# EXPERIMENTAL MICROVENOUS ANEURYSMS IN RATS: A NEW MODEL FOR MICROSURGICAL PRACTICE

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*SUMMARY*

*In this technique, a new laboratory microvenous aneurysm model was produced in rats. Aneurysms were formed in the intercarotid microvenous bridge anastomoses and clips were applied by microneurovascular surgical techniques. This method appeared to be a reliable experimental model, being inexpensive, simple and practical in clinical media.*

*Key words*: *Microvenous Aneurysm, Dissection, clipping, A new model*

## INTRODUCTION

Microsurgery seems to be an inseperable part of several surgical processess ranging from replantation surgery to urology and from coronary surgery to neurosurgery. However, it is obvious that the application of microneurosurgical procedures requires a special training together with precision and experience. A special technical ability acquired by a constant and persevering study in the field of microsurgery provides the surgeon with ability and experience for clinical application. Taking the effect of blood flow in the formation of aneurysms into consideration, we developed a simple, inexpensive and reliable model to be applied in any microsurgery laboratory.

## MATERIALS AND METHODS

The microvenous aneurysm model was developed on twelve rats weighing an average of 250 gm each. They were anesthetized with intramuscular injections of Innovar-vet (a combination of 0.4 mg Fentanyl and 20 mg Droperidol) at a dose of 0.1-0.2 ml/100 gm of body weight.

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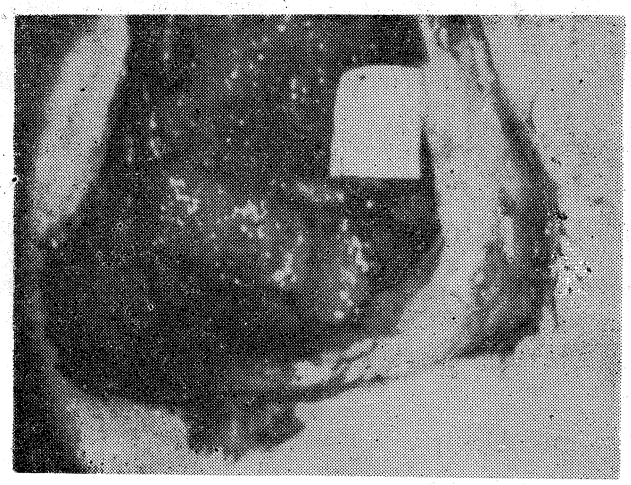
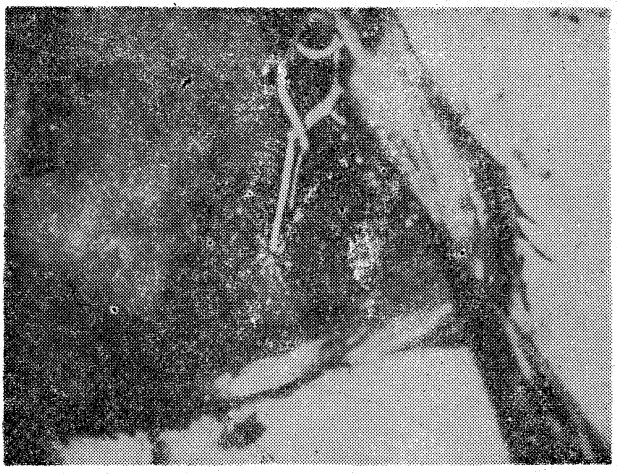
The rats were laid on a rat-operating board and restrained supine by their tails, arms, legs and teeth. A transverse cervical incision was employed at the clavicle level extending to the sternocleidomastoids muscles bilaterelly. By microsurgical technique, the right external jugular vein, an average of 1,2 mm in diameter, was dissected free from the accompanying tissues and the adventitia on it were cleaned. Its branches were coterized to give a free segment of vein graft about 15 mm long. This segment, after washed with an irrigation serum containing 50 U heparin/ml was fixed in physiological serum. Then the right carotid artery was dissected free from the beginning to the bifurcation point without injury to the accompanying vessels and nerves. Following the sweeping off the adventitia, a segment of sufficent length was applied with temporary microvascular clips. The narrover orifice of the vein graft (1,2 mm), which had been previously taken from the same rat, was anastomosed end-to-side °(with 12-14 sutures of 10-0 nylon) to form a right angle. The left carotid was in the same way dissected and the proximal end of the vein greft (2,Imm) was anastomosed end-to-side with 16-18 suture to form a right angle, approximately 4-5 mm away from the midpoint of vein graft to narrrover orifice was cleaned and the wall of the vein graft was thinned. Sublingual glandular tissues were removed, the wounds were closed and the rats were followed up for ten days.

Ten days following the procedure the rats were reanesthetized and by microsurgical technique, bridge anastomosis and aneurysm formation (if any) were carefully dissected free from the other tissues and photographed (Picture I). The aneurysms produced were coagulated with bipolar coagulation and clipped with Yaşargil aneurysm clips (Picture 2). Then the grefts were excised for examination under operation microscope and Scanning Electron Microscope (SEM).



Picture 1



Picture 2

## RESULTS

In two of the rats, in which blood flow allowed through both carotid arteries and no clips were applied, the vein graft was totally plugged by a mural thrombus and no aneurysm formation noted (Picture 3). In all of other rats, aneurysms were observed in several sizes and character (Table I).

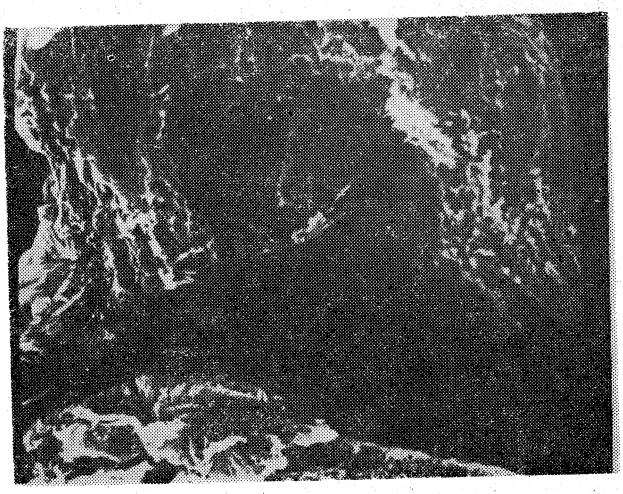
Picture 3

Table 1: The characteristics of microvenous aneurysms in 12 rats

| Rat Number | Blood Flow | Aneursysm Size | Pulsation | Description |
|---|---|---|---|---|
| 1 | Unilateral | 3,5 mm | Yes | Broad base, single lobule, Thin wall. |
| 2 | " | 2,5 mm | Yes | Broad base, single lobule, thin wall. |
| 3 | " | 3,0 mm | No | Broad base, single lobule trombosed. |
| 4 | " | 2,5 mm | Yes | Broad base, single lobule. |
| 5 | " | 4,0 mm | Yes | Broad base, single lobule, thin wall, aneurysm torn open. |
| 6 | " | 3,5 mm | No | Broad base, single lobule, thrombosed. |
| 7 | Bilateral | — | No | Graft is totally thrombosed |
| 8 | " | 2,5 mm | Yes | Small base, bilobulated. |
| 9 | " | 2,0 mm | Yes | Broad base, single lobule, wall excessively thin. |
| 10 | " | 1,0 mm | Yes | Broad base, single lobule. reduced by bipolar coagulation. |
| 11 | " | — | No | Vein graft is totally thrombosed. |
| 12 | " | 3,0 mm | Yes | Broad base, single lobule, thin wall. |

Two of the rats which died during 10 days following the procedure are not included in this study.

The sizes of aneurysms ranged from I mm to 4 mm,. The largest one in size was noted in number 5 in which the blood flow was bilateral. All of the aneurysms, except number 8, had single lobule and broad bases. The anuerysms were trombosed and no aneurysmal pulsation was observed in two of the rats (Number 3 and 6). The others had quite thin walls. In one of them, aneurysm was torn open during the dissection process. Nothing was observed on the periphery of aneurysms to indicate an aneurysmal bleeding. We did not apply clips to the thrombosed ones. The aneurysms to which clips were applied were supported by a piece of surgicell around the base on a point between the clip and the vein as it is usually practised in clinical application. The thrombosed aneurysms (Number 3 and 6) were evaluated by SEM and a thrombus of fibrous nature seemed to fill the lumens and a few plathelits and leucocytes were found on it. (Picture 4).



Picture 4

## DISCUSSION

It has been reported that several experimental models of aneurysms were intentionally developed since 1839 both for neurosurgical training and laboratory studies (14). In addition, several studies have been carried out on microanostomotic aneurysms and these studies showed that among the factors affected the formation of aneurysms were mechanical traumas, media necrosis, loss of elastic lamels, subintimal hyperplasis, ischemia and infections (1,2,8,12). Based on these factors, the substances such as nytrogen mustard causing mural necrosis and eventually leading to aneurysms were experimentally injected into the arteries of animals (13). And aneurysms were intentionally produced in rats by the help of surgical hypertension together wihth pharmacological agents (4,11). Hassler (5), reported that carotid ligation was followed by the formation of small media defects and minor aneurysms. Black and German (3) established a mathematical correlation between the size of aneurysm and that of orifice by using small segments of veins in dogs. In 1977, Kerper and Buschman (6) published the radiological findings of experimental carotid aneurysms. Stehbens (10) described some surgical techniques for the formation of aneurysms in various shapes. In 1982, Young and Yaşargil (14), managed to form aneurysms in rats for educational purposes by using jugular segments of veins in their arterial by-pass grafts as a result of 6-10 weeks controlling period. By this method, which is a modified form of Stehbens's technique, production of aneurysms of sufficient size and application of clips seem to be possible for educational purposes. According to the method we have developed, a venous anasthomosis forming a right angle between the two carotid arteries and aneurysm was produced on this vein graft. The venous graft was completely occluded in two of the rats which had bilateral

blood flow and no aneurysm was observed and the aneurysms in this group, if any, appeared to be smaller than those of the group in which unilateral blood flow was allowed. This is a proof of the effect of blood flow on the formation of aneurysms (7,9). On the other hand, the thrombosis of the aneurysms in this group, in which there was a unilateral blood flow , may be attributed to a slow down in blood circulation. We believe that our model is as reliable and inexpensive as that of Young and Yaşargil's and appears to be a satisfactory experimental method in the development of skill and technical ability in microsurgery.

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