A New Needle Driver for Minientry Coronary Artery Bypass

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ABSTRACT

Purpose: This article describes our clinical experience with a new needle driver (Olympus, Tokyo, Japan), which we have produced to facilitate minithoracotomy or port-access coronary artery anastomosis with the running suture technique.

Methods: The needle driver is 21 cm long, weighs 38 g, and has a grip shaft 1.4 cm in diameter. The device is held like a pencil. A side lever and a revolving disk in the shaft are manipulated with the fingers; a fine needle with a 7-0/8-0 monofilament suture can be grasped/released and driven to penetrate the coronary arterial wall. This device was employed in 10 consecutive patients (8 men, 2 women, 73 ± 7.5 years old), and off-pump bypass to the left anterior descending artery was achieved using the left internal thoracic artery or vein via a minithoracotomy (4.2 ± 0.6 cm long).

Results: There was no instrument-related injury during each anastomosis. The mean sewing time per anastomosis was 12 minutes (range, 8-18 minutes). Angiography confirmed the patency of the graft in all cases.

Conclusions: Although our experience is limited, we consider the present needle driver to be a viable device for facilitating off-pump, minientry coronary artery anastomosis with the suturing technique.

INTRODUCTION

Although its indications are limited, minimally invasive entry to perform coronary artery bypass eliminates the need for a full sternotomy approach. It is technically cumbersome, however, to handle the standard needle holder for coronary anastomosis through the small entry. We have produced a needle driver (Olympus, Tokyo, Japan) that can be controlled easily via a minithoracotomy or port. This article introduces the instrument and discusses the early clinical results we have obtained.


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placed between the LAD, and the graft was suspended on the wound. Thereafter, the graft was approximated down to the LAD, and the anastomosis was completed with placement of approximately 10 running stitches through the graft to the LAD. The needle driver was employed for carrying out stitching around the LAD; the LAD wall (alone or together with the graft wall) was sewn through the minithoracotomy under direct vision.

**RESULTS**

The minithoracotomy was 4.2 ± 0.6 cm long, ranging from 3.0 to 5.0 cm, and the wound was created precisely just above the LAD in each patient. There was no instrument-related injury during any anastomosis. The mean sewing time per anastomosis was 12 minutes (range, 8-18 minutes). There was no revision of running-suture anastomosis, although 1 additional stitch for hemostasis was placed in 3 cases. Angiography confirmed the patency of the graft in all cases.

**COMMENTS**

Our clinical experience with the present needle driver technique showed that off-pump coronary anastomosis by the running suture technique could be carried out safely and successfully through a minithoracotomy approximately 4 cm long placed just above the LAD. The new device functioned effectively with only finger control.

A number of innovative tools are currently available to facilitate coronary artery anastomosis. The one-touch coronary anastomosis technique using a mechanical or magnetic connector and the self-closing clip method have been used as alternatives to the standard suturing technique [Wolf 2003, Carrel 2004, Casselman 2004]. Although application of these new devices is limited to good-sized, noncalcified coronary arteries, and the long-term patency is unknown, these novel methods are promising and might facilitate minentry or port-access coronary anastomosis.

A machine assisted by robot technology has been developed and employed for totally endoscopic coronary artery bypass surgery [Bolton 2004]. The remote-controlled robot-hand has sophisticated motion and is therefore capable of coronary anastomosis by the standard sewing technique even in the closed chest cavity. The chief concept of our needle driver project is the same as the robot hand; the device can facilitate coronary suturing anastomosis in a limited space. However, the performance of the prototype needle driver is still primitive, and its function seems to be insufficient in more difficult situations, such as small coronary arteries located laterally or inferiorly. Therefore, further development is now under way to improve the device's performance.

In conclusion, although our experience is limited and further instrumental progress is required, the present needle
driver is considered to be a viable device for facilitating off-pump, minientry coronary artery anastomosis with the suturing technique.

REFERENCES


