

# The impact of a care pathway with systematical screening for cardiopulmonary complications, frailty, malnutrition and minimal hepatic encephalopathy in cirrhosis on patient care and hospital financing

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## Abstract

**Background and aim of the study:** Cardiopulmonary complications, malnutrition, frailty and minimal hepatic encephalopathy are underrecognized complications of cirrhosis with a major impact on mortality and morbidity. The aim of this study is to investigate a new locally introduced care pathway with standardized screening for these complications and its impact on patients care and hospital financing.

**Patients and methods:** We performed a single center retrospective study of 40 patients hospitalized with cirrhosis who participated in the care pathway between April 2023 and June 2024. Electronic medical records were evaluated for screened complications and financial outcomes were calculated within our population, consecutively with and without this care pathway. Long term data regarding survival and referral were collected in June 2025.

**Results:** Hepatopulmonary syndrome was diagnosed in 14.7% of the patients. Frailty was present in 57.7% of the patients and malnutrition in 45%. Minimal hepatic encephalopathy was established in 17.5% of the patients. The median justified hospital days were significantly higher with the care pathway compared to without [8.4 (6.0-10.8) vs 6.2( 4.9-8.6)  $p < 0.01$  ( $Z = -3.43$ )]. In 15 (37.5%) patients, the care pathway added a higher financial reimbursement for the hospital compared to when the care pathway would not have been performed.

**Conclusions:** This study emphasizes the importance of systematic screening and education of these complications. Due to systematical screening these underrecognized complications get identified earlier. Performing this care pathway did significantly and positively impact the number of justified hospital days and financial reimbursement for the hospital. (*Acta gastroenterol belg.*, 2026, 89, 3-11).

**Keywords:** Hepatopulmonary syndrome, cirrhotic cardiomyopathy, portopulmonary syndrome, justified hospital days, DRG.

## Introduction

Hepatic decompensation can be caused by lesser-known complications of cirrhosis such as hepatopulmonary syndrome (HPS), portopulmonary hypertension (PoPH) and cirrhotic cardiomyopathy (CCMP), as well as sarcopenia, frailty, malnutrition and minimal hepatic encephalopathy.

HPS is indicated by intrapulmonary vascular dilatations and arteriovenous shunts, resulting in impaired systemic oxygenation. PoPH is a type of pulmonary arterial hypertension due to increased pulmonary vascular resistance in portal hypertension. CCMP is a systolic and diastolic dysfunction in liver disease in absence of prior heart disease (1,2). Clinical symptoms are limited in early stages delaying the diagnosis, while in advanced stages it has a significant

overlap with typical symptoms of liver disease. Pulse oximetry has a low sensitivity (28% for a  $SpO_2 < 96\%$ ) for screening HPS, leaving early stage HPS undetected (3). Active screening is thus recommended with arterial blood gas and contrast-enhanced echocardiography (2,4-7).

Cardiopulmonary complications are associated with a poor prognosis and high mortality with a 5-year survival of 23% in HPS and 11% in patients with PoPH (8,9). Liver transplantation can be a resolution for HPS, PoPH and CCMP and is a MELD exception for transplantation in HPS and PoPH, on the condition that both syndromes are in early stages and pulmonary pressure in PoPH is controlled by medical therapy (10-12).

Malnutrition is a common complication and known as an imbalance of nutrients causing a measurable adverse event on tissue or function and / or clinical outcome (13,14). If the patient has a BMI  $< 18.5$  kg/m<sup>2</sup> or Child Pugh C, there is a high risk of malnutrition, nevertheless it should be screened in all patients with cirrhosis (15).

Frailty is a distinct biologic syndrome of decreasing physiologic reserve and increasing vulnerability to health stressors (16). In patients with end-stage liver disease (ESLD), frailty is best assessed using the Liver Frailty Index (LFI). The LFI includes three items: the sit-to-stand test, the balance test, and the grip strength test. This tool is simple to perform in routine clinical practice and inexpensive.

Sarcopenia, on the other hand, represents the loss of muscle mass and strength. A standard CT scan solely for the purpose of detection of sarcopenia is not a good screening tool, due to high costs and radiation. A simple L3 CT without injection is low in radiation exposure and cost, making it the gold standard for assessing muscle mass. Frailty worsens over time and is a predictor for mortality, decompensation, quality of life, risk of infection and prolonged hospital stay. If

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malnutrition, sarcopenia or frailty are present, it should be treated with intake related interventions, physical activity (with guidance of a physiotherapist) and correct follow-up (15,17-20).

Minimal hepatic encephalopathy is not frequently recognized and is often underdiagnosed due to the absence of clear signs. Diagnosis is made by performing psychometric testing, such as animal naming test and should be tested in each patient with cirrhosis. In contrast to its 'minimal' name, it has a major impact on the prognosis and quality of life of patients, with an increased risk of sleeping disorders, falls and inability to drive (21-25). More than half of the patients with mHE develop overt hepatic encephalopathy within 3 years (25). The treatment of mHE is mainly based on the treatment strategies for hepatic encephalopathy (26,27).

In the disease progression of cirrhosis, recurrent hospitalizations due to decompensation, bleeding, infections, hepatic encephalopathy... are common. In 2020, the total cost of hospital stays due to cirrhosis in Belgium was €37,841,040 with 3769 hospitalizations (28). The cost of the hospitalizations in Belgium is partially financed by DRG like other European countries. The DRG bundles patients with different diseases and treatments in one group based on the assumption that the cases within one group will have a similar level of complexity and their treatment is expected to utilize a similar level of hospital resources and thus similar costs. This allows illnesses to be grouped into economically homogenous groups. The costs are calculated based on the average expenditure on treatment in the previous year. Within one All Patient Refined-DRG (APR-DRG) category together with other variables like severity the justified hospital days are calculated. If the hospital stay within one disease category is shorter or longer than the justified number of hospital days, it can be beneficial or disadvantageous for the hospital, because the hospital is financed for respectively less or more days than the patient has been hospitalized (29,30).

In this study, our primary objective was to analyze the outcomes of a recently locally introduced care pathway as an internal quality control with systematic screening for cardiopulmonary complications, nutritional status, frailty and minimal hepatic encephalopathy. Secondly, we wanted to study its impact on patient care and hospital financing. The underlying hypothesis is that if we can diagnose these underrecognized complications of cirrhosis earlier, we might be able to offer our patients a better treatment and follow-up.

## Methods

### *Study design*

A retrospective single-center study was performed in the VITAZ hospital in Sint-Niklaas. The study was approved by the Ethics Committee of VITAZ

(EC24019) without the need for written informed consent.

All patients hospitalized with cirrhosis following the recently introduced care pathway in the period between April 2023 and June 2024 were eligible for inclusion. Exclusion criteria were age younger than 18 years or death within the same admission. The diagnosis of cirrhosis was based on a combination of clinical, endoscopic, imaging and biochemical data and histology if available.

Patient data collected in the database were liver disease related (etiology, duration of cirrhosis, MELD score, Child Pugh score), patient characteristics (age, sex, BMI, relevant medical history), hospitalization related (duration, reason) and liver related complications (nutritional data, cardiopulmonary complications, frailty scoring, ascites, variceal bleeding, encephalopathy and hepatorenal syndrome). The financial repercussions of this care pathway were evaluated by retrieving the APR-DRG, DRG, SOI, justified hospital days and invoiced hospital days from the financial records. These data were calculated within the 40 cirrhosis patients, consecutively with and without the performance of the care pathway.

In June 2025, one year after the end of the inclusion period, long term data were collected from the files including survival, TIPPS placement and referral to a transplant center.

### *Care pathway*

Since April 2023 a care pathway was introduced on the hospitalization ward of the VITAZ Hospital in Sint-Niklaas (Figure 1). Before, standard medical care according to the European association for the Study of the Liver (EASL) guidelines and Baveno recommendations was performed with standardized screening for ascites, varices, HCC... (11,31). The recently proposed care pathway additionally includes standard screening for minimal hepatic encephalopathy, malnutrition, frailty and cardiopulmonary complications.

Minimal hepatic encephalopathy is assessed with a bedside animal naming test administered by a gastroenterologist or internal medicine trainee. The test is presumed normal if more than 15 animals are counted within one minute, with a correction of 3 points if less than 8 years of education and 6 points if the patient is older than 80 years. If 15 animals or less are counted the test is suggestive for mHE (32). Screening for malnutrition is performed by a dietician based on the Nutritional Risk Screening (NRS) 2002 score, Global Leadership Initiative on Malnutrition (GLIM) criteria and clinical expertise. The NRS score includes weight loss, BMI and reduced dietary intake whereas the GLIM criteria contain three phenotypic criteria (weight loss, low body mass index, and reduced muscle mass) and two etiologic criteria (reduced food intake or assimilation, and inflammation or disease burden

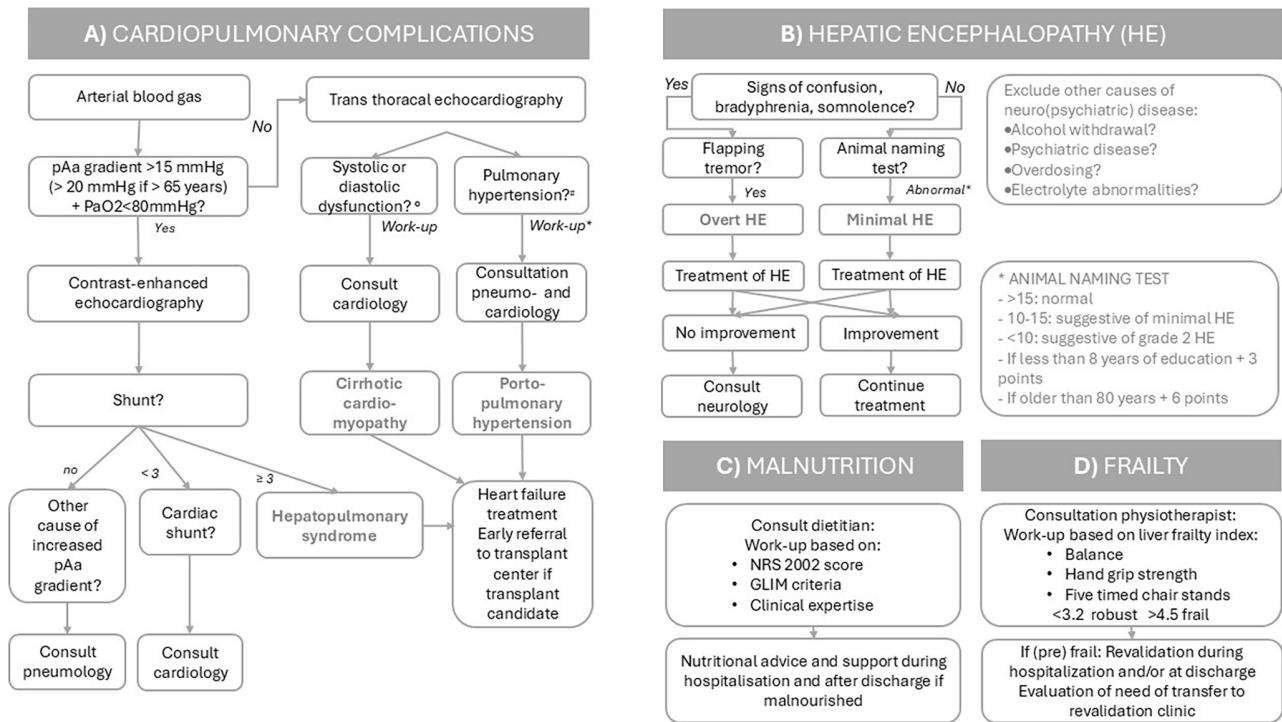


Figure 1. — Care pathway.

Legend: ° Diagnostic criteria diastolic dysfunction: Average E/e' >14, Septal e' velocity <7 cm/s OR Lateral e' velocity <10 cm/s, tricuspid velocity >2.8 m/s, left atrial volume index (LAVI) >34 ml/m.

° Diagnostic criteria systolic dysfunction: LVEF <55% , reduced left ventricular contractile response to stress.

# Criteria for pulmonary hypertension: Increased systolic peak tricuspid regurgitation velocity (peak TRV); measured with continuous wave Doppler >2.8m/s. Others: RV/LV basal diameter > 1.0, flattening of interventricular septum, RV outflow Doppler acceleration <105 msec, early diastolic pulmonary regurgitation velocity >2.2 m/s, PA diameter > 25 mm, IVC diameter >21 mm, RA end-systole area >18 cm².

\*Right heart catheterization if: Presence of right ventricular hypertrophy/ dysfunction, right ventricular systolic pressure >50mmHg.

(33,34). Frailty screening is done via the liver frailty index (LFI) administered by a physiotherapist (17,35). It incorporates 3 measurements: balance, hand grip strength and five timed chair stands. A LFI score of < 3.2 indicates a patient is robust and > 4.5 frail.

The screened cardiovascular complications are hepatopulmonary syndrome, portopulmonary syndrome and cirrhotic cardiomyopathy. An arterial blood gas was performed in each patient. If the pAa gradient was more than 15 mmHg (or more than 20 mmHg if 65 years or older) and PaO2 < 80 mmHg in absence of an acute pulmonary event (for example pneumonia), a contrast-enhanced echocardiography is performed. A hepatopulmonary syndrome is diagnosed when a shunt is present, defined by the presence of microbubbles in the left heart after 3 or more cardiac cycles. If the arterial blood gas did not meet the criteria for a contrast-enhanced echocardiography, a transthoracic echocardiography was performed. The presence of diastolic and systolic heart failure as well as pulmonary hypertension was examined by echocardiography. Pulmonary hypertension was diagnosed by several parameters on echocardiography including increased systolic peak tricuspid regurgitation velocity (peak TRV); measured with continuous wave Doppler > 2.8m/s. When heart failure or pulmonary hypertension were present, further cardiopulmonary work-up

excluded cardiopulmonary causes.

If complications were present, they were treated following current guidelines with nutritional support, medical rehabilitation, lactulose or rifaximin, heart failure medication or supplementary oxygen.

### Statistical analysis

For statistical analysis SPSS version 29 was used. Variables were expressed in means and standard deviation for normal distribution and median and IQR for non-normal distribution.

Wilcoxon matched-pairs signed-rank test was used for testing 2 paired data with non-normal distribution. P < 0.05 was the probability level for statistical significance.

## Results

### Patient characteristics

Between April 2023 and June 2024 40 patients have been hospitalized with cirrhosis included in the care pathway (Table 1). Mostly men (55%) were admitted with an average age of 64 (+11.3) years and a median of 24 (0-55.6) months since the first diagnosis of cirrhosis. The majority (80%) of cirrhosis were alcohol-

related (Figure 2) and almost half of the patients (47.5%) had a Child Pugh B score. Ascites was present in 67.5% of the patients and half of the patient had esophageal varices (Table 1). One third of the hospitalizations were caused by gastro-intestinal bleeding (Figure 3). The median duration of hospitalization was 6.2 (4.3-7) days.

*Care pathway*

HPS was diagnosed in 14.7% of the patients and 21% of the patients who underwent an echocardiography had a CCMP characterized by diastolic heart failure. More than half of the patients (57.5%) were frail. Malnutrition was present in almost half of the patients (45%). Minimal hepatic encephalopathy was established in 17.5% of the patients (Table 2).

*Therapy started due to care pathway*

Heart failure treatment was started in half of the patients with cirrhotic cardiomyopathy, no patient needed supplementary oxygen at home. Rehabilitation was performed during hospitalization in 70% of all the patients and in 95% of the patients with frailty (22/23).

At discharge 2 frail patients were sent to rehabilitation clinic, 6 frail patients started rehabilitation. Dietary information was provided to 85% of the patients during hospitalization and at discharge. Almost all patients with malnutrition received advice (17/18 94.4%). Only 1 patient started total parenteral nutrition (TPN), none needed enteral feeding. Only half of the patients with minimal hepatic encephalopathy started lactulose (Table 2).

*Impact on justified hospital days*

The median number of justified hospital days were significantly higher with the care pathway compared to without the care pathway [8.4 (6.0-10.8) vs 6.2 (4.9-8.6) respectively  $p < 0.01$  ( $Z = -3.43$ )]. In 15 (37.5%) patients, the care pathway added a financial gain for the hospital compared to when the care pathway would not have been performed (Figure 4).

*Longterm data*

Long-term follow-up data were collected in June 2025. Of the 40 patients included in the study, 15

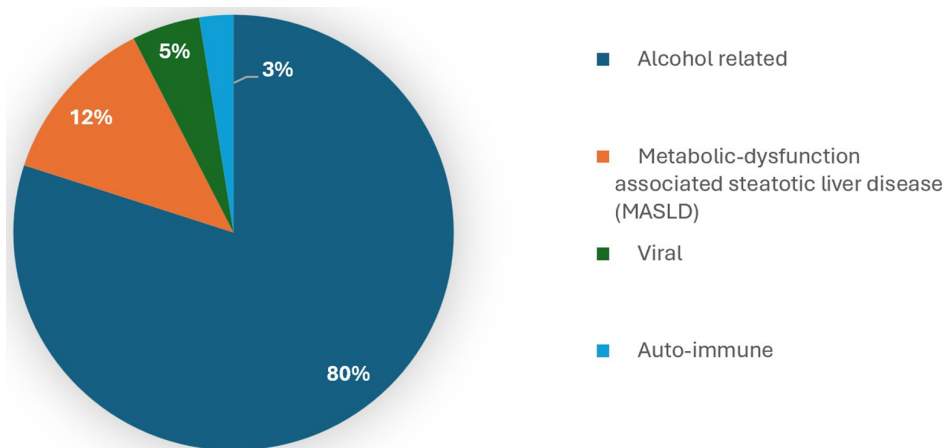


Figure 2. — Etiology of cirrhosis in the hospitalized patients.

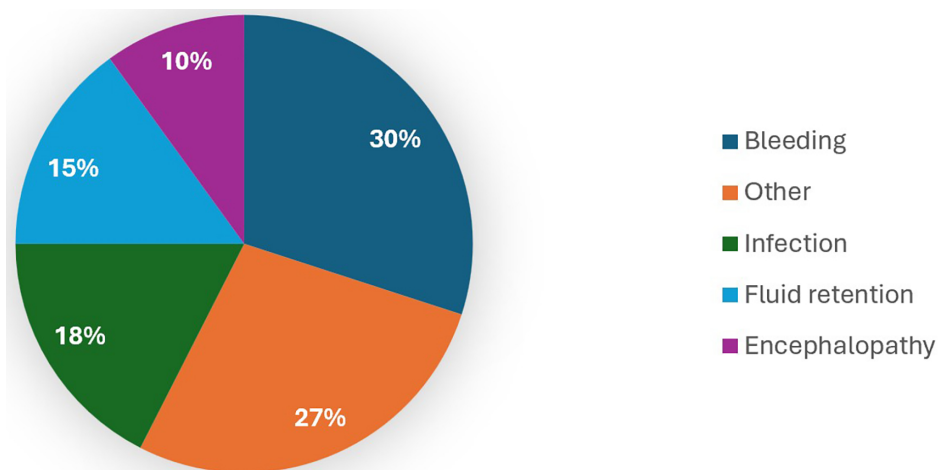


Figure 3. — Reason for hospitalization.

Table 1. — Characteristics of hospitalized patients with cirrhosis (N=40).

Patient characteristics (N=40)	
Age – years (m +- SD)	64.2 (11.3)
Female sex (n (%))	18 (45%)
Duration diagnosis of cirrhosis – months(Median (Q1- Q3))	24 (0 - 55.6)
BMI – kg /m2 (Median (Q1-Q3))	26 (20-29)
MELD score (Median (Q1-Q3))	12 (8.2-18.8)
Child Pugh score	
A	12 (30%)
B	19 (47.5%)
C	9 (22.5%)
DNR code	
0	30 (75%)
1	3 (7.5%)
2	7 (17.5%)
Complications diagnosed without care pathway	
Oedema (N (%))	15 (37.5%)
Ascites (N (%))	
Absent	14 (35%)
Grade 1	10 (25%)
Grade 2	7 (17.5%)
Grade 3	9 (22.5%)
Hepatorenal syndrome (N (%))	1 (2.5%)
Splenomegaly (N (%))	22 (55%)
HE	
Grade 0 (including m HE)	31 (77.5%)
Grade 1	4 (10%)
Grade 2	4 (10%)
Grade 3	0
Grade 4	1 (2.5 %)
Esophageal varices	
No varices	20 (50%)
Grade 1	5 (12.5%)
Grade 2	13 (32.5%)
Grade 3	2 (5%)
MELD : Model for End-Stage Liver disease; DNR : Do Not Resuscitate; HE: hepatic encephalopathy; mHE: minimal hepatic encephalopathy.	

patients (37.5%) had died during the follow-up period, with a mean survival of 9.6 months following hospital discharge.

Among the deceased patients (n=15), malnutrition was present in 8 individuals (53.3%). Frailty was documented in 11 patients (73.3%). Hepatopulmonary syndrome (HPS) was identified in 3 deceased patients (20.0%), cirrhotic cardiomyopathy (CCMP) in 1 patient (6.7%), and minimal hepatic encephalopathy (MHE) in 4 patients (26.7%).

During the follow-up period, one patient (2.5%) underwent placement of a transjugular intrahepatic portosystemic shunt (TIPS), and eight patients (20.0%)

were referred to a liver transplant center. However, none of the patients underwent liver transplantation during the observation period.

Among the referred patients (n = 8), 4 (50.0%) were malnourished and 4 patients (50.0%) were classified as frail. HPS was present in 1 patient (12.5%), CCMP in 2 patients (25.0%), and MHE in 1 patient (12.5%) (Table 2).

## Discussion

This study underscores the importance of systematic screening and education of frequent complications of cirrhosis.

Table 2. — Complications diagnosed with care pathway and initiated therapy.

Complications diagnosed with the care pathway		Initiated therapy		Referred to Tx center n=8
mHE	7 (17.5%)	Started lactulose	3 (42%)	1 (14.3%)
Malnutrition	18 (45%)	Dietary information given at discharge	17 (94.4%)	4 (22.2%)
LFI				
Robust	5 (12.5%)	Rehabilitation	0	2 (40%)
Pre frail	7 (17.5%)	Rehabilitation	0	2 (28.6%)
Frail	23 (57.5%)	Rehabilitation	8 (34.8%)	4 (17.4%)
Missing data	5 (12.5%)			1 (20%)
CCMP Missing data n=2	8 (21%)	Heart failure treatment	4(50%)	2 (25%)
HPS Missing data n=6	5 (14.7%)	Heart failure treatment	1 (20%)	1 (20%)
PoPH Missing data n=2	1 (2.1%)			1 (100%)

mHE: minimal hepatic encephalopathy; LFI: liver frailty index; CCMP: Cirrhotic cardiomyopathy; HPS :Hepatopulmonary syndrome; PoPH: Portopulmonary syndrome.

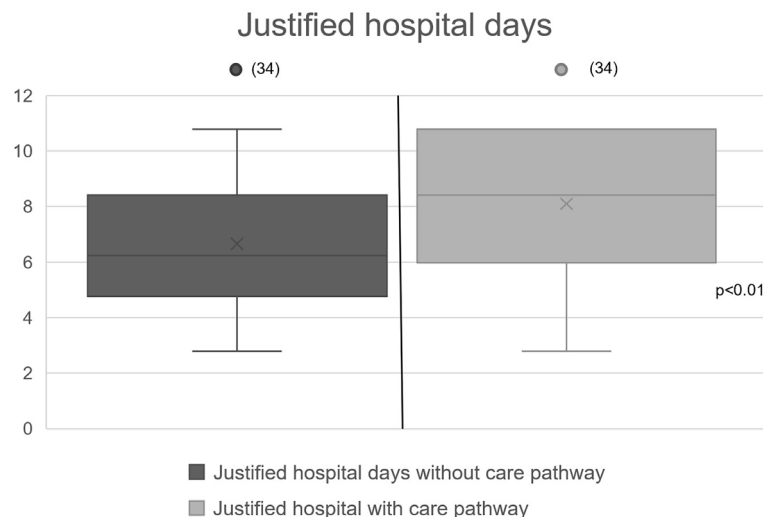


Figure 4. — Justified hospital days.

The prevalence of cardiopulmonary complications observed in our study aligns with previously reported data. Earlier studies have documented HPS in 16-26% and CCMP in up to 50% of the screened cirrhosis patients. The incidence of PoPH in screening studies involving liver transplant candidates is 3-10 % (2,4-7,36). These data demonstrate that cardiopulmonary complications are not a rarity and encountered in everyday hepatology practice.

It should be noted that populations screened in literature are not entirely comparable to our study. Most literature regarding screening is predominantly performed in patients evaluated for liver transplantation or TIPS placement (37), thus representing a cohort with a more advanced disease stage .

An impaired response to stress and hyperdynamic circulation are characteristics of CCMP in the absence of other known heart disease. Due to logistic limitations, stress echocardiography was not routinely performed in our study, although it is useful for identifying diastolic dysfunction and impaired contractile reserve. Although it is not included in the 2019 diagnostic criteria, it can aid in diagnosing CCMP (36).

HPS and PoPH do not consistently correlate with the severity of the underlying liver disease or degree of portal hypertension and are often asymptomatic (38). None of the patients in our cohort were hospitalized because of respiratory complaints. Without implementation of this care pathway these diagnoses with an established poor prognosis would

remain undetected. This emphasizes the importance of systematically screening for cardiopulmonary complications of cirrhosis. Identification of these complications has had an important role in the further management of our patients such as starting heart failure therapy in half of the patients with CCMP and awareness for earlier referral to a transplant center (8,9).

The prevalence of malnutrition in our study is comparable to a retrospective Belgian study that reported a prevalence of malnutrition of 45.3% (39). In contrast, two large multicenter retrospective studies in cirrhotic patients reported a much lower prevalence of malnutrition of only 6-12%, suggesting that malnutrition is frequently underdiagnosed and screening is valuable (39-41). Its diagnosis can be challenging due to fluid retention, obesity, impaired liver synthetic function and systemic inflammatory state (42).

Frailty is a common finding, present in more than half of our patients. The prevalence of frailty in our study was comparable to the inpatient study of Serper et al (43). It is a valuable prognostic parameter in patients with cirrhosis for several reasons. Firstly, it is linked to a poor prognosis with increased hospitalizations, transplant waiting list mortality and removal from transplant waiting list (18,43-47). Secondly, it is an independent prognostic parameter (46). MELD scores were similar between patients who were frail and non-frail with a significantly higher mortality in frail patients. Thirdly, the LFI is a cheap, easy and practical test, taking only few minutes to administer. Making it a reproducible test that can be easily included in clinical care and follow-up. Last and most importantly, improvements in frailty score over time result in reduced mortality, making it a potential modifiable risk factor responsive to intensive nutritional support and physical therapy (19).

Nutritional therapy and exercise can reduce the length of hospital stay and rehospitalization rate (20,48-50). It should be noted that dietary intervention appear more effective in improving survival in Child A compared to Child B and C cirrhosis (50,51). These findings suggest that early initiation of nutritional therapy may be a better strategy to ameliorate care and prevent further deterioration.

By implementing this care pathway and routinely screening for malnutrition and frailty, as one of the few modifiable factors in cirrhosis, these complications were found approximately in half of our patients, which would otherwise stay undetected. Screening is thus of primordial importance to early implement rehabilitation and nutritional interventions in order to improve the overall health status and identification of patients requiring closer follow-up after discharge (19,44,48).

In literature the incidence of mHE varies between 20 and 80% (52). This wide variability is explained by different testing methods, diagnostic criteria and sometimes under-investigation (52). A survey of the American Association for the Study of Liver Diseases (AASLD) in 2007 revealed that although most of the

physicians recognized mHE as a significant problem, only 50% screened their cirrhotic patients for it and 38% never performed any form of psychometric testing (53). The animal naming test (ANT) was selected for our care pathway due to its rapidly administration and ease of use during. Notwithstanding only half of the patients in our study diagnosed with mHE were started with lactulose. Given its subtle clinical presentation, poor prognosis and impact on quality of life, early recognition and screening is crucial.

This is the first Belgian study that describes the effect of a locally developed care pathway on the hospitalization cost of cirrhotic patients. Hahn et al. examined the effect of a care pathway for patients with decompensated cirrhosis in Germany, observing a trend of reduction in length of stay with a care pathway, but no significant economic gain in hospital reimbursement (54). Whereas our study demonstrated an increased received refund for hospitalizations and in this way a more realistically refund of the actual costs of the hospital stay in cirrhotic patients.

Roberts et al. investigated that screening for HPS was cost-effective when the prevalence of HPS was greater than 4%. The prevalence of HPS in our study was 14.7%. In patients who are no candidates for transplantation, screening is not cost-effective nor does not improve life expectancy given the lack of medical therapies (55).

Lim et al. found that malnutrition is associated with higher hospitalization costs due to a 1.5 times longer hospital stay and increased use of hospital resources in non-cirrhotic patients in Singapore (56). A German study showed an increase in hospital cost reimbursement by 8.3% due to screening and coding for malnutrition in the German DRG (G-DRG) system. A change in DRG was seen in 27% of the patients with malnutrition in their study, giving a favorable change in reimbursement. The other patients with the comorbidity malnutrition who did not change in DRG had already other complex comorbidities. So, no difference in case severity or reimbursement could be made (57).

Gundling et al. investigated that hepatic encephalopathy increases both the length of hospital stay and associated costs (58).

Our long-term data show that the mortality rate in our study cohort was 37.5%, which is substantial considering the relatively short follow-up period. This underscores the high vulnerability of hospitalized cirrhotic patients. Among the deceased patients, 73.3% were frail and 53.3% were malnourished, highlighting the prognostic importance of these complications. A quarter of the deceased patients had mHE. This highlights the need for structured post-discharge follow-up and continuity of care, particularly for complications with subtle clinical manifestations and a high impact on daily functioning and prognosis.

Eight patients (20.0%) were referred to a transplant center, though none underwent transplantation. This

likely reflects multiple barriers including comorbidities, substance use disorders, and limited transplant eligibility. Still, 50% of the referred patients were frail and malnourished, indicating a cohort at high risk for further decompensation. Given that timely transplant referral is critical, especially in the context of complications such as HPS and PoPH that carry poor prognoses and are only treatable by transplantation in an early stage, awareness for earlier referral is primordial.

These data suggest that screening enables identification of high-risk patients and complications. Since these complications have a persistent effect on patient trajectory well beyond discharge, further efforts in post-discharge management and transplant evaluation are needed to translate early detection into improved outcomes. Structured post-discharge management including nutritional support, physical rehabilitation, and neurocognitive monitoring should be part of a broader chronic care model for cirrhosis. Integration of this model with outpatient hepatology and transplant services could potentially improve THE prognosis this population.

The limitations of this study are a small patient population of 40 patients and absence of patient-centered data such as assessment of quality of life. The smaller-than-anticipated cohort size was mainly due to a shortage of hospitalization capacity during our inclusion period leading to most patients being treated on an ambulatory basis. For these reasons most patients with cirrhosis could not be included. Eighty percent of the patients had an alcohol-associated liver disease. Most of those patients had an underlying dependency disorder which might increase the chance of non-compliance with physiotherapy and dietary consultation. This is reflected by 30% of the patients refusing revalidation and 1 patient (5.6%) with malnutrition refusing nutritional advice. Since the (sub) results of the performed malnutrition screening tools were not noted in the patient files by the dietician and only the absence or presence of malnutrition based on the screening tools, we could not categorize the severity of malnutrition. Future larger-scale studies are needed to assess the benefits of systematic application of care models on a personal level (functional status, quality of life and re-admissions) and secondary on a healthcare level with economic impact.

## Conclusion

In conclusion, we diagnosed HPS in 14.7% of our patients which would not have been recognized without the systematic care pathway. Overall, 17.5% was diagnosed with mHE. Almost half of our patients were frail and malnourished. These patients benefited from this (early) diagnosis, as they were linked to a dietician and received adequate nutritional support.

Our study results emphasize the importance of awareness and systematic screening and education

in patients with cirrhosis by use of a systematic care pathway leading to a significant impact on the justified hospital days. This leads, in our Belgian health system, to an increase in reimbursement of hospitalization costs for the hospital as seen in 37.5% of the patients.

## Declarations

*Conflict of interest statement:* No conflicts of interest related to this study.

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