Valeology: International Journal of Medical Anthropology and Bioethics
(ISSN 2995-4924) VOLUME 02 ISSUE 09, 2024

MORPHOLOGICAL ASSESSMENT OF CHANGES IN TISSUE IN RECURRENT HERNIA AFTER ALLOPLASTY

Mustafakulov I.B
Samarkand State Medical University
Khaitov A. A
Termez branch of the Tashkent Medical Academy

Abstract:

A morphological analysis of biopsies taken from the area of surgical intervention was carried out in 64 patients who underwent repeat hernia alloplasty. The study included early (up to 6 months) and late (more than 6 months) relapses. It turned out that tissue reactions at the interface between the fiber and the endoprosthesis play a key role in the development of both early and late relapses. Particularly significant is the macrophage reaction, which maintains a state of chronic aseptic inflammation and processes of "false biodegradation" directed both at the implant itself and at the surrounding connective tissue. This contributes to the formation of gaps and rupture loci in fibrous-modified connective tissue, which, along with factors affecting the position of the endoprosthesis (in lay, on lay), contributes to the occurrence of relapses.

Keywords: *postoperative ventral hernia, relapse, morphological study.*

Introduction

Relevance. Postoperative ventral hernias of any location are a common complication in abdominal surgery. The frequency of their occurrence varies depending on the healing of the postoperative wound: with primary intention it is up to 1.5-4%, with secondary intention it reaches 22% [1,2,6,11].

The widespread use of synthetic implants with characteristics as close as possible to an ideal prosthetic material has revolutionized the treatment of this pathology. Over the past five years, in herniological practice, there has been a positive trend towards a reduction in the frequency of postoperative complications and relapses due to the almost universal use of tension-free methods of hernial orifice repair. At the same time, the relapse rate when using local tissues to close the hernial orifice remains high and reaches 12%.

Active discussions continue that the success of treatment of patients with hernias depends on the location of the synthetic endoprosthesis relative to the aponeuroses of the abdominal muscles. The relapse rate for in-lay and on-lay implant positions can reach 13%. The sub lay position is often accompanied by the development of adhesions [3,5,8,16,21]. When using combined methods of closing the hernial orifice, the relapse rate is only 3%.

In the first six months after anterior abdominal wall surgery, the method of surgery, the synthetic endoprosthesis used, and the general status of the patient are of paramount importance. However, in later stages, when the process of endoprosthesis integration must be completed, the mechanism of hernia recurrence remains unclear.

It is known that most artificial materials are destroyed in the body over time due to biodegradation factors. There are many studies on the physical, chemical and biological properties of polypropylene implants, but their results are often contradictory [4,5,7,13,17,20]. The lack of a comprehensive analysis makes it difficult to explain the causes of relapses in patients with postoperative ventral hernias.

Purpose of the study. To conduct a morphological study of the causes of relapses in patients who underwent surgery for postoperative ventral hernias at various stages.

Material and research methods

A morphological analysis of biopsy material obtained intraoperatively from 64 patients was carried out. The study included 18 men and 23 women, with an average age of 61 years.

All patients underwent implantation of both heavy and light synthetic polypropylene endoprostheses before relapse occurred. Recurrences were classified into early (up to 6 months after the last surgery) and late (more than 6 months).

Tissue samples for histological examination were taken directly from the area of hernia recurrence (newly formed hernia orifice) and consisted of four fragments measuring 0.5×0.5 cm. The material was fixed in a 10% solution of neutral formalin, dehydrated and embedded in paraffin. Sections 5–6 µm thick were prepared on a Sakura Accu-Cut SRM200 microtome (Sakura, Finetek, Japan), stained with hematoxylin and eosin, van Gieson picrofuchsin, and cresyl violet using standard techniques.

Viewing and photographing of preparations was carried out using the Videotest hardware complex and Morphology 5.2 software.

Research results and discussion

A microscopic examination of tissue fragments from patients with early relapse (19 people) revealed that the fibers of synthetic polypropylene endoprostheses, observed under a light microscope, did not undergo noticeable changes. The fibers remained smooth, and their average diameter in cross sections fully corresponded to the manufacturer's original data (0.14, 0.15, 0.16 mm).

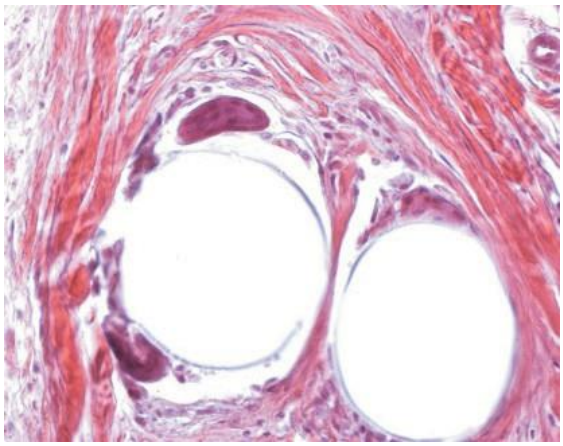
The interface between the fiber and the tissue was represented by an accumulation of macrophages and foreign body giant cells containing from 8 to 28 nuclei, visible in one plane of the histological section (Fig. 1). There were no fibrous structures in this zone, which formed a gap measuring 78.8 ± 19.3 µm. Closer to the periphery of the endoprosthesis fibers, connective tissue couplings with circularly oriented collagen fibers tending to fibrosis and a weakly expressed vascular component were observed, where hemodynamic disturbances such as sludge and stasis were noted. The granulation tissue adjacent to the fibers showed signs of mild to severe inflammation due to diffuse lymphocytic infiltration.

From the circular couplings to the periphery of the regenerate, the heterogeneity of the granulation tissue remained, with a predominance of the cellular component represented by activated fibroblasts against the background of inflammation and hemodynamic disturbances, expressed by congestion of the venous vessels, in the lumen of which blood clots were present. Perivascular hemorrhages were observed in some fields of view (Fig. 2).

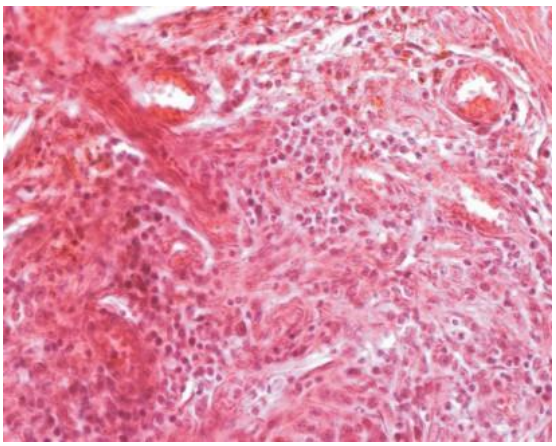
Single degranulated mast cells were detected perivascularly (Fig. 3).

The morphological picture in patients with late relapses of postoperative ventral hernias (45 people) showed the absence of completion of regenerative processes in the area of implantation of the synthetic endoprosthesis and signs of pathological restructuring of the regenerate while maintaining chronic aseptic inflammation.

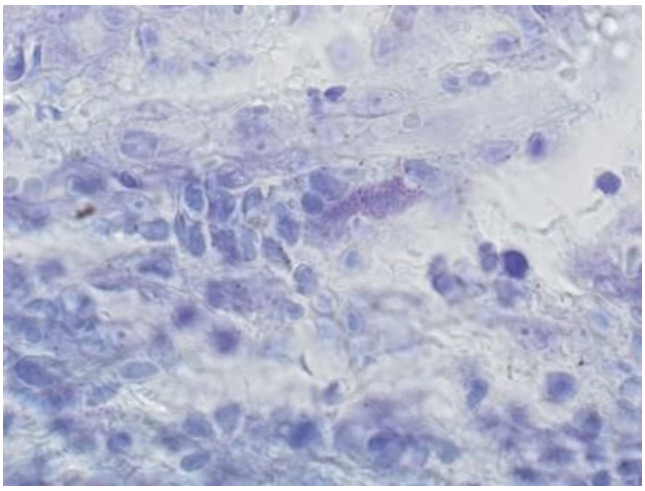
The granulation tissue around the fibers remained heterogeneous, with a predominance of the fibrous component, and the macrophage infiltrate was less pronounced. The zone of first contact between fiber and tissue was still represented by giant cells of foreign bodies with up to 50 nuclei in one plane of the histological section. The size of the gap between the fiber and the fabric increased to 425 ± 20.1 μm. Each fiber of the endoprosthesis was surrounded by a fibrous circularly oriented coupling, followed by longitudinally oriented fibrous connective tissue fibers.



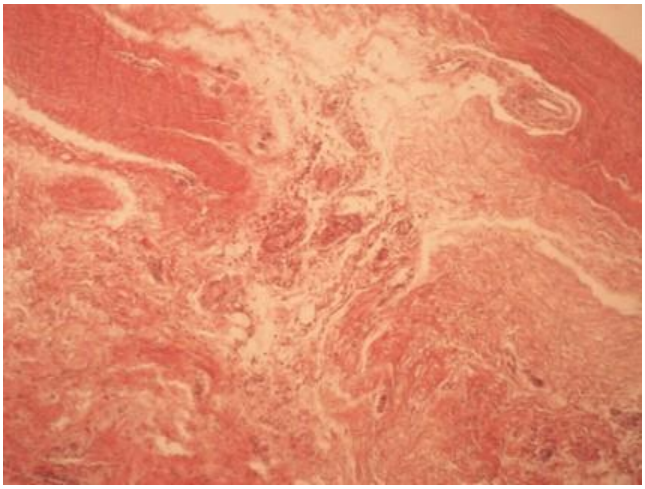
Rice. 1. Fragments of granulation tissue in a patient with early recurrence of a postoperative ventral hernia. Heterogeneous full-blooded granulation tissue adjacent to the fiber of a polypropylene endoprosthesis in the form of a sleeve. Foreign body giant cells (arrows). Hematoxylin-eosin staining. x260



Rice. 2. Fragments of granulation tissue in a patient with early recurrence of a postoperative ventral hernia. Heterogeneous full-blooded granulation tissue of the distant zone. Hematoxylin-eosin staining. x260



Rice. 3. Degranulated mast cell at the periphery of the connective tissue coupling (arrow). Coloring cresyl violet. x400



Rice. 4. Condition of the immediate relapse zone. Hematoxylin-eosin staining. Uv. 100

A characteristic feature was the zone of immediate relapse, in which bundles of collagen fibers with impaired integrity and filled with loose, unformed connective tissue were visualized (Fig. 4).

Thus, with the development of early and late relapse, the leading role is played by tissue reactions developing at the fiber-endoprosthesis interface. The macrophage reaction, which maintains chronic aseptic inflammation and "false-persistent biodegradation mechanisms," which are directed both at the material itself and at the surrounding connective tissue, is of key importance. All this leads to the formation of backlash, forms loci of ruptures of fibrous-changed connective tissue, which, together with the action of producing factors and the peculiarities of the location of the endoprosthesis (in lay, on lay), contribute to the development of relapse.

Conclusions.

1. Clinical manifestations of the disease in patients with recurrent ventral hernias depend on the technique of previous hernioplasty. After prosthetic tension hernioplasty, a complete relapse of the disease most often develops.The non-tension prosthetic method of plastic surgery is characterized by partial recurrence of hernias along the lower and upper contours of fixation of the prosthesis to the tissues, as well as hernias through defects of the damaged prosthesis.

2. In patients after tension prosthetic methods - connective tissue with the formation of voids around the synthetic prosthesis, leading to an inflammatory reaction around the fibers of the prosthesis; after non-tension combined methods of plastic surgery - mature connective tissue with signs of fibrous transformation, diffuse focal lipomatosis and moderate lymphocytic infiltration. The above factors, together with an increase in intra-abdominal pressure, are the basis for the formation of a recurrent hernia.

Literature.

1. Anthony T., Bergen PC, Kim LT, Henderson M., Fahey T., Rege RV, Turnage RH "Factors affecting recurrence following incisional herniorrhaphy." World Journal of Surgery, 2000, 24(1): 95-101. DOI: 10.1007/s002689910016.
2. Belokonev VI, Pushkin SY Simultaneous operations in patients with ventral hernias and gastrointestinal fistulas: feasibility and outcomes. Surgery, 2015.
3. Benfatto G., Catania G., D'Antoni S., Benfatto S., Licari V., Basile G., Tenaglia L., Chir G. Recurrence after hernioplasty according to Lichtenstein: analysis of the cause. 2002, Nov-Dec. 23(11-12) pp.427–430. Italian.
4. Carbonell AM, Warren JA, Prabhu AS, Ballecer CD, Holzman MD "The single-staged approach to the surgical management of abdominal wall hernias in contaminated fields." Hernia, 2013. DOI: 10.1007/s10029-013-1120-9.
5. Cothren CC, Moore EE, Johnson JL, Burch JM "Cervical spine fracture patterns predictive of blunt vertebral artery injury." Journal of Trauma, 2007, 62(5): 1127-1133. DOI: 10.1097/01.ta.0000229794.32749.3d.
6. Donnelly JP, Hanna M., Sperry BW, Seitz WH Jr. "Carpal Tunnel Syndrome: A Potential Early, Red-Flag Sign of Amyloidosis." *Journal of Hand Surgery*, 2019, 44(10): 868-876. DOI: [10.1016/j.jhsa.2019.06.016] (https://doi.org/10.1016/j.jhsa.2019.06.016).
7. Donnelly JP, Hanna M., Sperry BW, Seitz WH Jr. "Carpal Tunnel Syndrome: A Potential Early, Red-Flag Sign of Amyloidosis." Journal of Hand Surgery, 2019, 44(10): 868-876. DOI: 10.1016/j.jhsa.2019.06.016.
8. Egea AM, Martinez CE, Garijo JD, Sanchez JA "Use of biological mesh in complex abdominal wall repair." Surgery Today, 2010, 40(4): 380-384. DOI: 10.1007/s00595-009-4051-4.
9. Gillion JF, Galy M, Jan C, Tinel G Ann. Chir. 2017. 47(7) pp. 609–615. French.
10. Gislason H., Gronbech JE, Soreide O. "Burst Abdomen and Incisional Hernia after Major Gastrointestinal Operations—Comparison of Three Closure Techniques." *European Journal of Surgery*, 1995, 161, 349-354. DOI: [10.1007/BF00341265](https://doi.org/10.1007/BF00341265).
11. Haltmeier T., Groebli Y. Small Bowel Lesion due to Spiral Tacks after Laparoscopic Intraperitoneal Onlay Mesh Repair for Incisional Hernia. International Journal of Surgery Case Reports, 2013, 4, 283-285. DOI: [10.1016/j.ijscr.2012.12.005] (https://doi.org/10.1016/j.ijscr.2012.12.005)
12. Helgstrand F., Rosenberg J., Kehlet H., Jørgensen LN, Bisgaard T. "Nationwide prospective study of outcomes after elective incisional hernia repair." Journal of the American College of Surgeons, 2013; 216: 217-228. DOI:10.1016/j.jamcollsurg.2012.10.013
13. Heybeli T., Kulacoglu H., Genc V., Ergul Z., Ensari C., Kiziltay A., Yilmazer D., Serbetci K., Hasirci N. Basic fibroblast growth factor loaded polypropylene meshes in repair of abdominal

wall defects in rats. Chirurgia (Bucur). 2020, Nov-Dec. 105(6) pp. 809–816.

14. Malbrain MLNG, Chiumello D., Pelosi P., Bihari D., Innes R., Ranieri VM, De Keulenaer BL "Incidence and prognosis of intra-abdominal hypertension in a mixed population of critically ill patients: a multiple-center epidemiological study. " Critical Care Medicine, 2013, 41(1): 89-98. DOI: 10.1097/CCM.0b013e31826a39a7.
15. Matheson LA, Santerre JP, Labow RSJ Cell Physiol. 2014 Apr; 199(1) pp. 8–19.
16. Meintjes J, Yan S, Zhou L, Zheng S, Zheng M. Expert Rev. Med. Devices. 2011, Mar. 8(2) pp. 275-288. doi:10.1586/erd.10.64.
17. Napolitano L.M., Poulton C., Silva J., Martinez J. "Advanced Biological Mesh Applications in Hernia Surgery." Journal of the American College of Surgeons, 2004, 198(6): 1022-1031. DOI: 10.1016/j.jamcollsurg.2004.01.025.
18. Pascual G., Rodríguez M., Sotomayor S., Pérez-Köhler B., Bellón JM "Biological behavior of collagen-based meshes used in abdominal wall surgery." PLOS ONE, 2012, 7(4): e38342. DOI: 10.1371/journal.pone.0038342.
19. Sergent F., Gayet-Ageron A., Demartines N., Schäfer M. "Antibiotic prophylaxis in abdominal wall hernia repair: a prospective randomized controlled trial." Annals of Surgery, 2020, 251(2): 250-256. DOI: 10.1097/SLA.0b013e3181b4731e.
20. Szymczak C., Keller A., Montgomery A., Claes L. "Biomechanical studies on the suture retention properties of human fasciae." Hernia, 2012, 16(4): 489-498. DOI: 10.1007/s10029-012-0916-6.
21. Timmermans L., de Goede B., Eker HH, van Kempen BJ, Jeekel J., Lange JF Meta-analysis of primary mesh augmentation as a prophylactic measure to prevent incisional hernia. Dig Surg, 2019, 30, 401–409. DOI: [10.1159/000356202] (https://doi.org/10.1159/000356202)