OPTIMIZATION OF SURGICAL TREATMENT OF PATIENTS WITH THE USE OF HEMOBEN FOR SPLEEN INJURIES AGAINST THE BACKGROUND OF HYPOCOAGULATION

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Abstract: The article presents data on a new model of spleen injury reconstruction in experimental animals with active bleeding, which without therapeutic measures, recurs and leads to death. To assess the possibility of bleeding control from the spleen wound under drug hypocoagulation additional experiments were carried out using domestic local hemostatic preparations: hemosponges obtained from animal collagen and a hemostatic implant in the form of Hemoben powder. It has been proven, in case of spleen injury on hypocoagulation, hemosponge is ineffective, while Hemoben allows achieving hemostasis; however, the recurrence rate can increase up to 20% depending on the degree of the spleen capsule damage.

Keywords: chemoben, hemosponge, hemostatic effect, relapse.

ОПТИМИЗАЦИЯ ХИРУРГИЧЕСКОГО ЛЕЧЕНИЯ БОЛЬНЫХ С ПРИМЕНЕНИЕМ ХЕМОБЕНА ПРИ ПОВРЕЖДЕНИЯХ СЕЛЕЗЕНКИ НА ФОНЕ ГИПОКОАГУЛЯЦИИ

Аннотация: В статье представлены данные о новой модели реконструкции повреждения селезенки у экспериментальных животных с активным кровотечением, которое без проведения лечебных мероприятий рецидивирует и приводит к летальному исходу. Для оценки возможности остановки кровотечения из раны селезенки в условиях медикаментозной гипокоагуляции были проведены дополнительные эксперименты с использованием отечественных местных гемостатических препаратов: гемогубки, полученной из животного коллагена, и гемостатического имплантата в виде порошка «Гемобен». Доказано, что при повреждении селезенки в условиях гипокоагуляции гемогубка неэффективна, а «Гемобен» позволяет добиться гемостаза, однако частота рецидивов может возрастать до 20% в зависимости от степени повреждения капсулы селезенки.

Ключевые слова: хемобен, гемогубка, гемостатический эффект, рецидив.

SUMMARY

The article presents data on a new model of spleen injury reconstruction in experimental animals with active bleeding, which without therapeutic measures, recurs and leads to death. To assess the possibility of bleeding control from the spleen wound under drug hypocoagulation additional experiments were carried out using domestic local hemostatic preparations: hemosponges obtained from animal collagen and a hemostatic implant in the form of Hemoben powder. It has been proven, in case of spleen injury on hypocoagulation, hemosponge is ineffective, while Hemoben allows achieving hemostasis; however, the recurrence rate can increase up to 20% depending on the degree of the spleen capsule damage.

Relevance: Because the parenchyma of the spleen does not shrink with trauma, bleeding can be intense and prolonged. The primary cause of bleeding is considered to be abundant vasculature, blood overflow, and poor contractility of the spleen parenchyma, leading to longcontinued bleeding even with minor injuries. In surgery, various hemostatic sponges are increasingly used to control internal bleeding. Hemostasis and its control on hypocoagulation subsequently become an even more difficult task that needs to be solved since most topical drugs are ineffective on hypocoagulation .

MATERIALS AND METHODS

Currently there are no adequate models that could recreate spleen injury in experimental animals with bleeding similar to that in humans. As a rule, bleeding from the spleen in animals stops spontaneously. We have developed a new method that allows to achieve active bleeding, which recurs and leads to death without therapeutic measures. A similar situation occurs with spleen injury in humans. Thus, the new model makes it possible to evaluate the effectiveness of various methods of hemostasis in case of spleen injury, which can be used in clinical practice.

A method to solve it is proposed for experimental modeling of spleen injury in rats with mixed bleeding by inflicting a wound with a scalpel. It is characterized in that a linear incision up to 2 cm is made along the spleen outer surface to the capsule of the spleen inner edge. In this case, we achieve active mixed bleeding, which does not tend to stop itself. There are known methods of forming a model of damage to the parenchymal organ by applying a superficial wound using an abrasive tool. However, capillary bleeding is modeled in such cases. With abrasive action, the capsule of the parenchymal organ is damaged. It's worth noting that after damage to the spleen capsule, bleeding can stop spontaneously in rats, while it can be long-continued in humans. The main reason is that capillary bleeding is observed in rats, while in spleen injury, mixed bleeding develops in humans. Therefore, to use the abrasive method of damaging a parenchymal organ in an experimental animal with its subsequent surgical treatment and extrapolation of obtained results to possible damage in a human organ is incorrect and unreliable.

Spleen injury with mixed bleeding in rats is modeled by inflicting a wound with a scalpel, while a linear up to 2 cm wound is inflicted along the spleen outer surface to the capsule of the spleen inner edge. The spleen in rats varies depending on the age and weight of the animals. The average spleen size of a rat weighing 250-300 gr is up to 3 cm long; therefore, there is a subtotal dissection of the parenchyma with a cut length of up to 2 cm. In this case, active mixed bleeding occurs, and it does not tend to stop on its own.

The bleeding index was assessed by applying dry gauze balls and napkins until the bleeding completely stopped on its own. As a result of the study, it was found that the created model causes mixed bleeding, which lasts for 5-10 minutes with a loss of up to 1.5-2 ml of blood, which is over 30% of circulating blood volume. After hemostasis, the abdominal cavity was sutured. Animals woke up for quite a long time after the surgery. Animal activity was sluggish. On the next day, it was found that out of 4 operated specimens, death occurred in 2. When opening the abdominal cavity, there was liquid blood with clots, and the color of the internal organs was anemic. The removal of two other rats from the experiment made it possible to establish the presence of up to 1 ml of liquid blood in the abdominal cavity and a large hematoma in the area of the spleen wound.

It can be concluded that the created model of the spleen wound adequately models small wounds of the spleen in humans. Without hemostatic agents, bleeding has a slight tendency to stop, and in the postoperative period, it can resume with a fatal outcome.

Thus, the task is fundamentally solved by the claimed method. The present invention is recommended for use in experimental surgery of parenchymal organs of the abdominal cavity, primarily the spleen. The method is simple to perform, affordable, and recommended for widespread use in surgical departments of hospitals and clinics of the Republic. For this method, a utility model patent was obtained from the Intellectual Property Agency under the Ministry of Justice of the Republic of Uzbekistan "Method for modeling spleen injury with active bleeding of mixed nature in the experiment" No. FAP 2022 0096 dated March 16, 2022.

Experiments were performed on mature outbred white male rats weighing 220- 280 g to assess the possibility of the bleeding arrest from the spleen wound on drug hypocoagulation. Animals were kept in 4 specimens in one cage in a vivarium on a balanced diet. Rats in the experimental group (10) took aspirin 1 g per 100 ml of water added to the water. The approximate calculation was 10 mg per 200 g of animal weight per day. Seven days after taking the drug, the Lee-White blood clotting time (CT) was checked by taking blood from the tail vein. Experimental studies began providing elongation of the CT by 50-70%.

Studies on five outbred white rats with an average weight of 220 ± 5 g were performed using domestically produced hemo-sponges. When modeling the spleen injury under general anesthesia, active bleeding from the spleen was stopped by applying fragments of hemo-sponge (usually 0.7x2 cm in size) corresponding to the spleen injury size. The sponge quickly became saturated with blood and further lost its properties during the surgery. Therefore, to completely stop the bleeding, hemo- sponge fragments were used three times. As complete primary hemostasis was achieved, blood loss amounted to 2 ml. Gradual saturation of the sponge with incoming blood was noted during a 10-minute observation.

Postoperative mortality was 2 out of 5 specimens within 24 hours after surgery. The cause of death was continued bleeding from the spleen injury. The spleen was in a massive adhesive infiltrate in the form of loose adhesions in the rest of the animals withdrawn from the experiment the next day. There were traces of blood in the lateral parts of the abdomen. There were hematomas of varying severity in the hemo-sponge application area.

The spleen injury on hypocoagulation causes profuse blood loss with a fatal outcome. Use of domestically produced hemosponges in bleeding stop from a spleen wound is ineffective. There was a high risk of rebleeding in the postoperative period. Thus, use of a hemostatic sponge in an isolated form for hypocoagulable bleeding cannot be recommended in clinical practice.

Research in the experimental group was carried out on five white male rats with an average weight of 230+6g. The experimental conditions were the same as in the group with a hemo-sponge: upper median laparotomy under general anesthesia. The spleen was surgically delivered, and injury was modeled with the development of active mixed bleeding. Use of Hemoben powder on hypocoagulable bleeding led to rapid impregnation of the powder with blood with the formation of a gel. Subsequent blood flows required repeated application of Hemoben powder. A complete bleeding stop was achieved after 3-4 repeated applications of Hemoben powder with the formation of a rather loose thrombus. When observed for 10 minutes, there was a gradual saturation and blood soaking of the superficially located dry powder Hemoben. Subsequently, a thrombus sufficiently large in size and not solid enough, was formed. However, hemostasis was achieved in all cases. Blood loss amounted to approximately 1-2 ml.

There were no deaths in the postoperative period. When withdrawn from the experiment 1 day after the operation, a rather massive thrombus was detected in the area of the spleen injury with involvement of the omentum, surrounded by loose adhesions. There were traces of blood in the lateral sections of the abdomen.

The studies allowed us to establish that on hypocoagulable bleeding from a simulated spleen wound, use of the hemostatic drug Hemoben has noticeable hemostasis with the formation of a loose thrombus on the surface of the wound. However, the consumption of the drug increases by 2-3 times, and the thrombus tends to grow in the postoperative period. Thus, despite the

sufficient effectiveness of the hemostatic Hemoben in spleen injuries on hypocoagulation, the isolated use of the drug may be insufficient in clinical observations.

CONCLUSION

The study of the effect of the Hemoben hemostatic film on the biochemical parameters of blood serum before and after the surgery did not reveal significant changes compared with the parameters of small laboratory animals. The data obtained allowed us to conclude that the test substance does not have a negative effect. The data obtained allowed to conclude that "Hemoben" does not have a negative effect on the biochemical parameters of blood.

An experimental model of spleen injury has been developed, which, in terms of the degree and intensity of blood loss and consequences, is close to similar conditions in humans. Experimental studies have shown that the developed new hemostatic powder-form material can be used to stop parenchymal bleeding. Hemoben provides fine and stable hemostasis on medical hypocoagulation, which significantly exceeds the parameters of a hemostatic sponge. The hemospong is ineffective in the spleen injury on hypocoagulation while Hemoben allows achieving hemostasis; however, the recurrence rate can increase up to 20%, depending on the degree of damage to the spleen capsule.

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