

Conference paper

Sutureless Compression Anastomoses Formation with Use of TiNi Device on the Small Gut

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Abstract

A new device made of nickelid titanium and a way of formation of a sutureless compression anastomosis on the small bowel were developed with the purpose of creating a compression interintestinal anastomosis on the small bowel without the manual portion of seams. 28 sutureless compression anastomosis on the small bowel are created during the experiment. They include 10 «side-to-side» anastomoses, 10 «end-to-end» anastomoses and 8 «end-to-side» anastomoses. Mechanical and biological durability of anastomoses, terms of compression devices failure, primary permeability of anastomoses, morphogenesis of a compression seam are studied. No complications connected with the use of the compression device were noted. During the experiment it is proved that all sutureless compression anastomoses created by means of the nickelid titanium device are mechanically and is biologically tight. By the ninth day all the dogs had no compression devices in their abdominal cavities. The histological researches show that the process of neogenesis goes with the minimal symptoms of sclerosis and leads to the full adaptation of all small bowel layers. The new way of the formation of a sutureless compression anastomosis on the small bowel allowed to create a stronger and more reliable anastomosis and thereby to prevent the development of typical complications and to receive more favorable remote results.

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1 Introduction

The compression way of anastomoses creation is the most perfect method of tissue connection. Compression anastomoses have high physical durability, good biological tightness and insignificant development of cicatricial tissue [1, 9]. Such qualities of nickelid titanium as its high elasticity, biological inactivity, ability not to collapse while multiple using were the reasons for choosing it as a material for the production of compression devices [10, 11]. The number of devices is developed on the basis of nickelid titanium for the formation of compression anastomoses on the hollow organs [2, 3, 4, 5, 6, 7, 8, 9]. As a rule when forming compression anastomoses with the use of various nickelid titanium devices the imposing of manual stitches in the place of the introduction of a device to the gleam of the hollow organs is required. Based on the results of our own observations we noted the insolvency of compression anastomoses in all cases is noted in the field of the manual portion of seams. Though the portion of manual stitches in a compression anastomosis no more than 15% the aspiration to create the compression anastomosis along the whole perimeter without imposing the manual portion moved us to develop the special device and the method of the formation of a compression sutureless anastomosis on the small bowel.

2 Experimental

At the department of hospital surgery of the Siberian State Medical University together with Scientific Research Institute of Medical Materials and Implants With Shape Memory (Tomsk) the device was developed for the sutureless compression anastomosis formation on the small bowel without imposing the manual portion of stitches [12]. The developed device is made as two compressing branches and a spring which pulls them together up to their complete contact. The diameter of the branches matches the sizes of the small gut of experimental animals and is 17-18 mm on the average. The external diameter of the spring is 7 mm, the number of rounds is 4-5. The compression pressure between the squeezing elements of the device (branches) is 0,025 Hz/mm². Later during the experiment it was proved that namely this pressure leads to the implant failure during the 7th-8th day after the transaction and creates favorable conditions for the formation of the reliable sutureless compression anastomosis.

28 sutureless compression anastomoses were applied on the small bowels of the mongrel dogs during the experiment. The rejection terms and the device migration terms were observed in the course of the experiment. We studied the passability of anastomosis permeability and investigated the physical and

biological tightness of anastomoses. We also studied the time of the connective tissues fusion. The mechanical durability was determined with the help of the pneumahydraulic forging by V.P. Mateshuk's technique. The dynamics of the compression devices rejection was estimated by means of the X-ray examination in different terms after the operation and by observing the data of a morphological picture of anastomoses. The primary sutureless compression anastomosis permeability was studied by introducing the baric suspension.

3 Results and discussion

28 sutureless compression anastomosis are created on a small bowel with use the developed device. It includes 10 «side-to-side» anastomoses and 10 «end-to-end» anastomoses and 8 «end-to-side» anastomoses.

The ends of an intestine put in parallel when forming an enteric a «side-to-side» anastomosis. Purse-string sutures imposed on each wall and carried out complete cuts to 5 mm long in the transversal direction in the middle. Carried out a preliminary preparation of a device which includes coolings and delutions branches to the opposite sides. Rounds of branches entered into the created holes one-by-one and tightened purse-string sutures. The spiral heated up under the influence of body temperature, reduced and squeezed tissues by compression rings (Fig. 1).

For ensuring primary permeability was placed in a spiral. The gelatin capsule dissolved in a few minutes after installation. Primary permeability of anastomosis was restored after dissolution of capsula. Thanks to the capsule it was possible to avoid insertion tissues between spiral turns when purse-string sutures were tightening.

This way of a sutureless compression anastomosis formation allows to form an anastomosis on a small bowel not only type «side-to-side» but also «end-to-end» and «end-to-side» by a similar technique (Fig. 2, 3).



Fig. 1. Formation seamless compression anastomosis type "side-to-side"

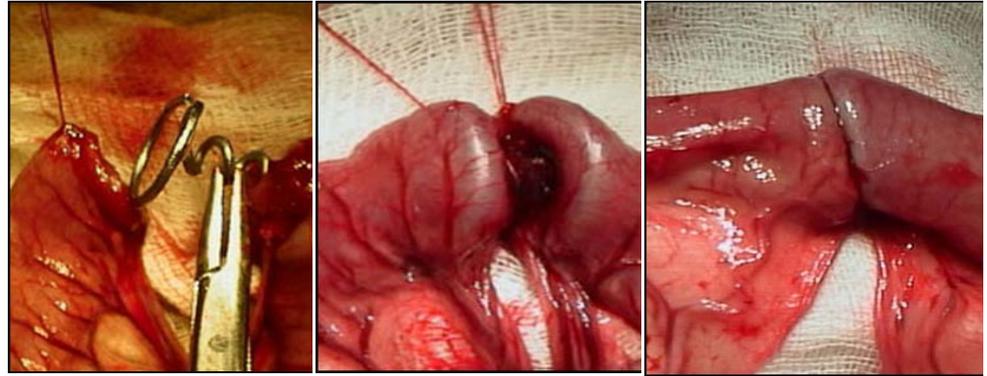


Fig. 2. Formation seamless compression anastomosis type "end-to-end"



Fig. 3. Formation seamless compression anastomosis type "end-to-side"

There are three animals died in the postoperative period. Two cases are connected to the progressive hypoxia in the postoperative period. One case is connected with narcosis complications (an overdose of drugs). There are no complications relative to use of the compression device.

The lowest mechanical durability of a sutureless compression anastomosis was observed for the 3-4th day after operation and was 125-130 mm hg. At 6th day it increased up to 170 mm hg and at 10-14th days approached 180-200 mm hg. The anastomosis wasn't destroyed even with a pressure of 260 mm hg in later terms. It is necessary to notice that even the lowest indicators of mechanical durability of compression seams by one and a half times exceed a threshold of physical tightness (50-60 mm hg).

In washings from area of a sutureless compression anastomosis crops were sterile. It testifies that anastomosis is biologically tight, impenetrable for a colibacillus. Microbial dissemination was minimum in three observations and made from 20 to 70 colonies. There was in tens times less than contamination

after applying of an anastomosis in the manual way. The received results allow to estimate sutureless compression anastomosis as biologically pressure-tight.

Physical and biological tightness of the sutureless compression anastomoses didn't differ in different types (the «end-to-end», the «side-to-side» and the end-to-side”) on a small gut significantly.

The devices were in the place of formed anastomoses within five days after surgery. For the 6-8th days the devices are still fixed on necrotic tissues but they are mobile, easily are displaced and come off. All dogs compression devices were absent in an abdominal cavity to 9th days. The complications connected with migration of a design weren't. Primary permeability of compression sutureless anastomoses was kept in all terms of an experiment.

Inflammatory reaction proceeds with the minimum reactive changes in layers of the anastomoses and is short-term according to results of microscopic examination. On 7th day a mucous layer epitelization begins and comes to an end to 14 days. There is a recovery of structure of a mucous membrane since 21th day on the 30th. The process of regeneration goes with the minimum phenomena of a sclerosis and leads to complete adaptation of all small gut layers. Maturing of a cicatrix comes to the end for the 30th days after surgery and connected with vascular reorganization. By 60th days there is a reduction of thickness of cicatricial tissue anastomoses takes place. The conducted histologic investigations show that healing of compression as primary tension and has considerable advantages before a manual stitches.

4 Summary

Using of developed TiNi device allows to create sutureless compression anastomosis on a small gut without imposing of a manual stitches. It improves durability and reliability of anastomosis. The developed method allows to create sutureless compression anastomoses on a small gut in different options: on type «side-to-side», on type «end-to-end» and «end-to-side». Sutureless compression anastomoses formation with use of a new elastic TiNi implant allows to prevent development of the typical complications from an anastomosis connected with its formation and to receive more favorable remote results.

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