Sidhu Ankur (Orcid ID: 0000-0002-7192-4652)

Title Page

Full Title

Outcomes of inguinal hernia repair in cirrhotics : A single tertiary centre experience.

Authors

Ankur Sidhu MBBS, FRACS *

Carlos Cabalag MBBS *

Eunice Lee MBBS FRACS

Chon Hann Liew MBBS FRACS

Alastair Young PhD, FRCS

Christopher Christophi Phd, FRACS

* - Equal first authors

This study was presented as a poster at the RACS ASC in 2017.

Number of Tables – 2

Abstract word count – 200

This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/ans.15666

Text word count – 1783

Corresponding author

Mr Ankur Sidhu

Northern Hospital

185 Cooper Street

Epping VIC 3076

Abstract

Introduction

Patients with liver cirrhosis are at a higher risk of peri-operative anaesthetic and surgical complications. Surgical repair of abdominal wall hernias in these patients have been widely discouraged. The main objective of this study was to evaluate the post-operative outcomes of patients with liver cirrhosis after inguinal hernia repair at a single institution.

Methods

A retrospective review of a prospectively maintained database of 31 patients with liver cirrhosis undergoing inguinal hernia repair between 2006 and 2016 was undertaken. Data in relation to patient demographics, clinicopathological characteristics, morbidity and mortality was collected.

Results

31 patients with median MELD score of 14 (7-36) underwent inguinal hernia repair within 10 year period of our study. There was one mortality in a patient with MELD score of 36 who presented with a strangulated hernia. Only one patient required return to theatre for evacuation of haematoma and one patient developed recurrent hernia in 1 year follow-up.

Discussion

Inguinal hernia repair in patients with cirrhosis is a safe procedure to perform in the elective setting. Nevertheless, significant consideration must be given in performing these operations in centres with

liver transplant units due to their extensive experience in pre-operative optimisation to reduce the risk of hepatic decompensation.

Keywords:

Inguinal, hernia, cirrhosis, liver, complication

INTRODUCTION

Liver cirrhosis is a major determinant of postoperative morbidity and mortality. [1,2] Ascites is one of the major complications of chronic liver disease and upto 50% of cirrhotic patients will develop ascites.[3] There is an increased propensity for patients with liver cirrhosis and ascites to develop abdominal wall hernias in comparison to the general population.[4] In patients with ascites, there is an increased risk of complications such as bleeding, infection and postoperative liver decompensation. Hence, surgical repair of abdominal wall hernias has been widely discouraged.[5] Nevertheless, several recent studies have demonstrated the safety of inguinal herniorrhaphy in selected patients with liver cirrhosis.[2,6,7]

The Child-Pugh classification is a widely accepted method of stratifying surgical risk in patients with liver cirrhosis.[8] Previous studies have noted an increase in mortality, both in elective and emergency procedures, with increasing severity of cirrhotic patients stratified by Child-Pugh criteria.[9,10] Using the MELD criterion (Model for End-stage Liver Disease)[11], other authors have also shown an association between worse post-operative outcome in patients with cirrhosis and worsening of their liver function.[12-14]

This present study evaluates the post-operative outcomes of patients with liver cirrhosis after inguinal hernia repair at a single institution and evaluates any clinical and pathological parameters that may be associated with poorer outcomes.

METHODS

A retrospective search was conducted on prospectively kept database of all patients who underwent inguinal hernia repair with a concurrent diagnosis of liver cirrhosis between January 2006 and December 2016. This was performed using the database through the Department of Hepatobiliary and Liver Transplant Surgery at Austin Hospital, Melbourne, Australia. Ethics approval was obtained for this study through the Austin Health Human Research Ethics Committee.

The diagnosis of liver cirrhosis was based upon biochemical tests and imaging, either in the form of computed tomography (CT), ultrasound (US) or Fibroscan. Pre-operative data collected from electronic medical records included age, sex, body mass index (BMI), laterality of the hernia, MELD score (and its individual components), and Child Pugh score. Other parameters assessed include American Society of Anaesthesiologists (ASA) score, type of repair, operative time, length of stay and post-operative complications. Hepatic decompensation was defined by worsening biochemical markers such as liver function tests, ammonia level, coagulation profile and renal function. Encephalopathy was defined as onset of asterixis and disorientation.

All patients who underwent elective surgery were independently assessed by the attending gastroenterology team and anaesthetics in order to optimise perioperative physiology. Ascites was appropriately controlled with diuretics and ascitic tapping prior to surgery. Measurement of coagulation was conducted and corrected if required, through the administration of vitamin K, platelet transfusion or fresh frozen plasma. All patients in our cohort received general anaesthesia and prior to induction, an intravenous dose of cefazolin was administered. Prophylaxis for deep vein thrombosis in the form of graduated compression stockings were used in all patients and chemical prophylaxis was not given. Post-operative care was administered by both surgical and gastroenterological teams.

Statistical Analysis

Preoperative data collected from electronic medical records were classified as either binomial, categorical or continuous variables. Continuous variables were presented either as a percentage of the total cohort, standard deviation (SD) or as a mean with a range. Logistic regression analysis was performed to determine if there was a significant association between morbidity and any of the preoperative data that was collected. A p-value of less than 0.05 was deemed significant. All statistical analyses were performed using SPSS Version 24 (Armonk, NY: IBM Corp).

RESULTS

Patient demographic and preoperative data

Between 2006 and 2016, 31 patients with liver cirrhosis were identified who underwent inguinal hernia repair. Demographic and preoperative data are shown in Table 1. The patient cohort consisted of 30 males and 1 female. The median age of the patients was 60.5 years. The severity of the liver cirrhosis was based on Child-Pugh classification and MELD score. 23 out of 31 (74%) patients had a Child Pugh classification of B or C. The median MELD score of our patient cohort was 14 (range: 7 – 36). MELD score, Child-Pugh score or ASA classification was not significantly associated with morbidity ($p = 0.68$).

In our study, 15 patients had a right sided inguinal hernia, 12 patients had a left sided hernia and 4 patients had bilateral hernia repairs. Out of the 31 patients, 2 patients were operated upon in an emergency setting due to incarceration. The remaining patients were operated upon in an elective setting. 20 out of 31 patients in our cohort (64 %) had their ascites drained pre-operatively. Lichtenstein repair was the most common operation performed with 29 patients undergoing this repair. One patient underwent an open darn repair of their hernia

and one patient underwent laparoscopic total extraperitoneal (TEP) repair of their hernia. The patient that underwent TEP repair of their hernia was found to have cirrhosis in the post-operative period.

The median values for biochemical parameters are as follows: albumin level was 30 grams per litre (33-46); bilirubin was 29 milligrams per decilitre (<21); platelet count was 89 X 10^9 units per litre (150-400); creatinine was 95 micromoles per litre (45-90); sodium was 137 millimoles per litre (135-145) and international normalised ratio was 1.4 (0.8-1.3). All of these aforementioned serum and biochemical measurements did not have a statistically significant effect on morbidity after logistic regression analysis.

The clinicopathological parameters of the study population is shown in Table 2. The average operative time for the cohort was 113 minutes with a median of 102 minutes (Interquartile range (IQR) 88 – 133). A prolonged operative time was not significantly associated with increasing morbidity within our cohort (p = 0.067). Nevertheless, 13 patients had a significantly longer operating time compared to the average. Three of these patients sustained post-operative hepatic decompensation, two patients had post-operative haematomas, one patient had a wound dehiscence, one patient had a wound infection and there was one mortality secondary to hepatic decompensation. The majority of patients underwent unilateral hernia repair with the exception of four patients who had bilateral inguinal hernias repair in the same index operation. These four patients had an operative time ranging from 78 to 166 minutes and three out of four of these patients had post-operative hepatic decompensation complicated by pneumonia and acute renal failure, all of which necessitated a prolonged hospital stay.

The median duration of hospital stay was 4 days. One of the patients stayed for 16 days who developed post-op haematoma and pneumonia requiring observation and antibiotics.

Complications

Three patients developed post-operative haematoma with one patient requiring return to theatre for evacuation of haematoma on the third post-operative day. Four patients developed post-operative encephalopathy that resolved without treatment. One patient developed an ascitic fistula that was managed non-operatively in the outpatient setting. This patient's ascites was optimised with the help of gastroeneterology team and the fistula eventually settled. There was one post-operative mortality in a patient who presented with incarcerated inguinal hernia and underwent emergency repair of their inguinal hernia. This patient developed hepatic decompensation and succumbed to multi-organ failure. Within a one year follow up period there was only one patient who had a recurrent hernia.

DISCUSSION

In theory, all patients with symptomatic inguinal hernias should be offered a repair.[15] Patients with concurrent liver cirrhosis have increased risk of mortality due to anaesthetic complications, post-surgical complications and recurrence.[4] However, previous studies have reported that life-threatening complications in patients with liver cirrhosis undergoing inguinal hernia repair are uncommon. Hurst et al.[16] reviewed eighteen cirrhotic patients who underwent groin hernia repair and showed that there were no major and only four minor complications that occurred in that group. In the present study of 31 patients, there was one mortality and one patient taken back to theatre for evacuation of post-operative haematoma. The remainder of the complications were minor and managed non-operatively with the input of a specialist gastroenterology team within a liver transplant unit. A study by Carbonell et al.[17] suggested that patients with cirrhosis should have elective hernia repair after medical optimisation. A retrospective study by Andraus et al.[18] also concluded that emergently treated patients have a significantly higher morbidity and mortality than electively treated patients. Our results support this conclusion, as the only mortality that occurred was in a patient who underwent emergency repair of their hernia with a pre-operative MELD score of 36 and was Child-Pugh class C.

Ascites in patients with cirrhosis should be managed adequately as it has a detrimental effect on morbidity in the form of ascitic leak and wound infection.[4] Ideally, in an elective setting, patients with poorly controlled ascites should be encouraged to forego repair if possible.[16] In a smaller series by Hurst et al., five groin hernias were electively repaired in the presence of significant ascites and only one patient had recurrence at 11 months. In our study, all the patients who underwent elective repair of their inguinal hernias were optimised medically with the help from the gastroenterology unit. All patients with ascites were managed with fluid restriction, diuretic control and those who had refractory ascites, underwent drainage of their ascites pre-operatively through paracentesis. This resulted in only one patient in our series with ascites leak from the wound post their

hernia repair. Although, there is lack of long-term data on the effect of ascites and inguinal hernias[8,16], ascites leak post-operatively can certainly lead to significant wound problems, infection and distress for the patient.

Mansour et al.[10] reported that patients with cirrhosis undergoing elective abdominal operation had a mortality rate of 10% in Child Pugh class A patients, 30% in Child Pugh class B patients and 82% in Child Pugh class C patients with mean mortality rate of 18%. In our study, 29 patients underwent elective repair of their inguinal hernia. Of these 29 patients, 80% of patients were Child Pugh class B or C. There was no mortality in our cohort of patients who underwent elective repair of their inguinal hernia. There were only minor complications post-operatively, with one patient requiring evacuation of haematoma in theatre. These results indicate that inguinal hernia repair in liver cirrhosis patients can be performed safely, regardless of their Child Pugh status. However, we do propose performing these operations in centres with liver transplant units. Liver transplant centres have multidisciplinary support and extensive experience in pre-operative optimisation to reduce the risk of post-operative hepatic decompensation.

In our study, majority of patients underwent Lichtenstein repair of their inguinal hernia. One patient underwent TEP repair of their hernia. This patient was found to have liver cirrhosis in the post-operative period. The optimal surgical approach of inguinal hernia repair in patients with liver cirrhosis is currently undefined. Various studies have shown that TEP repair of inguinal hernia in patients with liver cirrhosis is feasible and safe (19,20). At our institution, we would offer an open inguinal hernia repair to patients with liver cirrhosis.

We acknowledge that the main limitation of our study is the small number of patients recruited despite capturing our experience over a ten-year period. Our study failed to show a statistical significance, however there is a trend towards increasing morbidity with a prolonged operative time. Difficult cases with large hernias may be associated with prolonged operative time and increased risk of peri-operative complications. Moreover,

other factors that may have affected outcome is the experience of the primary surgeon as well as the size or complexity of the inguinal hernia.

Although our study is retrospective and constitutes a small series of patients, our findings suggest that elective inguinal hernia repair within a tertiary institution can be performed safely in conjunction with specialist gastroenterological and anaesthetic input in the patient's perioperative care. Key facets of preoperative clinical care include medical optimisation of hepatic dysfunction and management of ascites in order to improve clinical outcome. References

1. de la Pena CG, Fakih F, Marquez R, Dominguez-Adame E, Garcia F, Medina J. Umbilical herniorrhaphy in cirrhotic patients: a safe approach. Eur J Surg 2000; **166**:415–416.
2. Oh HK, Kim H, Ryoo S, Choe EK, Park KJ Inguinal hernia repair in patients with cirrhosis is not associated with increased risk of complications and recurrence. World J Surg. 2011; **35**:1229-1233.
3. Ginés P, Quintero E, Arroyo V et al. Compensated cirrhosis: natural history and prognostic factors. Hepatology. 1987; **7**:122–128.
4. Hur YH, Kim JC, Kim DY, Kim SK, Park CY. Inguinal hernia repair in patients with liver cirrhosis accompanied by ascites. J Korean Surg Soc. 2011; **80**:420-425.
5. Silva FP, Andraus W, Pinheiro RSN et al. Abdominal and inguinal hernia in cirrhotic patients: Whats the best approach? Brazilian Archives of Digestive Surgery. 2012 **25**(1): 52-55.
6. Patti R, Almasio PL, Buscemi S, Fama F, Craxi A, DiVita G. Inguinal hernioplasty improves the quality of life in patients with cirrhosis. Am J Surg. 2008; **196**:373–378
7. Lawson EH, Benjamin E, Busuttil RW, Hiatt JR. Groin herniorrhaphy in patients with cirrhosis and after liver transplantation. Am Surg 2009; **75**:962–965.
8. Odom SR, Gupta A, Talmor D, Novack V, Sagy I, Evenson AR. Emergency hernia repair in cirrhotic patients with ascites. Journal of trauma and acute care surgery. 2013; **75**(3): 404-409.

9. Garrison RN, Cryer HM, Howard DA, Polk HC, Jr. Clarification of risk factors for abdominal operations in patients with hepatic cirrhosis. Ann Surg. 1984; **199**(6):648-55
10. Mansour A, Watson W, Shayani V, Pickleman J. Abdominal operations in patients with cirrhosis: still a major surgical challenge. Surgery. 1997; **122**(4):730-5.
11. Kamath PS, Wiesner RH, Malinchoc M et al. A model to predict survival in patients with end-stage liver disease. Hepatology. 2001; **33**(2)464-70.
12. Befeler AS, Palmer DE, Hoffman M, Longo W, Solomon H, Di Bisceglie AM. The safety of intra-abdominal surgery in patients with cirrhosis: model for end-stage liver disease score is superior to Child-Turcotte-Pugh classification in predicting outcome. Arch Surg. 2005; **140**(7):650-4.
13. Carbo J, Garcia-Samaniego J, Castellano G, Iniguez A, Solis- Herruzo JA. Liver cirrhosis and mortality by abdominal surgery. A study of risk factors. Rev Esp Enferm Dig. **1998**; 90(2):105- 12.
14. del Olmo JA, Flor-Lorente B, Flor-Civera B et al. Risk factors for non-hepatic surgery in patients with cirrhosis. World J Surg. 2003; **27**(6):647-52.
15. Kingsnorth AN. Hernia Surgery : from guidelines to clinical practice. Annals of Royal College of Surgeons England. 2009; **91**;273-279.
16. Hurst RD, Butler BN, Soybel DI, Wright HK. Management of groin hernias in patients with ascites. Ann Surg 1992; **216**:696-700.
17. Carbonell AM, Wolfe LG, DeMaria EJ. Poor outcomes in cirrhosis associated hernia repair: a nationwide cohort study of 32,033 patients. Hernia. 2005; **9**(4): 353-357.
18. Andraus W, Pinheiro RS, Lai Q et al. Abdominal wall hernia in cirrhotic patients: emergency surgery results in higher morbidity and mortality. BMC Surgery. 2015; **15**(65)
19. Hassan AMA, Esmat ME, Elsebae MMA, Nasr MM. Inguinal hernia repair in patients with liver cirrhosis. Lichtenstein repair versus laparoscopic total extra-peritoneal approach. Int Surg J. 2019; **6**(8): 2865-2868.
20. Wang HMS, Fu JMS, Qi X, Sun J, Chen Y. Laparoscopic total extraperitoneal (TEP) inguinal hernia repair in patients with liver cirrhosis accompanied by ascites. Medicine. 2019; **98**(43): e17978.

Conflict of Interest

None

Table 1

Patient Characteristic	**Value**
Age	60.5 (years)
Gender (number of patients)	
• Male	30 (96.8)
• Female	1 (3.2)
ASA score (number of patients)	
• II	2 (6.5)
• III	22 (71.0)
• IV	5 (16.1)
Child Pugh score	
• A	6 (19.4)
• B	19 (61.3)
• C	6 (19.4)
MELD score	14

Table 1 – Demographics of patients with cirrhosis and inguinal hernia. Values are presented as median or number (percentage). ASA – American Society of Anaesthesiologists. MELD – Model of End Stage Liver Disease.

Table 2

Variable	Value
Anaesthesia	
• General	31
Elective operation	29
Emergency operation	2
Operative time (mins)	102 +/- 39.6 (50-225)
Method	
• Lictenstein	29
• Darn	1
• Laparoscopic TEP	1
Ascites drained	21
LOS (days)	4.3 +/- 3.4 (1-16)
Complications	
• Haematoma	3
• Wound Infection	1
• Ascites leak	1
• Post-operative encephalopathy	4
• Death	1

Table 2 – Operative parameters and outcomes in patients with cirrhosis and inguinal hernia. Values are presented as median or numbers. TEP – total extraperitoneal, LOS – length of stay.