

## Simultaneous coronary artery bypass grafting and peripheral revascularization in generalized atherosclerotic patients

*Yaygın aterosklerozisli hastalarda simultane koroner arter bypass ve periferik revaskülarizasyon*

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**Background:** Angiographically documented coexistence of coronary artery disease (CAD) and peripheric artery disease is as frequent as 37% to 78%. Although the coexistence of carotid artery stenosis or abdominal aortic aneurysm with CAD is a more common clinical situation, the prevalence of severe aortailiac occlusive disease (AIOD) has been reported as 4% and 15% in different series of patients undergoing coronary artery bypass operation. Short term follow-up results of the combined surgical interventions in a group of complicated patients with heavily calcified ascending aorta, simultaneous critical AIOD, low ejection fraction and/or unstable angina pectoris were evaluated in the present study.

**Methods:** Eleven male patients (mean age 62.8), with severe CAD and coexisting critical AIOD were included in the study. All patients underwent cardiac catheterization, lower extremity arterial Doppler ultrasonography, abdominal computed tomography and magnetic resonance angiography. Simultaneous coronary bypass on the beating heart and extraanatomical peripheric arterial revascularization were performed to all patients.

**Results:** There were no neurologic, respiratory complications, cardiac or peripheral ischemia in any of the cases in the postoperative follow-up period. The follow-up period was 3.4 years and only one patient has been reoperated due to an occluded graft.

**Conclusion:** We conclude that in patients with a high risk profile, combined surgical approach consisting of off-pump coronary bypass surgery and simultaneous extraanatomic peripheric revascularization, avoiding the manipulation of the heavily calcified ascending aorta, is a safe and preferable approach.

**Key words:** Arterial occlusive diseases; coronary artery bypass; vascular surgical procedures.

**Amaç:** Koroner arter hastalığı ve periferik arter hastalığının birlikteliği anjiyografik olarak %37 ila %78 gibi yüksek bir orandadır. Karotis arter stenozu veya abdominal aort anevrizması ile koroner arter hastalığının birlikteliği daha sık rastlanan bir klinik durum olmasına karşın koroner bypass cerrahi uygulanan hastaların %4-15'inde ciddi semptomatik aortoiliyak oklüziv hastalığın eşlik ettiği görülmektedir. Bu çalışmada ciddi kalsifik asendan aortalı, kritik aortoiliyak oklüziv hastalığın eşlik ettiği düşük ejeksiyon fraksiyonlu ve/veya instabil angina pectorisli komplike hasta grubunda uygulanan kombine cerrahi girişimin yakın dönem takip sonuçları incelendi.

**Çalışma planı:** Ciddi koroner arter hastalığı ve birlikte kritik aortoiliyak oklüziv hastalığı olan 11 erkek hasta (ort. yaş 62.8) çalışmaya alındı. Hastalara kardiyak kateterizasyon, alt ekstremitte arteriyel Doppler ultrasonografi, bilgisayarlı tomografi, manyetik rezonans anjiyografi uygulandı. Hastaların tamamına simultane çalışan kalpte koroner bypass ve ekstra anatomik periferik arteriyel revaskülarizasyon yapıldı.

**Bulgular:** Ameliyat sonrası takip döneminde herhangi bir nörolojik, respiratuvar komplikasyon, kardiyak veya periferik iskemi gelişen olgu olmadı. Toplam takip süresi 3.4 yıldır, bir hasta periferik arteriyel greft oklüzyonu nedeniyle tekrar ameliyat edildi.

**Sonuç:** Yüksek risk profiline sahip hastalarda kombine cerrahi yaklaşımın (ciddi kalsifik asendan aortanın maniplasyonundan kaçınılarak off pump koroner bypass cerrahi ve simultane ekstra anatomik periferik revaskülarizasyon) güvenli ve tercih edilir bir yöntem olduğu görülmüştür.

**Anahtar sözcükler:** Arteriyel oklüziv hastalık; koroner arter bypass; vasküler cerrahi işlem.

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The coexistence of coronary artery disease (CAD) and peripheral artery disease (PAD) is well known. Several studies report that angiographically, coronary arterial atherosclerotic changes are seen in about 40% of patients with PAD.<sup>[1-4]</sup> Although coexistence of carotid artery stenosis or aneurysm of abdominal aorta with CAD constitutes the most serious combination, patients with aorta iliac occlusive disease (AIOD) may also reveal serious problems. The prevalence of severe AIOD has been reported as 4% and 15% in different series of patients undergoing coronary aorta bypass (CABG) operation.<sup>[2,3]</sup>

Severe atheromatous disease of ascending aorta increases risk of perioperative atheroembolism and thus is associated with increased morbidity and mortality during CABG operation. The incidence of atheromatous disease of the ascending aorta in patients undergoing cardiac operation varies between 14-19%.<sup>[4,5]</sup>

Considering operational technique, choice of conduit and proximal anastomose sites; the coexistence of severe AIOD and critical CAD with heavily calcified ascending aorta is a dilemma for cardiovascular surgeon.

This article summarizes the results of combined procedures in our clinic, performed as off pump CABG surgery avoiding manipulation of the ascending aorta, and simultaneous extra anatomic peripheral arterial revascularization in patients with severe symptomatic AIOD disease and concomitant CAD with heavily calcified aorta.

**PATIENTS AND METHODS**

Eleven male patients (mean age 62.8 years) were enrolled in this study to determine the outcome of simultaneous off pump CABG operation with no touch

to ascending aorta and peripheral arterial revascularization. All patients had severe CAD with unstable angina pectoris and concomitant critical AIOD (with pain after walking less than one block or resting pain and/or ischemic skin lesions) and poor ventricular function. Preoperative patient profiles are shown in Table 1.

All patients were referred for surgery for coronary and iliac occlusive disease. The coronary lesions of the patients were as follows; only left anterior descending (LAD) artery lesion in two patients, both LAD and circumflex artery lesions in two patients, both LAD and right coronary artery lesions in three patients and four patients had lesions in all three coronary arteries.

The patients underwent cardiac catheterization and lower extremity arterial Doppler ultrasonography, abdominal computed tomography and magnetic resonance angiography or digital subtraction angiography. The patients were found to have severe AIOD. The surgical approach was decided as simultaneous operation for both the coronary and peripheral arteries.

The diagnosis of porcelain aorta was made before operation by chest X-Ray films with ring shaped calcifications of the aortic knob, by computed tomography scans, or by intraoperative inspection and palpation of aorta (pale or leather appearance, palpation of atheromatous debris, little bleeding during scalpel puncture of the ascending aorta for cannulation). Off pump CABG operation with no touch to aorta technique was applied to all patients.

**Surgical technique.** All patients underwent surgery without cardiopulmonary bypass. After classical median sternotomy, the left internal thoracic artery (IMA) was dissected and saphenous vein was harvested simultaneously. Then femoral arteries were bilaterally dissected and prepared for peripheral distal anastomosis.

**Table 1. Patient number five had an occluded aorta femoral graft, at the third year of operation his axillo femoral graft was thrombosed and underwent a new surgery for peripheric bypass**

Patients	Age	DM	Smoking	IRFT	Ejection fraction %	Graft number	Anastomotic site	Inotropic support	ICU stay (hrs)	Hospital stay (days)	Follow-up (months)
1	45	-	-	-	35	1	Innominate A.	-	50	8	62
2	66	-	+	-	30	1	Subclavian A.	-	30	7	56
3	75	-	+	-	45	2	Subclavian A.	-	32	7	46
4	45	+	+	+	35	2	Innominate A.	+	36	7	42
5	75	+	+	-	40	2	Axillary A.	-	24	7	40
6	67	-	-	-	45	2	Axillary A.	-	28	7	36
7	68	-	-	-	30	3	Subclavian A.	-	32	7	30
8	71	-	+	+	30	2	Subclavian A.	+	36	7	28
9	63	+	+	+	40	3	Subclavian A.	+	50	7	22
10	56	-	+	-	35	3	Axillary A.	-	28	7	14
11	60	+	+	-	40	3	Innominate A.	-	30	7	8

DM: Diabetes Mellitus, IRFT: Impaired respiratory function test, ICU: Intensive care unit.

Preferred proximal anastomotic sites for peripheral revascularisations were innominate artery in three patients, axillary artery in three patients and subclavian artery in five patients. Sternotomy incision is expanded toward the right infraclavicular region with a collar shaped incision to explore respectively subclavian or axillary arteries.

In patients, IMA harvested, distal anastomosis were done first on the beating heart with local coronary stabilizer (Octopus-2 coronary stabilizer, Medtronic, MN, USA). Then, full ringed polytetrafluoroethylene (PTFE) graft was proximally anastomosed to innominate artery or subclavian artery approximately 2 cm. after its origin, or axillary artery in end to side fashion. Proximal anastomosis of saphenous vein grafts were done on the tube graft (clamping the ascendant aorta was avoided) than coronary revascularisation was completed on the beating heart. Polytetrafluoroethylene graft was then directed into the right pleural cavity, reaching the costophrenic sulcus. It was tunneled through the diaphragmatic insertions into the retroperitoneal space (the entire route was extraperitoneal). Afterwards a lateral small flank incision at the level of the right iliac crest was done, through the abdominal muscles to the level of the peritoneum, without entering the peritoneum, the tube grafts were directed distally under the inguinal ligament towards the left and right common femoral arteries. Distal anastomoses of the grafts were done with end to side fashion on femoral arteries.

## RESULTS

All patients were under continuous hemodynamic monitoring during the operation and in the intensive care unit (ICU). The perioperative data of the patients are shown in Table 1. During the operation and postoperative period, the hemodynamic parameters were stable in all patients. Only in three patients there was a need for medical inotropic support for 24 to 36 hours postoperatively. There was no revision for bleeding complication.

Mean entubation time was 9.14 hours (6-14 hours). None of the patients had prolonged entubation duration due to respiratory problems. The mean stay in intensive care unit was 2 days (1-3 days).

Atrial fibrillation was seen in three patients postoperatively, and sinus rhythm was gained with medical therapy. No neurological complications, such as stroke, transient ischemic attack, stupor, or coma were seen.

All of the patients were under follow-up by regular visits in our outpatient clinic. Mean follow-up time was 3.7 years (8 months-5 years).

In one patient right axillobi-femoral graft thrombosis developed after 3 years of initial operation. This patient

had a transperitoneal peripheral revascularization operation before. Left axillobi-femoral bypass procedure was performed. One patient was lost because of lung cancer at the 3rd postoperative year.

All of the patients were free from angina, and at NYHA (New York Heart Association) functional class I or II at the end of their postoperative second year. Doppler ultrasonographic evaluation was applied to all patients at the first and second years and all of the patients had patent grafts.

## DISCUSSION

The concomitance of peripheral arterial, coronary disease and severe atherosclerosis of ascending aorta may reveal serious complications. Surgical approach in such a situation may be as following; operating the more serious, life-threatening manifestation first and perform the other operation after a delay (sequential or staged approach) or performing CABG and the vascular procedure as one operation (simultaneous or combined procedure).<sup>[2,3,6]</sup>

Survival of patients with poor left ventricular function undergoing major vascular surgery is not promising. Several studies have reported 40-70% incidence of perioperative severe myocardial ischemia and a 12-20% mortality from cardiac causes after major vascular surgery in patients with an ejection fraction of less than 30%.<sup>[2,4,7-9]</sup>

Harpole performed intraoperative radionuclide angiography and transesophageal echocardiography for the evaluation of left ventricular functions in patients with infra renal aortic cross clamping and evaluated a significant decrease in ejection fraction and increase in left ventricular end diastolic volume, pulmonary blood volume and left ventricular end systolic wall stress.<sup>[10]</sup> This may cause a sudden increase in pulmonary capillary wedge pressure and cardiac failure in patients with severe coronary artery disease.

On the other side, aortic clamping increases the severity of lower extremity ischemia and the accumulation of vasodepressor substances. Aortic declamping may lead to metabolic acidosis and secondary myocardial depression. The sudden decrease in peripheral vascular resistance after aortic declamping may cause coronary hypoperfusion. These may cause severe hemodynamic changes especially in patients with severe coronary artery disease.<sup>[2,4,8,9-12]</sup>

Coronary revascularization improves early and late survey in patients with peripheral arterial disease and concomitant coronary artery disease.<sup>[2-4]</sup> Reul evaluated the concomitance of coronary and peripheral arterial disease as a risk factor for morbidity and mortality in

1093 patients operated simultaneously or sequentially. In his evaluation, the simultaneous approach was not found to be a risk factor for morbidity and mortality. He also stated that, in staged approach, morbidity and mortality of peripheral arterial surgery when performed after CABG was improved.<sup>[8]</sup>

Currently, combined surgical approach is widely accepted.<sup>[2,4,8,13,14]</sup> In high risk patients the mortality rate of combined approach with CABG under cardiopulmonary bypass (CPB) is reported to be as high as 20%.<sup>[2,4,8,15-17]</sup>

Mohr et al<sup>[4]</sup> operated 4 patients with severe coronary artery disease and symptomatic AIOD with combined surgery technique under CPB and in two despite of the successful revascularization the ischemia of the extremity was aggravated. This was thought to be due to continuous flow extracorporeal circulation.

In patients with severe left ventricular dysfunction and/or unstable angina pectoris, off pump myocardial revascularization may provide a better myocardial preservation and lesser changes in hemodynamics. In our series none of the patients, despite of the poor ventricular function had significant hemodynamic instability.

Cardiopulmonary bypass and cardioplegic arrest results in physiologic inflammatory, coagulopathic and embolic changes that may result in end-organ damage. Pulmonary dysfunction after open heart surgery is multifactorial, including the effects of prolonged anesthesia, inflammatory reaction provoked by CPB and surgical trauma.

Bleeding complications may cause prolonged respiratory need and hemodynamic problems that may increase morbidity in patients with limited myocardial reserve and pulmonary capacity. In our study none of the patients had bleeding complication which may be another advantage of off pump operation compared to CABG under CPB.

Cannulation, partial or total clamping of ascending aorta in patients with severe aortic atherosclerosis may be disastrous; severe atheroembolic complications (stroke and systemic embolization in 45%) and rupture due to manipulation of aorta may occur.<sup>[5,17,18]</sup> Off pump coronary revascularization technique without manipulation of the aorta may avoid these complications. We did not see any neurologic complications in our serie. Several studies evaluated the patency of this type extra anatomic arterial reconstruction as 80-90% for 3 years.<sup>[19,20]</sup> In our study a mean 2 years follow up of patients revealed the patency as 91%.

There were no prolonged operation and entubation duration, hemodynamic instability, myocardial or cere-

bral ischemic event, renal failure, gastrointestinal complications and prolonged hospital stay in our patients. Even though the patient number operated with combined approach is limited to make a concrete evaluation, it is possible to say that in coronary artery patients with concomitant AIOD and calcific aorta, respiratory, renal, cerebral complications, wound infection and possible complications of the abdominal surgery, may be minimalized with extraanatomic peripheric arterial reconstruction and off pump CABG operation with no touch to aorta technique.

## CONCLUSION

In the combined surgery technique, the patient is operated in one procedure without additional risks of the delay period for the second stage. One advantage of this approach is that there is no need for intraperitoneal interventions; the complications of abdominal surgery are avoided. The incidence of perioperative stroke and systemic embolization risk according to the manipulation of atherosclerotic ascending aorta may be avoided. The operational stress for the patient is for only once and the whole hospital stay is not prolonged. We conclude that off-pump coronary artery bypass with no touch technique and extraanatomic peripheral revascularization may be a preferred method in patients with severe symptomatic coronary disease and peripheral artery disease and severe aortic atherosclerosis.

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