

BRIEF REPORT

Rates of timely paracentesis for patients admitted to hospital with cirrhosis and ascites remain low but are unaffected by the COVID-19 pandemic

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Abstract

For the first 6 months of the novel coronavirus-19 (COVID-19) pandemic, the hospital medicine procedure service at our center was temporarily unavailable. We assessed paracentesis rates and clinical outcomes for patients admitted with cirrhosis and ascites before and during the COVID-19 pandemic. Two hundred and twenty-four and 131 patients with cirrhosis and ascites were admitted to hospital before and during COVID-19 respectively. Approximately 50.9% and 49.6% of patients underwent a paracentesis within 24 h pre- and mid-pandemic, $p = .83$. No differences were observed for length-of-stay or 30-day readmissions. GI consultation was associated with higher rates of paracentesis in both eras ($p < .001$ pre-COVID-19, and $p = .01$ COVID-19). Changes due to the COVID-19 pandemic did not result in changes to rates of timely paracentesis in patients admitted with cirrhosis and ascites. While involvement of gastroenterology may increase rates of paracentesis, further efforts are needed to optimize rates of timely paracentesis to positively impact clinical outcomes.

INTRODUCTION

Cirrhosis is prevalent and associated with significant morbidity and mortality.¹ Patients with chronic liver disease have higher rates of hospitalization, readmissions, and longer hospital stays compared with patients with other chronic diseases.² As the burden of cirrhosis increases, there has been a greater focus on improving the delivery of quality care to this patient population.^{2,3}

Current practice guidelines recommend that a paracentesis be performed on any hospitalized patient who has cirrhosis and ascites.⁴ Hospitalized patients who receive early paracentesis have a lower risk of in-hospital mortality and reduced rates of 30-day readmissions.^{5,6} Rates of paracentesis, however, remain low in these patients.⁷ In a study analyzing the Nationwide Inpatient Sample, inpatient paracentesis was only performed in 61% of patients with cirrhosis and ascites.⁸ Similar results were

noted in a study of 75,462 patients with cirrhosis and ascites hospitalized in the United States; only 51.7% underwent paracentesis during their hospitalization.⁶ As a result, improving rates of diagnostic paracentesis in hospital has been deemed a high priority by the American Association for the Study of Liver Diseases (AASLD).³

For the first 6 months of the novel coronavirus disease-19 (COVID-19) pandemic the hospital medicine procedure service (HMPS) at our center was temporarily unavailable in order to provide staff for other services. The aim of this study was to assess rates of paracentesis upon admission and the clinical outcomes based on paracentesis performance before and during the COVID-19 pandemic. We hypothesized that rates of timely paracentesis during the COVID-19 pandemic would be significantly lower compared to the pre-COVID-19 era due to the unavailability of the HMPS at our center.

METHODS

A retrospective review was conducted of consecutive adults with cirrhosis and ascites admitted to hospital medicine teams at the University of Minnesota Medical Center from September 1, 2019 to September 30, 2020. Each hospital admission was counted independently. Individuals were separated into two “eras” – pre-COVID-19 pandemic (from September 1, 2019 to February 28, 2020) and during the COVID-19 pandemic (April 1, 2020–September 30, 2020). Patients were excluded if they were under 18 years of age, did not have cirrhosis, or were admitted to non-hospital medicine teams. Patients were excluded if they had no ascites or a trivial amount of ascites upon bedside ultrasound or during radiology examination. Patients were identified using ICD-9 and -10 codes for cirrhosis along with CPT codes for abdominal paracentesis. Three trained reviewers (D.L., A.V., and A.M) performed manual chart review, which was subsequently reviewed by one trained reviewer (E.A.). Socio-demographic, clinical, and laboratory data were collected in addition to primary admission service, gastroenterology (GI) consultation, and hospital length-of-stay (LOS).

The primary outcome was paracentesis during hospital admission. Secondary outcomes included timely paracentesis (within 24 h of hospital admission), LOS, 30-day readmissions, and in-hospital mortality. A subgroup analysis was conducted on weekend admissions.

Descriptive statistics were calculated and presented by the group. Median and interquartile range (IQR) were presented for continuous variables that were not normally distributed, while mean and standard deviation were present for continuous variables that were normally distributed. Frequency and percentage were presented for categorical variables. Categorical variables were analyzed using χ^2 test. Significance was defined as a *p* value < .05.

This study was approved by the Institutional Review Board at the University of Minnesota.

RESULTS

A total of 355 patients were admitted to hospital with cirrhosis and ascites - 224 and 131 patients were admitted during the pre-COVID-19 era and COVID-19 era, respectively. The mean age of all patients was 56 ± 13.3 years with 56.8% males. The most common etiology of cirrhosis was alcohol-related (58.8%) followed by nonalcoholic steatohepatitis (21.1%). The mean MELD-Na on admission was 24 ± 8. There were no significant differences between eras with regard to demographic data, except a higher percentage of patients in the pre-COVID-19 era had alcohol-related liver disease compared to the COVID-19 era (62.1% vs. 53.4%, *p* = .05; Table 1). Two patients refused paracentesis in the pre-COVID era, while no patients refused paracentesis in the COVID-19 era.

There were no differences between eras in terms of percentage of paracenteses performed during hospital admission (71.0% pre-COVID-19 vs. 80.2% COVID-19; *p* = .06) or within 24 h of hospital

TABLE 1 Demographic data

	Pre-COVID-19 (n = 224)	COVID-19 (n = 131)	<i>p</i> Value
Age, years	55 (13)	57 (14)	.14
Male gender	128 (57.1%)	74 (56.5%)	.90
Race/ethnicity			.06
Non-Hispanic White	183 (81.7%)	106 (80.9%)	
Non-Hispanic Black	17 (7.6%)	8 (6.1%)	
Hispanic or Latino	1 (0.4%)	2 (1.5%)	
Asian	3 (1.3%)	8 (6.1%)	
Other/unknown	20 (8.9%)	7 (5.3%)	
Etiology of cirrhosis			.05
Alcohol-related liver disease	139 (62.1%)	70 (53.4%)	
Hepatitis C	17 (7.6%)	3 (2.3%)	
NASH	41 (18.3%)	31 (23.7%)	
Hepatitis B	3 (1.3%)	7 (5.3%)	
Other/unknown	24 (10.7%)	20 (1.53%)	
MELD-Na	24 (8)	24 (8)	.66
Admissions on weekend days	64 (28.6%)	27 (20.6%)	.10

Note: Data represented as mean (standard deviation) or sample size (%), except for length of stay which is presented as median (interquartile range). 30-day readmission percentage was calculated based on number of patients who were discharged from the hospital.

Abbreviations: COVID-19, coronavirus disease 2019; MELD, model for end-stage liver disease; NASH, nonalcoholic steatohepatitis.

admission (50.9% pre-COVID-19 vs. 49.6% COVID-19; *p* = .83) (Table 2).

For patients who underwent a paracentesis during the pre-COVID-19 era, 67.9%, 11.9%, 11.3%, and 8.8% were performed by the HMPS, interventional radiology (IR), the primary team, and others respectively, whereas, during the COVID-19 era, 83.8% and 6.7% of paracenteses were performed by IR and the primary team respectively. There was a significant difference between eras with regards to who performed the procedures (*p* < .001).

In both eras, GI consultation was associated with higher rates of paracentesis during admission (*p* = .0006 pre-COVID-19 and *p* = .009 COVID-19), although rates of paracentesis within 24-h were unaffected by GI consultation (*p* = .17 pre-COVID-19, and *p* = .59 COVID-19).

No differences were observed between eras for LOS, 30-day readmissions, or in-hospital mortality (*p* = .34, *p* = .64, and *p* = .56, respectively) (Table 2).

For weekend admissions, no differences were observed between eras for paracentesis completion, timely paracentesis, LOS or 30-day readmissions (Table 2). Moreover, for weekend admissions, there

TABLE 2 Clinical outcomes

	Pre-COVID-19 (n = 224)	COVID-19 (n = 131)	p Value
All admissions			
Paracentesis during admission	159 (71.0%)	105 (80.2%)	.06
Paracentesis within 24 h	114 (50.9%)	65 (49.6%)	.83
Median length of stay, days	5 (3–10)	5 (3–5)	.34
In-hospital mortality	23 (10.3%)	11 (8.4%)	.56
30-day readmissions	90 (44.8%)	57 (47.5%)	.64
Weekend admissions			
Paracentesis during admission	48 (75.0%)	20 (74.1%)	1.00
Paracentesis within 24 h	32 (50.0%)	10 (37.0%)	.34
Median length of stay, days	4 (3–14)	5 (3–10)	.81
In-hospital mortality	6 (9.4%)	1 (3.7%)	.35
30-day readmissions	27 (46.6%)	10 (38.5%)	.49

Note: Data represented as mean (standard deviation) or sample size (%), except for length of stay which is presented as median (interquartile range). 30-day readmission percentage was calculated based on number of patients who were discharged from the hospital.

Abbreviation: COVID-19, coronavirus disease 2019.

were no differences between eras for paracentesis within 24-h (50.0% pre-COVID-19 vs. 37.0% COVID-19, $p = .34$), LOS (4 days vs. 5 days, $p = .81$), or 30-day readmissions (46.6% pre-COVID-19 vs. 38.5% COVID-19, $p = .49$).

Few patients experienced complications in either era. In the pre-COVID-19 era, 2.5% of patients experienced abdominal pain attributed to the paracentesis and 1.9% of patients experienced leakage of ascitic fluid respectively. No patients in the pre-COVID-19 era experienced post-procedural bleeding. In the COVID-19 era, 1.9%, 0.9%, and 0.9% of patients experienced abdominal pain, leakage of ascitic fluid, and post-procedural bleeding respectively. There were no significant differences between cohorts in terms of abdominal pain, leakage of ascitic fluid, and post-procedural bleeding ($p = .74$, $p = .54$, and $p = .22$, respectively).

DISCUSSION

In this study, we report that during the COVID-19 pandemic - when the HMPS was unavailable - that there was no difference in rates of paracentesis compared to the pre-COVID-19 era. Furthermore, rates of timely paracentesis were low during both eras.

Despite society practice guidelines and data that continues to emphasize the positive impact of early paracentesis on reduced mortality, paracentesis completion rates were suboptimal in our study.^{4,5,8} These data are similar to prior studies; in a national sample, only 61% of patients with cirrhosis admitted with ascites underwent a paracentesis during their admission.^{5,8} This has been identified by the AASLD as an area requiring attention and has even been proposed as a potential hospital quality metric.^{3,6} Several factors may be contributing to low paracentesis rates in hospitals including, but not limited to, lack of self-efficacy with paracentesis, concerns regarding the safety of paracentesis in patients with decompensated liver disease, and a lack of time.

The results of our study were surprising as we had hypothesized that the rates of timely paracentesis during the COVID-19 pandemic would be significantly lower compared to pre-COVID-19 due to the lack of an HMPS - especially given that recent study in the *Journal of Hospital Medicine* reported that the presence of an HMPS was associated with a lower time to paracentesis and shorter LOS.⁹ Compared with this recent study, our cohort was comprised exclusively of patients with cirrhosis and there were inherent differences between health systems- for example, our hospital does not have a gastroenterology primary team and all cirrhosis patients are admitted to medicine teams- which may also have contributed to our results.

While we expected an increase in IR-performed paracenteses in the COVID-19 era compared to the pre-COVID era, the difference observed was more prominent than anticipated. We conjecture that IR shifted their workforce to allow for increased availability for acute inpatient procedures, such as paracentesis, and decreased the capacity to perform time-sensitive but elective cases, as observed in Canada and the UK.^{10,11} We also observed a low proportion of procedures performed by primary hospitalist teams that then decreased in the pandemic era. This may be related to the shortage of personal protective equipment observed early in the pandemic but is also consistent with a national trend of bedside procedures being increasingly performed by non-internal medicine physicians due to changing training requirements and time commitments.¹² However, the recent rise to the prominence of HMPS has ushered in a new era of hospitalist procedural competence and institutional supports, which may precipitate a reversal in these trends.¹³

Additional work is clearly needed to improve early paracentesis rates upon admission. One modifiable factor is provider comfort level and competence regarding paracentesis. Previous work has demonstrated that educational interventions can improve self-efficacy with paracentesis and subsequent time from admission to paracentesis.^{7,14} In the outpatient setting, procedural training of residents has been shown to significantly increase self-efficacy and the number of procedures performed per year.¹⁵ Ongoing formal bedside procedural training of residents in paracentesis can increase competency, allowing residents to perform procedures independent of faculty, and potentially result in higher rates of timely procedures while maintaining patient safety.

Furthermore, we observed that GI consultation was associated with higher rates of paracentesis during both eras. This finding is consistent with prior studies showing that the involvement of GI specialists may result in increased adherence to quality indicators for patients admitted with cirrhosis.¹⁶ Rates of timely paracentesis, however, did not increase with GI consultation in our study; although, this may have been related to the timing of consultation, i.e. consultation for certain patients >24 h after admission.

We hypothesized that the percentage of timely paracenteses on weekends would be lower during the COVID-19 era due to a reduced capacity of IR to perform these non-urgent procedures. "The Weekend Effect" has been attributed to differences in inpatient mortality and was associated with lower rates of overall and timely paracentesis in a large database study.¹⁷ While we observed significantly fewer paracenteses being performed on weekends during the COVID-19 era, there was no difference in the percentage of timely paracenteses compared to the rest of the week. This discordance with prior data may be related to our relatively small sample size.

Our study has several strengths, but some potential limitations. Our study examined important outcomes for patients and providers, including paracentesis completion, LOS, and 30-day re-admissions, and all charts were manually reviewed for accuracy. The retrospective nature of our study has inherent flaws, and the university health center setting may limit generalizability to other practice settings. In addition, our sample size was limited given the reduced number of cirrhosis admissions during the pandemic compared to the prior year, reflective of national patterns.¹⁸ Finally, our 30-day readmission data may have been limited as patients may not be readmitted to the same center, particularly at university medical centers.

CONCLUSION

Systematic changes mandated because of the COVID-19 pandemic resulted in different operators but no differences in rates of overall or timely paracentesis. Rates of timely paracentesis remain sub-optimal regardless of pandemic status. While the involvement of GI consultants can facilitate improved rates of paracentesis, further efforts, such as ongoing training of residents to obtain procedural competency, are needed to optimize rates of timely paracentesis to positively impact clinical outcomes in patients with cirrhosis.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

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