


Cirrhosis and hernia repair in a cohort of 6352 patients in a tertiary hospital

Risk assessment and survival analysis

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Abstract

The prevalence of hernias in patient with cirrhosis can reach up to 40%. The pathophysiology of cirrhosis is closely linked to that of the umbilical hernia, but other types are also common in this population. The aim of this study is to evaluate factors that influence in the prognosis after hernia repair in patients with cirrhosis. A historical cohort of 6419 patients submitted to hernia repair was gathered. Clinical, epidemiological data and hernia characteristics were obtained. For patient with cirrhosis, data from exams, surgery and follow-up outcomes were also analyzed. Survival curves were constructed to assess the impact of clinical and surgical variables on survival. 342 of the 6352 herniated patients were cirrhotic. Patient with cirrhosis had a higher prevalence of umbilical hernia (67.5% × 24.2%, $P < .001$) and a lower prevalence of epigastric (1.8% × 9.0%, $P < .001$) and lumbar (0% × 0.18%, $P = .022$). There were no significant differences in relation to inguinal hernia ($P = .609$). Ascites was present in 70.1% of patient with cirrhosis and its prevalence was different in relation to the type of hernia ($P < .001$). The survival curve showed higher mortality for emergency surgery, MELD > 14 and ascites (HR 12.6 [3.79–41.65], 4.5 [2.00–10.34], and 6.1 [1.15–20.70], respectively, $P < .05$). Hernia correction surgery in patient with cirrhosis has a high mortality, especially when performed under urgent conditions associated with more severe clinical conditions of patients, such as the presence of ascites and elevated MELD.

Abbreviations: BMI = body mass index, CT = computed tomography, HCFMUSP = Hospital das Clínicas, UH = umbilical hernia.

Keywords: ascites, cirrhosis, complications, hernia, inguinal hernia, outcomes, surgery, survival, umbilical hernia

1. Introduction

Abdominal hernia is a clinical condition that occurs when there is a protrusion of an organ, or part of it, through the abdominal wall. This clinical picture is a common complication that affects about 20% of patients with cirrhosis.^[1,2] In Brazil, approximately 300,000 surgeries for hernia repair are performed each year. Laparoscopic techniques are used in about 30% of cases in worldwide, but in Brazil just 0.6% of cases are performed by laparoscopy in the public health system.^[3]

However, these procedures have been associated with significant morbidity and mortality in patients with cirrhosis. They are prone to different complications of the abdominal wall, mainly due to umbilical hernia (UH), but also inguinal hernia and incisional hernia.^[4] The prevalence of inguinal hernias in

patient with cirrhosis seems to be similar to the general population, but this has not yet been properly established.^[5,6] However, UH, the most common hernia in patient with cirrhosis, is present in 20% of compensated patient with cirrhosis and in 40% of patients with ascites. This is 10 times greater than the incidence of UH in the general population.^[1,7] This high prevalence is essentially due to the presence of ascites, attenuation of the abdominal wall and malnutrition.^[11,5] The onset of UH generally corresponds to the presence or history of ascites and, consequently, is associated with altered hepatocellular function.^[5]

In these patients, the presence of ascites is associated with poor quality of life, increased risk of spontaneous abdominal infections and renal failure.^[8] For these reasons, in addition to the supposed perioperative decompensation, the repair of hernias in the abdominal and inguinal wall in these patients

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All data generated or analyzed during this study are included in this published article [and its supplementary information files].

All procedures performed in this study were in accordance with the ethical standards of the Research Ethics Committee Hospital das Clínicas, Faculty of Medicine, University of São Paulo (HCFMUSP) (CAAE: 54675716.2.0000.0068) and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Written Informed consent was obtained from all individual adult participants included in this study.

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STRENGTHS AND LIMITATIONS OF THIS STUDY

Profile of 6352 patients with and without cirrhosis and prognostic factors in hernia repair surgery. Our study was the first to verify a similar prevalence of inguinal hernia in patient with cirrhosis (32.7%) and non-cirrhotic patient (34.1%), demonstrating that the incidence of this type of hernia is not influenced by the presence of ascites. Hernia correction surgery in patient with cirrhosis has a high mortality, especially when performed under urgent conditions associated with the presence of ascites and elevated MELD.

is traditionally managed by a “watch and see strategy.”^[5,8–12] However, this strategy can lead to worse outcomes for the patient in inadequate clinical conditions, such as in emergency cases, where an increased risk of perioperative morbidity and mortality is frequently found.^[13–15]

Thus, there is a vast literature on patients with cirrhosis evaluating hernia repair that shows a wide range of morbidity and mortality rates.^[7,16] However, there are few studies addressing the epidemiology of these hernias that consider how different cirrhosis etiologies could be related to the various clinical presentations and prognosis.

In this sense, this study seeks to present the profile of patients with and without cirrhosis and to evaluate prognostic factors in hernia correction surgery in patient with cirrhosis.

2. Methodology

2.1. Study design

This is a historical cohort study, where social and demographic data were collected from a database from the Department of Liver Transplant of the Hospital das Clínicas (HCFMUSP) who

were cirrhotic and were admitted in the hospital for hernia correction, between January 2010 and December 2017. It was also collected information about hernia etiology, recurrence, presence of complications (ascites, thrombosis, varices, encephalopathy, spontaneous bacterial peritonitis), previous paracentesis, location of hernia, clinical scale for pain (1–10), previous surgeries, surgery details (elective or urgency and postoperative complications) and length of hospital stay. Clinical exams (sodium, hemoglobin, plaquettes, CRP and albumin) were collected before and after surgery. Patients were classified based on MELD and CHILD score.

Another cohort of patients from the HCFMUSP of non-cirrhotic patient admitted for hernia correction between January 2010 and December 2017 was used as a comparison group. Social and demographic data from charts was also obtained. Data about hernia location and recurrence were available.

2.2. Compliance with ethical standards

All procedures performed in this study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the Hospital Ethics Committee (Faculty of Medicine, University of São Paulo – FMUSP – CAAE: 54675716.2.0000.0068).

2.3. Informed consent

Informed consent was obtained from all individual adult participants included in this study.

2.4. Population data

The study recruited 342 patients with cirrhosis (male and female adults) from the Department of Liver Transplantation of the HCFMUSP. Cirrhosis was confirmed with biopsy, liver ultrasound and abdominal computed tomography scan.

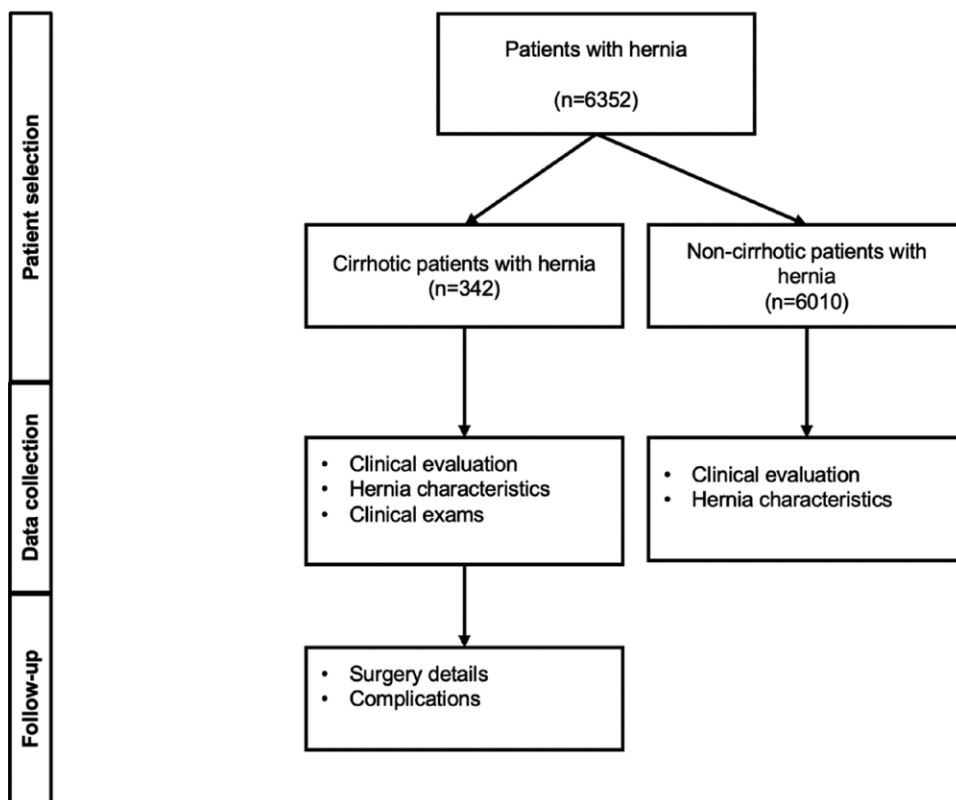


Figure 1. Population data and selection process based on inclusion and exclusion criteria. 6352 patients were included in this study.

Data from 6010 non-cirrhotic patient analyzed were included in this study (Fig. 1).

The eligible cases underwent clinical evaluation, comprising of age, sex, weight and height. A questionnaire concerning previous risk factors for hernia was carried out, which included hypertension, diabetes mellitus, smoking, alcoholism, dyslipidemia and cirrhosis.

Patients were followed for at least 30 days after surgery.

2.5. Patient and public involvement

It was not possible to involve patients or the public in the design, or conduct, or reporting, or dissemination plans of our research.

2.6. Inclusion criteria

Patients with hernia who were admitted to HCFMUSP between January 2010 and December 2017 were included in the study.

2.7. Exclusion criteria

Patients younger than 18 years old were excluded from the study. Patients who did not give informed consent to participate in the study were also excluded.

2.8. Statistical analysis

The estimates of the mean, median, standard deviation and minimum and maximum values were calculated for the quantitative variables.

Qualitative variables were presented as absolute and relative frequencies.

Association between qualitative variables was assessed by Pearson chi-square test or Fisher exact test, according to the

expected values criteria (if 20% or more of the expected values are <5 then Fisher exact test is used).

The comparison of a quantitative variable between two independent groups was performed by the Mann–Whitney test and the comparison between 3 independent groups by the Kruskal–Wallis test, after testing the hypothesis of normality of the data by the Kolmogorov–Smirnov test. A Kaplan–Meier survival curve was constructed to describe the survival of patients. The level of significance adopted was 5% for all hypothesis tests.

3. Results

3.1. Presence of cirrhosis and epidemiological characteristics

The two groups of cirrhotic and non-cirrhotic patient were compared in relation to epidemiological characteristics. All variables collected in both groups showed statistically significant differences ($P < .001$). Patients with hernias in the cirrhotic group had a higher prevalence of males (76.02%), were younger (55.7 ± 11.5) and had a lower body mass index (BMI) (26.2 ± 4.6) than non-cirrhotic patient. In addition, patient with cirrhosis had a lower prevalence of smoking (17.4%) and arterial hypertension (21%), but a higher prevalence of alcoholism (12.5%) and diabetes mellitus (22.3%) than non-cirrhotic patient. Data on dyslipidemia and ASA were also collected from non-cirrhotic patient (1 \rightarrow 24.0%, 2 \rightarrow 61.0%, 3 \rightarrow 14.8%, 4 \rightarrow 0.3%) (Table 1).

3.2. Presence of cirrhosis and hernia type distribution

The incidence of different types of hernia was found to be different in the cirrhotic and non-cirrhotic groups (Table 2). Patient with cirrhosis had a higher incidence of umbilical hernia (67.5% \times 24.2%, $P < .001$).

Table 1
Epidemiological characteristics according to the presence of cirrhosis.

		Presence of cirrhosis										P value
		Non-cirrhotic					Cirrhotic					
		n = 6077		n = 342		n = 342		n = 342		n = 342		
		n	%	Average	Standard deviation	Median	n	%	Average	Standard deviation	n	%
Gender	Woman	2200	36.7				82	24.0				
	Man	3798	63.3				260	76.0				
Age (yr)				59.4	13.6	61.0			55.7	11.5		56.1
Weight (kg)				77.0	17.2	75.0			73.3	15.3		72.0
Height (cm)				164.8	9.5	165.0			167.1	9.2		167.0
IMC (kg/cm ²)				28.4	6.2	27.3			26.2	4.6		25.4
Obesity	No	4081	70.5				254	83.6				
	Yes	1711	29.5				50	16.4				
Dyslipidemia	No	1942	93.7				0	0				
	Yes	130	6.3				0	0				NE
Arterial hypertension	No	1120	54.1				256	79.0				
	Yes	952	45.9				68	21.0				
Diabetes mellitus	No	1741	84.0				251	77.7				
	Yes	331	16.0				72	22.3				.005*
Smoking	No	3463	73.2				271	82.6				
	Yes	1269	26.8				57	17.4				
Alcoholism	No	5700	93.8				279	87.5				
	Yes	377	6.2				40	12.5				
ASA	1	1386	24.0				0	0				
	2	3528	61.0				0	0				NE
	3	857	14.8				0	0				
	4	16	0.3				0	0				

NE = non-evaluable.

* Pearson chi-square test.

† Mann-Whitney test.

Table 2
Types of hernia according to the presence of cirrhosis.

		Presence of cirrhosis				P value
		Non-cirrhotic		Cirrhotic		
		n	%	n	%	
		n = 6077		n = 342		
Umbilical hernia	No	3037	75.8	111	32.5	<.001*
	Yes	968	24.2	231	67.5	
Inguinal hernia	No	4005	65.9	230	67.3	.609*
	Yes	2072	34.1	112	32.7	
Right inguinal hernia	No	0	0	251	73.4	NE
	Yes	0	0	91	26.6	
Left inguinal hernia	No	0	0	294	86.0	NE
	Sim	0	0	48	14.0	
Femoral hernia	No	5998	98.7	335	98.0	.242*
	Yes	79	1.3	7	2.0	
Right femoral hernia	No	0	0	337	98.5	NE
	Yes	0	0	5	1.5	
Left femoral hernia	No	0	0	340	99.4	NE
	Yes	0	0	2	0.6	
Incisional hernia	No	4113	67.7	318	93.0	<.001*
	Yes			24	7.0	
Epigastric hernia	No	5532	91.0	336	98.2	<.001*
	Yes	545	9.0	6	1.8	
Parastomic hernia	No	6034	99.3	342	100.0	.171†
	Yes	43	0.7	0	0	
Hernia Spiegel	No	6035	99.3	342	100.0	.170†
	Yes	42	0.7	0	0	
Lumbar hernia grynfelt	No	6066	99.8	342	100.0	1.000†
	Yes	11	0.2	0	0	
Traumatic hernia	No	6048	99.5	342	100.0	.403†
	Yes	29	0.5	0	0	
Lumbar hernia	No	5999	98.7	342	100.0	.022†
	Yes	78	1.3	0	0	
Diaphragmatic hernia	No	6060	99.7	342	100.0	1.000†
	Yes	17	0.3	0	0	
Hernia lombar + Spiegel	No	5957	98.0	342	100.0	.009*
	Yes	120	2.0	0	0	

NE = non-evaluable.

*Pearson chi-square test.

†Fisher exact test.

Table 3
Epidemiological characteristics, comorbidity and type of hernia according to each etiology.

Etiology	General	HCV	HBV	Alcoholic	NASH	Autoimmune	Cryptogenic	Schistosomiasis
n	342	98	30	152	11	11	36	16
Gender (male)	76%	69.40%	96.6%*	92.7%*	45.4%*	27.2%*	69.40%	50%*
Age (yr)	55.72 (11.51)	57.47 (9.92)	61.00 (10.97)	56.65 (8.23)	55.15 (6.66)	36.31 (11.09)*	55.65 (15.20)	53.77 (8.06)
HBP	21%	19.80%	33.30%	20.70%	36.40%	9.10%	16.70%	21.40%
DM	22.30%	21.90%	16.70%	22.90%	27.30%	18.20%	33.30%	14.30%
Smoking	17.40%	17.50%	3.3%*	27.2%*	18.20%	0.00%	8.30%	0.00%
Alcoholism	12.50%	8.60%	6.90%	24.6%*	10.00%	0.00%	0%*	7.70%
Weight (kg)	73.33 (15.25)	70.56 (15.17)*	76.16 (11.05)	76.94 (16.82)*	76.45 (12.82)	67.99 (15.79)	71.98 (12.99)	62.93 (11.70)*
Height (cm)	167.08 (9.16)	165.36 (10.02)*	170.26 (6.64)	169.13 (8.61)*	166.73 (9.61)	163.22 (4.12)	165.55 (8.55)	161.86 (10.73)*
BMI (kg/cm ²)	26.19 (4.63)	25.72 (4.57)	26.20 (2.90)	26.83 (5.17)	27.45 (3.74)	25.61 (6.42)	26.17 (3.70)	23.88 (2.74)*
Obesity	16.40%	14.40%	6.90%	21.5%*	36%	22%	15%	0.00%

*Values of $P < .05$.

BMI = body mass index, DM = diabetes mellitus, HBP = high blood pressure, HBV = hepatitis B virus, HCV = hepatitis C virus, HBP = high blood pressure, NASH = nonalcoholic steatohepatitis.

However, epigastric (1.8%, $P < .001$) and lumbar (0%, $P = .022$) hernias had a lower incidence than in the non-cirrhotic group.

There was no statistically significant difference in relation to the other types of hernia analyzed: inguinal, femoral, parastomic, Spiegel, lumbar Grynfelt, traumatic and diaphragmatic.

Table 4

Description of deaths and probability of survival of patients with cirrhosis who underwent surgery.

	Total cases	Deaths	Survival	Mean survival time (mo)	Median survival time (mo)	Probability of survival<?Char=Mixed?>				P value*
						1 year	2-years	3-years	5-years	
Global survival Surgery	123	28 (22.8%)	95 (77.2%)	92.56	NE	79.9%	78.9%	76.9%	75.5%	
Emergency	56	25 (44.6%)	31 (55.4%)	66.31	NE	57.8%	55.8%	55.8%	52.9%	<.001
Elective	65	3 (4.6%)	62 (95.4%)	114.56	NE	98.5%	98.5%	94.4%	94.4%	

NE = non-evaluable.

* Log rank test.

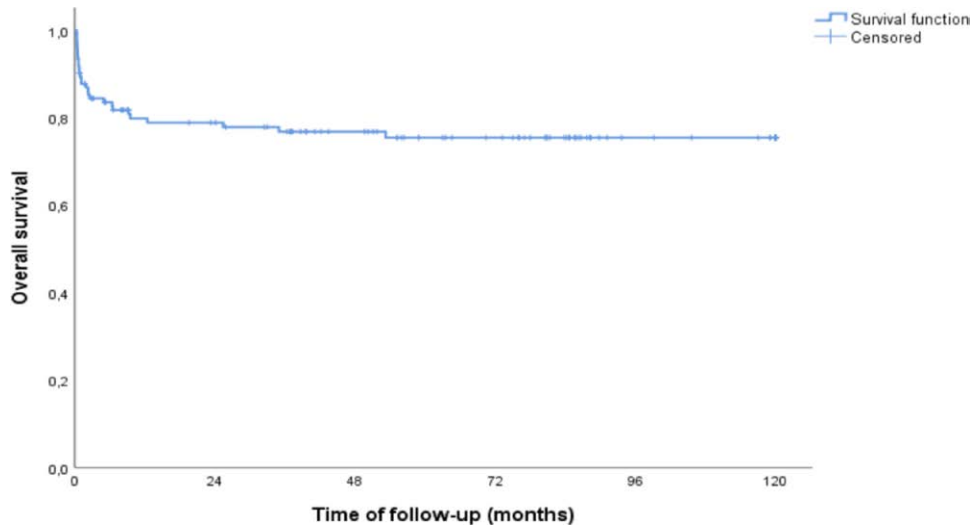


Figure 2. Overall survival curve.

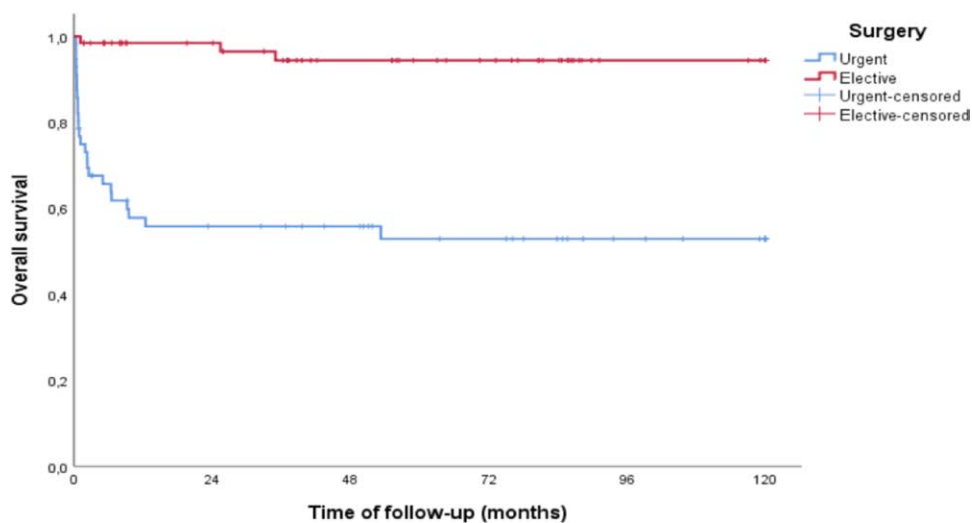


Figure 3. Survival curve based on surgery type.

3.3. Etiology, epidemiological characteristics, comorbidity and type of hernia

The etiology of some types of cirrhosis has specific characteristics in relation to the epidemiology, comorbidities, and type of hernia that the patient presented (Table 3). Detailed information can be found in the Supplemental Digital Content, <http://links.lww.com/MD/H818>.

3.4. Pain scale

Patients were assessed preoperatively with a pain scale ranging from 0 to 10. The average pain reported was 5.252 (SD 2.816). The type of hernia (location), epidemiological characteristics (gender) and comorbidity (arterial hypertension, diabetes mellitus, smoking and drinking) did not influence the pain reported by the patient.

Regarding the etiology of cirrhosis, only secondary biliary cirrhosis reported greater pain (8.0 ± 1.4 , $P = .034$).

Detailed information can be found in the Supplemental Digital Content, <http://links.lww.com/MD/H818>.

3.5. Ascites

Ascites was present in 70.1% of patient with cirrhosis with hernias. The presence of ascites was assessed for each type of cirrhosis etiology and there was no significant difference between groups.

Regarding the location of the hernia, patients with umbilical hernia had a higher prevalence of ascites (78.9%, $P = .001$). On the other hand, one types of hernia had a significantly lower prevalence: epigastric hernia (16.7%, $P = .01$).

3.6. MELD

The average of MELD values in patient with cirrhosis before surgery was 13.533 (SD = 5.3). The cutoff value of 14 points for elevated MELD was determined, according to the ROC curve of mortality. The sensitivity of the model was 0.724, with the Youden index of 0.405.

The presence of elevated MELD was not significantly different in relation to the etiology of cirrhosis and the location of the hernia ($P > .05$).

3.7. Survival curve

The median follow-up time for 123 patients with cirrhosis undergoing surgery was 42 months. At the end of the follow-up, 29 (23.6%) died. Of these patients, 25 underwent emergency surgery and four elective surgeries. The probability of 5-year survival for the total number of patients was 75.5%; for patients undergoing emergency surgery, 5-year survival was 52.9%, while for patients with elective surgery, the probability of 5-year survival was 94.4% ($P < .001$) (Table 4). Patients who underwent emergency surgery had approximately 12.6 times the risk of mortality compared to those who underwent elective surgery (95% CI 3.79–41.65; $P < .001$). The overall survival curves and by type of surgery are shown in Figures 2 and 3.

Similarly, survival curves were constructed separating patients in relation to MELD (Fig. 4) and the presence of ascites (Fig. 5).

Patients with MELD > 14 points (Table 5) had a HR for mortality of 4546 (95% CI [2.00–10.34], $P = .001$). As for ascites (Table 6), the HR was 6181 (95% CI 1.15–20.70, $P = .032$).

4. Discussion

The presence of hernias in patient with cirrhosis is a common condition, and its pathophysiology is well explained by the literature.^[1] However, detailed analysis of this population with these two diseases is still scarce.

Comorbidities associated with the development of cirrhosis have already been described, including alcohol,^[17] diabetes^[18] and chronic infections with hepatitis B and C.^[19] Risk factors for the development of hernia are also already consolidated in the literature,^[20] such as female sex, obesity, previous abdominal surgery and family history. However, the population of patients with hernia and cirrhosis is significantly different from that of hernia alone.

It was possible to observe the populations of patients with and without cirrhosis concomitant to the hernia in this study in an unprecedented way, showing that there is a significant difference between them.

Regarding sex, the group of patient with cirrhosis had a higher prevalence of men (76%) than non-cirrhotic patient, similar to that found by Pinheiro et al^[13] who only analyzed a population of patients with hernia and cirrhosis (73.9%). The BMI of patients with cirrhosis (26.2) in our study was lower than that found in the group without cirrhosis, probably due

to the state of malnutrition resulting from cirrhosis. However, it is worth mentioning that this BMI remains above the normal range often due to the presence of ascites.

While non-cirrhotic patient had a higher prevalence of arterial hypertension and smoking, patient with cirrhosis had a higher prevalence of diabetes and alcoholism. The increase in the prevalence of alcoholism is strongly related to the pathophysiology of the most common cause of cirrhosis in our study, alcoholic cirrhosis.

Due to the different pathophysiology of hernia formation in patient with cirrhosis, a reflection on the type of hernia these patients may develop is expected. Umbilical hernia (UH), the most common location, is present in 20% of compensated patient with cirrhosis, 10 times greater than the incidence of UH in the general population.^[5] In line with findings in the literature, our study showed a similar trend towards a higher proportion of UH in patient with cirrhosis (67.5%) compared to non-cirrhotic patient (24.2%). In the context of cirrhosis, collateral circulation triggered by portal hypertension in patient with cirrhosis can lead to recanalization of the obliterated umbilical vein or of the round ligament, which can increase defects present in the umbilical fascia and participate in the pathophysiology of HU.^[5]

In this situation of high prevalence of UH, the occurrence of other types of hernia may be difficulted, or yet, not influenced. Our study was the first to verify a similar prevalence of inguinal hernia in patient with cirrhosis (32.7%) and non-cirrhotic patient (34.1%), demonstrating that the incidence of this type of hernia is not influenced by the presence of cirrhosis with or without ascites. On the other hand, incisional hernias were more prevalent in the non-cirrhotic population (32.3%) than in the cirrhotic population (7%), however, incisional hernias are necessary secondary to prior surgical interventions and strongly related to the specific intervention performed. Due to the lack of data regarding prior surgical history, no conclusion can be drawn.

In addition to cirrhosis, the presence of ascites can also be another factor that influences the type of hernia in these patients. In this study, the majority of patient with cirrhosis with hernia had ascites (70.1%) and those with UH had an even higher prevalence of this condition (78.9%, $P = .001$), an expected result, given that the pathophysiology of these comorbidities is closely related. The increase in abdominal pressure caused by ascites forces the peritoneum through the umbilical ring into the subcutaneous space, favoring the eversion of the umbilicus and the formation of UH.^[5] In contrast, one other type of hernia had a significantly lower prevalence in the context of ascites epigastric hernia (16.7%, $P = .01$), again a result that can be explained by the specific characteristics of patients in a tertiary hospital.

Due to all the comorbidities of the patient with cirrhosis, hernia repair surgery presents greater risks in this population. Del Olmo et al^[14] compared 135 patient with cirrhosis with 86 non-cirrhotic patient undergoing general non-hepatic surgery and found a perioperative mortality of 16.3% in patients with cirrhosis compared to 3.5% in patients without cirrhosis. Similarly, Belghiti and Durand^[1] analyzed data from nine studies of patient with cirrhosis with hernias and found an average mortality of 7.75% in a total of 245 patients. The literature on cirrhosis patients undergoing hernia repair shows a wide range of morbidity and mortality rates. The variability is a result of the heterogeneity of this patient population. These factors include the type of procedure, be it elective or emergency, and the degree of liver dysfunction. Our study showed that the mortality of patient with cirrhosis who underwent hernia repair surgery in 5 years was 24.5%, reflecting the character of a tertiary hospital with the monitoring of more complicated cases.

In particular, it is worth highlighting the impact of the type of procedure, elective or emergency. This variable has already been extensively studied in surgery in general and also for hernia repair surgery. Primates and Goldacre^[21] showed that the mortality of patients who underwent emergency surgery is almost 5 times higher, especially in the first month of surgery.

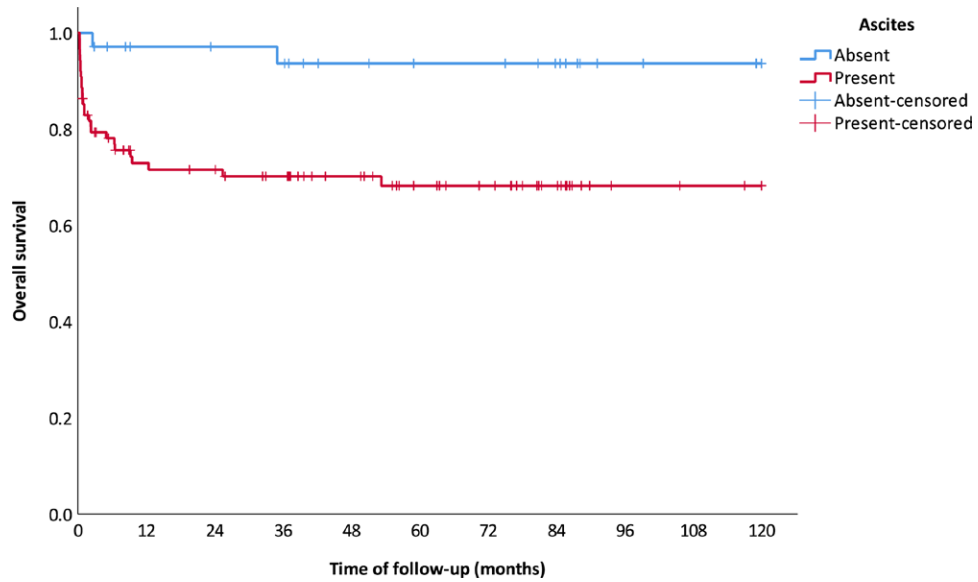


Figure 4. Survival curve based on the presence of ascites.

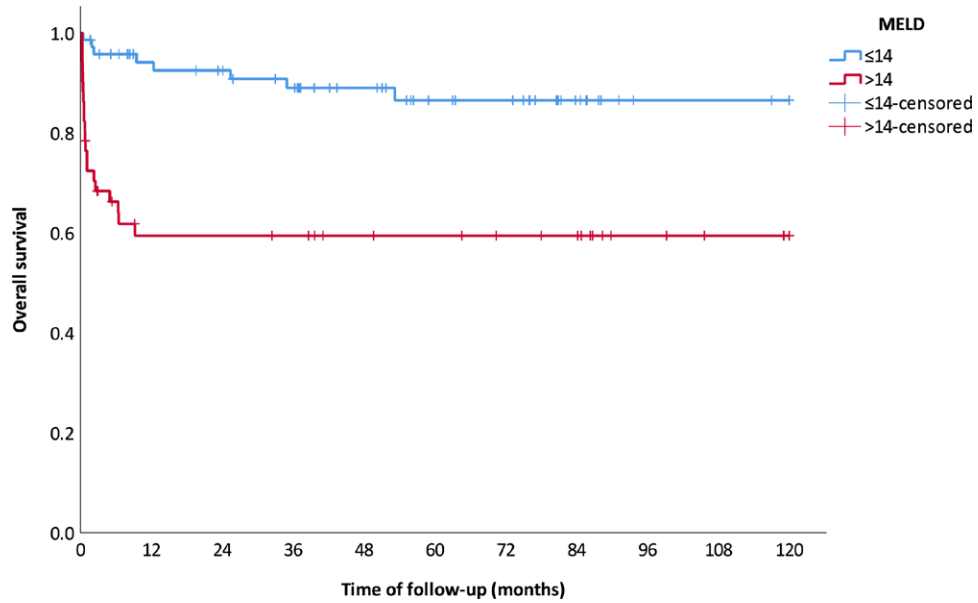


Figure 5. Survival curve based on MELD.

Table 5
Survival time according to presence of ascites.

Previous Ascites	Averages and medians for survival time			
	Estimate	Standard Error	Average	
			Inferior limit	Superior limit
Absent	113.694	4.333	105.202	122.186
Present	84.115	5.883	72.584	95.645
General	92.557	4.547	83.645	101.469

The survival of patients according to the type of surgery was also very different in our analysis. Emergency surgery had an HR of 12.56 compared to elective, in line with the findings in

the literature. The impact of the greater severity of patients who are operated on in the emergency room and the importance of adequate preparation with sufficient time for elective patients

Table 6
Survival time according to MELD.

MELD final (cutoff ≤ 14)	Averages and medians for survival time			
	Estimate	Standard error	Average	
			Inferior limit	Superior limit
≤14	106.646	4.429	97.965	115.327
>14	72.213	8.303	55.94	88.487
General	92.557	4.547	83.645	101.469

is evident. Thus, the fact that almost half of the surgeries performed in our study were performed on an urgent basis is yet another reason for the high mortality observed.

Another variable studied that predicted prognosis with high sensitivity was patient MELD score. Cho et al^[22] analyzed factors that influence the outcome for hernia surgery. Patients with a MELD value above 15 points had an odds ratio of 5.6 for adverse outcomes. Our study found a hazard ratio value of 6.1 for mortality in patients with MELD values greater than 14, consistent with other studies already published. Since MELD is a direct marker of disease severity in patient with cirrhosis, these patients are expected to have more complications, especially due to the higher prevalence of emergency surgery. The survival curve we found shows that this difference in survival is much more significant in the first months after the procedure, with a very small number of deaths after 1 year.

Finally, since hernia is a condition associated with loss in patient quality of life, partly due to pain,^[23] it was analyzed whether any of the patients' characteristics could be related to this condition. Andraus et al^[24] used the SF36 scale to assess the impact of the presence of hernias in patients with cirrhosis. In this study it was found that this condition has a significant impact on the quality of life of these patients and that the hernia correction can contribute to the improvement. One of the criteria used by this scale is the pain referred by the patient. Our study used a scale of 0 to 10 and obtained a mean of 5.252, similar to that found by Andraus (5.5). However, none of the comorbidities or type of hernia (location) analyzed interfered with the pain reported by patients. Similarly, the etiology of cirrhosis was also not associated with changes in reported pain, with the exception of patients with secondary biliary cirrhosis, who reported a significantly higher value (8.0). It is worth mentioning that despite being statistically significant, the small number of patients with some types of etiology may limit the conclusions reached.

Among the limitations of our study, the presence of a heterogeneous group with a reduced number of some etiologies and location of hernias in patient with cirrhosis is notable. In addition, the follow-up time between patients was variable. Finally, the assessment of the presence of pain was carried out in a single moment, which may have been influenced by some unevaluated factor.

The presence of a control group without cirrhosis with more than 6000 patients and one of the largest groups reported in the literature of patients with hernia concomitant to cirrhosis allowed a detailed analysis of the epidemiology and specific details of each etiology and location of the hernia in the patients. This description is of great value in clinical practice to guide patient treatment, expectations and prognosis.

5. Conclusion

This study characterized the epidemiological differences in relation to the presence of cirrhosis in patients with hernia using a

cohort of 6352 patients attended to in a tertiary hospital. The incidence of umbilical hernia in the cirrhotic population was 2.78 times higher than in the non-cirrhotic population, however this is the first study to show that no significant differences were found in relation to inguinal hernia. Hernia correction surgery in patient with cirrhosis has a high mortality, especially when performed under urgent conditions and associated with a more severe clinical condition of patients, such as the presence of ascites and elevated MELD. Understanding the impact of each of the related factors allows healthcare professionals to have more information about the patient's prognosis and improve their care.

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Author contributions

AM had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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