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ORIGINAL ARTICLE

Impact of a bleeding care pathway in the management of acute upper gastrointestinal bleeding

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Abstract
Objectives Upper gastrointestinal (UGI) bleeding carries high morbidity and mortality. The use of a bleeding care pathway (BCP) may improve outcomes, but the results are inconsistent in various studies.
Methods A BCP for patients with UGI bleed with admission in a bleeding care unit (BCU) has been in use at our hospital since 2005. Prior to this, a high dependency unit was used for management of all emergencies including UGI bleeding. We compared the length of stay in the bleeding care/high dependency unit, total hospital stay, time to UGI endoscopy after admission, and survival between pre-2005 and post-2005 patients.
Results Five hundred and fifty-one patients were admitted with acute UGI bleed in the last 5 years; 121 belonged to pre-BCP (2004) period and 430 after implementation of the pathway (2005–2008). The mean (SD) time to UGI endoscopy improved from 21.3 (7.4) hours in the pre-BCU era to 9.4 (9.9) hours in BCU, $p<0.001$. BCU stay was shorter from 2.41 (1.4) days pre-BCP to 1.93 (1.32) days post-BCP, ($p<0.001$). The total hospital stay in pre-BCU (4.0 [2.08] days) as compared to BCU (4.13 [2.62] days; $p=0.58$) was similar; there was no impact of BCU on survival.
Conclusion A BCU implementation showed improvement in time to UGI endoscopy, and did not reduce BCU stay or impact survival.

Keywords Gastrointestinal bleeding · Outcome research · Quality of care

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Introduction

Acute upper gastrointestinal (UGI) bleeding remains one of the most commonly encountered GI emergencies. UGI bleeding affects approximately 0.7–1.5 per 1,000 of general population in the United States annually [1, 2]. The true incidence of UGI bleed is not known in Pakistan but is expected to be comparable with global statistics.

Despite the high frequency of GI bleeding, guidelines to provide quality medical treatment in a standardized fashion are not well established in resource poor countries. Variations in treatment have been noted among various hospitals; furthermore, differences exist in its monitoring, timing of endoscopy, length of the hospital stay, and outcomes even within a single hospital [3].

Clinical care pathways have been proposed for diseases that are frequent causes of hospitalization; they are particularly used for diseases which are expensive to treat and have a high variation in the approach to diagnosis and treatment [4, 5]. The management of upper GI bleeding meets all these criteria and therefore qualifies for the need of a pathway. Clinical care pathways, also known as critical paths, care paths, and critical pathways, are management plans that display goals for patients and provide the sequence and timing of actions necessary to achieve these goals with optimal efficacy [6]. There has been some evidence that clinical care pathways for upper GI bleeding management can be useful in patient care [6–10]. There is no local or regional report on the development and impact of clinical care pathways in management of upper GI bleed.

In order to investigate the impact of bleeding care pathway (BCP) on improvement in upper GI bleeding care and outcomes, a five-bedded bleeding care unit (BCU) was established at Aga Khan University Hospital (AKUH), Karachi. Our hospital is an urban tertiary care center

established in 1987 which caters to the entire country and some referrals from adjacent areas, such as Afghanistan, Iran, and the United Arab Emirates.

The aim of our study was to standardize the treatment and to study the utility and efficacy of BCU in the management of upper GI bleeding at our institution.

Methods

Development of bleeding care unit

A quality improvement committee was developed at our institute in 2004. As a result of recommendation of this committee, a high dependency area previously named as special care unit (SCU) was designated as bleeding care unit. There were a total of seven SCUs established in the hospital, in which patients with acute non-cardiac medical emergencies, such as stroke, acute liver failure, acute kidney injury, acute respiratory distresses, electrolyte imbalances, diabetic coma, hepatic encephalopathy, upper GI bleed, etc. were admitted from emergency room (ER).

The committee for development of BCP and BCU comprised gastroenterologists, interventional radiologists, GI surgeons, ER physicians, GI fellows, nurse case managers, surgeons and senior nursing staff. The first step was the development of a pathway which was named as GI BCP followed by identifying one of SCU on the medical floor, close to the endoscopy suite as the GI bleeding care unit (BCU). Prior to the implementation of BCU, all patients with upper GI bleed were managed in a high dependency unit, catering to critically ill patients without a dedicated GI team. SCU as well as BCU has a capacity of accommodating five patients and is equipped with cardiac monitors for individual patients, crash cart trolley for advanced cardiac life saving (ACLS) resuscitative measures.

Unlike the SCU, BCU has a dedicated team of nurses and critical care technician (CCT) trained in managing GI bleeding and its complications; moreover, it has provided rush call pagers for GI bleeding care team and has a direct access to GI endoscopy unit. The BCU staff was specially trained to insert intravenous canulae, central lines and nasogastric tube, and conduct the ACLS. The training sessions were conducted for GI fellows, registered nurse (RN) and CCT involved in the emergency management of GI bleeding. The designated team for BCU included two full time on-call consultant gastroenterologists, one GI fellow, one resident, case manager, and one ER physician along with a registered nurse and CCT. The BCU was operational from January 2005 at this 650-bedded tertiary care hospital in Karachi, Pakistan. Facilities for upper GI endoscopy, interventional radiology, and surgery services were available round the clock.

All patients with upper GI bleed (variceal and non-variceal) with a high risk [11] (Table 1) were admitted from the ER to BCU. The BCP was started in all these patients. Patients not meeting the criteria were admitted in general medical wards of our hospital.

GI bleeding care pathway

The pathway management started from ER and ended on the fifth day of admission or earlier if patient was discharged. The parameters were recorded in patients staying for more than 3 days in BCU or overall stay was extended beyond 5 days.

The BCP has components of ER, BCU, and ward management of patients with upper GI bleed. It comprises components of patient's daily assessment, along with GI endoscopy report, and medications information. BCP was terminated earlier if: (1) patient was shifted to medical intensive care unit (ICU) for mechanical ventilation, (2) patient shifted to coronary care unit (due to active ischemic heart disease including myocardial infarction), and/or (3) angiographic embolization for non-variceal bleed, (4) transjugular intrahepatic portosystemic shunt (TIPSS) for variceal bleed, or (5) underwent a surgical procedure for upper GI bleed, after failure of endoscopic intervention(s) for hemostasis. The BCU setup for the management of GI bleeding was approved from the hospital operation team (HOT) committee of our hospital.

Management of upper gastrointestinal bleed

All the patients in pre-BCU and BCU era received a standardized medical and endoscopic treatment after initial resuscitation with intravenous fluids and packed cells transfusion as needed. Omeprazole was used in infusion form (80 mg IV stat followed by 8 mg per hour until EGD) or 40 mg IV infusion twice a day based on the physicians' discretion in high risk patients [12]. Parenteral omeprazole was converted to oral after finding a low risk lesion on EGD based on Forrest classification of ulcer or after ensuring hemostasis based on clinical judgment along with stabilization of hemoglobin in 48 h. Splanchnic vaso-constrictors, like terlipressin and octreotide were regularly used based on clinical grounds. Octreotide infusion was

Table 1 Criteria for BCU admission (high risk group)

- Age >55 years
- Pulse >110/min or systolic blood pressure <90 mmHg
- Postural hypotension >20 mmHg
- Active upper GI bleeding
- Prior history of cirrhosis
- Chronic comorbid conditions [11]

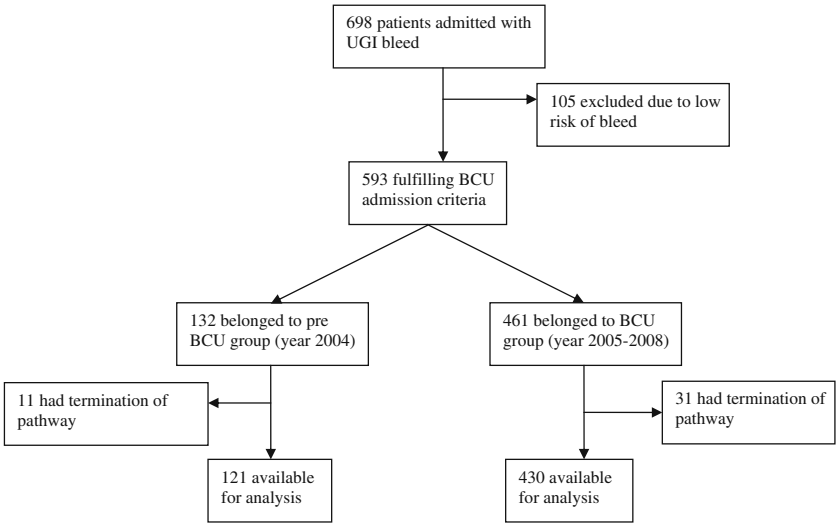

Fig. 1 Flow diagram of the patients included in the study

used in standard dose of 100 mcg stat followed by 50 mcg per hour infusion for 72 h in all the patients with known cirrhosis or suspected variceal bleeding. Terlipressin was given as 2 mg IV followed by 1 mg every 6 hourly for 72 h in esophageal variceal bleed [13, 14]. The endoscopic intervention in non-variceal bleeding included a combination of injection sclerotherapy and heater probe coagulation in all patients with high risk ulcer according to Forrest classification. Sclerotherapy was performed with adrenaline in a concentration of 1:10,000 up to 6–12 mL in aliquots injected in and around the ulcer [15, 16]. Esophageal variceal bleed was managed with endoscopic band ligation (EBL; *Saeed Multi Band Ligator*, Wilson-Cook , USA) [14].

Data collection

We prospectively collected the data of all upper GI bleeding patients admitted in BCU from 2005 to 2008. In order to assess our objectives, these data were compared with data of matched patients with upper GI bleed admitted in SCU prior to implementation of GI (BCP)s in bleeding control unit (pre-BCU) in 2004 by reviewing medical records. The data collected for both the groups of patients included the history, examination, laboratory investigations, and different outcomes. Success of BCP was assessed and compared with pre-BCU admissions for the following variables: (1) time between admission and upper GI endoscopy, (2) length of pre-BCU/BCU stay, (3) total hospital admission, and (4) mortality. The study was conducted after approval by Ethics Review Committee (ERC) of AKUH, Karachi.

Statistical analysis

Data are presented as mean (SD) or number (%) as applicable. Differences in proportions were assessed by using the Chi-square test or Fisher exact test wherever appropriate. For continuous variables, one way analysis of variance and independent sample t-test were used to assess the difference of means. All analysis were done using SPSS (version 14.0). All *p*-values were two-sided and considered as significant if <0.05.

Table 2 Characteristics of patient admitted before and after start of bleeding care unit

Variables	Pre-BCU *n*=121	BCU *n*=430	*p*-value
Age (years) (mean [SD])	56.5 (15)	54.9 (15.8)	0.29
Male	76 (62.8)	280 (65.1)	0.63
Comorbid illnesses	47 (38.8)	173 (40.2)	0.81
Transfusion	86 (71)	321 (74.6)	0.52
Average number of blood products (mean [SD])	2.7 (0.8)	2.9 (0.6)	0.62
Causes of UGI bleed			
Esophageal variceal bleed	62 (51.2)	262 (60.9)	0.005
Non-esophageal variceal bleed	47 (38.8)	144 (33.5)	
Both EV and non-EV bleed	6 (5)	21 (4.9)	
No source of bleeding identified	6 (5)	3 (0.7)	

Data are as *n* (%)

Table 3 Comparison of various outcome measures of patients admitted in BCU and year-wise pre-BCU period

Variables	Pre-BCU 2004; n=21	BCU 2005; n=117	BCU 2006; n=87	BCU 2007; n=110	BCU 2008; n=116	p-value
Length of stay (days)	2.41 (1.4)	2.38 (1.3)	2.17 (1.5)	1.69 (1.3)	*1.51 (0.87)	<0.001
Total hospital stay (days)	4 (2.08)	3.58 (2.2)	4.62 (3.1)	4.57 (2.02)	3.90 (2.8)	0.08
Time to endoscopy (hours)	21.3 (7.4)	12.2 (11.5)	10.4 (10.8)	7.3 (10.6)	12.7 (10)	<0.001
Outcome (survived)	109 (90.1)	106 (90.6)	79 (90.8)	107 (97.3)	110 (94.8)	0.15

*p-value is significant for this year

Results

A total of 698 patients were admitted with UGI bleed between 2004 and 2008; of these, 593 had acute UGI bleed fulfilling the criteria for BCU admission; 105 patients had low risk bleeding and were excluded. Of the 593 patients studied, 132 belonged to pre-BCU group and 461 patients were admitted in BCU. Bleeding care pathway was terminated early in 11 patients in the pre-BCU group and 31 patients in BCU group; two patients underwent surgical intervention for bleeding gastric ulcer despite endoscopic intervention twice; four had angio-embolization for duodenal ulcer, two were shifted to cardiac care unit (CCU) and one to ICU, and two had TIPSS in pre-BCU group; similarly, in the BCU group, 6 underwent surgery for gastric and/or duodenal ulcer, 12 had angio-embolization for duodenal ulcer, were shifted to CCU, and 4 needed mechanical ventilation in ICU while 4 had TIPSS for uncontrollable bleeding after endoscopic band ligation/sclerotherapy twice (Fig. 1).

After excluding patients in whom BCP was terminated early, there were 121 patients in pre-BCU group and 430 in the BCU group for the final analysis. There were 324 (58.8%) patients with variceal and 191 (34.6%) with non-variceal bleed; while 27 (4.9%) had both variceal and non-variceal source of bleed and in 9 (1.6%) patients the source was not identified after gastroscopy and colonoscopy. The distribution of demographics, such as age, gender, and co-morbid condition, number of patients requiring transfusion, and number of blood products transfused were similar in the two groups (Table 2). The severity of liver disease based on the Child Turcotte Pugh (CTP) score was comparable in the two groups; similarly, the severity of non-variceal bleed related findings were also comparable in pre-BCU and BCU era based on all patient refined—diagnosis related groups (APR—DRG) classification system [12, 17, 18]. There was no difference in the use of octreotide and terlipressin in the two groups as reported by Abid et al. [14] from our centre during the same period. Eight (6.6%) patients were receiving NSAIDs or aspirin in pre-BCU group as compared to 24 (6%) in BCU group.

The number of patients with upper GI bleed due to esophageal varices was higher in the BCU period (262 [60.9%] vs. pre-BCU 62 [51.2%]; p=0.005). Among patients with non-variceal bleed, 47 (38.8%) belonged to pre-BCU group; of these 22 (46.8%) had bleeding from gastric ulcer/erosions, 16 (35%) had duodenal ulcer, 6 (12.7%) had both gastric and duodenal ulcer, 2 (4.2%) had gastric cancer and one (2.1%) esophageal cancer. There were 144 (33.5%) patients in BCU period with non-variceal bleed; 71 (49.3%) patients had gastric ulcer/erosions, 53 (36.8%) had duodenal ulcer, 17 (11.8%) had both gastric and duodenal ulcers, 2 (1.3%) had Mallory Weiss tear and one (0.6%) had a gastric cancer.

Standard endoscopic interventions were used in our institute for variceal and non-variceal bleeding according to the guidelines [13–15]. Among the pre-BCU group, EBL was performed for esophageal varices in 58/62 patients, and four patients had endoscopic sclerotherapy (EST) with ethanolamine; dual endoscopic therapy (injection adrenaline+argon plasma coagulation) was used in 44/47 for non-variceal bleeding. In cases of rebleed, EST with EBL was performed in four patients with variceal bleed, and repeat dual therapy was performed in three patients with non-variceal bleed. In the BCU group, EBL was done in 250/262 patients with varices, and 12 had had EST+EBL as first line treatment; 143/144 patients with non-variceal bleed underwent dual endoscopic treatment, one patient with gastric cancer was managed conservatively. In cases of rebleed, repeat EST with EBL was done in 15 patients for esophageal varices; dual therapy for rebleed was repeated in eight patients with non-variceal bleed. There was no

Table 4 Comparison of overall outcome variables in pre-BCU and BCU period

Variables	Pre-BCU; n=121	BCU; n=430	p-value
Time between admission and endoscopy (hours)	21.3 (7.4)	9.42 (9.9)	<0.001
BCU length of stay (days)	2.41 (1.4)	1.93 (1.3)	<0.001
Length of hospital stay (days)	4 (2.08)	4.13 (2.62)	0.58
Survival (n [%])	109 (90.1)	402 (93.5)	0.20

Data are as mean (SD)

difference between the type of interventions and number of patients with rebleed among the pre-BCU and BCU group.

All the outcome variables assessed year-wise in pre-BCU and BCU patients are shown in Table 3. The mean (SD) time from admission to EGD improved after implementation of BCU and pathways from 21.3 (7.4) to 9.42 (9.9) hours (p-value <0.001; Table 4). We found a cumulative 4 years BCU stay improvement (BCU 1.93 [1.32] days vs. pre-BCU (2.41 [1.4] days); $p<0.001$). There was an improvement in the mean length of BCU stay (2.38 [1.3] days in 2005 and 1.51 [0.87] days in 2008) as compared to pre-BCU (2.41 [1.4] days in 2004) after BCPs were implemented ($p<0.001$). There was no difference in total length of hospital admission. There was no difference in survival of patients admitted with upper GI bleed in pre-BCU and BCU period.

Discussion

The implementation of BCU and BCP was successful in reducing time to endoscopy from admission. We were unable to achieve reduction in length of stay in BCU in the first year, but achieved this gradually over the next 3 years. However, we were unable to achieve improvement in total length of hospital stay and survival in patients with upper GI bleed.

Pathways propose an idea that transforming the care of all patients in the same manner may impact the outcome. The pathways are used in patient care with a varied success in different disease states [19, 20]. In clinical practice, pathways were used initially in the management of patients in coronary care units. The role of BCPs in management of GI bleed is insufficient. There are a few studies with limited success in management of upper GI bleed based on BCP, particularly non-variceal reported from developed countries [10, 21]; similar data are not available from developing countries.

Pfau et al. [20] did not demonstrate any improvement in the time to endoscopy; we achieved this success mainly by changing the practice of performing endoscopy within 24 h of admission. While some studies [10] have been able to demonstrate a reduction in total length of stay in hospital, others were unable to do so. Similarly, survival improvement has not been reported in any of the reports, except in one report which demonstrated a trend of improved survival. This study reported a mortality reduction to 7.5% with better monitoring. At our center, survival was over 90% in the pre-BCU and BCU data; similar results have been reported in other and our previous studies [10, 22, 23]. However, a trend of improvement in survival was observed in BCU data of 2007 up to 97%. We believe that the difference in survival was not significant because the survival was already high and the sample size needed for demonstrating the difference in outcome was not adequate.

Our report has achieved some important targets including reduction in time to endoscopy from admission and length of stay in BCU in subsequent years. Achievement of a single outcome in a pathway can be translated into significant impact in the clinical practice. We have achieved success in two outcomes which can be easily translated into reduction in the cost of management by reducing the time to endoscopy and ultimately reducing the length of stay in BCU. Pfau et al. [21] achieved cost-saving by reducing the use of IV H_2-receptor antagonists and routine chest radiographs, though they were unable to demonstrate reduction in time to endoscopy and hospital stay as they have only 1 year data.

One of the problems with BCPs is that they have not been tested in scientific or controlled settings to monitor the improvement in outcomes, such as length of stay and duration of a procedure [3]. Little research has been done on the efficacy of the BCP in an individual patient. One reason is that at any one medical center, "pathway" care cannot be compared with "usual" care because of contamination from the pathway intervention. Despite all these limitations, the pathways are being used to assess the improvement in quality of healthcare services.

We found that BCP implementation in UGI bleeding management was useful if practiced over longer time period.

There were few limitations of our study. First, the data in the control group was retrospective and we did not simultaneously compare the two groups. Second, as the survival was very high at ~ 90%, we were unable to achieve further improvement in it; further larger sample size may show significant improvement in survival. Third, two groups were matched for age and gender, but could not be matched for the cause of bleeding as it was a retrospective data.

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Potential competing interests None.

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