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APPLICATION OF CATGUT SUTURE TO PREVENT EARLY POST-OPERATIVE COMPLICATIONS IN CASE OF LIVER INJURY**ВИКОРИСТАННЯ ПОЛІМЕРНОГО ШОВНОГО МАТЕРІАЛУ, ЩО РОЗСМОКТУЄТЬСЯ З МЕТОЮ ПОПЕРЕДЖЕННЯ РАННІХ ПІСЛЯОПЕРАЦІЙНИХ УСКЛАДНЕНЬ ПРИ ТРАВ-МАХ ПЕЧІНКИ**

Резюме. Метою цього дослідження було покращання результатів хірургічного лікування хворих на травматичні ушкодження печінки шляхом запобігання ранніх післяопераційних ускладнень гнійно-запального характеру, з використанням розсмоктувального полімерного шовного матеріалу та включення внутрішньотканинного електрофорезу антисептичних засобів у комплекс лікувальних заходів. Робота була виконана в експерименті на 40 дорослих собаках середньою масою тіла 10-18 кг. Вставка вікрилових швів на травматичні дефекти печінки є обґрунтованою і доведеною, сприяє запобіганню розвитку гнійних ускладнень та забезпечення належних умов для загоєння ушкоджень печінки.

Ключові слова: ушкодження печінки, шовний матеріал, електричне поле постійного струму (ЕППС).

Traumatic injuries of the liver in general structure of acute abdominal injuries constitute about 8,2-21,8%, and are accompanied, depending on the severity of an injury, by fatal outcome of up to 80% [1]. Suppurative-septic complications after suturing liver injuries are the main cause of mortality, and they have not reached the tendency to decrease in recent years [2].

In the structure of postoperative complications suppurative-inflammatory ones constitute about 30% and are connected with the insertion of inadequately chosen suture material [5]. Microbial contamination in the area of inserting sutures on the liver increases the degree of inflammatory reaction of the liver tissue resulting in deterioration of reparative processes and unsatisfactory results [1,3]. Considering the aforementioned, the question to choose suture material in case of liver injuries and its affect on the regeneration of a traumatic injury is of great importance [4]. Therefore, examination of histopathological, biochemical and microbiological changes in the liver in case of inserting absorbable polymeric suture material was considered to be reasonable.

Objective: to determine peculiarities of reparative properties of the liver after correction of its traumatic injury by absorbable polymeric suture material (vicryl, dexion, capromed, catgut) in combination with DCEF.

Material and methods. Considering scientific-

methodical peculiarities and certain deontological restrictions, the research was conducted experimentally. The object of examination was 40 mature dogs with an average body weight of 10-18 kg. Bioethics: this experiment complies with the Order of the Ministry of Public Health of Ukraine No 281 dated 01.11.200, GLP (1981), Convention of the Council of Europe on the protection of vertebrate animals used in experiments and other scientific goals dated 18.03.1986, and other legal acts operating in Ukraine. Under thiopental sodium narcosis, after performing superior-median laparotomy, the right liver lobe was cut 10 cm long and 1,5-2 cm deep with further inserting catgut sutures – it was the first set of experiments. Dexon and capromed sutures were inserted in the second and third set of experiments, and vicryl sutures – in the fourth set of experiments, removed on the 2nd, 4th, 6th, 8th and 10th day of the experiment together with the liver slices. To study reparative properties of the liver in case of its traumatic injury depending on the type of suture material and the temponade methods of deep, especially deep-narrow injuries of the liver, and the omentum with the use of 0,5 ml 1% dioxidine solution and DCEF, we have conducted examination of biochemical, microbiological and pathohistological indices.

Results and discussion. The results of biochemical examinations detected the greatest changes

of blood plasma indices with the use of various types of suture material occurring on the 4th day after liver injury. Aminotrasferases activity (ALT, AST) was higher within the limits of 63-77%, and the content of urea and medium molecules – 40-90% as compared with the control. Further normalization of aminotransferase activity was noticed on the 8th day of the experiment with the use of vicryl sutures, and on the 10th day – for dexon and capromed sutures. ALT activity remained increased in all the periods of the experiment with the use of catgut. As to urea, its content in the blood plasma normalized on the 6th day of the experiment with the use of vicryl, dexon, capromed, and on the 8th day – with the use of catgut.

A high content of medium molecules in the early terms of the experiment (2-4 days) is achieved on the 8th day with the use of vicryl sutures, and on the 10th day – with the use of dexon sutures, and it remains reliably higher with the use of capromed and catgut. Considering this fact in our further experiments we studied a combined action of the suture material with the use of the omentum (the 5th group of animals), the omentum and dioxidine (the 6th group of animals), the oemntum, dioxidine and DCEF (the 7th group of animals). In the animals of the 5th group ALT activity in the blood plasma and urea content were not different from that of the control on the 6th day, and the level of medium molecules – on the 8th day of the experiment. Changes of AST activity were not found in all the terms of the examination.

A combined action of the omentum, dioxidine, galvanization (DCEF) against the ground of vicryl suture (the 7th group) made ALT activity in the blood plasma normal on the 4th day, and the indices of urea and medium molecules – on the 6th day of the experiment. Reliable changes of AST activity were not found.

Vicryl sutures were found to be optimal among those used. The use of vicryl sutures of the omentum, dioxidine and galvanization made the resumption of the liver functional state quicker.

The results of the study showed that tamponade by the omentum against vicryl sutures (the 5th group of animals) stimulated normalization of blood plasma ceruloplasmin, oxidative-modified proteins and reduced glutathione of the erythrocytes on the 8th day of the experiment. At the same time, the degree of liver protein oxidative modification remained increased on the 10th day of the experiment as compared with the control.

A combined action of the omentum and dioxidine against the background of vicryl sutures (the 6th group)

promoted stabilization of the examined indices of the pro- and antioxidant state of the blood and liver to those of the control on the 8th day of the experiment, except the level of oxidative-modified proteins (it remains reliably higher as compared with the control) on the 10th day of the experiment.

A combined action of the omentum, dioxidine and DCEF against vicryl sutures (the 7th group) caused the similar character of the indices studied, as well as vicryl suture itself on the early stages of the experiment (2-6 day), and they reached the control level on the 8th day of the experiment.

According to microbiological examinations aerobic and anaerobic bacteria were eliminated from the wound in the majority (in three out of four cases) of the experimental animals. Detection of the population level of every species of microorganisms persisting in the wound is of more informative value while studying persistency, decontamination and elimination of microorganisms from liver wound. The use of catgut, dexon, capromed as suture materials and the liver tamponade by the omentum results in elimination of certain species of anaerobic bacteria (*P. niger*, *B. fragilis*) as well as decrease of the population level of aerobic (*E. coli*) and anaerobic bacteria in liver traumatic injury (table 1).

At the same time, microecological indices (coefficients of importance and quantitative dominance) remain high. The use of vicryl, tamponade of liver wound by the omentum, introduction of 0,5 ml 1% dioxidine solution through a microirrigator in combination with DCEF leads to a considerable reduction of the population microflora level persisting in the wound. Microorganisms of every generic population are found in the wound in minimal amount.

Conducted numerous and various examinations concerning the influence of suture material on the generic content and population level of microflora in liver wound in case of traumatic injury made it possible to detect that complex measures, assuming tamponade of the liver wound by the omentum with the introduction of 0,5 ml 1% dioxidine solution in combination with DCEF (0,025 mA/cm²), results in the elimination of the majority of aerobic (*Escherichia*, *Klebsiella*, *Enterococcus* etc.) and anaerobic (*bacteroids*, *Peptococcus*, *Peptostreptococcus* etc.) bacteria as well as reduction of their population level (table 2).

According to pathohistological examination – the evaluation of the regeneration area condition, involution rate of inflammatory process, hepatocyte condition

Table 1

Generic content of the microflora of liver wound 10 days after injury depending on the suture material

	Statistic index	Microorganisms								
		E.coli			B.fragilis			P.niger		
		n	C%	Pi	n	C%	Pi	n	C%	Pi
catgut		4	100,0	0,50	4	100,0	0,50	-	-	-
vicryl	P	2	50,0 < 0,05	0,50	2	50,0 < 0,05	0,50	-	-	-
capromed	P P ₁	4	100,0 > 0,05 > 0,05	0,50	4	100,0 > 0,05 < 0,05	0,50	-	-	-
dexon	P P ₁ P ₂	4	100,0 > 0,05 < 0,05 > 0,05	0,44	4	100,0 > 0,05 < 0,05 > 0,05	0,44	1	25,0	0,11
tamponade by the oemntum	P P ₁ P ₂ P ₃	4	100,0 > 0,05 < 0,05 > 0,05 > 0,05	0,50	4	100,0 > 0,05 < 0,05 > 0,05 > 0,05	0,50	-	-	-
tamponade by the omen- tum+dioxidine	P P ₁ P ₂ P ₃ P ₄	2	50,0 < 0,05 > 0,05 < 0,05 < 0,05 < 0,05	0,67	1	25,0 < 0,05 < 0,05 < 0,05 < 0,05 < 0,05	0,33	-	-	-
tamponade by the omen- tum+dioxidine+D CEF	P P ₁ P ₂ P ₃ P ₄ P ₅	1	25,0 < 0,05 < 0,05 < 0,05 < 0,05 < 0,05	-	-	-	-	-	-	-

Notes:

1. n – the number of the strains isolated
2. C% - consistency coefficient
3. Pi – occurrence frequency

around the regeneration area – a conclusion can be drawn that the influence of various methods of treatment of the injured liver tissue is different.

The least successful method of treatment was the use of catgut – the granulation tissue did not develop even on the 10th day, the area where regeneration with the development of the granulation tissue

(substitution) was expected to develop was covered with suppurative inflammation so much pronounced that it was accompanied by the formation of micro-abscesses, early dissolving of catgut by proteolytic enzymes of the polymorphonuclear leukocytes. Hepatocytes around regeneration area were with expressed signs of alteration respectively (fig.1).

Population level of liver wound microflora 10 days after the injury depending on the suture material

	Stat- istic index	Microorganisms								
		E.coli			B.fragilis			P.niger		
		M±m	C	QDC	M±m	C	QDC	M±m	C	QDC
catgut		3,24± 0,34	0,62	124,6	1,97±0,10	0,38	75,8	-	-	-
vicryl	P	1,83± 0,12 < 0,05	0,51	50,8	1,78±0,01 > 0,05	0,44	49,4	-	-	-
capromed	P P ₁	2,28± 0,21 > 0,05	0,54	108,6	1,91± 0,17 > 0,05	0,45	90,0	-	-	-
dexon	P P ₁ P ₂	2,23± 0,15 > 0,05 < 0,05 > 0,05	0,49	112,1	1,97± 0,15 > 0,05 > 0,05 > 0,05	0,44	99,0	1,78	0,10	22,4
tamponade by the omentum	P P ₁ P ₂ P ₃	2,25± 0,15 > 0,05 < 0,05 > 0,05 > 0,05	0,51	102,7	2,13± 0,06 > 0,05 > 0,05 > 0,05 > 0,05	0,49	97,3	-	-	-
tamponade by the omen- tum+dioxid ine	P P ₁ P ₂ P ₃ P ₄	2,18± 0,02 < 0,05 < 0,05 > 0,05 > 0,05 > 0,05	0,72	53,4	1,90 > 0,05 > 0,05 > 0,05 > 0,05 > 0,05	0,31	23,3	-	-	-
tamponade by the omen- tum+dioxid ine+DCEF	P P ₁ P ₂ P ₃ P ₄ P ₅	1,60 < 0,05 > 0,05 < 0,05 < 0,05 < 0,05 < 0,05			-					

Notes:

1. M±m – population level;
2. C – occurrence coefficient;
3. QDC – quantitative domination coefficient.

The method of treatment with the use of capromed demonstrated somewhat better picture as compared with catgut, which was manifested by the formation of an uninterrupted area of regeneration with the formation of the young granulation tissue. The rates of its maturation were inhibited, which can be seen by insufficient formation of the fibrous component and blood vessels on the 10th day of the experiment. Young collagen fibers and the majority of the blood vessels had to be formed in the liver of animals on that moment. The cause of inhibition of regeneration could be the presence of an increased

number of polymorphonuclear leukocytes. Hepatocytes around the regeneration area were in the condition of necrobiosis, which is evidenced by an increased level of dystrophic and necrotic signs.

The method of treatment with dexon was similar to the previous method of treatment by the condition of the granulation tissue. Particularly, the granulation tissue in the area of regeneration on the 10th day of the experiment was underdeveloped as well, however, the presence of polymorphonuclear leukocytes was less. At the same time, the condition of hepatocytes around the regeneration area was much better.

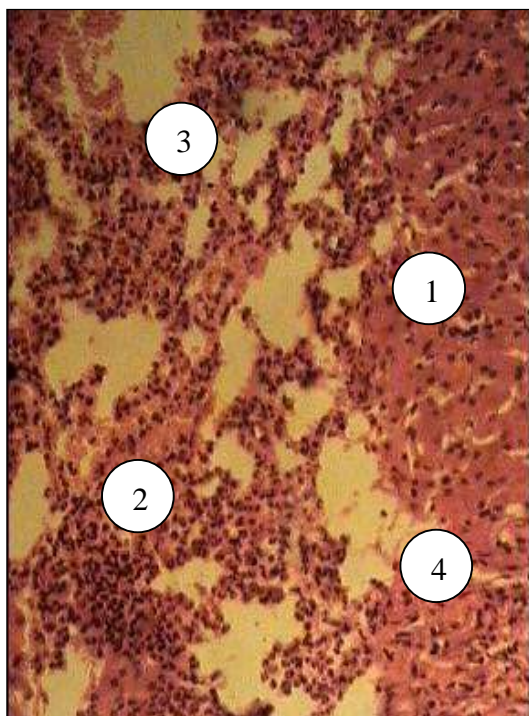


Fig. 1. Traumatic injury of the liver parenchyma. The use of catgut as suture material. 1 – hepatocytes around former injury. 2 – fragment of abscess. 3 – hemorrhages. 4 – fragment of the granulation tissue isle. Hematoxylin-eosin. x120.

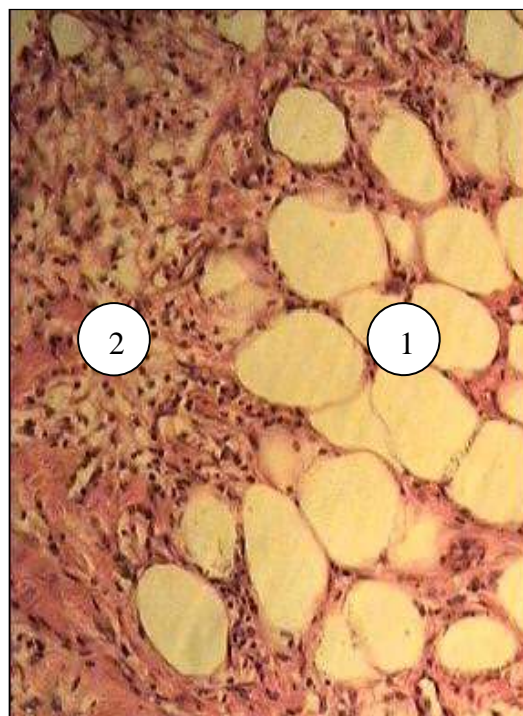


Fig. 2. Traumatic injury of the liver. The use of vicryl as suture material with the method of tamponade by the omentum and dioxidine introduction. 1 – fragment of the omentum. 2 – granulation tissue with fibroblasts, lymphoid cells, new blood vessels, moderate fibrous component. Hematoxylin-eosin.x120

The use of vicryl gave better results as compared with the methods with the use of other suture materials. It was seen by the level of granulation tissue development around the sutures – on the 10th day of the experiment collagen fibers and a number of the blood vessels visualized well near the fibroblasts. Polymorphonuclear leukocytes were rare. Hepatocytes around the regeneration area were without alternative changes or with the signs of alteration, it looked like granular dystrophy estimated as a reversible pathological process.

Additional use of electrophoresis in the complex treatment with insertion of vicryl and tamponade of the wound by the omentum and dioxidine made it possible to improve the condition of the granulation tissue and the condition of hepatocytes around the

regeneration area. Particularly, on the 10th day of the experiment the granulation tissue in the area of the former wound was more mature, it did not contain polymorphonuclear leukocytes, and hepatocytes around the wound were mostly characterized by the normal structure (fig.2).

Conclusion. The use of vicryl with the aim to apply suture in case of traumatic defects of the liver, tamponade by the omentum with the use of 0,5 ml 1% dioxidine solution and DCEF is substantiated and reasonable, prevents the development of suppurative complications, ensures favourable conditions for wound healing.

The prospect for further research include a comparative study of the peculiarities of healing post-traumatic liver injuries with the use of other types of suture materials.

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ИСПОЛЬЗОВАНИЕ РАССАСЫВАЮЩЕГО ПОЛИМЕРНОГО ШОВНОГО МАТЕРИАЛА С ЦЕЛЬЮ ПРЕДУПРЕЖДЕНИЯ РАННИХ ПОСЛЕОПЕРАЦИОННЫХ ОСЛОЖНЕНИЙ ПРИ ТРАВМАХ ПЕЧЕНИ

Резюме. Целью данного исследования было улучшение результатов хирургического лечения больных с травматическим повреждением печени, путем предотвращения ранних послеоперационных осложнений гнойно-воспалительного характера с использованием рассасывающее полимерного шовного материала и включения внутритканевого электрофореза антисептических средств в комплекс лечебных мероприятий. Работа была выполнена в эксперименте на 40 взрослых собаках со средней массой тела 10-18 кг. Вставка викриловых швов на травматические дефекты печени является обоснованной и доказанной, способствует предотвращению развития гнойных осложнений и обеспечению надлежащих условий для заживления повреждений печени.

Ключевые слова: повреждение печени, шовный материал, электрическое поле постоянного тока (ЭППТ).

APPLICATION OF CATGUT SUTURE TO PREVENT EARLY POST-OPERATIVE COMPLICATIONS IN CASE OF LIVER INJURY

Abstract. Abstract. The objective of the present study was to improve the results of surgical treatment of patients with traumatic liver injuries by means of preventing early postoperative complications of a suppurative-inflammatory character by inserting absorbable polymeric suture material and including intra-tissue antiseptic electrophoresis into the complex of therapeutic measures. The works was done in the experiment on 40 mature dogs with an average body weight of 10-18 kg. Insertion of vicryl sutures on traumatic liver defects was found to be substantiated and reasonable, preventing the development of suppurative complications and ensuring adequate conditions for healing liver injuries.

Key words: liver injury, suture, direct current electric field (DCEF).

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