ORIGINAL ARTICLE

Case series of non-operative management *vs.* operative management of splenic injury after blunt trauma

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ABSTRACT

BACKGROUND: The spleen is the most easily injured organ in abdominal trauma. The conservative, operative approach has been challenged by several reports of successful non-operative management aided by the power of modern diagnostic imaging. The aim of our retrospective study was to compare non-operative management with surgery for cases of splenic injury.

METHODS: We compared seven patients who were treated with non-operative management (NOM) between 2007 and 2011 to six patients with similar pre-operative characteristics who underwent operative management (OM).

RESULTS: The average hospital stay was lower in the NOM group than in the OM group, although the difference was not statistically significant. The NOM group required significantly fewer transfusions, and no patients in the NOM group required admission to the intensive care unit. In contrast 83% of patients in the OM group were admitted to the intensive care unity. The failure rate of NOM was 14.3% in our experience.

CONCLUSION: In our experience, NOM is the treatment of choice for grade I, II and III blunt splenic injuries. NOM is slightly less than surgery, but this is an unadjusted comparison and the 95% confidence interval is extremely wide - from 0.04 to 16.99. Splenectomy was the chosen technique in patients who met exclusion criteria for NOM, as well as for patients with grade IV and V injury.

Key words: Non-operative management; operative management; spleen; splenic injury.

INTRODUCTION

The spleen is the most easily injured organ in abdominal trauma. Isolated splenic injuries can be found in about one-third of blunt trauma and in 25-30% of patients who suffered a traffic accident.[1] Substantial changes in the treatment of blunt splenic injuries (BSIs) have occurred in the last forty years.

The history of the splenectomy can be traced back to Aristotle,[2] who was the first person to consider the spleen to be a non-essential organ. The idea that a splenectomy is the only appropriate treatment for blunt splenic injuries (BSIs) was based on the concept that the spleen is a fragile, vascular structure unsuitable for suturing lacerations, that there is a risk of uncontrollable bleeding in the absence of surgical removal, and the high mortality rate associated with non-operative management (NOM) (90-100%).[3]

The first change in the attitude towards OM occurred with the article by King and Schumacker in 1952, which showed that patients who underwent a splenectomy had a greater susceptibility to infection by *Streptococcus pneumoniae*.[4]

In 1968, Upadhyaya and Simpson published a retrospective clinical analysis of 52 children with splenic injury who underwent conservative medical treatment at the Hospital for Sick Children in Toronto.[5] The results of this study demonstrated that conservative treatment is efficacious in select patients.

Currently, modern diagnostic imaging has enabled more accurate monitoring of BSIs and an improvement in interventional radiology techniques has encouraged the NOM approach.[6] Thus, a splenectomy is now one of several possible treatment

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choices, rather than the only accepted approach.

The aim of our retrospective study was to compare NOM with surgery.

MATERIALS AND METHODS

Between January 2007 and December 2011, we treated seven patients with BSIs with NOM at the B Section of General and Emergency Surgery of Santa Maria Hospital in Terni.

In more than half of the cases, the patients arrived to the emergency room after a car accident (65%). Accidental falls and occupational incidents each represented 15% of the causes.

All patients underwent an initial assessment upon arrival to the emergency room using the Advanced Life Trauma Support (ATLS) protocol that describes the absolute priorities using the acronym ABCDE: A (Airway), B (Breathing), C (Circulation), D (Disability) and E (Exposure).[1]

Then, the patients underwent a FAST scan, which detects abdominal free fluid with a high degree of accuracy and has good sensitivity for liver and spleen injuries.[7]

Subsequent diagnostic procedures were utilized based on the hemodynamic stability of patients, evaluated according to the criteria established by ATLS, which recognizes three categories:

- A hemodynamically stable
- B hemodynamically stabilized
- C hemodynamically unstable.[7]

Group A consists of patients with normal vital signs and includes subjects with a hemoperitoneum >500-1000cc who are hemodynamically stable after one bolus of crystalloids. Based on the ATLS protocol, a stable patient should receive an abdominal CT scan with contrast in order to assess the location and degree of parenchymal lesions, concomitant extra-abdominal injuries and the extent of the hemoperitoneum.

If the CT scan did not show "blushing," we proceeded to NOM. However, if contrast medium was spreading during CT, patients were triaged to angioembolization (AE).

Patients included in category B are those with active bleeding requiring continuous hemodynamic support. The therapeutic approach has therefore been OM if early hemodynamic stabilization is not obtained, which would move patients to category A.

Group C consists of hemodynamically unstable patients unresponsive to intravenous fluids and intensive support. In these subjects, because of the severity of their condition, we used the principles of Damage Control to proceed with treatment, which is an approach based on controlling damage with the goal of helping the patient survive.[8]

To define the extent of the injury, we used the Organ Injury Scale of the American Association for the Surgery of Trauma (AAST), which describes 5 grades of splenic injury[9] (Table 1).

In our study, two patients undergoing NOM had a grade I injury, four patients had a grade II injury and one patient had a grade III injury.

NOM was attempted in patients who satisfied the following inclusion criteria:

- hemodynamic stability (systolic blood pressure > 90 mmHg, heart rate <100 bpm);
- good response to prompt infusion of 2000 ml of crystalloid (i.e. Ringer's lactate - RLS), with return to normal vital signs;

Table 1. Organ Injury Scale of the American Association for the Surgery of Trauma (AAST) (Federle,1998)[16]

Grade	Injury type	Description of injury
I	Hematoma	Subcapsular, nonexpanding, <10% della surface area
	Laceration	Capsular tear, nonbleeding, <1 cm parenchymal depth
II	Hematoma	Subcapsular, nonexpanding, 10-50% surface area
		Intraparenchymal, <2 cm in diameter, nonexpanding
	Laceration	Capsular tear, active bleeding, 1-3 cm parenchymal depth
III	Hematoma	Subcapsular, >50% surface area or expanding
	Laceration	Ruptured subcapsular hematoma with active bleeding
		Intraparenchymal, >2 cm in diameter, or expanding >3 cm parenchymal depth
IV	Hematoma	Ruptured intraparenchymal hematoma with active bleeding
	Laceration	Involvement of segmental or hilar vessels producing devascularization >25%
V	Laceration	Shattered spleen
	Vascular	Hilar vascular injury devascularizes spleen

- splenic injury grade I, II, III;
- hemoperitoneum only if it extended to less than three abdominal quadrants;
- concomitant abdominal injuries that did not require a surgical procedure.

During hospitalization, patients undergoing NOM were closely monitored using clinical and laboratory data to ensure that rapid intervention could be performed if needed.

In order to have a good OM group to compare to the NOM group, it was necessary to ensure that the characteristics of the patients in both groups were similar. We picked patients for the OM group using the departmental medical records. The institutional review board approved the study design and waived the need for informed consent. The present study was strictly observational and did not interfere with the decision-making process and clinical management.

We identified 19 patients managed operatively from January 2001 to December 2005. The retrospective OM control group was created by choosing six patients who had similar characteristics to the NOM group, had been hemodynamically stable and had splenic lesions ranging from grade I to III. In total, there were seven patients in the NOM group (mean age 54.6 years) and six in the OM surgery (historical group). The preoperative characteristics of the two groups did not differ significantly. The following data were collected and analyzed: age, gender, vital signs at presentation, grade of splenic injury, Injury Severity Score (ISS),[10] concomitant injuries, injuries requiring surgical procedures and simultaneous extra-abdominal pathologies.

Failure of NOM was defined by the occurrence of any of the following:

- evidence of hemodynamic instability during monitoring, notably the development of hypotension;[11]
- increasing hemoperitoneum, evidenced by ultrasonography and consequent reduction in hematocrit;
- presence of active bleeding requiring transfusion of more than 4 units of blood in the first 24 hours to achieve hemodynamic stability;
- development of complications;
- patient rejection of NOM.

We have chosen to include the latter criterion in our study to ensure statistical accuracy (modified intention to treat[12,13]), although in the past literature, this criterion has not been used.

In our series, there was one case of NOM failure.

The NOM failure occurred in a 41-year-old man who had a grade III splenic injury and met the inclusion criteria for NOM, but who did not agree to NOM and thus received a splenectomy (Fig. 1).

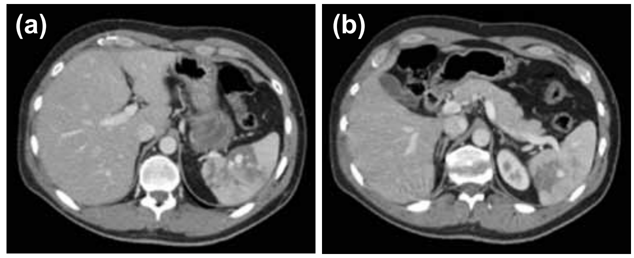

Figure 1. (a, b) Abdominal CT with contrast. There are hypodense areas diffusely throughout the majority of the spleen and a subcapsular hematoma with active bleeding. There is no free peri-splenic fluid.

A 77-year-old man with a grade II splenic injury, who had been treated with arterial embolization of the splenic artery according to the inclusion criteria, died 13 days after the intervention from a myocardial infarction. This was the only patient in our study who underwent splenic artery embolization with spirals (Fig. 2) for a grade II splenic lesion with ongoing arterial bleeding seen on CT scan.

RESULTS

This study included a total of 26 patients, 24 males and 2 females, whose mean age was 54 years. We compared seven patients who received NOM to six patients with similar preoperative characteristics who underwent OM.

Six patients in the NOM group had concomitant traumatic injuries compared to five in the OM group. In the OM patients, the concomitant injuries were mostly intra-abdominal, whereas in the NOM patients, they were mostly extra-abdominal. Forty-two percent of the concomitant injuries were intra-abdominal and 58% were extra-abdominal. We noted an association between NOM and orthopedic injuries (57%)

Figure 2. Splenic angioembolization. Distal selective embolization.

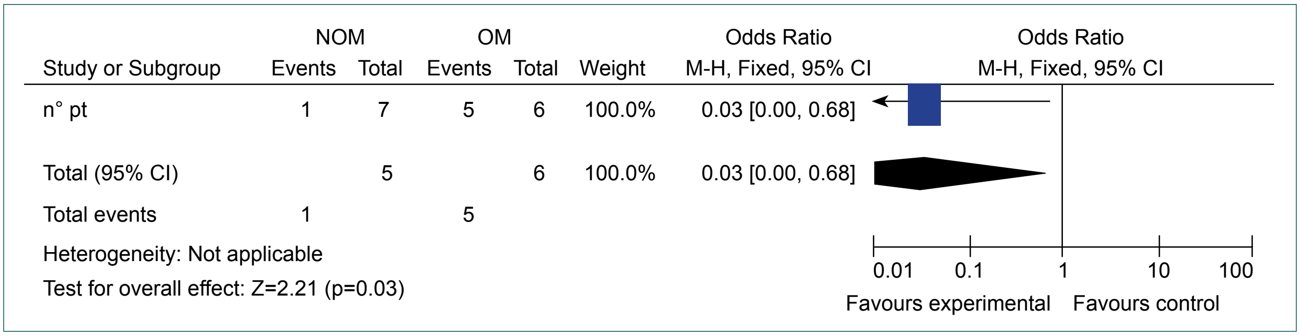

Figure 3. Transfusion rates in the NOM and OM groups. The NOM group required significantly fewer transfusions (14% NOM *vs.* 83% OM) (p=0.03).

and OM with traumatic lesions of the pancreas (50%). Furthermore, 54% of our patients had comorbid conditions that must be considered in estimating mortality, although this was not statistically significant (p=0.43). Thirty-one percent of the NOM had comorbidities compared to 23% of the OM group. The mean ISS of the OM group was 13.8 and was higher than the non-operative group that had a mean ISS of 8.8.

The average length of hospital stay was lower in the NOM group (10.6±3.5 days) than in patients with OM (20.8±13.1 days), although the difference was not statistically significant (p=0.09). The hospital stays were lengthy in both groups because some patients had concomitant traumatic injuries. For example, in the NOM group, the patients with grade III lesions were monitored by ultrasound long to allow the reduction of hematoma liver. The NOM group required significantly fewer transfusions (14% NOM *vs.* 83% OM) (p=0.03) (Fig. 3).

No patient in the NOM group needed care in the ICU, whereas 83% of patients recovering from surgery required admission to the ICU.

Our analysis revealed a slightly lower total morbidity in the splenectomy group (29% NOM *vs.* 17% OM) (p=0.62). In our study, the morbidity included acute respiratory failure, incisional hernia, non-healing surgical wound, acute myocardial infarction and concomitant traumatic injuries. Interventions for complications and readmissions were lower in the NOM group (0% NOM *vs.* 17% OM respectively) (p=0.41).

The only readmission occurred one year after discharge and was secondary to an incisional hernia, which required a prosthesis. In the non-operative group, there were no readmissions. In the splenectomy group, there were five cases of acute respiratory failure, all treated with continuous mechanical ventilation for less than 96 consecutive hours in the ICU. There was no mortality difference between the two groups of patients (14% NOM *vs.* 17% OM) (p=0.91).The failure rate of NOM was 14.3% in our experience (Table 2).

DISCUSSION

Our NOM success rate was 85.7%, which is similar to the past literature, which quotes rates around 80%.[14]

There were no cases that required suspension of NOM and emergency laparotomy. This demonstrates the importance of an accurate assessment of patients on arrival and of using strict inclusion criteria for NOM. In 2005, the study by Peitzman[15] demonstrated that 30-40% of NOM failures were due to inappropriate selection of patients, particularly with regards to hemodynamic instability and initial misdiagnosis.

It is also crucial to carefully monitor patients receiving NOM, according to the established protocol. It is important to note that when resuscitating hypotensive patients, large volumes of crystalloid given early during admission before hemostasis has occurred may increase bleeding. Hypotension is commonly seen in trauma cases without cranial injury.[16]

In our analysis, the NOM failure rate was 14.3%, which is similar to the 17% failure rate reported in previous studies. Our failure rate may be skewed by the criteria used to define

Table 2. Description of case failure of NOM

Failure of NOM	Age (years)	Sex	Grade of splenic injury	Associated injuries	Cause of failure
A.T.	41	Male	III	Fracture of left ribs 8, 9 ,10 at the posterior arch; minimal posterior, bilateral area of pulmonary contusion	Refusal of NOM

NON: Non-operative management.

failure, as we used patient refusal of NOM as an indication of failure. In our study, one patient refused NOM and dramatically impacted the rate due to the small number of cases included in this study.

No complications occurred in patients who underwent NOM. We must however emphasize patients who underwent NOM had less severe spleen injuries due to the exclusion criteria for NOM.

The study by Di Saverio and Moore[17] highlighted how patients with grade IV through V splenic injury were at increased risk for developing complications and had a higher NOM failure rate, even though NOM is being utilized increasingly more for high-grade lesions. Similarly, the study by Peitzman and Richardson[18] showed that the NOM failure rate was proportional to the splenic injury grade: 5% in grade I, 10% in grade II, 20% in grade III, 33% in grade IV and 75% in grade V. Comparable failure rates were seen in the study conducted by Velmahos[19] in 14 trauma centers, in which the failure rate was 34.5% for patients with grade IV lesions and 60% for grade V lesions.

A higher failure rate was found in the study by Malhotra,[20] which included patients with splenic and liver injuries that had either associated or single organ injuries. The failure rate for patients with associated injuries was 11.6% and 5.8% in patients with single organ injuries. It was not possible to compare these results to our study because patients in the Malhotra splenectomy group had a higher number of associated injuries.

Mortality in the NOM group was 14% in our study, and similarly, the rate was 12.6% in the past literature (12.6%).[15] The patient who died in the NOM group was a 77-year-old man in poor condition suffering from lung cancer with lymphatic and pleuric metastases who died of heart failure.

Mortality after NOM failure should be correlated with delayed treatment of any associated intra-abdominal injuries. It is estimated that reducing the delay in treatment of associated injuries would prevent mortality in 70% of cases.[15] Taking this into consideration, the presence of intra-abdominal injuries requiring surgical management is one of the NOM exclusion criteria used in this study.

Peitzman and Richardson[18] have described NOM as the treatment of choice in 61.5% of splenic injuries. However, in our study, NOM was only used for 27% of cases. This value is lower than the literature value because of the limited number of patients in this study and exclusion of patients with high grade lesions (IV and V) from the NOM group.

Treatment options seem to be influenced by the type of hospital a patients presents to. An analysis of 14901 patients with splenic injury showed that NOM was attempted in 60% of cases in public academic hospitals and in 54% of cases in both non-academic and rural hospitals.[21] This difference points out the necessity of specialized equipment and staff for the management of polytrauma patients.

NOM, as described in literature, should be adopted in most patients with splenic injuries, especially when the injury is isolated, but surgery is necessary for select cases and should not be interpreted as a defeat.[22]

In the literature, there are no definitive and widely accepted guidelines on the appropriate length of hospitalization or follow-up. Non-operative management can be advantageous as it preserves splenic function and prevents laparotomy-associated complications.[14] Nonetheless, there are some risks: delayed splenic rupture and delayed treatment of unrecognized intra-abdominal injuries. In 2006, the study by Franklin and Casós[23] described a mortality rate from Overwhelming Post-Splenectomy Infection (OPSI) of 1/10.000 for adult splenectomised patients. The odds of a patient dying from NOM are 20 times higher than this rate. Patients are now receiving more preventative treatment and are less likely to have OPSI. Our patients were vaccinated against *Pneumococcus*, *Meningococcus* and *Haemophilus* (ACWY quadrivalent meningococcal conjugate vaccine135 and ACT-HIB conjugated H. influenzae type b-vaccine).

Limitations

In addition to potential bias due to temporal confounders (changes in aspects of management over time), there was an insufficient sample size to adjust for other potentially important confounders (age, concomitant abdominal injuries, injury severity as measured by any of the validated trauma scores, etc). These limitations introduce significant potential for bias in the results.

Conclusions

In this study, patients with splenic injury treated operatively between 2001-2005 were compared to patients treated non-operatively between 2007-2011. In our experience, NOM was the treatment of choice for multiple reasons in blunt splenic injuries grade I, II and III. NOM is slightly less than surgery, but this is an unadjusted comparison and the 95% confidence interval is extremely wide - from 0.04 to 16.99. Splenectomy was the chosen technique in patients with exclusion criteria for NOM, as well as in those with grade IV and V injury. In the literature, the use of NOM in patients with grade IV and V splenic injuries is still under debate, and no unanimous opinion has been reached to date.

The authors make a lot of conclusions based on a very small sample size (n=13). The conclusions are not warranted based on the data. Therefore new and larger studies are needed in order to assess usefulness of conservative approach in IV and V grade and costs of NOM in all grades of splenic injury.

Conflict of interest: None declared.

REFERENCES

1. Buccoliero F, Ruscelli P. Splenic trauma. In the management of trauma. From the territory to the Trauma Center. Edited by: Cenammo A. Napoli: Italian Society of Surgery; 2010. p. 138-50.
2. Upadhyaya P. Conservative management of splenic trauma: history and current trends. Pediatr Surg Int 2003;19:617-27.
3. King H, Shumacker HB Jr. Splenic studies. I. Susceptibility to infection after splenectomy performed in infancy. Ann Surg 1952;136:239-42.
4. Surgeons. ACo. Manual ATLS (Advanced Trauma Life Support) by American College of Surgeons. 6th ed.
5. Upadhyaya P, Simpson JS. Splenic trauma in children. Surg Gynecol Obstet 1968;126:781-90.
6. Cirocchi R, Boselli C, Corsi A, Farinella E, Listorti C, Trastulli S, et al. Is non-operative management safe and effective for all splenic blunt trauma? A systematic review. Crit Care 2013;17:R185. [Epub ahead of print]
7. Surgeons. ACo. Manuale ATLS (Advanced Trauma Life Support).
8. Cirocchi R, Abraha I, Montedori A, Farinella E, Bonacini I, Tagliabue L, et al. Damage control surgery for abdominal trauma. Cochrane Database Syst Rev 2010;1:CD007438.
9. Prokop M GM. Spleen. In Verlag. GT (ed) Computed tomography; spiral and multilayer. Edition Gernany: 2003;514.
10. Trauma.org [http://www.trauma.org/archive/scores/iss.html]. In Edition.
11. Forsythe RM, Harbrecht BG, Peitzman AB. Blunt splenic trauma. Scand J Surg 2006;95:146-51.
12. Abraha I, Montedori A. Modified intention to treat reporting in randomised controlled trials: systematic review. BMJ 2010;340:c2697.
13. Montedori A, Bonacini MI, Casazza G, Luchetta ML, Duca P, Cozzolino F, et al. Modified versus standard intention-to-treat reporting: are there differences in methodological quality, sponsorship, and findings in randomized trials? A cross-sectional study. Trials 2011;12:58.
14. Tan KK, Chiu MT, Vijayan A. Management of isolated splenic injuries after blunt trauma: an institution's experience over 6 years. Med J Malaysia 2010;65:304-6.
15. Peitzman AB, Harbrecht BG, Rivera L, Heil B; Eastern Association for the Surgery of Trauma Multiinstitutional Trials Workgroup. Failure of observation of blunt splenic injury in adults: variability in practice and adverse consequences. J Am Coll Surg 2005;201:179-87.
16. Morrison CA, Carrick MM, Norman MA, Scott BG, Welsh FJ, Tsai P, et al. Hypotensive resuscitation strategy reduces transfusion requirements and severe postoperative coagulopathy in trauma patients with hemorrhagic shock: preliminary results of a randomized controlled trial. J Trauma 2011;70:652-63.
17. Di Saverio S, Moore EE, Tugnoli G, Naidoo N, Ansaloni L, Bonilauri S, et al. Non operative management of liver and spleen traumatic injuries: a giant with clay feet. World J Emerg Surg 2012;7(1):3.
18. Peitzman AB, Richardson JD. Surgical treatment of injuries to the solid abdominal organs: a 50-year perspective from the Journal of Trauma. J Trauma 2010;69:1011-21.
19. Velmahos GC, Zacharias N, Emhoff TA, Feeney JM, Hurst JM, Crookes BA, et al. Management of the most severely injured spleen: a multicenter study of the Research Consortium of New England Centers for Trauma (ReCONECT). Arch Surg 2010;145:456-60.
20. Malhotra AK, Latifi R, Fabian TC, Ivatury RR, Dhage S, Bee TK, et al. Multiplicity of solid organ injury: influence on management and outcomes after blunt abdominal trauma. J Trauma 2003;54:925-9.
21. Todd SR, Arthur M, Newgard C, Hedges JR, Mullins RJ. Hospital factors associated with splenectomy for splenic injury: a national perspective. J Trauma 2004;57:1065-71.
22. Castellani E, Covarelli P, Boselli C, Cirocchi R, Rulli A, Barberini F, et al. Spontaneous splenic rupture in patient with metastatic melanoma treated with vemurafenib. World J Surg Oncol 2012;10:155.
23. Franklin GA, Casós SR. Current advances in the surgical approach to abdominal trauma. Injury 2006;37:1143-56.

KLİNİK ÇALIŞMA - *ÖZET*

Künt travma sonrası oluşan dalak yaralanmasının cerrahi ve cerrahi dışı tedavisini karşılaştıran olgu çalışmalarının bir karşılaştırması

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AMAÇ: Karın travmalarında dalak en kolay yaralanan organdır. Başarılı cerrahi dışı tedavi ve modern tanısal görüntülemeye ilişkin birkaç rapor konservatif yaklaşımın yayılmasına giderek daha fazla olanak tanımıştır. Bu retrospektif çalışmada cerrahi dışı tedavi ile cerrahi tedavi karşılaştırıldı.
GEREÇ VE YÖNTEM: 2007 ila 2011 arasında benzer ameliyat öncesi özellikleri olan cerrahi dışı tedavi alan 7 hasta ile cerrahi tedavi alan 6 hasta karşılaştırıldı.
BULGULAR: Cerrahi dışı tedavi grubunda ortalama hastanede kalış süresi cerrahi tedavi alanlara göre istatistiksel açıdan anlamlı olmamakla birlikte daha kısaydı. Cerrahi dışı tedavi grubu anlamlı derecede daha az transfüzyona gerek göstermiş, bu grupta hiçbir hasta yoğun bakım ünitesinde (YBÜ) kalmayı gerektirmemişken cerrahi tedaviden sonra kendine gelen hastaların %83'ünün YBÜ'de kalması gerekmiştir. Deneyimlerimizde cerrahi dışı tedavinin başarısızlık oranı %14.3 düzeyindeydi.
TARTIŞMA: Deneyimimizde, cerrahi dışı tedavi, I, II, ve III. derece künt dalak yaralanmalarında birkaç avantajı sayesinde seçilen tedavi idi. Cerrahi dışı tedavi, cerrahiye göre biraz daha az avantajlı olmasına rağmen bu düzeltilme yapılmamış bir karşılaştırma olup %95 güven aralığı son derece genişti (0.04 ila 16.99 arasında). Cerrahi dışı tedavi için dışlanma kriterlerini taşıyan hastalarla birlikte IV ve V. derece yaralanmaları olanlarda splenektomi seçilen teknikti.

Anahtar sözcükler: Cerrahi dışı tedavi; cerrahi tedavi; dalak; dalak yaralanması.

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