World Journal of Pharmaceutical and Life Sciences
WJPLS
www.wjpls.org
SJIF Impact Factor: 6.129

CORONARY ARTERY BYPASS GRAFTING SURGERY IN SUB-SAHARAN AFRICA (SENEGAL): PRELIMINARY STUDY

Mouhamadou Bamba Ndiaye*[1], Dr. Joseph Salvador Mingou[1], Maguette Ba[6], Christelle Akagha Kondé[1], Fatou Aw[1], Simon Antoine Sarr[1], Malick Bodiian[1], Aliou Alassane Ngaidé[3], Alassane Mbaye[3], Adama Kane[4], Maboury Diao[1] and Abdoul Kane[5]

[1]Cardiology Department, Teaching Hospital Aristide Le Dantec.
[2]Cardiology Department, National Teaching Hospital of Fann.
[3]Cardiology Department, General Hospital of Grand Yoff.
[4]Gaston Berger University of Saint Louis.
[5]Cheikh Anta Diop University of Dakar.
[6]The Clinique du Cap of Dakar.

***Corresponding Author: Mouhamadou Bamba Ndiaye**
Cardiology Department, Teaching Hospital Aristide Le Dantec.

Article Received on 22/12/2019 **Article Revised on 11/01/2020** **Article Accepted on 31/01/2020**

ABSTRACT

Despite the evolution of percutaneous coronary interventions techniques, some coronary lesions still fall under revascularization surgery, in particular coronary artery bypass grafting (CABG) surgery. Accessibility to CABG remains difficult in developing countries, due to a deficit in suitable technical platform and low income of the populations. Through this series, we wanted to note the clinical profile of the patients who underwent CABG, as well as the different indications of coronary revascularization, and the surgical techniques used in these black subjects from Senegal. The study was retrospective, descriptive, carried out between October 2014 and March 2017 at the Clinique du Cap-Dakar, making it possible to identify 17 patients, mostly men (sex ration: 5.6). Hypertension was the most common risk factor (13 patients), and six of them were diabetic. Thirteen patients presented a three-vessel disease on coronary angiography. The average SYNTAX score was 34.9, while the calculated average EuroSCORE was 3.4. The majority of performed CABG were arterial (66.66%). Three patients had triple bypass surgery, the rest had a double bypass surgery. Only one patient had undergone the breast Y technique. No incidents or accidents were reported during the procedures. The intraoperative mortality was zero. Postoperatively, atrial fibrillation has been reported in one woman. Stroke and myocardial infarction were not recorded on return from the surgery. This series also shows that CABG is feasible in Dakar, and allows the revascularization of patients with complex coronary lesions. This technique must be extended to the public sector, but also to the sub-region in order to better manage these coronary diseases which are constantly growing in Africa.

KEYWORDS: Coronary bypass surgery, black subjects, Africa.

INTRODUCTION

Improving the prognosis of ischemic heart disease requires adequate management, which is currently well codified by the guidelines of learned societies.[1,2,3] Myocardial reperfusion is the ultimate goal of this management: it reduces the mortality of patients in acute episodes and improves their quality of life in the long term.[4,5] The different reperfusion techniques used are fibrinolysis, percutaneous coronary intervention (PCI) and revascularization surgery.[2] Fibrinolysis is indicated in the pre-hospital phase. PCI can be done urgently, or delayed. It has made enormous progress and is now making it possible to unclog increasingly complex lesions. Despite the evolution of PCI techniques, certain coronary lesions still fall under revascularization surgery, in particular coronary artery bypass grafting (CABG) surgery.[6] The choice between these reperfusion methods depends on the indications.

All these techniques are available in developed countries because they have modern medical infrastructure, with adequate financial resources. On the other hand, care can be difficult in developing countries because of a deficit in suitable technical facilities and the low income of the populations.[7]

In Senegal, especially in Dakar, in addition to thrombolysis which is more and more accessible, we

have had, since 2014 at the Aristide Le Dantec Hospital, a coronarography room. This room allows us to explore and care for patients with ischemic heart disease. Studies have already been done on fibrinolysis and PCI. The establishment of the coronary angiography room allowed the advent of coronary surgery. The CABG has been performed since 2014 at the Clinique du Cap by the team of Doctor Maguette BA and have not yet been evaluated. This is the goal of our work.

Our objectives were to describe the clinical profile of these patients; to determine the various indications for CABG in these patients as well as the surgical techniques used.

II. METHODOLOGY

Our work was done in Dakar, jointly with the Clinique du Cap and the Cardiology Department of the Aristide Le Dantec hospital. The Clinique du Cap is a private health facility designed to meet the demand for quality care. It provides the medical team with the most efficient equipment. It is the first medical structure (and currently the only one) to undergo CABG in Dakar. The first CABG was done in October 2014 by the team of Doctor Maguette Bâ.

The study was retrospective descriptive, carried out between October 2014 and March 2017, ie a period of 30 months. Were included in our work all patients who underwent CABG during the study period, and whose complete or incomplete records had been found. The medical records retained included at least the patient's age and gender, and the result of the coronary angiography indicating the CABG.

The data for each patient were listed on individual pre-established cards (see appendix) using the patient records available at the Clinique du Cap and at the Cardiology Department of Aristide Le Dantec Hospital.

The idea was to strip the medical records and the coronary angiography room registers, to question the patients and to make for those who were available a paraclinical check-up.

Socio-demographic, clinical, paraclinical and therapeutic data were collected.

The study was based on the collection of coronary angiography data, the indications for CABG and the evaluation of the surgical risk by Euro SCORE; as well as the technical aspects, the results of bypassing, and the progressive component after surgical intervention.

Data were entered and used from an Excel 2013 spreadsheet. The authorization of the head management of the two structures and the written or verbal consent of the patients were collected before the start of this study.

II. RESULTS

We identified seventeen patients whose average age was 61.3 ± 7.7 years. The majority of patients were male (sex ratio: 5.6). All of the women were menopausal and over the age of 60. Only one man was under 50.

Hypertension was the most common risk factor (13 patients), eight (08) patients had dyslipidemia and six were diabetic.

Two patients presented with lower extremity arterial disease (LEAD). Two coronary patients had an history of fibrinolysis and one patient had PCI.

One patient had an obstructive pulmonary disease (COPD) confirmed by spirometry.

At the electrocardiogram, all the patients were in sinus rhythm, one patient had a second degree AV block Mobitz I. Three patients had subepicardial ischemia. Two patients had electrical necrosis, one in the lower territory and the other in the extended anterior territory.

The average left ventricle ejection fraction (LVEF) was 52.5% ± 11.4%. Five of our patients had moderately impaired systolic LVEF.

In one of our patients, the echocardiography revealed an aortic disease (moderate aortic stenosis and moderate aortic regurgitation) and moderate mitral regurgitation, all rheumatic in appearance.

Among the ten patients who had a Doppler ultrasound of the supra-aortic trunks, two patients had significant carotid stenosis and four patients had diffuse atheromatous disease without significant stenosis.

For seven of our patients, the coronary angiography was indicated for a stable angina ; four of our patients had had an acute coronary syndrome for more than three months. A 50-year-old patient who complained for atypical precordialgia had undergone coronary angiography as part of the preoperative check-up for valvular heart disease (aortic disease and mitral regurgitation). Only one patient presented a significant lesion of the left main coronary artery (LMCA). The other patients had at least two-vessel diseases.

The coronary angiography of the patient with polyvalvulopathy found three-vessel disease.

In Figure 1, the patients are divided according to the number of affected coronary arteries.

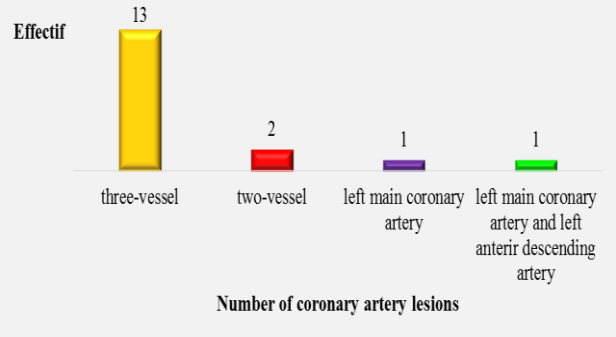

Figure 1: Distribution of patients according to the number of main coronary artery lesions at coronary angiography.

The SYNTAX score averaged 34.9 with extremes of 55 and 10. Only one patient had a SYNTAX score below 22.
The average EuroSCORE calculated in thirteen patients was 3.4 with extremes of 1.3 and 7.6. Only two patients had a high risk of operative mortality.

The CABG indications were:

- A high SYNTAX score (ten patients including five with diabetes); the coronarographic profile of patients with a high SYNTAX score is shown in Table VI; Concerning the patient who underwent for PCI with stent placement, the CABG indication was an angiographically proven intra-stent restenosis with a SYNTAX score of 35.
- A three-vessel disease (five patients including one with renal insufficiency) or two-vessel disease with a proximal left anterior descending artery involvment (one patient) and an intermediate SYNTAX score;
- A lesion of LMCA with a low SYNTAX score in one patient.

Operating procedure
During the study period, seventeen patients had undergone a CABG. We had found and used 15 operating reports. In all patients, the approach was a longitudinal median sternotomy. All bypasses had been done under extracorporeal circulation (ECC). For the patient who had undergone CABG combined with double valve replacement, the duration of the ECC was 280 minutes. For the other patients, the average duration of the ECC was 89.9 ± 16.9 minutes with extremes of 69 and 115 minutes.

For the patient who had undergone CABG combined with double valve replacement, the aortic clamping time was 229 minutes.

For the other patients, the average aortic clamping time was 64.5 ± 9.43 minutes with extremes of 50 and 82 minutes.

In all patients, myocardial protection was provided by anterograde iterative warm blood cardioplegia.

The majority of bypasses performed were all arterial.

Figure 2 shows the different types of grafts used in our sample.

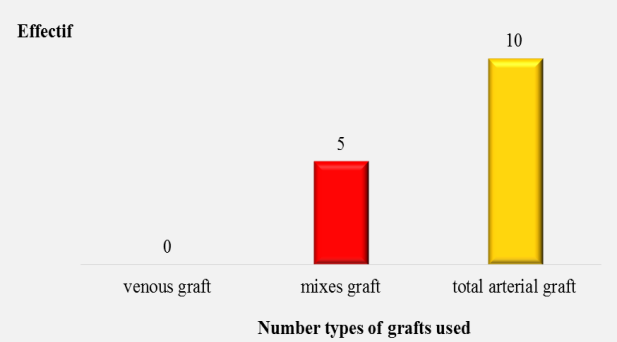

Figure 2: Distribution of patients according to the types of grafts used.

Three patients had undergone a triple bypass. All the other patients underwent double bypass surgery. The average number of bypasses was 2.2 ± 0.4.

Only one patient had benefited from the breast Y technique.

Table I summarizes the bypass techniques used in our patients.

Table I: Distribution of patients according to the bypass techniques used.

Type of CABG	Used technique	Number
Total arterial	Distal anastomosis of pedicled internal mammary artery to the target coronary artery	9
	Breast Y technique.	1
Mixed	- Distal anastomosis of pedicled internal mammary artery to the target coronary artery and - Peripheral venous anastomosis on the target coronary artery followed by proximal anastomosis on ascending aorta	5

When the LAD was affected, the pedicled left internal mammary artery was always anastomosed to it. After bypass surgery, the patient with mitro-aortic valve disease underwent double valve replacement in the mitral and aortic position. At the end of the intervention, before the sternum closed, the bypass permeability had been checked by the Doppler Médistim system.

For a patient who underwent double arterial bypass, the right internal breast graft was anastomosed to the first margin. This artery was very infiltrated, of small caliber, and calcified in places : the downstream bed was of poor quality. At the level of this internal breast graft, the permeability was not good. The left internal breast graft, on the other hand, was permeable. For the rest, all bypass surgeries were permeable. No incidents or accidents were reported during the procedures. The intraoperative mortality was zero. Post-operative anemia was the most common complication. Four patients had severe anemia and had been transfused. Two patients presented with acute renal failure (Table II) post-operatively: one with a chronic renal disease associated with several comorbidities (age, hypertension, type 2 diabetes, dyslipidemia, LEAD, occlusion of the right carotid artery, COPD) and, on the other hand, one who has had a double bypass associated with a double valvular replacement.

Their creatinine clearances, initially 40 mL / min and 87 mL / min, passed to 19.5 and 15.1 mL / min respectively on the third day of hospitalization.

These two patients had benefited from hemodialysis sessions with gradual return of creatinine clearance to initial values at the end of hospitalization. One patient had active bleeding from both drains. This bleeding necessitated a resumption of surgery for hemostasis which had allowed the bleeding to stop. One female patient had atrial fibrillation after the procedure. She had been treated with an anticoagulant and then benefited from a pharmacological cardioversion.

No patient had ever had a stroke or myocardial infarction as a complication.

Table II: Postoperative complications in our patients.

Type of complication	Number
Acute anemia	10
Acute renal failure	02
Active bleeding with secondary surgical revision	01
Atrial fibrillation	01
Ischemic stroke	00
Myocardial infarction	00
Death	00

The average length of hospital stay was 11 ± 2.4 days with extremes of 08 and 14 days.

All patients presented an improvement in the initial symptomatology after surgery. They had all returned to their daily activities.

At a distance from the intervention, one patient's echocardiography noted a small subaortic interventricular communication, which was not reported at the preoperative echocardiography.

III. DISCUSSION

Limit of the study

We had carried out a largely retrospective study in patients at a distance from their treatment, leading to incomplete processing of the medical reports on a small sample of patients. In effect, in total we could only include in the study fifteen cases of CABG. There was many reasons like the availability of the technique which is done only in a private structure, and so was inaccessible to the populations with a low income. The surgery team carried out annual or biannual missions because the majority of the team members did not live in Dakar. This contributed to generate an additional expense, which contributed to increase the cost of the procedure locally.

Study Population

Cardiac surgery is very little developed in Sub-Saharan Africa. There is almost no data on this activity in our regions. Through this study, we wanted to show the possibility of carrying out this recent and growing activity in our country, led by an experienced Senegalese heart surgeon.

The series revealed a clear male predominance. This observation had already been made in the CORONAFRIC I and II studies.[8] In Morocco, in a population of bypassed diabetics, the sex ratio was 3.9,[9] in favor of men. Close values have been found locally.

The average age was 61.3 ± 7.7 years, with extremes of 44 and 74 years. These data are in accordance with those of the CORONAFRIC II study in which patients with ischemic heart disease were on average 58.69 years old.[10]

The data collected by ElBardissi, showed an age between 60 and 65 years.[11] Moutakiallah also found an average age of 61 years.[12]

All of the women with bypass were over 60 and only one man was under 50. This could confirm the protective nature of estrogen before menopause.

The risk factors and comorbidities of the subjects highlight the type of population in which bypass surgery was performed in our series. The literature reports an ever-increasing number of patients with co-morbidities.[13,14] Our data also confirm that coronary patients are often polyvascular.

On echocardiography, more than half of the patients had segmental kinetic disorders. The systolic LVEF was moderately impaired in five of our patients. The altered LVEF argues in favor of an indication of CABG better than medical treatment.[13]

For seven of our patients, coronary angiography was indicated for stable angina (stable coronary artery disease).

A 50-year-old patient had undergone coronary angiography as part of the preoperative assessment of valvular heart disease (aortic disease and mitral regurgitation). This attitude is in line with current guidelines which recommend coronary angiography in men over 40 and women after menopause when they have to undergo valvular surgery.[15] This makes it possible to detect coronary lesions if they exist and to treat them concomitantly with the surgical intervention. In this 50-year-old patient, the degree of severity of the valvulopathy on the echocardiography did not in itself explain the atypical precordialgia, which constitutes an additional argument for performing coronary angiography.

The majority of patients had three-vessel diseases. These multi-vessel lesions tip the therapeutic decision towards the surgical solution.

The SYNTAX score was on average 34.9 with extremes of 55 and 10. Most often, in the case of complex lesions and when there is medical and surgical staff, the scores above 22 argue in favor of a surgical indication, especially since the surgical risk calculated by EuroSCORE was low (average score at 3.4).

The indications of our patients were in accordance with current guidelines.[1,2,3] CABG should remain the treatment of complex lesions, especially when associated with co-morbidities. Compared to PCI in these cases, it leads to a lower risk of cardiac death and iterative coronary vasculature.[16,17,18,19]

In all patients, the approach was a longitudinal median sternotomy. This is the conventional approach. The closed chest bypass grafting under video endothoracoscopy was carried out by Gandjbakch,[6] and is being tested by certain teams. It only supports a limited number of lesions, usually the LAD, resulting in incomplete revascularization.

All the bypasses were done under extracorporeal circulation. ECC offers a stable operating field without bloodshed. But it causes damage to red blood cells and an increase in stroke, resulting from the manipulation and clamping of the ascending aorta. Several teams try to work without ECC. This avoids manipulation of the aorta and reduces the occurrence of stroke. This type of procedure can be useful in patients with lesions that do not require dislocation of the heart, or in patients with significant comorbidity (left ventricular dysfunction, renal failure). But the technique limits the number of bypasses. The risk of incomplete revascularization is high. In addition, according to many large randomized trials, there is no clinical benefit and no long-term benefit on quality of life. The use of ECC is therefore still relevant.[6,13,9]

The average duration of ECC and aortic clamping was 89.9 minutes and 64.5 minutes, respectively. This result is better than that of the Moroccan team which found 134 minutes and 76 minutes respectively.[12]

The patient who underwent a combined procedure (bypass surgery associated with valve surgery) had a longer clamping time and ECC duration (229 and 280 minutes respectively), due to the complexity of this intervention.

In all patients, myocardial protection was provided by anterograde iterative warm blood cardioplegia. This type of protection could be beneficial because it looks like normal physiology, which could lead to a decrease in myocardial damage and better clinical results. Other surgeons have opted for crystalloid cardioplegia because it is less complex, less expensive and offers better operative visibility. A recent meta-analysis summarizing the data from 36 trials has not shown an obvious advantage of one type of cardioplegia over the other.[13,20] Therefore, it is up to each team to use the technique that they master best and which, according to them, has proven itself.

No isolated venous bypass had been done. The majority of bypasses performed were all arterial. The literature supports this therapeutic choice. Compared to PCI, multiple arterial transplants appear to increase the chances of survival better than mixed transplants.[21,22] In addition, venous bypasses are used less often because they get blocked quicker.[6,13]

Two patients had undergone triple CABG. All the other patients underwent double CABG. The average number of bypasses was 2.2. This joins the result of the Moroccan team which found an average number of 2.3.

Only one patient had benefited from the breast Y technique.

When the LAD was affected, the pedicled left internal mammary artery was always anastomosed to it. Grafting the left internal mammary artery onto the LAD would be the best option for prolonging survival.[6,13]

After bypass surgery, the patient with mitro-aortic valve disease underwent double valve replacement in the mitral and aortic position. Based on current guidelines, coronary angiography is required in patients with surgical valve disease. Patients with severe coronary lesions indicating bypass surgery should benefit from valve replacement concomitantly.[15]

At the end of the intervention, before the closure of the sternum, the bypass permeability was checked by the Doppler Médistim system. One of the female patients presented a non-permeable bypasse. For the other patients, all bypasses were permeable. Intraoperative angiography is normally the most reliable method for assessing the flow at the bypassed vessels. But the conditions are not met to practice it in standard operating rooms.[13] Among the techniques proposed, the transit time flow measurement (TTFM), a technique used by the Doppler Medistim system, is the one that provides a high diagnostic yield. With this technique, false positives are rare. It is therefore recommended, in the absence of angiography, to assess the flows at the time of bypass surgery.[13,23,24]

In our series, a patient who underwent double arterial bypass surgery had poor permeability of one of her grafts. This is certainly due to the significant infiltration of its arteries and the poor quality of its lower bed.

The low post-operative morbidity rate witnesses the training and experience of this surgical team. The average length of hospital stay was 11 days with extremes of 08 and 14 days. The Moroccan team had an average of 15.6 days.[12]

IV. CONCLUSION

Ischemic heart disease is a serious condition, burdened with high mortality even in low-income countries. They require, in the event of complex coronary lesions, a surgical revascularization by coronary artery bypass grafting surgery. This coronary surgery technique has been available in Senegal, particularly in Dakar since October 2014, and had not yet been evaluated.

Coronary artery bypass grafting surgery is therefore performed in Dakar using conventional techniques and following the guidelines of learned societies. In the future, it will be a question of extending the technique in both the private and public sectors, making it more accessible to populations and making it possible to carry out larger multicenter studies. The practice of coronary artery bypass grafting surgery in Dakar will thus reduce medical evacuations abroad, to the benefit of patients, their families and the whole community.

BIBLIOGRAPHY

1. The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC). 2017 Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. *Eur Heart J, 2017; 00: 1-66.*
2. The Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). 2014 ESC/EACTS Guidelines on myocardial revascularization. *Eur Heart J*, 2014; 35: 2541-619.
3. The Task Force on the management of stable coronary artery disease of the European Society of Cardiology. 2013 ESC guidelines on the management of stable coronary artery disease. *Eur Heart J*, 2013; 34: 2949-3003.
4. Danchin N, Kadri Z, Cambou JP. Prise en charge de l'infarctus du myocarde dans les études USIK : amélioration pronostique et rôle du délai d'admission. *Arch Mal Cœur Vaiss, 2005; 98: 1149-54.*
5. Danchin N, Puymirate E, Aissaoui N *et al*. Epidemiology of acute coronary syndromes in France and in Europe. *Ann Cardiol Angéiol, 2010; 59: 37-41.*
6. Gandjbakhch I, Ollivier JP. Chirurgie coronaire. In: Société Française de Cardiologie. Cardiologie et maladies vasculaires. Paris : Elsevier Masson, 2007; 1566-76.
7. Organisation mondiale de la santé (OMS). Maladies cardiovasculaires [en ligne]. Disponible sur : < http://www.who.int/mediacentre/factsheets/fs317/fr/ >. (Consulté le 25 novembre 2017) Score SYNTAX [en ligne]. Disponible sur : <http://www.syntaxscore.com/calculator/start.htm >. (Consulté le 10 juillet 2017).
8. Monassier JP, Monassier F. Revascularisation myocardique au début du XXI^{e} siècle : de moins en moins d'indications de pontages. *Presse Med*, 2008; 37: 1575-9.
9. Ba SA. Epidémiologie de la coronaropathie en Afrique. Congrès APPAC, 8-10 juin, 2016. Biarritz. [en ligne]. Disponible sur : < https://www.appac.fr/archives/2016/ > (Consulté le 14 août 2017).
10. ElBardissi AW, Aranki SF, Sheng *et al*. Trends in isolated coronary artery bypass grafting: an analysis of the Society of Thoracic Surgeons adult cardiac surgery database. *J Thorac Cardiovasc Surg*, 2012; 143: 273-81.
11. Moutakiallah Y, Benzaghmout K, Aithoussa *et al*. La chirurgie coronaire sous circulation extra-corporelle chez le patient diabétique. *Pan Afr Med* J, 2014; 17: 199.
12. Head SJ, Kieser TM, Falk V *et al*. Coronary artery bypass grafring: Part 1 – the evolution over the first 50 years. *Eur Heart J*, 2013; 34: 2862-72.

13. Deb S, Fremes SE. To bypass or stent? The changing rules of an advancing game. *J Thorac Cardiovasc Surg*, 2015; 149(3): 679-81.
14. The Task Force for the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and European Association for Cardio-Thoracic Surgery (EACTS). 2017 ESC/EACTS Guidelines for the management of valvular heart disease. *Eur Heart J, 2017; 00: 1-53.*
15. Menasché P. Revascularisation myocardique 30 ans après: la chirurgie toujours d'actualité. *Presse Med*, 2008; 37: 1569-74.
16. Smit Y, Vlayen J, Koppenaal H *et al*. Percutaneous coronary intervention versus coronary artery bypass grafting: A meta-analysis. *J Thorac Cardiovasc Surg*, 2015; 149(3): 831-8.
17. Kappetein AP, Dawkins KD, Mohr FW *et al*. Current percutaneous coronary intervention and coronary artery bypass grafting practices for three-vessel and left main coronary artery disease. Insights from the SYNTAX run-in phase. *Eur J Cardiothorac Surg*, 2006; 29: 486-91.
18. Kappetein AP, Head SJ, Morice MC *et al*. Treatment of complex coronary artery disease in patients with diabetes: 5-year results comparing outcomes of bypass surgery and percutaneous coronary intervention in SYNTAX trial. *Eur J Cardiothorac Surg*, 2013; 43: 1006-13.
19. Sa MP, Rueda FG, Ferraz PE *et al*. Is there any difference between blood and crystalloid cardioplegia for myocardial protection during cardiac surgery? A meta-analysis of 5576 patients from 36 randomized trials. *Perfusion*, 2012; 94: 2046-53.
20. Locker C, Schaff HV, Daly RC *et al.* Multiple arterial grafts improve survival with coronary artery bypass graft surgery versus conventional coronary artery bypass grafting compared with percutaneous coronary interventions. *J Thorac Cardiovasc Surg*, 2016; 152(2): 369-79.
21. Rosenblum JM, Harskamp RE, Hoedemaker N *et al*. Hybrid coronary revascularization versus coronary bypass surgery with bilateral or single internal mammary artery grafts. *J Thorac Cardiovasc Surg*, 2016; 151(4): 1081-9.
22. Jokinen JJ, Werkkala K, Perakyla T *et al*. Clinical value of intra-operative transit-time flow measurement for coronary artery bypass grafting: a prospective angiography-controlled study. *Eur J Cardiothorac Surg*, 2011; 39: 918-23.
23. Mack MJ. Intraoperative coronary graft assessment. *Curr Opin Cardiol*, 2008; 23: 568-72.