Impact of complete and incomplete revascularization on short- and long-term quality of life in patients with multivessel coronary artery disease

N. CHEN[1], J.-Y. ZHANG[1], S.-Z. YANG[2], Y.-D. LI[2]

[1]Department of Cardiology, the First Affiliated Hospital of Zhengzhou University, Zhengzhou, Henan Province, China
[2]Department of Cardiology, Nanyang Central Hospital, Nanyang, Henan Province, China

Abstract. – **OBJECTIVE:** In this study, we compared the impact of two main strategies of intervention against multivessel coronary disease (MVD), complete revascularization (CR) and incomplete revascularization (IR), on patients' quality of life.

PATIENTS AND METHODS: 210 patients with multivessel disease were selected for this study. The diagnosis was confirmed by coronary angiography, and patients were divided in two different groups according to the type of revascularization method they received: (1) the complete revascularization (CR) group and (2) the incomplete revascularization (IR) group. Patients were asked to fill out SF-36 life quality questionnaire in three-time points: (1) before the operation; (2) one month after the operation; and (3) one year after the operation.

RESULTS: Baseline conditions showed no significant intergroup differences. Scores obtained from different sections in the questionnaire were compared between two groups and results revealed that scores in every section were significantly different ($p < 0.05$) except for the general health condition section. Patients in the CR group scored higher in physical functioning, physical role, body pain, vitality, social role, emotional role and mental health. Scores obtained from different time points also varied significantly ($p < 0.05$), with those of one month and one year after operation being noticeably higher than the preoperative ones.

CONCLUSIONS: Both complete and incomplete revascularization methods can effectively improve the short- and long-term quality of life in patients with multivessel coronary artery disease. However, complete revascularization can produce better results.

Key Words:
    Coronary Artery Disease (CAD), Complete revascularization (CR), Incomplete revascularization (IR), PCI.

Introduction

Coronary Artery Disease (CAD), characterized by reduced blood supply to the heart muscle, is a major public health and medical concern in both developed and developing countries[1,2]. When at least two or three of the epicardial coronary arteries are involved with severe atherosclerosis, we have a condition called multivessel coronary disease (MVD). The current treatment modalities for this condition are balloon angioplasty, percutaneous coronary intervention (PCI) with coronary stenting, and coronary artery bypass graft surgery (CABG)[3,4]. The choice of treatment modality is based on various clinical characteristics, including patient's age, comorbidities, extent and severity of disease, number of diseased vessels, and finally lesion's characteristics. The optimal revascularization strategy for patients with multivessel coronary vessel disease remains a subject of debate.

As the modern medical model has shifted from biological alone to social psychological biomedical model, quality of life, as a composite indicator of individual physical, psychological and social function has received increasing attention, which is being used to evaluate clinical efficacy and prognosis. As the main strategies of intervention against MVD, complete revascularization (CR) and incomplete revascularization (IR) have been a hot topic in academic studies. However, the number of studies addressing the influences of different revascularization approaches on patients' life quality is limited.

In this prospective study, we used questionnaire to survey the preoperative and postoperative life quality in patients with MVD who received

different types of revascularization. We aimed to discuss the impact of different revascularization methods on the short- and long-term quality of life in patients with MVD.

Patients and Methods

Patients

The study cohort consisted of 210 coronary angiograms confirmed MVD patients from Nanyang Central Hospital. According to the revascularization methods they received, patients were divided in two groups: the CR group and the IR group. Out of the 210 patients, 10 patients were excluded during follow-ups due to various reasons such as loss of life (4 cases), migration (5 cases) and communication interruption (1 case). The remaining 200 patients completed the follow-ups, with 97 in the CR group and 103 in the IR group (follow-up rate=95%). For this study, we defined MVD as the involvement of 2 or more main coronary arteries with a diameter of no less than 2 mm confirmed by coronary angiography and angiostenosis of great severity ($\geq$ 50%).

Choice of the Revascularization Method

The Siemens angiography system was employed to identify patients with MVD by multi-site selective angiography via the radial artery or femoral artery. In consideration of the technical difficulty and the patients' preferences, complete or incomplete revascularization surgeries were performed. In both conditions, the stents were DES. After the intervention, patients without any remaining main or branch coronary artery angiostenosis over 75% were classified as CR, whereas patients with more than one main or branch coronary artery remaining angiostenosis over 5% were classified as IR.

Methods

The questionnaire we used in this study was designed by an American company (Pfizer, Inc., New York, NY, USA), Quality Metric, and consisted of 36 questions in 8 sections, i.e. physical functioning, physical role, body pain, general health condition, vitality, social role, emotional role and mental health. The question about whether patient's health condition changed during the 12 months period prior to the date of completion the questionnaire was not calculated into the final score. Patients were surveyed at 3 time points: (1) one day before the operation; (2) one month after the operation; (3) one year after the operation. During face-to-face inquiries, telephone follow-ups or clinic re-examinations, all patients were surveyed by trained professionals and asked to complete the questionnaire. The questionnaire was then scored according to the scoring system of the SF-36 scale.

Statistical Analysis

We used SPSS 13.0 software (SPSS Inc., Chicago, IL, USA) for statistical analyses. Enumeration data were presented in percentage and t-test was used for intergroup comparison. Between groups comparison was done using X^2-test. The comparison of quality of life between the two groups was done through repeated measures for the general linear model to accomplish analysis of variance of repeated measured data. $p < 0.05$ meant that the difference was statistically significant.

Results

Baseline Comparison Between the Two Groups

No statistically significant difference was observed between the two groups in baseline characteristics including age, gender, LVEF, presence of diabetes, hypertension, and hyperlipidemia ($p > 0.05$) (Table I).

Quality of Life Comparison Between the two Groups

Eight aspects of life quality were followed up in both groups (Table II). Repeated ANOVA analyses were performed to compare the impact of CR and IR. Scores obtained from different sections in the questionnaire were compared between 2 groups and results revealed that scores in every section were significantly different ($p < 0.05$) except for the general health condition section. Patients in the CR group scored higher in most sections (physical functioning, physical role, body pain, vitality, social role, emotional role and mental health). The more significant advantage of CR was observed in the condition of body pain, physical functioning and mental health ($p < 0.01$). Scores at different time points also differed from each other significantly ($p < 0.05$), with those of one month and one year after operation noticeably higher than the preoperative ones. A positive correlation was detected between the time passed after the operation and the quality of life in both groups.

Table I. Characteristics of patients for different groups.

Characteristics	CR group	IR group	χ^2 /t	P
Age(year)	58.2±10.3	57.4±11.2	0.538	0.591
Male (n %)	65(63.1)	66(61.6)	0.045	0.831
BMI	23.5±1.3	24.2±1.2	1.886	0.061
LVEF	0.48±0.06	0.45±0.08	0.826	0.410
History of HP (n %)	64(62.1)	59(55.1)	1.058	0.304
History of DM (n %)	24(23.3)	22(20.6)	0.230	0.631
History of hyperlipidemia (n %)	39(37.8)	46(42.9)	0.572	0.490
Smoking (n %)	68(66.1)	71(66.3)	0.003	0.959
Family history (n %)	25(24.3)	20(18.7)	0.971	0.325
STEMI	10(9.7)	11(10.3)	0.019	0.890
NSTEMI	12(11.6)	13(12.1)	0.012	0.911
UA	51(49.5)	54(50.5)	0.019	0.890

BMI: Body Mass Index; LVEF: Left Ventricular Ejection Fraction; HP: Hypertension; DM: Diabetes Mellitus; STEMI: ST Elevated Myocardial Infarction; NSTEMI: Non-ST Elevated Myocardial Infarction; UA: Unstable Angina.

Discussion

The intervention strategy for the multivessel coronary disease has long been the focus of attention in a clinical circle. Both complete revascularization (CR) and incomplete revascularization (IR) have their pros and cons, but results obtained from earlier studies showed that CR is probably more advantageous for patients with 3-vessel CAD who underwent coronary artery bypass graft (CABG)[5-7]. Results obtained from these studies showed that the survival time for patients treated by CR was longer than those who were treated by IR[5-7].

Also, it has been shown that compare to IR, CR has fewer primary and secondary adverse results (deaths, nonfatal myocardial infarction and repeated revascularization)[8,9]. Results from a large meta-analysis report[10] suggested that among patients with multivessel coronary artery disease, CR may be the optimal revascularization strategy. Several studies[11-13] have investigated the benefits of revascularization; however, in recent years, the quality of life is now increasingly used as a factor in the evaluation of clinical efficacy and prognosis. In recent years, plenty of attention has been drawn to the fact that interventions must be chosen according to patients' real medical conditions and preferences in order to increase the chance of success[14,15].

Our findings showed that after operation (one month and one year), patients in both groups showed significant improvement in various aspects, including physical functioning, physical role, body pain, vitality, social role, emotional role and mental health, demonstrating the benefits of coronary interventions on patients' quality of life. The intergroup comparison showed that one month and one year after the operation, the CR group scored higher than the IR group, especially in body pain, physical functioning and mental health. This difference may be explained by the fact that incomplete revascularization is mostly a palliative treatment that only addresses those problems associated with the culprit vessel. IR was chosen because of patients' preferences or the complicated nature of coronary lesions such as bifurcation lesion, vessel tortuosity, angulation, smallness, and diffuse calcification or the technical difficulty of PCI surgery for severely tortuous and calcified vessels or chronic occlusive diseases. Due to ischemia in myocardial cells, areas that were unable to receive revascularization suffered from myocardial fibrosis, ventricular remodeling and reduced cardiac function. Consequently, the IR group was scored lower in the physical role section compared to the CR group. The ability of complete revascularization to significantly lessen postoperative angina may explain why the CR group was scored higher in body pain section. And because they were unable to accomplish complete revascularization, some patients in the IR group felt a great deal of stress, anxiety and depression, which accounted for their lower scores in the mental health section. Scores of the general health condition section showed no significant intra- or intergroup differences, may be because options related to this section in the questionnaire were not well-adapted for this study.

We are aware that the present work had some limitations. All surgeries were performed by a single

Table II. Scores for quality of life comparison between the two groups.

Indexes	CR group (n=97)			IR group (n=103)			Groups (F/P values)	Times (F/P values)	Interactions (F/P values)
	Preoperation	One month postoperation	One year postoperation	Preoperation	One month postoperation	One year postoperation			
Physical Function	55.3±20.7	76.4±18.2	78.5±16.9	56.2±19.7	60.3±18.1	71.2±10.9	325.783 (<0.001)	47.253(0.009)	11.064(0.042)
Body Pain	42.4±30.2	65.8±27.1	69.6±25.3	43.6±29.2	47.9±25.2	60.8±23.3	219.567 (<0.001)	38.125(0.015)	21.900(0.010)
Mental Health	51.8±21.2	80.2±15.4	83.2±13.6	52.6±20.1	65.1±18.6	70.5±16.4	562.197 (<0.001)	37.613(0.018)	9.607(0.045)
General Health Condition	49.2±18.4	50.3±16.7	52.6±15.3	50.2±19.7	51.7±14.2	52.4±12.6	1.344(0.058)	0.722(0.107)	1.056(0.075)
Vitality	57.2±16.3	75.6±11.9	78.5±11.4	56.1±18.7	72.3±10.7	73.6±8.3	39.827(0.041)	23.927(0.023)	9.002(0.046)
Social Role	50.1±21.7	68.9±17.5	72.6±18.6	50.2±19.4	63.7±15.4	70.8±15.3	87.192(0.026)	17.381(0.042)	12.975(0.038)
Emotional Role	56.7±23.6	65.9±22.6	69.8±19.6	56.2±20.9	60.4±9.2	62.7±17.5	69.773(0.033)	19.215(0.030)	18.061(0.027)
Physical Role	65.8±19.4	78.4±16.7	88.6±18.4	66.9±20.3	70.5±15.6	72.8±14.2	71.658(0.031)	12.193(0.045)	12.763(0.040)

surgeon, and this reduced surgical variability, thus, making the groups more comparable. Nevertheless, we cannot prove that these findings can be generalized to other surgeons and health care systems.

Conclusions

Choosing treatment strategy for MVD, the clinical efficacy should not be the only factor to be considered. The impact of treatment strategy on patients' quality of life also needs to be taken into consideration. Similar to an earlier study[16], the present report has demonstrated that both revascularization methods can effectively improve the short- and long-term quality of life in patients with multivessel coronary artery disease, while complete revascularization produced better results. We believe that this work has provided an important evidence to assist clinicians in evaluating the treatment methods and their effects.

Conflicts of interest
The authors declare no conflicts of interest.

References

1) ROGER VL, GO AS, LLOYD-JONES DM, BENJAMIN EJ, BERRY JD, BORDEN WB, BRAVATA DM, DAI S, FORD ES, FOX CS, FULLERTON HJ, GILLESPIE C, HAILPERN SM, HEIT JA, HOWARD VJ, KISSELA BM, KITTNER SJ, LACKLAND DT, LICHTMAN JH, LISABETH LD, MAKUC DM, MARCUS GM, MARELLI A, MATCHAR DB, MOY CS, MOZAFFARIAN D, MUSSOLINO ME, NICHOL G, PAYNTER NP, SOLIMAN EZ, SORLIE PD, SOTOODEHNIA N, TURAN TN, VIRANI SS, WONG ND, WOO D, TURNER MB; American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics--2012 update: a report from the American Heart Association. Circulation 2012; 125: e2-e220.

2) WANG S, ZHOU J, CAI JF. Traditional coronary artery bypass graft versus totally endoscopic coronary artery bypass graft or robot-assisted coronary artery bypass graft--meta-analysis of 16 studies. Eur Rev Med Pharmacol Sci 2014; 18: 790-797.

3) LEVINE GN, BATES ER, BLANKENSHIP JC, BAILEY SR, BITTL JA, CERCEK B, CHAMBERS CE, ELLIS SG, GUYTON RA, HOLLENBERG SM, KHOT UN, LANGE RA, MAURI L, MEHRAN R, MOUSSA ID, MUKHERJEE D, NALLAMOTHU BK, TING HH. 2011 ACCF/AHA/SCAI Guideline for Percutaneous Coronary Intervention: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines and the Society for Cardiovascular Angiography and Interventions. Circulation 2011; 124: e574-651.

4) Memetoglu ME, Kehlibar T, Yilmaz M, Gunay R, Arslan Y, Tuygun A, Kocaaslan C, Coskun G, Ketenci B, Guney MR, Demirtas M. Serum uric acid level predicts new-onset atrial fibrillation after coronary artery bypass graft operation. Eur Rev Med Pharmacol Sci 2015; 19: 784-789.

5) Buda AJ, Macdonald IL, Anderson MJ, Strauss HD, David TE, Berman ND. Long-term results following coronary bypass operation. Importance of preoperative actors and complete revascularization. J Thorac Cardiovasc Surg 1981; 82: 383-390.

6) Assad-Morell JL, Frye RL, Connolly DC, Davis GD, Pluth JR, Wallace RB, Barnhorst DA, Elveback LR, Danielson GK. Aorta-coronary artery saphenous vein bypass surgery: clinical and angiographic results. Mayo Clin Proc 1975; 50: 379-386.

7) Jones EL, Craver JM, Guyton RA, Bone DK, Hatcher CR Jr., Riechwald N. Importance of complete revascularization in performance of the coronary bypass operation. Am J Cardiol 1983; 51: 7-12.

8) Mohr FW, Rastan AJ, Serruys PW, Kappetein AP, Holmes DR, Pomar JL, Westaby S, Leadley K, Dawkins KD, Mack MJ. Complex coronary anatomy in coronary artery bypass graft surgery: impact of complex coronary anatomy in modern bypass surgery? Lessons learned from the SYNTAX trial after two years. J Thorac Cardiovasc Surg 2011; 141: 130-140.

9) Scott R, Blackstone EH, McCarthy PM, Lytle BW, Loop FD, White JA, Cosgrove DM. Isolated bypass grafting of the left internal thoracic artery to the left anterior descending coronary artery: late consequences of incomplete revascularization. J Thorac Cardiovasc Surg 2000; 120: 173-184.

10) Garcia S, Sandoval Y, Roukoz H, Adabag S, Canoniero M, Yannopoulos D, Brilakis ES. Outcomes after complete versus incomplete revascularization of patients with multivessel coronary artery disease: a meta-analysis of 89,883 patients enrolled in randomized clinical trials and observational studies. J Am Coll Cardiol 2013; 62: 1421-1431.

11) Guleserian KJ, Maniar HS, Camillo CJ, Bailey MS, Damiano RJ Jr., Moon MR. Quality of life and survival after transmyocardial laser revascularization with the holmium:YAG laser. Ann Thorac Surg 2003; 75: 1842-1848.

12) Safley DM, House JA, Laster SB, Daniel WC, Spertus JA, Marso SP. Quantifying improvement in symptoms, functioning, and quality of life after peripheral endovascular revascularization. Circulation 2007; 115: 569-575.

13) Bourassa MG, Yeh W, Holubkov R, Sopko G, Detre KM. Long-term outcome of patients with incomplete vs complete revascularization after multivessel PTCA. A report from the NHLBI PTCA registry. Eur Heart J 1998; 19: 103-111.

14) Bartlett SJ, Barnes T, McIvor RA. Integrating patients into meaningful real-world research. Ann Am Thorac Soc 2014; 11 Suppl 2: S112-117.

15) Luo J, Xu H, Liu B. Real world research: a complementary method to establish the effectiveness of acupuncture. BMC Complement Altern Med 2015; 15: 153.

16) Mariani G, De Servi S, Dellavalle A, Repetto S, Chierchia S, D'Urbano M, Repetto A, Klersy C, Group RS. Complete or incomplete percutaneous coronary revascularization in patients with unstable angina in stent era: are early and one-year results different? Catheter Cardiovasc Interv 2001; 54: 448-453.