which elevates intrapericardial pressure and prevent filling.[1] Pulsus paradoxus, tachycardia, elevated jugular venous pressure and hypotension are non-specific but important clues for the diagnosis. Echocardiography is an important tool to assess existence of effusion and also its hemodynamic results.[2]

Cardiac tamponade is critical condition and requires emergent treatment.[1] A variety of percutaneous or surgical therapeutic methods have been applied. Pericardiocentesis (PC), pleuro-pericardial window, subxiphoid pericardial drainage and pericardioscopy are the treatment option.[3] Percutaneous balloon pericardiotomy is another technique to create a nonsurgical pericardial

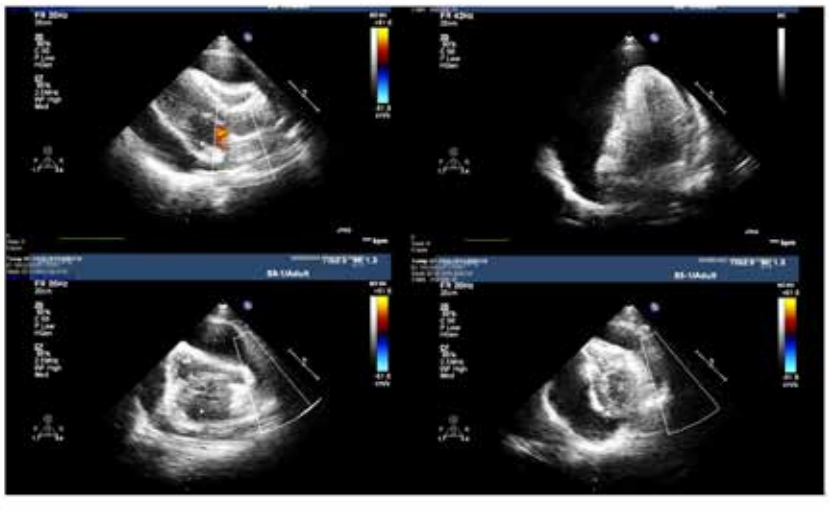


Figure 1. Transthoracic echocardiographic images of massive pericardial effusion and diastolic collapse of right ventricular free wall which is a sign of cardiac tamponade.

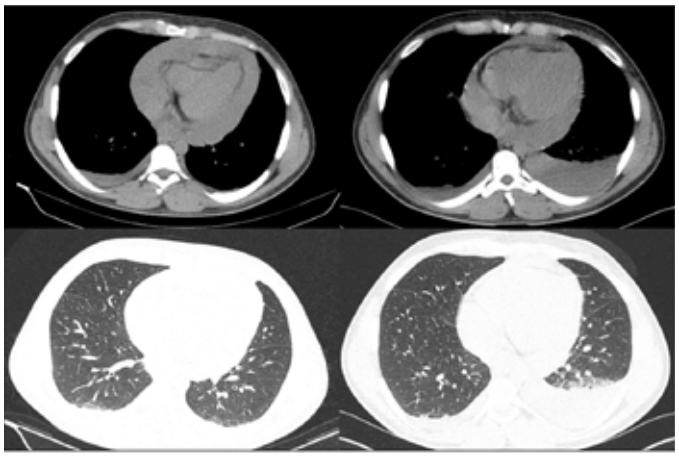
window for large pericardial effusions of critically ill patients especially with limited life expectancy.[4,5]

Percutaneous PC had been done blind or, electrocardiographically or fluoroscopically guided before the 2D-echocardiography-guided era.[6,7] Echocardiography guided pericardiocentesis is safe and effective way for drainage of large, symptomatic pericardial effusions or in case of cardiac tamponade.[6,8,9] Echocardiographic guidance facilitates detection of the puncture site, such as near the cardiac apex or sternal border or where the largest fluid collects. In a large study which investigate more than 1100 echocardiography-guided PC cases, the para-apical location was the most frequently utilized location (68%), while the subcostal or subxiphoid locations were used only in 15% of cases .

Large observational studies of echocardiography-guided pericardiocentesis report major and minor complication rates of <2% for non-emergent procedures.[10,11] The major complications of pericardiocentesis are myocardial rupture, vascular injury, pericardial hemorrhage, air embolism, injury to the liver or abdominal viscera, infection and arrhythmia.[12]

In our clinic, most of the PC are done by apical approach with lower complication rates. In this case, a complication happened during emergent PC which is likely to occur. Despite symptomatic and haemodynamic relief of patient, immediate echocardiographic study and CT scan was taken due to continuing of clinical suspicion. Thoracal drainage tube inserted fastly as a result of increase in left pleural effusion. We think that increase in the amount of pleural fluid is an acceptable result confronting with the life threatening feature of tamponade. Mutual result of tamponade, haemodynamic parameters, clinical backround of patient as well as collaborative assesment of imaging techniques are contributing to the outcome.

Figure 2. Tomographic images of increase in amount of left pleural effusion before (left side images) and after (right side images) the pericardiocentesis procedure



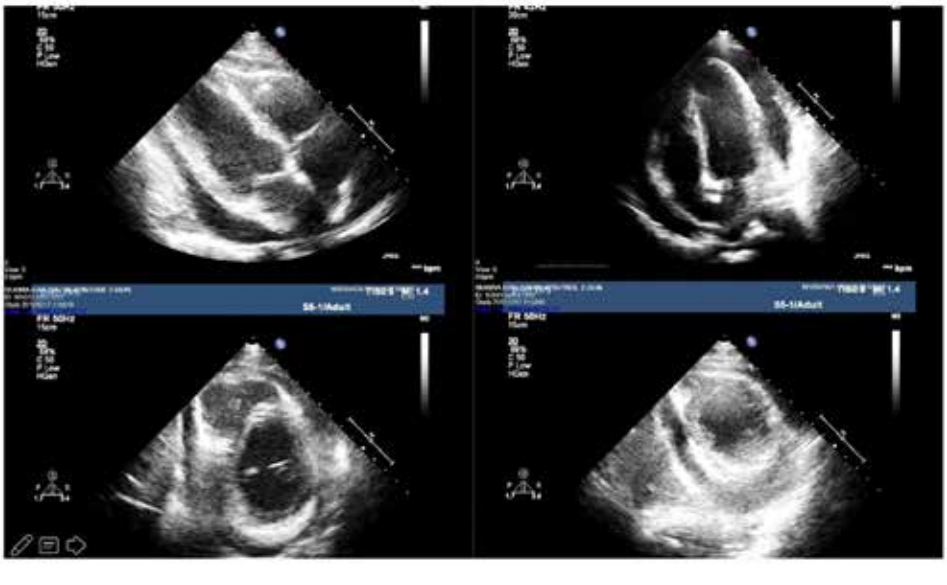


Figure 3. Transthoracic echocardiographic images of residual pericardial effusion and absence of right ventricular diastolic collapse.

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Aortic rupture due to pseudocoarctation caused by migrated stent graft

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Abstract

Migration of the stent graft is one of the complications of the endovascular aneurysm repair. Sometimes migration might cause fracture of the stent graft. This fracture might be viewed like a coarctation in the computerized tomographic examinations. In this situation, intraluminal aortic pressure of the proximal segment of the aorta will increase and might cause aortic rupture. Herein, we are presenting surgical treatment of the aortic rupture of the aorta, caused by the pseudocarctation of the migrated stent graft 6-year after the endovascular stent graft repair of the abdominal aortic aneurysm.

Key words: Aortic aneurysm, coarctation, endovascular procedure, migration, stent fracture.

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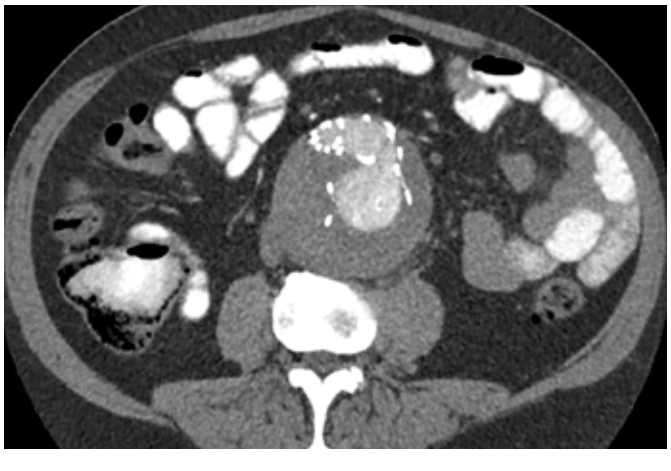
Introduction

Antegrade stent graft migration is one of the complications following endovascular treatment of abdominal aortic aneurysm (AAA). Caudal migration of stent graft might progress due to shortness of the intact aortic neck, small diameter of stent graft or infrarenal native aortic dilatation. Migration precipitates type I and III endoleaks, which poses high risk factor for aotic rupture related with increased morbidity and mortality. Fracture of stent graft develops where the endurance of the implant is less. Collapsing of the stent graft leads to an aortic pseudocoarctation, that increases blood pressure on the proximal aortic tissue. This increased blood pressure might cause dilatation in proximal aorta and other related complications, especially life-threatening acute rupture of the aorta. In this article, we are reporting surgical treatment of the acute aortic rupture which is caused by the pseudocoarctation of the stent graft.

Case report

A 72 year old male patient was admitted to the emergency service with the complaints of a suddenly developed abdominal distention and pain. Six years ago, endovascular aneurysm repair (EVAR) was performed to the patient with the diagnosis of the abdominal aortic aneurysm at another institution. He was checked up routinely. There was not aortic dilatation, and stent graft was normal position during the examinations. He was admitted to the emergency service with hypertensive crisis a week before. At that time, he was discharged from the hospital after his arterial pressure was controlled with medications. He did not have any symptoms for a week. However sudden abdominal pain was developed one week after the hypertensive crisis.

Figure 1. View of pseudocoarctation in transvers axis of CT angiogram



He was fatigue, his face was pale and his blood pressure and rate were normal. Abdominal distention and pulsatile mass was revealed in the physical examination. There was retroperitoneal fluid in urgent ultrasonography and a migration of the stent graft and aortic rupture was diagnosed with computerized tomography (CT) **(Figure 1-2)**.

The patients underwent urgent operation with these findings. After laporatomy, aorta was explored at the juxtarenal level. Aortic clamp was applied proximal of the renal arteries. After clamping of the iliac arteries, retroperiteon was opened and aortotomy was performed. The stent graft which was migrated to the caudally was excluded. Aorto-biiliac bypass operation with 20/10 Dacron graft was performed. Postoperative period was uneventful and the patient was discharged from the hos-

Figure 2. 3D view of pseudocoarctation of the stent graft in CT angiography.



pital at postperative 10th day.

Discussion

After EVAR procedure, the complications of endoleak, migration, graft thrombosis, infection, aortoenteric fistula, new aneurysm, fabrik erosian, detachment of the components, fracture of the stent, and rupture have been reported.[1-4] Aortic rupture might develop due to fracture or migration of the stent graft. In our case migrated stent graft was fractured and was mimicking a coarctation. We are presenting this situation as pseudocoarctation; a new complication of the EVAR procedure. Pseudocoarctation of the stent graft increases risks of aortic dilatation and rupture due to increased intraaortic pressure in the proximal aorta.

It is an important complication of the EVAR which necessitates urgent operation. In our case, aortic rupture, caused by increased intraaortic pressure, occured at proximal part of the aneurysmal sac. Dehissence of proximal segment of the stent graft might be developed due to hypertensive crisis and stent graft was migrated one week after the crisis. This migration caused fracture of the stent graft and coarctation-like view was observed in the CT examination. This acute narrowing of the aortic lumen increased proximal intra-aortic pressure and caused acute aortic rupture.

The purpose of the endovascular treatment of the AAA is to protect the aneurysm sac from the aortic rupture and to decrease the risks of the aortic rupture which is related with increased mortality. Aneurysm's neck is unstable, aortic dilatation continues unless it is fixed safely.[4] Stent graft migration occurs in the cases of dilatation of the proximal neck and in the absence of the fixation systems of the stent grafts.[5] Migration is directly associated with dilatation of the aneurysmatic aorta and aortic rupture. Litwinski et al.[6] reported that short proximal fixation and inferior positioned stent graft are the risk factors for the migration in the long term; however length and diameter of the aorta, aneurysm diameter, usage of proximal cuff and oversizing are not risk factors for the migration. The distance between the renal artery and stent graft increases the risk of migration 5.8% per mm, while proximal fixation length decreases 2,5% per mm.[7]

Graft migration facilitates type 1 endoleak, thus improves dilatation of the aneurysmatic sac and rupture.[3] Migration risk increases by the time and it develops in an average of 30 months following the procedure.[7] Zarins et al.[7] reported freedom from the migration rates 98.6%, 93.4% and 81.2% at 1st, 2nd and 3rd years, respectively. In our case, EVAR was performed 6 years before the migration and stent graft was at normal position in all control examinations. Aortic rupture occurred due to migrated stent graft which is developed one week after the hypertensive crisis. In the follow up of the EVAR procedure, regulation of the arterial pressure with medications, and detailed examination with the suspicion of aortic rupture in the hypertensive crisis is important to decrease the risks of mortality and morbidity.

Dilatation and lengthening of the infrarenal aorta even after the surgical repair of AAA was reported. This situation might malposition the proximal suture line to the caudally and might lead to pseudoanerysm.[6] Increasing in the infrarenal diameter of aortic neck, shortening of the infrarenal neck are the damaging factors of the integrity of the stent graft. Endoleak, migration and rupture develops due to damage of the proximal fixation. Caudal migration with keeping proximal landing-zone (that stent graft did not fall into aortic sac) is a benign clinical situation.[6] Fixation system at the proximal segment of the stent graft and postprocedural balloon dilatation might be used to decrease the risk of graft migration. In addition, effective radial force with efficient oversizing prevents migration by sealing the stent graft to the aortic wall.[6] It was also reported that extension of the stent graft through to the iliac bifurcation might be effective to prevent graft migration.[8] Complications of EVAR have been decreasing with development in the stent graft technology which improves stent graft fixation to the aortic wall.

Conclusion

Pseudocaorctation due to fracture of the stent graft might cause aortic dilatation and rupture of the proximal aorta. Acute hypertensive crisis, even after many years of EVAR procedure, might migrate stent graft caudally and be cause of the pseudocoarctation and aortic rupture.

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Endovascular treatment of aortoiliac occlusive disease involving the aortic bifurcation: Case Report

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Abstract

Endovascular treatment of aortoiliac occlusive disease (AIOD) involving the aortic bifurcation is challenging. We presented you a 81 year-old male patient suffering from vertigo and buttock claudication. Both carotid and peripheric angiographies were performed in our cardiovascular clinic. The left carotid artery was 90% stenotic and the distal abdominal aorta was occluded (TASC II Classification, Type C lesion, short segment distal aortic occlusion at aortic bifurcation). The patient underwent endovascular treatment for AIOD (occlusive lesion at aortic bifurcation), two weeks after the carotid endarterectomy operation. The occlusions were recanalised succesfully with a bare-metal self expandable stent and two kissing covered ballon expandable stents for both iliac arteries. Endovascular treatment of aortic bifurcation lesions is a suitable, less invasive alternative for high-risk patients for open surgery.

Key words: Aortoiliac occlusive, aortic bifurcation, endovascular treatment, distal abdominal aorta.

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Introduction

Endovascular treatment of aortoiliac occlusive disease (AIOD) involving the aortic bifurcation is challenging. The firstline therapy is open surgery with patency rates up to 90% at 5 years but it has considerable morbidity and mortality. Endovascular treatment of aortic bifurcation lesions is a suitable, less invasive alternative for high-risk patients for open surgery.

Case

We presented you a 81 year-old male patient suffering from vertigo and buttock claudication. The computed tomography anjiography showed peripheral arterial occlusive disease that generates nearly occlusion at bilateral main iliac arteries **(Figure 1)**. He was admitted to our cardiovascular surgery department and we performed peripheral and carotid anjiography; the patient had TASC II classification, Type C lesion, short segment distal aortic occlusion at the entrance to the main iliac arteries and 90% narrowing at left carotid artery **(Figure 2,3)**.

Primarily left carotid endarterectomy operation was performed without any problem. The patient underwent endovascular treatment for distal abdominal aorta occlusion (occlusive lesion at aortic bifurcation), two weeks after the carotid endarterectomy operation. A bare-metal self expandable stent (WallstentTM) and two kissing covered ballon expandable stents (Atrium, Advanta V12TM) for both iliac arteries were implanted in our hybrid operating room. The occlusions were recanalised succesfully **(Figure 4)**. The distal pulses were palpable and no complications were observed related to the intervention. The patient was discharged 3 days later after the intervention.

Discussion

Chronic occlusion of the distal abdominal aorta and bilateral iliac arteries is termed infrarenal aortoiliac occlusion and categorized by the Trans-Atlantic Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II) as a type C or variant of a type D lesion. TASC II guidelines recommends surgical therapy for type C and D lesions whereas endovascular treatment remains in the forefront.[1]

Aortabifemoral bypass is regarded as the gold standard for the treatment of severe AIOD with 5 and 10 years patency rates approximately 90% and 75% respectively. But with the improvements in endovascular techniques and balloon, stent technology, more successful endovascular interventions were accomplished for the treatment of complex aortoiliac lesions. But the long term patency rates of endovascular therapies are uncertain for type C and D lesions.[2-4] In some recent reports authors revealed good results that approximating those of open surgery for type B or C lesions.[5-8]

Figure 1. Computed tomography (CT) anjiographic view of nearly occlusion in bilateral main iliac arteries at level of aortic bifurcation.



Figure 2. Anjiographic view of 90% narrowing at left carotid artery.



Saher S Sabri at al. reported fifty-four patients with atherosclerotic occlusive disease at the aortic bifurcation that treated by kissing stents. They compared the results of bare metal ballon expandable stents with covered stents. Technical success was achieved in 100% of patients in both groups. They declared better patency rates in covered stent group than bare metal stents at median 21 months follow up. Improvement of symptoms was also better in covered stent group.[9]

In this case we used a bare metal self-expandable stent (Wallstent Endoprosthesis TM)at the level of infrarenal aorta, to benefit its high radial force. Then we used two kissing covered balloon expandable stents (Atrium, Advanta V12TM, Maquet, Getinge Group) that entering into the Wallstent endoprosthesis at the proximal part, for eliminating the occlusion of the aortic bifurcation.

Lun Y et al. compared midterm outcomes of aortoiliac stent (AIS) placement with those of surgical treatment in patients with chronic infrarenal aortoiliac occlusion. The technical success rate was significantly lower in the AIS group than in the surgery group. Surgically treated patients had a longer average postoperative hospital stay and higher rates of postoperative complications caused by especially respiratory and renal disfunction and multiple organ failure. AIS for infrarenal abdominal aortic occlusions were associated with a shorter hospital stay and lower postoperative morbidity rates than open surgery.[2]

Endovascular treatment of extensive AIOD can be performed successfully by experienced interventionists in selected patients. This case was an example of serious, nearly total occlusion of distal aorta just at the aortic bifurcation. The occlusion is treated succesfully with endovascular therapy.

Endovascular procedures enables us to avoid abdominal incision, related postoperative serious complications and prolonged hospital stay. Endovascular therapies for type C and D lesions with good outflow, appears to be a safe, feasible and minimally invasive method with lower morbidity than open surgery especially in high-risk patients.



Figure 3. Anjiographic view of peripheral occlusive disease at distal abdominal aorta (TASC II classification, Type C lesion)



Figure 4. Succesfully treated distal abdominal aortic peripheral arterial occlusive disease (near occlusion at level of aortic bifurcation) by a bare-metal self expandable stent (WallstentTM) and two kissing covered ballon expandable stents (Atrium, Advanta V12TM).

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An isolated femoral vein injury caused by bull horn

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Abstract

Animal related injuries are frequently reported in countries where the bulls are used for traditional show events like bullfighting and bull-running as well as in countries where the farming and livestock rearing is predominantly practiced. Although they are rare among other penetrating traumas, they often tend to be mortal. They have a unique pattern of injury mechanism. Bull gore injuries frequently target the perineal, abdominal and inguinal regions. An isolated femoral vein injury which is caused by an inguinal bull gore with a massive hemorrhage is unusual and it has not been reported in the available literature. In this paper, successfully treated a male patient from the villages of Kars district, who presented with an isolated femoral vein injury after bull gore was presented.

Keywords: Bull gore, femoral vein, injury.

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Introduction

Bullhorn injuries have rarely been documented in the literature. Most of the articles are related to the injuries occurred during bullfighting shows and bull-running festivals. [1] Bullfighting is still a popular and uniquely cultural tradition of many Ibero-American countries (Spain, Portugal, Mexico etc.).[2] Injuries of bull attack frequently occur in these countries because these animal are used in the celebrations and shows.[3] However, animal related injuries are more frequently reported in countries where the bulls are used for farming and stockbreeding.[4]

Despite their rate is low among all injuries, bull gorings tend to be fatal. Major vascular injuries to the limbs caused by this type of penetrating traumas often involve the arteries.[2,5] However, these vascular traumas, being either arterial or venous, need a prompt and precise intervention.[6] Injuries and even deaths caused by bulls can also be seen in Kars province, the easternmost part of Turkey, where farming and livestock rearing are widespread practiced. An isolated injury to the femoral vein caused by an inguinal bull gore has not been reported so far in the available literature. In this article, an unusual case of an isolated femoral vein injury due to bull gore without any arterial or neurologic involvement and its successful surgical treatment are presented.

Case Report

A 34-year-old male referred to the emergency department after gored with the horns of a bull in his left femoral region. There was a massive bleeding from the femoral triangle with a hematoma inside the horn entry site. Palpation of the peripheral pulses revealed no pulse deficit. Color Doppler ultrasound showed triphasic patterns in all distal arterial vasculatures. He was semi-conscious due to massive blood loss with a blood pressure of 60/35 mmHg and a heart rate of 123 bpm.

Computerized Tomography (CT) Angiography examination was performed to determine the origin of the bleeding and vascular injury. CT Angiography scans revealed no arterial injury, but an opaque extravasation over the left femoral vein was inspected **(Figure 1)**. That extravasation and femoral sheath opacification demonstrated the left femoral vein injury.

The patient was taken to the operating room. Under general anesthesia, the left femoral region was explored through a longitudinal skin incision. The femoral sheath was reached under the fulminant bleeding. The common femoral vein laceration was identified. Proximal and distal clamps were entrenched, and a side-clamp was positioned to secure further the vein from bleeding **(Figure 2)**. Unfractionated heparin was given intravenously.

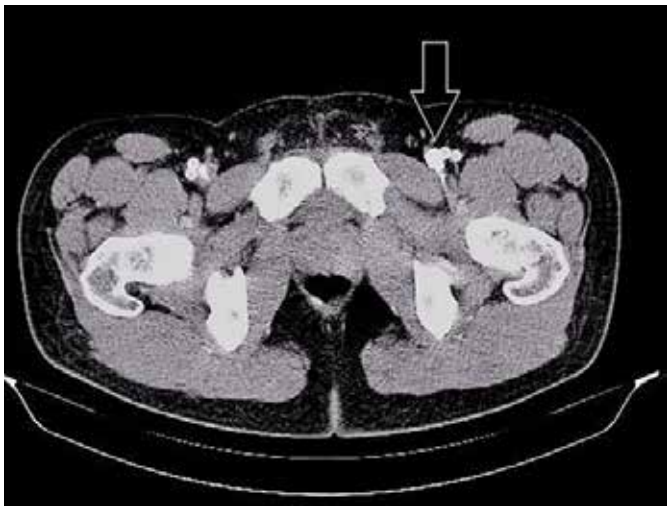


Figure 1. Computerized Tomography (CT) Angiography scan. Arrow is showing the opaque extravasation out of the left common femoral vein laceration.

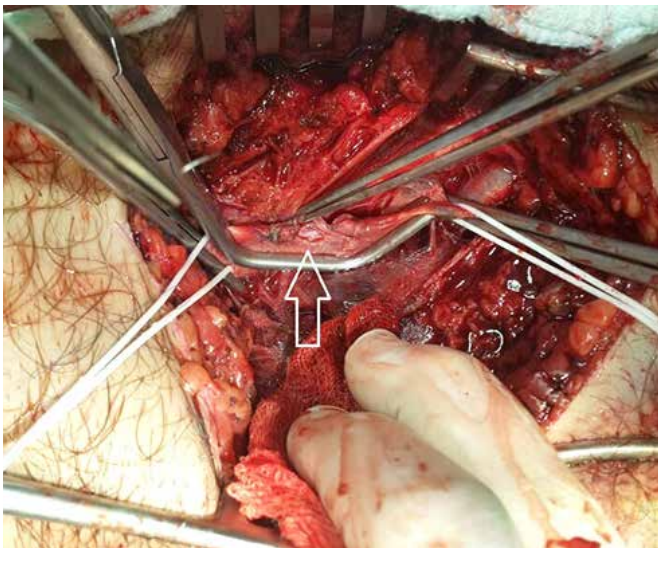


Figure 2. Arrow is showing laceration on the side-clamped common femoral vein.

The vein was repaired primarily with lateral venorrhaphy technique **(Figure 3)**. The venous tissue loss was not extensive, and the primary suturing gave a good result. Polypropylene 6-0 with a 13 mm needle was used as the suture material. The vein was then unclamped, and an intact venous refilling was observed. Erythrocyte suspensions were transfused intraoperatively to increase the hemoglobin levels. Gentamycin (160 mg/day), Cefazolin (1500 mg/day), Acetylsalicylic acid (150 mg/day) were administered during the postoperative follow-up. The patient was discharged sixth postoperative day with no further complication.

Discussion

Despite the urbanization, injuries and deaths as the result of animal attacks are still encountered all over the world.[7] Although their rate is low compared to other usual penetrating injuries, they tend to be severe.[8] People whose occupation is animal husbandry may be the target of such an attack and may be severely injured or killed while tending to large animals.[3] Apart from the farmers, other people who work with the animals including veterinarians, butchers, workers in zoos and circuses are all at high risk of bull gore.[9] According to the studies, most of the victims of the bull attack are either the owner of the animals or workers who are responsible for their care.[3] Bull gore injuries are common in Latin countries because these animals are frequently used in certain shows and fests.[10] Therefore, a specialized and unique medical care for the bullfighters named Cirurgica Taurina has been established in the big arenas in Spain and South America during past two decades.[11]

Figure 3. Surgical reconstruction of the common femoral vein with venorrhaphy



The bull is normally a calm animal and may even be domesticated, but an aggressive behavior may be exhibited with no apparent reason.[12] Bullfighting and bull-running provoke aggressive behavior. Bullhorn injuries and its unique mechanisms have been documented in details. Understanding this mechanism of injury due to the interaction of multiple distinct forces allows handling different complex wound patterns.[1]

As the matador or victim stand in front of the attacking animal, the horn of the bull follows a semicircular path sideways and upwards.[13] The depth of the wound is dependent on the penetration force of the bull's horn into the body and the animal's body weight and strength.[10] The surgeon should be suspicious of underlying injuries that cannot be seen initially because of high kinetic energy transformed into the potential energy.[1,13] In addition, the victim's body weight exerts an equal oppositional force as his body is lifted and suspended by the bull's horns. As the animal attempts to disengage the person's body, a rotational movement occurs because of an unstable balance depending on the center of gravity. This rotational movement during goring is called "rag-doll" and "spinning top" appearance.[1]

Figure 4. Patterns of bull gore injuries in different countries

Country	Most common injury site	Other common injury sites
India[14]	Perineum (36.6%)	Abdomen (24.8%), Head&Neck (15.8%) Thorax (13.9%), Extremities (9.8%)
Turkey [3]	Abdomen (60.9%)	Thorax (39.1%)
Latin Countries[1,2]	Lower extremity (>50.0%)	Perineum (10.5%)

In bull gore during bullfighting, lower leg and the thigh injuries account 50% of all wounds.[13] Major vessels can be lacerated because of the rotational movement of the bull's head leading to a retraction in the media and intimal layers of the vasculature. This may further trigger the Virchow's triad that slows the bleeding.[14] The second common site of goring is the perineum. Scrotal avulsion and anal destruction often need surgical reconstruction.[15] Abdominal injuries constitute the third common injury site and have been documented most commonly on the right side.

The predominance of the right side involvement may be because of the instant reflex of the victim to turn the right side to protect himself with his right arm.[1] Fortunately, the intestinal damage is seen only 10% of the abdominal injury cases.[13] However, as the pattern of injury varies in different countries, the injury site predominance also changes. For example, the perineal injuries are predominate in India while the lower extremity injuries are more common in Latin countries.[3,14,16] This contradiction is demonstrated in **Figure 4**.

In the management of bull gore, precise and extensive exploration of all wounds for damage assessment under local or general anesthesia is essential.[1] Trauma to the anus, rectum, and abdomen increase the morbidity due to fecal contamination.[14] Bull gores directed to the femoral triangle may cause injury to the femoral sheet that contains femoral artery, femoral vein, and femoral nerve and are potentially lethal.[2]

In the case of the femoral vein injury, several surgical techniques were described according to the injury mechanism and injury site. If there is no gross tissue loss the vein can be primarily repaired. The lateral venorrhaphy is the most preferred type of primary reconstruction unless it does not result in sandglass shape of the vein. Alternative reconstruction techniques include the patchplasty, division and reanastomosis, anastomosis of the femoral vein to the deep femoral vein.[6]

In conclusion, bull gore injuries exhibit bizarre and complex wounds that require a prompt identification and exploration. Understanding the mechanism and the nature of bull gores enables the surgeon to handle adequately such atypical injuries for better outcomes. In addition to that, caution is needed for the people having close contact and working with bulls and other animals that may cause injury. The risk may be reduced by using restraints and barriers with appropriate housing and confining structures. Dehorning may also be applied as a precaution to prevent bull gore injuries.

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