Endoscopic Conduit Harvesting and Conventional Conduit Harvesting for Coronary Artery Bypass Graft Surgery

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Conventional conduit harvesting used for coronary artery bypass graft for many decades but there has been some wound complication problem. Endoscopic conduit harvesting is a minimal invasive surgery for reduced wounds complication. The authors aimed to compare the result between two techniques.

Material and Method: *Prospective enroll of 100 patients for elective coronary artery bypass graft surgery. Divided in 2 groups. The first groups was a convention conduit harvesting (C groups) and the second groups was endoscopic conduit harvesting (E groups). The endoscopic conduit harvesting performed using the Maquet Vasoview system under CO_2 inflation assisted.*

Results: *Endoscopic conduit harvesting was successful 94%. Harvest time C group 32.4 mins E group 48.9 mins, ET CO_2 C group 40.3, E group 50.9, Wounds infection C group 6% E group 0, wounds echymosis C group 6% E group 44%.*

Conclusion: *Endoscopic conduit harvesting showed better results with conventional conduit harvesting in wounds with serious complications but they need more harvest time and risk of CO_2 embolism. However, a long term graft patency needs more investigation.*

Keywords: *Endoscopic conduit harvesting, Coronary artery bypass graft surgery*

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Coronary artery bypass surgery continues to be a widely used therapy for the treatment of ischemic heart disease[1]. The long saphenous vein and radial artery remains the most commonly used conduit for coronary artery bypass graft surgery. With conduit harvest being such a critical part of this operation it deserves greater attention in order to reduce morbidity from this component of the operation.

The conventional conduit harvesting has been done for many decades in Coronary artery bypass surgery (CABG) but morbidity from these large incisions must be taken very seriously as prolonged pain, wound infection, bleeding and seroma can all lead to a prolonged length of stay in the hospital (Fig. 1) and contribute to the morbidity and rarely mortality associated with coronary artery bypass surgery[2]. Many studies have shown reduced rates of postoperative wound complications following endoscopic harvesting approaches compared to the conventional technique of conduit harvest[3-5]. And in the USA endoscopic harvesting is widely used[7-9].

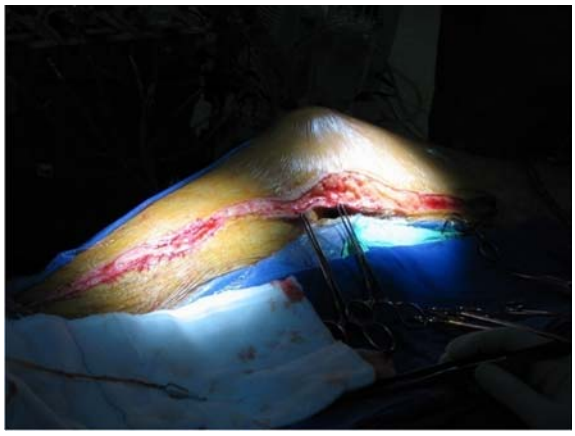

Fig. 1 Conventional harvesting incicsion

The present study was to compare the result between conventional conduit harvesting and endoscopic harvesting, in order to reach an alternative

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method of conduit harvesting in CABG surgery.

Material and Method

Patients

After Central Chest Institute of Thailand ethic committee approval No. 017/2008. 100 consecutive patients, undergoing elective CABG were prospectively enrolled into the present study. Divided in 2 groups by Hospital number, odd numbers are conventional groups (C groups), even numbers are endoscopic group (E group). The authors collected demographics data, risk factors, diagnosis, postoperative result, ICU stay, hospital stay, hospital cost and readmission.

Surgeon

Cardiovascularthoracic surgeon in present study have CABG experience of more than 400 cases and endoscopic conduit harvesting of more than 50 cases.

Instruments

1. Basic endoscopic instrument such as, camera, picture processor, monitor (Fig. 2).

2. Maquet Vasoview endoscopic conduit harvesting system and lens (Fig. 3-5).

Fig. 2 Basic endoscopic instruments

Surgical technigue

Conventional sphenouse vein harvest techniques

Open incision above vein divided and ligation by metal clip or suture. Electric cauterization at bleeding

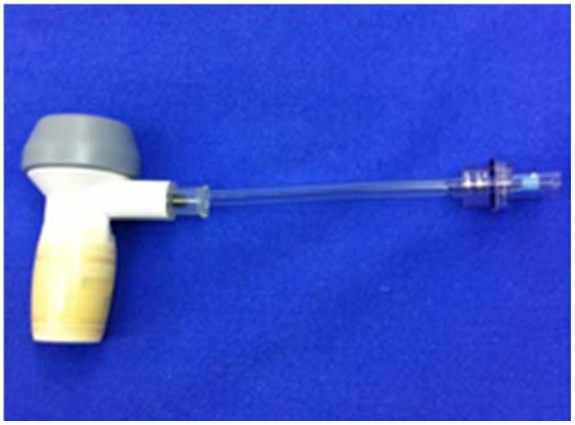

Fig. 3 Balloon trocar

Fig. 4 Cone-tip dissector

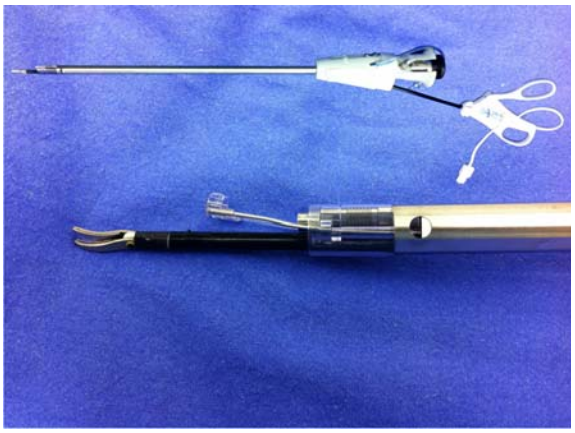

Fig. 5 Cautery scissors

of raw surface. If surgical wounds were so deep. Used negative pressure suction drain (redivac drain) for reduced collection in surgical wounds. Pressure dressing by elastic bandage.

Endoscopic sphenouse vein harvesting technigue (EVH)

EVH procedure was performed using the Maquet Vasoview system with the assistance of carbon dioxide (CO_2) insufflation. 2-3 cm skin incision was made at the medial site of tibial surgical neck exploration of the underlying saphenous vein. The saphenous vein was encircled by a vascular loop. Additional proximal dissection was performed about 3-4 cm in depth to allow insertion of a balloon trocar (Fig. 3). Insertion of cone tip dissector (Fig. 4) along sphenouse vein for separated underlying tissue 5-6 cm insertion ballon trocar. 10-15 mmHg pressure CO_2 inflation created tunnel along sphenouse vein. Advanced cone tip dissector separated underlying tissue and branches through sphenous opening or instrument length. Changed cone-tip dissector to cautery scissors (Fig. 5) divided and clear branches and underlying tissue. A stab wound was made at the groin for grasping of the proximal saphenous vein, which then was divided and ligated. The divided vein was retrieved by the Vasoview C-ring and brought outside via the first incision. If additional length was required, similar techniques could be applied in the lower leg. The saphenous vein then was gently distended and branches were clipped or ligated *ex vivo*. Squeeze blood from tunnel suture incision and pressure dressing by elastic bandage.

Endoscopic radial harvesting

Preparation of donor's arm as usual harvesting. A tourniquet was applied at the arm but not pressurized. A longitudinal 2-3 cm incision over radial artery at wrist level. The radial artery and both accompanying venae comitantes (radial pedicle) were exposed and controlled with a small vessel loop. Sodium heparin (3,000 U) was administered through a central intravenous catheter. The dissection at the incision relieved the anterior aspect of the radial pedicle from superficial fascia and connective tissue. A blunt dissector was used to create a hole for insertion of the cone-tip trocar port. After 2 minutes of heparin administration, Soft vascular clamps were placed on the most distal end of the radial artery like modified Allen's test the result as positive the harvesting was go on. If was negative the harvesting was abandoned. The entire hand and forearm was then wrapped from distal to proximal with an Esmark bandage and the tourniquet was inflated to 200 mmHg. The Esmark bandage was removed then Cone-tip dissector was inserted dissection 4-5 cm in dept allowed balloon trocar in incision.10-15 mmHg CO_2 inflation more advanced cone-tip dissector though brachial artery origin. Disection separated radial artery form underlying tissue whole range of radial artery. Changed cone-tip dissector to cautery scissors inserted into the predissected tunnel. Branch division was carried out in the same manner as with established saphenous vein harvesting technique. All electrocautery was performed at a safe distance from the artery as with the standard open technique. The bipolar electrocautery was set to 30 watts. A stab wound was done inserted vascular cramp graping proximal radial artery divided radial artery by scissors. Removal of radial artery and canulated at proximal end and flushed papaverine. Radial artery was examined closely for bleeding, spasm and hematoma. Arterial branches ligation by metal clip of the donors' arm and hand were pressured dressing with an elastic bandage. A tourniquet was deflated and removed.

Statistical Analysis

Statistical analyses were performed using descriptive statistics (mean, standard deviation, number (%), the paired t-test and χ^2 or fishers' exactest where approach (Statistica-Stat Soft, Tulsa, OK). A p-value of less than 0.05 was considered significant.

Results

100 patients underwent elective Coronary artery bypass graft surgery. All patients were male 70 patients, average age was 61.49 (+ 8.9) years, average body weight was 65.88 (+ 13.6) kg, Height was 161.6 (+ 8.3) and risk factors was Diabetic Mellitus 56%, Hypertension 76%, Dyslipidemia 25%, Smoking 24% and average left ventricular ejection fraction was 52 (+ 17.7)%. Desmographic characteristics, types of operation and risk factor are separated in to two groups Conventional groups (C groups) and Endoscopic groups (E groups). Desmographic are not statistical significant difference between two groups as Table 1.

The postoperative result shown in Table 2. These are statistical significance difference in harvest time $ETCO_2$. In fishers' exactest with hypothesis was endoscopic better than conventional in p-value < 0.05. Readmision, wound infection and hematoma was accept hypothesis. Wound echymosis rejected hypothesis.

Table 1. Demographic Data

	Total	Conventional (C) groups	Endoscopic (E) groups	p-value
Number	100	50	50	
Sex				
Male	70	35	35	
Female	30	15	15	
Ages (mean) ± SD	61.49 ± 8.9	60.87 ± 9.1	61.69 ± 8.5	0.423
Weight ± SD	65.88 ± 13.6	66.56 ± 14.5	64.86 ± 13.3	0.368
Hight ± SD	161.65 ± 8.3	159.16 ± 7.9	162.01 ± 8.6	0.256
Operation: (n, %)				
CABG only	89	44 (88)	45 (90)	0.443
CABG + valve	11	6 (12)	5 (14)	0.345
Convertion	7	0	7 (14)	
Risk factor				
Diabetic mellitus	56	29 (58)	27 (54)	0.257
Hypertension	76	38 (76)	38 (76)	0.476
Dyslipidemia	25	12 (24)	13 (26)	0.592
Smoking	24	13 (26)	11 (22)	0.323
LVEF	52.87 ± 17.7	51.27 ± 16.9	52.98 ± 18.3	0.479

CABG = Coronary artery bypass graft surgery, LVEF = Left ventricular ejection fraction

Table 2. Postoperative result

	Total groups n = 50	Conventional groups n = 50	Endoscopic	p-value
Harvest time (mins) ± SD	40.84 ± 20.1	32.04 ± 16.6	48.90 ± 19.7	0.01
ET CO_2	45.80 ± 8.6	40.30 ± 5.2	50.90 ± 8.9	< 0.01
Graft length (cm) ± SD	34.236 ± 4.5	33.50 ± 3.7	34.10 ± 2.5	0.484
Icu stays (days) ± SD	2.55 ± 0.3	2.33 ± 1.0	2.75 ± 1.6	0.597
Hospital stays (days) ± SD	10.60 ± 5.1	10.13 ± 5.4	11.17 ± 4.8	0.583
Hospital cost (thousand baht)	201.20 ± 739.8	194.50 ± 704.5	207.50 ± 772.4	0.453
Readmission	11	9 (16)	2 (4)	0.056*
Wounds complication				
Infection	3	3 (6)	0	0.126*
Hematoma	1	1 (2)	0	0.5*
Echymosis	25	3 (6)	22 (44)	0*

ET CO_2 = End tidal CO_2, *Fishers'exactest

Disscusion

Conventional conduit harvesting has been the technique of choice for conduit harvest in coronary artery bypass surgery for several decades, minimally invasive techniques have become increasingly popular in a wide range of surgical specialities. Minimally invasive techniques offer a number of advantages over their open alternatives. These include reduced wound pain, wound infection rate, wound complications, length of hospital stay, required analgesia etc.

Endoscopic vein harvest has become increasingly used as an alternative to the open technique. The advantages of this technique includes reduced leg wound complications, postoperative pain, required analgesia and incision length. Some disadvantage has been the learning curve for endoscopic vein harvest with an increased operative time for the vein harvest compared to the open technique reported in several studies[4,7,8]. Another is the risk of CO_2 inflation embolism. Some studies have

shown significant CO_2 embolism during endoscopic harvesting[9]. However there are no document mortality form CO_2 embolism following endoscopic harvesting.

In quality of conduit after endoscopic conduit harvesting, especiality histological. Griffith GL report that histological result between endoscopic harvesting and conventional harvesting are similar[10].

The present study shows the comparative result between conventional techniques and endoscopic techniques in the same group of patients, same surgeons and same time of operation. The demographic data and risk factors have shown no statistical significance. Postoperative result no wounds infection in endoscopic groups but 3 in conventional groups and readmission endoscopic only one patient. However, in endoscopic groups harvesting time is more than conventional groups significantly mean need more learning curve. 50 cases are too small in numbers. In CO_2 embolism in present study no intra-operative tranesophageal echocardiogram but there are end-tidal CO_2 record in endoscopic groups end tidal CO_2 rising more than conventional groups but fortunately no serious CO_2 embolism complication.

However, the present study has weak points such as small number of patients only 50 cases in each group. No angiographic report has been shown. And no long term result of the patency conduit compared between the 2 groups.

Conclusion

In present study shows wound complications results are better in endoscopic conduit harvesting but endoscopic techniques need more harvest time or more learning curve. However, the authors feel further investigation of long term patency of conduit from endoscopic harvesting is required.

Potential conflicts of interest

None.

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การเลาะเส้นเลือดสำหรับการผ่าตัดตัดต่อเส้นเลือดด้วยวิธีใช้กล้องส่องภายในและวิธีแบบดั้งเดิม

เกรียงไกร นามไธสง, ชูศักดิ์ เกษมศานติ์

การเลาะเส้นเลือดเพื่อใช้ในการผ่าตัดตัดต่อเส้นเลือดแบบวิธีดั้งเดิม (conventional conduit harvesting) เป็นวิธีการที่ใช้ร่วมกับการผ่าตัดตักต่อเส้นเลือดหัวใจโคโรนารีมาตลอด แต่ก็พบว่ามีปัญหาเรื่องการแทรกซ้อนของแผลผ่าตัดนั้นพอสมควร การเลาะเส้นเลือดด้วยกล้องส่องภายใน (Endoscopic conduit harvesting) เป็นวิธีที่บาดเจ็บน้อยกว่ามาใช้เพื่อลดปัญหาดังกล่าว การเปรียบเทียบผลการผ่าตัดของทั้งสองวิธีจึงเป็นจุดประสงค์ของการศึกษานี้

***วัสดุและวิธีการ**: ได้นำผู้ป่วยที่วางแผนจะผ่าตัดตัดต่อเส้นเลือดหัวใจ 100 ราย แยกเป็นสองกลุ่ม กลุ่มแรกเป็นการเลาะเส้นเลือดแบบดั้งเดิม (C group) และอีกกลุ่มเป็นการเลาะแบบใช้กล้องส่องภายใน (E groups) การเลาะด้วยกล้องส่องภายในใช้วิธีการของ Maquet Vasoview system และใช้ก๊าซคาร์บอนไดออกไซด์เป่าช่วย*

***ผลการศึกษา**: การเลาะเส้นเลือดด้วยกล้องเป็นผลสำเร็จ 94% เวลาในการใช้เลาะเส้นเลือด C groups 32.4 นาที E groups 48.9 นาที, ET CO_2 C groups 40.3 E groups 50.9, บาดแผลติดเชื้อ C groups 6% E groups 0% แผลเป็นจ้ำเลือด C groups 6% E groups 44% ส่วนอื่นๆ เท่าเทียมกันทางสถิติ*

***สรุป**: การเลาะเส้นเลือดด้วยกล้องส่องภายในผลการรักษาจะดีกว่าวิธีดั้งเดิมในเรื่องผลแทรกซ้อน ของแผลผ่าตัด แต่ต้องใช้เวลาในการผ่าตัดมากกว่าและมีโอกาสเกิด CO_2 embolism ได้มากกว่า อย่างไรก็ตามคุณภาพของเส้นเลือดในระยะยาวคงต้องมีการศึกษาอีกต่อไป*