

# Health & Research Journal

Vol 8, No 4 (2022)

Volume 8 Issue 4 October - December 2022



Volume 8 Issue 4 October - December 2022

#### EDITORIAL

INTER-PROFESSIONAL TEAMWORK CHALLENGES IN THE EMERGENCY ROOM AND CRITICAL CARE UNIT

#### BRIEF REPORT

FAMILIAL HYPERCHOLESTEROLEMIA. PERSPECTIVES ON FH REGISTRY SYSTEMS

#### RESEARCH ARTICLES

ORGANIZATION AND MANAGEMENT OF INTENSIVE CARE UNIT, CORRELATION OF TEAM CLIMATE WITH JOB SATISFACTION OF THE NURSES IN THE ICU

COST-EFFECTIVE SURGICAL MANAGEMENT OF LIVER DISEASE IN AN UNIVERSITY HOSPITAL: A RETROSPECTIVE STUDY

NUTRITIONAL PREFERENCES OF PRESCHOOL CHILDREN FOR BREAKFAST

DETERMINATION OF FEVER MANAGEMENT AND RATIONAL DRUG USE OF MOTHERS WITH CHILDREN UNDER SIX YEARS OLD

RELIGIOSITY AND CORONARY HEART DISEASE IN GREEK ADULTS

#### SYSTEMIC REVIEW

MANAGEMENT OF ACUTE PANCREATITIS IN THE EMERGENCY DEPARTMENT

INVASIVE TECHNIQUES FOR THE REMOVAL OF NECROTIC TISSUE IN CHRONIC WOUNDS, A SYSTEMATIC REVIEW

Published in cooperation with the Postgraduate Program "Intensive Care Units", the Hellenic Society of Nursing Research and Education and the Helerga

## Cost-effective surgical management of liver disease in an university hospital: A retrospective study

*Ioanna Tseka, Michael Chrisofos, Elissaios Kontis, Christos Triantafyllou, Panagiotis Kokoropoulos, Nikolaos Arkadopoulos*

doi: [10.12681/healthresj.29409](https://doi.org/10.12681/healthresj.29409)

### To cite this article:

Tseka, I., Chrisofos, M., Kontis, E., Triantafyllou, C., Kokoropoulos, P., & Arkadopoulos, N. (2022). Cost-effective surgical management of liver disease in an university hospital: A retrospective study. *Health & Research Journal*, 8(4), 284-292. <https://doi.org/10.12681/healthresj.29409>

## RESEARCH ARTICLE

## COST-EFFECTIVE SURGICAL MANAGEMENT OF LIVER DISEASE IN A UNIVERSITY HOSPITAL: A RETROSPECTIVE STUDY

Ioanna Tseka<sup>1</sup>, Michael Chrisofos<sup>2</sup>, Elissaios Kontis<sup>3</sup>, Christos Triantafyllou<sup>4</sup>, Panagiotis Kokoropoulos<sup>5</sup>, Nikolaos Arkadopoulos<sup>6</sup>

1. RN, MSc, PhD (c), National and Kapodistrian University of Athens, Medical School, Athens, Greece.
2. Professor of Urology, 3rd Department of Urology, University General Hospital "ATTIKON", National and University of Athens, Medical School, Athens, Greece.
3. MD, PhD, Institute of Liver Studies, King's College Hospital NHS Foundation Trust, London, United Kingdom.
4. RN, MSCE, PhD (c), Department of Nursing, National and Kapodistrian University of Athens, Athens, Greece
5. MD, MSc, PhD (c), 4th Department of Surgery, University General Hospital "ATTIKON", National and University of Athens, Medical School, Athens, Greece
6. Professor of Surgery, 4th Department of Surgery, University General Hospital "ATTIKON", National and University of Athens, Medical School, Athens, Greece

**Abstract**

**Background:** Hepatobiliary surgery is a high-end surgery comprising of complex operations associated with high economic burden to a healthcare system. The aim of this study was to evaluate the cost-effectiveness of a hepatobiliary surgery highly standardized operative protocol, that minimizes intraoperative and postoperative costs, implemented by the same surgical team, in a Greek university hospital for a five-year period (2012-2016).

**Method and Material:** The digital medical records of all patients undergoing liver resection at a tertiary university hospital from January 2012 to December 2016 by a single surgical team were retrospectively reviewed. The financial cost of the patients' treatment was calculated in collaboration with the hospital's logistics department, and it involved all preoperative, intraoperative, and postoperative expenses from admission to discharge, excluding physician fees and salary cost of the hospital's nurses.

**Results:** In this study, 127 patients underwent hepatectomy. The patient's health status was improved after the surgery in most of the cases (121, 95.2%). The mean Length of Stay (LOS) was 13.4 (SD±17.3) days. The mean total hospitalization cost was 4,729 (SD ± 5,486) euros (€), while the cost of surgery, the higher mean cost was noted in 2013 (925, SD±974.64 €) and the lower in 2015 (142, SD±219 €).

**Conclusions:** This protocol allows the performance of hepatectomies with a significantly decreased cost without compromising patient outcomes.

**Keywords:** Hepatobiliary surgery, cost estimation, cost-effective method, adverse events.

**Corresponding Author:** Christos Triantafyllou RN, MSCE, PhD (c), Department of Nursing, National and Kapodistrian University of Athens, 123 Papadimantopoulou str., Goudi, 11527 Athens, Tel: (+30) 6971842775, email: [christian@nurs.uoa.gr](mailto:christian@nurs.uoa.gr)

Cite as: Tseka, I., Chrisofos, M., Kontis, E., Triantafyllou, C., Kokoropoulos, P., Arkadopoulos, N. (2022). Cost-effective surgical management of liver disease in a university hospital: a retrospective study. *Health and Research Journal*,8(4),284-292. <https://ejournals.epublishing.ekt.gr/index.php/HealthRes/>

## INTRODUCTION

Primary liver cancer is the fifth most common malignancy worldwide, with yearly fatality ratio of the order of 1, indicating that the majority of the cases do not survive more than a year.<sup>1</sup> The highest incidence rates of liver cancer were observed in Eastern and South-Eastern Asia, Northern and Southern Africa, with China accounting for about 50% of all cases.<sup>2</sup>

Hepatobiliary surgery is a high-end surgery comprising of complex operations associated with high economic burden to a healthcare system. The laparoscopic liver surgery has developed progressively and cautiously over the last years.<sup>3-5</sup> A potential barrier to laparoscopic liver surgery diffusion is their uncertain effect on financial costs.

In a considerable number of studies, it was found that the considerable perioperative costs associated with the minimally invasive surgery technique resulted greatly counterbalanced by postoperative cost-savings, comparing with the open surgery, and have favored their implementation by health care systems.<sup>6-8</sup>

For example, previous study that was conducted in Greece which aim to evaluate the cost-effectiveness of a standardized protocol of open liver resection,<sup>9</sup> found that this protocol allows the performance of hepatectomies with a significantly decreased cost without compromising surgical outcomes. This indicates that its application in financially struggling hospitals, that cannot afford minimal invasive procedures, or open liver surgery using expensive disposables is feasible.

Liver resection is the basic curative treatment for the majority of hepatobiliary malignant.<sup>10</sup> Progress in surgical techniques and perioperative management have led to an important drop in mortality to less than 5% in specialized center.<sup>11</sup> In spite of the low morbidity and good oncologic outcome,<sup>12,13</sup> the presumed intraoperative higher costs for the laparoscopic approach, comparing with the open surgery, may be a barrier to widespread adoption like the laparoscopic liver resections.<sup>13</sup>

A systematic review that assessed the cost of liver resections, the operative costs for the laparoscopic approach exceeded this of open surgery due to higher equipment costs.<sup>14</sup> Although, the conflicting data of the existing studies,<sup>15,16</sup> suggest the need for additional studies.

Thus, the aim of this study was to evaluate the cost-effectiveness

of hepatobiliary surgery highly standardized operative protocol, that minimize intraoperative and postoperative costs, implemented by the same surgical team, in a Greek university hospital for a five-year period (2012-2016).

## METHODOLOGY

### *Study design, patient selection and operative technique*

A retrospective observational study was carried out from January 2012 to December 2016, at a tertiary university hospital among all patients undergoing liver resection for any indication (primary or metastatic, benign, or malignant) by the same surgical team. The digital medical records of all patients included in the study. Regarding liver resections, all hepatectomies were performed with a standardized surgical protocol, which involves selective hepatic vascular exclusion (SHVE) of the liver and transection of the hepatic parenchyma with a scalpel, maintaining central venous pressure (CVP) within  $\pm 20\%$  of baseline values, and implementing a combination of general and epidural anesthesia to all patients.<sup>17</sup>

Summarily, the liver was assembled by transection of the hepatic ligaments and ligation of the short hepatic veins of the inferior vena cava. Intraoperative ultrasonography was used to certify lesion resectability and perform the transection plane. The liver inflow was disciplined by Pringle maneuver and the outflow by clamping both the right hepatic vein and the common trunk of the middle and left hepatic veins at the hepatocaval junction. Aberrant extrahepatic vessels were also disciplined with bulldog clamps. Coming the fixed plane of resection, the hepatic parenchyma was transected with the use of scalpel. The orifices of all major vascular and biliary structures were sutured with polypropylene sutures. Additional hemostatic sutures were placed after the release of hepatic outflow and inflow, while simple diathermy was also used when indicated. After completion of hemostasis, a patch of round ligament or greater omentum 2-0 polypropylene sutures on the liver cut surface. Before abdominal closure, a drain was placed in the right subdiaphragmatic space and connected to a closed system without suction.

### *Data collection*

All eligible patients were identified from hospital records using

ICD-10 codes for both diagnosis and operational procedure. Data extracted included demographics, comorbidities, and pre-operative diagnosis. Also details of the operation were recorded and intraoperative data were obtained from the operation notes. The financial cost of the patients' treatment was calculated in collaboration with the hospital's logistics department and it involved all preoperative, intraoperative, and postoperative expenses from admission to discharge, excluding physician fees and salary cost of the hospital's nurses.

Patients operated by a different surgical team was not included in this study.

### **Ethics approval and consent to participate**

The study was approved by both the Ethics Committee of a Greek University and the Hospital's review board. The study was noninvasive and did not involve any risk or harm to the participants. Informed consent was waived due to the observational nature of the study.

### **Statistical analysis**

Descriptive statistics, either parametric (mean (m), standard deviations (SD)), or non-parametric (counts, and percentages (%)) are presented as appropriately. All numeric variables were assessed for normality by Kolmogorov-Smirnov test. Student's t-test or Mann-Whitney U test was used for comparisons between treatment groups as appropriate. Chi-square test ( $\chi^2$ ) was used to for categorical data. Spearman's rho was used to assess the association between continuous variables such as cost, duration of surgery, length of stay (LOS). Spearman's rho values between 0.1 and 0.39 (-0.39 and -0.1), 0.4 and 0.69 (-0.69 and -0.4), 0.7 and 0.89 (-0.89 and -0.7) and 0.9 and 1 (-1 and -0.9) indicate a weak, moderate, strong and very strong positive (negative) correlation, respectively<sup>18</sup>. A cut-off of  $p \leq 0.05$  was set for statistical significance. The statistical software SPSS version 20.0 was used for the statistical analyses.

### **RESULTS**

During the study period we identified 127 patients who underwent hepatectomy and their demographics and operation de-

tails are presented in **Table 1**. The majority (53.5%) were females; and their mean age was 62.1 (SD±13.5) year. Moreover, only 11 (8.6%) were admitted to Intensive Care Unit (ICU), and only 6 (4.7%) patients died during or after the surgery. The mean LOS was 13.4 (SD±17.3) days.

In **table 2** are presented data about the type of surgery, the volume and type of tumor and information about the cost of hospitalization and surgery. The majority of tumors were malignant (88, 69.2 %). Regarding hospitalization cost, the mean total cost was 4,729.02 ± 5,486.33 euros (€), the higher cost was observed in 2013 (6,357, SD±9,421€) and the lower in 2016 (3,689, SD±1,641€). Concerning the surgery cost, the higher mean cost was noted in 2013 (925, SD±974 €) and the lower in in 2015 (142, SD±219€).

Statistically significant weak correlation was found between LOS and duration surgery and between LOS and cost of surgery ( $\rho=0.333$ ,  $p<0.0005$ ;  $0.201$ ,  $p=0.024$ , respectively). Moreover, hospitalization cost correlated moderately and statistically significantly with LOS ( $\rho=0.612$ ,  $p<0.005$ ). Duration of surgery was correlated, weakly and statistically significantly with hospitalization cost ( $\rho=0.298$ ,  $p=0.001$ ) and surgery cost ( $\rho=0.390$ ,  $p<0.0005$ ).

Difference was found between males and females regarding duration of surgery. Specifically, the mean duration of surgery was longer in males (157.5 minutes) than in females (138.4 minutes) (**table 3**). Lastly, there was no statistically significant difference between patients' gender and outcome (death or not during or after the surgery) ( $\chi^2= 2.06$ ,  $df = 1$ ,  $p>0.05$ ).

### **DISCUSSION**

The goal of this study was to evaluate the cost-effectiveness of hepatobiliary surgery highly standardized operative protocol, that minimize intraoperative and postoperative costs, implemented by the same surgical team, in a Greek university hospital for a five-year period (2012-2016). This is the first study in which the evolution of cost was observed, when the same surgical team implemented the same standardized operative protocol many times. The results of this study will allow the exchange of information, among researchers and care providers worldwide,

and may enable their implementation in everyday clinical practice worldwide.

Liver surgery for malignant and benign tumors used to be associated with individually increased mortality and morbidity.<sup>19-22</sup> Improvements in surgical performance and anesthesia, understanding of liver structure and function, better imaging, improvements in surgical technology, and accretion of experience have contributed to an acute decrease in mortality, less blood loss, less postoperative pain, fewer wound infections, and shorter hospital stay.<sup>12,13,23</sup> This upturn in surgery allowed the application of laparoscopic techniques in liver resection and later on robotics.<sup>13,24,25</sup> Prior to the establishment of laparoscopic and robotic liver resection and the ever-increasing use of energy devices and expendables, studies about perioperative and hospitalization cost were scarce.

In this study, it was found that the majority of patients that underwent hepatectomy, did not need ICU admission (91.3 %) or re-laparotomy for bleeding (98.4 %), only 6 (4.7 %) patients died during or after the surgery, while the mean total hospitalization and surgery cost was 4,729 € and 673€. These results indicated that this standardized operative protocol of liver resection is cost-effective due to the low number of deaths and complications that lead patient to ICU and to re-laparotomy. Moreover, these results are on the line with those of past studies assessing open liver resection in terms of clinical outcomes, perioperative parameters, and cost.<sup>9,26,27</sup> Although, the mean LOS was 13.46 days, which was higher than this that was observed in patient underwent laparoscopic liver resection in previous studies.<sup>28-30</sup> This study has some limitations. It is a retrospective study of local data, and the presence of selection biases or elusive variables is possible. All financial data came from a single institution reducing the generalization of our results to other populations, clinical settings, and countries. One limitation of this study would be that the fees of the healthcare personnel has not been accounted for, although they have been subject to income deductions during the study period. Implementation of these amounts would directly affect the comparison with previously reported case series.

## CONCLUSIONS

In conclusion, this protocol allows the performance of hepatectomies with a significantly decreased cost without compromising patient outcomes. Application of this protocol, in financially struggling institutions that cannot afford laparoscopic, robotic, or open liver surgery using expensive disposables is feasible. Accumulation of experience in this protocol is mandatory to achieve clinical and economical effectiveness.

Last but not least, all the new surgical techniques should be evaluated regarding their safety, clinical effectiveness, the learning curve surgeons encounter when adopting a new approach and their pre- peri- and post-operative costs, particularly given the economic implications for many healthcare systems of countries that struggle financially and apply health budget cuts.<sup>31-33</sup>

## Conflict of interest

The authors declare that they have no competing interests.

## REFERENCES

1. Marengo A, Rosso C, Bugianesi E. Liver Cancer: Connections with Obesity, Fatty Liver, and Cirrhosis. *Annu Rev Med* 2016;67(1):103-17.
2. Ferlay J, Soerjomataram I, Dikshit R, Eser S, Mathers C, Rebelo M, et al. Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. *Int J Cancer* 2015;136(5):E359-386.
3. Ciria R, Cherqui D, Geller DA, Briceno J, Wakabayashi G. Comparative Short-term Benefits of Laparoscopic Liver Resection: 9000 Cases and Climbing. *Ann Surg* 2016;263(4):761-77.
4. Ratti F, Cipriani F, Ariotti R, Gagliano A, Paganelli M, Catena M, et al. Safety and feasibility of laparoscopic liver resection with associated lymphadenectomy for intrahepatic cholangiocarcinoma: a propensity score-based case-matched analysis from a single institution. *Surg Endosc* 2016;30(5):1999-2010.
5. Scuderi V, Barkhatov L, Montalti R, Ratti F, Cipriani F, Pardo F, et al. Outcome after laparoscopic and open resections of posterosuperior segments of the liver. *Br J Surg* 2017;104(6):751-9.

6. Bell R, Pandanaboyana S, Hanif F, Shah N, Hidalgo E, Lodge JPA, et al. A cost effective analysis of a laparoscopic versus an open left lateral sectionectomy in a liver transplant unit. *HPB* 2015;17(4):332–6.
7. Kawaguchi Y, Otsuka Y, Kaneko H, Nagai M, Nomura Y, Yamamoto M, et al. Comparisons of financial and short-term outcomes between laparoscopic and open hepatectomy: benefits for patients and hospitals. *Surg Today* 2016;46(5):535–42.
8. Stoot JHMB, van Dam RM, Coelen RJS, Winkens B, Olde Damink SWM, Bemelmans MHA, et al. The introduction of a laparoscopic liver surgery programme: a cost analysis of initial experience in a university hospital. *Scand J Surg SJS Off Organ Finn Surg Soc Scand Surg Soc* 2012;101(1):32–7.
9. Arkadopoulos N, Gemenetzi G, Danias N, Kokoropoulos P, Koukoupoulou I, Bartsokas C, et al. Cost-Effective Surgical Management of Liver Disease Amidst a Financial Crisis. *World J Surg* 2016;40(7):1695–701.
10. Arkadopoulos N, Gemenetzi G, Danias N, Kokoropoulos P, Koukoupoulou I, Bartsokas C, et al. Cost-Effective Surgical Management of Liver Disease Amidst a Financial Crisis. *World J Surg* 2016;40(7):1695–701.
11. Sato M, Saku N, Takeda A, Suzuki N, Saito T, Minato N, et al. [A case report--pulmonary cryptococcosis associated with systemic lupus erythematosus and review of 44 cases in Japan]. *Ryumachi Rheum* 1993;33(1):56–62.
12. Doula C, Kostakis ID, Damaskos C, Machairas N, Vardakostas DV, Feretis T, et al. Comparison Between Minimally Invasive and Open Pancreaticoduodenectomy: A Systematic Review. *Surg Laparosc Endosc Percutan Tech* 2016;26(1):6–16.
13. Okunrintemi V, Gani F, Pawlik TM. National Trends in Post-operative Outcomes and Cost Comparing Minimally Invasive Versus Open Liver and Pancreatic Surgery. *J Gastrointest Surg Off J Soc Surg Aliment Tract* 2016;20(11):1836–43.
14. Limongelli P, Vitiello C, Belli A, Pai M, Tolone S, Del Genio G, et al. Costs of laparoscopic and open liver and pancreatic resection: a systematic review. *World J Gastroenterol* 2014;20(46):17595–602.
15. Limongelli P, Vitiello C, Belli A, Pai M, Tolone S, Del Genio G, et al. Costs of laparoscopic and open liver and pancreatic resection: a systematic review. *World J Gastroenterol* 2014;20(46):17595–602.
16. Okunrintemi V, Gani F, Pawlik TM. National Trends in Post-operative Outcomes and Cost Comparing Minimally Invasive Versus Open Liver and Pancreatic Surgery. *J Gastrointest Surg Off J Soc Surg Aliment Tract* 2016;20(11):1836–43.
17. Smyrniotis V, Arkadopoulos N, Kostopanagiotou G, Farantos C, Vassiliou J, Contis J, et al. Sharp liver transection versus clamp crushing technique in liver resections: a prospective study. *Surgery* 2005;137(3):306–11.
18. Schober P, Boer C, Schwarte LA. Correlation Coefficients: Appropriate Use and Interpretation. *Anesth Analg* 2018;126(5):1763–8.
19. Di Saverio S, Catena F, Filicori F, Ansaloni L, Coccolini F, Keutgen XM, et al. Predictive factors of morbidity and mortality in grade IV and V liver trauma undergoing perihepatic packing: single institution 14 years experience at European trauma centre. *Injury* 2012;43(9):1347–54.
20. Jarnagin WR, Gonen M, Fong Y, DeMatteo RP, Ben-Porat L, Little S, et al. Improvement in perioperative outcome after hepatic resection: analysis of 1,803 consecutive cases over the past decade. *Ann Surg* 2002;236(4):397–406; discussion 406–407.
21. Parkin DM, Bray FI, Devesa SS. Cancer burden in the year 2000. The global picture. *Eur J Cancer Oxf Engl* 1990. 2001;37 Suppl 8:S4–66.
22. Parkin DM, Bray F, Ferlay J, Pisani P. Global cancer statistics, 2002. *CA Cancer J Clin* 2005;55(2):74–108.
23. Kenjo A, Miyata H, Gotoh M, Kitagawa Y, Shimada M, Baba H, et al. Risk stratification of 7,732 hepatectomy cases in 2011 from the National Clinical Database for Japan. *J Am Coll Surg* 2014;218(3):412–22.
24. Azagra JS, Goergen M, Gilbert E, Jacobs D. Laparoscopic anatomical (hepatic) left lateral segmentectomy-technical aspects. *Surg Endosc* 1996;10(7):758–61.
25. Hanly EJ, Talamini MA. Robotic abdominal surgery. *Am J Surg* 2004;188(4A Suppl):19S–26S.

26. Medbery RL, Chadid TS, Sweeney JF, Knechtle SJ, Kooby DA, Maithel SK, et al. Laparoscopic vs open right hepatectomy: a value-based analysis. *J Am Coll Surg* 2014;218(5):929–39.
27. Zhang X, Yang J, Yan L, Li B, Wen T, Xu M, et al. Comparison of laparoscopy-assisted and open donor right hepatectomy: a prospective case-matched study from china. *J Gastrointest Surg Off J Soc Surg Aliment Tract* 2014;18(4):744–50.
28. Cipriani F, Ratti F, Cardella A, Catena M, Paganelli M, Aldrighetti L. Laparoscopic Versus Open Major Hepatectomy: Analysis of Clinical Outcomes and Cost Effectiveness in a High-Volume Center. *J Gastrointest Surg Off J Soc Surg Aliment Tract* 2019;23(11):2163–73.
29. Cleary SP, Han H-S, Yamamoto M, Wakabayashi G, Asbun HJ. The comparative costs of laparoscopic and open liver resection: a report for the 2nd International Consensus Conference on Laparoscopic Liver Resection. *Surg Endosc* 2016;30(11):4691–6.
30. Peng J-X, Wang L-Z, Diao J-F, Tan Z-J, Zhong X-S, Zhen Z-P, et al. Major hepatectomy for primary hepatolithiasis: a comparative study of laparoscopic versus open treatment. *Surg Endosc* 2018;32(10):4271–6.
31. Cuschieri A, Ferreira E, Goh P, Idezuki Y, Maddern G, Marks G, et al. Guidelines for conducting economic outcomes studies for endoscopic procedures. *Surg Endosc* 1997;11(3):308–14.
32. Souliotis K, Golna C, Tountas Y, Siskou O, Kaitelidou D, Liaropoulos L. Informal payments in the Greek health sector amid the financial crisis: old habits die last.. *Eur J Health Econ HEPAC Health Econ Prev Care* 2016;17(2):159–70.
33. Wilson CB. Adoption of new surgical technology. *BMJ*. 2006;332(7533):112–4.

## ANNEX

**Table 1.** Demographics and characteristics of the 127 patients that underwent hepatectomy.

|                                      | <b>N (%), mean <math>\pm</math> SD</b> |
|--------------------------------------|--|
| <b>Sex</b>                           |  |
| Female                               | 68 (53.54)                             |
| Male                                 | 59 (46.46)                             |
| <b>Age</b>                           | 62.12 $\pm$ 13.55                      |
| <b>Length of stay (days)</b>         | 13.46 $\pm$ 17.31                      |
| <b>Duration of surgery (minutes)</b> | 147.34 $\pm$ 54.46                     |
| <b>Re-laparotomy for bleeding</b>    |  |
| Yes                                  | 2 (1.57)                               |
| No                                   | 125 (98.43)                            |
| <b>ICU Admission</b>                 |  |
| Yes                                  | 11 (8.67)                              |
| No                                   | 116 (91.34)                            |
| <b>Blood transfusion</b>             |  |
| Yes                                  | 66 (51.97)                             |
| No                                   | 61 (48.03)                             |
| <b>Outcome</b>                       |  |
| Death                                | 6 (4.72)                               |
| Improvement                          | 121 (95.28)                            |

**Note.** ICU, Intensive Care Unit; SD, Standard Deviation



**Table 2.** Information regarding hepatectomies.

|                                 | <b>N (%), mean <math>\pm</math> SD</b> |
|---------------------------------|--|
| <b>Type of surgery</b>          |  |
| <2 seg                          | 50 (41)                                |
| >3 seg                          | 51(41,8)                               |
| Metastasectomy                  | 21 (17,2)                              |
| <b>Tumor volume (gr)</b>        | 426.1 $\pm$ 374.2                      |
| <b>Type of tumor</b>            |  |
| Benign                          | 36 (29)                                |
| Malignant                       | 88 (71)                                |
| <b>Hospitalization cost (€)</b> |  |
| 2012                            | 3,740 $\pm$ 2,797                      |
| 2013                            | 6,357 $\pm$ 9,421                      |
| 2014                            | 5,207 $\pm$ 3,029                      |
| 2015                            | 3,769 $\pm$ 1,512                      |
| 2016                            | 3,689 $\pm$ 1,641                      |
| Total                           | 4,729 $\pm$ 5,486                      |
| <b>Surgery cost (€)</b>         |  |
| 2012                            | 837 $\pm$ 966                          |
| 2013                            | 925 $\pm$ 974                          |
| 2014                            | 891 $\pm$ 1,195                        |
| 2015                            | 142 $\pm$ 219                          |
| 2016                            | 342 $\pm$ 526                          |
| Total                           | 673 $\pm$ 916                          |

**Note.** Seg, segment; NALR, nonanatomic liver resection

**Table 3.** Student's t-test results and descriptive statistical indicators by gender (Hepatectomies).

| Indicators                 | Gender |        |    |       |        |    | 95% CI        | t      | df  |
|----------------------------|--------|--------|----|-------|--------|----|---------------|--------|-----|
|                            | Female |        |    | Male  |        |    |               |        |     |
|                            | M      | SD     | n  | M     | SD     | n  |               |        |     |
| LOS (days)                 | 21.1   | ±18.9  | 68 | 20.6  | ±16.4  | 59 | -4.7, 5.7     | 0.15   | 125 |
| Surgery duration (minutes) | 138.4  | ±51.6  | 68 | 157.5 | ±56.2  | 59 | -34.9, -3.2   | -1.98* | 125 |
| Tumor volume (gr)          | 423.8  | ±389.9 | 68 | 429   | ±358.8 | 59 | -115.9, 105.5 | -0.08  | 125 |
| Hospitalization cost (€)   | 4,488  | ±2,897 | 68 | 5,011 | ±7,482 | 59 | -2,248, 1,201 | -0.50  | 125 |
| Surgery cost (€)           | 630    | ±948   | 68 | 723   | ±881   | 59 | -363, 177     | -0,56  | 125 |

**Note.** M, mean; SD, standard deviation, CI, confidence interval, t, student's t-test; LOS, Length of Stay

\* Pvalue <0.05.