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A new aneurysm wrapping material: polyglactin 910 + fibrin sealant

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Abstract

Aneurysms experimentally induced by using the silver nitrate coagulation method in 10 Wistar Albino rats are wrapped with Polyglactin 910 and Fibrin Sealant. 6 weeks later the rats are sacrificed and compared with the control group. In the group in which Polyglactin 910 and Fibrin Sealant were used as the wrapping material, non-specific inflammatory granulation tissue development around the aneurysms is observed. We suggest that a Polyglactin 910 and Fibrin Sealant combination can be used as a wrapping material in the treatment of aneurysms where clipping is not possible.

Keywords: Aneurysm, wrapping.

1 Introduction

Wrapping method: although wrapping was a popular method in the surgical treatment of intracranial saccular aneurysms before microneurosurgery was developed, today it is used only in cases where clipping is not possible [2, 11]. Various materials have been used for wrapping of the experimentally induced aneurysms. The main aim in using this method is to initiate a tissue reaction that provides thickening of the aneurysmal wall [9]. In our study, aneurysms, which were experimentally induced by using the silver nitrate coagulation method at the common carotid artery of the rats, are wrapped by using Vicryl Mesh* and Fibrin as the wrapping material, as far as we know as the first time in the world.

2 Materials and method

For this study, 10 female albino rats, each 6 months old and weighing between 200–250 grams, were provided from the Experimental Medicine Research Center (DETAM) of the University of Istanbul. 3 cm long cutaneous incision was done on the right side of the rat under general anaesthesia by thiopentone sodium (Penthotal) 50 mgr/kg intraperitoneal, in a supine position. The tunica adventitia was microsurgically decollated from the tunica media in a flap style after exploration of the carotids. The tunica media was then coagulated with a very small amount of silver nitrate ($AgNO_3$). The operation area was irrigated with physiological serum appoximately 5 seconds later to prevent the penetration of silver nitrate into the deeper tissues. After completion of this procedure, the lesion area was covered with a layer of decollated adventitia, and the wound was closed [10]. The rats, which were kept at room temperature in their cages in groups of two were given drinking water containing 1% NaCl to induce hypertension. During reexploration 15 days later aneurysms with diameter of 2–4 mm were found in 9 of the rats. The aneurysms in 5 rats were rewrapped with a single layer of synthetic, absorbable polyfilament of Vicryl* (Polyglactin 910) Mesh after replac-

* Vicryl Mesh manufactured by ETHICON Neuilly, France

** Tisseel Kit manufactured by IMMUNO AG Vienna, Austria

Figure 1. Photomicrograph of specimen from wrapped aneurysm showing loss of the elastic filaments, degeneration of myointimal substance **(curved arrow)**, nonspecific granulation tissue **(arrow)** at the aneurysm wall. Van Giesson x 80. **A:** Aneurysm wall

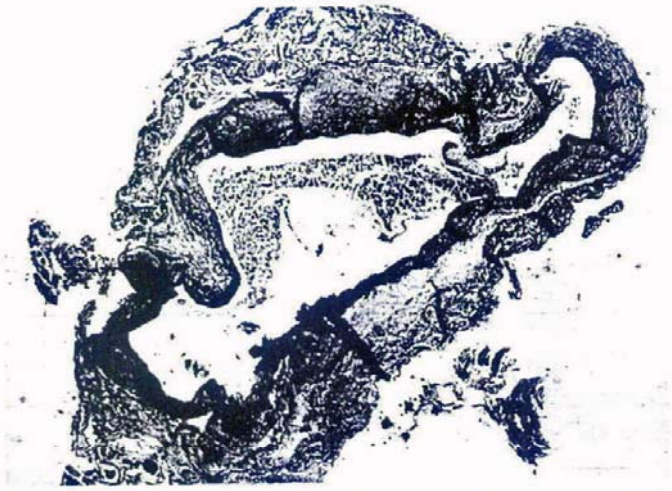

Figure 2. Photomicrograph of specimen from control group carotid artery showing disappearance of the lamina elastica interna at the aneurysm wall. HE x 32.

ing the Fibrin Sealant (Tisseel** kit) over the aneurysmal vessel segment. The other 4 subjects were left untreated. The aneurysmal vessel segments were fixated with 10% solution of formalin after polyglactin 910 was absorbed totally after 6 weeks. The aneurysmal dissections wereinvestigated by using hematoxylin eosin and Van Giesson staining.

3 Results

With the $AgNO_3$ coagulation method that we used, aneurysm developed in 90% of the rats. One rat did not show any aneurysmal development due to generalized thrombosis at the CCA. Circulation was observed at the CCA's of all subjects during exploration six months later. This histopathological investigation of the aneurysmal walls in the five rats in which Fibrin Sealant and Vicryl Mesh were used as the wrapping material, loss of elastic fibers and degeneration of the myointimal medium substance was observed (Figure 1). The vessel wall was also thinner in these areas, with inflammatory non-specific granulation and minimal scar tissues at the surrounding tissues and at the adventitia neighboring the areas showing loss of elastic fibers. At the histopathological investigation of the aneurysmal vessels of 4 of the control group rats, there was an extreme thinning of the wall in areas with loss of lamina elastica and no surrounding scar tissue (Figure 2).

4 Discussion

Aneurysms can be induced in laboratory animals by using two methods. One is the venous pouch method [1, 4, 7, 9, 12]; the other involves application of applying mechanical and chemical forces to the vessel wall [5, 6]. In our study we used the second method to induce aneurysm. After decollating the adventitial tunica, the tunica muscularis is coagulated with $AgNO_3$ [10]. We chose this method since aneurysms induced in this way do not show any adhesions to the surrounding tissues and the lumen remained open. Until today, various wrapping materials have been used in laboratory animals. SACHS [8] has used muscle as the wrapping material in dog ICA; this did not provide sufficient fibrous tissue. EBINE at all [3] tried muscle, fascia, dura mater, cotton, lyophilized dura and cyanoacrylate in intracranial arteries of dogs. In the dogs in which cotton was used, there was collagen infiltration at the aneurysm wall and the cotton fibers showed strong adhesions to the vessel. Other investigators have used Fibrin Sealant, Polydioxanone, Indian ink, and cotton leaflets in the wrapping of venous pouch aneurysms in rats. It has been found that both Fibrin sealant and Indian ink induced thickening and foreign tissue effect over the aneurysm wall. In our study, we used Polyglactin 910 (Vicryl) as the major wrapping material and Fibrin sealant to hold it around the aneurysm. Histopathological investigation of the aneurysm created by the method described previously showed minimal reduction in the size of the vessel wall and inflammatory non-specific granulation tissue around the aneurysm wall accompanied

trol group showed extreme thinning and no scar tissue. The results of the previous studies of various wrapping materials applied in the clinical practice show similar histopathological changes in the study groups in comparison with the control group, such strength of the vessel wall [3, 8]. Taking into con deration such similarities, we suggest that Polygl tin 910 and Fibrin Sealant combination can be us as an efficient wrapping material in the treatment the non-clippable aneurysms.

References

[1] BLACK SPW, WJ GERMAN: Observations on the relationships between the volume and size of the orifice of experimental aneurysms. J Neurosurg 17 (1960) 984–990

[2] DOTT NM: Intracranial aneurysms: cerebral arteriography; surgical treatment. Edinb Med J 40 (1930) 219–234

[3] EBINA K, T IWABUCHI, S SUZUKI: A clinico-experimental study on various wrapping materials of cerebral aneurysms. Acta Neurochir 72 (1984) 61–71

[4] GERMAN WJ, SPW BLACK: Experimental production of carotid aneurysms. N Eng J Med 250 (1954) 104–106

[5] HASHIMOTO N, H HANDA, F HAZAMA: Experimentally induced aneurysms in rats. Surg Neurol 11 (1979) 243–247

[6] HASSLER O: Experimental carotid ligation followed by aneurysmal formation and other morphological changes in the circle of Willis. J Neurosurg 20 (1963) 1–7

[7] NISHIKAWA M, RD SMITH, Y YONEKAWA: Experimental intracranial aneurysms. Surg Neurol 7 (1977) 241–244

[8] SACHS E Jr: The fate of muscle and cotton wrapp about intracranial carotid arteries and aneurys A laboratory and clinicopathological study. A Neurochir 26 (1972) 121–137

[9] SADASIVAN B, S MA, M DUJOVNY, KL HO, JI A MAN: Use of experimental Aneurysms to evalu wrapping materials. Surg Neurol 34 (1990) 3–7

[10] SHAMSI AA: $AgNo_3$ Koagülasyon Yöntemi Deneysel Anevrizma Olusturulmasi (Docto Dissertation) Istanbul, Turkey, 1991

[11] YAŞARGIL MG: Addendum in Microneurosurg Vol. 2 Georg Thieme Verlag, Stuttgart 1984

[12] YOUNG PH, MG YASARGIL: Experimental carc artery aneurysms in rats: a new model for microsu cal practice. J Microsurg 3 (1982) 135–146

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