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CONTENTS

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ROBOTIC VERSUS CONVENTIONAL LAPAROSCOPIC TECHNIQUE FOR THE TREATMENT OF COLORECTAL CANCER DISEASE

Igor Černi

ABSTRACT

Background: Robotic surgery addresses many of the technical and ergonomic limitations of laparoscopic surgery, but the literature regarding clinical outcomes in colorectal surgery is limited. The purpose of this study is to analyze the differences between laparoscopy and robotics for colorectal cancer in terms of oncologic and clinical outcomes in an initial experience.

Methods: In our study we analyzed and compared two group of patients operated robotically and laparoscopically. 85 patients operated robotically (49% female, 51% male). The average age was 63.5 years, 110 patients operated laparoscopic operations (64% male, 36% female), the average age was 65.5 years.

Results: In all patients radical resection has been done. The average number of isolated lymph nodes in the robotic method was 19 while in laparoscopic method was 15,5. The hospitalization was shorter in robotic operated patients (average 7,3days), on the other hand the time of the robotic operations was longer than laparoscopic operations. Intraoperative blood loss was in the robotic method smaller (50-120 ml) in comparison with laparoscopic method (100-300 ml). Conversion to open surgery was in robotic method lower (4,5%) than in laparoscopic method (7%). Laparoscopic method has more frequent complications 9 (10,3%) while robotic method 4 (9%). In 10 years follow up 9 laparoscopically operated died (10,3%), (5 due to cardiovascular disease, 4 due to progression of disease). In this period 3 robotically operated patients died (6%), one due to progression of disease, the others due to cardiovascular disease. The most common operation was right hemicolectomy (46%) by laparoscopic procedure, in the robotic method was anterior resection of rectum (54%).

Conclusion: Robotic colorectal surgery (RCS) is a promising technique and is safe and effective alternative to laparoscopic colorectal surgery. The advantages of RCS include reduced EBLs, lower conversion rates and shorter times to recovery of bowel function. Further studies are required to define the financial effects of RCS and the effects of RCS on long-term oncologic outcomes.

Keywords: robotic surgery, colorectal cancer, oncologic outcomes

INTRODUCTION

Robotic surgery for colorectal cancer has been widely accepted in recent years [1,2]. It has emerged as minimally invasive alternative to traditional laparoscopy. Robotic surgery addresses many of the technical and ergonomic limitations of laparoscopic surgery, but the literature regarding clinical outcomes in colorectal surgery is limited. The purpose of this study is to analyze the differences between laparoscopy and robotics for colorectal cancer in terms of oncologic and clinical outcomes in an initial experience We present our initial observations and results of robotic operations of the large intestine with special regard to the patient undergoing robotic surgery of the colon, rectum cancer and compare to the laparoscopic.

METHODS

The first totally robotic-assisted resection of rectum cancer in our department in Slovenia (single docking system with da Vinci SI system) was performed in May 2014. The last patient in 2020 was operated on before the outbreak of SARS-CoV-2 virus infection, and then no robotic operations were performed until September 2022. Due to the lack of staff, we only carried out emergency operations. After that, we started again and more than 100 operations of colon and rectum have been done. Retrospectively we analyzed 85 patients operated robotically, (49% female, 51 % male). The average age was 63,5 years. 62 % had ASA classification II, colorectal carcinoma was presented in 76 % patients, the others had diverticulosis and benign diseases. Carcinoma of rectum and recto-sigmoid colon was presented in 62% of patients. Retrospectively we analyzed 110 laparoscopic operations as well (64 % male, 36 % female), the average age was 65,5 years. 40 % of the patients had ASA classification III. Adenocarcinoma were presented in 75 % patients, the others had diverticulosis and benign diseases. The degree of differentiation of the tumor (gradus II) in laparoscopic method was presented in 67 % patients, while in robotic method was presented in 68 % patients. According to the TNM classification in both methods was dominated stage T3 (laparoscopic 44 %, robotic 46 %). Stage N0 for lymph nodes was in laparoscopically operated patients 54 %, in robotically operated patients

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was 40 %. T1 and T2 tumor were presented in 26 % in the robotic operated patients, and 23 % patients operated laparoscopically.

The most common localization in laparoscopic operations was cancer of cecum and ascending colon (45 %), in the robotic was rectum (22 %) and recto-sigmoid colon (40 %).

Surgery

Robotic surgery was performed according to standards which are described elsewhere [2-4]. For surgery we used the Da Vinci Si platform. The patient was positioned in the lithotomy anti-Trendelenburg position. The ports were positioned as depicted in Figure 1.

Figure 1. Port positioning for the Da Vinci Si platform

The surgery was performed by a specially trained dedicated team under the leadership of the head surgeon IC. The positioning of the DaVinci Si system is presented in figure 2.

Data sources

All data were prospectively stored in the department's database. In addition, we used the hospital's data registry to collect additional demographic data like comorbidity, previous medical history, and histology results. The data acquisition was done under strict central supervision. Only the permanent employees of the Department for abdominal and general surgery in the Teaching hospital Celje had access to these databases. The quality of data acquisition and surgical quality control was assessed externally. The acquired procedural data was sent to ABA Medica (Gragnano, Italy). ABA Medica analyzed the data and only certified robotic surgeons were allowed to send and request the data. For this study, all data has been blinded. The study was approved by a local ethics committee.

Data processing

The retrieved data is coded and analyzed by designated surgeons for robotic surgery (IC and OS). The patients were grouped by pathology and performed the surgery. The continuous data were presented as mean ± SD, while the discrete variables were presented as %. All graphs were plotted with Microsoft Excel for Windows version 2022 (Microsoft, Washington, USA)

RESULTS

Patients

The average age of operated patients was similar in both groups (63 years), however; more patients in the laparoscopic group were male compared to robotic group (64% vs 51%). Seven patients in the robotic group received preoperative radio-chemotherapy for rectal cancer. Patients in the laparoscopic group tended to have more accompanying diseases. The most prevalent pathology was adenocarcinoma in both groups. The most common operation in the laparoscopic group was the right hemicolectomy, compared to sigmoid resection in the robotic group. More patients had an anterior resection in the robotic group (54% vs 14%). The proportion of the low anterior resection was similar in both groups (7% in robotic vs. 5% in laparoscopic group). The TNM stage was similarly distributed in both groups. Stage pT3N0M0 was the most prevalent. In both groups the UICC stage III was the most prevalent. The clinicopathological characteristics are presented in Table 1.

Perioperative results

The average console time in robotic surgery was 186,6 minutes, which was comparable to the operation time in laparoscopic surgery. The range of intraoperative blood loss in the robotic group was 50 – 150 ml, which was lower compared to laparoscopic surgery (100-300ml). The average number of extracted lymph nodes was comparable in both groups (18 in the robotic vs. 16 in the laparoscopic group). Patients in the robotic group resumed oral diet faster (3.7 days vs 4.6 days) and had a significantly shorter hospital stay compared to the laparoscopic group (7.5 days vs 10.3 days). Morbidity was comparable in both groups, while the conversion rate was lower in the robotic group (4.5% vs 7%).

RESULTS

Robotic surgery for colorectal cancer has been widely accepted and embraced in recent years [2, 13, 14]. It offers many decisive advantages to laparoscopic surgery and makes difficult cases safer to operate. The department for abdominal and general surgery in the Teaching hospital Celje introduced robotic colorectal surgery in Slovenia in 2014. At that time this was a novel surgical procedure in Slovenia and opened the region for a wider acceptance of robotic surgery in other centers. In the present paper, we present the initial experience of robotic colorectal surgery at the Department for abdominal and general surgery in Celje and compare the results to laparoscopic colorectal operations.

Patients in the robotic group although of comparable age to the laparoscopic group were in better general shape. This might be due to the initial period of the robotic surgery introduction, where the patient selection might have been present. Even so, the distribution of presenting pathology and the stage distribution of tumors were similar. We could therefore argue that, although patients might have been in a better general condition in the robotic group, we did not select easier patients with early cancer for robotic surgery. Therefore we feel both groups were comparable. This is also true for the patients who received anterior and low anterior resections. In both groups, these operations were

similarly distributed and hence comparable.

Regarding the perioperative results, we could confirm that the morbidity of the robotic surgery was comparable to the laparoscopic procedures. Despite that these results present the initial period of the introduction of the robotic platform for colorectal patients, we could show that this method is safe and feasible and the procedure takes comparable time to perform. Similar results were obtained in other pioneer studies [2-4]. Spinoglio et al. showed that robotic surgery is comparable to laparoscopy in regard to safety [5]. We agree with Yasir et al. who stated that the use of the robotic platform is intuitive and has a short learning curve for an experienced laparoscopist [6]. Our results are in line with this observations since we could bring down the perioperative morbidity rates despite this being the initial period.

Robotic platforms not only have articulated instruments allowing better surgical dexterity, but the decisive advantage is also that surgery is easier in small operative fields like the pelvis. As the male pelvis can be narrow the visibility, especially in obese patients can be difficult. These are even more so challenging to overcome in laparoscopic surgery. Robotic surgery has decisive advantages with superior 3D visibility, motion scaling, and angulation. This was possibly the reason for smaller blood loss and smaller conversion rates in the robotic group. Similar results were observed in other studies [5, 7-12].

We believe that less intraoperative bleeding and a more precise dissection in the robotic group were the main factors influencing the faster postoperative regaining of digestive functions. Patients in the robotic group passed stool and restarted oral diet earlier, which eventually lead to shorter hospital stay compared to laparoscopic group. Similarly Spinoglio et al observed significantly shorter hospital stay in the robotic group compared to laparoscopic surgery [5].

This study presents only the initial experience of robotic surgery, therefore there might be some bias in respect to patient selection. We still believe that our results firmly support the further use of robotic surgery in colorectal cancer patients. Robotic surgery allows surgeons to perform complex surgical tasks in confined surgical fields, which brings decisive advantages to demanding patients, reducing the need for conversions, blood loss, and other intraoperative complications. Additionally, shorter hospital stays could also reduce the total costs of treatment justifying the higher costs of the robotic platforms compared to laparoscopy. Perhaps it is important to recognize the limitations and benefits of both laparoscopic and robotic surgery, determine a suitable minimally invasive surgical approach and ultimately choose the ideal surgical technique most appropriate for the specific surgical indication.

DECLARATIONS

Competing Interests: Not applicable.

Funding: Not applicable.

Acknowledgments: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Written informed consent has been obtained from the patient(s) to publish this paper

Ethics approval: The study was approved by the local ethics committee.

Conflicts of Interest: None declared.

Consent for publication: Not applicable.

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FIGURES

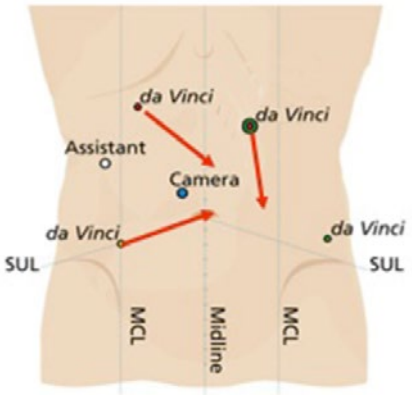

Figure 1. Port positioning for the Da Vinci Si platform

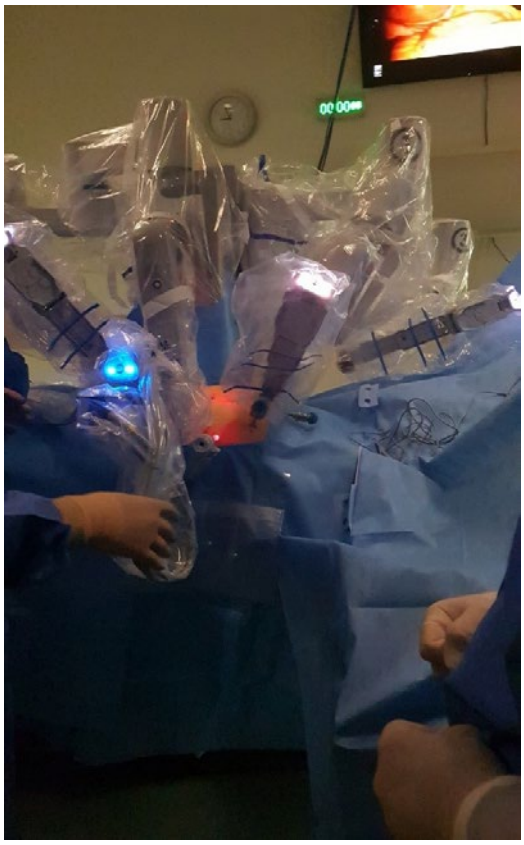

Figure 2a

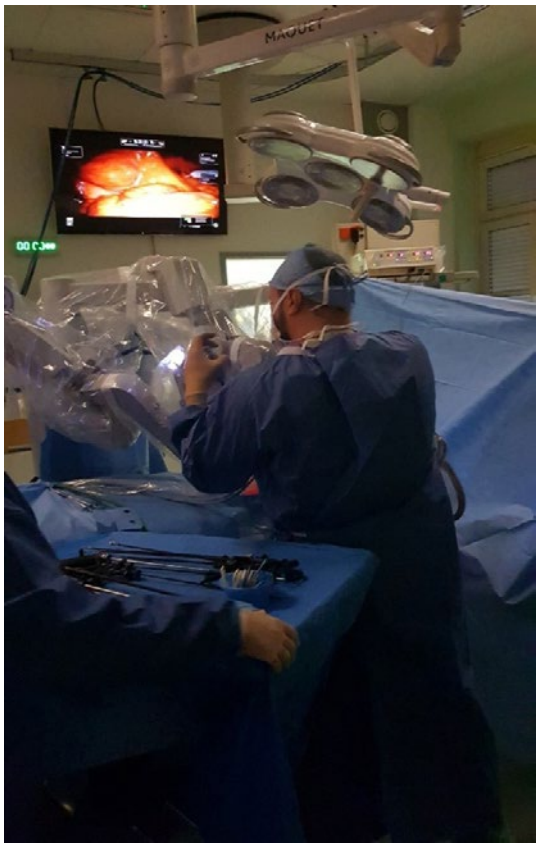

Figure 2b

Figure 2 a, b. The positioning of the DaVinci Si platform for the left hemicolectomy

Figure 3 a, b. Port placement for robotic right hemicolectomy

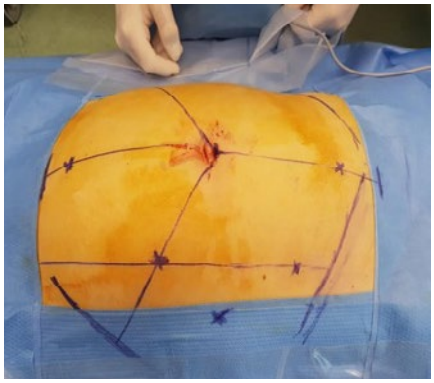

Figure 3a

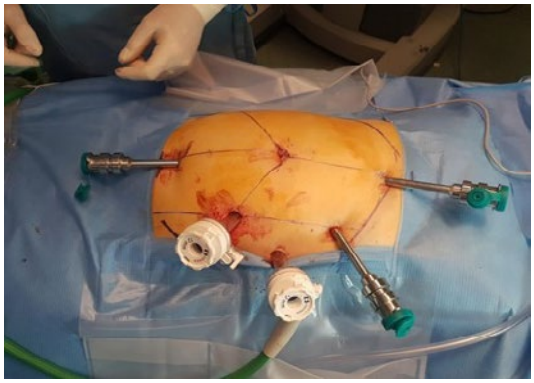

Figure 3b

Figure 4. Rectosigma resection

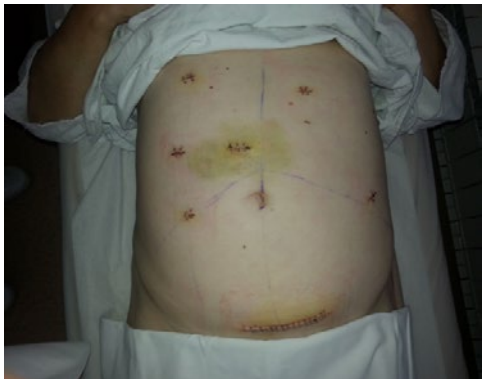

Figure 5. Postoperative view of the patient

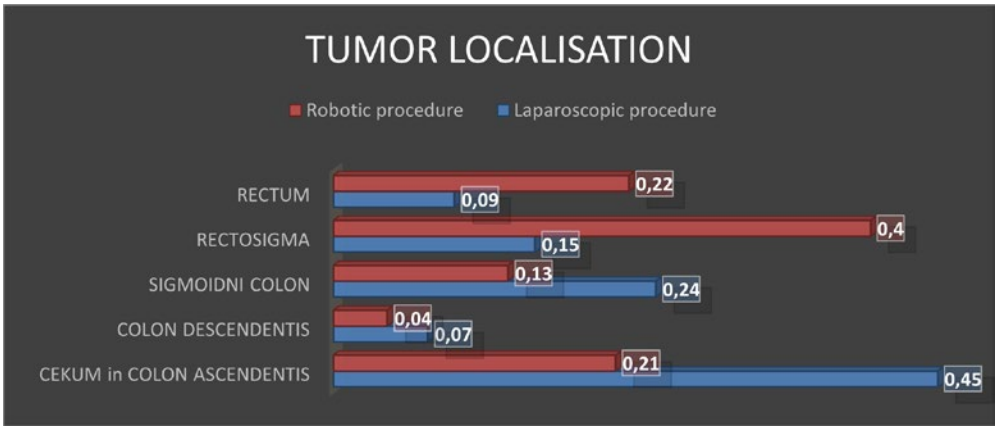

Fig:6 Localisation of tumor: Robotic/ laparoscopic procedure

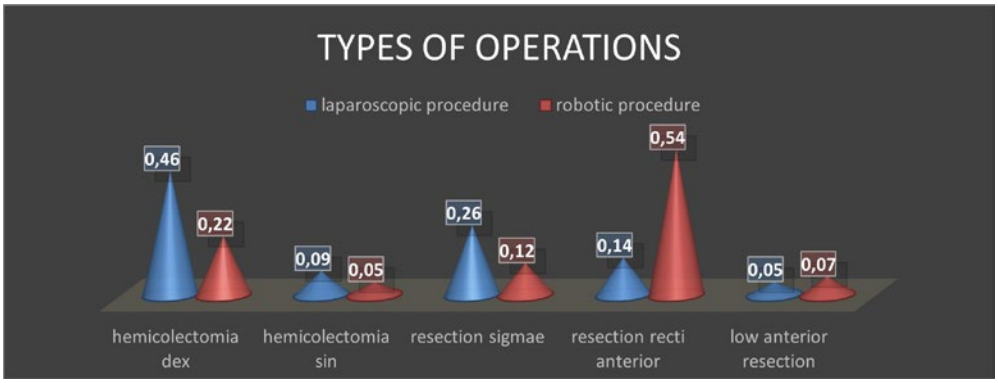

Fig. 7: Types of operations (robotic/ laparoscopic procedure)

TABLES

	Robotic surgery	Laparoscopic surgery
ASA		
I	37%	7%
II	62%	51%
III	1%	40%
	0%	2%
Sex		
M	51%	36%
F	49%	64%
Indication for surgery		
Adenocarcinoma	76.6%	74.1%
Adenoma	11.6%	15.2%
Polipectomia	10%	7.1%
Diverticulitis	1.7%	3.5%
Tumor location		
Right colon	21%	45%
Left colon	4%	7%
Sigmoid colon	13%	24%
Rectosigmoid junction	40%	15%
Rectum	22%	9%
Types of operations		
Right hemicolectomy	22%	46%
Left hemicolectomy	5%	9%
Sigmoid resections	12%	26%
Anterior rectal resection	54%	14%
Low anterior resection	7%	5%
T stage		
1	9%	17%
2	39%	35%
3	46%	44%
4	6%	4%
N stage		
0	40%	54%
1	36%	37%
2	24%	9%
UICC stage		
I	51%	30%
II	15%	33%
III	34%	37%
IV	0%	0%
Tumor Grade		
I	15.8%	7.8%
I-II	11.5%	17.9%
II	67.6%	67.2%
III	5%	6.2%
Operation time	186.6 min	187.6 min
Blood loss (range)	50-150 ml	100-300 ml
Number of extracted LNs	18.5	16.5
Oral diet	3.7 days	4.6 days
First stool	4.5 days	4.6 days
Morbidity	9%	10.3%
Conversion	4.5%	7%
Hospital stay	7.5 days	10.3 days

Table 1. Patients' characteristics, pathology and operative results.

	Laparoscopic procedure	Robotic procedure
Duration of operation (min)	187,6 min.	186,6 min (operation on conzole)
Intraoperative blood loss (ml) average	100-300 ml	50-150 ml
Average number of lymph-nodes	16,5	18,5
Time to resume regular diet(days)	4,6	3,7 days
Time to passage of stool(-days)	4,1 days	4,5 days
Lenght of stay in hospital (days)	10,3 days	7,5 days
Complication(n%)	(10,3%)	(9,0%)
Conversion to open surgery (n(%)	(7%)	(4.5%)

Table 2. Laparoscopic/ Robotic procedure (statistic analyze)

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INTRODUCTION OF ROBOT-ASSISTED SURGERY AT UNIVERSITY HOSPITAL CENTRE SPLIT

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ABSTRACT

Robot-assisted surgery is becoming a widely accepted method, especially as it expands indications for minimally invasive surgical procedures. This technology enhances accuracy, safety, and improves treatment outcomes, as it is associated with reduced blood loss, decreased morbidity, and accelerated recovery.

For the safe and successful introduction of robot-assisted surgery into a hospital, especially if it involves a new and first robotic system in the country, several interconnected prerequisites need to be fulfilled. First of all, it is necessary to have secured funds and the cooperation and support of the Ministry of Health. In particular project, funds are secured from EU funds. Additionally, it is necessary to have a consensus of the hospital's directorate and the heads of the organizational units within the hospital. The hospital must have a developed program for minimally invasive surgery and a large number of surgical procedures. Finally, the support and cooperation from the Agency for Medicinal Products and Medical Devices, equipment manufacturers and hospital specialist services are required. This program has been developing at University Hospital Split for about two years and the first surgical procedures were performed on March 11, 2024.

Keywords: robot-assisted surgery, University Hospital Centre Split

INTRODUCTION

As part of the National Recovery and Resilience Plan 2021-2026 (NRRP), a total of EUR 12,000,000.00 has been secured for University Hospital Split (UH Split). Of these funds, EUR 9,954,210.63 has been secured for the investment C5.1. R5-I1 Digital integration of operating rooms and robotic surgery at UH Split (EUR 1,990,842.63 from the state budget and EUR 7,963,368.50 from the NRRP). The cost of introducing robot-assisted surgical procedures at UH Split amounted to EUR 5,688,667.63 [1].

The application for this project stated that this investment would improve the quality of healthcare, monitor outcomes and extend the lives of patients, especially those with malignant diseases. The digitalization and integration of operating rooms will optimize the planning, documentation, storage, the exchange of data about patients and the types and methods of surgical treatments. Robotic surgery will increase the number of minimally invasive surgeries performed using this most advanced method of surgical treatment, improve treatment outcomes, reduce complications, and increase patient's chances of recovery [1].

As part of this investment, the HUGO™ RAS System, manufactured by Medtronic, USA (Hugo), along with the necessary supporting equipment and instruments for performing robot-assisted surgical procedures, was acquired [2,3].

Hugo consists of a surgical console with a special device for training and simulation, 4 surgical robotic arms and an endoscopic tower. Using appropriate cables, the robotic arm and the surgical console are connected to the endoscopic column, which together form a unique system for performing robot-assisted surgical procedures [2].

This is one of the most advanced devices of its kind in Croatia and this part of Europe. The Clinical Hospital Centre Split thus becomes a hospital where robot-assisted surgical operations will be performed, with the possibility to develop into an international educational center for robotic surgery [2].

METHODS

Successful implementation of the project for introducing robot-assisted surgery in the hospital requires initiating a series of procedures and meeting a number of conditions:

1. a sufficient number of educated and trained specialists from various fields
2. collaboration and consensus among leading experts and hospital management, as well as other involved departments
3. collaboration and consensus with the Ministry of Health

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4. securing funding for consumable materials
5. collaboration with the regulatory body (HALMED)
6. collaboration with the equipment manufacturer
7. availability of appropriate technology
8. available and well-developed education for performing surgical operations

Ad 1. Sufficient number of educated and trained specialists from various fields

At UH Split, minimally invasive surgery holds an important and irreplaceable position. At the Clinic for Surgery, all surgeons perform minimally invasive procedures. In the field of abdominal surgery, all gallbladder and appendix surgeries are performed laparoscopically, along with numerous other surgeries such as hernia, colon, bile duct, stomach, spleen, liver surgeries and more. In addition, pioneering procedures in Croatia and the entire region (this part of Europe), such as transvaginal and transanal operations, were performed at the Clinic for Surgery. In thoracic surgery, a large number of different thoracoscopic and mediastinoscopic operations are performed, some of which were performed for the first time both in Croatia and this part of Europe. Also, at the Clinic for Surgery, advanced endoscopic surgery courses are performed. Similarly, at the Clinics for Pediatric Surgery, Urology and Gynecology, a large number of advanced minimally invasive surgical procedures are performed.

Ad 2. Collaboration and consensus among leading experts and hospital management, as well as other involved departments

For the implementation of such a complex project the consensus among leading clinical experts and hospital management is necessary. Consensus must exist in the commitment to the project and in defining the hospital's needs. Finally, close cooperation is needed between departments of technical services, European funds, procurement and others.

Ad 3. Collaboration and consensus with the Ministry of Health

This project is of strategic interest for the entire Republic of Croatia, so the involvement of the Ministry of health was necessary from the beginning. Consensus in the project's implementation is crucial from the initial application for EU funding to the project's completion (adhering to deadlines, integrating into clinical practice, monitoring outcomes, etc.).

Ad 4. Ensuring methods of covering the costs of consumable materials

Robot-assisted surgery is associated with increased costs for consumable materials per surgical procedure. Therefore, during the project implementation, it was insisted on procuring a sufficient quantity of instruments and other consumables. At the very beginning of the project, contact was established with the Croatian Health Insurance Fund (HZZO) to find a way to cover the increased costs of robot-assisted surgeries. The temporary solution is for HZZO to cover the additional cost of consumables, with the ultimate goal being to achieve a separate coding for all robot-assisted operations.

Ad 5. Collaboration with the regulatory body (HALMED)

At the project's inception, it was necessary to clarify with regulators what are the essential requirements and whether there are any barriers to introducing new and previously unknown technology to the Croatian market. This information was crucial, especially for the equipment manufacturers, to ensure that entering the Croatian market would not incur additional costs or require compliance with regulatory demands. Fortunately, since the equipment is already present in the EU and approved by EU regulators, no additional alignment was necessary. Additionally, thanks to our positive laws and regulations, there was no need for translation of accompanying documentation or user interfaces into the Croatian language, which was of utmost importance to equipment manufacturers.

Ad 6. Collaboration with the equipment manufacturer

When introducing new technology, collaboration with the equipment manufacturer is necessary. This collaboration involves exchanging information with all manufacturers to fulfill predetermined needs and expectations. Manufacturer's technical departments and the hospital are required to determine all the use cases in a particular hospital in regards to access paths for the equipment, as well as the all prerequirements to integrate the device into the hospital's energy and IT systems.

Ad 7. Availability of appropriate technology

This technology is of strategic interest not only to manufacturers and hospitals but also to the wider community. Manufacturers have their strategic plans, which often do not include smaller countries like the Republic of Croatia. Fortunately, through the wholehearted efforts of all involved parties in the process, it was possible to influence manufacturer's strategies. Today, thanks to this project, all currently relevant technology in the field of robot-assisted surgery is available in the Republic of Croatia. Thus, in a unique way, this project led to the complete opening and integration of the Republic of Croatia into the world's elite society of robot-assisted surgery.

Ad 8. Available and well-developed education and procedures for performing initial surgical procedures

After the system arrived at the hospital, appropriate education began, as it was a contractual obligation of the equipment supplier. Initially, training started on the simulator, which is an integral part of the process. The next step were practices in the operating room, setting up and dismantling the robotic arms, placing trocars on models and sterile covering of robotic arms. The most crucial part of the team's education (two surgeons and instrument nurse) took place at the Orsi Academy in Ghent, Belgium, in the duration of 4 days. After the introductory and theoretical part, the core of the training consisted of exercises with the robot: setting up and removing trocars and robotic arms; eliminating of defects and malfunctions during procedures; handling emergencies; operating on tissue models, pigs, and cadavers. An essential part of the final training and the beginning of surgical procedures was the presence of necessary technical staff and proctors for the initial period of performing surgical procedures [4].

RESULTS

The HUGO™ RAS System has been installed and is fully functional at UH Split. The first supervised surgeries under proctor's supervision were performed on March 11, 2024.

From March 11, 2024, when the first surgery was performed, to March 20, 2024, a total of 6 patients were operated. There were 5 males and 1 female, with an average age of 56.7 years (range 33-73 years). Three cholecystectomies were performed due to chronic calculous cholecystitis and 3 hernioplasties (2 bilateral).

The average docking time of the system was 22.5 minutes (range 15-35 minutes).

The average duration of cholecystectomy surgeries ranged from 50-60 minutes and for hernioplasties, it ranged from 30-80 minutes (bilateral hernia).

During surgery, in the immediate and later postoperative period, there were no complications.

All patients were part of the day surgery program and were discharged from the hospital within 24 hours of admission.

DISCUSSION

For the successful implementation of robot-assisted procedures in a hospital, it is necessary to fulfill a series of prerequisites, especially if such a system is being introduced for the first time in the entire country.

Robot-assisted surgical procedures can certainly be introduced in hospitals where minimally invasive surgery is well-developed, with sufficiently skilled staff and a high volume of surgical procedures. Based on our modest experience, the setup time and performance of surgical procedures may be slightly longer initially, but surgeries can be safely performed without complications even during the initial period of the system implementation.

CONCLUSION

The successful introduction and application of the robot-assisted surgery system at UH Split have opened the way for the introduction of such systems in other hospitals in the Republic of Croatia. After UH Split's initial engagement over several years, just a few months after introducing this system in our hospital, another robotic system has already been installed in Croatia and one public procurement process is being carried out. There are also indications of the introduction of several more systems in different hospitals, with the potential of the healthcare system in the Republic of Croatia for introducing up to 8 such or similar systems.

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THE EFFECT OF CONTINUOUS USE OF INTRAVENOUS ANALGESIA ON THE QUALITY OF POSTOPERATIVE HEALTH CARE

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ABSTRACT

Background: To investigate the effects of continuous administration of intravenous analgesia on the quality of postoperative care, and the impact of analgesia on reducing the length of stay in the intensive care unit.

Material and methods: A cross-sectional study was conducted that included 199 patients who were hospitalized at the Clinic for Anesthesiology, Reanimation, Intensive Medicine and Pain Therapy, Department of Anesthesiology, Postoperative Care and Intensive Medicine for Surgical Patients, University hospital Center Zagreb. For the purpose of the research, a visual analogue pain assessment scale was used. The research was conducted in the period from June 2022 to September 2022.

Results: The average age of the patients is 66 years, 67.8% had abdominal surgery, and 64.8% were male. Trauma patients are significantly younger than abdominal and vascular patients (P=0.001). The largest number of patients after abdominal surgery received continuous + bolus analgesia (P<0.001). Older patients have a lower initial VAS than younger patients (P=0.014). Men (P<0.001), abdominal patients (P=0.010) and patients after continuous (P=0.010), continuous + bolus (P=0.001) and bolus analgesia (P<0.001) had a higher initial VAS value and average VAS value. . Patients with higher initial values on the VAS scale had a higher average VAS value (P<0.001).

Conclusion: The continuous application of analgesia with the use of bolus analgesia has a more favorable effect on pain and affects the quality of patient healthcare during hospitalization in the Intensive Care Unit.

Keywords: Analgesia, pain, postoperative care

INTRODUCTION

As the most common symptom of patients in intensive care units, pain occurs in different intensity and depends on the underlying disease, individual characteristics of the patient and the interventions performed in relation to the assessment [1,2]. The pain of patients in intensive care units is most often the result of surgery, burns, trauma or malignant disease, and is associated with an acute reaction to stress, psychological distress and neuroendocrine secretion [3-6]. Pain is defined as an unpleasant, emotional and sensory experience that is associated with potential or actual tissue damage or is described in terms of said damage, and pain assessment differs in relation to the patient's condition, i.e. the level of communication ability [2,7]. Pain assessment methods can be divided into subjective, objective, and interventions and measurements. Subjective assessment is based on the patient's statements, objective on signs such as painful facial expression, redness, change in color of the affected area, weight loss, performing protective movements and insomnia. Pain assessment based on interventions and measurements refers to the application of pain assessment instruments. For acute pain, which is caused by trauma, surgery, childbirth or acute illness, determining the location, temporal aspects and intensity of pain is necessary to determine the characterization of the pain and to evaluate the effects of treatment of the current condition and the primary cause [8,9]. The most reliable and correct methods for pain assessment are self-assessment scales, according to which the patient's self-assessment of pain is evaluated in relation to reference standards. A visual analogue scale (VAS), a four-point verbal rating scale (VRS4), a five-point verbal rating scale (VRS5) and a numerical scale (English Numerical Rating Scale, NRS) . In patients who do not have the ability to verbalize pain independently, the Behavioral Pain Scale (BPS) and the Critical Care Pain Observation Tool (CPOT) are most often used [10]. Assessment of the intensity of acute pain is most often carried out using the VAS and numerical rating scale, which are equally sensitive in assessment, while the four-point verbal categorical scale is less sensitive than those mentioned [8,9]. After surgery, pain control represents the greatest challenge for the clinician, because postoperative pain causes respiratory effort and reduces lung function, resulting in atelectasis, airway obstruction, and hypoxemia. Postoperative analgesia is a key component in the prevention of chronic postoperative pain syndrome, postoperative complications and in encouraging early patient mobilization [11]. Analgesia can be applied in a

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bolus (intravenous administration of a prescribed dose of analgesic at certain intervals) or continuous infusion (continuous infusion of a certain dose of analgesic at a constant rate), and the choice of the method of administration depends on the individual assessment of the patient's needs based on pain assessment using assessment scales [12]. Bolus analgesia refers to the intermittent administration of non-opioid analgesics intravenously, while continuous analgesia is the administration of opioid analgesics intravenously using a perfusor for a certain time, at a certain speed and in a certain dose. Epidural analgesia is a continuous infusion of a combination of local anesthetic and opioid. Table 1 shows the combination of drugs used for bolus and continuous analgesia.

The main goal of the research is to examine the effect of continuous application of analgesia on reducing the length of stay of patients in the intensive care unit and to investigate which type of analgesia has the most favorable effect. It was also investigated which patients (patient characteristics, type of surgery) have the highest VAS value.

MATERIAL AND METHODS

A cross-sectional study was conducted. 199 patients, who are of legal age, were included in the research, with a signed and explained consent to participate in the research, which also specified analgesia. The approval of the Ethics Committee of the Zagreb Clinical Hospital Center was obtained. Data collection was carried out in strict compliance with the General Data Protection Regulation, and a numerical pain assessment scale was used for the purpose of the research. The research was conducted in the period from June to September 2022 at the Clinic for Anesthesiology, Reanimation, Intensive Care Medicine and Pain Therapy, Department of Anesthesiology, Postoperative Care and Intensive Medicine for Surgical Patients, KBC Zagreb. The intensity of pain in the patients was assessed immediately after the operation (VAS initial value) and 24 hours after (VAS average value) while monitoring the type of analgesia that was applied. The scale used is a scoring system that requires patient cooperation and describes the level of pain according to a rating scale from zero to ten (0-10).

Statistical analyses

The demographic data of the respondents were presented with descriptive statistics (median, range, interquartile range – IQR, minimal and maximal value), and the normality of the distribution of continuous numerical variables was tested with the D'Agostino-Pearson test. Continuous variables were analyzed using ANOVA, Mann-Whitney test, or rank correlation: Categorical variable were analyzed using χ2-test. All statistical analyses were performed using MedCalc 20.305 (MedCalc Software Ltd, Ostend, Belgium). P values less than 0.05 were considered statistically significant.

RESULTS

In the research participated 199 patients. The structure of the examined sample according to age and sex, type of surgery and analgesia is shown in table 2.

Considering the irregular age distribution, no significant differences were observed in relation to age (P=0.221), but trauma patients were significantly younger compared to patients who had abdominal or peripheral vascular surgery. The largest number of patients had abdominal surgery (135), while a smaller number of patients had vascular (39) and trauma (25) surgery (Table 1). The median age of patients with abdominal surgery was 65 years (range 22-93; IQR 19), with vascular 70 years (range 45-93; IQR: 14), and with trauma surgery 51 years (range 22-93, IQR: 41).

In relation to gender, there are no significant differences in the type of operation (P=0.312, X2-test). However, trauma patients are significantly younger than abdominal and vascular patients (P=0.001, ANOVA).

According to the research results, 12 patients (men 7, women 5) received continuous analgesia, 125 patients (men 82, women 43) received continuous + bolus analgesia, and 62 patients (men 82, women 22) received bolus analgesia (Table) 2.). No significant differences were observed in relation to the type of analgesia and gender (P=0.879, X2 test).

Significant differences were observed in relation to analgesia and type of surgery (Table 3): only continuous analgesia was received by 11 patients after abdominal surgery, 1 patient after vascular surgery and none after trauma surgery. Continuous + bolus analgesia was received by 101 patients after abdominal, 17 after vascular and 7 after trauma surgery, while only bolus was received by 23 patients after abdominal, 21 after vascular and 18 after trauma surgery (P<0.001, X2-test).

Older patients have a lower initial VAS (P=0.014. In contrast, patients who had a higher initial VAS also have a higher average VAS (P<0.001). Men who have a higher initial VAS also have a higher average VAS (P<0.001), and abdominal patients who had a higher initial VAS have a higher average VAS (P=0.010).

Also, significant differences were observed in relation to the type of analgesia. In patients who received only continuous analgesia, a strong correlation between the initial VAS value and the average VAS value was observed in such a way that those who had a higher initial VAS value also had a higher average VAS value (Spearmn's rho coefficient: 0.4709, 95 %, CI: 0.228 to 0.912 P=0.010), a weak association was observed in patients who received continuous + bolus analgesia (Spearmn's rho coefficient: 0.291, 95 %, CI: 0.121 to

0.444, P=0.001), and a medium strong association in patients who received only bolus analgesia (Spearmn's rho coefficient: 0.502, 95 %, CI: 0.288 to 0.668)P<0.001).

The results show that the number of days in JIM was not correlated with age (P=0.275, Spearman's rho 0.078, 95% CI: -0.062 to 0.215), type of operation P=0.854, ANOVA), type of analgesia (P=0.723, ANOVA), by initial VAS assessment (P=0.913, Spearman's rho 0.008, 95% CI: -0.132 to 0.147) and mean VAS assessment (P=0.333, Spearman's rho 0.069, 95% CI: -0.071 to 0.207).

DISCUSSION

Most surgical patients, regardless of the type of operation, require the use of different combinations of drugs that are applied according to algorithms for control and monitoring in real time and for the purpose of highly effective pain control [13]. This research was conducted with the aim of examining the effect of continuous administration of iv analgesia on the impact on shortening the stay of patients in the intensive care unit.

In the total investigated patient sample, the largest number of patients had abdominal surgery and received continuous + bolus analgesia. It is observed that older patients had a significantly lower result of the initial VAS value. The above can be associated with cognitive and motor changes that accompany the aging process, which can affect a person's ability to correctly assess the intensity of pain according to a given scale [14]. Also, these results can be explained by the loss of pain receptors in old age and increased tolerance to acute pain in old age [15]. Younger patients had trauma surgery more often, which is explained by the fact that the largest number of trauma patients were hospitalized after polytrauma, which resulted from traffic accidents.

According to the results, patients who had abdominal surgery had a higher initial VAS value regardless of the type of analgesia and a higher average VAS value. Abdominal operations are significantly more difficult than vascular and trauma operations and are characterized by a longer recovery time compared to other procedures [16,17]. Patients with abdominal surgery due to a large and painful incision have compromised respiratory function and compromised coughing [11]. According to research, pain after abdominal surgery is greater and lasts longer than pain during other procedures and requires a proper approach, because otherwise the risk of complications from prolonged lying down increases [16]. In contrast to our results, research in Germany, which included 115,775 patients (a total of 50,199 patients were taken into account in the comparison of results) showed that the pain rating was the highest after orthopedic and traumatological operations, and that patients after abdominal operations had pain scored relatively low, which contradicts our results [19].

According to the results obtained in patients who received continuous + bolus analgesia, the most favorable effect on pain was observed according to the assessment of the initial and average VAS values. By searching the literature, there are no studies on the connection between the method of administering analgesia and the effect on the quality of postoperative health care, which includes the types of drugs and the method of administration, therefore this research can be considered significant. The obtained results showed that the number of days spent in the ICU was not correlated with age, type of surgery, type of analgesia, initial VAS assessment and mean VAS assessment. Research conducted in the United States of America shows that adequate postoperative care and a proper approach to pain management significantly reduce the length of hospitalization and the risk of complications, especially when talking about abdominal surgical procedures [16], which is not in accordance with our results that show that the treatment of postoperative pain does not affect the number of days spent in the ICU. In the same study, it was shown that postoperative pain is poorly controlled in almost 80% of cases, while according to the results of our study, pain control is effective [16].

CONCLUSION

Patients after vascular surgery have a lower VAS value than patients who have abdominal procedures, while younger patients, regardless of the type of procedure, have a higher VAS than older patients. The continuous application of analgesia with the use of bolus analgesia has a more favorable effect on pain and affects the increase in the quality of patient health care during hospitalization in the Intensive Care Unit.

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CONFLICT OF INTEREST:

The authors declare that there is no conflict of interest.

TABLES

Agent /Combination of agents	No. of patients
None	1
Paracetamol	11
+ Metamizole	14
+ Tramadol	13
+ Ketoprofen	3
+ Metamizole + Tramadol	6
+ Metamizole + Ketoprofen	1
+ Tramadol+ Ketoprofen	3
Metamizole	1
+ Tramadol	1
+ Tramadol+ Ketoprofen	1
Tramadol	1
Ketoprofen	0
Sufentanil	9
+ Paracetamol	21
+ Metamizole	6
+ Tramadol	2
+ Ketoprofen	1
+ Morphine	1

Agent /Combination of agents	No. of patients
+ Paracetamol + Metamizole	42
+ Paracetamol + Tramadol	17
+ Paracetamol + Ketoprofen	14
+ Metamizole + Tramadol	2
+ Metamizole + Ketoprofen	1
+ Paracetamol + Metamizole + Tramadol	7
+ Paracetamol + Metamizole + Ketoprofen	2
+ Paracetamol + Metamizole + Morphine	2
+ Paracetamol + Tramadol+ Ketoprofen	2
+ Metamizole + Tramadol+ Ketoprofen	2
+ Paracetamol + Metamizole + Tramadol + Morphine	2
Morphine	1
+ Paracetamol	4
+ Paracetamol + Metamizole	1
+ Paracetamol + Metamizole + Tramadol	1
Epiduralna analgezija	3
+ Paracetamol	2

Table 1. Combinations of drugs for bolus and continuous analgesia

Patients' characteristics	
Age, years	median (range, ICR)
Male	66 (22-93, 19)
Female	66 (22-93, 21)
Gender	
Male	129 (64,8)
Female	70 (35,2)
Type of surgery	
Abdomen	135 (67,8)
Vascular	39 (19,6)
Traumatological	25 (12,6)
Type of analgesia	
Continuous	12 (6)
Bolus	62 (31,2)
+ Paracetamol + Metamizole + Tramadol	1
Epiduralna analgezija	3
+ Paracetamol	2

Table 2. Structure of the examined sample

	Patients' characteristics		
	Continuous	Continuous + intermitent boluses	Intermitetn boluses
No. of patients (male + female)	7 + 5	83 + 52	82 + 22
Type of surgery			
Abdominal	11	101	23
Vascular	1	17	21
Traumatological	0	7	18
Continuous	12 (6)	12 (6)	12 (6)
Bolus	62 (31,2)	62 (31,2)	62 (31,2)
+ Paracetamol + Metamizole + Tramadol	1	1	1
Epiduralna analgezija	3	3	3
+ Paracetamol	2	2	2

Table 3. Frequency of application of different types of analgesia

Acta Chir Croat 2024; 21: 23-26

SURGICAL TREATMENT OF GASTROINTESTINAL STROMAL TUMORS – A SINGLE CENTRE RETROSPECTIVE STUDY

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ABSTRACT

Background: Gastrointestinal stromal tumors (GIST) account for 1-3% of all malignant tumors of the gastrointestinal tract, with an annual incidence of 1.5 per 100,000 inhabitants. GISTs are the most common symptomatic tumors of the small intestine while the most common site of is the stomach followed by the small intestine and colon.

Material and methods: A retrospective, single centre study was conducted and it encompassed all patients who underwent surgical treatment of GIST in a period 2010-2020 at General Hospital Karlovac. Data were obtained from medical records using institutional digital system. Data on demographic, tumor and operative characteristics as well as outcomes were collected and analysed.

Results: A total of 12 patients with pathological diagnosis of GIST were treated in the study period. There were four men and eight women with mean age of xx (ranged 49 - 79 years).

The tumor was located in stomach in seven cases (58.3%), three were arising in small intestine, one in omentum, and one in mesenteric root. The most common clinical presentation was bleeding in seven patients followed by obstruction in three and palpable tumor mass with pain in two patients. All patients underwent surgery under general anaesthesia. They were monitored over a period of minimally 5 years and 10 patients had no recurrence, while one patient died within the first year due to cardiovascular incident. Only one patient died as a result of disseminated GIST.

Conclusion: GISTs are uncommon tumors, but in most cases have favorable prognosis mainly due to sucesful surgical resection and availaility of potent targeted therapy. Abdominal surgeons should be familiar with etiology and pathophysiology of GISTs and diagnostic and therpetuc approaches in GIST management.

Keywords: Gastrointestinal stromal tumour, GIST, Surgical treatment

INTRODUCTION

Gastrointestinal stromal tumors (GIST) are the most common symptomatic tumors of the small intestine and account for 1-3% of all malignant tumors of the gastrointestinal tract, with an annual incidence of 1.5 per 100,000 inhabitants [1,3]. In the USA, there are 10-20 cases per million inhabitants, and in Europe, 6-14.5 cases per million [4]. They arise from interstitial cells of Cajal (ICC) by mutation of the KIT or PDGFR-alpha gene [5]. The most common localization of the GIST is the stomach (50%) followed by small intestine (25%) and less often the colon (10%), oesophagus (5), rectum, omentum, and mesentery (7%).

Stomach GISTs are usually less aggressive than GISTs arising in other sites.

These tumors may grow intraluminally or extraluminally and can be exulcerated and cause bleeding within the digestive system. In addition, GISTs may cause obstruction, intussusception or hollow organ perforation [2-6]. Large tumors may be necrotic in the centre, which is caused by a disproportion between the growth of the tumor and its blood supply.

GIST tumors are made of spindle (70%) and epithelioid cells (30%), and benign GIST tumors are three to four times more common than the malignant form of GIST. The majority (90%) of GISTs have the expression of CD117, a kit proto-oncogene protein that is a transmembrane receptor for stem cell growth factor, and 70-80% expression of CD34 antigen of human progenitor cells, and is less often positive for actin and desmin. The incidence is equal in men and women and occurs more often in the fifth decade of life [3,7].

Predictive factors for aggressive tumor behaviour and an increased risk of local tumor recurrence are mitotic rates greater than 5 per 10 HPF, tumor sizes greater than 5 cm and 10 cm, and mitotic activity greater than 2 per 50 high power fields. The diagnosis is based on the clinical presentation (bleeding from the digestive tract, obstruction, perforation, palpable tumor mass, and undefined abdominal pain), radiological evaluation (X-ray of the abdomen), CT and MRI of the abdomen, endoscopic examinations, pathohistological verification, and immunohistochemical methods.

The gold standard in the treatment of non-metastatic GIST tumors is surgical treatment with negative excision

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margins (2–3 cm). Adjuvant treatment with tirosine kinase inhibitors such as imatinib can significantly reduce tumor recurrence and positively affect the survival especially in high-risk cases.

MATERIALS AND METHODS

A retrospective, single-center study was conducted, and it encompassed all patients who underwent surgical treatment of GIST in a period 2010-2020 at General Hospital Karlovac. Patients aged >18 with pathohistologically confirmed GIST were included. Data were obtained from medical records using an institutional digital system. Data on demographic, tumor, and operative characteristics, as well as outcomes, were collected. Descriptive analysis was performed, with results presented in corresponding tables. All surgical procedures were performed by experienced abdominal surgeons, and the patients were thoroughly informed about the therapeutic procedure, possible intraoperative and postoperative complications, and the prognosis of the disease. All patients underwent preoperative preparation, which included complete laboratory tests, X-rays of the heart and lungs, an ECG-electrocardiogram, and preoperative examination by the anesthesiologist. Patients were monitored over a period of minimally 5 years.

RESULTS

A total of 12 patients with pathological diagnosis of GIST were treated in the study period. There were four men and eight women with mean age of 63.5 years (ranged 49 - 79 years). The tumor was located in stomach in seven cases (58.3%) (Fig.1), three were arising in small intestine (Fig. 2), one in omentum, and one in mesenteric root (Fig.4). The most common clinical presentation was bleeding in seven patients followed by obstruction in three and palpable tumor mass with pain in two patients. All patients underwent surgery under general anaesthesia. Baseline data and clinical presentations are shown in Table 1. Most common presentation was intraluminal bleeding. In all cases CT scan was performed and in 8 patientscan additional endoscopic evaluation was done.

In three patients with a location of GIST in the stomach, 2/3 resection of the stomach was performed according to the Billroth II method (Fig. 5). In other 4 patients a resection of the tumor with the wall of the stomach was performed with margin more than 3 cm from the tumor. In patients with small intestinal GISTs, partial resection of the small intestine with similar resection margins was performed. All patients underwent primary anastomosis. In a patient with omental GIST, a complete resection of the greater omentum was performed, and in a patient with a tumor in the area of the radix of the mesentery, a radical tumor resection with preservation of small bowel was performed.

The mean size of the tumor was 4.7cm and ranged between 3 and 8 cm. Mitotic activity ranged 2-8 per 10 HPF. Immunohistochemically, all tumors were CD117 and CD34 positive, and in 4 patients, Ki 67 was positive as well. Pathohistological findings showed in all cases polymorphic, polygonal spindle cells, hyperchromatic nuclei, vacuolated with part of bright cytoplasm. The macroscopic appearance showed a solid, partly cystic, encapsulated tumor, and in four cases it had necrosis and bleeding in the central part of the mucous membrane with ulceration. ere were no distant metastases and no infiltration of local lymph nodes.

Postoperative outcomes are shown in Table 2. The patients were monitored for minimally 5 years and had clinical and CT follow up every 6-12 months. When indicated, patients underwent repeated endoscopic evaluation. One patient had intraabdominal abscess treated by percutaneous drainage and no other complications were noted. The five-year survival rate was 83.3% (10/12), and 9 patients had no disease recurrence at 5 years' follow-up. One patient died within the first year due to a heart failure. In one patient, disease recurrence occurred after 3 years with dissemination of the tumor along the radix of the mesentery. It was treated with imatinib, but after 5 years form the diagnosis the patient died.

DISCUSSION

The surgical treatment of gastrointestinal stromal tumors (GISTs) is a cornerstone of managing this unique subset of tumors. GISTs often arise in the stomach and small intestine and can vary significantly in size and malignancy potential. The primary goal of surgical intervention is complete resection, which has been shown to correlate with improved outcomes and reduced recurrence rates. Studies indicate that achieving clear margins during surgery is crucial, as even microscopic residual disease can lead to tumor recurrence and metastasis [2,8]. However, metastases in the lymph nodes are rare and routine lymphadenectomy is not necessary [9,10]. In cases where GISTs are diagnosed at an advanced stage or exhibit metastatic behavior, the role of surgery becomes more complex. While surgical resection may still be indicated for isolated metastases, it is often combined with targeted therapies such as imatinib, which has revolutionized GIST management. These therapies can shrink tumors preoperatively, making surgical removal more feasible and effective [11-12]. The role of minimally invasive techniques, such as laparoscopic surgery, has gained traction, providing patients with quicker recovery times and less postoperative discomfort. Postoperative monitoring is also essential, as GISTs can recur despite initial successful resection. Regular follow-ups, including imaging studies and serum markers, are recommended to detect any signs of

recurrence early. Overall, a multidisciplinary approach involving surgical oncologists, medical oncologists, and radiologists is critical to optimize treatment outcomes for patients with GISTs. Continued research into the molecular characteristics of GISTs may further enhance surgical strategies and adjuvant therapies, leading to better patient prognoses. Our results are in line with outcomes reported in the literature and generally the clinical course was favorable which is mainly a result of successful radical surgical tumor resection.

CONCLUSION

Surgical management of gastrointestinal stromal tumors (GISTs) remains the primary treatment modality, particularly for localized disease. Complete surgical resection is essential for optimal outcomes, as it significantly reduces the risk of recurrence and offers the best chance for long-term survival. For advanced GISTs or those with metastasis, surgery may be complemented by targeted therapies like imatinib to improve prognosis.

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CONFLICT OF INTEREST:

The authors declare that there is no conflict of interest.

FIGURES

Figure 1. Stomach GIST

Figure 2. Small intestine GIST

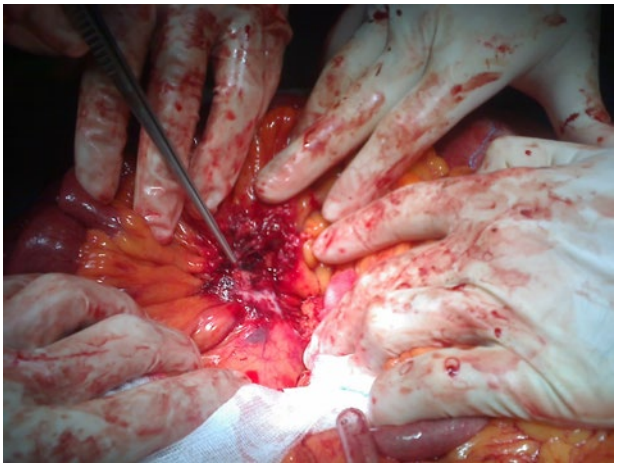

Figure 3. Mesentery GIST

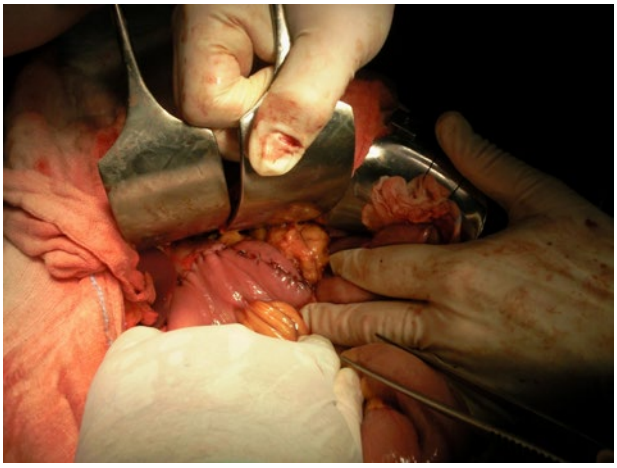

Figure 4. Gastric resection according to the Billroth II procedure

TABLES

Category	
Number of patients	12
Age (mean ± SD)	63.5 ± 14
Male/Female	4/8
BMI, kg/m2 (mean ± SD)	24.1 ± 4.2
ASA score ≥ 3, n (%)	2 (16.6)
Previous abdominal surgery, n (%)	4 (33.3)
Tumor location	
- Stomach	7 (58.3)
- Small intestine	3 (25.0)
- Omentum	1 (8.3)
- Mesentery	1 (8.3)
Clinical presentation	
- Bleeding	7 (58.3)
- Obstruction	3 (25%)
- Palpable tumor mass	2 (16.6%)
Tumor characteristics	
- Tumor size mean (range) cm	4.7 (3-8)
- Mitotic activity, mean (range)	5 (2-8)

Table 1. Baseline and operative characteristics

Category	
- Hospital stay, days (mean, range)	8.2 (5-18)
- Severe morbidity (≥IIIa)*	1 (8.3)
- 1-year survival, n(%)	12/12 (100%)
- 5-years survival, n(%)	10/12 (83.3)
- 5-years recurence free survival, n(%)	9/12 (75.0)
- Adjuvant chemotherapy used	4/12 (33.3)

*According to Clavien-Dindo

Table 2. Postoperative outcomes

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TRAUMATIC DISLOCATION OF L4 VERTEBRA, ASSOCIATED WITH PERFORATION OF SMALL INTESTINE AND DISSECTION OF INFRARENAL AORTA: A CASE REPORT AND REVIEW OF LITERATURE

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ABSTRACT

Background: A section of the spine most often affected by trauma is located between the T10 and L2 segments. In this paper, we present a patient who suffered injury at the l4–l5 level, as well as dissection of the infrarenal aorta and perforation of the small intestine.

Case study: A 39-year-old woman was injured in a car accident as a passenger, restrained by a seat belt. After resuscitation and diagnostic procedures, the injuries were treated in three stages. First, explorative laparotomy, resection, and T-T anastomosis of the small intestine were done. Repair of infrarenal aorta dissection with the CERAB technique followed. Finally, open reduction and stabilization of the lumbar spine, with exploration of the spinal canal and repair of the dural sac, were performed. In the postoperative period, normal function of the gastrointestinal tract, normal blood flow in the lower extremities, and normal alignment of the lumbar spine were restored, associated with partial recovery in the neurological status of the lower extremities.

Conclusion: The possibility of abdominal aortic rupture associated with lumbar spine fracture should always be considered in blunt force trauma. Endovascular stent-graft repair techniques, including the CERAB method, are a valid method for treating these patients. Vascular repair needs to be followed by early spinal stabilization to further diminish mortality and complications rate.

Keywords: spine injury, spine dislocation, traumatic aortic dissection, CERAB

INTRODUCTION

We present a case of traumatic dislocation of the L4 vertebra, associated with perforation of the small intestine and dissection of the infrarenal aorta. Furthermore, we describe our experiences with the surgical treatment of this complicated injury.

CASE STUDY

A 39 years old woman was transferred to our Emergency Department after initial resuscitation in another hospital. She was injured the same evening in a car accident as a passenger, restrained by a seat-belt. On initial physical examination she demonstrated normal consciousness (GCS 15), painful left shoulder, thorax and abdomen, with haematoma consistent with seat-belt injury, and total paraplegia below L1 level. A polytrauma-protocol computed tomography, consisting of a native CT-scan of the head and cervical spine, followed by contrast-enhanced CT-scan of chest, abdomen and pelvis, revealed: perforation of small intestine with pneumoperitoneum, dissection of infrarenal aorta with retroperitoneal haematoma, and dislocation of L4 vertebra (traumatic spondylolisthesis grade 5, i.e. spondyloptosis) (Fig.1).

The patient was immediately taken to OR, where emergency laparotomy was performed. Multiple contusions and lacerations of the small intestine were found, and resection with T-T anastomosis was done. Following short stabilization of the patient in the ICU, she was again transported to the OR, where aortic injury was treated by Covered Endovascular Reconstruction of the Aortic Bifurcation technique (CERAB) through bilateral transfemoral approach (Fig.2). After stent graft position and patency check, the patient was turned in a prone position and lumbosacral spine was approached through standard midline incision. Transpedicular screws were inserted in L3, L4, L5, and S1 vertebrae. Screws were connected with longitudinal rods, and with limited distraction, full reposition of dislocation was accomplished (Fig.3). Laminectomies of L4 and L5 vertebrae and exploration of the spinal canal followed. Multiple dural lacerations and avulsions of cauda equina nerve roots were encountered. After repositioning of neural structures in the dural sac, dura was reconstructed with polyester urethane patch and monofilament sutures.

In postoperative period, the patient went through remarkable recovery. Normal function of the gastrointestinal tract was restored. Control doppler-sonography verified bilateral normal patency of AFC, AFS, AP, ATP, and ADP, regular three-phase flow

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spectrum and velocity, without haemodynamic irregularities. Wound on the back healed normally, without signs of CSF leakage. Control radiography showed normal alignment of lumbar spine and good position of pedicular screws. Gradually, neurological status of lower extremities also improved: at the two-weeks' time after injury, when she was released from the hospital, the patient could demonstrate active flexion in the right hip and active extension in the right knee.

DISCUSSION

Severe spinal injuries occur in around 10% of polytraumatized patients [1]. Majority of these are caused by accidental falls (58.9%) and traffic accidents (20.9%) [2]. However, a section of spine which is the most often affected by trauma is located between T10 and L2 segments – an area known as the thoracolumbar junction [3]. The thoracic spine is relatively rigid due to coronal orientation of its facet joints and to bilateral costovertebral attachments. Conversely, sagittally oriented facets and lack of additional stabilization by thoracic cage, enable a considerably higher degree of motion in lumbar spine. The transitional zone between these two areas is a site of accumulation of kynetic energy transferred by trauma to other sections of spine, which makes the thoracolumbar junction particularly vulnerable to injury [4].

In this paper we present a patient who, unusually, suffered injury in L4-L5 level. We speculate this to be associated with seat-belt restrainment, which presumably acted as a fulcrum in flexion-extension movement of body during impact.

Spinal cord injury (SCI) is present in 26% of patients with thoracolumbar spine fracture [5]. Patients with lesion above the conus predominantly have symptoms of upper motor neuron dysfunction. Injuries below the conus caracteristically cause lower motor neuron function deficit [3].

Our patient presented herself primarily with signs of lower motor neuron lesion. This was caused by avulsion and entrapment of cauda equina nerve roots, which was intraoperatively verified. Neural structures were decompressed and repositioned in the dural sac. The dura was reconstructed with polyesterurethane patch and non-absorbable monofilament sutures.

The role of timing of surgery in long-term neurological recovery of patients with SCI remains unclear [6-8]. However, most studies agree that early surgery (typically within 72 hours of injury) is associated with significantly less complications and with shorter duration of hospitalization [9-11].

Our patient was transferred to our Emergency Department approximately four hours after injury. The first surgical procedure was initiated 30 minutes later. All surgical interventions were completed within 24 hours of injury, therefore, we met the criteria for early surgery.

Intraabdominal injuries are present in 7.6% of patients with thoracolumbar fractures after blunt force trauma [5]. However, this percentage is predictably much higher in more severe types of fractures – up to 38.7% in flexion-distraction injuries [12-15].

In our case, three perforations of the small intestine were found during exploration of the abdominal cavity. They were treated with resection and T-T anastomosis. No lesions of solid organs were encountered.

Aortic rupture has a very low occurrence in non-penetrating abdominal trauma with fracture of thoracolumbar spine [16]. However, it is a very dangerous condition, with a total mortality rate of 90%, and estimated prehospital mortality of 85% [17-20].

Furthermore, traumatic aortic rupture is usually located on the level of isthmus – just distal to the origin of left subclavian artery [19]. Ruptures of subdiaphragmatic/abdominal aorta associated with a spinal fracture, as seen in our patient, are extremely rare, with only several cases described in literature [16, 17,21-24].

Open surgery was traditionally considered a golden standard in treatment of aortic ruptures. However, its grave complications (risk of renal failure and neurological deficit, pulmonary complications, prolonged intubation and mechanical ventilation) have encouraged development of endovascular repair technique [19]. Studies have demonstrated decrease of mortality rate from 35-45% in open surgery to 9% in endovascular stent-graft repair of thoracic aortic ruptures [24-27]. Further improvement in treatment of aortic bifurcation pathologies have been achieved by development of Covered Endovascular Reconstruction of the Aortic Bifurcation (CERAB) technique [28]. The goal of this procedure is to improve stent patency rate by imitating physiologic and anatomical characteristics of aortic bifurcation [29-30].

In our patent, we successfully repaired abdominal aortic rupture by using the CERAB method. Dimensions of aortic stent graft were 14×49 mm, and of iliac grafts 8×57 mm on right side, and 7×57 mm on left side. Postoperative doppler-sonography has shown normal patency of grafts with regular hemodynamic flow parameters.

CONCLUSION

Despite its relatively rare incidence, the possibility of abdominal aortic rupture associated with lumbar spine fracture should always be considered in blunt force trauma. It is extremely high mortality rate can be reduced by urgent and precise diagnostic work-up, primarily in the form of contrast-enhanced whole-body CT scan,

and prompt surgical treatment. Endovascular stent-graft repair techniques, including the CERAB method, are burdened with less complications than classic open surgery. Vascular repair needs to be followed by early spinal stabilisation, as it further diminishes mortality, complications rate, and duration of hospitalization.

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CONFLICT OF INTEREST:

The authors declare that there is no conflict of interest.

FIGURES

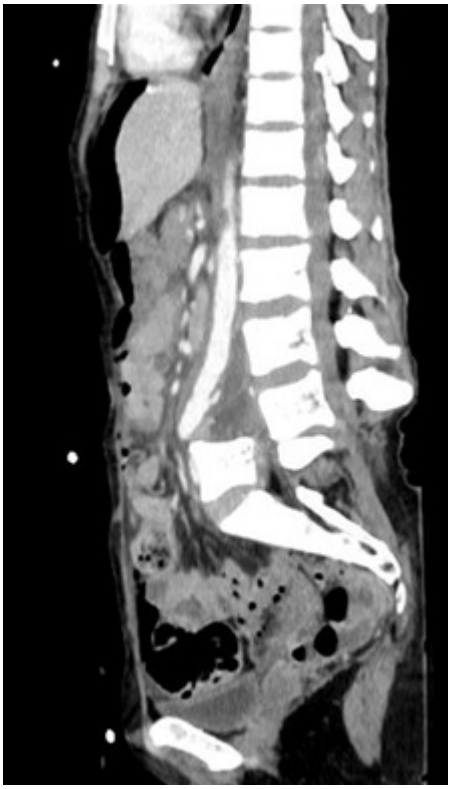

Figure 1. Preoperative polytrauma-protocol computed tomography

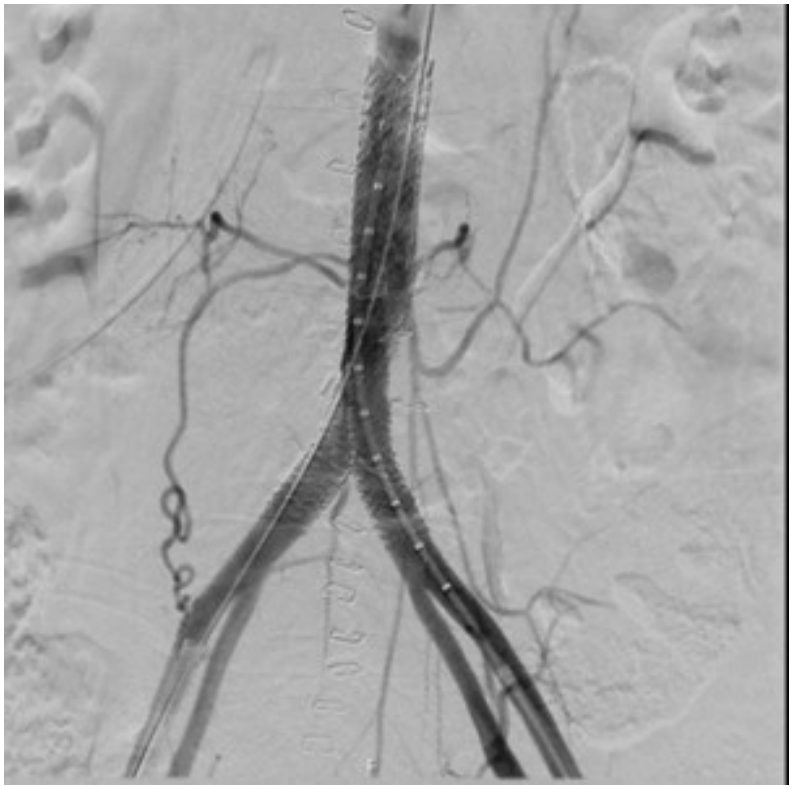

Figure 2. Repair of aortic dissection using CERAB technique

Figure 3. Surgical reduction and transpedicular fixation of L4 vertebral dislocation

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ABDOMINOSCROTAL HYDROCELE IN A 5-MONTH OLD INFANT: CASE REPORT

Asmir Jonuzi[1], Zlatan Zvizdic[1], Emir Milišić [1], Elma Bečić [2]

ABSTRACT

Abdominoscrotal hydrocele (ASH) is a very rare condition in which the hydrocele sac extends beyond the scrotum to the abdomen via the inguinal canal. This condition is characterised by a large abdominal and scrotal component connected by an isthmus within the inguinal canal. The precise etiology of ASH is not known. Diagnosis can be made clinically and confirmed by ultrasound. Spontaneous resolution is rare and long-standing ASH may lead to complications, thus early surgical intervention is recommended. We present a 5-month-old male infant with a large right cystic inguinoscrotal mass that had been increasing in size since birth.

Keywords: Abdominoscrotal hydrocele, congenital hydrocele, inguinoscrotal mass

INTRODUCTION

Abdominoscrotal hydrocele (ASH) is an unusual condition, characterized by a large scrotal hydrocele, which communicates in an hour-glass fashion with a large "intra-abdominal" component through the inguinal canal. ASH begins as a large scrotal hydrocele during the neonatal period and later expands, first, into the inguinal canal and, finally, into the abdominal cavity during the next few months of life [1,2]. It is the rarest type of hydrocele, with a reported incidence between 0.4% and 3.1% of the paediatric hydroceles [3,4]. Currently, physical examination and ultrasonography are practical diagnostic methods for ASH [5,6]. Patients are usually asymptomatic, but longstanding ASH may lead to complications that are mainly pressure related. These include hydronephrosis, hydroureter, testicular dysmorphism, testicular torsion, effect on spermatogenesis, spontaneous rupture or haemorrhage, and malignant transformation such as mesothelioma due to neoplastic change in peritoneal lining [7-9]. Because spontaneous resolution in ASH cases is rare, early surgical intervention is recommended [3]. Herein we present a 5-month-old male infant with a large right- sided ASH that had been increasing in size since birth.

CASE REPORT

We present a 5-month-old male infant with a large right cystic ASH (Figure 1). The remainder of the examination was normal. Abdominal ultrasound showed unremarkable appearance of the intra-abdominal organs. On the right side scrotum, a large ASH, which extended through the inguinal canal into the pelvis. There was no evidence of bowel herniating through the inguinal canal on right side, and right testicle had unremarkable appearance. The patient underwent surgical repair through an inguinal approach. A dilated cystic dumbbell-shaped mass, which extended from the scrotum to the abdominal cavity above the internal ring, was identified. Needle decompression with was performed to facilitate the dissection, and 100 mL of fluid was evacuated before the mass collapsed completely (Figure 2). Once the vessels and vas deferens were identified and carefully separated from the wall of the sac, the preperitoneal component was excised. The scrotal component, including the testis, was delivered to the operating field and the tunica vaginalis was excised. Post-operative course was uneventful, the patient did well and was discharged home on 4 th post-operative day. The patient is on our follow-up for the past 6 months without any problem.

DISCUSSION

Abdominoscrotal hydroceles are collections of fluid in the tunica vaginalis, which extend from the scrotum to the abdominal cavity. ASH typically present as a scrotal hydrocele associated with an ipsilateral abdominal mass. The nature of the lesion becomes apparent when a mass is felt above the inguinal ring and fluid is seen to move between the abdomen and scrotum on compression of either structure [2]. These rare hydroceles typically begin as ordinary ones and develop after the testicle descends through the inguinal canal to its final destination in the scrotum. It is at this point that the processus vaginalis normally loses its communication with the peritoneal cavity. This gives the hydrocele the potential to extend from the scrotum into the inguinal canal, via the external inguinal ring, and enter into the abdominal cavity after passing through the internal inguinal ring.

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Since the first description by Dupuytren in 1834 when it was called hydrocele en bisac, many titles have been used until Bickle in 1919 suggested the abdominoscrotal hydrocele as a proper descriptive term [10]. ASH is most commonly seen in the pediatric age group of less than five years and second and third decade in adults. The three most commonly proposed theories are a s follows: (1) cephalad extension of a simple hydrocele, (2) high obliteration of processus vaginalis (PPV), and (3) PPV acting as a one-way valve with cephalad extension of hydrocele. However, the most widely accepted theory is Dupuytren's original theory of high intracystic pressure in the scrotal component that leads to cephalad extension through the musculofascial inguinal canal and formation of the abdominal sac [3]. Testicular ectopia or cryptorchidism is the most common congenital anomalies associated with ASH [10]. ASH should be differentiated from hernia, chord lymphangioma, spermatocele, cystic abdominal mass, and ascites. Long-standing ASH leads to pressure-related complication like hydroureteronephrosis, deep vein thrombosis, leg edema, testicular dysraphism, and impaired spermatogenesis and rarely malignant transformation [11]. Accurate physical examination in patients presenting with hydrocele and an abdominal mass could be very suggestive of the diagnosis; compression of the lower abdominal mass will result in enlargement of the ipsilateral scrotal component and vice versa. This is one of the most common diagnostic features of ASH, named "springing back ball" sign [12]. USG abdomen demonstrates encapsulated anechoic fluid collection extending from the abdomen to the scrotal cavity through an inguinal ring. However, there may be a possibility that the relationship between the abdomen and the scrotal sac cannot be clearly delineated on a USG. In such a situation, CT or magnetic resonance imaging through the multiplanar approach may help to delineate the full extent of the ASH. The surgery is often difficult because of adherence of the hydrocele to the cord structures [9,13]. Dissection of the distended and thickened tunica vaginalis is often facilitated by aspiration of the hydrocele fluid [1,3,8]. In our experience, an inguinal approach provides excellent exposure and access for both the abdominal and scrotal components through a small incision in the inguinal skin crease line, which is cosmetically acceptable. Additionally, intraoperative fluid decompression enables the excision of the majority of the wall sac, while allowing identification and preservation of the vessels and vas deferens without compromising the testis. Optimal time for surgery is unknown, but it has been described as early as 8 weeks, and surgical complications are usually minor, most commonly being inguinal/scrotal swelling [3,5]. Regardless of the surgical approach, recurrences are not reported in the literature [3].

CONCLUSIONS

ASH is a rare lesion reported mainly in single case reports and rare cause of abdominoscrotal swelling, which has different etiological hypotheses and multiple clinicopathological variants. Complete excision of the sac via inguinoscrotal incision remains the standard approach.

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CONFLICT OF INTEREST:

The authors declare that there is no conflict of interest.

The patients' parents gave informed consent prior to child's inclusion in case report.

FIGURES

Figure 1. ASH with abdominal and scrotal components

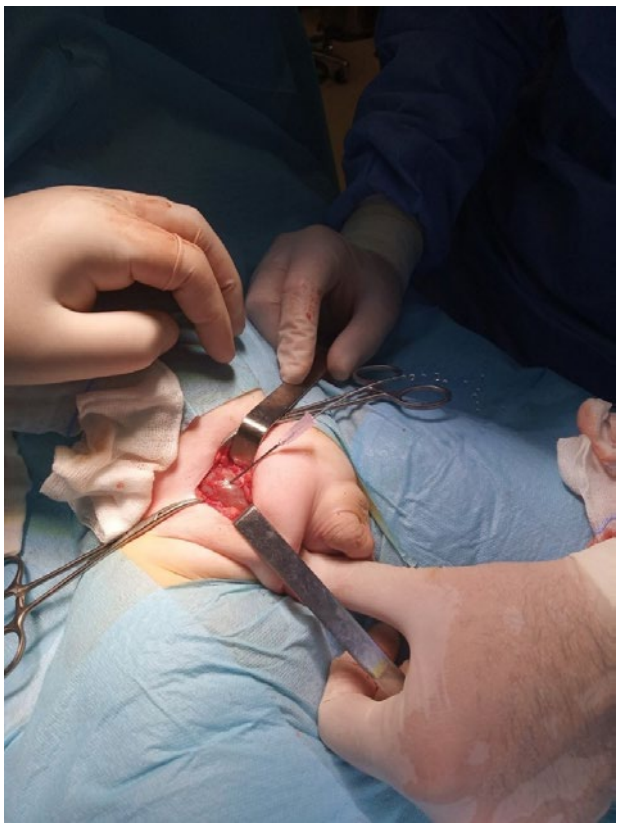

Figure 2. Intraoperative fluid decompression of the mass

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LAPAROSCOPIC CHOLECYSTECTOMY IN SITUS INVERSUS TOTALIS: A CASE REPORT AND REVIEW OF THE SURGICAL TECHNIQUES

Hakan Arıkan, Ergin Erginöz, Egemen Özdemir

ABSTRACT

Background: Situs inversus totalis is a rare condition characterized by the mirror image transposition of internal organs. Diagnosis may be difficult when the patient has situs inversus as the presenting symptoms may lead to confusion. Laparoscopic cholecystectomy becomes more technically demanding for surgeons due to the modification and reorientation of the surgical procedure.

Case study: A 46-year-old male patient presented with left upper quadrant pain, nausea, and vomiting. Physical examination revealed mild tenderness to palpation in the left upper quadrant region. Murphy's sign was negative and the laboratory results were normal. Abdominal ultrasonography revealed situs inversus and a single 36-mm gallstone. The patient underwent laparoscopic cholecystectomy and the postoperative course was uneventful.

Conclusion: Due to the reversal of internal organs in patients with situs inversus totalis, laparoscopic cholecystectomy becomes technically demanding in patients who present with cholelithiasis. Various techniques have been suggested to minimize reorientation issues during surgery.

Keywords: Situs inversus, cholelithiasis, laparoscopic cholecystectomy

INTRODUCTION

Situs inversus totalis is a rare congenital abnormality characterized by the mirror image transposition of both abdominal and thoracic organs. It has been reported that the incidence of situs inversus totalis varies between 1:5,000 and 1:20,000 and is more common in males [1–3]. Situs inversus alone is not a risk factor for cholelithiasis. Since the signs and symptoms in patients who have not been diagnosed with situs inversus arise from an abnormally located gallbladder, it is a matter of confusion and leads to a delay in diagnosis.

The first laparoscopic cholecystectomy in a patient with situs inversus was performed by Campos and Sipes in 1991 [4]. Since then, more than 60 cases of laparoscopic cholecystectomy in situs inversus patients have been reported [4]. Laparoscopic cholecystectomy remains the gold standard for symptomatic cholelithiasis even in the presence of situs inversus [5].

The presence of situs inversus poses some technical difficulties during the laparoscopic approach. There are uncertainties in port placement due to the normal anatomy being reversed. Since some important dissections must be performed using the left hand during the operation, it may pose a technical difficulty for right–handed surgeons [4]. In this case report, we present a 46-year-old male patient who presented with left upper quadrant pain and underwent laparoscopic cholecystectomy for symptomatic gallstone disease.

CASE REPORT

A 46-year-old male patient presented to the outpatient clinic with left upper quadrant pain for two weeks in duration. The patient also noted nausea and vomiting. Medical history was unremarkable with no chronic medication use. Physical examination revealed mild tenderness to palpation in the left upper quadrant region. Murphy's sign was negative and the laboratory results were normal. Abdominal ultrasonography revealed situs inversus and a single 36-mm gallstone. The preoperative chest X-ray revealed dextrocardia (Figure 1). The patient underwent laparoscopic cholecystectomy and the postoperative course was uneventful (Figures 2–4). The patient was discharged the following day and did not develop any complications.

Written informed consent was obtained from the patient.

DISCUSSION

Diagnosing a patient with gallstone disease can be difficult if situs inversus is not previously known. These patients typically present with left upper quadrant pain, which was the case in our patient. Although rare, right upper quadrant pain may occur in 10% of cases [4]. Other symptoms include nausea, vomiting, and discomfort in the epigastric region. Hepatobiliary ultrasonography and hepatobiliary iminodiacetic acid (HIDA) scintigraphy are useful in making the diagnosis.

Various techniques have been used for laparoscopic cholecystectomy in patients with situs inversus. The most commonly used surgical technique is to apply the

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mirror image of the normally applied technique. This method was also used in our case. In this technique, the right hand is used to retract the infundibulum and the left hand is used to dissect the gallbladder. Some surgeons ask their assistants to retract the infundibulum because they find it difficult to use the non-dominant hand in critical dissection, which allows the surgeon to dissect using their right hand [4–5].

Some surgeons prefer to retract the gallbladder infundibulum through the epigastric port, while using the right hand to do the dissection through the left mid-clavicular port, placing the patient either in supine or lithotomy position [4]. In one case report, a surgeon developed the three-port technique, which included the epigastric port, supraumbilical port, and left mid-clavicular port. The surgeon would retract the gallbladder with the right hand and perform the dissection with his left hand [6]. In another case, laparoscopic cholecystectomy was performed with a single incision using traditional instruments. A curvilinear infraumblical incision of approximately 2.5 cm in size was performed. Two 10-mm trocars were inserted. The trocar located on the right side of the patient was used for the laparoscope while the one on the left side for cautery or suturing. The gallbladder was suspended on the anterior abdominal wall with the help of two sutures. The first of these was inserted into the anterior axillary line through the 10th intercostal space on the left side, and the seromuscular layer of the gallbladder fundus was punctured and retracted towards the anterior abdominal wall. The Hartmann's pouch was punctured and retracted using the second suture which was inserted in the epigastrium and taken out through the left hypochondrium to expose the Calot's triangle. In this way, the surgery could be performed through a single incision [7].

Single-port laparoscopic cholecystectomy has also been favored in approaching patients with situs inversus. To reduce morbidity and improve the cosmesis of laparoscopic surgery, this technique has recently emerged and resulted in better cosmesis, less post-operative pain, and a better "scarless" surgery. Various surgeons also tried the Alexis wound retractor and a glove as the single access port [8,9].

CONCLUSİON

Patients with situs inversus who have cholelithiasis usually present with left upper quadrant pain and may have vague symptoms. Laparoscopic cholecystectomy still remains the gold standard in treating these patients. Since the anatomical structures are reversed, this may pose a challenge and confusion during surgery. To reduce this, various surgical techniques have been developed and surgeries that result in minimal scar tissue, such as single-port cholecystectomy, have been favored.

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CONFLICT OF INTEREST:

The authors declare that they have no conflict of interest.

The patient gave his informed consent prior to his inclusion in case report.

FIGURES

Figure 1. Dextrocardia is observed in the chest X-ray of the patient

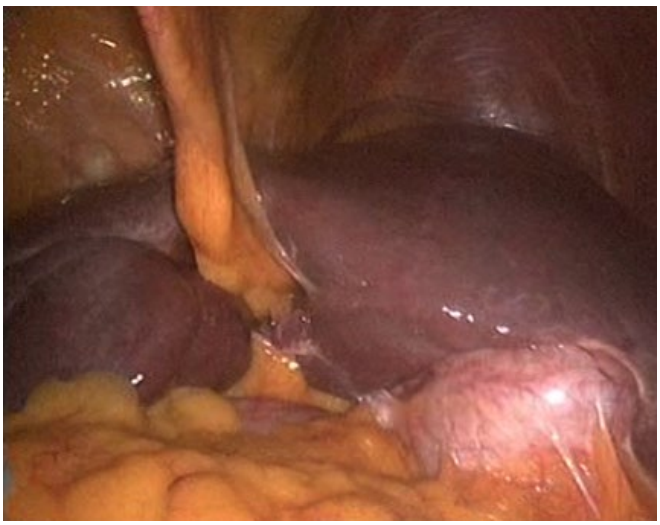

Figure 2. The reversed liver and gallbladder appearance in the patient

Figure 3. The reversed port placement in laparoscopic cholecystectomy

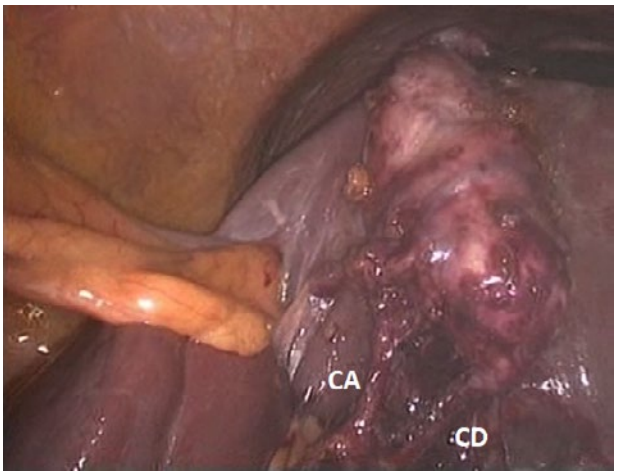

Figure 4. Cystic artery (CA) and cystic duct (CD) appearance in the patient.

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PORTOMESENTERIC THROMBOSIS WITH BOWEL NECROSIS IN COVID-19 PATIENT: CASE REPORT

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ABSTRACT

Background: COVID-19 related hypercoagulability is by now a well-established complication of this viral disease. The exact pathophysiological mechanisms of this process are not entirely clear but endothelial cell damage is thought to be a precursor to the pathological activation of the coagulation cascade. Although pulmonary embolism is the commonest thrombotic event, thromboemboli can form anywhere in the body and intraabdominal vessels are no exception. Descriptions of cases with bowel necrosis due to portomesenteric thrombosis have been increasingly emerging.

Case study: We present the case of a 60-year-old male COVID-19 positive patient with a radiologically confirmed portal vein and superior mesenteric vein thrombosis with small bowel necrosis treated surgically at our Institution. The thrombotic event was contributed to the viral infection and in conjunction with surgical treatment anticoagulant therapy was introduced.

Conclusion: Although often self limiting, gastrointestinal complaints in covid patients could also prove to be a surgical emergency. High risk of thromboembolic events in COVID-19 patients has to be taken into consideration while examining and treating the patient.

Keywords: COVID-19, thromboembolism, portal vein thrombosis, bowel necrosis

INTRODUCTION

Since the start of the COVID-19 pandemic many possible complications of the disease have been described, some of them (perhaps unexpectedly) requiring even surgical intervention. The covid related hypercoagulability has emerged as a very real danger and precursor of unfavourable and fatal outcomes. One review of literature found that approximately 20% of covid patients were affected by some form of venous thromboembolism. The commonest form of thrombotic event was of course pulmonary embolism [1]. The exact pathophysiological mechanisms are up to the present time not entirely clear but endothelial cell damage (often attributed to coronaviruses in general) seems to be the primary event leading to the activation of the coagulation cascade [2-6].

As a result, thromboprophylaxis with anticoagulant therapy became a mainstay of COVID-19 treatment and one of the markers most often used to determine severity of thrombotic-event-risk became D dimers - products of fibrin degradation demonstrating that the coagulation process has begun [6-8].

Outside the respiratory system thromboembolisms related to COVID-19 are possible in all macro- and microvascular structures in the body and acute cardiac and cerebral events as well as deep vein thrombosis in the extremities and gastrointestinal complications have been reported. Descriptions of thrombotic events in intraabdominal vessels similar to the one we are presenting have been increasingly emerging [9-17].

CASE REPORT

A surgical consult for a 60-year-old male patient hospitalised on the covid ward was requested. The patient's chief complaint was abdominal pain, dull in character and without propagation which started one day prior to hospitalisation. The patient reported one passing of a large amount of loose stool without abnormal changes at the beginning of symptoms, he was not febrile, denied nausea and emesis and had no dysuric problems. His medical history included total gastrectomy with esophagojejunal anastomosis due to cancer and right colectomy performed as treatment of cecal malignancy. Inflammatory blood markers were partially elevated (leukocytes 8.0 x 109/L, CRP 122, procalcitonin 0,15). D-dimer level was 4745µg/L. On examination the abdomen was distended, painful to palpation with signs of peritoneal irritation. Radiologic pulmonary findings were consistent with a milder covid pneumonia. Computed tomography of the abdomen was ordered and showed portal vein and superior mesenteric vein thrombosis (figure 1) with oedema of small bowel loops and a large collection of intraabdominal free fluid. Small bowel perforation was suspected, and emergent laparotomy was performed. Necrosis of a 10 cm-long jejunal segment was found and consequently resected and a termino-terminal anastomosis was formed. Extensive intraabdominal lavage was performed and antibiotics continued. Considering the extensive thrombotic intraabdominal

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events, medical history of two malignant intraabdominal diseases and the covid positive status, low molecular weight heparin in the form of dalteparin was continued for 3 months postoperatively. The postoperative course was otherwise uneventful. The patient was discharged on the 10th postoperative day.

DISCUSSION

Although COVID-19 is primarily a respiratory disease, possibility of complications in other organ systems should not be disregarded. Bearing in mind that especially critically ill covid patients have high thrombotic tendencies, it is important to undergo a more cautious search for causes of specific gastrointestinal symptoms. Often self limiting, gastrointestinal complaints in covid patients could also prove to be a surgical emergency as is shown in the patient we presented. The exact mechanism of COVID-19 hypercoagulability is not fully understood but thrombotic events in viral diseases are a well-known complication [3]. As it has done in all aspects of medical practices, the COVID-19 pandemic has taken its toll on surgical patient care. Unfavourable effects on oncological patients pre- and postoperatively have been well established. Whilst it is perhaps uncommon, persons infected with COVID-19 can stand in need of surgical intervention where a complication of the viral infection is the direct cause of the surgical emergency.

CONCLUSION

The purpose of this case report is to gather new and contribute to the existing information relating to possible COVID-19 complications. A gastrointestinal complaint in a covid patient can reveal itself as a surgical emergency. Being mindful of this helps us mitigate negative, even fatal outcomes.

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CONFLICT OF INTEREST:

The authors declare that there is no conflict of interest.

The patient gave his informed consent prior to his inclusion in case report.

FIGURES

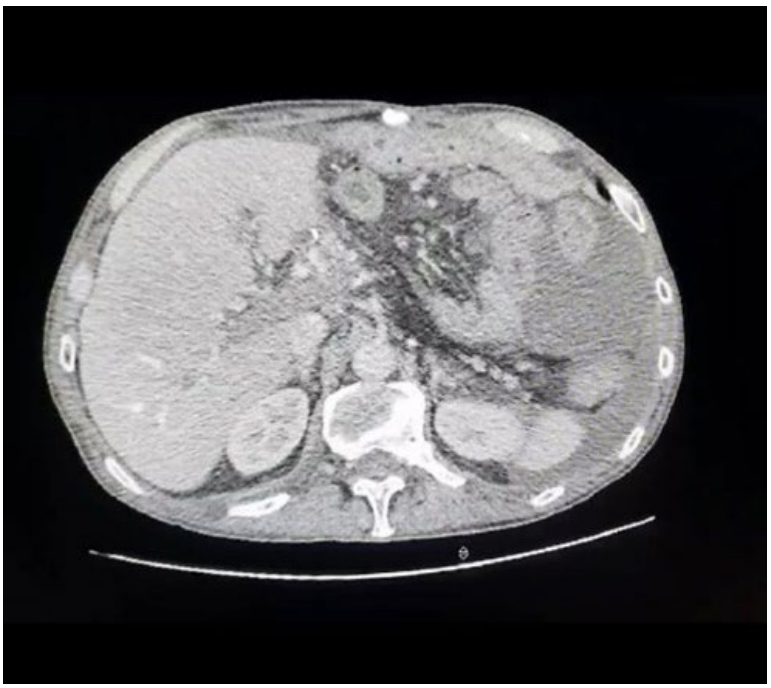

Figure 1. Abdominal computed tomography scan showing portomesenteric thrombosis

AUTHOR'S INDEX