

Interval Results with Right Gastroepiploic Bypass

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ABSTRACT

Objective: Right gastroepiploic artery bypass grafting has proved to be a viable surgical choice since the mid-1980s. Long-term graft patency, however, has been challenged ever since. We present 43 patients who underwent right gastroepiploic artery bypass surgery off pump with minimal invasive techniques with an average follow-up period of 57.9 months since 1996.

Methods: Operative methods are described and were confined to a subxiphoid incision. The series consists of 43 patients (38 male and 5 female) with an age range of 44 to 79 years. All patients had heart disease classified as Canadian Cardiovascular Society class III-IV and 35/43 (81.3%) of patients had undergone 1 to 3 reoperations. Postoperatively, 93% had no complications. Crude mortality was 2.3%, with an expected mortality of 4% and risk-adjusted mortality of 1.45%. Nine patients underwent combined procedures.

Results: Of the 43 patients, 41 were alive at 57.4 months (range, 20-76 months). Results of Doppler studies and angiography proved 95.3% and 91.6% patency.

Conclusion: In this series, our highest-risk patients with reoperative coronary artery disease had low mortality and no intervention in this interval follow-up.

INTRODUCTION

Coronary bypass with the right gastroepiploic artery (RGEA) has been a viable arterial bypass graft [Pym 1987]. The long-term patency of the RGEA has not been well documented in the literature in either short-term or long-term follow-up, especially for operative anastomoses performed off pump. Suma [1987] reported the highest number of patients followed for a period of up to 10 years on whom the operation was performed on pump. Follow-up discrepancies exist as far as patency and flow characteristics and are a cause for concern. To shed some light on these factors, Masau Ochi et al [2001a] have challenged the flow capacity of RGEA and

suggested preoperative evaluation to eliminate anatomical variations and detect small-caliber RGEAs with low flow.

The purpose of our paper therefore is to give a mid-term, interval follow-up based on our experience in the past 5 years. All operations were performed off pump, and their purpose was to revascularize the inferior aspect of the heart mostly on patients with reoperative recurrent disease.

MATERIAL AND METHODS

During the period from May 1996 to April 2001, 43 patients underwent surgery off pump to revascularize the inferior aspect of the heart. The average patient follow-up period was 57.4 months (range, 20-76 months). Five female and 38 male patients were operated on. Average patient age was 64.5 years (range, 44-79 years). Ejection fraction varied from 26% to 70% (average, 46.6%). Most patients had heart disease classified as Canadian Cardiovascular Society class III (19 patients, 44.1%) or class IV (24 patients, 55.9%). The total number of grafts performed was 52 (1.22 per patient). Thirty-five of 43 patients (81.3%) had reoperations; 40 of 43 patients (93%) had no postoperative complications. The average length of stay postoperatively was 6.8 days (Table 1). The New York State database was used for evaluation of pre- and postoperative complications.

Methods

Detailed operative technique was described previously [Akhter 1997]. The subxiphoid approach was used in all cases (1 patient had to be converted to full thoracotomy because of instability). The lower third of the sternum was divided, and usually the lower 3 wires were removed while retracting the peritoneum, the pericardium was opened, and dissection of adhesions led to the exposure. The target vessel was identified first after dissection of the adhesions followed by a midline small laparotomy. After the RGEA was identified and the branches were tied, the pedicle was divided. Papaverine was injected into the pedicle and diluted verapamil into the artery after the division of the pedicle. Intravenous (IV) diltiazem HCl (Cardizem) drip 4 mg per minute was maintained throughout the procedure while the inferior aspect of the heart was stabilized, and the anastomosis was completed with 7-0 Prolene. Postoperatively the IV diltiazem HCl was maintained until the nasogastric tube was removed, and then switched to diltiazem HCl 60 mg every other day for 6 to

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Table 1. Patient Characteristics

Average follow-up, mo	57.4 (20-76)
Age, y	53 (44-79)
Sex	
Female	5
Male	38
Primary procedures	8 (18.5%)
Reoperative coronary artery bypass graft	35 (81.5%)
Ejection fraction	46.6 (26-70%)
Canadian Class III	19 (44.1%)
Canadian Class IV	24 (55.9%)
Number of grafts	52 (1.22/patient)
Reoperations	35 (81.3%)
Days in hospital (postoperative)	6.8

12 months. Flow measurements were performed by Medistim flow meter in all cases. Patients were discharged in 5 to 10 days (average, 6.8 days) postoperatively with 180 mg diltiazem HCl, plus their previous medications.

RESULTS

The operative mortality was 1(2.3%), expected mortality was 4.0%, risk-adjusted mortality was 1.45% (Table 2). One patient died in the postoperative period; this patient had undergone 2 previous open-heart procedures, the first for multiple coronary artery bypass graft and the second for aortic valve replacement.

Eight patients had primary procedures, and 35 patients had reoperations. The RGEA bypass was the first reoperation in 22 cases, the second reoperation in 9 cases, and the third one in 4 cases. The RGEA was directly anastomosed to either the posterior descending artery, posterior lateral artery, or terminal circumflex artery in 34 patients. In 9 of 43 patients vein interposition was used; 5 patients had left anterior descending (LAD) graft simultaneously, 4 with left internal mammary artery, and 1 patient had a bypass from left subclavian artery to LAD (Table 3).

In-hospital complications included 1 cholecystectomy, 1 conversion to pump, 1 case of urosepsis, and 1 patient requiring postoperative intraaortic balloon pumping (Table 4). Postdischarge complications were as follows: 1 patient required reoperation (left thoracotomy) to regraft the left circumflex artery, and other patients required cholecystectomy, epigastric hernia repairs, and a muscle flap to cover the xiphoid process.

Table 3. Combined Operations (n = 18)*

Combined Procedures	Double Grafts	Vein Interposition	Primary Procedure	Reoperative Cases
LIMA-PDA 5 Patients (Subclavian vein, 1)	PDA & PLA 4 Patients (Vein bridge, 2) (Vein graft, 2)	9 Patients	8 Patients	1st reop, 22 patients 2nd reop, 9 patients 3rd reop, 4 patients Total, 35 patients

*LIMA indicates left internal mammary artery; PDA, posterior descending artery; PLA, posterior lateral artery.

Table 2. Results: Mortality

Operative mortality	1 (2.3%)
Late mortality (42 mo)	1
Estimated mortality	4.05% (0.3%-20.4%)
Risk-adjusted mortality (NY State Model)	1.45%

Follow-up procedure included immediate postoperative Doppler and 1-year and 5-year follow-up exams. Angiography was performed when possible during the follow-up period. Postoperatively, 22 of 24 (91.6%) of graft patency was verified with angiography and 41/43 (95.3%) with Doppler studies. Long-term follow-up included Doppler studies on 19/41 patients (Table 5) and selective angiography on 14 patients (Table 6). One late sudden death occurred in an asymptomatic patient 42 months postoperatively.

DISCUSSION

Minimally invasive off-pump RGEA grafting [Akhter 1997, Tavilla 1997, Lajos 2001] requires special considerations:

1. Indications
2. Technical considerations
3. Flow assessments
4. Patient selection

Indications and Technical Considerations

Limited indications are confined to the right coronary artery (RCA) and its branches. Sequential grafting is difficult [Voutilainen 1998], therefore we have often used vein bridges between the branches of the RCA. Stabilization of the target vessel also requires imaginative approaches. If the target vessel is highly diseased the operation may have to be abandoned. Extended indications with double grafting and simultaneous minimally invasive direct coronary artery bypass procedures should be considered but limited to carefully selected patients. We have done the LAD anastomosis first in these cases (Table 7).

Flow Assessments

Flow assessments were performed in our institution with the Transit Time Flow Measurements during surgery [D’Ancona 1999]. Recent articles suggest preoperative assessment of flow and caliber RGEA by angiography [Ochi 2001a]. This step should be seriously considered, because we have experienced the complete obstruction of the celiac artery resulting in

Table 4. Complications

In hospital	
1 Cholecystectomy	
1 Conversion to pump	
1 Urosepsis	
1 Intraaortic balloon pumping	
After discharge	
1 Cholecystectomy	
2 Epigastric hernia	
1 Recurrent angina pectoris (left circumflex artery graft)	
1 Muscle flap to cover xyphoid	

decreased flow in RGEA through collaterals. It has been also well documented [Nakao 1993] that significant stenosis of the grafted vessel has to exist proximal to the RGEA anastomosis. If vigorous competitive flow exists the “slender sign” will develop in the RGEA. There is no proof that as time goes on the RGEA will compensate with increased flow in the same way that the internal mammary artery does as more disease develops in the native circulation [Robicsek 1993].

Angiography was performed in the follow-up period to depict possible technical problems and/or anastomatic stenosis when Doppler measurements were questionable and/or patients had recurrent angina pectoris. Concomitant angiography was also performed when the left coronary artery had to be studied. Doppler studies have proven essential in our follow-up with these patients. We have seen gradual improved flow in asymptomatic patients from immediate postoperative flow to later follow-up flow.

Patient Selection

Patient selection should be scrutinized. Obesity, previous major abdominal surgeries, and/or other concomitant pathology, such as valve disease and/or concomitant disease of the left coronary artery or its branches, are contraindications. In the presence of left coronary disease, hybrid procedures or sequential grafting [Ochi 2001b] should be considered. We have done these procedures on 9 patients.

In 5 patients, simultaneous LAD grafts were performed as noted above. In these patients we felt that both lesions (RCA and LAD) were significant and both systems should be grafted. Previous gastrointestinal surgery is also a contraindication, although some of our patients had previous cholecystectomy. Patients with existing gastric and duodenal ulcers are not candidates for this operation. Patients who have peripheral vascular disease and/or abdominal aortic disease will definitely require preoperative angiography [Ochi 2001a].

Table 5. Doppler Studies

	Open	Closed	Questionable
Postoperative, 41/43 (95.3%)	40	—	1
Follow-up (1 mo-5 y, average 12.1 mo), 19/41	17	1	1

Table 6. Angiography

Postoperative angiography (n = 17 patients with 24 grafts)	
Grafts studied	24
Grafts patent	22/24 (91.6%)
Follow-up angiography (14/43 patients)	
Open	11
Closed	1
Questionable	2

Table 7. Indications for Right Gastroepiploic Artery Bypass

Limited indications	
Reoperative or single right coronary artery (RCA) disease	
Significant stenosis of posterior descending artery branch of RCA	
Significant stenosis of posterior lateral artery branch of RCA	
Significant stenosis of left circumflex artery	
Extended indications	
Combined posterior descending artery and posterior lateral artery disease	
Combined disease of left anterior descending artery and RCA or its branches	

Selective postoperative angiography is the only gold standard of final evaluations. The lack of long-term follow-up with off-pump cases is not excusable; any “new” procedure has to be fully evaluated in the long run as well as the short term [Suma 2000].

In our series indications were strict and operations were performed with the same operative team and with scrutinized postoperative follow-ups. This operation has a steep learning curve [Fonger 1999], which necessitates operative team continuity. A mortality rate of 8%, even on reoperative cases, is unjustifiable.

Based on experience, we feel that the procedure is sound if it is well evaluated preoperatively and meticulously followed postoperatively. It can be carried out with low operative mortality on high-risk patients as long as indications are well scrutinized.

CONCLUSION

Crude and risk-adjusted mortality rates were good. Interval survival periods (average 57.9 months) on 42 patients were excellent. Patients were relieved of their symptoms and did not require reintervention. Graft patency was confirmed by Doppler echo and angiography in the follow-up period.

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