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Original research

Improved outcomes following the implementation of a decompensated cirrhosis discharge bundle

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ABSTRACT

Introduction Mortality from liver disease is increasing and management of decompensated cirrhosis (DC) is inconsistent across the UK. Patients with DC have complex medical needs when discharged from hospital and early readmissions are common. Our aims were: (1) to develop a Decompensated Cirrhosis Discharge Bundle (DCDB) to optimise ongoing care and (2) evaluate the impact of the DCDB.

Methods A baseline review of the management of patients with DC was conducted in Newcastle in 2017. The DCCB was developed and implemented in 2018. Impact of the DCDB was evaluated in two cycles, first a paper version (November 2018–October 2019) and then an electronic version (November 2020–March 2021). Key clinical data were collected from the time of discharge.

Results Overall, 192 patients (62% male; median age 55; median model for end-stage liver disease 17; 72% alcohol related) were reviewed in three cycles. At baseline, management was suboptimal, particularly ascites/diuretic management and provision of follow-up for alcohol misuse and 12% of patients had a potentially avoidable readmission within 30 days. After DCDB introduction, care improved across most domains, particularly electrolyte monitoring (p=0.012) and provision of community alcohol follow-up (p=0.026). Potentially preventable readmissions fell to 5% (p=0.055).

Conclusions Use of a care bundle for patients with DC can standardise care and improve patient management. If used more widely this could improve outcomes and reduce variability in care for patients with DC.

Significance of this study

What is already known on this topic

⇒ Mortality rates from liver disease have risen substantially in the UK over the last few decades.
⇒ There is wide variation in the management of patients with liver disease and this is reflected in outcomes and mortality.
⇒ Patients with decompensated cirrhosis have complex hospital discharges and readmissions are common.
⇒ Care bundles can help standardise the management of liver disease and improve outcomes

What this study adds

⇒ Management of patients with cirrhosis was inconsistent at discharge and readmissions were common.
⇒ A decompensated cirrhosis discharge bundle was developed to optimise hospital discharge with the aim of reducing variation in care. This bundle has now been endorsed by the British Society of Gastroenterology and the British Association for the Study of the Liver.
⇒ Use of the bundle was associated with an improvement in the care of patients with decompensated cirrhosis at the time of hospital discharge.

How might it impact on clinical practice in the foreseeable future

⇒ Wider implementation of this care bundle could improve outcomes for patients with cirrhosis, reduce avoidable readmissions and reduce variability in care.

INTRODUCTION

There has been a rising incidence of liver disease in the UK over recent decades and this has been associated with a substantial increase in mortality.[1] Decompensated cirrhosis (DC) is a common reason for hospital admission and carries a high risk of short-term mortality.[2] Patients with cirrhosis are complex and frequently

have multiple complications such as ascites, hepatic encephalopathy (HE) and varices that require ongoing management following hospital discharge. Importantly, multiple evidence-based treatments are available to treat liver-related complications, which have been shown to improve outcomes.[3 4] Despite their wide availability these treatments are frequently not initiated. This may be due either to them not being offered by clinicians or through non-engagement by patients, which may be partly due to patients not being provided adequate information about their condition.[5] Alcohol remains the leading cause of liver disease in the UK and accounts for 60% of all cases.[6] The National Confidential Enquiry into Patient Outcome and Death (NCEPOD) report (2013) showed significant variation in the provision of quality care for patients with alcohol-related liver disease (ARLD), with less than half of patients receiving 'good' care during hospital admission.[7]

Due to the complex nature of patients with DC, hospital readmissions following discharge are common. The NCEPOD report found that 1752 patients amassed 7656 admissions in 2 years.[7] Ascites is the most common reason for readmission within 1 month, but this can largely be avoided by the effective use of day case paracentesis services.[5] Other common reasons for readmission include electrolyte disturbance and acute kidney injury from over diuresis, which can be minimised by close monitoring of electrolytes and adjustment of diuretics. Moreover, both short-term and long-term mortality rates in patients with DC are high and readmission is an independent predictor of mortality.[8] Therefore, processes need to be in place in all hospitals to ensure that patients receive appropriate follow-up monitoring and information about their condition prior to hospital discharge to improve outcomes.

One way of improving outcomes in patients with complex medical needs is using 'bundles' that prompt staff to follow guidelines. The British Society of Gastroenterology (BSG)/British Association for the study for the liver (BASL) 'Decompensated Cirrhosis Admission Bundle', which promotes a systematic approach to the management of DC for the first 24 hours, has been shown to improve care and shorten hospital stay.[9 10]

The overall aim of this service improvement project was to improve the quality of discharge of patients with DC, with the ultimate objective of reducing hospital readmissions and improving long-term outcomes.

Our specific aims were to:

1. To assess the quality of discharge in patients with DC and determine if discharge plans comprehensively addressed all patients' medical and social needs.
2. Determine the frequency of hospital readmissions and potentially preventable admissions.
3. Develop a 'decompensated cirrhosis discharge bundle (DCDB)' and a 'cirrhosis self-management toolkit' to standardise care on discharge and ensure that patients were well informed on their condition.
4. To assess the impact of implementation of the DCDB on patient outcomes

METHODS

Baseline review of the management of patients with DC at discharge

Consecutive patients discharged with DC (including Jaundice, ascites, variceal bleeding and HE) from the gastroenterology/hepatology wards at the Newcastle upon Tyne Hospitals NHS Foundation Trust (NUTH) were included from January to December 2017. Individual patients were only included once during the review period.

A comprehensive data collection tool was developed to review the management of cirrhotic complications at discharge based on the recommendations from the European Association for the Study of the Liver (EASL).[4] A retrospective review of the patients' medical notes was undertaken to identify if specific aspects of their management were addressed at discharge, including management of ascites, varices, HE, diuretics/electrolyte monitoring and alcohol harm reduction. In addition, we assessed 30-day readmission rates, including the presenting reason. 'Potentially preventable' readmissions were defined as those that we believe could have been avoided with improved discharge planning (eg, a patient presenting with ascites to the emergency department rather than having day-case elective paracentesis).

Development of the 'DCDB' and 'cirrhosis patient self-management toolkit'

Following the baseline review, we developed the 'DCDB' to standardise the management of patients at the time of discharge (figure 1 and online supplemental file 1). This provides a perihospital discharge checklist to be completed by the ward medical staff to ensure that appropriate investigations and management are instituted according to EASL guidelines. Subsequently, the DCDB was reviewed by the BSG liver section and BASL and was endorsed following some minor modification. The BSG/BASL versions of the DCDB are available at https://wwwbsgorguk/clinical-resource/decompensated-cirrhosis-discharge-bundle.

Second, in collaboration with LIVErNORTH, our local liver patient charity, we developed a 'Cirrhosis patient self-management toolkit' (online supplemental file 2) to provide detailed information about cirrhosis to help patients and their caregivers to manage aspects of their care. This document includes helpful information to empower patients and encourage self-management of complications such as HE and ascites.

Review of the impact of the implementation of the DCDB

The DCDB was implemented at NUTH in September 2018. All medical staff working on the gastroenterology/

Decompensated Cirrhosis Discharge Bundle

This checklist should be completed by a member of the ward team. It should be started a minimum of 48 hours prior to discharge but can be done earlier and should be completed alongside the discharge letter. The information on the checklist should be reviewed on the consultant ward round prior to discharge.

Named consultant	
Date of liver follow up appointment	
Aetiology of liver disease	
Cause of decompensation (if known)	

Ascites		
Ascites present	Y	N
Previous SBP	Y	N
If yes: Date		
Organism (if known)		
Prophylactic antibiotics	Y	N
If yes: name _____		
If no: reason why_____		
Patients with ascites who have had an episode of SBP should be considered for antibiotics (secondary prophylaxis). Co trimoxazole 480mg od first line unless contraindicated		
Current management of ascites		
Diuretics	Y	N
Paracentesis	Y	N
Weight at discharge and documented in discharge letter	_____	Kg
If requiring paracentesis:		
Predicted interval _____weeks		
Day unit appointment booked for _____		
Or Information given to patient to contact Day Unit at Freeman Hospital		

Renal function		
Have the following been documented in the discharge letter:		
Discharge creatinine	Y	N
Frequency of U&Es monitoring in the community	Y	N
Once ascites is controlled that diuretics can be reduced to the lowest effective dose	Y	N

Hepatic encephalopathy		
Encephalopathy present	Y	N
Lactulose	Y	N
Rifaximin	Y	N
Lactulose and Rifaximin are recommended for patients with persistent or a previous un-provoked episode of encephalopathy, unless contraindicated.		

Portal hypertension		
Varices	Y	N
Grade of varices 1 2 3		
Previous variceal bleed?	Y	N
Is a repeat OGD required?	Y	N
If so, date booked for _____		
Prophylaxis		
Is patient on a B Blocker (carvedilol preferred)	Y	N
If not, why not? _____		
Has advice been given about titrating dose? (aim HR 60/min and SBP >100)	Y	N
Variceal band ligation	Y	N
A repeat OGD is recommended at 4 weeks for those who have had variceal banding. Non-selective βBlockers are recommended as primary prophylaxis for medium/large varices and for small varices with red signs or Childs C cirrhosis.		

Substance / alcohol misuse		
Alcohol misuse	Y	N
Input from alcohol liaison team	Y	N
Community follow up plans _____	Y	N
Thiamine prescribed	Y	N

Treatment plan		
If treatment limitations or palliative care have been decided, has this been detailed in the discharge letter and does the patient have an appropriate Treatment Escalation Plan or Emergency Health Care Plan?	Y	N

Communication with patient		
Have the following been explained to the patient and/or family?		
The diagnosis of chronic liver disease	Y	N
The importance of abstinence (if applicable)	Y	N
Current medications and reasons for taking them	Y	N
Patient given the cirrhosis management toolkit leaflet	Y	N

Figure 1 The decompensated cirrhosis discharge bundle. HR. hear-rate; OGD, oesophago-gastro-duodenoscopy; SBP, spontaneous bacterial peritonitis.

hepatology wards were given training on the DCDB and it was envisaged that the bundle would be used for all patients discharged with DC. The training included a presentation of the results of our baseline review and emphasised the areas requiring improvement. In addition, the training discussed the rationale and evidence base behind the recommendations contained within the DCCB. At the time of implementation, our medical notes were paper based, so a paper version was used. Following implementation, a review of the use of the DCDB and its impact was undertaken for consecutive patients discharged between November 2018 and October 2019 using similar methodology to the original review. In October 2019, our Trust moved to a completely electronic medical record so an electronic version of the DCDB was incorporated into the electronic patient record (eRecord, Cerner Millennium). Given the move to eRecord was a significant change in the way of working for staff, we waited several months to allow staff to become comfortable with the new system before conducting a further review. Further training on the electronic DCDB was undertaken with staff. A subsequent review of the use and impact of the electronic version of the DCDB was conducted on consecutive patients between November 2020 and March 2021 using the same methodology as previously.

Data analysis

Statistical analysis was performed using SPSS V.25.0. Fisher's exact test was used to determine differences in categorical variables between groups. A $p<0.05$ was considered statistically significant.

RESULTS

Description of the cohort

A total of 192 patient's records were reviewed across the 3 periods, 61 patients in the baseline review and 131 patients after bundle implementation. Overall, 62% of the cohort were male and the median age was 55 (range 22–89). The median Model for End-stage Liver Disease score for the cohort was 17 (range 6–38). ARLD was the most common aetiology of liver disease, accounting for 72% the total cohort. Overall, 70% had ascites and 43% had HE at the time of admission. Thirteen per cent of the cohort presented with variceal bleeding. There were no significant differences in the clinical characteristics or presenting features among patients in the three data collection periods.

Baseline review of the quality of discharge of patients with DC

A summary of the management at hospital discharge of the 61 patients who were included in the baseline review is shown in table 1. Overall, areas for improvement were identified, particularly the need to increase

Table 1 A summary of the 61 patients who were included in the baseline review of the management of the patients at time of hospital discharge

Total patients (n)	61
Patients with current alcohol misuse	59% (36)
Alcohol team review	64% (23)
Thiamine prescribed	94% (34)
Community alcohol plan	39% (14)
Patients with HE-related admission	49% (30)
Lactulose prescribed	93% (28)
Rifaximin prescribed	90% (27)
Patients with ascites	74% (45)
Discharge creatinine documented in discharge summary	2% (1)
Documented plan for electrolyte monitoring in community	24% (11)
Patients presenting with variceal bleed	8% (5)
Treated with beta-blockers, and/or repeat gastroscopy booked or TIPSS	100% (5)
Readmission within 30 days	30% (18)
Potentially preventable liver related 30-day readmission	11% (7/61)

HE, hepatic encephalopathy; TIPSS, transcutaneous intrahepatic portosystemic shunt.

the proportion of patients with current alcohol misuse who were reviewed by the alcohol team and to better document plan for follow-up with the community alcohol team. In addition, there was a clear need to improve communication with primary care regarding plans for electrolyte monitoring, which were inadequate with only 24% having a documented recommendation for electrolyte monitoring and only 2% of patients having their discharge creatinine noted.

The overall 30-day readmission rate was high at 30% (18/61), with a high proportion of these being potentially preventable at 12% (7/61). All preventable readmissions were patients presenting with recurrent ascites who could have been treated with a planned day case large volume paracentesis.

Review of the impact of implementation of the DCDB

A total of 131 patients were reviewed following implementation of the DCDB, 86 when the bundle was in paper format and 45 using the electronic version. In the first review period, only 23 out of 86 (27%) patients had the DCDB completed. Completion rates increased to 69% (31/45) when the electronic version was introduced.

Table 2 shows the comparison of the clinical management of patients at hospital discharge between those with and without a completed DCDB, including patients from all three review periods. Overall, use of the DCDB was associated with improvements in most aspects of care, with statistically significant improvements in the proportion of patients having an alcohol liaison review (85% vs 66%, p=0.044) and community alcohol team follow-up (62% vs 39%, p=0.026). Moreover, there were significant improvements in

Table 2 A comparison of the clinical management of patients at the time of hospital discharge in patients with and without a completed DCDB

	DCDB n=54	No DCDB n=138	P value
Patients with current alcohol misuse	63% (34)	64% (88)	0.917
Alcohol team review	85% (29)	66% (58)	0.044
Thiamine prescribed	91% (31)	85% (75)	0.552
Community alcohol plan	62% (21)	39% (34)	0.026
Patients with HE-related admission	30% (16)	42% (58)	0.138
Lactulose prescribed	94% (15)	91% (53)	1.0
Rifaximin prescribed	94% (15)	84% (49)	0.679
Patients with ascites	70% (38)	69% (95)	0.886
Discharge creatinine documented in discharge summary	66% (25)	6% (6)	<0.001
Documented plan for electrolyte monitoring in community	61% (23)	36% (34)	0.012
Patients presenting with variceal bleed	15% (8)	11% (15)	0.464
Treated with beta-blockers, and/or repeat gastroscopy booked or TIPSS	100% (8)	89% (13)	0.526
Readmission within 30 days	31% (17)	25% (35)	0.470
Potentially preventable liver related 30-day readmission	4% (2)	7% (10)	0.407

DCDB, decompensated cirrhosis discharge bundle; HE, hepatic encephalopathy; TIPSS, transcutaneous intrahepatic portosystemic shunt.

communication with primary care about electrolyte monitoring (61% vs 36% p=0.012) and improvement in documentation of creatinine in the discharge summary (66% vs 6% p<0.001). Overall readmission rates and potentially preventable admissions were similar between patients with and without a completed bundle. When compared with the baseline review, however, there was a trend towards fewer potentially preventable readmissions after implementation of the DCDB whether or not the bundle was used (7/61 (12%) vs 5/131 (4%), p=0.055).

A breakdown of patient management for the three review periods reported separately is shown in table 3. This shows that patients with a DCDB had numerically higher rates of appropriate management at discharge in most aspects of care when compared with those without a bundle and those in the baseline review, but numbers were too small to perform statistical analysis on these groups.

DISCUSSION

Multiple reports have shown that the care provided to patients with liver disease in the UK is variable and does not consistently meet the recommended standards set out by international guidelines.[1 5 7 11] Due to the complex nature of patients with DC, admissions

Table 3 A comparison of the clinical management of patients at the time of hospital discharge in patients at baseline and in the two cycles post implementation with and without a completed bundle

		Post-DCDB implementation—first review			Post-DCDB implementation—second review		
	Baseline	Total	Completed	Not completed	Total	Completed	Not completed
	61	86	23	63	45	31	14
Patients with current alcohol misuse	59% (36)	72% (62)	91% (21)	(65%) (41)	53% (24)	42% (13)	79% (11)
Alcohol team review	64% (23)	71% (44)	81% (17/21)	66% (27/41)	83% (20)	92% (12)	73% (8)
Thiamine prescribed	94% (34)	84% (52)	90% (19/21)	80% (33/41)	83% (20)	92% (12)	73% (8)
Community alcohol plan	39% (14)	44% (27)	62% (13/21)	34% (14/41)	58% (14)	62% (8)	55% (6)
Patients with HE-related admission	49% (30)	37% (32)	30% (7)	40% (25)	27% (12)	29% (9)	21% (3)
Lactulose prescribed	93% (28)	88% (28)	86% (6/7)	88% (22/25)	100% (12)	100% (9)	100% (3)
Rifaximin prescribed	90% (27)	81% (26)	86% (6/7)	80% (20/25)	92% (11)	100% (9)	67% (2)
Patients with ascites	74% (45)	67% (58)	70% (16)	67% (42)	67% (30)	71% (22)	57% (8)
Discharge creatinine documented in discharge summary	2% (1)	17% (10)	44% (7/16)	7% (3/42)	67 (20)	82% (18)	25% (2)
Documented plan for electrolyte monitoring in community	24% (11)	50% (29)	54% (9/16)	48% (20/42)	57% (17)	64% (14)	38% (3)
Patients presenting with variceal bleed	8% (5)	13% (11)	9% (2)	14% (9)	16% (7)	19% (6)	7% (1)
Treated with beta-blockers, and/or repeat gastroscopy booked or TIPSS	100% (5)	82% (9)	100% (2/2)	78% (7/9)	100% (7)	100% (6)	100% (1)
Readmission within 30 days	30% (18)	26% (22)	35% (8)	22% (14)	27% (12)	29% (9)	21% (3)
Potentially preventable liver related 30-day readmission	12% (7)	5% (4)	4% (1/8)	5% (3/14)	2% (1)	3% (1)	0% (0)

DCDB, decompensated cirrhosis discharge bundle; HE, hepatic encephalopathy; TIPSS, transcutaneous intrahepatic portosystemic shunt.

are frequently prolonged and discharge planning can be complex, with the need for ongoing treatment and monitoring in the community. Given, the BSG/BASL Decompensated Cirrhosis Admission Bundle successfully improved outcomes for patients during their hospital admission,[9 10] we developed a bundle to improve management of patients with DC at hospital discharge and have evaluated its impact.

A baseline review of the quality of discharge following an admission with DC showed areas for improvement. We found a high potentially avoidable readmission rate of 12%, primarily due to patients being readmitted with ascites requiring paracentesis when this procedure could have been performed as a planned outpatient procedure. In addition, some aspects of management were inadequate including documentation of alcohol team reviews, linking patients up with community alcohol services and failure to recommend ongoing monitoring of electrolytes. Given the wide variability in care and outcomes from liver disease identified in the Atlas of Variation on Liver disease, it is likely that deficiencies occur in the management of patients with DC in other hospitals that could be improved.[11]

After implementation of the DCDB (figure 1), we found that patients with a completed DCDB were more likely to have important aspects of care completed or documented, particularly the provision of harm reduction from alcohol and electrolyte monitoring, which were inadequate in the baseline review. Wider implementation of the DCDB could improve outcomes in other hospitals and help to reduce variability in care.

One of the aims of the bundle was to reduce avoidable readmissions. Interestingly, although we found no difference in the avoidable readmission rate between those with and without a completed DCDB, there was a trend (p=0.055) towards fewer avoidable readmission after implementation of the bundle (with or without DCDB) compared with the baseline review. This could be due to patients being provided better information about cirrhotic complications with the self-management toolkit, which was likely to be given to most patients even if they did not have a completed DCDB. This toolkit encourages patients to arrange a paracentesis directly with our day treatment centre when required. Another explanation may be that this work generally raised the profile of improving the care of patients with DC in the department, potentially attenuating differences between those with and without a bundle. Moreover, the small sample size may have not been sufficient to detect a difference.

One of the frustrating aspects of this quality improvement project was that after initial implementation only 27% of patients had a completed bundle in the first assessment. This was a similar pattern to what was observed when we first introduced the DC admission bundle in Newcastle; in that project only 25% of patients had a completed bundle in the first cycle. However, completion rates increased to 90% after three cycles in that project.[10] This emphasises the challenges of implementing 'change' in working practices, and shows perseverance, consistent feedback and re-education are required to implement change. In the current work, completion rates improved to 69% in the second cycle with the electronic version, but this remains below desirable levels. Further work is ongoing with the aim of achieving >90% completion rates. We hope that this data showing improved outcomes associated with use of the bundle will convince the whole team of its benefits and promote its use.

Our study did have some limitations. First, as with all projects that use a retrospective case note review methodology, data collected relies on what has been documented in the notes, which may not be entirely reflective of patient's actual management, but the methodology used was consistent throughout the review period. Second, the overall study cohort was small, particularly those who had a completed bundle, which means strong conclusions cannot be made from these results. Moreover, there were small numbers of patients in many of the subgroups, so we were unable to undertake a more detailed statistical analysis of the cohorts. In addition, patient numbers were too small to assess any impact on long term outcomes such as mortality. Now that the DCDB has been endorsed by the BSG and BASL, we hope to further assess of the impact of the DCDB on larger scale with a multicentre audit to make more definitive conclusions.

In conclusion, management of DC at the time of hospital discharge is variable, with areas that require improvement. We developed a DCDB to standardise the provision of evidence-based care at discharge and this improved outcomes. If implemented more widely, the DCDB could help reduce variability in care and improve outcomes in patients with DC.

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Contributors KS: data collection, data analysis, writing of first draft of manuscript. JG: data collection, data analysis, writing of first draft of manuscript. LJ: codeveloped the bundle, data collection, data analysis. TM: data collection. AJ: codeveloped patient self-management toolkit, data collection. PC: data collection. DM: codeveloped the bundle, revised manuscript. SM: project lead, codeveloped the bundle and toolkit, data analysis, writing of manuscript, guarantor.

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Patient consent for publication Not applicable.

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