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Ten years of laparoscopic cholecystectomy: A comparison between a developed and a less developed country

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Zehn Jahre laparoskopische Cholezystektomie – ein Vergleich zwischen Italien und Bosnien-Herzegowina

Zusammenfassung. *Ziel der Studie:* Vergleich der Besonderheiten und Ergebnisse einer laparakopischen Cholezystektomie (LC) in 2 Spitälern – eines in Bosnien-Herzegowina (BH) und das andere in Italien, einem voll entwickeltem westlichen Industrieland.

Methoden: Vom Jänner 1995 bis Dezember 2005 wurden insgesamt 2018 Patienten laparsokopisch cholezystektomiert: 1066 im Krankenhaus Mostar (BH) und 952 im Universitätsspital von Chieti in Italien. Die Unterschiede in der Klinik, in den Diagnoseprotokollen, der Medikation, der angewandten chirurgischen Therapie, sowie in den Komplikationen und Ergebnissen wurden erhoben.

Ergebnisse: Die Analyse der Daten ergab, dass die Zahl der lebensbedrohlichen Situationen in Italien vergleichsweise geringer (15 oder 1,5% vs. 53 oder 4,9%; $p < 0{,}001$) war, ebenso wie der Einsatz von Analgesie bzw. von Antibiotika (131 oder 13,96% vs. 873 oder 81,79%; $p < 0{,}001$). Eine biliäre Chirurgie mit direktem Zugang war in Italien selten – der Großteil der Patienten konnte laparoskopisch operiert werden (nur 44 bzw. 4,41% hatten eine konventionelle Operation, wobei die 35 Patienten [3,61%], bei denen intraoperativ auf offenen Zugang umgestiegen werden musste, schon inkludiert sind). Im Vergleich dazu wurden in Mostar 1661 (61%) einer Zehnjahresperiode von insgesamt 2735 cholezystektomierten Patienten per offenem Zugang operiert. Es wurde ein signifikanter Unterschied in der Zahl der chirurgischen Komplikationen (8 oder 0,84% vs. 40 oder 3,75%; $p < 0{,}002$) bzw. der postoperativen Infektionen nach chirurgischer Inzision (0 vs. 6 oder 0,56%; $p < 0.033$) zugunsten des italienischen Spitals festgestellt.

Schlussfolgerungen: Für die Chirurgen in Bosnien-Herzegowina ist es ermutigend, feststellen zu können, dass zufriedenstellende Ergebnisse auch in einem vergleichsweise weniger entwickelten Land erreicht werden können. Die Zahl der in Mostar aufgetretenen Komplikationen betont allerdings die Notwendigkeit einer weiteren Verbesserung der chirurgischen Technik durch besser strukturiertes Training mit strenger Supervision der jüngeren Kollegen. Die Tatsache des zwar seltenen, aber doch beobachteten Auftretens von postoperativen Infektionen in BH sollte für eine bessere Infektionskontrolle im dortigen Krankenhaus Anlass sein.

Summary. *Objective:* To compare the specific features and outcomes of laparoscopic cholecystectomy in two university hospitals, one in a developing country, Bosnia-Herzegovina, and the other in a well developed country, Italy.

Methods: Between January 1996 and December 2005, a total of 2018 patients underwent laparoscopic cholecystectomy in Mostar Clinical Hospital, Bosnia-Herzegovina (1066) and in Chieti University Hospital, Chieti, Italy (952). Differences in patients' presentations, diagnostic protocols, medication, surgical treatment, complications and outcomes were analyzed.

Results: The number of patients with life-threatening conditions was lower in Italy (15 or 1.5% vs. 53 or 4.9%; $P < 0.001$), as was the use of analgesia and antibiotics (131 or 13.96% vs. 873 or 81.97%; $P < 0.001$). Open-access biliary surgery was rare in Italy, where the vast majority of patients were operated laparoscopically; only 44 (4.41%) patients had open-access surgery, including 35 (3.61%) conversion patients. In comparison, 1669 (61%) patients in Bosnia-Herzegovina underwent open-access operations. There was a significant difference, in favor of the Italian hospital, in the number of surgical complications (8 or 0.84% vs. 40 or 3.75%; $P < 0.002$) and also in the number of postoperative infections following surgical incision (0 or 0.0% vs. 6 or 0.56%; $P < 0.033$).

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Competing interests: None declared.

Conclusions: It is encouraging for surgeons in Bosnia-Herzegovina to find that satisfactory results can be achieved in a developing country. However, the number of complications encountered in the Mostar hospital emphasizes the need for further improvement of surgical technique through better structured training combined with strict supervision of junior staff. The finding of postoperative infections in the Bosnia-Herzegovina hospital, despite that their occurrence was relatively rare, highlights the necessity for further improvement of hospital infection control.

Key words: Gallstone disease, laparoscopic cholecystectomy, bile duct injury, minimal-access surgery, complications, intra-hospital infection.

Introduction

Laparoscopic cholecystectomy was introduced into surgical practice by Erich Mühe in Böblingen, Germany, on September 12, 1985 [1]. Philip Mouret followed him in 1987 and improved the technique [2]. In the USA and Canada approximately 90% of all biliary tract surgery is done laparoscopically [3], and in the EU approximately two-thirds of all patients are treated laparascopically [4–8]. Exact statistical data for Italy and Bosnia-Herzegovina are not available.

The first laparoscopic cholecystectomy in Mostar Clinical Hospital was performed on October 19, 1996, one year after the war in Bosnia-Herzegovina ended. The development of other laparoscopic surgical procedures has been slow: the first laparoscopic appendectomy was in 2002, the first laparoscopic removal of a hepatic echinococcus cyst in 2003, and a repair of a perforated gastric ulceration in 2004.

Thanks to the initiative of Italian surgeons in Chieti, an international cooperation was started in 2005, aimed at establishment of an association of surgeons from both sides of the Adriatic and Aegean Seas. The initiative was given a symbolic name, Surgeons United by the Sea (SUBS). We believed that analysis of the current situation in the two surgical services could be an appropriate starting point for this cooperation, and we decided to carry out a joint study on laparoscopic cholecystectomy.

The specific objective was to compare the results of laparoscopic surgery on both sides of the Adriatic. Two hospitals were chosen: one in Bosnia-Herzegovina, a developing country with a gross national product (GNP) of US$ 4,769 million, and the other in Italy, a developed country and member of the G8 club with a GNP of US$ 1,088,754 million. The respective per capita annual incomes were US$ 1,170 and US$ 18,790. Given these economic circumstances we expected to find significant differences in the diagnostic and treatment protocols and in the achieved results, including the kind and number of complications. We hypothesized that it would be possible to identify weak points in the developing country, as well as existing opportunities for improvement of its surgical service [9–11].

Patients and methods

Study design

The study was designed as a retrospective review of data collected in prospective databases. All patients who underwent any kind of laparoscopically assisted surgical procedure related to biliary tract disease were considered for inclusion in this study.

Clinical Settings

Chieti University Hospital is a teaching hospital in the south-east of Italy and is part of Gabriele d'Annunzio University, founded in 1965. Since 1982 further development of the university has occurred chiefly in two large cities, Chieti and Pescara, but research and teaching are also carried out in smaller cities in the region. The University headquarters are in Chieti.

Mostar Clinical Hospital is a teaching hospital located in south-west Bosnia-Herzegovina and serves a population of approximately 500,000 inhabitants. The hospital was established in 1888 with 45 beds but now has 716 beds (with 99 at the Surgical Clinic) and 1219 employees (146 medical specialists,

Table 1. Baseline clinical characteristics of patients with laparoscopic cholecystectomy

Variable and Procedure	Italy (n=952)	Bosnia-Herzegovina (n=1066)	*P* value*	χ^2 test	Degrees of freedom
Female sex	540 (56.72)	786 (73.73%)	$P<0.001$	63.831	1
Symptom severity class I	783 (82.24%)	858 (80.48%)	$P<0.339$	0.913	1
Symptom severity class II	154 (16.17%)	155 (14.54%)	$P<0.338$	0.916	1
Symptom severity class III	15 (1.57%)	53 (4.97%)	$P<0.001$	16.786	1
Laboratory tests	952 (100.0%)	1066 (100.0%)	not tested	not tested	not tested
Ultrasonography	952 (100.0%)	1066 (100.0%)	not tested	not tested	not tested
ERCP	45 (4.72%)	0 (0.0%)	$P<0.001$	51.538	1 (Fisher)
Computed tomography	52 (5.46%)	12 (1.12%)	$P<0.001$	29.399	1
CHG p.o.	1 (0.1%)	0 (0%)	$P<0.472$	1.120	1 (Fisher)
CGG i.v.	0 (0.0%)	651 (61.06%)	$P<0.001$	858.249	1
MRC	65 (6.82%)	0 (0.0%)	$P<0.001$	75.206	1

*$P < 0.05$ was considered statistically significant. *Laboratory tests* blood cells count, biochemistry, hepatic function; *ERCP* endoscopic retrograde cholangiopancreatography; $CHG_{p.o.}$ cholangiography, per oral; $CGG_{i.v.}$ cholangiography, intravenous; *MRC* magnetic resonance cholangiography.

Table 2. Medical non-surgical treatment

Pharmaceuticals	Italy (n = 952)	Bosnia-Herzegovina (n = 1066)	*P* value*	χ^2 test	Degrees of freedom
Antispasmodics					
Narcotics	5 (0.52%)	0 (0.0%)	$P < 0.023$	5.613	1 (Fisher)
Anticholinergics/antispasmodics	807 (84.77%)	1044 (97.93%)	$P < 0.001$	114.865	1
NSAID	902 (94.75%)	1046 (98.12%)	$P < 0.001$	17.116	1
*Antibiotics***	131 (13.76%)	873 (81.89%)	$P < 0.001$	80.386	1
Semi-synthetic penicillin	108 (11.34%)	192 (18.01%)	$P < 0.001$	17.660	1
Aminoglycoside	2 (0.21%)	181 (16.97%)	$P < 0.001$	171.497	1
Cephalosporins (3rd & 4th generation)	21 (2.41%)	501 (46.99%)	$P < 0.001$	526.161	1
Anticholelithics					
Ursodeoxycholitic acid	25 (2.51%)	2 (0.18%)	$P < 0.001$	22.625	1
ESWL + anticholelithics	0 (0.0%)	1 (0.09%)	$P < 1.000$	0.894	1 (Fisher)

*$P < 0.05$ was considered statistically significant. Narcotics (fentanyl, meperidine, hydrocodone); Anticholinergics/antispasmodics (atropine); NSAID (diclofenac, Voltaren); Aminoglycoside (amikacin, gentamicin); *ESWL* external shockwave lithotripsy. **In Mostar ca. 90% were treated with double antibiotic therapy (aminoglycoside + semi-synthetic penicillin).

47 residents, 649 nurses, 377 staff in administration and hospital services). The annual budget is approximately € 12 million. The Medical Faculty, which admits 40–45 students annually, was opened in 1997. Since then four generations of students have graduated (121 medical doctors) and most of them (about 75%) work in the hospital or in regional primary healthcare services [9–11].

A clinical database was maintained at the Clinic of General Surgery for all patients undergoing biliary surgery at Mostar Clinical Hospital. Data collected include demographics, clinical presentation features, diagnostic studies, treatment, indication for operation, types of complication and follow-up. All laparoscopic operations were recorded by camcorder and the analog data transferred in digital form and stored.

Patient population and follow-up

During the period between January 1996 and December 2005 a total of 2018 patients included in the study were operated in the two university medical centers: Chieti, 952 patients; Mostar, 1066 patients.

Inclusion criteria

All patients with biliary tract disease treated laparascopically were included in this series.

Exclusion criteria

We excluded those patients for whom we were unable to retrieve all pertinent data relating to the diagnostic or the operative procedure proper or to follow up their postoperative course.

Diagnosis

To establish an accurate diagnosis and indication for operation, the standard diagnostic protocol was followed.

True symptoms of gallstones include a febrile illness with pain and tenderness in the right upper quadrant and clear-cut biliary colic lasting at least half an hour, with or without jaundice. Ultrasonography was the mainstay of the preoperative diagnosis of gallstone disease [12]. Endoscopic retrograde cholangiopancreatography (ERCP) is currently the only reliable and widely available investigation for duct stones; computed tomography was a useful alternative when filling the bile duct was unsuccessful in ERCP. Magnetic resonance cholangiography (MRC) was gradually replacing ERCP for diagnostic purposes [13]. Endoscopic ultrasonography was available, although it is unlikely to be used widely because of its labor-intensive nature [14]; percutaneous transhepatic cholangiography was used occasionally [14].

Classification of patients

After the diagnosis was established, patients were classified into three groups according to the severity of their symptoms and illness status, using a classification devised for the purpose of this study:

Class I: chronic biliary tract disease (e.g. gallstones, bile duct stenosis, chronic inflammation).

Class II: acute biliary tract disease (e.g. acute cholecystitis, empyema, cirrhotic patients, Mirizzi syndrome). The presence of acute cholecystitis/cholangitis at the time of referral was defined as the presence of fever > 38 °C, leukocytosis > 10 K/μl, and hyperbilirubinemia > 3 mg/100 ml.

Class III: acute attack with life-threatening conditions (e.g. perforation of gallbladder or ducts with bile peritonitis, gangrenous gallbladder, and sepsis).

Medical treatment

Treatment protocols at both hospitals initially focused on palliation of patient symptoms and prevention of development of life-threatening sepsis by percutaneous drainage of fluid collections, decompression of biliary obstructions and administration of antibiotics when appropriate.

Antispasmodic drugs: biliary colic usually responded to pethidine, often given with an antispasmodic agent such as atropine or glycopyrronium.

Antibiotics: a great number of antibiotics were available; the most appropriate choice whenever the bacteria were not identified was a wide-spectrum antibiotic from the semi-synthetic penicillin, aminoglycoside or fourth generation cephalosporin sub-group.

Anticholelithics: bile acid therapy was a non-standard form of treatment and the best currently available substance was ursodeoxycholic acid. This was most successful when gallstones were small and of the 'floating' type. Unfortunately this treatment is very expensive.

Gallstone solvents: a solvent such as methyl tertiary-butyl ether was instilled via percutaneous puncture of the gallbladder.

External shockwave lithotripsy: this has been used successfully but often leaves fragments of stones.

Indications for surgery

The presence of gallstones without abdominal symptoms was not considered an indication for cholecystectomy unless there was a predisposition for the malignant course of disease. Once a patient with gallstones became symptomatic, elective cholecystectomy was indicated. The primary indication for urgent cholecystectomy was acute cholecystitis.

Surgical treatment

Cholecystectomy can be performed using laparoscopic techniques or by laparotomy. The advantages of the laparoscopic approach are less pain, shorter hospital stay, faster return to normal activity and less abdominal scarring [3–8]. In the two hospitals in the study, operations were classified into three groups in relation to the surgical approach used: (i) open approach – laparotomy; (ii) minimal-access approach – laparoscopy; and (iii) initial minimal-access approach converted to laparotomy.

Cases were classified as routine or difficult cholecystectomy in relation to the intraoperative findings. We defined difficult cholecystectomy as (1) dense adhesions at the triangle of Calot; (2) contracted and fibrotic gallbladder; (3) previous abdominal surgery; (4) gangrenous gallbladder; (5) acutely inflamed gallbladder; (6) empyema gallbladder; and (7) cholecystogastric or cholecystoduodenal fistula (Table 3).

Surgeons in both hospitals used Olympus equipment for laparoscopy; in Mostar only one set was available and was used by all the surgeons.

Complications

Complications were subdivided into general, non-surgery related and intraoperative; the latter were rare and, according to the literature, directly related to the experience of the laparoscopic surgeon [15–20].

Statistical analysis

Fisher's exact test was used when expected frequencies were lacking during the comparison of variables. The chi-squared test was used for differences between nominal and ordinal data. Data were analyzed with Statistical Package for Social Science, SPSS for Windows (13.0 SPSS Inc., Chicago, Il., USA). $P < 0.05$ was considered statistically significant.

Results

Analysis of the baseline clinical characteristics showed that although the majority of patients were female in both series, the number of females was significantly higher in Mostar: 540 (56.7%) in Chieti v. 786 (73.7%); $P < 0.001$. The only significant difference between the two series in severity of symptoms at admission was in patients with life-threatening conditions (Class III): 15 (1.6%) in Chieti vs. 53 (4.97%) in Mostar; $P < 0.001$.

According to the diagnostic protocols, all patients in both hospitals underwent a set of laboratory tests and an ultrasound examination. Use of computed tomography, ERCP and MRC was significantly higher in Chieti ($P < 0.001$), and intravenous cholangiography in Mostar ($P < 0.001$) (Table 1).

The use of pharmaceuticals was also analyzed. The finding that use of analgesics and antibiotics was significantly lower in Chieti was unexpected ($P < 0.001$). According to the Italian database, aminoglycosides were almost never used and cephalosporins only very rarely. Anticholelithics were rarely used in Chieti and never in Mostar (Table 2).

During the 10-year period, 2735 cholecystectomies were performed in Mostar: open-access surgery in 1669 (61.02%) patients and laparoscopic surgery in 1066 (38.97%). Of the latter cases, the authors (ZB, general surgeon and GĐ, resident) performed 559 (52.43%) of the operations; the other 507 (47.56%) procedures were performed by six other surgeons. Forty-three conversions to open-access cholecystectomy (4.03%) were undertaken for different causes (Table 3).

Table 3. Modalities of surgical treatment, conversions and causes of 'difficult' laparoscopic cholecystectomy

Modalities of surgical treatment, conversions and causes of 'difficult' laparoscopic cholecystectomy	Italy (n=996)	Bosnia-Herzegovina (n=2735)	*P* value*	χ^2 test	Degrees of freedom
Laparotomy	44 (4.41%)	1669 (61.02%)	$P<0.001$	942.084	1
Minimal-access cholecystectomy (MAC)	952 (95.58%)	1066 (38.97%)	$P<0.001$	939.806	1
Conversion of MAC into laparotomy	32 (3.61%)	43 (4.03%)	$P<0.629$	0.233	1
Adhesions at Calot's triangle	142 (14.91%)	73 (6.84%)	$P<0.001$	34.388	1
Contracted gallbladder	0 (0.0%)	179 (16.79%)	$P<0.001$	175.417	1
Acutely inflamed gallbladder	321 (33.72%)	155 (14.54%)	$P<0.001$	102.621	1
Empyema gallbladder	48 (5.04%)	58 (5.44%)	$P<0.688$	0.161	1
Gangrenous gallbladder	24 (2.52%)	43 (4.03%)	$P<0.058$	3.585	1
Previous abdominal operation	406 (42.65%)	28 (2.62%)	$P<0.001$	477.127	1
Choloenteric fistula	7 (0.73%)	2 (0.18%)	$P<0.093$	3.397	1 (Fisher)

*$P < 0.05$ was considered statistically significant.

Table 4. The most frequent causes for conversion of minimal-access cholecystectomy into laparotomy

Causes for conversion of MAC into laparotomy	Italy (n=952)	Bosnia-Herzegovina (n=1066)	*P* value*	χ^2 test	Degrees of freedom
Adhesions at Calot's triangle	18 (1.89%)	19 (1.78%)	$P<0.856$	0.033	1
Liver parenchyma bleeding	1 (0.1%)	11 (1.03%)	$P<0.007$	7.308	1
Cystic/hepatic artery bleeding	0 (0.0%)	6 (0.56%)	$P<0.033$	3.643	1 (Fisher)
Injury to the bile ducts	0 (0.0%)	1 (0.09%)	$P<1.000$	not tested	not tested
Injury to duodenum (thermal)	0 (0.0%)	1 (0.09%)	$P<1.000$	not tested	not tested
Gallbladder cancer	0 (0.0%)	1 (0.09%)	$P<1.000$	not tested	not tested
Common bile duct cancer	0 (0.0%)	1 (0.09%)	$P<1.000$	not tested	not tested
Liver portal cancer	0 (0.0%)	1 (0.09%)	$P<1.000$	not tested	not tested
Equipment malfunction	0 (0.0%)	2 (0.01%)	$P<0.501$	0.395	1 (Fisher)
Pneumoperitoneum intolerance	1 (0.1%)	0 (0.0%)	$P<1.000$	not tested	not tested
Choloenteric fistula	5 (0.52%)	0 (0.0%)	$P<0.023$	3.689	1 (Fisher)
Non-iatrogenic lesion of biliary tract	1 (0.1%)	0 (0.0%)	1.0	not tested	not tested
Distension of small intestine	1 (0.1%)	0 (0.0%)	1.0	not tested	not tested
Hepatic hypertrophy	1 (0.1%)	0 (0.0%)	1.0	not tested	not tested
Cholecystic perforation	1 (0.1%)	0 (0.0%)	1.0	not tested	not tested
Intraoperative bleeding	3 (0.31%)	0 (0.0%)	$P<0.105$	1.576	1 (Fisher)
Total	32 (3.36%)	43 (4.03%)	$P<0.425$	0.635	

*$P<0.05$ was considered statistically significant. *MAC* minimal-access cholecystectomy.

In Chieti, there were 996 cholecystectomies: open-access surgery in 44 (4.41%) patients and laparoscopic surgery in 952 (95.58%). Conversions to open-access cholecystectomy were necessary in 32 Chieti patients (3.61%); these were included in the open-access surgery group.

It is clear that the vast majority of patients in Chieti were operated laparoscopically: only 44 or 4.41% patients had open-access surgery (35 or 3.61% of conversion patients included) compared with the 1669 (61%) Mostar patients who underwent open-access operations ($P < 0.001$). All other categories in Table 3 were calculated in relation to the 952 Italian patients and the 1066 Bosnia-Herzegovina patients who underwent laparoscopic cholecystectomy.

The overall number of causes for conversion of minimal-access cholecystectomy into laparotomy was too small to analyze. There was no significant difference between the two hospitals in total numbers of conversions: 32 in Chieti and 43 in Mostar; $P < 0.629$ (Table 4).

Similarly, the number of major clinical complications not directly related to surgical procedure was too small to allow any meaningful analysis, as was the total number of complications (two in Chieti and four in Mostar, or 0.21% and 0.37%, respectively).

Analysis of complications directly related to surgical procedure gave more interesting findings: complications were noted in eight patients (0.84%) in Chieti and 40 (3.75%) in Mostar. Statistically significant differences were noted for intraoperative bleeding from cystic and hepatic arteries ($P < 0.002$) and for wound infections ($P < 0.033$) (Table 5).

Discussion

Our comparative study of surgical services at a hospital in Italy and a hospital in Bosnia-Herzegovina has clearly shown that it is possible to achieve satisfactory results in a poorly developed country with meager resources. As is usually the case, it appears that the human factor plays the major role.

In our series there was rarely a necessity to convert a minimal-access surgical procedure to an open one; 32 (3.61%) cases in Italy vs. 43 (4.03%) in Bosnia-Herzegovina ($P < 0.629$). The most common reason for conversion was the presence of dense adhesions at the triangle of Calot, with gastric and duodenal fistulas and intraoperative bleeding being the second and third most common reasons. Injury to the common bile duct enforced conversions in only three cases, all of which were identified intraoperatively and managed in the same sitting. All patients having increased postoperative bile leak were managed conservatively and the leak ceased spontaneously within seven days.

Some lessons were learnt from this study and will be used in the process of further planning and developing surgical services. The first interesting finding was related to patients' preoperative clinical status. We devised a simple new classification for use in this study, dividing the patients into three groups, one of which, Class III, was for patients with life-threatening conditions. Our analysis revealed that this group of patients was significantly smaller in Chieti, clearly reflecting Italy's overall superior organization of healthcare. The finding also underlined the need to improve the situation in Bosnia-Herzegovina, where patients could and should be referred to specialists' attention in the earlier phase of illness.

A further interesting finding was the considerably more limited use of analgesics and especially antibiotics in the Italian hospital, which could serve as a model for the rational use of pharmaceuticals in accordance to strict protocols.

Table 5. Major clinical complications directly related to surgical procedure

Complication (surgery related)	Italy (n=952)	Bosnia-Herzegovina (n=1066)	*P* value*	χ^2 test	Degrees of freedom
Intraoperative bleeding from:					
Liver parenchyma	1 (0.10%)	6 (0.56%)	$P<0.129$	1.869	1 (Fisher)
Cystic/hepatic arteries	0 (0.0%)	11 (1.03%)	$P<0.002$	9.877	1
Other sites (intercostal artery)	0 (0.0%)	1 (0.09%)	$P<1.0$	not tested	not tested
Gallstone-related complications:					
Retained gallstones	3 (0.31%)	3 (0.28%)	$P<1.0$	not tested	not tested
Injury to duodenum	0 (0.0%)	2 (0.18%)	$P<0.501$	0.395	1 (Fisher)
Pneumoperitoneum related	1 (0.10%)	1 (0.09%)	$P<1.0$	not tested	not tested
Access-related injuries (Veres needle, trocar)	2 (0.21%)	0 (0.0%)	$P<0.222$	0.622	1 (Fisher)
Wound infections	0 (0.0%)	6 (0.56%)	$P<0.033$	3.643	1 (Fisher)
Peritonitis	0 (0.0%)	2 (0.18%)	$P<0.501$	0.395	1 (Fisher)
Incision hernia	0 (0.0%)	2 (0.18%)	$P<0.501$	0.395	1 (Fisher)
Death**	1 (0.10%)	3 (0.28%)	$P<0.627$	0.151	1 (Fisher)
Total	8 (0.84%)	40 (3.75)	$P<0.01$	18.365	1 (Fisher)

*$P<0.05$ was considered statistically significant. **In the Mostar hospital two patients died as the result of intraoperative thermal injury to the duodenum; the third death was unrelated to the surgery proper – a cerebrovascular stroke in late postoperative period. In Chieti one patient died as the result of respiratory distress syndrome.

It is clear that open-access biliary surgery is a rarity in Italy and is rapidly becoming a procedure of the past – one more lesson to be learned by surgeons in Bosnia-Herzegovina, where an open access is still the dominant procedure.

There was a significant difference between the two hospitals in the number of surgical complications ($P < 0.01$), highlighting the need for improvement of surgical technique, based on better structured clinical training and strict supervision of junior surgical staff, in Mostar.

Probably the most valuable finding in this study is the evidence that postoperative infection is virtually non-existent in Chieti University Hospital. Although the number of postoperative wound infections in Mostar Clinical Hospital is small and not alarming, only six patients (0.56%) in series of 1066, there is still room for improving the hospital's infection control.

In the literature the mortality rate in a low-risk patient group undergoing elective operation is <0.1% [15, 17, 18, 20]; this is in concordance with data in our series. We had one case of death (0.1%) in Chieti and three (0.28%) in Mostar ($P < 0.627$). The death in Chieti and one of the deaths in Mostar were surgery non-related: a respiratory distress syndrome and cerebrovascular stroke, respectively.

In conclusion, this comparison of one small segment of surgical work in two hospitals was fruitful in many ways. The study can encourage those colleagues who are working under similar conditions to surgeons in Bosnia-Herzegovina – satisfactory results can be gained through strong individual commitment. On the other hand, the results of the study will serve a very practical purpose, highlighting the areas in need of improvement in Mostar. It should be mandatory to continue the data collection and to repeat the analysis in a similar manner in a few years' time in order to follow up the further development of surgical healthcare in Bosnia-Herzegovina.

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