

Inguinal hernioplasty in patients with cirrhosis and ascites: what preventive measures are needed for a safe procedure?



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Inguinal hernioplasty in patients with cirrhosis and ascites: what preventive measures are needed for a safe procedure?

BACKGROUND: *Inguinal hernioplasty in patients with LC and ascites has been long discouraged for the incidence of post-operative complications. The aim is to evaluate the appropriateness of this elective surgical procedure in patients with LC and ascites.*

METHODS: *Thirty consecutive LC patients with ascites and affected by inguinal hernia (LC group), who underwent elective open inguinal hernioplasty with mesh placement, have been matched with the same number of patients non-LC (non-LC group) who underwent the same surgical procedure in the same period of time. All patients in LC group received a careful hepatological assessment and were classified according to the etiology of LC and to the Child's class. Patients of both groups received an antibiotic prophylaxis and were operated under local anesthesia.*

RESULTS: *No significant complications were observed in any patients during surgery. The hospital stay was significantly longer in LC group. During the postoperative time, 4 inguinoscrotal hematoma appeared in LC group, of which 3 in class C (LC VS non-LC $p > 0.05$; non-LC VS Child's class C $p < 0.023$). Ascites leakage or wound infection were not observed.*

CONCLUSION: *Inguinal hernioplasty can be safely performed for LC patients in Child's class A and B; for patients in class C, careful attention must be paid to the hemorrhagic events.*

KEY WORDS: Ascites, Cirrhosis, Hernioplasty

Introduction

Inguinal hernia is a common disease, which affects several people all over the world, above all among men. Inguinal hernioplasty with mesh is the surgery procedure most performed because it shows a lower relapse rate and a lower incidence of minor surgical site complica-

tions such as wound infection and hematoma formation. Liver cirrhosis (LC) is a chronic disease, which leads to liver failure. Because of the recent increased alcohol consumption, of the high rates of Hepatitis C Virus and Hepatitis B Virus and of the widespread obesity, we are witnessing an increasing number of patients with non-alcoholic steatohepatitis and non-alcoholic fatty liver disease, predisposing to LC onset¹.

Patients with LC are likely to present several disorders of metabolism involving various organs and apparatus, whose severity is related to the stage of the disease. The alterations that surgically interfere, complicating the post-operative course, firstly involve the blood coagulations, the immunological status and the nutritional status of the patients. The hemostasis disorders are due to the liver impaired production of the coagulation factors. The innate immune dysfunctions result from the loss of liver reticuloendothelial cells, to the decreased neutrophil

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mobilization and phagocytic activity and to lower levels of immunoglobulins. Furthermore, malnutrition is typical of patients with LC especially for the metabolic disorders to which they are subject. In patients suffering from LC and presenting inguinal hernia the sequelae of haemostatic, immunological and nutritional conditions may result in postoperative complications such as bleeding, infections and impaired wound healing respectively^{2,3}. Until recent years, the surgical treatment for patients suffering from LC and affected by inguinal hernia has been discouraged. There is not yet a unified opinion on whether or not is safe the surgical treatment for patients with LC and inguinal hernia. Otherwise, many recent studies show that elective surgery should be proposed to improve the quality of life of these patients without significantly increasing the postoperative complications⁴. Moreover, developing an acute incarcerated inguinal hernia as a result of ascites is a possible but not well documented complication of LC⁵. In our work we propose a case-control study, comparing the postoperative course of a group of patients affected by LC and ascites with inguinal hernia to that of a group of patients non-LC suffering from inguinal hernia, both underwent an elective open inguinal hernioplasty with mesh placement. The aim is to evaluate the appropriateness of this elective surgical procedure in patients with LC and ascites, observing eventual postoperative complications onset in the two groups.

Patients and Methods

A case-control study has been conducted including a group of 30 consecutive male patients suffering from LC and ascites with symptomatic and not complicated primitive inguinal hernia (LC group) who had undergone elective open hernioplasty with mesh placement from March 2005 to March 2015. These patients were matched with an equal number of patients affected by inguinal hernia who had been treated during the same period (non-LC group).

All these patients had been admitted to our Department and were under the care of the same surgical team. Matching criteria included: age; BMI; the presence of comorbidities (except for cirrhoses); the type of hernia according to Nhyus classification⁶; the side of hernia; the ASA score. In group LC, all patients had been previously admitted to the Gastrointestinal and Liver Unit to evaluate their functional hepatic status and subsequently referred to the General Surgery Unit to perform a hernioplasty in order to get symptomatic relief. All patients gave written informed consent. Exclusion criteria were the presence of a large umbilical hernia, late-stage hepatocellular carcinoma, or severe heart disease. All patients underwent surgery after a careful metabolic and coagulation assessment and were classified according to the etiology of liver cirrhosis and to the Child's class.

Patients were treated with increased doses of diuretics up to 400 mg of spironolactone per day, 160 mg of furosemide per day, and sodium restriction (50 mEq/d). This medical management was continued until the disappearance of ascites, and only at this point they underwent surgery. A lack of body weight response, defined as a loss of body weight less than 200 g/d after 4 days, or the development of diuretic-induced complications that precluded the use of effective diuretic dosage were defined as refractory ascites. No patient received transjugular intrahepatic portosystemic shunt or peritoneovenous shunt before enrollment and during the study period. The presence of ascites was determined based on preoperative abdominal ultrasounds or abdominal computed tomography. A short-term antibiotic prophylaxis with 2 g intravenous ceftazidime was administered 1 hour before surgery in all patients of the 2 groups. As to the type of anesthesia administered, all patients of group LC and non-LC received local anesthesia using a mixture of 40 mL 1% mepivacaine and 20 mL 0.5% bupivacaine plus 2 mL sodium bicarbonate.

Postoperative pain was assessed by the patients by means of a verbal pain intensity scale ranging from 0 (no pain) to 10 (worst pain imaginable) at 24 hours, 72 hours and on postoperative days (POD) 7. Patients discharged before these times were requested to record pain at home. Clinical and instrumental controls were performed up to two years after surgery.

SURGICAL PROCEDURE

A tension-free Lichtenstein hernioplasty with polypropylene mesh placement was performed for all patients of the two groups by 1 surgeon (GDV). The hernial sac was carefully isolated from the related structures in order to avoid perforation, and, subsequently, it was invaginated without opening the abdominal cavity. In patients with a large-size hernial sac, it was cautiously isolated from the close structures. It was subsequently fastened on the basis, and its distal part was cut and secured with a transfix suture to avoid the risk of ascitic leak and, finally, invaginated at the internal inguinal ring. The aponeurosis was closed performing water tight closure with a running suture using an absorbable monofilament. A tubular suction drainage was placed in the dead space only when it was large.

STATISTICAL ANALYSIS

All statistical analysis were performed using a statistical program (Graph Pad Instat Version 3.06 for Windows). Both continuous variable (as mean and standard deviation) and categorical data of the 2 groups were given, compared using Unpaired T test with Welch correction and Fisher's test, respectively.

Results

Demographic data matched (age, BMI, ASA score and comorbidities) are shown in Table I; among LC patients, 7 resulted affected by hepatocellular carcinoma and under treatment (23.3%). The etiology of liver cirrhosis and Child's class are reported in Table II. Type of hernia according to Nhyus classification, side of hernia, duration of operation and duration of hospital stay are reported in Table III. No significant complications were observed in any patients of the two groups during surgery. Wound drainages were placed in 21 patients, 13 of LC group and 8 of non-LC group and they have been removed between 24 and 48 hours after surgery. The hospital stay was significantly longer for patients in LC group ($p=0.0132$). No patients complained severe

TABLE I - Demographic matched data of 60 patients (30 with LC and ascites and 30 non-LC). LC: liver cirrhosis; BMI: Body Max Index; ASA: American society of Anesthesiologists; COPD: Chronic obstructive pulmonary disease; HCC: hepatocellular carcinoma.

	LC Group N (%)	non-LC Group N (%)	P
Age (y)			
Mean \pm SD	54.6 \pm 9.5	52.8 \pm 10.2	n.s.
BMI (Kg/m ²)			
< 25	11 (36,6%)	16 (53,3%)	n.s.
\geq 25	19 (63,3%)	14 (46,6%)	
ASA Score			
I	0 (0%)	1 (3,3%)	n.s.
II	2 (6,6%)	3 (10%)	
III	24 (80%)	14 (46,6%)	
IV	4 (13,3%)	2 (6,6%)	
Comorbidities			
Diabetes	6 (20%)	8 (26,6%)	n.s.
Arterial Hypertension	12 (40%)	11 (36,6%)	
Atherosclerosis	0 (0%)	1 (3,3%)	
Atrial Fibrillation	2 (6,6%)	1 (3,3%)	
COPD	3 (10%)	2 (6,6%)	

TABLE II - Child's class and Etiology of liver cirrhosis in patients of LC group with ascites. HCV: Hepatitis C virus; HBV: Hepatitis B virus.

	LC Group N (%)
Child's class	
A	7 (23,3%)
B	10 (33,3%)
C	13 (43,3%)
Etiology of LC	
HCV	12 (40%)
HBV	5 (16,6%)
Alcoholic	11 (36,6%)
Autoimmune	1 (6,6%)
Metabolic Syndrome	1 (6,6%)

TABLE III - Classification of inguinal hernia and surgical features of patients in LC group and in non-LC group. V.P.I.S.: Verbal Pain Intensity Scale

	LC Group	non-LC Group	P
Type of hernia (Nhyus)			
II			
III A	3 (10%)	2 (6,6%)	n.s.
III B	13 (43,3%)	16 (53,3%)	
IV A	10 (33,3%)	11 (36,6%)	
	4 (13,3%)	1 (3,3%)	
Side of hernia			
Right	12 (40%)	11 (36,6%)	n.s.
Left	18 (60%)	19 (63,3%)	
Bilateral	0 (0%)	0 (0%)	
Duration of operation (min)	49 \pm 10.9	45 \pm 8.1	n.s.
Mean \pm SD			
Hospital stay (d)			
Mean \pm SD	2.3 \pm 3.2	0.8 \pm 0.3	0.0132
Postoperative pain (V.P.I.S.)	4.3 \pm 0.4	4.1 \pm 0.6	n.s.
score \pm SD			

pain or indicated a pain intensity score over 5 points on POD 1,3 and 7, with no significant difference observed comparing the 2 groups. Postoperative complications are reported in Table IV During the postoperative time 4 inguinoscrotal hematoma appeared in LC group, of which 1 patient was in Child's class B and the other 3 patients were in class C; no significant difference was observed between LC group and non-LC group. Otherwise, comparing Child's class C in LC group with non-LC group, the difference was significant ($p=0.023$). None of these patients had been treated with drugs that could cause alterations in hemocoagulation. All hematoma resolved spontaneously, with no need for reintervention. Furthermore, 2 cases of swelling were noticed, 1 for each group (3.3%). After surgery, ascites leakage from the surgical wound or wound infection was never observed. Twenty-four months after hernioplasty only 1 hernia recurrence was detected in a patient of group LC in Child's class C. As to the postoperative mortality, none of the patients died during the perioperative time; within 2 years from the hernioplasty, 2 patients who belonged to Child's class C in LC group died. Nevertheless, this is ascribed to a negative evolution of cirrhotic disease, regardless of the surgery.

Discussion

In the present study, we show that inguinal hernioplasty under local anesthesia in cirrhotic patients with refractory ascites could be performed safely in Child class A

Table IV - Complications during postoperative course in patients of LC and non-LC groups.

	Hematoma N (%)	Swelling N (%)	Infection N (%)	Recurrence N (%)	Leakage N (%)	Mortality** N (%)
LC Group	4 (13.3%)	1 (3.3%)	0 (0%)	1 (3.3%)	0 (0%)	2 (6.6%)
Child A	0	0	0	0	0	0
Child B	1	0	0	0	0	0
Child C*	3	1	0	1	0	2
Non-LC Group	0 (0%)	1 (3.3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
P	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Total	5 (8.3%)	2 (3.3%)	0 (0%)	1 (1.6%)	0 (0%)	3 (5%)

* Child's class C VS non-LC group (p=0,023) ** Mortality within 2 years from the operation.

and B, with low rates of morbidity and recurrence. In Child class C the incidence of hematoma in surgical wound has significantly increased (p=0.023). Finally, patients of LC group showed a significantly longer hospital stay (p=0.0132). The incidence and natural history of inguinal hernias in cirrhotic patients are not fully described. In contrast to umbilical hernia, the incidence of inguinal hernia does not seem to correlate with ascites; moreover, the life-threatening complications are uncommon in cirrhotics⁸⁻⁹. Even the optimal management of inguinal hernia in cirrhotic patients with or without ascites remains a matter of debate. Until recent years, the surgical treatment for patients suffering from LC and affected by inguinal hernia has been discouraged, because the risk of mortality due to the complications of anesthesia, the risk of post-surgical complications and the risk of recurrence were elevated even in case of elective procedures. Moreover, Pere et al¹⁰ reported on 3 patients with stable cirrhosis and controlled ascites whose conditions severely deteriorated after elective inguinal herniorrhaphy. A Danish nationwide cohort¹¹ showed that among 256 patients with cirrhosis undergoing inguinal hernia repair, 7 died within 30 days (2.7%), compared with 5 of 741 (0.7%) in the control group, resulting in an adjusted odd ratio for 30-day mortality of 4.4. Rhuling et al², in their multivariate logistic regression analysis, observed a significantly increased risk for wound infection or hemorrhage within 30 days after inguinal hernioplasty in patients with liver cirrhosis. Otherwise, others recent studies based on treatment experience of hernias of the abdominal wall (umbilical, inguinal and incisional) have suggested that in patients with decompensated cirrhosis and inguinal hernia, the hernioplasty may improve the quality of life^{3,4} and can be safely performed on elective basis, without an increased surgical risk or an undue incidence of recurrences. Horn et al¹² showed a semiconservative attitude, observing that hernia repair in patients with advanced portal hypertension and ascites should be approached with caution and treated conservatively whenever possible, because cirrhosis increases the risk of significant perioperative complications, such as infection, recurrence and ascites leakage.

Hurst et al¹³ reported that life-threatening complications after inguinal hernia repair are uncommon in these patients and that morbidity and long-term mortality rates are primary due to the progression of the underlying liver disease. Hur et al¹⁴ in a retrospective analysis of 22 patients with cirrhosis accompanied by ascites who underwent mesh plug hernia repair, asserted that the surgical procedure can be performed safely without severe complications even in patients with refractory ascites or in Child class C. However, in this study 2 cases of hematoma (9.1%) have been observed, both managed with conservative treatment [14]. Gubitosi et al¹⁵, in a study with a cohort of 52 cirrhotic patients who underwent inguinal hernioplasty, concluded that hernia repair in LC patients can be safely performed with previous parasurgical measures. Another 10-years retrospective review, conducted by Oh et al¹⁶ and involving 129 LC patients (62.8% with ascites) and 651 non-LC patients who received a standard Mc Vay hernia repair, showed a not significant difference between the 2 groups concerning all postoperative complications. However, looking at the formation of postoperative hematoma, the incidence rate in LC group amounts to 7.8%, against the 2% of non-LC patients; a statistical analysis reveals a significant difference between these 2 groups (p=0.0027)¹⁶. Among the metabolic disorders caused by the liver failure in cirrhotic patients, the impaired coagulation and the malnutrition represent those which are responsible for the main postoperative complications. Coagulopathy is the major concern for surgeons, because both pro- and anti-coagulants result reduced in LC. Furthermore, thrombocytopenia (due to malnutrition, to myelosuppression in case of hepatitis C, folate deficiency or/and to ethanol toxicity), hypersplenism and the presence of varices may exacerbate bleeding problems¹. On the other hand, liver cirrhosis patients present decreased levels of protein C, protein S, and antithrombin, which lead to an altered anticoagulation system¹⁷. In this study, the hemorrhagic complications resulted as the most frequent, in agreement with other Authors^{14,16}. Even if the overall comparison between LC and non-LC group, regarding the incidence of post-

operative hematoma, does not reveal any significant difference; although, the difference is statistically significant if considering the control group against patients in Child class C ($p=0.023$). For all patients presenting postoperative hematoma, hemocoagulative preoperative screening was normal; therefore, a better assessment of the degree of coagulopathy is necessary for patients in Child's class C: tromboelastography¹⁸ and fibrinogen and C protein dosage¹⁹ might be useful to determine the risk of bleeding. The application of fibrin glue and of local hemostatic could reduce hemorrhagic events¹⁵. Malnutrition is the other condition that weakens LC patients, predisposing them to an impaired wound-healing process and to infections. According to Nusrat et al²⁰, the factors that predispose cirrhotics to infections are not well known. In our study no cases of surgical wound infection have been observed, probably because the group is few in number and also antibiotic prophylaxis may have contributed to obtain these results. We believe, according to Sipeki et al²¹, that an antibiotic prophylaxis should be performed for all patients with LC on late-stage, for their characteristic immune system dysfunctions and to prevent ascites infections. As to the type of anesthesia to be administered, it is good to keep in mind that general anesthesia could be life-threatening in patients with liver failure and with consequent altered drug metabolism and that, otherwise, spinal anesthesia might expose LC patients to bleeding and spinal hematoma formation, resulting from their coagulopathy. Pere et al²², comparing local anesthesia infiltration with spinal anesthesia and with total intravenous anesthesia for open inguinal herniorrhaphy, affirmed that local anesthesia infiltration is correlated to the fastest recovery without related postoperative complications²². Furthermore, data in the literature for cirrhotics undergoing hernioplasty in local anesthesia are few¹³. Bernhardt²³ supposed that if more operations would be performed using local anesthesia, among LC patients, there would be an increased number of patients (even with ASA IV and V) who would benefit from surgery. Although Oh et al¹⁶ observed no cases of recurrence after hernioplasty without mesh placement, we consider that the usage of mesh is quite appropriated for these patients, because it reduces the incidence of recurrence and because the healing processes are impaired. As to liver transplantation candidates, if the waiting list is too long, the inguinal hernioplasty can be performed before the transplantation even to improve the quality of life of these patients; in case of short waiting list, the hernioplasty can be delayed and performed during or after liver transplantation, as affirmed by Lawson et al²⁴ in their retrospective study of 40 patients who underwent inguinal hernioplasty before, during or after liver transplantation, finding less morbidity and fewer recurrences in patients operated after liver transplantation²³.

Conclusion

Inguinal hernioplasty in cirrhotic patients with ascites may be performed in local anesthesia and with mesh placement, with a low incidence rate of complications for patients in Child's Class A and B; for patients in Child's class C, careful attention must be paid to the hemorrhagic events.

Riassunto

INTRODUZIONE: La ernioplastica inguinale in pazienti affetti da cirrosi epatica e ascite è stata a lungo sconsigliata per la incidenza di complicanze post-operatorie. Scopo del nostro lavoro è valutare la appropriatezza della ernioplastica inguinale in elezione in soggetti: 30 con cirrosi epatica e ascite.

MATERIALI E METODI: pazienti consecutivi, cirrotici e con ascite, affetti da ernia inguinale (gruppo LC), sottoposti a ernioplastica open in elezione con posizionamento di protesi, sono stati comparati con lo stesso numero di pazienti non cirrotici (gruppo non-LC) sottoposti ad analoga procedura chirurgica nello stesso periodo di tempo. Tutti i pazienti nel gruppo LC sono stati sottoposti a valutazione gastroenterologica preoperatoria e sono stati quindi classificati secondo l'eziologia della cirrosi epatica e la classe di Child-Pugh. Tutti i pazienti di entrambi i gruppi hanno ricevuto antibiotico profilassi preoperatoria e sono stati operati in anestesia locoregionale.

RISULTATI: Non sono state osservate complicanze significative in alcun paziente durante la procedura chirurgica. La degenza è stata significativamente più lunga nel gruppo LC. Nel periodo post-operatorio nel gruppo LC si sono verificati 4 ematomi inguino-scrotali, dei quali 3 nel gruppo Child C (LC versus non-LC $p>0.05$; non-LC versus Child's class C $p<0.023$). Non sono state osservate perdite di ascite dalla ferita chirurgica o infezioni d ferita.

CONCLUSIONI: Le ernioplastica inguinale può essere eseguita in sicurezza nei soggetti cirrotici in classe A e B secondo Child; per i pazienti in classe C, deve essere posta particolare attenzione agli eventi emorragici.

References

1. Lopez-Delgado JC, Ballus J, Esteve F, Betancur-Zambrano NL, Corral-Velez V, Mañez R, Betbese AJ, Roncal JA, Javierre C: *Outcomes of abdominal surgery in patients with liver cirrhosis*. World Journal of Gastroenterology, 2016; 22(9):2657-667.
2. Rühling V, Gunnarsson U, Dahlstrand U, Sandblom G: *Wound healing following open groin hernia surgery: the impact of comorbidity*. World Journal of Surgery, 2015; 39(10):2392-399.
3. Buffone A, Costanzo M, Basile G, Terranova L, Papa V, Catania A, Cannizzaro MA: *Spontaneous rupture of an umbilical hernia in a cirrhotic patient with ascites. A case report and review of the liter-*

- ature. *Ann Ital Chir* 2012;e publish 29 October 2012. pii: S2239253X1202021X.
4. Patti R, Almasio P, Buscemi S, Famà F, Craxì A, Di Vita G: *Inguinal hernioplasty improves the quality of life in patients with cirrhosis*. *The American Journal of Surgery*, 2008; 196(3):373-78.
 5. Zeitler MR, Wouk N: *Incarcerated inguinal hernia as a complication of new-onset ascites*. *BMJ Case Rep*, 2017; doi: 10.1136/bcr-2017-219613.
 6. Nyhus LM: *Individualisation of hernia repair: A new era*. *Surgery*, 1993; 114:1-2.
 7. Belghiti J, Durand F: *Abdominal wall hernias in the setting of cirrhosis*. *Seminar in Liver Disease*, 1997; 17(3):219-26.
 8. Mansour A, Watson W, Shayani V, Pickleman J: *Abdominal operations in patients with cirrhosis: Still a major surgical challenge*. *Surgery*, 1997; 122(4):730-36.
 9. Park JK, Lee SH, Yoon WJ, Lee JK, Park SC, Park BJ, Jung YJ, Kim BG, Yoon JH, Kim CY, Ha J, Park KJ, Kim YJ: *Evaluation of hernia repair operation in Child-Turcotte-Pugh class C cirrhosis and refractory ascites*. *Journal of Gastroenterology and Hepatology*, 2007; 22(3):377-82.
 10. Pere P, Hockerstedt K, Lindgren L: *Life-threatening liver failure after inguinal herniorrhaphy in patients with cirrhosis*. *European Journal of Surgery*, 1999; 165(10):1000-1002.
 11. Hansen JB, Thulstrup AM, Vilstup H, Sørensen HT: *Danish nationwide cohort study of postoperative death in patients with liver cirrhosis undergoing hernia repair*. *British Journal of Surgery*, 2002; 89(6):805-06.
 12. Horn TW, Harris JA, Martindale R, Gadacz T: *When a hernia is not a hernia: the evaluation of inguinal hernias in the cirrhotic patient*. *American Journal of Surgery*, 2001; 67(11):1093-95.
 13. Hurst RD, Butler BN, Soybel DI, Wright HK: *Management of groin hernias in patients with ascites*. *Annals of Surgery*, 1992; 216(6):696-700.
 14. Hur YH, Kim JC, Kim DY, Kim SK, Park CY: *Inguinal hernia repair in patients with liver cirrhosis accompanied by ascites*. *Journal of the Korean Surgical Society*, 2011; 80(6):420-25.
 15. Gubitosi A, Ruggiero R, Docimo G, Avenia N, Villaccio G, Esposito A, Foroni F, Agresti M: *Hepatic cirrhosis and groin hernia: binomial or dichotomy? Our experience with a safe surgical treatment protocol*. *Ann Ital Chir*, 2011; 82(3):197-204.
 16. Oh HK, Kim H, Ryoo S, Choe EK, Park K: *Inguinal hernia repair in patients with cirrhosis is not associated with increased risk of complications and recurrence*. *World Journal of Surgery*, 2011; 35(6):1229-233.
 17. Vucelic D, Golubovic M, Bjelovic M: *PFA-100 test in the detection of platelet dysfunction and monitoring DDAVP in a patient with liver cirrhosis undergoing inguinal hernia repair*. *Srpski Arhiv Za Celokupno Lekarstvo*, 2012; 140(11-12):782-85.
 18. Tripodi A, Primignani M, Lemma L, Chantarangkul V, Dell'Era A, Iannuzzi F, Aghemo A, Mannucci PM: *Detection of the imbalance of procoagulant versus anticoagulant factors in cirrhosis by a simple laboratory method*. *Hepatology*, 2010; 52(1):249-55.
 19. Amarapurkar PD, Amarapurkar DN: *Management of coagulopathy in patients with decompensated liver cirrhosis*. *International Journal of Hepatology*, 2011; 695470.
 20. Nusrat S, S Khan M, Fazili J, Madhoun MF: *Cirrhosis and its complications: Evidence based treatment*. *World Journal of Gastroenterology*, 2014; 20(18):5442-460.
 21. Sipeki N, Antal-Szalmas P, Lakatos PL, Papp M: *Immune dysfunction in cirrhosis*. *World Journal of Gastroenterology*, 2014; 20(10):2564-577.
 22. Pere P, Harju J, Kairaluoma P, Remes V, Turunen P, Rosenberg PH: *Randomized comparison of the feasibility of three anesthetic techniques for day-case open inguinal hernia repair*. *Journal of Clinical Anesthesia*, 2016; 34:166-175.
 23. Bernhardt GA: *Inguinal hernia repair under local anaesthesia in patients with cirrhosis*. *World Journal of Surgery*, 2012; 36(6):1443-444.
 24. Lawson EH, Benjamin E, Busuttill RW, Hiatt JR: *Groin herniorrhaphy in patients with cirrhosis and after liver transplantation*. *The American Surgeon*, 2009; 75(10):962-65.