

CHANGES OF TISSUE FIBRINOLYSIS IN CASE OF INSUFFICIENCY OF INTESTINAL SUTURES

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ЗМІНИ ТКАНИННОГО ФІБРИНОЛІЗУ ПРИ НЕСПРОМОЖНОСТІ КИШКОВИХ ШВІВ

Резюме. В експерименті встановлено, що при неспроможності кишкових швів у тканинах ділянки з'єднання має місце стрімке і виражене зростання сумарної фібринолітичної активності як за рахунок неферментативної, так і ферментативної. Порушення первинної біологічної герметичності швів у ранні терміни (12 год.) та регенерації ділянки з'єднання (24-72 год.), спричинені надмірною активацією тканинного фібринолізу, можуть бути основою для виникнення неспроможності кишкових швів.

Ключові слова: неспроможність кишкових швів, фібриноліз.

Insufficiency of intestinal sutures (IIS) is a grave postoperative complication which is a principal cause of the onset of postoperative peritonitis with the case fatality rate up to 90% [1, 2]. The severity of the course and the unsatisfactory results of treatment of this polyethiological complication are largely associated with an insufficient study of its pathogenetic aspects. It is known [3] that primary biological leak resistance of sutures on the hollow digestive organs is provided by the formation of fibrin on the serous membranes at the place of their connection. Furthermore, the tissue fibrin network is a matrix for fibroblasts that stimulates their growth and synthesis of the collagenous fibers, contributing to an optimal healing of the suture line. The process of the formation and destruction of fibrin depends on the activity of the fibrinolytic system. Individual papers are partially devoted to a study of the processes of fibrinolysis in the tissue of the hollow organs of digestion [4]. The state of the tissue fibrinolysis of the intestine in the region of sutures in case of their incompetence remains obscure.

The object of the research: to study changes of the tissue fibrinolysis of the intestine in the region of sutures under the conditions of the development of their insufficiency.

Material and methods. The experiments have been carried out on 56 albino nonlinear male rats, weighting 180 ± 20 g. All the animals underwent a resection of the cupula of the cecum with suturing the intestinal foramen by means of interrupted stitches (polyamide 5-0). IIS was modelled by way

of excessive mobilization of the area of union and a rare application of stitches in the animals of the experimental group. In 12, 24, 48 and 72 hours following a surgical interference under ether anesthesia euthanasia of the animals was performed and a sample of the intestinal tissue in the region of sutures was taken for an analysis. The indices of the total (TFA), nonenzymatic (NFA) and enzymatic (EFA) fibrinolytic activity with the aid of an assay kit – "Simko Ltd" (Ukraine) according to Kukhar-chuk's procedure (1996). Statistical processing of the results of the investigation was performed on PC AMD Athlon XP 1800+ by means of a package of programs – "Biostatistics" (Primer of Biostatistics, 4th Edition, S.A.Glantz, McGraw-Hill) with a computation of the validity of distinctions according to Student's t-test. The experiments were carried out with the observance of the requirements of the European convention as to the protection of vertebrate animals that are used for experimental and other scientific purposes (Strasbourg, 1986).

The results of the investigation and their discussion. According to the results of the table the parameters of the fibrinolytic activity under study were reliably higher in the animals of the experimental group as compared with the control one throughout the entire period of observation. In the process of investigating the dynamics of TFA changes in 12 h. following the operation a reliable elevation of its index was disclosed in both groups of animals compared with the intact ones. In 24 h. TFA in the animals of the trial series demonstrated

an upward tendency, whereas it considerably decreased in the animals of the control group. The TFA parameter in the animals with IIS turned out to be lower in dynamics in 48 h., whereas in the animals of the control group it had a tendency towards a rise. In 72 h., reliable changes of TFA were absent in two groups.

While studying the dynamics of changes of NFA in 12 h. following surgery, its reliable growth was detected both in the animals of the experimental group and the control one. In 24 h. the NFA parameter in the animals with IIS did not change considerably, while it had a downward tendency in the control group. In 48 h. a decline of NFA was detected in the animals of the trial series, whereas in the animals of the control group – a tendency toward its elevation. In 72 h. the NFA index in the animals with IIS did not change, whereas in the ani-

mals of the control group it reliably decreased. Upon investigating the dynamics of EFA changes in 12 h. a reliable rise of its index in both groups of animals was detected. A valid rise of EFA was revealed in the animals with IIS in 24 h., while in the animals of the control group – its reliable decline. Subsequently, the EFA parameters in both groups did not change reliably, however, they remained twice as high in the animals with IIS than the control value. When analysing the obtained findings it has been established that during the first 12 h. following the operation in the animals with IIS there occurs a swift marked rise of TFA, both at the expense of NFA and EFA. Hereat, the NFA indices in the animals of the trial series exceeded the control findings one and a half time. As is generally known, an activation of the nonenzymatic fibrinolysis is a counterbalance of a stress reaction. The formation of the adrenaline-

Table

Dynamics of fibrinolytic indices ($E_{440/h \cdot xg}$ of the tissue) in the tissue of the rat cecum in the region of the suture line

Indices	Number in succession	Research time	Control		Experiment	
			A		B	
			M±m	P	M±m	P
Total fibrinolytic activity	1	Before the operation	40,48±1,564			
	2	12 hours a/o	55,80±1,483	1-2***	82,60±1,024	A-B*** 1-2***
	3	24 hours a/o	43,04±1,993	2-3***	86,64±1,318	A-B*** 2-3*
	4	48 hours a/o	48,76±1,974	2-4*	80,32±1,115	A-B*** 3-4**
	5	72 hours a/o	45,52±2,189	2-5**	83,44±1,335	A-B***
Nonenzymatic fibrinolytic activity	6	Before the operation	21,20±1,079			
	7	12 hours a/o	28,80±1,285	6-7**	44,36±0,995	A-B*** 6-7***
	8	24 hours a/o	22,32±1,635	7-8*	45,04±1,072	A-B***
	9	48 hours a/o	24,40±1,035	7-9*	40,16±0,538	A-B*** 8-9**
	10	72 hours a/o	21,96±1,189	7-10**	40,40±0,953	A-B***
Enzymatic fibrinolytic activity	11	Before the operation	19,28±0,644			
	12	12 hours a/o	27,00±0,429	11-12***	38,24±0,508	A-B*** 11-12***
	13	24 hours a/o	20,72±0,492	12-13***	41,60±0,316	A-B*** 12-13***
	14	48 hours a/o	24,36±0,941	12-14*	40,16±0,578	A-B*** 12-14*
	15	72 hours a/o	23,56±1,007	12-15*	43,04±0,574	A-B*** 12-15***

Notes: a/o – after the operation; * – P<0,05; ** – P<0,01; *** – P<0,001 – statistical reliable distinctions.

heparin-antithrombin III complex, activating plasminogen, contributing to its transformation into plasmin and splitting of fibrin, underlies it. However, such an impetuous and pronounced activation of fibrinolysis in the region of the connection may bring about a disturbance of the primary biological leak resistance of the suture line, infecting the thread canal and a penetration of microorganisms out of the intestinal lumen on their surface. The formation of loose adhesions with the participation of infiltrated hyperemic tissues of the omentum, the loops of the small intestine and the adjacent loops of the large intestine constituted visual manifestations of IIS in all the animals of the experimental group during this period.

During a later period (24-72 h.) an elevation of the tissue fibrinolytic activity was detected in the animals with IIS, largely at the expense of EFA which exceeded twice the control data. The latter depends on the amount of plasminogen in the tissues and the tissue-type plasminogen activator. Vasodilatation, developing during this period, is a manifestation of the exudative phase of an inflammation, contributing to an increase of tissue plasminogen and in consequence of tissue destruction in the region of an inflammation there occurs an elevation of the tissue-type plasminogen activator.

Such an excessive activation of the tissue fibrinolysis at the expense of lysis of the fibrin matrix may cause a disturbance of the fixation of fibroblasts in the tissues of the connection area and its regeneration with the IIS development. Thus, numerous hemorrhages and only solitary films of fibrin in the region of the connection with separate defects and interintestinal abscesses were revealed within the specified period in the trial series against a background of a considerable amount of serous-fibrinous exudate in the abdominal cavity.

Conclusions and prospects of further research. 1. An increase of the total fibrinolytic activity is observed both at the expense of the nonenzymatic and enzymatic ones in case of the development of intestinal suture insufficiency in the tissues of the connection region. 2. An enhanced fibrinolytic activity may result in a disturbance of the primary biological leak resistance of the suture line during earlier terms (12hours). 3. At a later stage (24-72hours) an excessive activation of fibrinolysis may result in a disturbance of a regeneration of the connection region with the onset of suture insufficiency. 4. We consider it expedient to study correlations between the fibrinolytic and proteolytic activity in the region of the interintestinal connection in case of suture insufficiency.

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ИЗМЕНЕНИЯ ТКАНЕВОГО ФИБРИНОЛИЗА ПРИ НЕСОСТОЯТЕЛЬНОСТИ КИШЕЧНЫХ ШВОВ

Резюме. В эксперименте установлено, что при несостоятельности кишечных швов в тканях зоны соединения имеет место стремительное и выраженное повышение суммарной фибринолитической активности как за счет неферментативной, так и ферментативной. Нарушение первичной биологической герметичности швов в ранние сроки (12 час.) и регенерации зоны соединения (24-72 час.), вызванные чрезмерной активацией тканевого фибринолиза, могут быть основой для развития несостоятельности кишечных швов.

Ключевые слова: несостоятельность кишечных швов, фибринолиз.

CHANGES OF TISSUE FIBRINOLYSIS IN CASE OF INSUFFICIENCY OF INTESTINAL SUTURES

Abstract. It has been established in an experiment that in case of intestinal suture insufficiency in the tissues of the connection region there occurs a swift and pronounced elevation of the total fibrinolytic activity both at the expense of the nonenzymatic and enzymatic ones. A disturbance of the primary biological leak resistance of the sutures at early stages (12hours) and regeneration of the connection zone (24-72hours) induced by an excessive activation of tissue fibrinolysis, may be a basis for the development of intestinal suture insufficiency.

Key words: intestinal suture insufficiency, fibrinolysis.

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