

Less Invasive Radial Artery Harvest

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ABSTRACT

Background: Recent studies have sparked a renewed interest in the use of autogenous radial arteries in coronary operations. Some concerns have been found about sequelae of conventional harvesting. A less invasive technique for radial artery harvesting has been proposed by others using endoscopic devices. This technique is time consuming, needs expensive instrumentation and an important learning curve.

Methods: A new less invasive approach for radial harvesting has been developed with a light assisted retractor under direct vision. A small skin incision, median in the forearm, is followed by dissection of the proper plane of the artery. A subcutaneous tunnel is created around the vessel and all the branches are ligated or clipped. The dissection of the pedicle under the skin is completed with the aid of a modified light assisted retractor, originally designed for the saphenous vein harvesting. The incision is closed after heparin reversal with a small redon as drainage.

Results: A preliminary serie of 15 patients have been operated with this technique. In all patients the radial artery was patent and functional at the post-operative angiography. Morbidity included only a light hematoma at the beginning of our experience.

Conclusion: This less invasive technique for the radial artery harvesting appears to be an excellent surgical compromise between the "open" technique and the endoscopic procedure; it is easy to perform, the learning curve is acceptable and it offers an excellent aesthetic result.

INTRODUCTION

The high incidence of late obstruction of venous bypass grafts combined with the proven advantage of total arterial revascularization led worldwide to revive the use of Radial Artery (RA) in CABG [Acar 1992, Cheng 1997, De Oliveira 1999]. Conventional harvesting the RA creates a longitudinal scar in the forearm after the operation. Moreover, many patients suffered of hand or forearm symptoms like paresthesia, numbness, weakness, infection and limitation of hand activity [Trick 2000, Anyanwu 2001, Denton 2001]. Most of these symptoms are inherent consequences of the inevitable tissue trauma and edema around the superficial branch of the radial nerve and of the lateral antebrachial cutaneous nerve [Reyes 1995]. Last but not less important is the psychological trauma related to the cosmetic result of the scar, especially in the young population of patients. Serching the minimally invasive RA harvest techniques we found only an endoscopic approach using a proper instrumentation. This technique, reported in 6 cases, needs two surgeons, appear to be time and cost consuming [Terada 1998, Uchida 1998].

In the present work we report an alternative surgical technique of a less invasive approach to the RA harvest using a specific instrumentation originally designed for the saphenous vein harvest; this technique appear to be a surgical compromise between the conventional “open” technique and the endoscopic approach. The preliminary results are encouraging and the technical details are discussed.

MATERIALS AND METHODS

The equipment includes a modified retractor (Rad-LITE System, Genzyme Biosurgery, Cambridge MA USA) (Figure1) originally used for the less invasive saphenous veins harvesting; a self-retaining system with pneumatic locking designed to permit a single operator use (Genzarm, Genzyme Biosurgery, Cambridge MA USA); vessel loop; a Slim line muscle retractor and flexible hook. Only the light-panel integrated to the Rad-LITE system is not reusable.

A series of 15 patients, scheduled for Off-Pump Coronary Artery By-pass form the basis of this report; the quality of the graft was assessed before the implantation taking samples for the histological exam and postoperatively by controlling its patency with angiography. For the histology a 0,5 cm width samples were stored in 10% buffered formaldehyde for light microscopy and 4% buffered glutaraldehyde for scanning electron microscopy. A pathologist, blinded to the procedure, studied the specimens on the basis of morphologic and descriptive criteria. Postoperative coronary angiography was performed within 1 month after the operation in all cases.

Surgical Technique

The Genzarm needs to be attached on the bed prior to patient prep. The non dominant arm is selected for radial artery harvest. The circulation of the hand is preoperatively and perprocedure evaluated. A classical and a modified Allen Test is repeated in all the cases. The RA and the left IMA can be approached in the same time. The upper extremity is circumferentially prepared; the arm is extended and supinated on the operative arm board positioned at 90° to the operative table. The forearm to be used should be free of venous catheters. A pulse oximeter probe can be placed on the thumb of the chosen hand for intraoperative monitoring of oxygen saturation.

The harvesting begins with a 3 cm skin incision, median in the forearm; in this zone the RA exits from underneath the cover of the brachioradialis muscle. To establish the proper plane of dissection chephalad and caudal, a subcutaneous tunnel is created with the finger looking to the position and direction of the RA pedicle.

The Genzarm is now positioned to retract upper tissue in the tunnel, lighting the view and giving clear visualization of the artery below. Both hands of the surgeon are now free to retract, cauterize, dissect, suction or clip the artery and surrounding tissues. Placement of the retractor into the tunnel gives light and direct visibility to travel along the artery. One or two U stitches are used from inside to outside the subcutaneous tunnel in order to increase direct vision of the entire pedicle. Initial dissection begins with a vessel loop placed around the pedicle that is gently mobilized with the comitantes venae (Figure2).

Light upward traction lift the RA free from its muscular bed and the perforating branches are, at this level, ligated or clipped. The dissection of the entire RA pedicle under the skin and subcutaneous flap is completed with the aid of the light assisted retractor. The stainless steel retractor with a curved blade is ergonomically designed to facilitate direct vision during the harvest and, once this retractor is gradually inserted into the subcutaneous tunnel, the harvesting of the artery is realized in an atraumatic manner. A Slim line muscle retractor and flexible hook allow to visualize the perforator branches that are clipped or cauterized.

For the maximum length of the radial pedicle a contraincision of two cm is made, when necessary, at the proximal zone of the forearm. The incision is closed after heparin reversal with a small redon as drainage. Once the artery is out, it is prepared in the usual manner using a heparin based solution; the graft is than examined for untied branches with gentle hydrostatic dilation.

RESULTS

The time required to harvesting all the RAs ranged from 25 to 65 minutes, (MEDIAN 35; 25th – 75th percentile: 31-44 minutes) taking in count the learning curve. No complications such as nerve damage, delay in healing was observed; only a light hematoma of the inferior portion of forearm at the beginning of our experience constituted the morbidity of the serie. The histology exams show no signs of trauma or anatomical lesions attributed to the harvesting technique. After conditioning, any graft showed vascular spasm and any functional neurologic sign was reported after the operation. All the grafts were patents and functionals to the control angiography.

DISCUSSION

The continuous rise in using RA for CABG is legitimated by the success of arterial revascularisation especially in young population of patients; little concern exist about morbidity of the conduits harvesting technique. Many experiences report an important incidence of hand and forearm related symptoms most of which related to the often inevitable tissue trauma and edema around the nerve branches [Trick 2000, Anyanwu 2001, Denton 2001]. Denton et al. in a series of 560 patients, reported an overall neurologic complication rate, related to the RAs harvesting, of 30.1% [Denton 2001]; Anyanwu et al. showed a 51% neurologic complication rate in a serie of 151 patients [Anyanwu 2001]. Moreover, similar experience have been described in saphenous vein harvesting in which complications associated with the conventional open harvesting (hematoma, seroma, infection, paresthesia) have an incidence of up to 44% [De Laria 1981, Wipke-Tevis 1996]. To extend the proven advantage of minimally invasive harvesting of saphenous vein, many endoscopic approach to the RA harvesting have been proposed [Terada 1998, Uchida 1998, Trick 2000]. In these technique, the procedure is time and costs consuming, the learning curve is important due to the unnatural operative feel (2D vision, Hands/Instruments misaligned) and to the very limited dexterity inside (Long instruments, hands outside, fixed instruments tips inside). Last but not at least, the need of two surgeons to complete the procedure.

Our technique appear to be a surgical compromise between the open conventional technique and the total endoscopic procedure; limiting the dissection in the forearm, using direct vision and the hand control all times, the entire RA pedicle is harvested quickly and without trauma. The self retaining system authorize the solo surgery as for the conventional technique. Special care must be taken to avoid damaging the superficial radial nerve that travels in close proximity to the RA; the lateral antebrachial cutaneous nerve can be avoided if the proper tissueplane of dissection is obtained.

The cosmetic impact was the most spectacular advantage; the 3 cm long skin incisions, without others small stab incisions over the branches, were sufficient to complete the procedures in most of patients. Our study demonstrated the practicability and reliability of the new method, which will probably became an established method for RA harvesting; the preliminary results are encouraging and althought further studies are needed to assure long term patency of the RA, this technique can contribute greatly to the minimally invasive harvesting of RA, preventing associated morbidity and improving the aesthetic and functional outcome of the donor site.

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Figure 1. The RadLITE System is a modified light assisted retractor that allows to harvest the artery under direct vision.

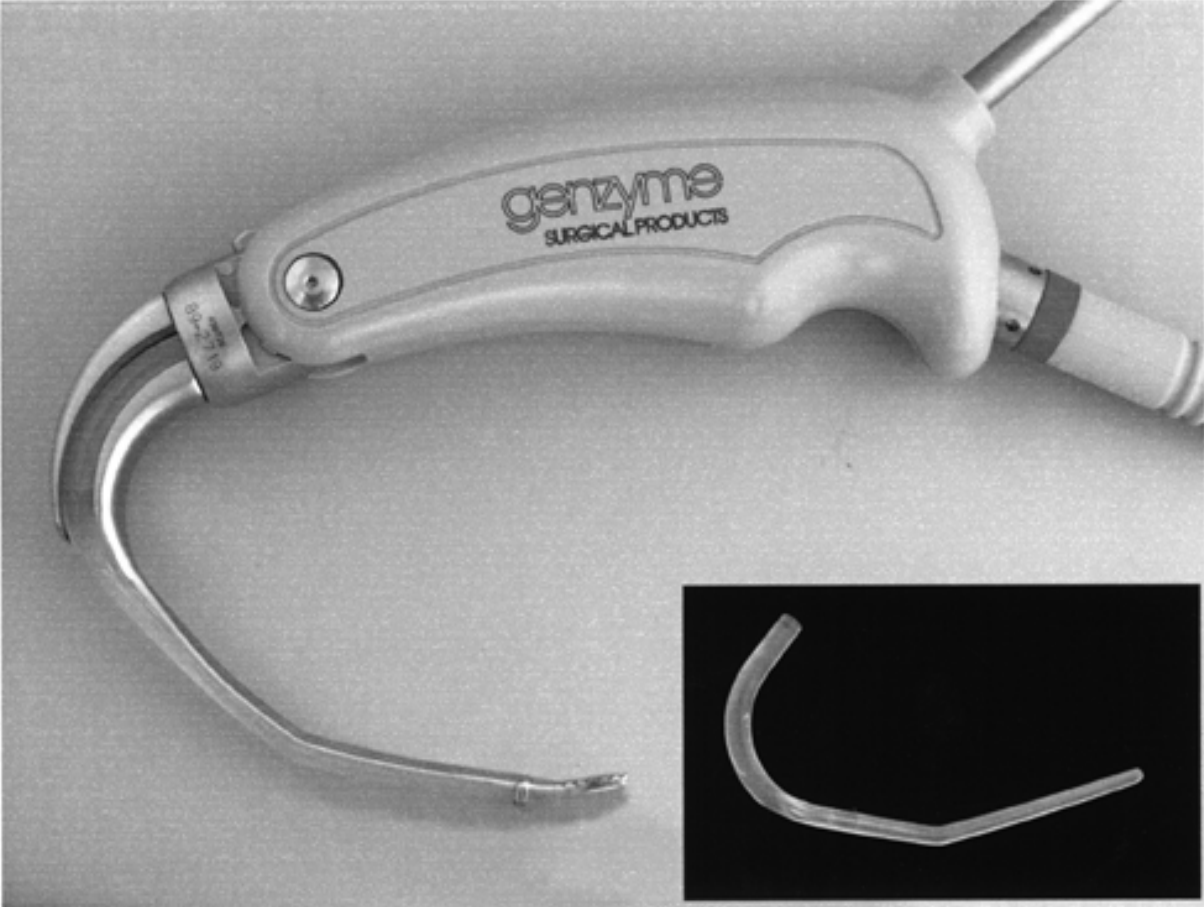


Figure 2. Dissection of the artery pedicle under the skin flap.

