Preoperative evaluation of the saphenous vein by 3-D contrastless computed tomography

Yuji Maruyama^{a,*}, Hajime Imura^a, Makoto Shirakawa^a and Masami Ochi^b

^a Department of Cardiovascular Surgery, Nippon Medical School, Musashikosugi Hospital, Kawasaki, Kanagawa, Japan

^b Department of Cardiovascular Surgery, Nippon Medical School, Tokyo, Japan

* Corresponding author. 1-396, Kosugi-cho, Nakahara-ku, Kawasaki, Kanagawa 211-8533, Japan. Tel: +81-44-7335181; fax: +81-44-7118875; e-mail: maruyamayuji@nms.ac.jp (Y. Maruyama).

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Abstract

Volume-rendering computed tomography (CT) without contrast medium has clearly demonstrated the 3-D mapping of the saphenous vein (SV). Contrastless volume-rendering CT was used to preoperatively evaluate the SV anatomy before coronary artery bypass grafting (CABG). This technique was useful for atypical anatomical variations, such as partial duplication of SV (Case 1) or varicose veins (Case 2). Volume-rendering CT may also help with redo CABG (to determine remaining SV) or during endoscopic SV harvesting with restricted view. Volume-rendering CT is an objective, less time-consuming modality to evaluate the SV preoperatively and may be less invasive in terms of avoiding unnecessary skin incision.

Keywords: CABG • Venous grafts

INTRODUCTION

Despite the widespread use and superior patency of the arterial graft for coronary artery bypass grafting (CABG), the saphenous vein (SV) continues to be the most commonly used conduit [1]. Occasionally, SV grafts are unsuitable for grafting owing to inherent problems, such as duplication, large accessory SV or varicose veins [2]. In addition, the quality of the SV grafts impacts on short- and long-term graft patency; however, there is some concern regarding the preoperative evaluation of the SV grafts. Volume-rendering computed tomography (CT) without contrast medium has been clearly shown to demonstrate the benefit of 3-D mapping of the SV [3], which enables surgeons (especially junior surgeons) to harvest the SV from the appropriate part of the leg with confidence. We have applied the volume-rendering CT technique to obtain suitable 3-D images for preoperative SV evaluation before CABG. CT examinations were performed with a 16-multidetector CT (Aquilion 16, TOSHIBA, Tokyo, Japan) scanner. All thin-section axial images were transferred to a workstation running PC-based 3-D reconstruction software (M900Quadra, Ziosoft, Tokyo, Japan). Individual volume data were loaded into the 3-D programme, and one experienced technician performed the 3-D reconstruction, which took 10 min or less.

CASE REPORTS

We present two cases in which preoperative 3-D contrastless volume-rendering CT was useful before CABG.

Case 1

A 61-year old man who had triple vessel disease involving proximal tandem stenosis of the left anterior descending artery (LAD) was referred to our hospital. Preoperative volume-rendering CT demonstrated partial duplication of the SV (Fig. 1). The SV was harvested from the opposite side in the thigh with a skip incision. The use of the radial artery was abandoned due to renal insufficiency. The patient underwent off-pump CABG with five branches; the left internal thoracic artery (ITA) was anastomosed to the LAD and diagonal branch; the right ITA was anastomosed to the obtuse marginal branch and the SV was anastomosed to two distal branches of the right coronary artery (RCA).

Case 2

A 66-year old woman who had triple vessel disease was referred to our hospital. Preoperative volume-rendering CT demonstrated varicose veins of both legs, but the right SV below the knee was not dilated (Fig. 2). The SV was harvested from the lower part of the right leg. The use of the right ITA was abandoned due to diabetic mellitus treated with insulin. The patient underwent off-pump CABG with four branches; the left ITA was anastomosed to the LAD; the right gastroepiploic artery was anastomosed to the posterior descending artery and the SV was anastomosed to the obtuse marginal and posterior lateral branches.

DISCUSSION

To our knowledge, this is the first report to preoperatively evaluate the SV by 3-D contrastless volume-rendering CT before

Figure 1: Volume-rendering CT demonstrates partial duplication (arrows) of the saphenous vein. The saphenous vein was harvested from the opposite side.

Figure 2: Volume-rendering CT demonstrates varicose veins of both legs. The saphenous vein was harvested from the lower part of right leg (arrows).

CABG. Volume-rendering CT was useful for defining atypical anatomical variations, such as partial duplication of SV (Fig. 1) or varicose veins (Fig. 2). According to a previous report [2], the incidence of SV abnormalities is ~30% and can occur in both the thigh and the calf portion of the legs. Hence, it is essential that surgeons recognize SV anatomy preoperatively when the SV is used as a bypass conduit. In general, the SV is preoperatively evaluated by ultrasound [4], which has many limitations such as operator-dependent variable results and a time-consuming procedure. In contrast, volume-rendering CT could comprehensively display a detailed 3-D mapping of the SV in a single screen within 10 min. Consequently, surgeons evaluate the SV objectively, which could make it possible to harvest the appropriate part of the SV with confidence. In addition, it should be emphasized that this procedure needs no contrast medium to acquire a 3D view of the superficial vein. However, radiation exposure and additional cost can be disadvantages. As a future perspective, volume-rendering CT may be helpful, particularly in redo CABG, to determine the remaining SV or when the SV is harvested endoscopically under restricted view.

In conclusion, volume-rendering CT is an objective, less time-consuming modality to preoperatively evaluate SV characteristics, while reducing invasive exploration in terms of avoiding unnecessary skin incision.

Conflict of interest: none declared.

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