

Utilization of POCUS in a Specialist Palliative Care Setting: A Retrospective Chart Review.

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Abstract

Background: The use of Point-Of-Care Ultrasound (POCUS) has increased rapidly across various medical disciplines due to technological advancements providing high quality POCUS units. POCUS can help clinicians at the bed side with information regarding patient management in real time. However, literature reveals scant evidence of POCUS use in Palliative Care. This study's objective was to examine the use of POCUS in a specialist palliative care setting.

Methods: A retrospective chart review was conducted from January 2018 to June 2019 to evaluate characteristics of patients for whom POCUS was utilized. These patients were identified through pre-existing logs and descriptive information was collected from the electronic health records. This included demographic information, life-limiting diagnosis, patient assessment location, diagnosis made with POCUS and, if applicable, volume of fluid drained.

Results: We identified 126 uses of POCUS in 89 unique patients. 62 patients (69.7%) had a cancer diagnosis, with patients most commonly suffering from GI, Lung and Breast pathologies. 61 POCUS cases (48.4%) were in the outpatient setting. 81 POCUS cases (64.3%) revealed a diagnosis of ascites and 21 POCUS cases (16.7%) revealed a diagnosis of pleural effusion. Other diagnoses made with POCUS included bowel obstruction, pneumonia and congestive heart failure. During the study period, 52 paracentesis and 7 thoracentesis procedures were performed using POCUS guidance.

Conclusion: We identified multiple indications in our specialist palliative care setting where POCUS aided in diagnosis/management of patients in both inpatient and outpatient settings. Further studies can be conducted to identify the potential benefits in symptom burden, patient & caregiver satisfaction and health care utilization in palliative care patients receiving POCUS.

Background

The delivery of Palliative Care is constantly evolving to better suit the needs of patients. Historically, the provision of palliative care was limited to end-of-life care in hospital settings and hospice centers [1]. However, the new definition according to the World Health Organization has broadened the scope of palliative care to include all patients with life threatening illness [2]. Indeed, strong evidence now has resulted in a shift towards earlier integration of palliative care for patients with a variety of life-threatening medical conditions [3]. The basic model of integrated palliative care suggests that it should be incorporated as early as possible in conjunction to disease management therapy [4]. Due to this evolution, palliative care is now delivered in a multitude of different settings by interprofessional teams consisting of nurses, physiotherapists, social workers, and other allied health staff [5–7]. Consequentially, specialist palliative care has grown rapidly, and provides more flexibility in provision of care to these patients based on their individual needs. This needs-based availability opens delivery of palliative care programs to outside the hospital, such as long term care centers, outpatient clinics, home care, and

telehealth networks [8]. This has resulted in better symptom control, patient satisfaction, improved quality of life and reduced visits to the hospital, and a decreased number of in-hospital deaths [9].

At the same time, over the last several decades, there has been rapid growth of use of Point-of-Care Ultrasound (POCUS) for physicians in Critical Care Medicine and Emergency Medicine [10]. This diagnostic tool allows clinicians to obtain real-time visualization and rapid results right at the patient's bedside with reduced procedural complications [10–11]. Current literature shows the extent of POCUS use in diagnosing conditions such as malignant and non-malignant ascites and pleural effusions to assess the need for bedside procedures such as paracentesis and thoracentesis [12]. POCUS has been shown to improve physician confidence [13] and has been associated with significantly fewer adverse events such as post-drainage infection and haematoma. Furthermore, recent advances in POCUS technology have made it more accessible to patients in the outpatient setting via portable, compact devices that continue to become less expensive, and require minimal infrastructural support [14].

Patients receiving palliative care often develop complications such as ascites or pleural effusions, which cause debilitating symptoms such as pain, dyspnea, loss of appetite, swelling and reduction in an individual's mobility, interfering with their quality of life [11]. In fact, respiratory or abdominal complaints were listed in the top 10 reasons for patient visits to the emergency during the last 30 days of their lives [15]. Despite the prevalence and advantages of the use of POCUS, and the frequency of indications where POCUS would be beneficial, there is scarcity of evidence examining POCUS use in Palliative Medicine.

The aim of this retrospective chart review was to explore the utilization of POCUS in a specialist palliative care setting. The study characterized the profiles of patients in which POCUS was utilized and examined the different applications of POCUS in both inpatients and outpatients.

Methods

This retrospective chart review was conducted on all palliative care patients in whom POCUS was utilized. All patients were receiving care from Palliative Care Physicians associated with a large multi-specialty community hospital in Ontario, Canada. Institutional ethics approval was granted by the William Osler Research Ethics Board at William Osler Health Systems (REB# 18–0043). In January of 2018, the Division of Palliative Care at William Osler Health System's Brampton Civic Hospital purchased two portable POCUS units for use: 1) a Clarius C3 Black and white scanner with virtual phased array and 2) a Sonosite iViz Ultrasound system. Two of our physicians undertook prior training in ultrasonography and served as mentors for other colleagues in the division. Physicians conducting POCUS assessments kept logs of patients in whom POCUS was indicated between January 2018 – June 2019 inclusive, and these patients were reviewed for the scope of the study. Local Research Ethics Board review was conducted and approval was received prior to any research activity. Due to the nature of this research study being a retrospective chart review, obtaining explicit informed consent was not required. There was minimal risk to the subjects and did not adversely influence the rights and welfare of the subjects. Patients were assigned a unique, sequential study identification number, and their de-identified data was stored on

password protected files on a secure, internal hospital server. Information retrieved included demographic information (age, sex), life limiting diagnosis, location of patient assessment, diagnosis made with POCUS, and, if applicable, volume of fluid drained. All other relevant information was collected from electronic health records and stored on secure Microsoft spreadsheets.

Results

A total of 89 unique patients were identified. Some patients received POCUS on multiple occasions, resulting in 126 total assessments. Of the 89 patients, 53% were females (47), and 62% were over 70 years old (View Table 1). 67 patients (75%) had a cancer diagnosis, and one of the patients was diagnosed with two primary malignancies. Gastrointestinal cancers accounted for 46% of all cancer diagnoses. Nine patients (10%) in our cohort had multiple diagnoses using POCUS.

Table 1
Patient Demographics

Demographics	Patients	
	n = 89	
Gender distribution	Females	Males
	n = 47 (52.81%)	n = 42 (47.19%)
Patients per age group	30–39–1 (1.12%)	
	40–49–5 (5.6%)	
	50–59–18 (20.2%)	
	60–69–10 (11.2%)	
	70–79–25 (28.1%)	
	80–89–26 (29.2%)	
	90–99–4 (4.5%)	
Type of Cancer		
Gastrointestinal*	45.6%	
Lung	19.1%	
Genito-urinary (GU)**	19.1%	
Breast	10.3%	
Unknown Primary	2.9%	
Plasma Cell	1.5%	
MDS	1.5%	
* Please refer to appendix 1 for breakdown of all Gastrointestinal cancers and their percentages in our patients		
** Please refer to appendix 2 for breakdown of all Genito-urinary cancers and their percentages in our patients		

The assessments using POCUS were distributed across admitted patients (67, 53%) and patients in the outpatient setting (59, 47%). As per Fig. 1, most of the patients receiving POCUS administration were admitted to the Palliative Care Unit (57, 45%), followed by the Outpatient Palliative Care Clinic (30, 24%), patient home (22, 17%), other hospital location (10, 8%), and long-term care facility (7, 6%), in descending order. The 126 assessments conducted using POCUS yielded 120 diagnoses (Table 2) and 59 procedures, including 7 thoracenteses (Table 3) and 52 paracenteses (Table 4). POCUS assessments also yielded

diagnoses of pneumonia, congestive heart failure, bowel obstruction, and pneumothorax in descending order. An average of 2.55 L of fluid was drained during all paracentesis procedures, ranging from 0.6L to 6.8L. An average of 1.14 L fluid was drained from all patients who had a thoracentesis, which ranged from 0.5L to 1.8L. 2 paracentesis procedures resulted in no fluid being drained.

Table 2
POCUS based diagnoses

DIAGNOSIS	n (%)
Ascites	81 (59.5%)
Pleural Effusions	21 (15.4%)
CHF	13 (9.6%)
Bowel Obstruction	2 (1.5%)
Pneumothorax	2 (1.5%)
No Diagnosis	1 (0.8%)
	16 (11.8%)

Table 3
Patients with diagnosis of pleural effusion

	Diagnosis of pleural effusion	Thoracentesis performed	Thoracentesis not indicated
Patients (n)	21	7	14

Table 4
Patients with diagnosis of ascites

	Diagnosis of ascites	Paracentesis performed	Paracentesis not indicated
Patients (n)	81	52	29

Discussion

Overall, there is scarcity of data on the utility of POCUS in palliative medicine. In one of the first few reports in literature concerning POCUS use in palliative care, Gishen et al. described the use of POCUS in an inpatient unit [16]. The authors reported drainage of ascites as the most common use of POCUS, in addition to other indications. To date, there have been only a few small studies which demonstrated use of POCUS in outpatient palliative care settings [13, 17–20]. These smaller studies report on successful

assessments using POCUS in hospice settings, as well as preventing unnecessary procedures and trips to the hospital [21–23]. One retrospective chart review reported on patients with ascites in non-hospital settings such as hospice, residential care, and patient homes [13]. The most prevalent pathology in the cohort was ovarian cancer, followed by various GI cancers, Lung, cancers, breast cancers, genitourinary cancers, and cancers of unknown origin. In our study, which included 89 patients, we found a similar distribution of patients across all cancer types (Table 1).

Our retrospective study is the first of its kind to measure the utilization of POCUS in a comprehensive specialist palliative care program which provides patient care across multiple care settings, including homes, long term care facilities and outpatient clinics in addition to hospital based support [8] (Fig. 3). Furthermore, the study highlights the opportunities of POCUS use for a variety of diagnoses, with assessment of peritoneal or pleural fluid being the most common indication [13, 24, 25]. Specifically, POCUS has long been established as a tool to help clinicians distinguish between fluid accumulations causing symptomatic sequelae in patients and other pathologic abnormalities. We notably observed that 47% of our patients received bed-side interventions assisted by POCUS. 53% of patients in our cohort did not require fluid removal, likely due to inadequate amount of fluid present, assessed using POCUS. This is in line with what has been observed in other studies as well. Landers et al reported that 19/32 patients (59%) had fluid accumulation that was removed via POCUS [12]. They also reported another patient where loculated fluid was observed during POCUS assessment, but was not removed due to inaccessibility. Dhamija et al mention that POCUS assessments can help clinicians differentiate abdominal distension due to fluids as compared to other causes, thus reducing unnecessary procedures, which could put the patient at risk of complications such as bowel perforation [10].

Pneumonia is another established cause of morbidity and mortality in patients with advanced life-limiting diagnosis, and is associated with increased discomfort [26, 27]. Considering the different pulmonary causes of distress in palliative care patients, it becomes imperative to effectively diagnose these issues in order to facilitate competent care, and specifically to facilitate discussion around goals of care. POCUS utility has been well documented in differentiating lung pathologies in critically ill patients, including pneumonia, pneumothorax, pulmonary embolism, and obstructive respiratory disorders [28]. However, use of POCUS for diagnosis of pulmonary complexities has been fairly limited in palliative care. We were effectively able to diagnose 13 cases of pneumonia and one pneumothorax, further signifying the utility of POCUS across multiple indications. Using POCUS, we were able to diagnose patients with congestive heart failure exacerbation and bowel obstruction as well, which expands the indications for POCUS. Gishen et al also explored additional indications in their patients, which shed further light on POCUS utility [16]. There is insufficient evidence in literature with regards to POCUS assessments in multiple different sites in the same patient. However, we observed this to be the clinical picture in 10% of our patients, where multiple symptoms led to use of POCUS to diagnose or rule out different etiologies in an individual. Our study adds to the literature by reporting on this unique aspect of the utility of POCUS in such scenarios.

Study Limitations

This study was associated with limitations. First, the data collected in our study did not look at adverse events associated with POCUS guided procedures. Second, the study did not collect health utilization data that would help highlight the cost effectiveness of administering POCUS in the community, an area that can be looked at in future studies. Third, the study was focused on a single site and may not be reproducible at other sites. While many patients had other imaging per clinical standard of care, diagnoses made by POCUS were not routinely confirmed with other imaging modalities. These data can therefore not comment on the sensitivity or specificity of POCUS in our cohort. Finally, the study focused on the outcomes of the use of POCUS for trained palliative care physicians but did not highlight the processes used to provide this training to clinicians.

Conclusion

Through our retrospective chart review of palliative care patients on whom POCUS was utilized, POCUS appears to be a versatile tool which can assist the physician in a variety of palliative care settings, both for aiding with diagnosis as well as guiding procedures. In particular, the most common uses of POCUS in our specialist palliative care setting are for diagnosis and management of ascites and pleural effusions in patients with advanced cancer. Considering symptoms caused by these fluid collections contribute significantly to hospital visits for patients near the end of life, POCUS provides great potential for efficient and patient-centered care. Future studies on POCUS use in a palliative care setting may look to further measure patient symptom control and satisfaction, while also assessing health care utilization and cost.

Declarations

Institutional ethics approval was granted by the William Osler Health System's Research Ethics Board before to conducting any study related activities. All authors have approved the submitted version. The authors declare that they have no competing interests. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request. Authors AA, RD, ND, RB, MC were involved in conception/design of the work, DG, AA2 were involved in data acquisition, AA, RD, AS, DG, AA2 were involved in the data analysis, and interpretation, and AA, RD, AS, ND, DG, AA2, RB, MC were involved in the drafting of the manuscript.

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Appendix

Appendix 1: Gastrointestinal Cancers

Site	Percentage
Colorectal	9%
Liver	4.5%
Hepatocellular	3%
Pancreatic	9%
Gastric	3%
Bile Ducts	6%
Gallbladder	3%
Peritoneal	1.5%
Upper GI	1.5%
Appendiceal	1.5%
Sigmoid	1.5%
Duodenal	1.5%

Appendix 2: Genito-urinary Cancers

Site	Percentage
Ovarian	6%
Uterine	1.5%
Prostate	3%
Endometrial	1.5%
Cervical	3%
Penile	1.5%
Gynecological origin	1.5%

Figures

Location of Pocus Uses

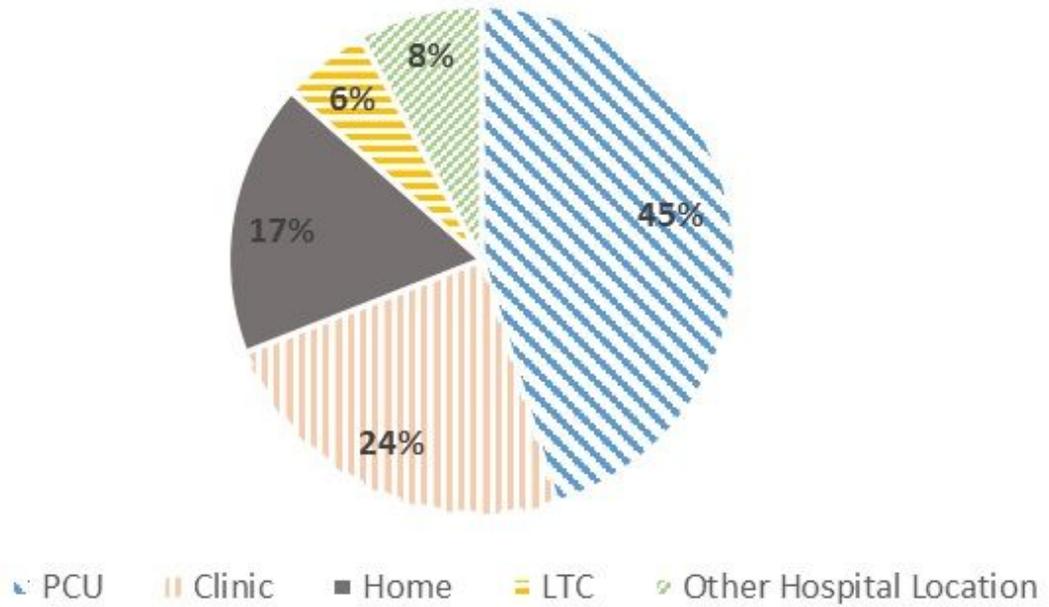
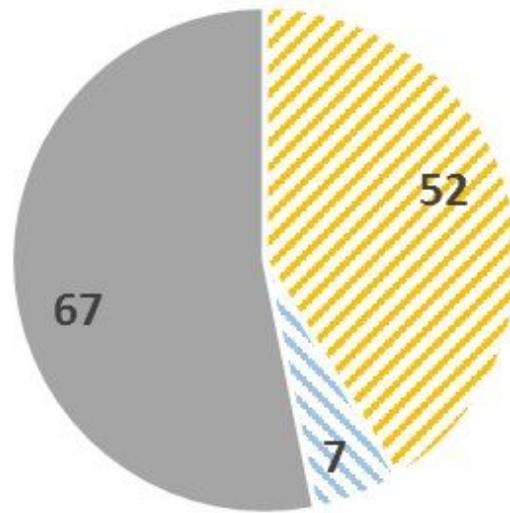


Figure 1

Location of POCUS uses (PCU = Palliative Care Unit, LTC = Long Term Care)

Procedures



■ Paracentesis ■ Thoracentesis ■ No Intervention

Figure 2

Procedures breakdown.

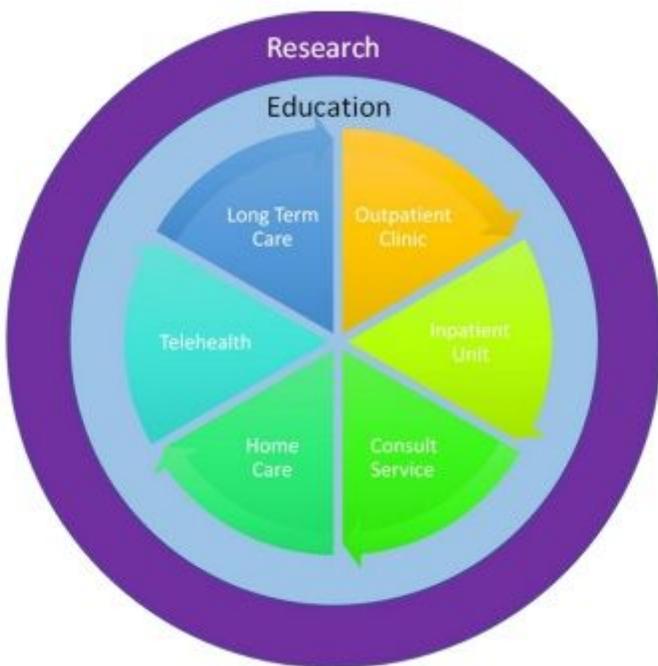


Figure 3

Pillars of the Supportive Palliative Care Program developed and incorporated in the context of education and research (Taken with permission from authors - <http://www.williamoslerhs.ca/docs/default-source/research-education/early-palliative-care-in-patients-with-lung-cancer-at-brampton-civic-hospital.pdf?sfvrsn=0>)