LAPAROSCOPIC SPLEEN PRESERVING PROCEDURES

ANDRZEJ BUDZYŃSKI, ANNA GWÓŹDŹ, JAN KULAWIK, MARCIN STRZAŁKA, MACIEJ MATŁOK

2nd Department of General Surgery, Collegium Medicum Jagiellonian University in Cracow
Kierownik: prof. dr hab. D. Karcz

Laparoscopic splenectomy evolved into one of the principal operations of the spleen. High short- and long-term morbidity associated with asplenia has prompted surgeons to implement spleen preserving procedures.

The aim of the study was to evaluate laparoscopic spleen preserving procedures with regard to their feasibility and treatment results.

Material and methods. Prospective evaluation of treatment results in patients submitted to laparoscopic operations of the spleen in 2nd Department of General Surgery CM UJ in Cracow. From August 1998 until May 2009 we performed 278 laparoscopic operations of the spleen. The group consisted of 164 females and 114 males, of which 256 (92.09%) patients were operated on electively and 22 (7.91%) in emergency settings. 235 patients (84.53%) were assigned to total splenectomy (most for ITP – 142 patients). In 43 patients (15.47%) the laparoscopic spleen preserving procedure was attempted. The indications included rupture of the spleen, cysts, tumors and abscess.

Results. Laparoscopic spleen preserving procedure was successfully performed in 23 out of 43 patients (53.49%). There were 9 excisions of the splenic cysts, 8 hemostases from ruptured spleen, 5 resections of the tumors and one drainage of the abscess. Postoperative complications were observed in 16 (7.66%) patients after total splenectomy, including 8 (3.4%) infectious. 3 patients (6.98%) after spleen preserving procedure were re-operated due to bleeding. There were no infectious complications in this group.

Conclusions. There is a limited number of indications for laparoscopic procedures preserving splenic parenchyma. Despite high failure rate attempts to perform laparoscopic spleen sparing operation are usually beneficial due to low risk of complications, particularly infections.

Key words: laparoscopic splenectomy, spleen preserving procedures

Two significant aspects of progress, which has occurred in spleen surgery, have shaped current opinions on treating diseases of this organ. The first aspect was the introduction, and then wider utilization, of procedures saving the biggest possible part of its parenchyma, which aim to reduce the amount of early and late postoperative complications (1). The second aspect included the use of laparoscopic techniques related with more advantageous postoperative course that is typical for minimally invasive laparoscopic techniques (2, 3, 4). Therefore a tendency has occurred not to remove the whole spleen, whenever such a situation is possible, while on the other hand, to use the widest possible classification of patients to minimally invasive procedures. Procedures saving splenic parenchyma are mainly a domain of traumatic surgery, and this means classical operating techniques. Here laparoscopic operations are only a slight percentage (5). Minimally invasive surgical procedures are performed mainly as scheduled operations, performed because of haematological recommendations, and in case of these diseases it is usually the widest possible removal of splenic parenchyma that decides about the advantage of surgical treatment. Recommendations to remove only a part of this organ in patients treated according to schedule are rare. However, it seems that due to increasing experience, it is possible to join both these
The aim of the thesis was to determine the possibility to use laparoscopic technique in procedures saving splenic parenchyma.

**MATERIAL AND METHODS**

**Methods**

We have evaluated results obtained in patients treated operationally between August 1998 and May 2009 in the 2nd Department of General Surgery, Jagiellonian University Medical College with the use of laparoscopic technique due to spleen diseases. The following aspects were evaluated: gender, age, recommendations for the procedure, type of the procedure, frequency and type of early (to 30 days) postoperative complications, as well as earlier postoperative death rate. Particular attention was paid to percentage of failures related with the usage of laparoscopic technique and risk of infection complications.

Patients treated due to various haematological diseases were classified for scheduled whole spleen removal procedures. Scheduled surgical procedures of partial resection of splenic parenchyma were performed in patients with focal lesions in spleen, when its location enabled to obtain good vascularisation of the remained parenchyma fragment. In posttraumatic cases increasing of free fluid amount in peritoneal space in subsequent ultrasound examinations were considered as recommendations for laparoscopic operations. These patients were haemodynamically stable, and an attempt to utilize such means of procedure did not delay undertaking other essential treatment activities.

Between 1998 and 2009 several types of laparoscopic splenectomy procedure were performed, varying in places of trocar injection, as well as the amount and means of treating spleen vessels. All procedures, both procedures of complete splenectomy, as well as those saving splenic parenchyma, were performed in a lateral position, on the right side. Between 1998 and 2005 during laparoscopic splenectomy almost the only utilized technique was the “vessels first” technique. Its high universality was confirmed during procedures performed due to various recommendations, even in case of incredibly enlarged spleens, and in selected posttraumatic cases. Only in exceptional situations the spleen was removed with the use of Endo-GIA vascular stapler placed on the whole area of spleen cavity without isolating particular units, almost “blindly” and all tissues were cut. During the last two years the utilised spleen removal technique was using Ligasure apparatus, which cut the spleen cavity closing the lumen of vessel network. In majority of cases the core of the artery, or artery and vein was previously isolated with singular clips, without the necessity to cut these vessels.

Each of the utilized methods required the knowledge of spleen vessels isolation technique, which also allowed elaborating methods of partial splenic parenchyma removal, with previous devascularisation of the resected fragment. In case of partial spleen resection due to tumours, after gaining complete actuation of the spleen, vessels coming into the resected fragment of splenic parenchyma were closed with Ligasure apparatus. When ischaemia was obtained, confirmed with livedo, indicated border of the resection. Then the lumen of stem in spleen vessels was closed by ligation with a rubber suspender, and a resection was performed with Ligasure apparatus – coagulation of cut surface with rubber suspender, and a resection was performed with Ligasure apparatus – coagulation of cut surface with argon plasma. Only in case of cyst fenestration it was possible to cut fragment of the cyst wall, without suspending network of spleen vessels. Cutting a wide window was performed by means of scissors with electrocoagulation, harmonic knife or Endo-GIA endoscopic stapler. Argon plasma coagulation (APC) was used to stop bleeding from the edges. The use of APC also damaged the lining of remaining cyst walls located within the parenchyma.

In patients operated because of abdominal cavity injuries, argon plasma coagulation or preparations with local haemostatic activity, such as Tachocomb or Surgicel, were used during haemostasis.

**Material**

Between August 1998 and May 2009 278 patients were qualified for laparoscopic operation due to spleen diseases. This group included 164 women and 114 men. The average age was respectively 38.35 years old (15-78 years old, SD = 17.2) and 43.51 years old (16-84 years old, SD = 15.8). Within the above-mentioned group 256 patients (92.09%) were oper-
ated according to schedule, whereas 22 (7.91%) were operated because of emergency recommendations. The age of patients operated on schedule (on average 40.98 years old, 15-84 years old, SD = 16.8) did not significantly differ statistically from the age of persons operated due to emergency recommendations (on average 34.7 years old, 17-71 years old, SD = 16.3) (p=0.18).

From the whole group of 278 patients, 235 (84.53%) were initially qualified for complete laparoscopic splenectomy, whereas 43 (15.47%) were qualified for procedure saving splenic parenchyma. Patients qualified for whole spleen resection were operated on schedule due to haematological ailments, most commonly due to immune thromocytopenic purpura (ITP) (142 patients) and diagnosis or suspicion of non-Hodgkin lymphoma (NHL) (47 patients). Less often the recommendations were based on ischaemia: microspherocytic anaemia – 18 patients or autoimmune haemolytic anaemia – 13 patients, hypersplenism – 6 patients, Echinococcus granulosus – 3 patients, symptomatic splenomegaly – 3 patients, osteomyelofibrosis – 2 patients and splenic artery aneurysm – 1 patient (tab. 1).

Within a group of 43 patients qualified for laparoscopic surgery saving the splenic parenchyma due to the character of the basic disease, there were 21 patients (8.2%) from among 256 operated on schedule. The following may be enumerated among recommendations for partial resection of splenic parenchyma: simple splenic cysts – 8 patients, tumour of the spleen – 10 patients, multicellular atypical cyst of the spleen – 2 patients and splenic abscess – 1 patient.

This group also included 22 patients operated due to spleen rupture with symptoms of bleeding below the cyst or into the peritoneal cavity. All these patients were haemodynamically stable, and subsequent ultrasound examinations documented a progression of free fluid in abdominal cavity. In majority of cases, rupture resulting from blunt injury of the abdomen constituted the indication for surgical intervention (20 patients). One patient was operated due to self-rupture of the spleen, enlarged in the course of mononucleosis, while another female patient underwent surgery because of iatrogenic injury during laparoscopic left-sided adrenalectomy. In case of all these patients an attempt of administering treatment saving splenic parenchyma was made (tab. 1).

### Results

In a group of 235 patients initially qualified for complete laparoscopic splenectomy, the procedure was ended with minimally invasive technique in 228 patients (97.02%), and in 7 (2.98%) cases conversion to laparotomy was necessary due to bleeding, which could not have been stopped with laparoscopic technique (5 patients) or because there was no possibility to safely access the area of the cavity due to lymph node sets. During the initial stage of

<table>
<thead>
<tr>
<th>Type of indications</th>
<th>n (%)</th>
<th>Indications</th>
<th>n</th>
<th>Type of procedure</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elective</td>
<td>256 (92,09)</td>
<td>immune thrombocytopenic purpura</td>
<td>142</td>
<td>total splenectomy</td>
<td>235 (84,53)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>non-Hodgkin lymphomas</td>
<td>47</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>anemia</td>
<td>31</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>hypersplenism</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Echinococcus</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>splenomegaly</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>osteomyelofibrosis</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>splenic artery aneurysm</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>cysts</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>tumors</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>abscess</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency</td>
<td>22 (7,91)</td>
<td>blunt abdominal trauma</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>spontaneous rupture (mononucleosis)</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>iatrogenic injury</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
gaining experience in 3 patients (1.58%), due to significant splenomegaly, a video-assisted splenectomy was performed (tab. 2).

Simultaneously, together with the removal of the spleen, in 19 patients other operations were performed (sometimes even three types of procedures were performed in the same patient). Usually these procedures included: cholecystectomy (15 patients), umbilical hernioplasty (3 patients), sampling lymph nodes of retroperitoneal cavity (2 patients), ovary cyst operation (2 female patients), and removal of lymphoma infiltration from abdominal cavity layers (1 female patient).

In case of 217 patients from a group of 235 patients, who underwent complete splenectomy (92.34%), there were no complications during the postoperative course, whereas in 18 patients (7.66%) certain complications were observed. In 8 patients (3.40%) they were infectious complications. This group covered abscesses in the cavity after splenectomy – 6 patients (2.55%), pulmonary infections – 1 patient (0.43%) and infection of postoperative wound – 1 patient (0.43%). One of the 6 patients with abscess in the cavity after splenectomy was treated with good result by means of drainage, under ultrasound control. Within this group, 3 patients underwent successful repeated operation with laparoscopic technique, and 2 required reoperation with the use of classical method.

In 10 patients, complications other than infectious ones were related with operating technique – patients were reoperated twice due to haemorrhage, injury of diaphragm and pneumothorax were observed twice, two stomach perforations were observed and one pancreatic fistula occurred. Other complications include: fluid receptacle in the cavity after spleen treated conservatively (2 patients), post-operative acute pancreatitis and pulmonary embolism. One patient (0.43%) died on the 8th day after the operation due to pulmonary thromboembolism (tab. 3).

Out of 43 patients qualified for saving procedure, it was possible to perform laparoscopic operation saving the splenic parenchyma in case of 23 of them (53.49%). In 9 patients this was a successful cyst wall resection, and in further 8 patients haemostasis after spleen injuries, in 5 patients a fragment of splenic parenchyma with the tumour was removed, and one patient had splenic abscess drainage. In patients, who underwent laparoscopic procedure of removing part of splenic parenchyma (5 patients) – these were three resections of about 2/3 of the organ, twice 1/2. As far as histological evaluation of preparations after resection procedures performed in 14 patients is concerned, the following was stated: straight cyst (7 patients), haemangioma (4 patients), false cyst (2 patients) and SANT (Sclerosing Angiomatoid Nodular Transformation) (1 patient).

In 20 patients (46.51%) an attempt to perform laparoscopic procedure saving splenic parenchyma ended in failure. In case of 9 pa-

<table>
<thead>
<tr>
<th>Number of patients</th>
<th>Success rate</th>
<th>Complications</th>
<th>Infectious complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Total splenectomy</td>
<td>235</td>
<td>84.53</td>
<td>228</td>
</tr>
<tr>
<td>Spleen preserving procedure</td>
<td>43</td>
<td>15.47</td>
<td>23</td>
</tr>
</tbody>
</table>
patients a complete spleen removal was removed with laparoscopic technique, in 9 patients a classic splenectomy was performed, while in case of 2 patients saving splenic parenchyma classic procedure was performed (tab. 2). From among 20 patients, in case of whom it was impossible to perform surgical procedure saving splenic parenchyma, 15 were operated due to splenic rupture. Because of the fact that this method is unsuccessful in stopping bleeding, in 4 of these patients a laparoscopic splenectomy was executed, in 2 of them the bleeding was stopped by means of classical method, and in case of 9 patients a splenectomy with open method was performed. The remaining 5 patients, in case of whom the attempt to realise procedure saving parenchyma ended in failure, were operated on schedule. All of them underwent complete laparoscopic splenectomy. In three patients with splenic tumours a transoperational decision was made to avoid partial resection due to size of the tumour not allowing for saving enough amount of the parenchyma, multifocal character, and suspicion of malignant character of the lesion. In one female patient qualified for partial resection of the spleen due to atypical, multilocular cyst, a transoperational decision was made to perform complete splenectomy due to doubtful lifespan of the remaining part of the splenic parenchyma. In one patient a complete removal of the spleen was executed due to multiple cysts.

3 complications (6.98%) were observed during postoperative period in a group of 23 patients, who underwent saving procedure (from among 43 ones, in case of whom an attempt to save splenic parenchyma was realised). Two of them, with traumatic spleen rupture, who had bleeding from the spleen stopped with use of laparoscopic technique, suffered from recurrence within several hours after the operation. During reoperation a complete spleen removal was performed in the above cases, in one patient with laparoscopic method, whereas in case of the second patient from classical access. One patient after partial spleen resection due to a tumour was reoperated two weeks later in another centre, because of bleeding from the maintained fragment of the spleen. None of the patients, who underwent procedure saving splenic parenchyma, suffered from infectious complications. Complications observed in the distant postoperative period in the group of patients operated in an emergency mode due to splenic rupture were related with previous multi-organ injury, without direct relation with performed spleen operation (tab. 3).

**DISCUSSION**

During the first several dozen years of surgery, complete removal of the spleen was a therapy selected for all diseases of this organ. This proceeding resulted from the belief that spleen is not an organ necessary to live, it does not heal, and in case of injuries, the bleeding often recurs. Despite the results of experimental studies, proving significant immune splenic functions, and the disadvantageous influence asplenism may pose on the ability to survive infection in animal models, only the 60s of the 20th century brought a change in perceiving the role of the spleen by surgeons, and by the same the operational strategy to treat its diseases. It was proved then, among others, that splenectomy predisposes the patient to bacterial infection till the end of his life, and that some of them proceed in a rapid manner and are related with enormous death rate (OPSI – overwhelming postsplenectomy infections) (6).

Resection of the spleen, the biggest and concurrently the most important organ of the reticuloendothelial system, causes long lasting impairment of hormonal response, lowering M class immunoglobulin level, and it impairs response for areolar bacterial antigens (7,8). It also causes impairment of T lymphocytes functions, and opsonisation as well as phagocytosis by Browicz-Kupffer cells (9). It seems that impairment of hormonal response, next to phagocytosing spleen functions constitutes the main cause of OPSI (10). It was also proved that splenectomy increases risk of pulmonary thromboembolism and ischaemic heart disease, probably due to increased amount of platelets (11, 12, 13).

Despite slight OPSI morbidity in adults, estimated for about 0.5%, significant death rate, reaching up to 50%, makes it a clinical problem (14, 15). As a result there was a tendency to perform less radical procedures, and the development of operational technique enabled to execute operations saving healthy splenic parenchyma. During 70s and 80s of the 20th century various saving procedures with the use of electrocoagulation, spongostan lining, collagen, cellulose, argon coagulation,
absorbable nets, spleen suture, with ligature of segmental vessels and removal of necrotic tissues were implemented and more widely used in traumatic spleen injuries. With the use of the above-mentioned techniques it was possible to avoid splenectomy in 50-75% of blunt abdominal injuries. 90s of the 20th century brought yet another revolutionary change in proceeding with splenic injuries. Nowadays, conservative therapy forms the basis of treating spleen injuries in haemodynamically stable patients, which allows avoiding operational treatment in about 50-60% of all victims with blunt abdominal injuries. Efficiency of such conduct in haemodynamically stable patients reaches 90%, however, in case of failure and necessity to perform operational treatment the number of complications is much greater than in patients, who underwent early operational therapy. The risk of failure in conservative treatment is indicated by improper results of imaging techniques, mainly the ultrasound examinations and computer tomography of the abdominal cavity with contrast medium in the peritoneal cavity and necessity to transfuse blood derivatives.

The strategy we used, which was related with treating haemodynamically stable patients with spleen injuries, where a series of abdominal cavity ultrasound examinations showed a growing amount of fluid, hence the risk of failure related with conservative treatment was considerable, lied in laparoscopic exploration of the abdominal cavity and possible attempt to stop bleeding with the use of minimally invasive techniques saving the splenic parenchyma. This enabled saving splenic parenchyma in about 25% of patients, while other patients had to undergone splenectomy performed with laparoscopic or open technique.

Currently, laparoscopic procedures, which have become more and more popular during the recent 15 years, seem to be a “golden standard” in schedule treatment of spleen injuries. The use of laparoscopic techniques in surgery concerning the organ with such anatomical structure and location within the abdominal cavity like that of the spleen, allows good visualisation of operating field, performing in situ procedure, as well as decreasing a widely perceived perioperational injury. This seems to be particularly important in patients with diseases requiring the removal of the spleen: smaller intraoperative blood loss, smaller operational pain, better postoperative pulmonary activity, earlier restoration of alimentary tract functions, shortening the period of hospitalisation, and as a consequence decreasing the risk of infections. Despite of the above, laparoscopic technique was not widely used in treating spleen injuries. Casuistic reports in literature on laparoscopic treatment of spleen injuries prove the possibility of using this technique, also with saving splenic parenchyma, and our results also confirm the above. The results of the biggest hitherto published group, covering 11 haemodynamically stable patients with multi-organ injury, show that in 6 patients a laparoscopic splenectomy was performed, and in 5 of them bleeding was stopped with saving splenic parenchyma, and only one patient required conversion. These results reason that combination of minimally invasive techniques and therapy saving splenic parenchyma is enforceable in certain proportion of patients. The question, which still remains open, is whether in case of failure in laparoscopic methods of stopping bleeding it shall be better to perform complete splenectomy, or whether after conversion to open operation it is advisable to undertake therapy saving splenic parenchyma.

It is assumed that in order to save functions in immune system it is essential to save at least 30% of the mass of splenic parenchyma properly supplied with blood. From among numerous recommendations for scheduled spleen operations, only in some cases (splenic cysts – except for parasitical ones, benign tumours of the spleen, splenic metastases, spleen infarctions, Gaucher’s disease) treatment saving the splenic parenchyma may be of therapeutic value. In our group of 256 patients treated on schedule surgically due to splenic diseases, only 21 patients (8.2%) with cysts and tumours qualified for this kind of therapy. In 12 of them procedures saving parenchyma were performed – laparoscopic fenestrations in case of cysts, laparoscopic hemisplenectomy in case of splenic tumours and drainage of splenic abscess. As far as haematological diseases resistant to conservative therapy (ITP, haemolytic anaemia, spherocytosis, lymphomas) are concerned, being the most common recommendations for scheduled operational treatment and constituting more than 90% of
patients within our group, retaining splenic parenchyma is usually related with inefficiency of the treatment.

Postoperative complications among patients qualified for laparoscopic treatment saving splenic parenchyma was slightly less often than in patients, who underwent complete laparoscopic splenectomy (7.66% vs. 6.98%). Whereas infectious complications occurred only in case of few patients, who had whole spleen removed (3.68%). This reflects the data in literature (2, 24, 25). Spleen removal, regardless of recommendations or mode of performing the operation is related with increased number of early postoperative complications. This risk is most considerable in cases of the so-called incidental splenectomy, and in patients operated due to gastric carcinoma, colonic carcinoma and during peripheral pancreatic resection (27-33). It is emphasized that performing partial splenectomy does not fully secure against occurrence of infectious complications, and only significantly decreases their proportion. It is assumed that the main reason may lie in retaining an insufficient amount of active splenic parenchyma after wide resections or repeated infarctions within the area of the remained part of the organ. Probably the difference in frequency of complications in patients after complete splenectomy and in patients after procedures saving parenchyma also partially results from heterogeneity of these populations. Acknowledged risk factors related with postoperative complications – preoperative use of steroids, malicious tumours and splenomegaly occurred almost solely in patients who underwent complete splenectomy (25, 26). On the other hand because of inadequate amount of patients undergoing treatment saving parenchyma, we cannot exclude disadvantageous influence of splenectomy on postoperative course, which is reported in literature.

CONCLUSIONS

Utilisation of laparoscopic procedures saving the parenchyma in treating spleen diseases is the right choice only in case of several recommendations. Such a procedure is possible only in certain, quite rare scheduled recommendations, and in selected patients with spleen injuries. Despite the significant proportion of failures related with laparoscopic technique – requiring conversion to open method or performing complete laparoscopic splenectomy – it is worth to try to undertake the treatment with minimally invasive techniques saving the splenic parenchyma, which is related with low proportion of complications, especially infections.

REFERENCES

Spleen parenchyma sparing operations are considered as extremely difficult procedures. Therefore, the need to search for less invasive and more reliable techniques, as compared to laparotomy, are of utmost importance. Thus, high hopes connected with laparoscopy. The Authors of the above-mentioned study presented these issues quite clearly. I would like to congratulate them on the selection of the problem rarely mentioned in literature data. Worldwide, only several dozen of these procedures have been performed. Publications usually concerned isolated cases.

The study is worth attention, due to the large material and wide range of laparoscopic techniques, considering spleen surgery.

The study is very interesting. The aim of the study was to determine the possibilities of the use of the laparoscopic technique in case of spleen parenchyma sparing operations. Additionally, the Authors analyzed all laparoscopic splenectomy operation results, which was not the issue of the above-mentioned study. Detailed analysis of laparoscopic splenectomy results definitely requires another study to be performed.

One should also mention the low percentage of patients where we were able to perform parenchymal spleen sparing laparoscopic operations without conversion to open surgery. The above-mentioned evidence of the low efficacy of laparoscopy, considering parenchymal spleen sparing operations.

The problem concerning laparoscopic splenectomy is also controversial, especially in case of patients with spleen injuries. The Authors seem too optimistic concerning the issue. As it is well-known, treatment of the above-mentioned...
is dangerous, due to the uncertain parenchymal blood supply, and remaining potential source of bleeding. We are not convinced as to the conception of the abdominal approach with the intention of a sparing operation in case of patients after spleen injuries subjected to conservative treatment. Due to the deteriorating general condition of these patients surgery is indicated. Such management usually ends in failure.

The actual problem and greatest obstacle of partial splenectomy were technical difficulties connected with the persistent, difficult to stop bleeding from the severed parenchymal spleen. Considering the latest publications these limitations are rarely observed, due to progress in operative techniques and increasing experience in the use of novel surgical equipment. The introduction of tissue glues, coagulation, both argon and of unipolar radiofrequency, Ligasure equipment, harmonic knife, and linear staplers significantly facilitated local hemostasis, and improved the technique and safety of the above-mentioned operations. Thus, I agree with the Authors of the study that the laparoscopic technique performed in selected cases can limit the number of unnecessary laparotomies.

In conclusion, laparoscopic spleen parenchymal sparing operations are difficult procedures, although might initially seem technically easy, requiring an experienced team, and thus, should be performed in referential centers.

Prof. dr hab. Waldemar Kostewicz
Oddział Chirurgii Ogólnej i Naczyniowej,
Międzyleşme Szpital Specjalistyczny
w Warszawie