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/ IMPRESSUM

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REVIEW

Advanced methods in the surgical treatment of pancreatic tumors

Amir Tursunovic[1]

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ABSTRACT

The basic method of treating patients with pancreatic tumors is surgery, which involves complete removal of the tumor. The growing experience of surgeons and improved technical capabilities make it possible to perform extensive resections without increasing the complication rate. Whipple's pancreaticoduodenectomy remains the standard treatment method for patients with a head tumor or an uncinate process of the pancreas. Modifications of this method that allow preservation of the pylorus do not affect long-term oncological results. Involvement of large arterial vessels was a contraindication for resection in patients with pancreatic tumors. Involvement of the middle mesenteric vein is not in itself a criterion of inoperability. Current surgical practices have described a regional pancreatectomy approach that includes "en bloc" resection of the peripancreatic soft tissue, regional lymph nodes with resection of the portal vein, and the superior mesenteric artery. "Minimally invasive" surgical procedures, performed through a small incision, are preferred in the treatment of pancreatic tumors. The technologies used today are considered the most important developments in modern surgery and offer many advantages for patients and doctors compared to classic open surgery. Laparoscopic and robotic surgery, compared to open surgery, minimize the length of hospital stay and offer the patient a faster recovery.

Keywords: pancreatic tumor, laparoscopic, robotic, surgery

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Introduction

The most important goal in the treatment of patients with pancreatic adenocarcinoma has always been its complete removal. In the last twenty years, the importance of chemotherapy or chemoradiotherapy prior to surgery has increased. Combined with the use of vascular reconstruction techniques, this has enabled the complete removal of tumors that were previously considered inoperable[1]. A pancreatic tumor in the early stage is usually a clinically silent tumor, and symptoms only appear when it affects the surrounding tissues or develops distant metastases. Most patients with pancreatic tumor symptoms are already at an advanced stage when the diagnosis is made[2]. Important access to modern imaging techniques allows proper assessment of the lesion before surgery. Abdominal CT remains the best tool in the initial diagnosis of a pancreatic tumor and assessment of its stage of advancement. The best assessment is achieved by a combination of several methods of organ imaging, such as contrast CT, endoscopic ultrasound, magnetic resonance, and especially MR cholangiopancreatography[3,4]. During an endoscopic ultrasound examination, tissue samples can also be taken, or a fine needle aspiration biopsy can be performed. CT and MRI scans enable the assessment of vascular invasion, the condition of the lymph nodes and the detection of even small metastases (3-5 mm in diameter)[5,6]. Although there are no randomized studies, the results of follow-up studies have shown that in patients with advanced pancreatic tumor involving the portal vein, superior mesenteric vein, and the terminal part of the splenic vein, surgical treatment can increase the 5-year survival rate to 23%, provided that complete recovery is achieved. - R0 resection[7,8]. The growing experience of surgeons and improved technical capabilities make it possible to perform extensive resections without a statistically significant increase in the incidence of perioperative complications, which has been confirmed in numerous retrospective analyses[9,10]. During a classical Whipple procedure, it is technically difficult to remove a tumor on the head of the pancreas that infiltrates the superior mesenteric vein, the portal vein and the terminal part of the splenic vein, because the pancreas cannot be resected in a typical way, i.e. the border of the head and body. Then it is recommended to perform a modified pancreaticoduodenectomy, known as the WATSA (Whipple at the Splenic Artery) procedure[11,12] (Figure 1).

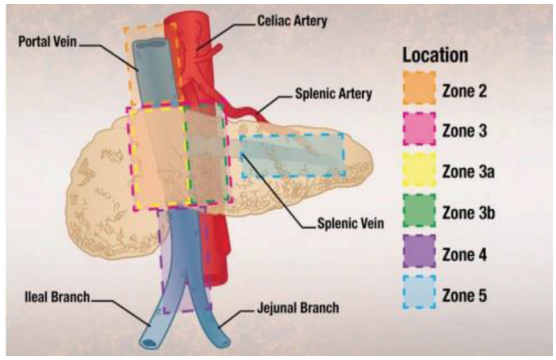

Figure 1. Zones of vein involvement. Zone 1 (not shown) extends from the hilum of the liver to the hepatoduodenal ligament (zone 2). Zone 3 marks the splenic vein/portal vein confluence and is further divided into right (3a) and left (3b). Zone 4 extends inferiorly from the estuary and includes the ileal and jejunal branches. Zone 5 extends along the splenic vein.

During this operation, the resection line of the pancreas is moved to the left by approximately 1-2 cm, to the point where the splenic artery reaches the upper border of the pancreas. The lines of resection of the walls of the portal vein and the superior mesenteric vein then run approximately 1 cm from the tumor. If technically possible, the cut vessels are anastomosed by end to end anastomosis. Otherwise, it is necessary to implant a vein graft or a plastic vascular prosthesis[13,14] (Figure 2).

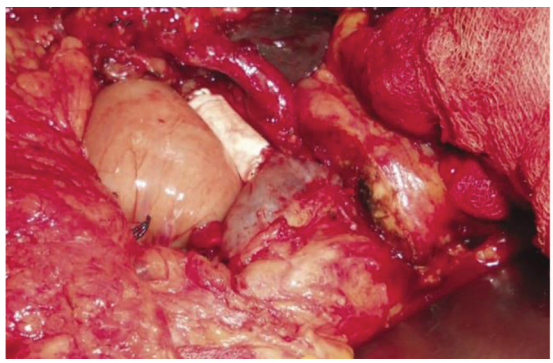

Figure 2. The resected part of the portal vein replaced by a 10mm PTFE prosthesis.

Preliminary results confirm the effectiveness and safety of this method used in pancreatic surgery centers. It enables a higher rate of R0 resections without increasing the rate of perioperative complications. Previous short-term observation of patients undergoing this procedure did not show the development of left portal hypertension after ligation of the splenic vein[15].

Results of previous research

There are more and more reports in the literature that confirm the possibility of vascular reconstruction after extensive tumor resections in the pancreaticoduodenal area. In 2012, Kaneoka et al. described the possibility of using a patient's own vein graft for vascular transplantation, to reconstruct the superior mesenteric vein, the portal vein, the hepatic vein, or the inferior vena cava after extended resection procedures for pancreatic tumors and ampulla of Vater[16]. They determined that the use of autologous material reduces the risk of developing infections, and ensures better patency of the reconstructed vessel compared to that observed after the installation of a prosthesis made of synthetic materials. The great saphenous vein, which is commonly used in vascular surgery, can be used for reconstruction[17] (Figure 3).

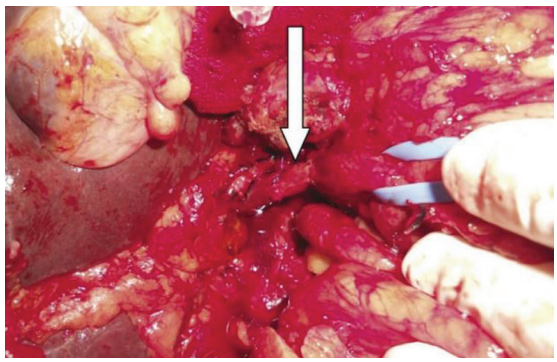

Figure 3. Reconstruction of the resected portal vein with a VSM graft.

The safety of extensive pancreatic head resections combined with resection of the portal vein or superior mesenteric vein has also been demonstrated in many European studies. Müller et al. performed such operations on almost 500 patients with an advanced type of pancreatic tumor, and found the influence of the reconstruction method on the frequency of perioperative complications or mortality. At the time of diagnosis, more than 50% of patients have distant metastases, and the tumor is considered potentially resectable in 15-20%[18]. The European Society of Medical Oncology (ESMO) recommends the inclusion of patients with potentially operable tumors in clinical trials evaluating the benefit of chemotherapy or chemoradiotherapy before surgery. The biological characteristics of pancreatic adenocarcinoma that contribute to its highly aggressive course and rapid formation of distant metastases mean that patients with locally advanced pancreatic tumors may benefit from this type of treatment. There are some papers that present the reduction of the tumor mass, even achieving resectability, thanks to the application of neoadjuvant chemotherapy or chemoradiotherapy in patients with locally advanced tumors with vascular invasion, which were previously considered to be marginally resectable or unresectable[19]. The optimal neoadjuvant regimen has not yet been established, but it is in the phase of clinical trials. Some studies have observed a statistically significant increase in the incidence of perioperative complications among patients who underwent neoadjuvant radiotherapy, although other authors do not confirm this[20]. According to the ESMO, intraoperative radiotherapy remains an experimental method and is not recommended for standard use in patients with pancreatic tumors. The importance of extended lymphadenectomy in lymph node metastases is an independent prognostic factor that worsens the survival rate. Changes in one lymph node do not affect survival compared to those observed in patients without node metastases. Farnell et al. retrospectively analyzed the results obtained in over 400 patients operated on for adenocarcinoma of the pancreatic head. In their case, classic lymphadenectomy was extended to include removal of lymph nodes in the hepatic hilus, para-aortic nodes between the origin of the celiac trunk and the origin of the superior mesenteric artery, nodes located laterally from the origin of the renal arteries, and nodes of the entire circumference of the celiac trunk, superior

mesenteric artery and hepatoduodenal ligament. The authors did not observe any improvement in long-term survival after such surgery[21]. According to current recommendations, including those of the ESMO and the European Society of Digestive Oncology (ESDO), standard lymphadenectomy should be performed, covering the lymph nodes of the right side of the hepatoduodenal ligament, the common hepatic artery, the portal vein, the right side of the celiac trunk, and the right part of the superior mesenteric artery. Infiltration of the retroperitoneal space significantly increases the risk of local recurrence and thus reduces the patient's chances of a full recovery[22]. The term "mesopancreas" refers to tissue located retroperitoneally, outside the pancreas and portal veins, through which pancreaticoduodenal vessels and neural plexuses pass. It extends between the posterior surface of the head of the pancreas and the posterior surface of the superior mesenteric vein and the portal vein, along the right edge of the superior mesenteric artery and the celiac trunk, to the preaortic fascia[23]. The results of the latest research confirm that the removal of this tissue during the Whipple operation significantly increases the percentage of R0 resections performed[24].

Treatment of pancreatic tumor with metastases in the liver

If metastases in the liver are only detected during surgery in a patient treated for a potentially resectable pancreatic tumor, they are classified for palliative treatment. However, advances in modern surgery make it possible to perform resection of the pancreas and liver during the same procedure. No randomized trials have been conducted, but the results of retrospective analyses show that the survival of patients after resection procedures is longer than in patients who only underwent palliative bypass. Klein et al. reported that the median survival time of patients after removal of liver metastases increased compared to that observed after palliative surgery alone. Liver resection undertaken at the same time as pancreatic resection did not increase perioperative mortality, which was below 5%. Such good results are only achieved in centers with extensive experience in pancreatic and liver surgery. Complete simultaneous surgery of the pancreas and liver has a special role in patients with pancreatic neuroendocrine tumors - it increases long-term survival, therefore it is considered the optimal treatment in this group[25].

Use of minimally invasive surgical techniques

Due to the extraperitoneal location of the pancreas and its complex anatomical condition, progress in the introduction of minimally invasive techniques in pancreatic surgery has taken a relatively long time. There was concern that their use would increase the incidence of life-threatening complications, such as intraoperative bleeding or pancreatic fistulas. As surgeons have gained experience and improved surgical technique, it has become easier to avoid such complications. This is confirmed by the results obtained in centers with extensive experience in pancreatic surgery and the application of laparoscopic techniques. In the currently published papers, there are no differences in oncological outcomes between laparoscopic and open operations. Laparoscopic procedures, however, result in statistically significantly less blood loss, and thus less need for blood transfusion, fewer postoperative wound infections, fewer postoperative complications, and shorter hospital stay. It should also be noted that there has been a significant increase in the number of laparoscopic peripheral resections of the pancreas with preservation of the spleen[26].

Conclusion

The goal of modern surgical treatment of patients with pancreatic tumors is the complete removal of the tumor. The growing experience of surgeons and improved technical capabilities allow extensive resections to be performed without a statistically significant increase in perioperative complications. The results of retrospective analyses confirm a prolongation of survival time or an increase in the percentage of complete healing in patients who have undergone extended radical resection of the pancreas. Modern surgical treatment of malignant tumors asks multidisciplinary treatment.

The use of chemotherapy and radiotherapy enables an increase in the percentage of complete resections (R0). Great importance is attached to the wider application of laparoscopic techniques as minimally invasive, safe methods that represent a lower risk of perioperative complications, and enable the achievement of results comparable to those achieved after classical operations. In specialized centers, peripheral laparoscopic resection of the pancreas is now becoming a standard method of treatment for patients with tumors of the body or tail of the pancreas.

Conflict of interests

The author has no relevant financial or non-financial interest to disclose.

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ORIGINAL ARTICLE

Assessment of Dyspnea, ECOG and Karnofsky Performance Scale after VATS Pleurodesis in Patients with Malignant Pleural Effusions

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ABSTRACT

Background: Malignant pleural effusions (MPE) are a pathological build-up of fluid and cancer cells within the pleural space. Patients have a significantly impaired quality and quantity of life, as this condition usually indicates an advanced disease. Video-assisted thoracoscopic (VATS) pleurodesis is a minimally invasive and effective treatment modality for patients with MPE.

Material and Methods: We conducted a retrospective study of 60 patients with MPE treated with VATS pleurodesis. Success rates within a one-month follow-up, the intensity of dyspnea, Karnofsky and ECOG Performance Status Scales before and after the procedure, and length of hospital stay were observed.

Results: VATS pleurodesis had a high success rate at the end of a one-month follow-up. A statistically significant difference was observed regarding the intensity of dyspnea, Karnofsky, and ECOG Performance Status before and after VATS pleurodesis. The average length of hospital stay was 7.5 days for these patients.

Conclusion: Video-assisted thoracoscopic (VATS) pleurodesis is associated with low morbidity and a high success rate and is a reliable treatment modality for patients with MPE.

Keywords: pleural effusion, Video-Assisted Thoracic Surgery, pleurodesis, malignant

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Introduction

Malignant pleural effusions (MPEs) are the second most common type of exudative effusions within the pleural space. Approximately 200,000 patients in the USA, 50,000 patients in the UK, and 100,000 patients across Europe per year suffer from MPI secondary either to direct extension of cancer cells into the pleural cavity or inflammation induced by a malignant tumor[1]. Lung adenocarcinoma and breast cancer account for more than half of all cases of MPE[2].

Patients with MPE are usually treated symptomatically, since this type of effusion usually indicates an advanced disease. In these cases, chemotherapy seems to be generally less effective. Dyspnea is the most common symptom attributable to the effusion, found in more than half of cases. Patients may also present with a non-productive, dry cough, and chest pain due to the involvement of the sensory neurons on the parietal pleura[3]. The assessment of the general physical condition of the patient and performance status in daily activities, i.e. the degree of functional impairment, are evaluated using the Karnofsky Performance Scale Index and the ECOG Performance Status Scale.

A diagnostic pleural tap (thoracentesis) with fluid analysis according to Light's criteria should be the first diagnostic tool to distinguish between transudative and exudative pleural effusion. Exudative effusions are commonly caused by an underlying malignancy, and rarely by an infection, pulmonary embolism, or gastrointestinal disease. However, in some rare cases, malignant effusions can also be transudative, depending on the underlying condition, and due to either increased hydrostatic or low oncotic pressure[4].

Currently, there are several treatment options available for patients with significantly disabling MPE. Consecutive thoracenteses, with the removal of up to 1.5 liters of effusion, are sometimes performed for short-term management of MPE. If the MPE reoccurs, reasonable long-term modalities include chest tube placement, with the instillation of talc slurry, as well as either open or endoscopic, i.e. Video-Assisted Thoracic Surgery (VATS), chemical pleurodesis. Sclerosing agents that are used as chemicals include: talc, tetracyclines, silver nitrate, iodopovidone, autologous blood, cisplatin, etc.

According to the post-procedure radiographic resolution of pleural effusion, as seen on a chest X-ray (CXR), the effectiveness or success of chemical pleurodesis can be either complete, partial, or failed pleurodesis. Successful pleurodesis is defined as the continued absence of re-accumulation of pleural fluid during a follow-up period of 30 days[5].

Material and methods

The study was designed as a retrospective, single-center cohort study of 60 patients with MPE treated with VATS pleurodesis (using either Vibramycin or Talk suspension/powder) within two years at the Clinic for Thoracic Surgery, of the University of Sarajevo Clinical Center. The basic sample consisted of all patients with MPE, treated with VATS pleurodesis, in whom malignancy was determined by a cytology exam of the pleural fluid.

For patients of both genders and over 18 years of age, who had had a recurrent malignant pleural effusion, a Karnofsky Performance Scale Index score equal or greater than 50, predicted life expectancy of at least more than one month, and better subjective and overall condition after the initial thoracic intervention (pleural tap or tube thoracostomy), were included in the study.

On the other hand, the exclusion criteria were: patients who had a Karnofsky Performance Scale Index score lower than 50, poor general condition associated with a predicted life expectancy of less than one month, patients with pleural empyema and visceral pleura thickening, or the inability to achieve complete lung reexpansion and contact between the visceral and parietal pleura due to the existing lung disease, pregnancy, and previous exposure to radiation therapy.

The sclerosing agents used as chemicals for pleurodesis were a suspension of five grams of talc, or five grams of purified, asbestos-free, talc powder (particle size >15 μm), or 1000 to 1500 mg doxycycline, which were

administered to patients during the VATS procedure under general anesthesia.

Patient data included in this study were collected using the medical history of each patient. Categorical variables were expressed as counts and percentages. Independent t-tests were performed to compare the means of the continuous variables with normally distributed data. Alternatively, the Wilcoxon signed-rank test was performed to compare matched paired samples. Statistical analysis was performed using the MedCalc V.12.6.1.0. A p-value less than 0.05 ($p<0.005$) was considered statistically significant.

Results

A total of 19 (32%) male and 41 (68%) female patients were included in this study. The mean age was 60.42±10.39. The youngest patient was 31 years old and the oldest was 80 years old. The most common type of primary tumor associated with the MPE was breast cancer, found in 20 patients (33%), followed by lung and pleural tumors in 13 patients (22%), and lymphomas in nine patients (15%).

The average length of hospital stay for patients treated with VATS pleurodesis was 7.52±1.41 days (ranging from seven to 13 days). VATS pleurodesis was successful in 57 patients (95%) included in our study, whereas partial success was observed in the remaining five patients (5%), observed within 30 days of follow-up.

With the application of the Student's t-test for dependent samples, a statistically significant difference was determined in the value of the Karnofsky Performance Scale Index before and after VATS pleurodesis ($t = 18.05$, $p<0.0001$) (Table 1).

Table 1. Inferential statistics for paired samples t-test: Karnofsky Performance Scale

Karnofsky Performance Scale Index	Before VATS pleurodesis	After VATS pleurodesis
Sample size	60	60
Arithmetic mean	68.0000	82.5000
95% CI for the mean	65.5378 to 70.4622	79.6612 to 85.3388
Variance	90.8475	120.7627
Standard deviation	9.5314	10.9892
Standard error of the mean	1.2305	1.4187

Paired samples t-test

Mean difference	14.5000
Standard deviation	6.2232
95% CI	12.8924 to 16.1076
Test statistic t	18.048
Degrees of Freedom (DF)	59
Two-tailed probability	P < 0.0001

Using the Wilcoxon matched pairs test for dependent samples, a significant difference was observed regarding the intensity of dyspnea before and after VATS pleurodesis (Md=4.00 vs Md=1.00, $z=6.736$, $p<0.0001$) (Table 2).

Table 2. Inferential statistics for the Wilcoxon matched pairs test: Dyspnea

Dyspnea	Before VATS pleurodesis	After VATS pleurodesis
Sample size	60	60
Lowest value	2.0000	0.0000
Highest value	5.0000	3.0000
Median	4.0000	1.0000
95% CI for the median	4.0000 to 4.0609	0.0000 to 1.0000
Interquartile range	4.0000 to 5.0000	0.0000 to 1.0000

Wilcoxon test (paired samples)

Number of positive differences	0
Number of negative differences	60
Large sample test statistic Z	6.735867
Two-tailed probability	P < 0.0001

The Wilcoxon signed-rank test for dependent samples showed a statistically significant difference regarding the ECOG Performance Status Scale in patients before and after VATS pleurodesis (Md=3.00 vs Md=1.00, z=6.780, p<0.0001) (Table 3).

Table 3. Inferential statistics for the Wilcoxon matched pairs test: ECOG Performance Status Scale

ECOG Performance Status Scale	Before VATS pleurodesis	After VATS pleurodesis
Sample size	60	60
Lowest value	1.0000	0.0000
Highest value	4.0000	2.0000
Median	3.0000	1.0000
95% CI for the median	3.0000 to 3.0000	0.0000 to 1.0000
Interquartile range	2.0000 to 3.0000	0.0000 to 1.0000

Wilcoxon test (paired samples)

Number of positive differences	0
Number of negative differences	60
Large sample test statistic Z	6.679959
Two-tailed probability	P < 0.0001

Discussion

Pleurodesis is a procedure that aims to obliterate the pleural space in patients where air or recurrent and excessive intrapleural fluid with cancer cells may build up. In our study, breast cancer was the most common type of primary tumor associated with the MPE, observed in a third of our patients. A single-center, retrospective study by Hirata et al., demonstrated that breast cancer was the second-ranking cause of MPE, with up to 11% of these patients having MPE during their disease[6].

MPE gives rise to dyspnea, cough, and chest pain, which leads to a reduced activity level and an overall decrease in quality of life. VATS pleurodesis with sclerosing agents provides reliable and effective palliation of malignant pleural effusion, with high success rates. Every patient in our study who underwent VATS pleurodesis had either a complete (57 patients, 95%) or partial success (three patients, 5%), i.e. resolution of symptoms, within a one-month follow-up. Earlier prospective studies by Musch et al. and Van Belle et al. demonstrated a 30-day success rate of 75% and 91% in patients with breast cancer and MPEs treated with VATS pleurodesis[7,8]. One recent retrospective, single-center study of 135 patients with MPE, treated with VATS (talc) pleurodesis, showed a somewhat similar result: 78.4% of patients were pleural effusion-free at a one-month follow-up[9].

The mean length of stay for our patients was 7.5 days, whereas some studies reported a prolonged stay of up to 10.4 days - mostly due to post-operative air space, air leak, empyema, and prolonged intercostal catheter drainage[10]. The most common postprocedural complications in our patients, which may be attributed to the prolonged duration of stay, were as follows: accidental removal of a chest tube in three patients (5% of cases), fever in two patients (3.3% of cases), and procedure-related acute respiratory failure and chest pain in two patients (3.3% of cases).

Quality and quantity of life are significantly impaired in patients with MPEs, and proper control and alleviation of symptoms is the primary goal of care in these patients. In our study, the Karnofsky and ECOG Performance Status Scales, and the intensity of dyspnea showed statistically significant differences before and after pleurodesis. A retrospective analysis of a database collected prospectively from June 2004 to July 2014 by Mingarini Terra et al. showed that after VATS pleurodesis, there was a significant improvement in respiratory symptoms, physical domain, and the general health of patients compared to the preprocedural state[11].

Conclusion

VATS pleurodesis is associated with low morbidity and a high success rate, especially within the first month after the procedure. It is a generally safe and reliable, minimally invasive option in a selected group of patients, that significantly reduces hospital stay, improves the patients' general condition, and alleviates debilitating symptoms, especially dyspnea.

Conflict of interests

The authors have no relevant financial or non-financial interest to disclose.

Patient Consent Form: All participants were informed about subject of the study.

Author's Contributions: Alma Alihodžić-Pašalić: Conceptualization, Data curation, Visualization, Investigation, Writing. Orhan Čustović: Conceptualization, Investigation, Software, Writing. Ilijaz Pilav: Validation, Methodology. Alen Pilav: Conceptualization, Methodology. Ademir Hadžismailović: Data curation, Investigation. Kenan Kadić: Data curation, Investigation. Meho Dapčević: Data curation, Investigation. Veljko Marić: Methodology, Validation.

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PROFESSIONAL PAPER

The frequency of rupture in undiscovered aneurysms of the abdominal aorta

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ABSTRACT

Background: Abdominal aortic aneurysm rupture remains a major challenge and is one of the most urgent conditions in medicine. The prevalence of abdominal aortic aneurysm is between 4.0%- 8.0% in studies related mainly to men. That is why we perform study to determine the frequency of ruptures in previously unrecognized abdominal aortic aneurysms in the total sample.

Material and Methods: The study was designed involving patients of the Clinic for Cardiovascular Surgery at the Clinical Center of the University of Sarajevo, who underwent surgery for rupture of an abdominal aortic aneurysm.

Results: Of the total of 71 patients admitted due to a ruptured abdominal aortic aneurysm, in 59 the abdominal aortic aneurysm had not been recognized, that is, 83.1%. The most common rupture position was on the left retroperitoneally, in 45 or 63.4% of cases, then on the right retroperitoneally in 16 or 22.5%. The rarest site was intraperitoneal in 10 or 14.1%. The average size of AAA in the total sample (N=71) was 8.2±1.8 cm.

Conclusions: In most patients the abdominal aortic aneurysm had not been previously recognized. In the largest number of patients the position of the rupture was on the left retroperitoneally. Most patients who died had an intraperitoneal rupture.

Keywords: rupture, abdominal aortic aneurysm, unrecognized, position

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Introduction

The prevalence of abdominal aortic aneurysm is between 4.0%- 8.0% in studies related mainly to men. Abdominal aortic aneurysms (AAA) detected at screening are in most cases small in diameter. Aneurysms of 5.5 cm or larger were only found in 0.4%-0.6% of patients examined[1]. One study conducted in a male population aged 65-74 showed an incidence of AAA of 55 per 100,000 people, increasing to 112 per 100 000 people for men aged 75-85[2]. The same study showed a further increase of 298 per 100,000 people over 85 years of age[3]. The predictive values of hypertension, age, gender, beta-blocker use, and diabetes mellitus are inconsistent. However, most studies have shown a negative association between diabetes mellitus and aneurysm growth[4]. Perioperative mortality and morbidity, as well as other complications, were determined by the degree of urgency, comorbidities, the type of reconstructive procedure, and other factors[5]. The rate of expansion of the abdominal aortic aneurysm remains unchanged. In the male population with a detected sub-aneurysmal aorta (2.6 to 2.9 cm), 57.6% developed an abdominal aortic aneurysm greater than 3.0 cm in the subsequent 5 years. Twenty-eight percent developed a large abdominal aortic aneurysm (>5.5 cm) within 15 years[6]. Population screening studies provide the best evidence to determine the prevalence of AAA. The prevalence varies depending on age, and gender, as well as geographical location. The population prevalence of AAA is three times higher in men than in women. Smoking is closely related to the expansion of the aneurysm[7]. Factors related to AAA growth across multiple studies include: chronic obstructive pulmonary disease (COPD), fat metabolism disorder, and unregulated body weight. Other, less studied factors are: alcohol use, genetics, Chlamydia pneumonia, use of certain drugs (NSAIDs, angiotensin II blockers, angiotensin-converting enzyme inhibitors, roxithromycin, and corticosteroids), positive medical history of peripheral blood vessel disease, organ transplantation, height, and physical activity[8].

The predictive values of hypertension, age, gender, beta-blocker use, and diabetes mellitus are inconsistent. However, most studies have shown a negative association between diabetes mellitus and aneurysm growth[8].

The objectives of this study were to determine the percentage of ruptures in primarily unrecognized abdominal aortic aneurysms, to find any correlation between the rupture position and its impact on the patient's outcome, and to determine the influence of age on the size of the AAA.

Material and methods

The study was designed in the form of classical retrospective clinical-analytical observational research. The research was conducted at the Clinic for Cardiovascular Surgery of the Clinical Center of the University of Sarajevo (UKCS). The study included patients who were admitted to an emergency room due to a ruptured abdominal aortic aneurysm from 2020 to 2023. A total of 88 patients were included in the study, 74 male and 14 female patients. Selection for abdominal aortic aneurysm rupture surgery was performed on the basis of a clinical examination by a specialist, confirmation of the diagnosis by CT angiography, and confirmation of the existence of indications for that procedure. All the patients underwent a surgical procedure that implied unconditional and uncompromising adherence to proper aseptic work in the operating rooms, as well as in the surgical station and intensive care.

The study was conducted on the basis of a special registry created for each patient containing anamnestic data, data from the specialist's physical examination, and data on the local status of the patient taken at admission (before surgery).

On the basis of the exclusion criteria, 17 patients were eliminated, and 71 patients of both sexes were included in the definitive study, 63 male patients and 8 female patients. All the patients were monitored from the moment of admission to the hospital until the moment of discharge from the hospital, or possible transfer to another hospital or clinic. The criteria for inclusion in the study included the following: rupture of the abdominal aortic aneurysm, confirmed diagnosis, no previous AAA repair, infrarenal

aneurysm, and the existence of complete data in the register. The exclusion criteria from the study included the following: a lack of the necessary medical documentation, patients with symptomatic aneurysm without rupture, non-ruptured aneurysms, traumatic aneurysms, iatrogenic aneurysms, and hereditary disorders

Patients with significant comorbidities that could affect the outcome or complicate the interpretation of results, previous aortic surgery, and pregnancy were excluded.

Retrospective analysis observed the parameters that demonstrated the quality and character of the course of the examined pathological change, that is, rupture of the abdominal aortic aneurysm.

The parameters taken were recorded based on anamnestic data for each patient taken from the medical records archives available at the cardiovascular surgery clinic of UKCS. The parameters included: age, sex, the size of the aneurysm, aneurysms in other localization, patient outcome and rupture position.

Furthermore, all these data were used to determine any correlations or risk factors for the occurrence of an aneurysm or its rupture. Moreover, we used the data to determine the correlation between the position of the aneurysm rupture and the patient's outcome.

Statistical analysis

Testing of statistical differences and impacts was performed using the Student's t-test, chi-square test and Pearson's coefficient of linear correlation. The results of all these tests were considered statistically significant at a 95% confidence level or where $p<0.05$. The analysis was carried out using the IBM Statistics SPSS v 23.0 statistical package

Results

The analysis of the age of the respondents of our study showed that the average age of the total sample (N=71) was 70.6± 9.7, where the age of the youngest patient was 51 years, and the oldest respondent was 94 years old at the time of admission to the clinic.

Analysis of gender representation from the total sample (N=71) showed that men were significantly more represented, with 63 men or 88.7% of cases, compared to eight women, 11.3%.

Table 1. The Relationship between Recognized and Unrecognized Abdoimnal Aortic Aneurysms

Aneurysm		
	N	%
Unrecognized	59	83
Recognized	12	16.9
Total	71	100

On the basis of the analysis in our study, based on the data from the UKCS archives, we found a significant correlation between the non-timely recognition of an abdominal aortic aneurysm and its rupture. Namely, we found that out of the total of 71 patients who were admitted due to a ruptured abdominal aortic aneurysm, in 59 of them the abdominal aortic aneurysm had not been previously recognized, that is in 83.1%, compared to 12 patients, or 16.9% who had a previously recognized abdominal aortic aneurysm that had not been electively resolved.

Table 2. Correlation between Abdominal Aortic Aneurysm Size and Fatal Outcome

Aneurysm size (cm)						
	N	Average	SD	I AM	Minimum	Maximum
Survivors	59	8.08	1.60	0.21	4.30	12.60
Exitus Letalis	12	8.48	2.57	0.74	4.20	13.00
Total	71	8.15	1.78	0.21	4.20	13.00

Our analysis found that the average size of the aneurysm in the total sample (N=71) was 8.2±1.8 cm. The smallest ruptured aneurysm measured was 4.2 cm, and the largest was 13 cm.

Table 3. Abdominal Aortic Aneurysm Rupture Positions

Rupture position		
	N	%
Intraperitoneal	10	14.1
Retroperitoneal - left	45	63.4
Retroperitoneal - right	16	22.5
Total	71	100.0

The most common position of rupture was on the left retroperitoneallyin 45 or 63.4% of cases, then on the right retroperitoneally in 16 or 22.5%, and the rarest was intraperitoneal in 10 or 14.1%.

Table 4. Correlation Between Intraperitoneal Rupture and Fatal Outcome

Outcome * Rupture position					
			Rupture position		Total
			Other locations	Intraperitoneal	
Outcome	Survivors	N	57	2	59
		%	93.4	20.0	83,1
	Exitus letalis	N	4	8	12
		%	6.6	80.0	16,9
Total		N	61	10	71
		%	100,0	100.0	100.0

The analysis of fatalities in relation to the rupture position shows that as many as 80% of patients with intraperitoneal rupture had a fatal outcome, compared to only 6.6% of patients with rupture in other positions (retroperitoneal L and R).

Discussion

Abdominal aortic aneurysm rupture remains a major challenge and is one of the most urgent conditions in medicine. In Germany, there were 2410 cases of rupture of the abdominal aortic aneurysm in 2010[9]. Abdominal aortic aneurysm rupture should most commonly be suspected in patients over 50 years of age who complain of abdominal or back pain, and in whom a pulsating abdominal mass, consistent with systole, can be observed during a physical examination[9]. Abdominal aortic aneurysm most commonly ruptures posteriorly into the retroperitoneal cavity, anteriorly into the intraperitoneal cavity, and, in rare cases, into the abdominal veins of the intestine. The different positions of the rupture determine the variety of common and rare symptoms and signs we see in patients with ruptured abdominal aortic aneurysms. Recognition of these diverse clinical presentations will lead to earlier diagnosis and timely intervention, which may have a positive impact on the high mortality rate associated with abdominal aortic aneurysm rupture[10]. Analysis of the ages of the respondents in our study shows that the average age of the total sample (N=71) was 70.6± 9.7, where the age of the youngest patient was 51 years, and the oldest respondent was 94 years old.

Analysis of gender representation in the total sample (N=71) shows that men were significantly more represented, with 63 or 88.7%, compared to women, of whom there were eight, which is 11.3% of cases[11, 12].

The incidence of rupture is far higher in patients with unrecognized aneurysms, which results in increased mortality from this condition (Table 1). It emerges that the greatest problem is the lack of screening and the non-recognition of symptoms, as well as the lack of theoretical knowledge about this disease. In our study, we tried to determine the correlation between aneurysm size and patient death (Table 2). Namely, out of the total number of patients (N= 71), 59 or 83.1% survived the surgery, while 12 or 16.9% of patients had a fatal outcome. The most common position of the rupture was on the left retroperitoneally (Table 3) in 45 or 63.4% of cases, then on the right retroperitoneally in 16 or 22.5%, and the rarest was intraperitoneal in 10 or 14.1%.

The analysis of fatalities in relation to the rupture position shows that as many as 80% of patients with intraperitoneal rupture (Table 4) had a fatal outcome, compared to only 6.6% of patients with ruptures in other positions. Of the total number of patients admitted to the Clinical Center of the University of Sarajevo, the largest number of patients underwent surgery and survived - 55 or 77.5% of cases, in four or 5.6% of cases the patients were transferred to other centers for treatment, while 16.9% had a fatal outcome. This is considered to be affirmative because mortality from AAA rupture, depending on the report, is estimated at 70-90%[13]. Also, a comparison of mean age versus death shows that patients with exitus letalis were significantly older (75.4±8.7 years; range 65-94 years) compared to patients who survived (69.6±9.7 years; range 51-89 years). Statistical analysis using the Student's t-test and Pearson's linear correlation coefficient showed that there was a statistically significant difference, as well as a correlation between death and age ($p<0.05$). This can be explained by the greater number of comorbid conditions in the elderly population.

Conclusion

Most patients did not have a previously recognized abdominal aortic aneurysm. The share of abdominal aortic aneurysms in our study was 83.1%, which confirms our hypothesis. Most of the patients were male. Men accounted for 88.1% of the total sample. All the patients were elderly. Statistical analysis showed that the average age was 70.6± 9.7. In most patients, in 63.4% of cases, the abdominal aortic aneurysm ruptured on the left retroperitoneally.

The highest number of deaths occurred in patients who had intraperitoneal rupture of the abdominal aorta. We showed that as many as 80% of the deaths were due to intraperitoneal rupture of the abdominal aorta.

Conflict of interests

The authors have no relevant financial or non-financial interest to disclose.

Patient Consent Form: All participants were informed about subject of the study.

Author's Contribution: Ali Gavrankapetanovic: Data curation, Visualization, Investigation, Writing-Reviewing, Edin Hodzic: Data curation, Visualization, Investigation, Bekir Rovcanin; Conceptualization,-Methodology, Sanela Brzika: Data curation, Investigation, Admir Bektesevic; Conceptualization, Methodology, Amel Hadzimehmedagic; Writing-Original draft, Supervision.

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CASE REPORT

Laparoscopic ELAPE: a case report and review of the literature

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ABSTRACT

Extralevator abdominoperineal excision (ELAPE) is relatively new method of surgical treatment for low and ultra-low rectal cancers. Combined with the laparoscopic technique, laparoscopic ELAPE (LELAPE) has the potential to reduce invasion and hasten postoperative recovery.

A laparoscopic approach to the resection can result in fewer postoperative complications, and the modified ELAPE reduces the perineal complications, simplifies the operation and accelerates patient recovery. Here, we report the case of a patient who underwent a laparoscopic ELAPE procedure for cancer, which was the first laparoscopic ELAPE procedure in Bosnia and Herzegovina.

Keywords: Extralevator abdominoperineal excision, rectal cancer, perineal dissection, levators.

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Introduction

Extralevator abdominoperineal excision (ELAPE) or cylindrical abdominoperineal excision (CAPE) has been reported to effectively reduce high rates of bowel perforation and positive circumferential resection margin (CRM) in conventional APR[1].

This technique aims to reduce the rates of CRM+ by expanding the area of resection, including resection of the anal canal, all of the levator ani muscle, and the lower mesorectum[2].

Conventional abdominoperineal excision for low rectal carcinoma, because of the retained levator muscles, and due to rectal perforation, or the positive circumferential resection margin (CRM), led to the high risk of local recurrence and lower survival. However, an extralevator abdominoperineal excision (ELAPE) may be more feasible through en bloc resection of the levator muscles covering the distal mesorectum and the removal of more tissue in the distal rectum. This technique may increase the incidence of postoperative perineal wound complications, urinary and sexual dysfunction, and the occurrence of chronic pain in regio perinealis[3].

Early reports suggest that ELAPE can improve patient prognosis without a significant increase in morbidity with superior oncological outcome, as compared to standard techniques[4].

Case Report

Under general anesthesia, the patient was first placed in the Trendelenburg position (30°) with a right lateral tilt (15–20°). The operator stood on the right side of the patient, the first assistant on the left, and the camera holder on the cranial side. The pneumoperitoneal pressure was set at 12 mmHg, and the port sites were placed as shown. In detail, a 10 mm trocar was inserted above the umbilicus as the observation site, a 12 mm or 10 mm main operating port was made about 5 cm below the umbilical level on the right midclavicular line, and a 5 mm assistant trocar was inserted at the umbilical level on the same line. At the planned site for the sigmoid colon stoma, a 5 mm trocar was placed for the assistant, which was later lengthened for the colostomy. Another 5 mm trocar was inserted 2 cm above the pubic symphysis for assistance.

Using a harmonic scalpel, the corresponding part of the mesorectum of the rectosigmoid was resected, while displaying and managing the hem-o-lock clips of the main blood vessels and displaying the left ureter. Further preparation of the mesorectum continued according to the principles of Total Mesorectal Excision (TME), reaching the posterior wall of the uterus, and stopping there. Hemostasis control and toileting were performed (Figure 1 and 2).

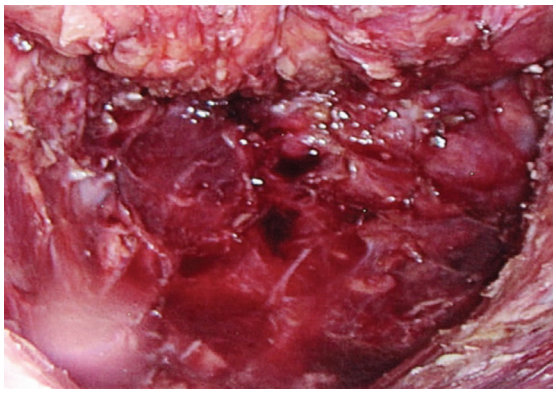

Figure 1. Dissection of the rectum (anterior).

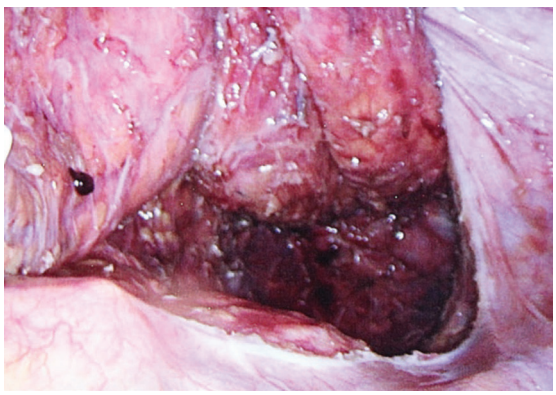

Figure 2. Dissection of the rectum (posterior).

The inferior mesenteric artery and vein were identified, and a section was made between them distally from the origin of the superior rectal artery (Figure 3). Subsequently, dissection of the rectum was performed.

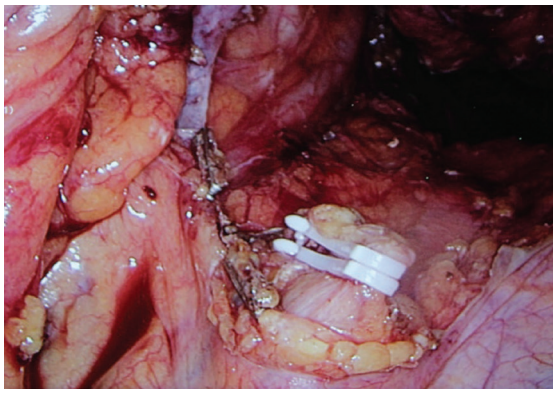

Figure 3. Inferior mesenteric artery secured by Hem-o-lok XL clip.

The rectum was freed from the presacral fascia while preserving the integrity of the presacral venous plexus. The rectum was dissected deep into the pelvis. Laterally, the rectum was dissected to the levator ani muscles, with sectioning of the lateral rectal ligaments and the middle hemorrhoidal arteries and veins. Posteriorly, the rectum was dissected to the tip of the coccygeal bone. Then, the rectum was resected at the level of the rectosigmoid junction (Figure 4).

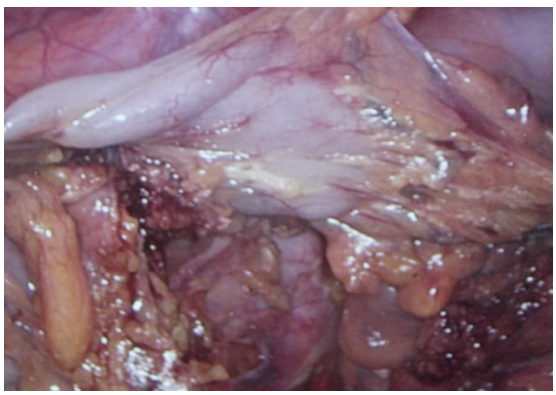

Figure 4. Rectum prepared for resection.

The oral end was brought out as a terminal left-sided iliac colostomy in the area of the left rectus abdominis muscle, at the border of the middle and left third of the interspinal line (Figure 5). (The incision was anterior to the rectal vagina in a cross shape, longitudinally 3-3.5 cm and transversely 2 cm).

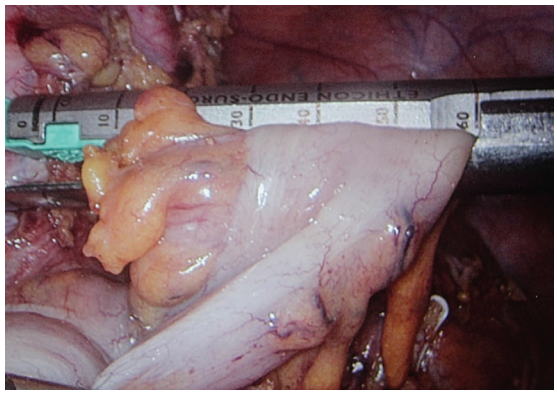

Figure 5. Resection of the rectosigmoid colon with endo GIA stapler.

The perineal steps of the operation were as follows: the patient's position on the table was changed. The patient was placed in the Jackknife position. This was followed by a wide extralevator excision of the anorectum, completing the excision of the rectum. An elliptical incision was made around the anus in the skin and subcutaneous tissue (Figure 6). In the region of the tip of the coccygeal bone, a transverse incision was made along Waldayer's fascia and the anococcygeal ligament. After that, entry was made into the retrorectal space. The posterior wall of the rectum was dissected from the presacral fascia. The middle sacral artery and vein were ligated and severed. Bilateral incisions were made in the rectococcygeal muscles. Access was made to the ischiorectal space. The inferior hemorrhoidal artery and vein were ligated and severed. The lateral walls of the rectum were sharply dissected from the edges of the levator muscles on the left and right. The rectal stump was pulled out, and the rectum freed. The puborectal muscle was cut along the anterior wall of the rectum, and the rectum removed with the anus.

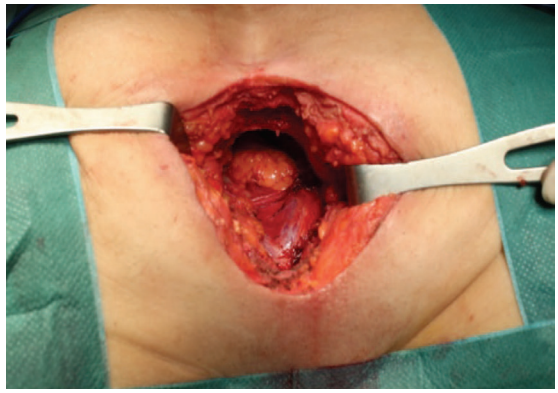

Figure 6, a and b. Perianal extirpation of rectosigmoid colon.

Figure 7, a and b. Closed perianal wound (Jack-knife position) and a stoma was performed on the anterior abdominal wall.

The perineal wound was sutured with individual stitches of subcutaneous tissue and skin with drainage. Douglas' pouch was drained. The incision wounds were sutured. The stoma was performed on the anterior abdominal wall. (Figure 7).

Discussion

The prone jackknife position provides a better surgical field to the surgeon, enabling comfortable manipulation. In addition, the improved visual field helps the surgeon to clearly define the resection range, which in consequence reduces the incidence of intestinal perforation. Meanwhile, vascular and genital nerve injury can be avoided and thus the incidence of intraoperative bleeding and sexual dysfunction reduced[5].

The extralevator abdominoperineal resection (ELAPE) lays emphasis on precise anatomy and complies with the principle of radical resection of tumors and results in a reduced rate of intraoperative perforation, positive CRM and local recurrence, compared with the conventional abdominoperineal resection(cAPR) procedure[6].

The prone jackknife position enables sharp, standardized, and direct vision for resection of the rectal stump, which ensuring en bloc excision of the primary tumor, less CRM positivity, and lower perforation rates. Since the levator ani muscles are resected by laparoscopy, the perineal phase of the prone jackknife position is easier. In addition, this modified technique reduces blood loss and operative time, and the oncological benefits are greater than with classic APR[7].

A positive circumferential resection margin is associated with a high risk of local recurrence and distant metastasis after total mesorectal excision for rectal cancer. The mesorectum is thinner anteriorly than posteriorly, and the risk of a positive resection margin may be higher for anterior than for posterior tumors[8].

Conventional abdominoperineal resection (APR) has a high rate of local recurrence. Extralevator abdominoperineal excision (ELAPE) can potentially diminish the rate of intraoperative tumor perforation (IOTP) and can provide wider circumferential resection margins (CRM), but at the price of a higher perineal complication rate[9].

ELAPE could decrease the rate of positive circumferential resection margins and intraoperative perforation and may further decrease local recurrence rate and improve survival.

Conclusion

The surgery was performed without any adverse events. The patient was discharged seven days after surgery, with one day intensive care unit monitoring, with no signs of complications. Clinical follow- up performed at one week, and one and three months after surgery showed a satisfactory result. This case report is limited to the eight patients we have treated in a three year period.

We found no significant differences between the two procedures regarding wound-related complications. In conclusion, it can be said that this procedure is superior to abdominoperineal resection, and should be standardized in our center in the future.

Conflict of interests

The authors have no relevant financial or non-financial interests to disclose.

Patient Consent Form: All participants were informed about subject of the study.

Author's Contributions: Haris Kuralic: Data curation, Visualization, Investigation, Writing. Enes Idrizovic: Data curation, Conceptualization, Investigation Sara Ganić: Data curation, Investigation.

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CASE REPORT

Incarcerated Rectal Prolapse - how to treat this acute surgical condition?

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ABSTRACT

The standard surgical procedure for rectal prolapse is laparoscopic and robotic-assisted ventral rectopexy using prolene mesh. However, very rarely there may be patients with incarcerated rectal prolapse, a condition which is urgent and presents a challenge to surgeons.

We present a case of a large incarcerated rectal prolapse treated using the open method, by posterior rectopexy, using prolene mesh.

Keywords: rectal prolapse, ventral rectopexy, posterior, mesh.

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Introduction

Rectal prolapse is a condition which always requires surgical intervention. The standard surgical procedure for rectal prolapse today is laparoscopic and robotic-assisted ventral rectopexy using prolene mesh[1]. However, very rarely there may be patients with incarcerated rectal prolapse, a condition which is urgent and presents a challenge to surgeons.

Case Report

A seventy-year-old woman was admitted as an emergency to the Clinic for Surgery due to incarcerated rectal prolapse (Figure 1). After application of a spasmolytic, manual reposition was attempted, but without success and it was decided to perform emergency surgery. Explorative laparotomy was performed and, with synchronous traction of the rectosigmoid bowel and gentle external pressure on the incarcerated part of the bowel, manual repositioning was achieved.

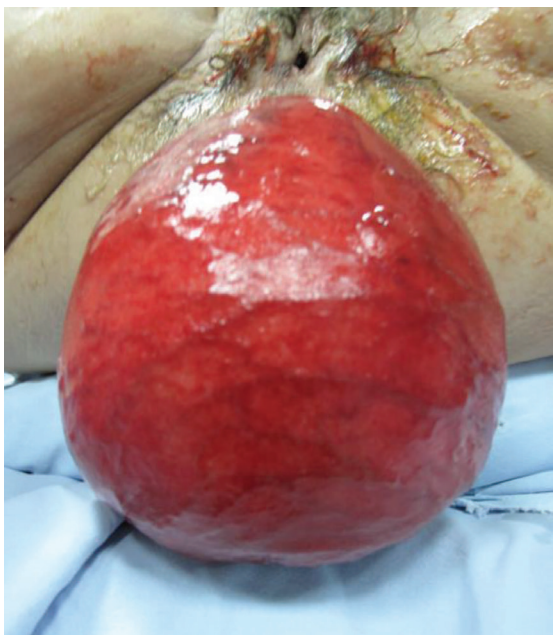

Figure 1. The incarcerated rectal prolapse in the form of a ball sized 20 x 20 cm.

After that, posterior rectoplexy, according to Notaras, was performed, with placement of prolene mesh, 3 x 2 cm, which was fixed between the posterior rectal wall and the sacral promontory, with a 2-0 prolene suture (Figure 2).

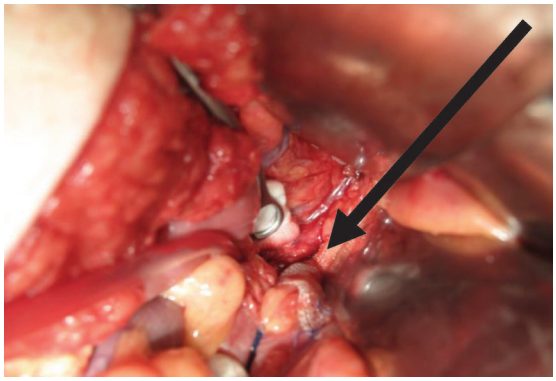

Figure 2. The mesh placed on the posterior rectal wall fixed to the sacral promontory.

During her time in hospital the patient was stable, on the second day after surgery she began liquid food, and on the seventh day she was discharged.

Discussion

The precise cause and mechanism of rectal prolapse has not been established. Pregnancy, obesity, injuries to the perineum, chronic constipation or other conditions result in an increase in intraabdominal pressure and lead to rectal prolapse. Anatomical variations such as a deep cul-de-sac of Douglas or dolichosygma may also be the cause[2]. Preoperative Preparation in elective patients includes a physical examination, colonoscopy, anoscopy, anal manometry and defecography[3].

Non-surgical treatment includes using supplements rich in fibre, fibre intake, which are useful in minor (first or second degree) rectal prolapse and may help with constipation or incontinence before surgery in patients with complete prolapse.

In practice there are various surgical methods used to resolve rectal prolapse. Transabdominal

procedures were previously the method of choice in all healthy patients, regardless of their age. Perineal procedures (such as ligation, mucosal excision) may be performed in patients with total prolapse who are not candidates for the transabdominal approach and those with second or third degree prolapse[4].

Laparoscopic ventral rectopexy is now the standard and has a relapse rate of less than 5%, similar to posterior rectopexy. The advantages of the laparoscopic approach are lower morbidity and shorter hospital stay, as well as the reduced likelihood of re-occurrence of constipation5. A meta analysis comparing laparoscopic rectopexy with the open method showed no statistical differences in relapse, incontinence or constipation between the two methods.

Ventral rectopexy using prolene mesh is now the accepted and standardized for treatment of prolapse of pelvic organs. The combined benefits of the laparoscopic approach and ventral rectopexy have made the procedure safe and effective, with minimal post-operative functional difficulties[6,7]. During ventral rectopexy, fixation of the posterior vaginal fornices to the lowest point of the mesh additionally strengthens the pelvic floor. Today robot-assisted ventral rectopexy is gradually becoming the standard.

However, the question remains of surgical treatment of incarcerated rectal prolapse. Several surgical approaches are possible, but there is no consensus regarding which approach is best for the patient, because this depends on the patient's condition, the occurrence of relapse, bowel function and the surgical risk itself. Cases have been described of incarcerated rectal prolapse which were treated by abdominal laparotomy then resection of the sigmoid colon and posterior rectopexy using prolene mesh fixed to the sacrum[8].

Experience has shown that in irreducible rectal prolapse, surgery should be performed in the shortest possible time[9].

When considering treatment, the discussion includes observation of the condition of the congested incarcerated bowel, and perineal proctosigmoidectomy is proposed after determining the risk of dehiscence or loosening of the anastomotic line[10].

This case shows that open rectopexy remains the treatment choice in cases of incarcerated prolapse which cannot be resolved by manual manipulation, and we believe that it is the method of choice for resolving this condition.

Conflict of interests

The authors have no relevant financial or non-financial interests to disclose.

Patient Consent Form: The participant was informed about subject of the study.

Author's Contributions: Samir Delibegovic: Data curation, Visualization, Investigation, Writing. Haris Kuralic: Data curation, writing.

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INSTRUCTIONS TO AUTHORS__

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