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RESEARCH

Outcomes of umbilical hernia repair in cirrhotic veterans: a VASQIP study

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Abstract

Purpose Umbilical hernia repair (UHR) in cirrhotics with ascites is a challenging problem associated with increased morbidity and mortality. This study examines the outcomes of UHR in veterans, comparing those undergoing elective versus emergent repair.

Methods VASQIP was queried for all UHRs during the period 2008–2015. Data collection included demographics, operative details, Model for End-stage Liver Disease (MELD) score, and postoperative outcomes. Univariate and multivariate regression analyses were performed, and a p value of ≤ 0.05 was considered significant.

Results A total of 383 patients were included in the analysis. Overall, mean age was 58.9, 99.0% were males, mean body mass index (BMI) was 26.7 kg/m^2, 98.2% had American Society of Anesthesiologists (ASA) classification ≥ III, and 87.7% had independent functional status. More than 1/3 the patients underwent emergent UHR (37.6%). Compared with the elective UHR group, who underwent emergent repair were older, more likely to be functionally dependent, higher MELD score. Hypoalbuminemia, emergency repair and MELD score were found to be independent predictors of poor outcomes.

Conclusion UHR in cirrhotic veterans has worse outcomes when performed emergently. Diagnosis should be followed by medical optimization and elective repair, rather than waiting for an emergent indication in > 1/3 of patients.

Keywords Umbilical hernia repair · Cirrhosis · Veterans · Outcomes · VASQIP

Introduction

The Veteran Affairs (VA) medical system represents the largest single healthcare provider for patients with liver cirrhosis, with approximately 60,000 veterans with cirrhosis annually [1]. Cirrhotic patients are at increased risk of developing abdominal wall hernia in general (20–40%), with umbilical hernia being the most common (40–60%) [2–4]. The causality is multifactorial including increased intraabdominal pressure, weakness of the fascia and malnutrition [4, 5]. Due to the increased morbidity and mortality associated with the umbilical hernia repair (UHR) in patients with liver cirrhosis, it represents a challenge to surgeons. The old approach in these patients was watch-and-wait policy, and defer surgical intervention until complications occur [5–8], and this practice changed over time [9]. In 2020, European Hernia Society and American Hernia Society provided recommendations on elective UHR when Model of End-Stage Liver Disease (MELD) score < 15 with weak evidence [10].

Overall, mortality rates in patients with cirrhosis were higher when compared to non-cirrhotic population (6% vs. 1%, respectively) [11]. Postoperative morbidity was also reported to be high (9%-68%), with odd ratio (OR) 2.79 compared to non-cirrhotic patients [11–15]. Only two studies utilized the Veterans Affairs Surgical Quality Improvement Program (VASQIP) to evaluate UHR in cirrhotic, both with small sample sizes [9, 16]. The aim of this study is to compare outcomes of emergent vs. elective UHR in cirrhotic veterans and examine possible predictors of postoperative morbidity and mortality.

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Methods

Data source and study subjects

The Veterans Affairs Surgical Quality Improvement Program (VASQIP) was queried to identify all patients who underwent umbilical hernia repairs from January 1, 2008, to December 31, 2015. To identify the umbilical hernia repair procedures, we used the following primary current procedural terminology (CPT) codes: 49,585, 49,587, 49,652, and 49,653. Furthermore, umbilical hernias were filtered using the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) coding, and the codes 551.1, 552.1, and 553.1 were included in our analysis.

The diagnosis of liver cirrhosis was identified preoperatively in patients with ascites based on physical examination, abdominal imaging within 30 days prior to the operation. Documentation should state a history of or active liver disease (e.g., jaundice, encephalopathy, hepatomegaly, portal hypertension, liver failure, or spider telangiectasia). Demographics, comorbidities, operative details, postoperative complications, and 30-day, 90-day, six-month and one-year mortality rates were collected. Functional status is assessed based on the patient's abilities to perform activities of daily living (ADLs) in the 30 days prior to surgery. 30-day morbidity is defined as occurrence of at least one complication within 30 days from the procedure. The VASQIP captures up to 28 different postoperative events as complications. Model for End-stage Liver Disease (MELD) score was calculated using preoperative values of serum total bilirubin, international normalized ratio (INR), and serum creatinine, using the following formula: $11.2 \times \log_e(\text{INR}) + 3.78 \times \log_e\left(\text{serumbilirubin}\ [\text{mg/dL}]\right) + 9.57 \times \log_e(\text{serumcreatinine}\ [\text{mg/dL}]) + 6.43$ [17]. Any patient with a laboratory value < 1 was given one. MELD score was classified into mild (≤ 8), moderate (9–16), and severe (≥ 17), to correlate with Child-Turcotte-Pugh score classes A, B, and C, respectively [18, 19]. We excluded patients < 18-year-old, and patients with incomplete data to calculate MELD score.

Statistical analysis

The chi-square test was utilized to analyze categorical variables. Two-sided unpaired Student's *t*-test or Mann–Whitney U test were used for numerical variables as appropriate. Multivariate logistic regression adjusting for demographics, comorbidities, and other preoperative factors was used to analyze postoperative outcomes. $P < 0.05$ was considered statistically significant.

All analyses were performed using SPSS (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.). This study was granted a full approval by the institutional review board of Wayne State University, Detroit, Michigan, and the research office, John D. Dingell VA Medical Center, Detroit, Michigan. Because the study used de-identified data from the VASQIP database, informed consent was waived.

Results

Overall analysis

A total of 383 patients were included in the analysis. Overall, mean age was 58.9 ± 7.5, with 19.8% ≥ 65 years old, 99.0% were males, mean body mass index (BMI) was 26.7 ± 5.6 kg/m^2 and 26.6% were obese (BMI ≥ 30 kg/m^2), 98.2% had American Society of Anesthesiologists (ASA) classification ≥ III, and 87.7% had independent functional status. More than half of patients were smokers (52.5%), and 18.3% were use alcohol. Hypoalbuminemia (< 3.5 mg/dL) was reported in 73.9%, and 64.0% had thrombocytopenia (platelet count < 150 X 10^9/L).

More than 1/3 the patients underwent emergent UHR (37.6%), and open approach was used in 97.9% of cases, with mean operative time (OT) 1.2 ± 0.8 h, and 2.3% received at least one unit of packed red blood cells (PRBC) intraoperatively. Mean postoperative length of stay (LOS) was 7.2 ± 7.8 days, with overall morbidity rate of 13.1%, and 30-day, 90-day, six-month and one-year mortality rates of 7.0%, 14.1%, 18.5%, and 28.5%, respectively.

Comparing emergent vs. elective repairs

Compared with the elective UHR group, veterans who underwent emergent repair were older, more likely to be functionally dependent, had higher MELD score, and more incidence of hypoalbuminemia (Table 1). Postoperatively, the emergent UHR group had longer LOS, higher morbidity and mortality rates, as listed in Table 2. The most common complications were pneumonia, reintubation and renal failure.

Table 3 lists 30-day mortality and morbidity rates based on MELD classes and comparing elective vs. emergent cases, which showed increase in rates as the MELD score increases, and emergent cases had worse outcomes compared to elective ones.

Using adjusted multivariate logistic regression analysis, which summarized in Table 4, multiple independent predictors of morbidity, 30-day, 90-day, 6-month, and one-year mortality rates were identified, with MELD score being the consistent risk factor with increased odds of adverse outcomes by 1.1 for each one-point increase in MELD score. Moreover, hypoalbuminemia, emergency repair, chronic obstructive pulmonary disease (COPD), dyspnea, age, hypertension and thrombocytopenia were also other independent predictors.

Table 1 Patient characteristics and comorbidities comparing elective vs. emergent repairs

n. (%)	Elective Cases 239 (62.4)	Emergency Cases 143 (37.6)	*P* value
Age (mean ± SD, years)	58.3 ± 7.3	60.2 ± 7.7	0.018
Old age (≥ 65 years)	44 (18.4)	32 (22.2)	0.365
Sex (male)	236 (98.7)	143 (99.3)	0.601
ASA class			0.199
I or II	6 (2.5)	1 (0.7)	
≥ III	233 (97.5)	143 (99.3)	
BMI (mean ± SD, kg/m^2)	26.9 ± 5.4	26.3 ± 5.8	0.403
Obesity	64 (26.8)	38 (26.4)	0.933
Current smoker	122(51.0)	79 (54.9)	0.469
Current alcohol use	42 (17.6)	28 (19.4)	0.646
Independent functional status	221 (92.5)	115 (79.9)	< 0.001
Weight loss > 10%	30 (12.6)	24 (16.7)	0.262
Comorbidities			
Bleeding disorder	79 (33.1)	53 (36.8)	0.454
Diabetes Mellitus	47 (19.7)	33 (22.9)	0.448
Cardiac disease	6 (2.5)	9 (6.3)	0.068
PVD	3 (1.3)	7 (4.9)	0.032
COPD	49 (20.5)	26 (18.1)	0.559
Dyspnea	39 (16.3)	35 (24.3)	0.055
Hypertension	140 (58.6)	86 (59.7)	0.825
Acute kidney injury	2 (0.8)	4 (2.8)	0.138
Renal failure on dialysis	2 (0.8)	0 (0.0)	0.271
Preoperative chemotherapy	3 (1.3)	0 (0.0)	0.177
Preoperative radiotherapy	1 (0.4)	0 (0.0)	0.437
MELD Score (mean ± SD)	14.6 ± 6.5	16.4 ± 7.5	0.017
Mild (≤ 8)	37 (16.7)	18 (13.3)	0.103
Moderate (9–16)	106 (48.0)	54 (40.0)	
Severe (≥ 17)	78 (35.3)	63 (46.7)	
Preoperative laboratory tests			
Hypoalbuminemia (< 3.5 mg/dL)	168 (70.3)	115 (79.9)	0.039
Sodium (mean ± SD, mEq/L)	134.9 ± 4.0	134.8 ± 5.3	0.721
Creatinine (mean ± SD, mg/Dl)	1.1 ± 0.6	1.2 ± 0.7	0.180
Thrombocytopenia (< 150 X 10^9/L)	154 (64.4)	91 (63.2)	0.806

SD standard deviation, *ASA* American Society of Anesthesiologists, *BMI* body mass index, *PVD* peripheral vascular disease, *COPD* chronic obstruction pulmonary disease, *MELD* Model for End-stage Liver Disease

Discussion

In this study, we analyzed outcomes following UHR in cirrhotic veterans using the VASQIP database. To our knowledge, this is the largest study that has used the VASQIP database to address this topic. Our main findings are: (1) UHR in cirrhotic patients is associated with increased morbidity and mortality rates, (2) More > 1/3 of the patients required emergent repair, (3) Emergent repair, hypoalbuminemia, and MELD score were independent predictors of increased postoperative adverse outcomes.

In this study we demonstrated the high morbidity and mortality rates following UHR in patient with liver cirrhosis (13.1% and 7%, respectively), and these rates are similar to what reported previously from VA system (13% and 8%, respectively) [9]. In the private sector the reported 30-day mortality rate ranged from 0–22.7%, with pooled mortality rate of 6% [8, 11, 14, 20–23]. While the morbidity rate was 9–68%, with pooled rate of 13.9% [6, 11, 13, 14, 23].

As noted in our study, as well as in previous reports, emergency UHR in patient with liver cirrhosis is associated with worse outcomes, compared with elective and planned repairs [6, 8, 11, 16, 24]. 30-day mortality rate in our population was 7 times higher in the emergent repair group (2.1% vs. 15.3%, $p < 0.001$), and morbidity rate was tripled compared to elective group (6.7% vs. 23.6%, $p < 0.001$). We are

Table 2 Unadjusted analysis of operative and postoperative mortalities, LOS, and morbidities comparing emergent and elective cases

n. (%)	Elective Cases 239 (62.4)	Emergency Cases 143 (37.6)	*P* value
Operation Duration (mean ± SD, hour)	1.2 ± 0.7	1.3 ± 1.0	0.386
Minimal invasive approach	7 (3.0)	1 (0.7)	< 0.001
Intraoperative transfusion ≥ 1 unit	4 (1.7)	5 (3.5)	0.260
30-Day mortality	5 (2.1)	22 (15.3)	< 0.001
90-Day mortality	22 (9.2)	32 (22.2)	< 0.001
6-Month mortality	32 (13.4)	39 (27.1)	0.001
1-Year mortality	57 (23.8)	52 (36.1)	0.010
Postoperative LOS, (mean ± SD, day)	5.6 ± 6.5	9.0 ± 8.7	< 0.001
Morbidity (≥ 1 complication)	16 (6.7)	34 (23.6)	< 0.001
Surgical complications			
Superficial SSI	2 (0.8)	3 (2.1)	0.298
Deep SSI	0 (0.0)	1 (0.7)	0.197
Organ space SSI	2 (0.8)	3 (2.1)	0.298
Wound dehiscence	1 (0.4)	0 (0.0)	0.437
Reoperation	9 (3.8)	9 (6.3)	0.266
Medical complications			
Pneumonia	3 (1.3)	8 (5.6)	0.015
Need for reintubation	3 (1.3)	9 (6.3)	0.007
Failure to wean	0 (0.0)	2 (1.4)	0.068
Renal failure	0 (0.0)	3 (2.1)	0.025
Cardiac arrest	1 (0.4)	0 (0.0)	0.437
Urinary tract infection	1 (0.4)	1 (0.7)	0.717
Clostridium difficile colitis	0 (0.0)	4 (2.8)	0.010

LOS length of stay, *SD* standard deviation, *SSI* surgical site infection

Table 3 Comparison of 30-day mortality and morbidity based MELD score classes

MELD Score Classes n(%)	Mild (≤ 8) 55 (15.4)		Moderate (9–16) 160 (44.9)		Severe (≥ 17) 141 (39.6)		*P* value
	EL	EM	EL	EM	EL	EM	
30-Day Mortality	0 (0)	1 (1.8)	1 (0.6)	6 (3.8)	4 (2.8)	15 (10.6)	0.03
Morbidity	1 (1.8)	5 (9.1)	5 (3.1)	9 (5.6)	8 (5.7)	20 (14.2)	0.016

MELD Model for End-stage Liver Disease, *EL* Elective, *EM* Emergent

opposed to watchful waiting strategy in cirrhotic patients with umbilical hernia, regardless of their symptoms. As shown out in our data, along with other previous studies, surgical repair of UH in cirrhotic patients is relatively a safe option [2, 5, 24]. Looking at 1-year mortality rate in our study, morality rate was lower in elective UHR group with 12% reduction, (23.8% vs. 36.1%, $p = 0.010$).

Furthermore, elective UH repair in cirrhotic patients is frequently faced with scrutiny due to fear of local wound complications. Our data showed that overall morbidity due to wound complications is relatively low, ranging from 0% to 6.8% in both groups (Table 3), statistically similar in both groups. Indeed, most of the morbidity in our study is mainly secondary to decompensated liver failure, as suggested by immediate and long-term mortality. It is reasonable to assume that rapidly progression to acute renal failure, especially secondary to hepatorenal syndrome, and hepatic encephalopathy leading to respiratory failure, are likely the culprits for the increased morbidity, rather than local wound complications.

Emergency repair, hypoalbuminemia and MELD score were found to be independent predictors of increased morbidity and mortality as shown in Table 3, along with other factors. These findings are consistent with previous reports [6, 8, 25]. The MELD score still proves that it is a useful planning tool in non-transplant surgical procedures [6, 8, 26], with increased odds of adverse outcome by 1.1 for each point. Of the listed factors that identified in our study using multivariate logistic regression, emergency repair reclaim itself as an important modifiable risk factor, which can be targeted by surgeons, primary care practitioners,

Table 4 Multivariate logistic regression analysis of predictors of outcomes in cirrhotic patients with umbilical hernia

	Odd Ratio	Confidence Interval 95%	*P* Value
Morbidity			
Emergency procedure	4.36	2.02–9.44	< 0.001
Hypoalbuminemia	4.22	1.25–14.28	0.021
COPD	2.48	1.03–5.97	0.043
MELD score (each point)	1.11	1.01–1.22	0.036
30-Day mortality			
Hypoalbuminemia	8.47	1.12–64.10	0.039
Emergency procedure	6.13	2.01–19.85	0.002
Dyspnea	3.74	1.25–11.13	0.018
MELD score (each point)	1.23	1.07–1.43	0.005
Age	1.15	1.02–1.29	0.025
90-Day mortality			
Emergency procedure	2.27	1.11–4.62	0.025
MELD score (each point)	1.16	1.05–1.27	0.003
6-Month mortality			
Hypoalbuminemia	4.01	1.39–11.57	0.010
Emergency procedure	1.98	1.06–3.70	0.033
MELD score (each point)	1.12	1.03–1.22	0.007
1-Year mortality			
Thrombocytopenia	2.46	1.28–4.72	0.007
Dyspnea	2.41	1.22–4.77	0.012
Hypertension	2.02	1.17–3.48	0.011
MELD score (each point)	1.12	1.040–1.27	0.003

COPD chronic obstruction pulmonary disease, *MELD* Model for End-stage Liver Disease. The preoperative factors the were adjusted include age, sex, ASA class, BMI, smoking, alcohol use, functional status

and hepatologists to initiate early referral and perioperative optimization to improve outcomes in this group of patients. Saleh et al. proposed a nomogram to predict 30-day morality, and they found that MELD score, albumin, white blood count, and platelet counts were significant factors [8]. Likewise, our study also confirmed thrombocytopenia as an independent risk factor, likely working a surrogate marker of chronic liver failure and portal hypertension.

We acknowledge multiple limitations in our study. As a database analysis, data collection lacked certain important information regarding preoperative factors that may have affected the surgical approach and timing including previous abdominal surgery and severity of the ascites, as well as important operative details, including use of mesh and the size of the hernia. Moreover, database lack certain postoperative complications like decompensated liver failure and persistent wound leakage. Moreover, no data on postoperative management of ascites. Also, the nature of the VA patient population, which is mainly male and elderly, make our findings may not generalize to other patient populations.

Conclusion

Umbilical hernia in cirrhotic veterans remains a challenge for the VA surgeon, with increased morbidity and mortality. Elective repair is recommended, and it is associated with the lower adverse outcomes compared to emergent repair. Multiple risk factors can be identified preoperatively, which will help with better assessment of postoperative expected outcomes.

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Declarations

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Conflict of interest The authors declare that there is no conflict of interest.

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