

# Changes Secondary to Splenic Artery Ligation and Dearterialization Seen in Rats After Splenic Trauma\*

RATLARDA SPLENİK ARTER LİGASYONU VE DEARTERİALİZASYONUNA SEKONDER DEĞİŞİKLİKLER

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## SUMMARY

77!« study was performed on 30 rats and these were divided into three groups. After splenic trauma involving entire splenic capsule and parcnchima was performed, no further surgical procedure was done in the first group. In the second group a. lienalis was ligated and divided. In addition to ligation of a. lienalis, short gastric vessels were ligated and severed in the third group. Hemoglobin, hematocrit, RBC, WBC and ombocytes were measured preoperatively, on 15<sup>th</sup> and 30<sup>th</sup> day and abdominal cavity was examined for hemorrhage, adhesion and liemostasis followed by splenectomy and liver biopsy. In conclusion, our study revealed that effective liemostasis can be obtained by either splenic artery ligation of splenic devascularization after splenic trauma. As for, hematologic changes there is no significant difference between both procedures. However, as devascularization of spleen leads to more damage to the spleen, splenic artery ligation appears to be more suitable procedure alternative to splenectomy.

**KeyWords:** Splenic trauma, Splenic artery ligation, Splenic dearterialization

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## ÖZET

Bu çalışına üç gruptan oluşan 30 rai üzerinde gerçekleştirildi. Tüm rotlarda dalak kapsül ve parankimini içeren travma oluşturulduktan sonra I. gruptaki rotlara (n = 10) hiçbir cerrahi işlem yapılmadı. II. gruptaki rotlarda (n = 10) a.lienalis bağlanarak kesildi, III. gruptakilerde (n = 10) ise, a.lienalis ek olarak gastrik brevia damarları da bağlanarak kesildi. Preop, poslop 15. gün ve 30. gün Hb, Hcl, Eritrosit, lökosit ve trombosit değerlerine bakıldı. Poslop 30. gün relaparotomi ile eksplorasyon sonrası splenektomi ve karaciğer biopsisi yapıldı. Splenik travma sonrası splenik arter ligasyonu ve dearterializasyonun etkili hemostaz sağladıkları, hematolojik yönden sonuçların farklı olmadığı, fakat hispalolojik yönden devaskularizasyonun dalakta daha ağır hasara yol açtığı gözlemlendi. Bu nedenle splenik arter ligasyonunun splenektomiye alternatif bir prosedür olarak kullanılabilir uygun bir yöntem olduğu sonucuna varıldı.

**Anahtar Kelimeler:** Splenik travma, Splenik arter ligasyonu, Splenik devaskularizasyon

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Studies about the role of spleen on immun system have demonstrated ceasing of production of opsonin and tufts in along with decrease of antibody and IgM in splenectomy/cd patients (1,2). Various surgical procedures, alternative to splenectomy, have been offered due to high incidence of infection and sepsis after splenectomy, particularly in

children under age three (3,4,5). However, the effects of ligation of splenic artery and splenic dearterialization, which are among alternative procedures to splenectomy, on functions and histopathology of spleen is not clear. In view of these facts, the purpose of this study is to reveal the effects of splenic artery ligation and splenic dearterialization on hemostasis after splenic trauma. In addition, hematologic and histopathologic changes secondary to these procedures are evaluated.

## MATERIAL VE METHODS

This study was performed on 30 rats (Swiss-Albino type) weighing 170-260 g. These were divided into three study groups. After ether anesthesia and median laparotomy, splenic trauma which involved entire splenic capsule and parenchima, was performed on all groups. In the first group, which was control group, no surgical procedures were performed on the spleen after trauma. In the second group, a lienalis was ligated by 3-0 silk and severed after splenic trauma. In addition to ligation of a lienalis, short gastric arteries were ligated and severed in the third group. Hemoglobin, hematocrit, RBC, WBC and trombocytes were measured preoperatively, on 15<sup>th</sup> and 30<sup>th</sup> day postoperatively (Contraves Analyzer 4300 and Contraves Trombocell 1000). On postoperative 30<sup>th</sup> day the abdominal cavity was examined for hemorrhage, adhesion and hemostasis followed by splenectomy and liver biopsy in the second and third group during re-laparotomy.

## RESULTS

Mean values of hemoglobin, hematocrit and RBC obtained preoperatively and on postoperative 15<sup>th</sup> and 30<sup>th</sup> days in all rats of second and third groups are seen in Table 1. There was no significant statistical difference ( $p > 0.05$ ) between mean values of hemoglobin, hematocrit and RBC pre and postoperatively. In Table 2, mean values of WBC and trombocytes are seen. When preoperative and postoperative 15<sup>th</sup> day values of WBC were compared, the difference was significant in the third group ( $p < 0.05$ ). Comparison of 15<sup>th</sup> day postoperative mean trombocyte values showed statistical significance in both groups ( $p < 0.05$  in the second,  $p < 0.01$  in the third group) whereas the difference was nonsignificant in postoperative 30<sup>th</sup> day.

Two rats which were in the control group, died within postoperative 48 hours. In post-mortem

Table 1. Mean Hemoglobin, Hematocrit and RBC Values of Second and Third Group

	Pre Op	Post	
	(Control)	15 <sup>th</sup> Day	30 <sup>th</sup> Day
<b>GROUP II</b>			
RBC	7.97 ± 0.6	7.65 ± 0.5	8.01 ± 0.5
Hemoglobin	14.93 ± 1.4	14.05 ± 1.4	14.87 ± 1.1
Hematocrit	44.58 ± 3.7	44.12 ± 3.6	48.20 ± 3.1
<b>GROUP III</b>			
RBC	8.05 ± 0.7	7.13 ± 1.2	7.93 ± 0.9
Hemoglobin	14.89 ± 1.1	12.96 ± 4.5	14.05 ± 1.7
Hematocrit	44.74 ± 5.1	41.93 ± 6.4	47.75 ± 4.1

Table 2. Mean WBC and Trombocyte Count of Second and Third Group

	Pre Op	Post Op	
	(Control)	15 <sup>th</sup> Day	30 <sup>th</sup> Day
<b>GROUP II</b>			
WBC	16.95 ± 2.2	13.16 ± 2.0	12.71 ± 8.1
Trombocyte	423.14 ± 119.1	694.11 ± 48.7	519.75 ± 111.2
<b>GROUP III</b>			
WBC	11.94 ± 1.5	20.77 ± 2.1	13.63 ± 3.0
Trombocyte	477.40 ± 29.6	957.25 ± 34.8	596.50 ± 67.3

study a large hematoma and free blood in the peritoneal cavity were noted. Remaining rats in the control group were re-operated on the seventh day following trauma and exploration showed large hematoma in the region of the spleen.

Effective hemostasis was noted in rats of the second and third groups when re-laparotomy was performed on postoperative 30<sup>th</sup> day. Microscopic examination of the spleen revealed minimal to moderate thickening of spleen capsule and severe congestion in the second group in which splenic artery was ligated. Moderate thickening of the splenic capsule and massive tissue necrosis were found in the third group in which the rats had splenic devascularization. In both groups liver biopsy showed minimal congestion.

## DISCUSSION

Experimental studies related to ligation of splenic artery and splenic devascularization in the treatment of splenic trauma seem to be increasing in number since 1970. However, further experimental and clinical studies in this field are needed. In an experimental study performed on dogs it has been shown that hemoglobin, hematocrit and RBC values do not change significantly after ligation of the

splenic artery (6,7). Dimitris et al (8) reported no important change of hemoglobin, hematocrit and RBC values in the children who have ligation of splenic artery after trauma on spleen. In our study, since there is no significant difference in the values of hemoglobin, hematocrit and RBC pre and postoperative in both splenic artery ligation and splenic devascularization group effective hemostasis appears to be obtained. In fact, this effective hemostasis was confirmed in rc-laparotomy performed on 30<sup>th</sup> postoperative day. We found significant difference in the values of WBC between preoperative and postoperative 15<sup>th</sup> day after splenic devascularization. On the 30<sup>th</sup> postoperative day. We found significant difference in the values of WBC between preoperative and postoperative 15<sup>th</sup> day after splenic devascularization. On the 30<sup>th</sup> postoperative day, however, WBC were close to preoperative values. These results can be explained on the basis of significant decrease of splenic blood flow after splenic devascularization (7). It may also be suggested that WBC shows almost normal values as a result of increased splenic blood flow after second postoperative week. In the splenic artery ligation group, comparison of pre and postoperative WBC values showed no significant change. Tsogas et al (9). have also reported similar results in dogs. As for trombocyte count, on postoperative 15<sup>th</sup> day, significant increase of trombocytes in both splenic artery and splenic devascularization groups were detected. But this was most significant in the splenic devascularization group ( $p < 0.01$ ). However, on 30<sup>th</sup> postoperative day, trombocyte count returned to normal values. Increase of trombocyte count detected on postoperative 15<sup>th</sup> day is related to decrease in splenic blood flow. As collateral blood flow formation appears, trombocyte counts return to normal. Similarly, it has been demonstrated on aortograms that contrast material reaches the distal part of ligated splenic artery by collaterals (8,10,11). Histopathologic evaluation of spleen on 30<sup>th</sup> postoperative day showed significant thickening of splenic capsule in the splenic artery ligation group whereas there was 30 percent massive tissue necrosis in the splenic devascularization group (Fig. 1). In two separate experimental studies in the literature, changes like thickening of splenic capsule and increase of fibrous stroma after splenic artery ligation, 10 percent necrosis of spleen after splenic devascularization have been reported (9). In our study the amount of massive necrosis of spleen appears to be higher.



Figure 1. Changes secondary to SAL and SD seen in rats after splenic trauma.

Our study revealed that effective hemostasis can be obtained by either splenic artery ligation or splenic devascularization after splenic trauma. In view of hematologic changes, there is no significant difference between both procedures. However, as devascularization of spleen leads to more histopathologic damage to the spleen, it has been concluded that splenic artery ligation is a more suitable procedure alternative to splenectomy.

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