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World J Gastroenterol 2001;7(6):876-879
World Journal of Gastroenterology
 ISSN 1007-9327

• BRIEF REPORT •

Clinical application of serial operations with preserving spleen

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Received 2001-06-03 **Accepted** 2001-08-05

Abstract

AIM: **To evaluate the clinical application of serial operations with preservation of spleen.**

METHODS: **Serial operations with preserving spleen were performed on 211 cases in our hospital from 1980 to 2000. The patient's age ranged from 13 to 56 years, averaging 38 years. Diseases included splenic injury in 171 cases, portal hypertension in 9 cases, splenic cyst in 10 cases, and the lesion of pancreatic body and tail in 21 cases.**

RESULTS: **All the cases were cured, and 129 patients were followe dup from 3 months to 3 years with the leukocyte phagocytosis test, detection of immunoglubin, CT, ^{99m}Tc scanning and ultrasonography. The results were satisfactory.**

CONCLUSION: **The operations with preserving spleen were safe, feasible, and worth of clinical application.**

Subject headings spleen; spleen-preservation operation; splenic injury; splectomy; methods; human; clinical application; portal hypertension

Jiang HC, Sun B, Qiao HQ, Xu J, Piao DX, Yin H. Clinical application o f serial operations with preserving spleen. *World J Gastroenterol*, 2001; 7(6):876-879

INTRODUCTION

Serial operations with preservation of spleen, which are mainly performed to treat splenic injury, in addition to portal hypertension, splenic cyst and lesion of body and tail of pancreas, were performed in our hospital on 211 cases from the early 80s to January 2000. The clinical application study on preserving spleen is reported below.

CLINICAL MATERIALS

Among the 211 patients, including 165 males and 46 females, with average age of 38 years (range 13-56 years), 171 had splenic injuries complicated with hepatic lacerations in 9 and 18 hemorrhagic shock in 17 and mesentery lacerations in 21, portal hypertensions in 9, 10 splenic cysts in 10 and lesions of body and tail of pancreas in 21 which included 8 pancreatic cyst adenom as and 3 pancreatic pseudocysts and 3 insulinomas and 7 pancreatic injuries. All the injuries were abdominal closed injuries. All the patients were cured, and 129 patients were followed up from 3 months to 3 years with the leukocyte phagocytosis test, detection of immunoglubin, splenic CT scan, ultrasonography and Technetium ^{99m}sp lenic scan. The results of following up were satisfactory (Table 1).

Table 1 Operative procedures of preserving spleen

Diagnosis	Operative procedures	*N*	Rate (%)
Splenic injury	Arresting bleeding by adhesion	9	4.3
	Suture and repair	19	9.0
	Ligation of splenic artery	7	3.3
	Partial splenectomy	27	12.8
	Ligation of splenic artery plus Suture and repair	23	10.9
	Suture and repair or adhesives plus partial splenectomy	28	13.3
	Autosplenosis after splenectomy	58	27.5
Splenic cyst	Partial splenectomy	5	2.4
	Autosplenosis after splenectomy	2	1.0
	Paracentesis under BUS	3	1.4
Portal hypertension	Subtotal splenectomy and splenorenal venous shunt	9	4.3
Lesions of body and tail of the pancreas	Resection of the body and tail of the pancreas with preservation of spleen	21	10.0
Total		221	100

METHODS, RESULTS and DISCUSSION

Spleen is not an essential organ to life, though it has many important functions[1,2]. Tempestuous bleeding and h emorrhagic shock are the most commont manifestation of splenic laceration, which are often complicated with other organ injuries and need to be rescued rapidly and decisively following the fundamental treatment principle (or golden standard) of splenic injury-saving life first, preserving spleen second. It is the modern viewpoint that we should do our best to preserve the spleen (tissue) if it permits. In this study, 58% of the cases with splenic injury underwent total splenectomy, which was nearly 61% reported by Livingston, and 63% of the m underwent autosplenosis after splenectomy when the patients' vital signs were permitted. We realized that in treating splenic injury, the fundamental principle is "saving life first, preserving spleen second"; the younger the patient is, the more precedent the spleen-preserved operation is chosen; choose the best operative procedure according to the degree and type of splenic injury; and it is more safe and practical to combine with several operative procedures in preserving spleen.

It is controversy whether the spleen of the patient with portal hypertension should be preserved[3-8]. It was reported that 31% of patients with portal hypertension had immunologic function[9-12]. It has more practical significance for patients with portal hypertension to undergo the operation that can not only protect the immunologic function of spleen but also eliminate the hypersplenism, which is the source of Warren's operation[13-16]. The effect of Warren's operation is not satisfactory in China because post-hepatitis cirrhosis is more

frequently encountered and splenomegalia and hypersplenism are more severe[17-20]. It is difficult to improve the hypersplenism if the spleen has been preserved[21-26]. According to this point of view, we designed the subtotal splenectomy and splenoren al venous shunt by artificial vessel bypass to treat portal hypertension. In all the 9 cases, 1-3 years' postoperative follow-up gave no evidence of recurrent bleeding. It also showed that the hypersplenism relieved and the residual spleen had immunologic function. The significance of this operative procedure is: This operative procedure of preserving spleen is also fit for portal hypertensio n provided we follow the principle of partialsplenectomy, This method does not only eliminate hypersplenism but also preserve the spleen and its immunologic function; and this gives a new way to treat portal hypertension.

Spleen is located near the body and tail of pancreas. When we dealt with the lesion of the body and tail of pancreas previously, we always resected the spleen, though the spleen was healthy, which is called "innocent splenectomy". In fact, the blood supply and function of spleen can b e preserved even if splenic artery is ligated or resected. In this study, 21 cases of distal pancr eatectomy with preservation of spleen were performed. This operative procedure can be classified into two types, one is conservation of splenic vessels (14 cases), the other is conservation of short gastric vessels and left gastropepipolic vessels (7 cases). The former operative procedure is the first choice, because the original blood supply and anatomy of spleen are intact. The latter is the second choice, because the splenic blood supply is influenced and the splenic clearance ability to bacteria is decreased.

Splenic cyst is a benign lesion of spleen, so we should try our best to preserve the spleen and its function[27-30]. If the congenital or acquired splenic cyst is small or symptomless, usually no treatment is needed. If the splenic cyst is big or located at the hilus of spleen or complicated with secondary infection or might autorupture or causes symptoms, it should be treated with cystectomy which mainly includes partial splenectomy (5 cases in our group) and autosplenosis in omental bursa after splenectomy (2 cases). The former operative procedure can preserve the splenic function better. If the patient does not accept the operation or cannot tolerate the operation, we can use the method of splenopuncture drainage under BUS guide (3 cases), its therapeutic effect is definite and can be performed repeatedly. But splenic cyst is liable to relapse (2 cases) and to be infected secondarily, which influences the late results. This method is the second choice and it is especially prohibited when applied for parasitic splenic cyst[31-36].

We should master the types of spleen-preserving operation and choose suitable operative procedures according to splenic injury degree correctly[37-39].The degree of splenic injury is the pathological foundation of spleen -preserving operative procedure[40]. Classification and standard for splenic injury[41-44] varied among different countries. We should set up a new classification of splenic injury degree based on our national conditions and the development of splenic surgery soas to facilitate the academic exchange and the statistics and analysis of document. By synthesizing 121 cases of splenic injury treated in our hospital, we put forward the IV degree clinical classification of splenic injury and corresponding spleen-preserving operative procedures (Table 2). Degree I:rupture of splenic capsule or solitary and multiple splenic laceration , length<5.0 cm, depth<1.0 cm; Degree II: solitary or multiple splenic lacerat ion with intact splenic hilus, length >5.0 cm, depth>1.0 cm; Degree III: irregular laceration, with destroyed splenichilus or a part of spleen broken; Degree IV: spleen is widely broken, capsule is widely peeled, the trunk of splenic vessels are destroyed or broken. The characters of this classification are: simple, convenient and practical; including all the injury types from capsule to parenchyma, from branch to trunk of splenic vessels; the splenic injury degree is classified by quantified index and can be judged promptly; it meets with the common mechanism of splenic injury in our country to date; it stems from practice and can help choose treatment principle and spleen-preserving operative procedures clinically. In clinical practice, the degree of splenic injury can not be as classical as the standard of splenic injury classification. No operative procedure can fit all the patients with splenic injury. We should flexibly choose and use several operative procedures jointly based on the indication and basic skill of the operative procedure. And we should not use some spleen-preserving operative procedure mechanically. Among all the 211 cases of spleen-preserving operations performed in our hospital, 171 cases (81.0%) were splenic injuries, including 9 cases by arresting bleeding by adhesion, 19 cases by suture and repair, 7 cases by ligating splenic artery, 23 by ligating splenic artery and suture and rep air, 28 by suture and repair and arresting bleeding by adhesion plus partial splenectomy, 27 by partial splenectomy, and 58 cases by autosplenosis after total splenectomy.

Table 2 The degree of splenic injury and the choice of therape utic method

I	Nonsurgical treatment
	Arresting bleeding by adhesion
	Suture and repair
II	Partial splenectomy
	Binding the rupture of spleen
III	Ligation of splenic artery
IV	Splenectomy plus autosplenosis

Grasping the main technical points of spleen-preserving operation is the most important factor in the serial operations with preserving spleen.

Suture and repair of the rupture of spleen

The parenchyma of spleen is fragile like bean curd so that suturing and knotting often tear it open, which is liable to cause bleeding or impediment of blood supply[38,39]. We met two cases. One bled to bleed more and more seriously during suturing, so we had to perform total splenectomy because of the turbulent life sign. The other case had to undergo upper-half splenectomy because of the impediment of blood supply res ulting from wide and deep suturing. The width and depth of the suture should be proper, the strength knotted should be well distributed, drawing dexterously and knotting slowly. In order to prevent the second knot from cutting the spleen tissue, or the first knot sliding and loosing while making the second knot, the first knot must be pressed with forceps. To prevent the thread cutting the spleen tissue, a pad of galform or with a piece of omentum beneath the rupture should be used for the knotting. If the suture and repair of the spleen failed or new rupture and bleeding occurred, we should change the operative procedure decisively instead of sticking to suturing and repairing.

Partial splenectomy

Partial splenectomy means less than half of splenectomy, half splenectomy and subtotal splenectomy. We should handle the corresponding blood vessels near the rupture of spleen with each bundle, and observe the boundary of blood supply of spleen, which is the relative avascular plane[40,41]. The "U" shaped interlock suture was performed withdrawing 0.5cm from the boundary to blood supply side. The spleen was excised with forcipressi on. If blood still oozes from the splenic cross-section, wet gauze was used to hemostasis by compression, or "8" shaped suture was made. We covered the cross-section with the capsule pealed off from the cut spleen, and immobilized the capsule on the cross-section with round needle and 1# thread. The advantages of this method are: transplanting splenic capsule can prevent bleeding or liquefaction and necrosis of the cross-

section; the transplanted capsule made the cross-section peritoneal metasplasia, which can decrease the chance of abdominal adhesion; omentum was not used to cover the cross-section rountinely, which reduced the interruption of the abdominal cavity, pre serving the function of the omentum. The splenic capsule is a tissue containing serous coat of its off, so transplanting splenic capsule has a high success rate; the collagen of the transplanted capsule is exposed, which facilitate activating coagulation system to hemostasis effectively and eliminate the dead space. This method has been used in handling the cross-section of partial spleen transplantation. The cross-section is still in good condition after rejection occurred several times. In this group, 41 cases underwent partial splenectomy, including 27 cases with splenic injury, 5 cases with splenic cyst and 9 cases with portal hypertension.

Autosplenosis

After the spleen is excised, it is washed with cold normal saline and put into the 4℃ Hartmann solution[45]. The abdominal cavity was washed and the splenic capsule pealed off and the slice of spleen tissue prepared. The spleen slices of 2.0 cm×2.0 cm×0.4 cm made from 1/3 of the spleen were put into the space between the anterior and posterior lobe of great omentum rich in blood supply. We found that peeling off the capsule facilitates the establishment of blood supply between the graft and the transplantion space, making the hormone from the spleen come into blood cir culation easily. We suggest that autosplenosis should be performed in the omental bursa by transplanting the little splenic cubes peeled off the capsule. In our study, 60 cases of autosplenosis after splenectomy were performed, including 58 cases with splenic injury and 2 cases with splenic cyst .

Resection of the body and tail of the pancreas with preservation of spleen

Dissociating the posterior pancreas space: Dissect the gastrocolic ligment out of the gastro epiploic vessels, then come into the lesser omental bursa, and expose the body and tail of pancre as and the pedicle of spleen[46-49], and protect the short gastric vessels extremely[50,51]. In the avascular area between the upper and lower edge of the body and tail of the pancreas, incise the posterior peritoneum along the pancreas longitudinally, an d dissociate the soft tissue behind the pancreas bluntly to join together with right index finger[52-55]. And then the body and tail of the pancreas and the splenic vessels are dissociated completely with the tissue around them[56-58]; Exsecting the pancreas: Exsect the pa ncreas at the proximal end of the pancreas where you want to cut, and ligate the pancreatic duct, then suture the proximal end of the pancreas with silk thread interruptedly; Dissociating splenic vessels: Clamp the distal end of the pancreas with Kocher's forceps, dissociate the splenic vessels from the pancreas tissues towards the tails of pancreas and protect the splenic vessels, which is called antidromic dissociated method (10 cases)[59-62], on the cont rary, dissociate the splenic vessels from the tail to the proximal end of pancreas, which is called anterograde dissociated method (4 cases). The former method is more commonly used in clinic, because it is difficult to recognize the tail of the pancreas from the fat tissue around t he pedicle of spleen, and the vessels of the tail of the pancreas remified to many thin branches. The resection of the body and tail of the pancreas comes to an end when the splenic vessels are dissociated from the pancreas tissues completely. When the adhesion between the splenic vessels and the pancreas tissue is wide and inseparable and it is too difficult to preserve the spleen vessels, the trunk of splenic vessels far away from the splenichilus and near the tail of the pancreas (1.0 cm from the branch of splenic vessels at least) should be ligated. At this moment, the preserved short gastric vessels and left gastroepiploic vessels supply the blood of spleen (7 cases). To the resectied body and tail of the pancreas with preservati on of spleen and its vessels, the splenic vessels should be immobilized properly because the ve ssels losing the support of the pancreas are easy to twist and bend. For those with preserved short gastvic vessels and left blood vessel of gastric omentum for the blood supply of pancreas, the breaking end of splenic vessels should be ligated exactly. Finally, check the colour and activity of spleen before close the abdomen[63,64].

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Edited by Ma JY