New Method

A New Probe for the Anastomosis of Small Vessels

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We developed new probes with three varying sizes (ø1.0, 1.5 and 2.0 mm) with a trench for guiding the needle which made small vessel anastomoses easy and suture placement accurate with clear identification of the vessel lumen. We evaluated the efficiency of these probes on anastomoses using the bilateral common carotid arteries of cadaver rabbits. The anastomosis time of end-to-side anastomosis was shortened by using the probe from 20.2±3.3 to 15.4±2.6 min, and of side-to-side anastomosis from 20.2±1.3 to 16.0±1.2 min. Of the 5 end-to-side anastomoses without the probe, there was one deformity of the anastomoses site and of the 5 side-to-side anastomoses without the probe, there was one stenosis of the anastomosis. There were neither deformity nor stenosis of the 10 anastomoses of 5 end-to-side and 5 side-to-side anastomoses with the probes. In conclusion, the probe with a trench for guiding the needle made small vessel anastomoses easy. (Ann Thorac Cardiovasc Surg 2003; 9: 142–5)

Key words: coronary bypass, anastomosis, probe

Introduction

It is difficult to run a needle from outside to inside in the anastomosis of small vessels. When we can get clear identification of the lumen and protection of the posterior wall of the vessel from injury by the needle, it is easier to run the needle in an outside-in fashion. We thus developed a new probe with a trench to make small vessel anastomosis easy.

Materials and Methods

Ten cadaver rabbits which were sacrificed after another experiment for extracorporeal circulation were used for the experiment. The bilateral common carotid arteries were dissected out and the left common carotid artery was resected about 5 cm long to be a free graft. Two 8 mm long incisions were made in the right common carotid artery (Fig. 1). The end of the left common carotid artery was anastomosed to the proximal orifice of the right common carotid artery in an end-to-side fashion with 8-0 Pronova running suture and the side incision of the left carotid artery was anastomosed to the distal side orifice of the right carotid artery in a side-to-side fashion with 8-0 Pronova running suture (Fig. 1). The anastomoses were done using a new probe in every other rabbit to eliminate the effect of learning. The suture time was measured form the start of the first running to the end of knotting. After the anastomosis, the opposite side of the anastomosis of the right carotid artery was opened and the anastomosis site and the intima observed with a 3.2× surgical loupe.

All animals received humane care under the permission of the Committee of Animal Experiments of Kyushu University.

Results

We made three types of the new probes (ø1.0, 1.5 and 2.0 mm) as shown in Fig. 2 (Senko Ikakougyou, Inc., Tokyo). Type A probes were made only with a 2.0 mm diameter due to the technical difficulty. Probes less than 2.0 mm with some trenches did not have enough

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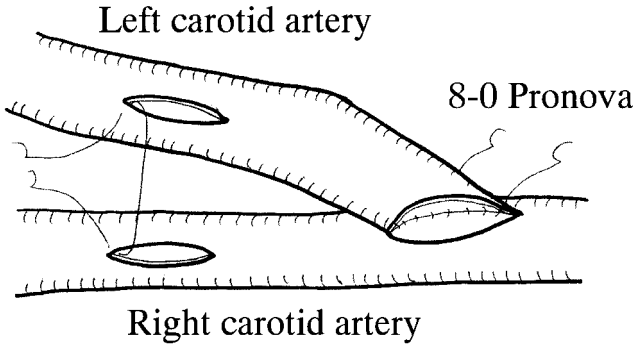

Fig. 1. Experimental model of anastomosis.
A rabbit left common carotid artery was anastomosed to the right common carotid artery in an end-to-side and side-to-side fashion.

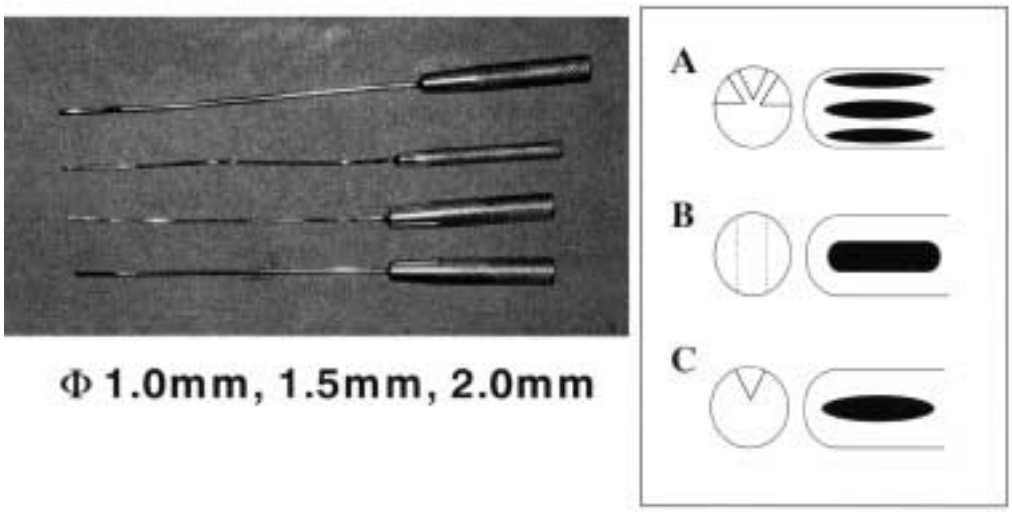

Fig. 2. New probes for anastomosis of small vessels.
The left photo shows an overview of some of the new probes. The right shows the three types of tips of the new probes.

rigidity. All carotid arteries in this study were less than 2.0 mm and we could not use the type A probes. The type B probes were not good because the needle fell down in the slit and picking up the needle was difficult. The anastomosis time using the type B probe was longer than that without any devices. Thus, in this study, the type C probes of 1.0 mm and 1.5 mm were used.

Using the new probe as shown in Fig. 3, the anastomosis time was shortened from 20.2±3.3 to 15.4±2.6 min in the end-to-side anastomosis and from 20.2±1.3 to 16.0±1.2 min in the side-to-side anastomosis (Fig. 4).

There was one deformity of the anastomosis site out of the 5 end-to-side anastomoses without the new probes and one stenosis out of the 5 side-to-side anastomoses without the new probes. There was neither deformity nor stenosis in the 10 anastomoses with the new probe out of the 5 end-to-side anastomoses and the 5 side-to-side anastomoses (Fig. 4). The intima around the anastomosis site was not injured as far as observation by the surgical loupe.

Discussion

Running a needle outside to inside in a small vessel may be troublesome because the identification of the lumen is sometimes difficult and the risk of injuring the posterior wall of the vessel is substantial. Using the usual probe without a trench, we may scratch and injure the near-side intima of the artery. To prevent this problem, we developed a new probe with a trench.

We anastomosed the arteries without any assistants. With such a thin vessel as a rabbit carotid artery it was hard to identify the lumen without an assistant, but lumen identification became very easy using the new probes. It is, in particular, useful when we run the angle of the side-to-side anastomosis as shown in Fig. 3C. In addition, we found it useful in enlarging the orifice of the small artery as shown in Fig. 5 because the incision line does not go off the center of the vessel if we use this new probe appropriately.

Parsonnet et al. reported that graduated probes which were made of reinforced fiber covered by polyurethane

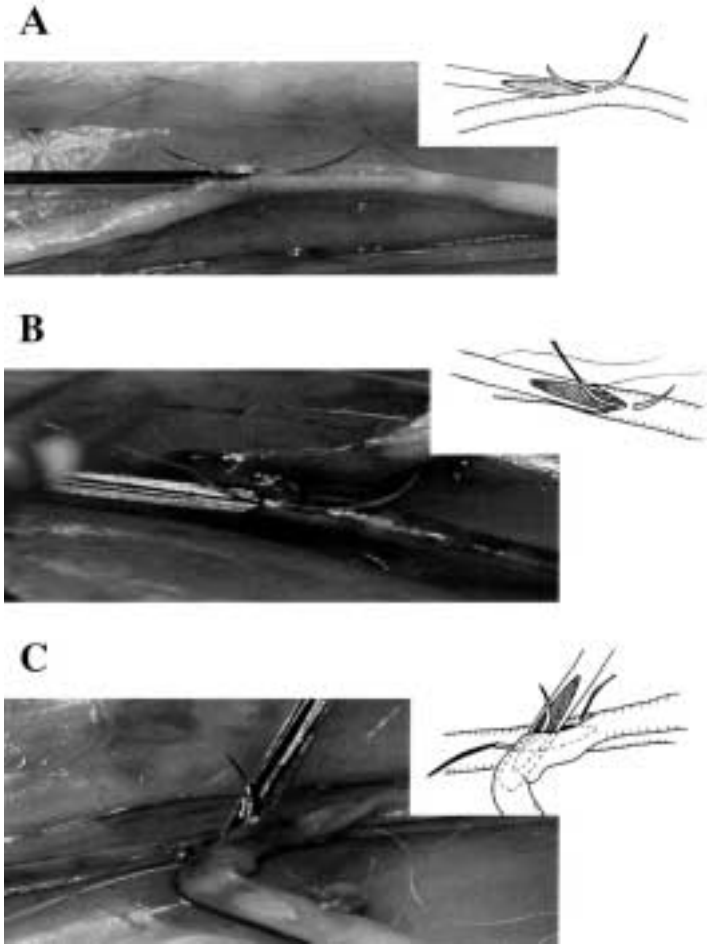

Fig. 3. Suture using the new probes.
A: The needle of 8-0 Pronova was run from outside to inside of the vessel.
B: The needle of 8-0 Pronova was run from inside to outside of the vessel.
C: The needle of 8-0 Pronova was run from outside to inside in the angle of the vessel in a side-to-side fashion.

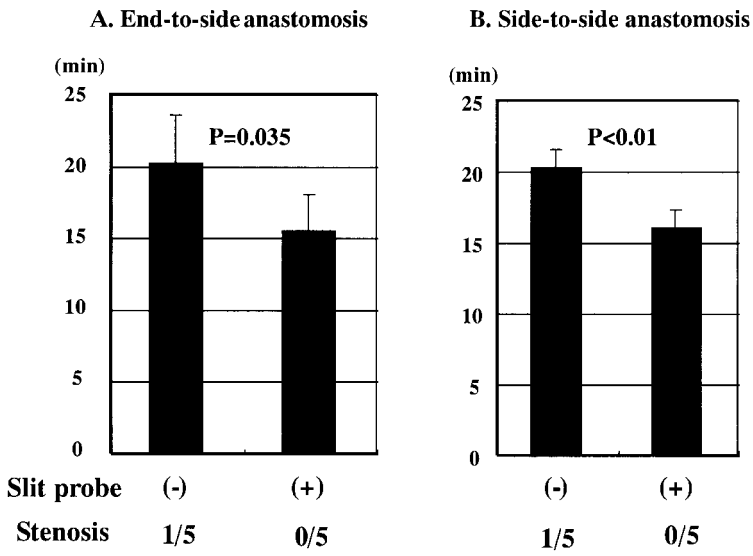

Fig. 4. The new probes facilitate anastomosis of small vessels and decrease the risk of stenosis.
Two columns show the time for anastomosis in an end-to-side (A) and side-to-side (B) fashion.

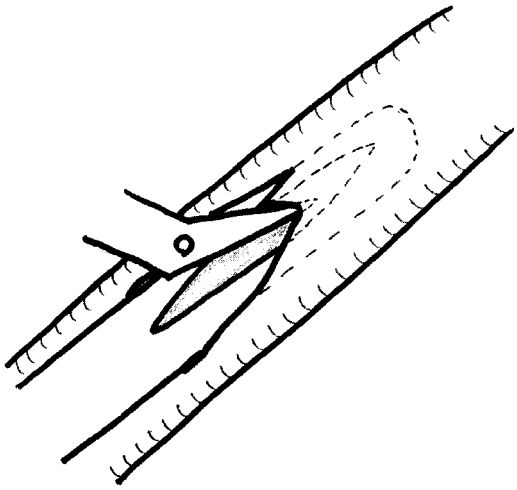

Fig. 5. The new probes also facilitate enlarging the orifice of a vessel by scissors.

facilitated the insertion of sutures.[1] Ludington et al. also reported that soft flexible catheter stents facilitated the vein-coronary anastomosis.[2] But both techniques have the risk that the devise itself can be involved in the suture and they have not become popular. To make a 0.5 mm trench on a 1.0 mm probe needs a substantially high level of technology and thus such probes have not appeared so far as we have searched.

There is a problem that these probes injure the intima when inserting. The tip of the probes was made smooth the same as the usual probes. Therefore, the risk of injuring the intima by the new probes was the same as the usual probes. Because we do not need any traction of the vessel to idenitify the lumen, the insertion of the new probe is rather protective for the intima.

In conclusion, a new probe with a trench facilitates anastomosis of small vessels and may decrease the risk of stenosis of the anastomosis.

References

1. Parsonnet V, Gilbert L, Gielchinsk I. Graduated probes for coronary bypass surgery. *J Thorac Cardiovasc Surg* 1974; **68**: 424–7.
2. Ludington LG, Kaftouni G, Peterson MH, et al. Technique for using soft, flexible catheter stents in aortocoronary vein bypass operations. *Ann Thorac Surg* 1976; **21**: 328–31.