

Postoperative Investigations Resulting in Cost Reduction in Oncological Patients Undergoing Major Abdominal and Pelvic Surgery

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Rezumat

Investigații postoperatorii cu impact în reducerea costurilor la pacientul oncologic, în chirurgia abdomino-pelvină majoră

Obiectiv: Costurile în creștere în domeniul îngrijirii sănătății sunt de interes tot mai mare și un factor major care afectează costurile de spitalizare sunt complicațiile postoperatorii. Complicațiile după Intervențiile Chirurgicale Abdominale Majore (ICAM) sunt asociate cu o morbiditate și mortalitate crescută. În acest studiu sunt estimate costurile îngrijirilor postoperatorii asociate cu complicațiile.

Metodă: Noi am efectuat un studiu retrospectiv pe 254 de pacienți internați în Clinica I de Chirurgie Generală și Oncologică a Institutului Oncologic din București, care au suferit ICAM. Au fost analizate costurile totale de spitalizare, complicațiile și tratamentul efectuat.

Rezultate: Pentru un pacient care a suferit ICAM, costurile medii pentru intervenția chirurgicală, fără complicații, sunt de 5.791,3 lei și ajung la o medie de 20.806 lei după complicații majore.

Concluzie: Rezultatele oferă o perspectivă asupra costurilor de spitalizare la pacienții oncologici operați. Complicațiile apar la 20,86% dintre pacienții care au suferit ICAM și reprezintă 50% dintre costurile totale de îngrijire. Stabilirea și aplicarea unui protocol care vizează diagnosticarea și tratamentul precoce al complicațiilor specifice ar putea duce la o scădere a morbidității și a mortalității, dar și al costurilor de spitalizare.

Cuvinte cheie: chirurgia oncologică genitală și digestivă, complicații postoperatorii, costuri spitalizare pacienți

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Abstract

Aim: Rising costs in health care are of progressively growing interest and a major factor affecting hospitalization costs is represented by postoperative complications. Complications of Major Abdominal Surgery (MAS) are associated with increased morbidity and mortality. This study estimates the costs of postoperative care associated with complications.

Material and Methods: We performed a retrospective study on 254 patients admitted to the 1st General and Oncological Surgery Clinic of the Bucharest Oncology Institute who were submitted to MAS. The total hospitalization, complications and treatment costs were analysed. **Results:** For a patient undergoing MAS, the average costs for surgery without complications are 5,791.3 RON and reach an average of 20,806 RON after major complications.

Conclusion: The results provide insight into the costs of hospitalization for oncology patients submitted to surgical interventions. Complications occur in 20.86% of patients undergoing MAS and account for 50% of total care costs. Establishing and implementing a protocol aimed at early diagnosis and treatment of specific complications could lead to a decrease in morbidity and mortality, as well as of the costs of hospitalization.

Key words: genital and digestive oncological surgery, postoperative complications, patient hospitalization costs

Introduction

Rising costs in health care are of progressively growing interest and a major factor affecting hospitalization costs is represented by postoperative complications. Major abdominal and pelvic surgery (MAPS) can be defined as surgical oncological interventions performed in the genital area (uterine, cervical, ovarian tumours) and abdominal area (gastric, hepato-bilio-pancreatic, colorectal tumours). Digestive surgery involves anastomoses and / or stomas.

Complications arising from major abdominal surgery (genital and digestive) may be associated with a morbidity between 3.7 and 35%, and mortality is increased (1.4-12.3%). Data from the literature show that postoperatively complications may occur in a percentage between 12.3% and 20% (1,2,3). Complications require intensive care and close monitoring of patients. Increased morbidity and mortality imply an increase in the number of days spent in ICU (anaesthesia and intensive care unit) and in the total days of hospitalization, resulting in an increase of over 50% in hospital costs (1).

Material and Method

The classification of postoperative complications was done in accordance with the one proposed by Dindo-Clavien, which divides complications into minor and major (4, 5). Grade I and II minor complications require non-invasive treatment, while for grade III and IV major complications invasive treatment under local or general anaesthesia (surgical reintervention, CT guided drainage etc.) and / or readmission and monitoring in ICU are required, which also generated an increase in hospital resources requirement (sanitary materials, medication, additional paraclinical and imaging investigations etc.). Our study estimates the costs of postoperative care associated with complications.

We performed a retrospective study, conducted between August 2015 and December 2016, on 254 patients who underwent major abdominal and pelvic surgery (MAPS). The analysis was carried out in the 1st General and Oncological Surgery Clinic of "Al. Trestioreanu" Oncology Institute in Bucharest.

The laboratory investigations performed to diagnose and monitor complications were:

1. CBC (complete blood count) – the number of leukocytes was monitored by increasing blood testing frequency;
2. CRP (C-reactive protein) – value increase and whether or not it returned to normal;
3. Measurement of leukocyte count from peritoneal fluid (performed only for patients with digestive sutures).

The additional imaging investigations performed to diagnose and monitor complications were:

1. Abdomino-pelvic ultrasound exam;
2. Chest ± abdomen X-ray;
3. Chest ± abdomen ± pelvis contrast CT (oral and intravenous).

It should be mentioned that interventional radiology was not used, and patients who, according to clinical and paraclinical data, required surgery, were submitted to reinterventions (11 patients - 35.48% of those with major complications).

Thus, we analysed:

- total hospitalization costs;
- complications and treatment costs.

Costs were determined by:

- Number of days of hospital stay (ward + ICU ± reinterventions);
- Laboratory investigations;
- Imaging investigations.

The costs for investigations at the Bucharest Oncology Institute (approved by the Bucharest Health Insurance House) were of:

- CBC – 19 RON;
- CRP – 12 RON;
- Leukocyte count from peritoneal fluid – 9 RON;
- Pulmonary/abdomen X-ray – 32 RON;
- Abdomen + pelvis ultrasound exam – 90 RON;
- Chest/abdomen contrast CT – considered the most eloquent imaging exam – 290/290 RON.

Data provided by the Statistics Department of the Bucharest Oncology Institute were used for cost analysis. Costs of complications were tracked for patients who exceeded the average hospital stay, namely 14 days for digestive inter-

ventions (more than 5 days in the ICU) and 9 days for patients requiring surgery for genital neoplasms (more than 1 day in the ICU). Expenses for hospitalization, food, medication, sanitary materials, laboratory tests and imaging investigations were analysed. The costs of surgical reinterventions were not separately analysed.

Apart from the basic blood tests, C-reactive protein (CRP) and leucocytosis in the peritoneal drainage fluid were evaluated in patients with digestive interventions on days 1, 3 and 5 postoperatively. Peritoneal leukocyte count was performed by centrifugation in the urinalysis machine. The data obtained were correlated with the leukocyte count and haemoglobin value progression on the CBC. In patients with genital tumours, leukocyte count and haemoglobin value progression were monitored.

Clinical data collected from the patient (fever, dynamic ileus, intestinal occlusion, vomiting, increase in naso-gastric fluid volume and changes in appearance, peritoneal irritation signs, hepato-renal failure, tachyarrhythmias etc.) were correlated with paraclinical and imaging investigations.

All patients received antibiotics (cephalosporins) and pre- and postoperative thrombo-prophylaxis. Major complications (grades III-V according to Dindo-Clavien) required invasive treatment, ICU monitoring, and also increased hospital stay. These complications led to the allocation of additional budgetary resources within the hospital, also affecting the costs of the Surgery Clinic.

Results

The following tumour localizations were taken under supervision:

- Digestive (anastomoses ± stomas) (120 patients):
 - Stomach + small bowel 14.17% (out of 254);
 - Liver, MBD (main bile duct), pancreas 9.44% (out of 254);
 - Colorectal 23.62% (out of 254);
- Genital (134 patients):

- Cervix 27.55% (out of 254);
- Uterus 11.02% (out of 254);
- Ovaries 14.17% (out of 254).

Of the 254 patients, 201 had no postoperative complications (79.13%). However, 53 patients presented various complications, representing 20.86%. 31 patients (12.20%) presented major complications (*Table 1*).

Of the 134 patients submitted to pelvic surgery, 9 (6.71%) had major complications, accounting for 16.98% of the total complications. The 9 patients accounted for 3.5% of the total patients and accounted for 29.03% of major postoperative complications (*Table 1*).

Patients operated on at the level of the digestive tract were in a number 120. Of these, 22 (18.33%) had major complications representing 83.02% of the total complications. The 22 patients constituted 8.66% of the investigated patients and represented 70.96% of the major postoperative complications.

The postoperative mortality recorded for the entire group of 254 patients during hospitalization was of 6 patients, representing 2.36% (0.39% - genital and 1.96% - digestive

respectively). Compared to the group with major complications, deaths represented 19.35% (3.22% genital and 16.12% digestive) (*Table 1*). Other clinics (1, 3) report major postoperative complications ranging from 15% to 24%, and mortality between 14% - 15.3%. In our lot, major complications were recorded in 12.30% of cases, and mortality in those with major complications was 19.35%.

In the patients included in the study (254), 11 reinterventions (4.33%) were required out of the entire group, 7 for patients submitted to surgery on the digestive tract (5.83%) and 4 for genital area interventions in women (2.98%). All these reinterventions required prolonged treatment in the ICU (13.57 days on average), increased hospital stay to an average of 24.28 days, and higher hospitalization costs: 21.046 RON on average per reintervention (*Tables 2, 3 and 4*).

Of the 254 patients, 53 patients had various complications representing 20.86%. 31 patients (12.20%) experienced major complications. Costs of treatment for an oncological patient were on average (*Table 4*).

Table 1. Features of patients submitted to surgery

Patients	Without complications	Minor complications	Major complications
Number - 254	201 (79.13%)	22 (8.66%)	31 (12.22%)
Male - 68	53	6	11
Female - 186	150	16 (9 genital, 7 digestive)	20 (9 genital, 11 digestive)
Average age = 60.63 years	63.2 years – digestive 58.45 years – genital 60.27 years – general	64.7 (62.2 – genital, 67 – digestive)	61 (59.44 – genital, 61.59 – digestive)
Surgical interventions	Stomach + small bowel = 22 Liver-MBD, pancreas = 19 Colorectal = 44 Cervix = 64 Uterus = 23 Ovaries = 29	4 2 7 2 2 5	10 3 9 4 2 3
Hospital stay (days)	12 – digestive 8,34 – genital Total = 18,65	15.54 – digestive 18,5 – genital Total = 17.02	30.8 – digestive 26,88 – genital Total = 28.84
ICU stay (days)	4.5 – digestive 1 – genital Total = 7,16	5.81 – digestive 5.2 – genital Total = 5.5	18 – digestive 8.49 – genital Total = 13.24
Mortality = 6	0	0	5 – digestive 1 – genital

Table 2. Postoperative complications

Patient complications	Digestive	Genital	Total
Specific postoperative complications			
Postoperative haemorrhage	2	3	5
Surgical wound seroma/abscess	4	4	8
Intestinal fistula	13	1	14
Intestinal occlusion	2	1	3
Superior digestive haemorrhage	4	0	4
Peritonitis	3	0	3
Ascites	1	0	1
Subphrenic abscess	2	0	2
Pre- and retroperitoneal hematoma	1	0	1
Sepsis, peritoneal abscess	1	0	1
Metrorrhagia	0	1	1
Surgical wound dehiscence – evisceration	0	1	1
Total specific complications	33	11	44
General complications			
Bronchopneumonia/Acute Respiratory Failure	4	0	4
Cardiac arrhythmia	1	2	3
Thromboembolism	0	1	1
Lower limb deep vein thrombosis	0	1	1
Hepatic failure	5	0	5
Urinary infection	1	0	1
Pleurisy	5	1	6
Acute renal failure	3	4	7
Macroscopic haematuria	1	1	2
Stroke	1	0	1
Secondary anaemia	7	5	12
Pericarditis	1	0	1
MSOF- Multisystem organ failure	2	1	3
Catheter thrombophlebitis	0	1	1
Hyper K ⁺	0	1	1
Diarrheic syndrome with Clostridium Difficile	0	2	2
Total general complications	31	20	51
Total complications	64	31	95
Reintervention	7	4	11
Death	5	1	6

Discussions

Major abdominal and pelvic oncological surgery (digestive and genital) involves the possible occurrence of complications. The timely tracing of severe complications entails a more prompt therapeutic approach, before changes implied by multiple organ failure occur. Frequently, these complications generate a true cascade of events, with a major impact on the patient's biological balance. If they overlap with an immunocompromised field, due to radio-chemotherapy, at an age with modest functional reserves, all the conditions for a poor outcome are outlined.

Going through the postoperative complications table (*Table 2*) one can observe their polymorphous nature. Thus, a number of 51 general complications (53.68%) was recorded, compared to 44 complications specific to the surgical intervention (46.31%). It should be noted that the ratio between these two groups of complications is approximately equal, and several complications may be reported in the same patient, both general and specific. Thus, the 53 patients with complications developed a number of 95 postoperative events. At the same time, a significantly higher rate of complications after digestive surgery was recorded compared to pelvic surgery. Moreover, the complications arising after digestive system surgery have a degree of

Table 3. Average ICU and hospital stay for patients submitted to surgery

Interventions	Complications	ICU stay (days)	Hospital stay (days)
Digestive	Without complications	4.5	12
	Major complications	18	30.8
Genital	Without complications	1	8.34
	Major complications	8.49	26.88

Table 4. Average costs of surgery with and without major complications

Interventions	Complications	Cost
Digestive	Without complications	7,542 RON
	Major complications	30,578 RON
Genital	Without complications	4,040.6 RON
	Major complications	11,034.2 RON
Average intervention cost	Without complication	5,791.3 RON
	Major complications	20,806 RON

severity that exceeds that of the complications after gynaecological interventions.

Diagnosis and treatment of these severe complications remain a challenge and are important in reducing morbidity and mortality. The occurrence of postoperative complications involved an increase in the number of laboratory tests, the introduction of additional investigations (CRP, leukocyte count from the peritoneal drainage fluid), additional imaging investigations (X-rays, ultrasound exam, CT), prolonged conservative treatment and / or surgical reinterventions, all leading to prolonged ICU and hospital stay. Thus, our study shows how postoperative complications, especially major ones (classified by Dindo-Clavien), can significantly increase patient treatment costs.

In our patients, complications occurred in 20.86% of cases, out of which major ones represented about 12.20%, a percentage similar to that reported by other clinics with similar pathology (1). Compared to major complications, deaths were 19.35% (3.22% genital and 16.12% digestive). Other clinics (1,3) report major postoperative complications ranging from 15% to 24%, and mortality between 14% - 15.3%.

The occurrence of these complications led to an average increase of costs from 5,791.3 RON to 20,806 RON, 3.5 times higher compared to uncomplicated patients. A major impact of the costs of patients with major complications on the hospital budget was observed. It should be noted that patients who present a major postoperative complication may require continued outpatient treatment and / or home care, and in some of them present delays in returning to work, which can involve additional costs for society.

With regard to this, the study also aimed to search / associate laboratory and imaging investigations that would allow the discovery of specific complications and their early treatment. This could translate into fewer days of hospitalization (both in the ICU and on the ward postoperatively) and, therefore, lower hospital costs. The data obtained by us, as well as those in the literature, show that CRP may

foreshadow the occurrence of a complication long before its clinical and imaging manifestation (1.5 days versus 4 days), allowing early diagnosis and aggressive treatment (6). For new digestive sutures we also introduced leukocyte count monitoring from peritoneal drainage fluid, along with CRP and CBC. Major abdominal and pelvic surgery sometimes involves extensive interventions, sometimes with multiple organ resections. These interventions predispose to incidents and intraoperative accidents, which can contribute to increased hospitalization costs (7).

Abdominal and pelvic surgical interventions for cancer require the administration of an injectable anticoagulant to prevent deep vein thrombosis (DVT) and its complications (thromboembolism). Data from the literature show that the incidence of thromboembolism was 4.89% in patients followed for 90 days postoperatively. Occurrence of DVT in patients undergoing major abdominal surgery resulted in a 1.5-fold increase in hospitalization duration and a 2.8-fold increase in total costs at 90 days postoperatively, compared to patients who did not develop this complication. Thus, effective prophylactic treatment of DVT is recommended to reduce the economic burden associated with major abdominal surgery. (8)

In terms of gynaecological interventions for cancer, the percentage of patients with major complications is 3 times lower than that observed in patients who underwent surgery at the level of the digestive tract (6.71% versus 18.33%). On the other hand, complications following gynaecological surgery are of considerably smaller size and lower severity than those of digestive surgery. Good management of fast postoperative recovery, with the prevention and timely treatment of possible complications, is associated with low morbidity and a substantial reduction in hospitalization costs. (9,10)

Thoraco-abdominal X-ray and abdomino-pelvic ultrasound were the most used imaging investigations. CT was performed at the indication of a specialist (anaesthesia and intensive care specialist, surgeon, neurologist etc.), without the possibility of treatment of

abdomino-pelvic septic complications through percutaneous drainage.

Any surgeon's dream is surgery without complications. Our endeavours and efforts are directed accordingly. All efforts are being made to achieve this goal. However, there are a number of variables that interfere with the patient's postoperative evolution, making complications possible: vascular field, preexisting septic factors, nutrition status, neoplasia, radio-chemotherapy, the magnitude of the surgical intervention, and others.

Conclusions

Postoperative complications in abdominal and pelvic oncological surgery occur in approximately 20.86% of patients and represent approximately 54% of the costs of patients undergoing these surgeries. Major complications were present in a percentage of 12.20%, relative to the entire studied group, and increased patient costs by 3.5 times. Severe complications require emergency employment of exploration means needed to obtain early diagnosis and initiate prompt treatment.

We consider that the introduction into the diagnostic protocol of complications of CRP (C-Reactive Protein) and of leukocyte count from the peritoneal fluid, together with CBC, are useful for early diagnosis of postoperative complications. Abdomino-pelvic ultrasound and thoraco-abdominal radiography, which are cost-effective, could also contribute to these.

In the future, we are trying to introduce CRP determination and leukocyte count from the peritoneal fluid as a standard for early postoperative diagnosis of specific complications. CT scanning remains the most valuable method providing topographical data regarding the site of the complication, indicating the approach pathway: interventional CT or classic / laparoscopic surgical approach.

General postoperative complications do not fall into the surgeon's field of work, their diagnosis and resolution being in their entirety the responsibility of the intensive care physician. These complications may precede or may develop concurrently with complications specific to the surgical intervention.

The results we obtained provide an insight into the cost of hospitalization in oncological patients undergoing surgery. Establishing and applying a protocol aimed at early diagnosis and treatment of specific complications could lead to a decrease in morbidity, mortality, as well as in hospitalization costs.

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