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Outcomes of a PBM-Aligned Single-Unit Platelet Transfusion Policy in Severe UGI Bleeding

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YCT and TSC (study design, interpretation of data, data analysis, and manuscript drafting). YSH, YCC, CJL, CFC, YTC, PYC, KCT, and JRY contributed to the study design and data interpretation. All authors contributed to the manuscript writing and approved the final manuscript.

1. Abstract

1.1. Introduction

Platelet transfusion practices in patients with upper gastrointestinal (UGI) bleeding have traditionally varied, with limited consensus on optimal dosing or thresholds especially for severe cases. Our institution implemented a restrictive, single-unit platelet transfusion policy as part of a broader patient blood management (PBM) initiative.

1.2. Aim

This study aimed to assess whether the new policy could reduce unnecessary transfusions while preserving patient safety and clinical outcomes.

1.3. Methods

A retrospective cohort study was conducted involving patients with severe UGI bleeding during two study periods: pre-policy (October 2017–September 2018, n = 105) and post-policy (October 2020–September 2021, n = 75). Transfusion metrics—including platelet, red blood cell (RBC), and fresh frozen plasma (FFP) usage-were evaluated alongside clinical outcomes such as length of stay, hemodynamic stability, and key laboratory parameters. The post-policy interval coincided with intensified institutional PBM promotion, enabling us to assess whether PBM initiatives resulted in worse outcomes of patients.

1.4. Results

Significant reductions in platelet transfusion volume, frequency, and per-event dosing were observed during the post-policy period (all $p < 0.05$). Decreases in RBC and FFP utilization were also noted, although not all reached statistical significance. Together, these ongoing decreases indicate that transfusion practices have significantly changed, probably due to both the single-unit policy and stronger PBM advocacy efforts. Importantly, no deterioration in clinical outcomes was detected. Length of hospital stay remained comparable between the two periods ($p > 0.2$), and no increase in adverse laboratory or hemodynamic indicators (e.g., haemoglobin < 7 g/dL, hypotension) was observed. A reduction in haemoglobin testing frequency further indicated maintained clinical stability following the practice change.

1.5. Conclusion

The implementation of a single-unit platelet transfusion policy, reinforced by robust PBM promotion, effectively modified clinical transfusion behaviour and reduced overall blood product utilization without compromising patient safety. These findings underscore the value of coordinated PBM initiatives in guiding more

judicious transfusion practices and support the continued integration of PBM principles into the management of UGI bleeding.

2. Introduction

Intractable gastrointestinal (GI) haemorrhage refers to bleeding in the digestive tract that continues or returns, even after medical, endoscopic, or surgical treatment. This condition frequently occurs due to variceal rupture or severe peptic ulcers. It entails major blood loss and high morbidity/mortality, frequently compounded by cirrhosis, portal hypertension, and coagulopathy, and thus requires multidisciplinary care [1-3]. Supplement with blood components including packaged red blood cells, fresh frozen plasma, and platelets sometimes becomes the last procedure to maintain or improve their condition conservatively.

Blood transfusion is a critical intervention in managing severe GI bleeding. Evidence increasingly supports a restrictive red blood cell (RBC) transfusion strategy, targeting hemoglobin levels between 7-8 g/dL, as it has been associated with lower rebleeding rates, reduced mortality, and fewer complications compared to more liberal transfusion strategies [4-6]. The restrictive approach also decreases the risk of transfusion-related complications, such as transfusion-associated circulatory overload (TACO) and transfusion-related acute lung injury (TRALI), which can adversely affect critically ill patients [7,8]. In addition, platelet transfusions are typically reserved for cases where platelet counts fall below 50×109/L, as their role in GI bleeding management is less defined.

In cases of acute UGI bleeding, current guidelines-such as those from AABB and BSG-primarily focus on red blood cell transfusion thresholds while offering limited guidance on platelet transfusion for critically ill patients [9]. Notably, large UGI bleeding trials often exclude hemodynamically unstable patients, leaving an evidence gap for supporting vigorous platelet transfusion in intractable GI bleeding patients. Building on trauma/obstetric success, massive transfusion protocol (MTP)-style care has been studied in nontraumatic haemorrhage-including intractable GI bleeding—with a 2019 meta-analysis showing improved survival after MTP implementation [10]. Moreover, a Korean study demonstrated successful application of MTP principles specifically to GI bleeding scenarios. Parallel to this, Australia's adoption of a single-unit transfusion policy reflects broader PBM efforts endorsed by WHO, aiming to optimize clinical efficacy while conserving resources [4-6]. Based on these developments, our study investigates the impact of a restrictive single-unit platelet transfusion policy in patients with intractable UGI bleeding. We compared clinical outcomes before and after policy implementation to determine if such stringent stewardship could maintain patient safety and effectiveness while significantly reducing platelet utilization.

3. Methods

3.1. Study Design and Methods

This retrospective study analysed data from the Chang Gung Medical Research Database (CGRD), focusing on patients at the Linkou Chang Gung Memorial Hospital who received platelet transfusions for gastrointestinal bleeding. Two periods were compared: pre-policy (Oct 2017–Sep 2018) and post-policy (Oct 2020–Sep 2021), following implementation of a hospital-wide single-unit platelet transfusion policy. The study assessed its clinical impact on patients with confirmed bleeding, particularly from gastric ulcers or oesophageal varices.

3.2. Study Population

Patients with confirmed gastrointestinal bleeding through endoscopic examination and receiving platelet transfusions during the study period were included. Key demographic data such as age, gender, comorbidities, and clinical outcomes were recorded and analysed. Primary outcomes of interest included the number of transfused platelet units, mortality rate, days to death, length of hospital stay, and the incidence of vital sign abnormalities such as blood pressure (BP < 90 mmHg) and oxygen saturation (SpO2 < 95%). Laboratory data, including haemoglobin levels (Hb < 7 g/dL or Hb < 8 g/dL), were also evaluated.

3.3. Statistical Analysis

Continuous variables were expressed as mean ± standard deviation (SD) and compared between the two groups using a two-sample t-test. A p-value of less than 0.05 was considered statistically significant. All statistical analyses were performed using SAS version 9.4.

4. Results

4.1. Baseline Characteristics Support Outcome Evaluation Across Two Policy Periods

A total of 180 patients with UGI bleeding were included: 105 in the pre-policy period (Oct 2017–Sep 2018) and 75 in the post-policy period (Oct 2020–Sep 2021). The cohorts were demographically comparable. Mean age was 64 ± 17 and 64 ± 18 years, respectively; males comprised the majority in both groups (64.8% vs. 76.0%). Comorbidities were generally balanced, with cancer being most common (9.5% vs. 16.0%), followed by other systemic diseases (9.5% vs. 10.7%). No significant differences were observed in liver, cardiac, renal, or cerebrovascular conditions. This demographic equivalence supports attributing outcome differences to the transfusion policy rather than baseline variation (Table 1).

Table 1: Baseline Demographic and Clinical Characteristics of Patients.

This table summarizes the baseline demographic and clinical characteristics of patients admitted during two distinct observation periods: October 2017 to September 2018 and October 2020 to September 2021. Variables include total number of patients, gender distribution, mean age with standard deviation, and the presence of major comorbid conditions such as cancers, cerebrovascular diseases, cardiac diseases, liver diseases, renal diseases, and other chronic conditions. Values are presented as counts or mean ± standard deviation where appropriate.

Observation Period	201710-201809	202010-202109
Patients	105	75
Gender (Male)	68	57
Age	64±17	64±18
Co-mobilities		
Cancers	10	12
Cerebral vascular diseases	3	1
Cardiac diseases	2	2
Liver diseases	3	2
Renal diseases	0	1
Other diseases	10	8

4.2. No Hospital Stay Adjustments Following Transfusion Policy Implementation

The length of hospital stay was compared between pre-policy (2017–2018) and post-policy (2020–2021) periods, stratified by patient outcomes (survived vs. deceased). As shown in Figure 1, no statistically significant difference in admission duration was observed between the two periods overall. Among surviving patients (n = 69 pre-policy, n = 46 post-policy), the mean length of stay was 12.89 ± 11.77 days before the policy and 11.88 ± 8.44 days after implementation (p = 0.292), indicating a small, non-significant reduction. In the deceased group (n = 36 pre-policy, n = 29 post-policy), the mean stay decreased slightly from 14.47 ± 10.81 to 13.48 ± 12.66 days (p = 0.368). These findings suggest that single-unit platelet transfusion did not prolong hospitalization. While not statistically significant, trends indicate more efficient recovery among survivors and slightly extended support in terminal cases post-policy.

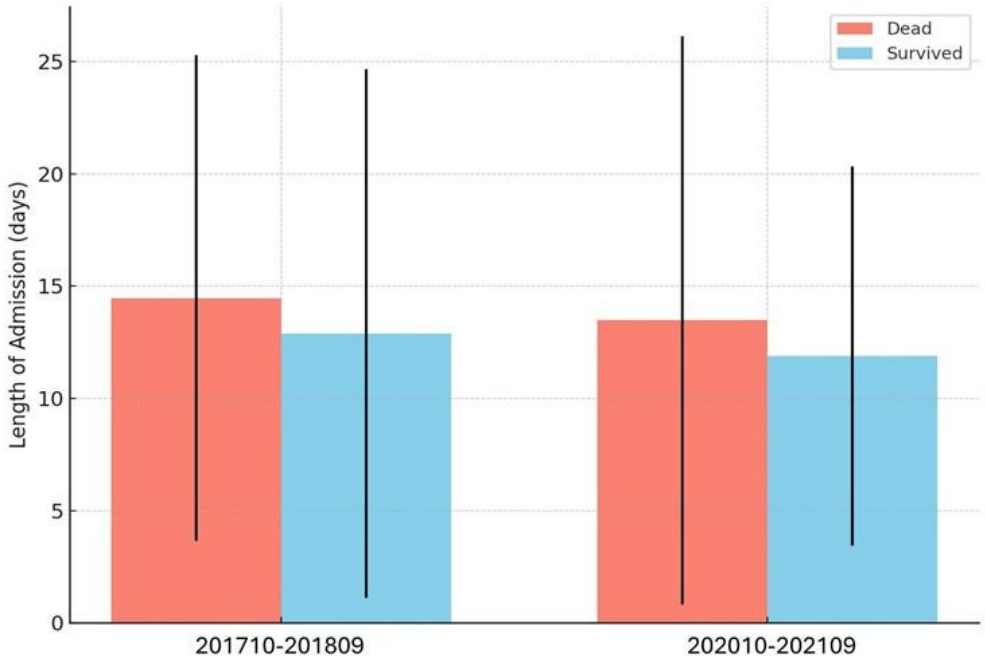

Figure 1: Comparison of Length of Hospital Admission by Outcome.

For deceased patients, the average admission duration decreased from 14.47 ± 10.81 to 13.48 ± 12.66 days ($p = 0.368$). For surviving patients, the duration decreased from 12.89 ± 11.77 to 11.88 ± 8.44 days ($p = 0.292$).

4.3. Significantly Lower Transfusion Volume and Frequency in the Post-Policy Period

Platelet transfusion usage was analysed in greater detail by stratifying patients based on clinical outcome (deceased vs. survived) and observation period (pre-policy vs. post-policy), as shown in Figure 2. In Figure 2a, which illustrates the total units of platelet transfused, deceased patients (n = 36 pre-policy, n = 29 post-policy) showed a significant reduction from 5.49 ± 4.94 units to 3.24 ± 3.90 units (p = 0.0245). Among surviving patients (n = 69 pre-policy, n = 46 post-policy), total platelet use also declined from 2.86 ± 4.12 to 1.82 ± 1.06 (p = 0.027). Figure 2b presents the total number of platelet transfusion events. In deceased patients, the number of events decreased from 5.00 ± 4.58 to 3.24 ± 3.90 (p = 0.052), while in survivors, transfusion frequency fell from 2.67 ± 3.70 to 1.82 ± 1.06 (p = 0.0404). In Figure 2c, showing the average number of units per transfusion event, a statistically significant reduction was observed in both groups. Among deceased patients, the value decreased from 1.12 ± 0.24 to 1.00 (p = 0.003), and among survivors, from 1.03 ± 0.14 to 1.00 (p = 0.019), indicating strong compliance with the single-unit transfusion policy. Implementation of the single-unit platelet transfusion policy resulted in a significant and consistent reduction in both volume and frequency of use across patient groups. The effect was most pronounced in surviving patients, with both groups showing full adherence as average doses converged to exactly 1.00 per transfusion event post-policy. These findings suggest successful implementation without compromising care.

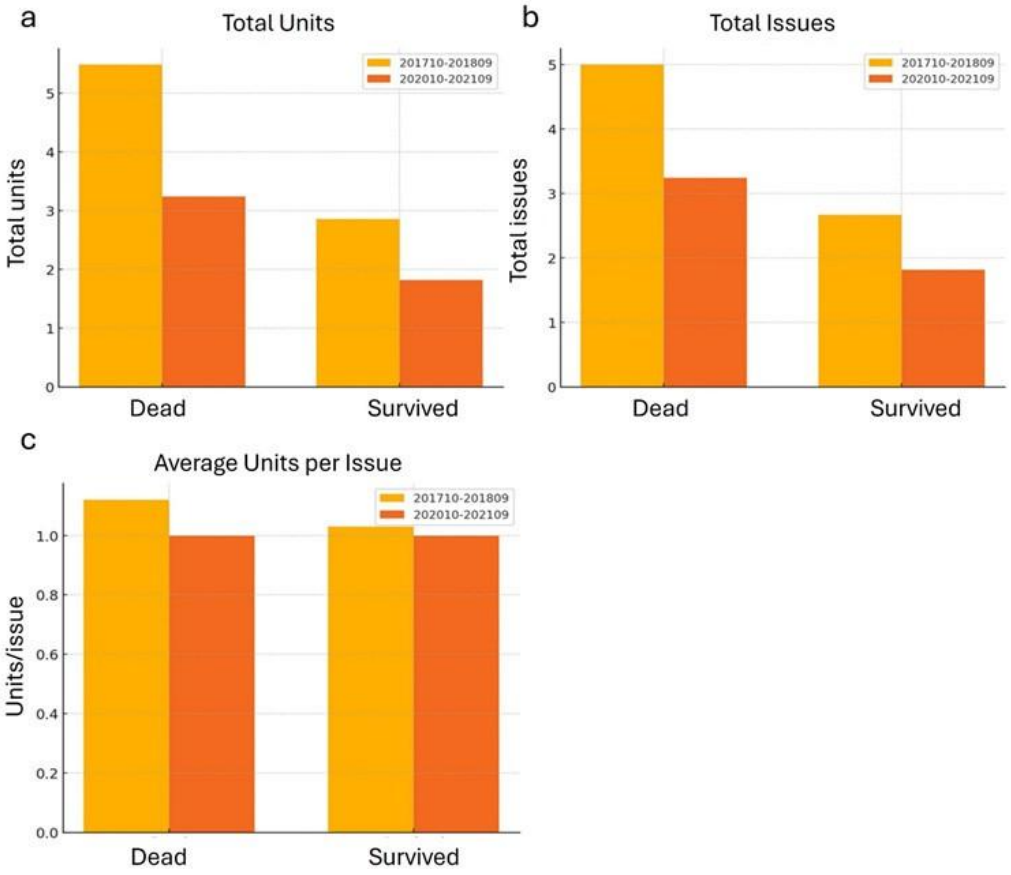

Figure 2: Comparison of Platelet Transfusion Metrics Between Deceased and Surviving Patients.
(a) Total platelet units transfused decreased significantly in both deceased (5.49 ± 4.94 to 3.24 ± 3.90, p = 0.0245) and surviving patients (2.86 ± 4.12 to 1.82 ± 1.06, p = 0.027). (b) Transfusion events declined in deceased (5.00 ± 4.58 to 3.24 ± 3.90, p = 0.052) and survivors (2.67 ± 3.70 to 1.82 ± 1.06, p = 0.0404). (c) Platelet units per transfusion decreased slightly in both groups (deceased: 1.12 ± 0.24 to 1.00 [0], p = 0.003; survivors: 1.03 ± 0.14 to 1.00 [0], p = 0.019). Values are mean ± SD or median (IQR). One-tailed tests compared periods within each subgroup.

4.4. No Change in RBC Transfusion Patterns After Restricting Platelet Transfusions

RBC transfusion metrics were examined across the two observation periods, stratified by survival outcome, as depicted in Figure 3. Figure 3a shows the total number of RBC units administered per patient. Among deceased individuals (n = 35 pre-policy, n = 26 post-policy), transfused volume declined from 20.11 ± 20.35 units before the policy to 13.62 ± 12.76 units after implementation, indicating a downward trend that approached statistical significance (p = 0.062). In contrast, among survivors (n = 62 pre-policy, n = 40 post-policy), the average volume changed only slightly from 8.75 ± 9.29 to 8.38 ± 6.55 (p = 0.396). In Figure 3b, which presents the frequency of RBC transfusion events, a similar trend was noted. The number of transfusion episodes among deceased patients decreased from 9.20 ± 8.83 to 6.45 ± 5.83 (p = 0.070), while the change among survivors—from 4.12 ± 3.42 to 4.27 ± 3.57—was minimal and not statistically significant (p = 0.410). Figure 3c illustrates the average number of RBC units per transfusion event. Among deceased patients, a slight increase was observed from 2.11 ± 0.49 to 2.27 ± 1.09 (p = 0.232). Survivors also showed a

small increase from 2.02 ± 0.59 to 2.19 ± 0.97 (p = 0.140), with neither difference reaching significance. In conclusion, RBC transfusion showed a modest decline among deceased patients but remained stable in survivors, suggesting minimal impact from the restrictive policy. This contrasts with the more pronounced reductions observed in platelet use.

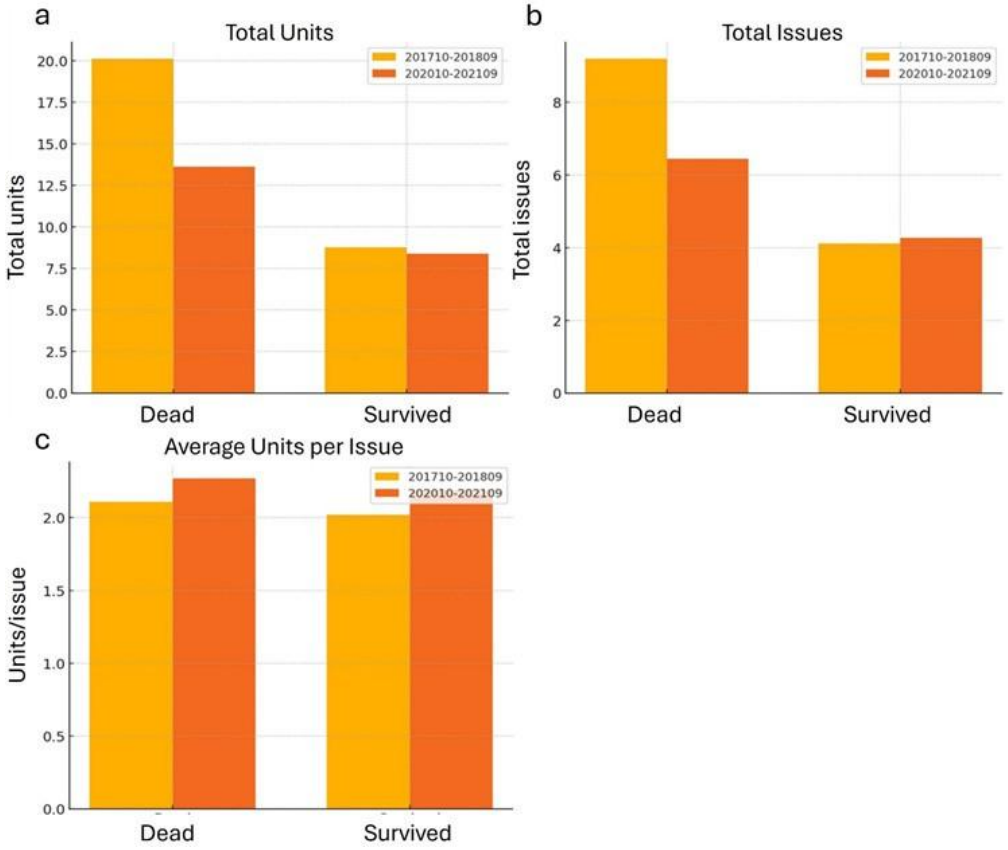

Figure 3: Comparison of RBC Transfusion Metrics Between Deceased and Surviving Patients.
(a) Total RBC units transfused trended lower in deceased patients (20.11 ± 20.35 to 13.62 ± 12.76, *p* = 0.062) but remained similar in survivors (8.75 ± 9.29 vs. 8.38 ± 6.55, *p* = 0.396). (b) Transfusion events per patient decreased in deceased (9.20 ± 8.83 vs. 6.45 ± 5.83, *p* = 0.070) and were stable in survivors (4.12 ± 3.42 vs. 4.27 ± 3.57, *p* = 0.410). (c) RBC units per transfusion increased slightly but non-significantly in both groups (deceased: 2.11 ± 0.49 to 2.27 ± 1.09, *p* = 0.232; survivors: 2.02 ± 0.59 to 2.19 ± 0.97, *p* = 0.140). Values are mean ± SD. One-tailed tests compared periods within each subgroup.

4.5. No Significant Reduction in Plasma Transfusion Volume and Frequency in the Post-Policy Period

Utilization of FFP was examined across both time periods, stratified by survival outcome. The results are presented in Figure 4, with separate panels depicting total volume, transfusion frequency, and per-event dosing. In Figure 4a, the cumulative number of FFP units administered per patient showed a declining trend following implementation of the restrictive transfusion policy. Among deceased patients (n = 31 pre-policy, n = 23 post-policy), the mean transfused volume decreased from 27.29 ± 37.83 units to 15.00 ± 14.54 units (p = 0.0531). A similar decrease was observed among survivors (n = 39 pre-policy, n = 25 post-policy), with average units declining from 10.18 ± 9.30 to 7.35 ± 6.31 (p = 0.067). Figure 4b shows the total number of FFP transfusion events. In deceased patients, this number dropped from 9.94 ± 11.05 to 6.48 ± 6.05 (p = 0.074), while among survivors, transfusion events declined from 4.36 ± 4.37 to 3.12 ± 2.68 (p = 0.059). Although not statistically significant, the reductions in both groups were directionally consistent and suggest clinical adaptation to the new policy. Figure 4c depicts the average volume of FFP per transfusion episode. A statistically significant reduction was noted in the deceased group, from 2.64 ± 0.89 to 2.27 ± 0.58 (p = 0.035), indicating a shift toward smaller, more controlled doses. Among survivors, the change was minimal from 2.30 ± 0.58 to 2.38 ± 0.64 (p = 0.299)-and not statistically meaningful. In conclusion, although not all differences were statistically significant, the consistent reductions in FFP volume and frequency-especially among deceased patients-suggest improved plasma stewardship following policy implementation. These findings support extending restrictive transfusion strategies beyond platelets to include FFP.

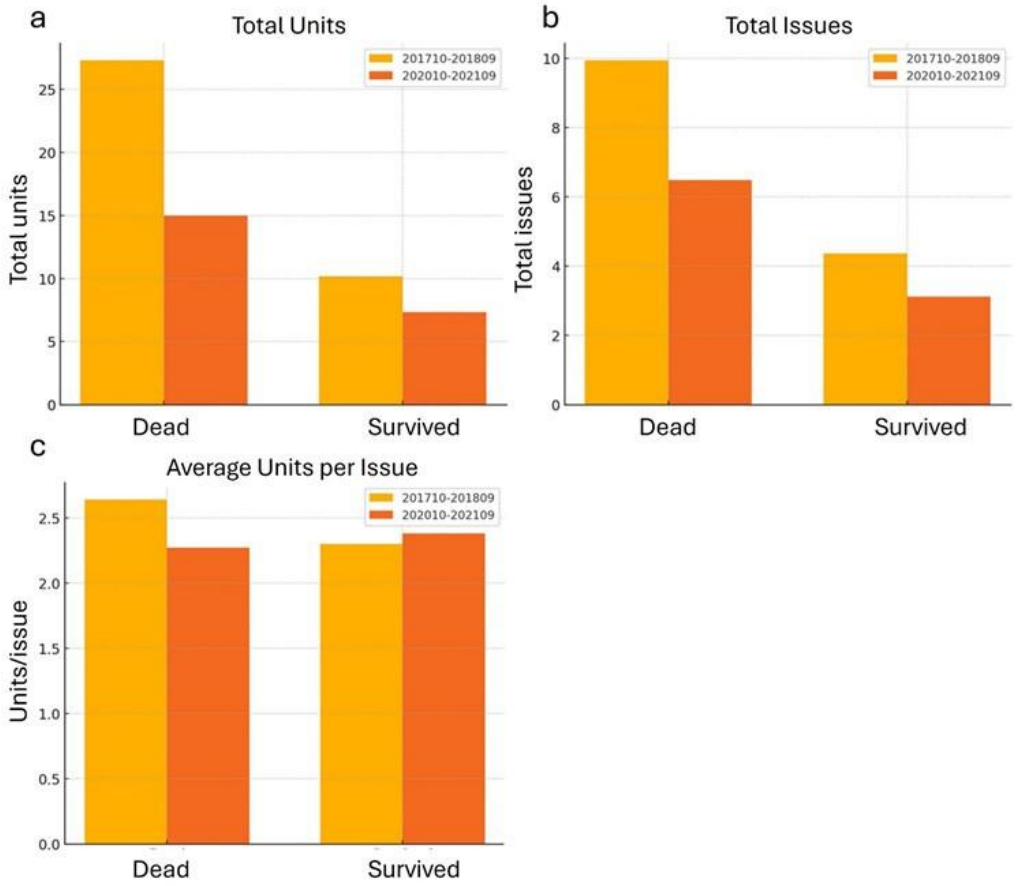

Figure 4: Comparison of FFP Transfusion Metrics Between Dead and Survived Patients.
(a) Total FFP units transfused decreased in deceased patients (27.29 ± 37.83 to 15.00 ± 14.54, $p = 0.0531$) and survivors (10.18 ± 9.30 to 7.35 ± 6.31, $p = 0.067$). (b) Transfusion events declined in deceased (9.94 ± 11.05 to 6.48 ± 6.05, $p = 0.074$) and survivors (4.36 ± 4.37 to 3.12 ± 2.68, $p = 0.059$). (c) FFP units per transfusion decreased significantly in deceased patients (2.64 ± 0.89 to 2.27 ± 0.58, $p = 0.035$) but remained stable in survivors (2.30 ± 0.58 to 2.38 ± 0.64, $p = 0.299$). Values are mean ± SD. One-tailed tests compared periods within each subgroup.

4.6. Improved Systolic Blood Pressure (SBP) and Peripheral Capillary Oxygen Saturation (SpO_2) in the Post-Policy Period

To evaluate the physiologic effects of transfusion policy changes, trends in peripheral SpO_2 and SBP were compared across study periods. Figure 5a illustrates the proportion of SpO_2 measurements below 95% per admission. Among patients with oxygen data available (n = 95 pre-policy, n = 70 post-policy), the mean proportion of desaturation episodes significantly declined from 0.18 ± 0.24 to 0.11 ± 0.17 (p = 0.0227), suggesting improved respiratory status or timelier clinical intervention under the restricted transfusion protocol. Monitoring frequency remained similar across groups (371.1 vs. 338.0 measurements per admission). Figure 5b presents the rate of SBP < 90 mmHg per admission. In patients with recorded SBP values (n = 105 pre-policy, n = 75 post-policy), no significant difference was observed between periods (0.06 ± 0.14 vs. 0.07 ± 0.16, p = 0.189). The number of SBP readings per admission was also comparable (121.7 vs. 138.1), indicating stable monitoring practices. In summary, the restrictive transfusion policy was not associated with deterioration in vital signs. Instead, a modest improvement in oxygenation and no increase in hypotensive episodes were observed, supporting the safety of the strategy.

4.7. Fewer Haemoglobin (Hb) Checks for Anaemia Exacerbation After Restricting Platelet Transfusions

Hb monitoring data were analysed to assess changes in anaemia burden and clinical surveillance across the two observation periods. In Figure 6a, which displays the average number of Hb measurements per admission, a substantial reduction in testing frequency was observed. Among patients with available Hb data (n = 105 pre-policy, n = 75 post-policy), the average number of measurements decreased from 45.27 ± 64.23 to 21.14 ± 41.78. This reduction may suggest that patients in the post-policy period had more stable haemoglobin profiles and required less intensive monitoring. Figure 6b illustrates the rate of admissions with Hb < 7 g/dL, which remained unchanged at 0.13 in both periods (p = 0.418), indicating no increase in critical anaemia events despite reduced testing frequency. In Figure 6c, the rate of Hb < 8 g/dL showed a slight, non-significant rise from 0.29 ± 0.24 to 0.33 ± 0.26 (p = 0.133), further supporting the overall stability in anaemia severity. Taken together, the decline in haemoglobin testing likely reflects improved patient stability rather than clinical oversight, consistent with a resource-conscious approach under the revised transfusion strategy.

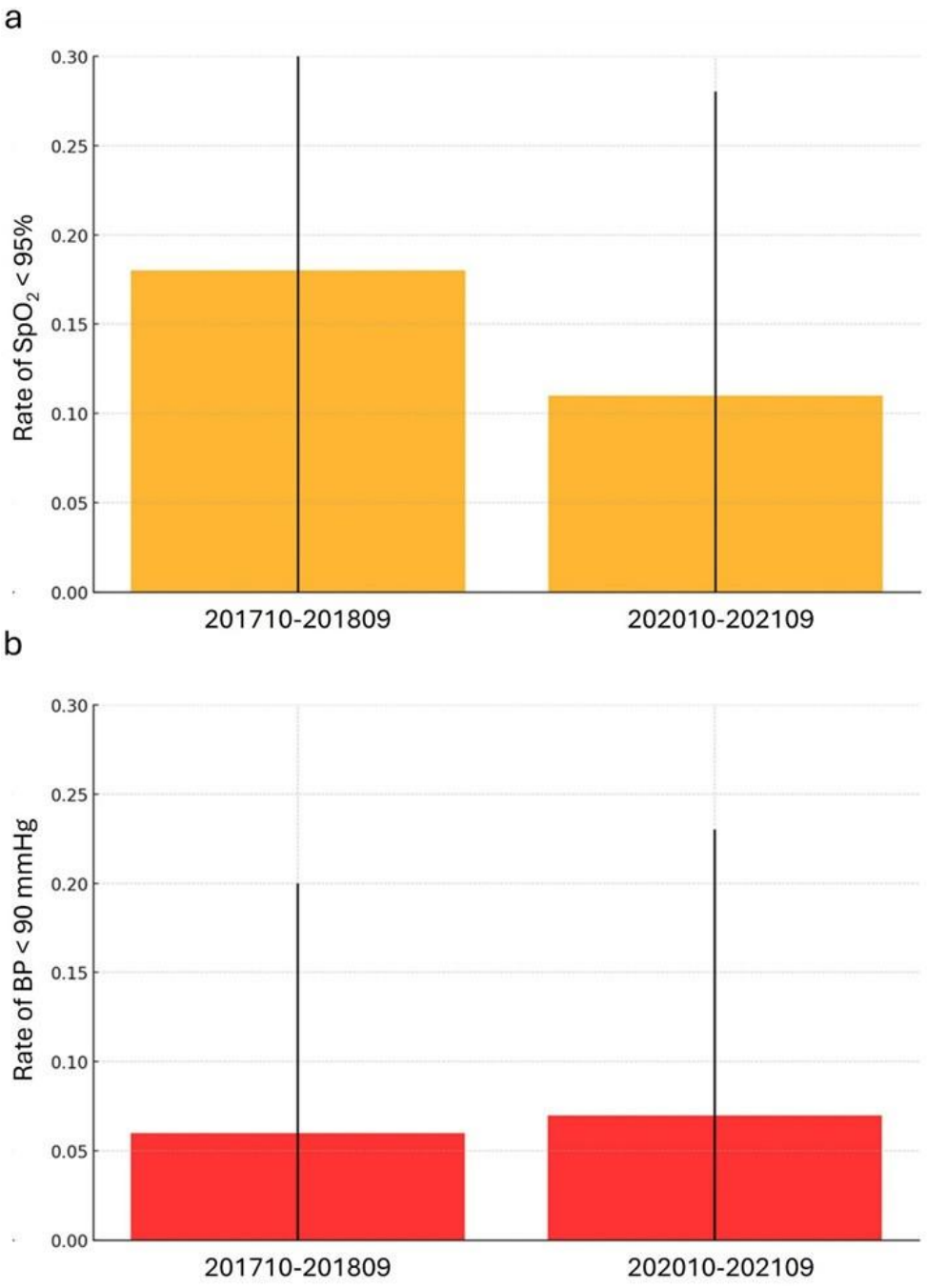

Figure 5: Analysis of SpO2 and BP Monitoring Trends Across Two Time Periods.
(a) Percentage of SpO_2 readings < 95% decreased significantly from 0.18 ± 0.24 to 0.11 ± 0.17 (p = 0.0227). (b) Proportion of systolic blood pressure readings < 90 mmHg showed no significant change (0.06 ± 0.14 vs. 0.07 ± 0.16, p = 0.189). Values are mean ± SD. One-tailed tests compared periods.

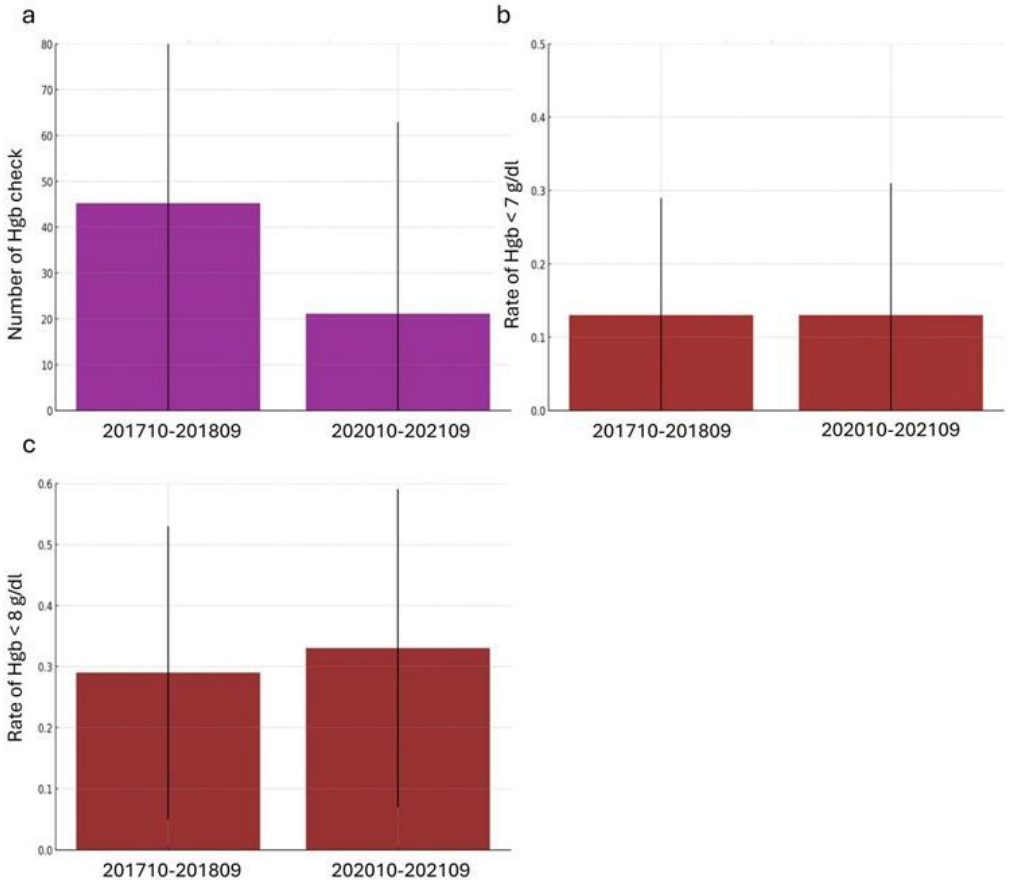

Figure 6: Comparison of Hemoglobin Monitoring and Low Hb Ratios between Two Periods.

(a) Average number of Hb tests per admission decreased from 45.27 ± 64.23 to 21.14 ± 41.78. (b) Proportion of Hb < 7 g/dL remained unchanged (0.13 ± 0.16 vs. 0.13 ± 0.18, $p = 0.418$). (c) Proportion of Hb < 8 g/dL showed a non-significant increase (0.29 ± 0.24 vs. 0.33 ± 0.26, $p = 0.133$). Values are mean ± SD. One-tailed tests compared periods.

5. Discussion

Originally designed for trauma and obstetric haemorrhage, MTPs now inform care for other critical bleeds. Evidence supports MTP-style approaches in nontraumatic upper gastrointestinal bleeding, where rapid haemostasis and balanced component transfusion improve outcomes [10, 11]. In our real-world cohort, a restrictive, single-unit strategy adapted from MTP principles was feasible and safe, reducing platelet and plasma use without compromising outcomes. Consistent with safety, the length of hospital stay remained stable in both deceased and surviving subgroups across the pre- and post-policy periods (Figure 1). The implementation of a restrictive transfusion protocol did not result in prolonged hospitalization for either group. Among survivors, the mean duration of admission decreased slightly from 12.89 days to 11.88 days (p = 0.292). Similarly, in deceased patients, the average length of stay declined from 14.47 days to 13.48 days (p = 0.368), though neither difference was statistically significant. This finding supports the clinical safety of a conservative platelet transfusion strategy. Among survivors, modestly shorter hospital stays may reflect fewer transfusion-related complications or faster stabilization. In deceased patients, comparable durations suggest that limiting transfusions did not compromise care. Overall, the stable hospitalization length across groups (Figure 1) reinforces that reduced platelet use did not adversely impact recovery or end-of-life management in UGI bleeding.

The observed reduction in blood component utilization-including platelets, RBCs, and FFP-extends beyond the targeted single-unit platelet transfusion policy. During the study period, Taiwan intensified its PBM efforts, promoting individualized transfusion thresholds, single-unit protocols, and evidence-based blood product use. These initiatives were in response to Taiwan's historically high per-capita blood utilization rates-47.6 RBC units, 11.1 platelet units, and 26.8 FFP units per 1,000 population in 2015—values well above regional counterparts [12]. Although our intervention focused only on platelet transfusions, RBC and FFP usage also declined. Among deceased patients, mean RBC volume decreased (from 20.11 to 13.62 units; Figure 3), and FFP saw a similar decline (from 27.29 to 15.00 units; Figure 4), despite no formal restrictions on these components. Platelet transfusion likewise dropped significantly (Figure 2), highlighting the effectiveness of the single-unit policy across disciplines. These parallel reductions likely reflect systemwide adoption of PBM principles, subtly changing clinical behaviour even in the absence of direct mandates. Critically, this transformation occurred without increasing hospital length of stay or compromising vital signs or laboratory stability (Figure 1, 5, and 6), underlining the safety and feasibility of PBM-guided transfusion strategies in acute UGI bleeding situations.

Implementation of the single-unit platelet transfusion policy in patients with severe UGI bleeding did not adversely affect key

clinical outcomes or laboratory parameters. As shown in Figure 1, the length of hospital stay remained similar between the pre-policy and post-policy periods for both deceased (14.47 ± 10.81 vs. 13.48 ± 12.66 days, p = 0.368) and surviving patients (12.89 ± 11.77 vs. 11.88 ± 8.44 days, p = 0.292), suggesting that the restrictive policy did not prolong hospitalization. Furthermore, vital sign monitoring (Figure 5) revealed no increase in episodes of hypotension (BP < 90 mmHg) or oxygen desaturation (SpO_2 < 95%) after the policy. In fact, the frequency of SpO_2 < 95% decreased significantly in the post-policy group (0.18 ± 0.24 vs. 0.11 ± 0.17, p = 0.0227), indicating improved physiological stability or fewer hypoxic episodes during hospitalization. Laboratory indicators also demonstrated reassuring trends. As shown in Figure 6, haemoglobin (Hb) levels remained stable, with no significant increase in the proportion of patients with Hb < 7 g/dL (0.13 ± 0.16 vs. 0.13 ± 0.18, p = 0.418) or Hb < 8 g/dL (0.29 ± 0.24 vs. 0.33 ± 0.26, p = 0.133). Additionally, the frequency of Hb testing per patient decreased substantially (from 45.27 ± 64.23 to 21.14 ± 41.78), which may reflect greater clinical confidence and fewer bleeding complications in the post-policy era. Collectively, these findings suggest that restricting platelet transfusion in UGI bleeding patients did not compromise patient safety or hinder clinical recovery. On the contrary, the results highlight the potential for resource optimization without sacrificing quality of care.

This study demonstrates the feasibility and potential benefits of a restrictive platelet transfusion strategy in UGI bleeding. Following policy implementation, platelet use declined significantly in both volume and frequency (Figure 2), while key outcomes-including hospital stay (Figure 1), vital sign trends (Figure 5), and haemoglobin levels (Figure 6)-remained stable across survival groups. These findings challenge traditional liberal thresholds, highlighting that platelet transfusions, often driven by empiricism or procedural concern, may not improve outcomes and could increase risk or resource use. In non-invasive settings, a single-unit strategy may better balance safety with stewardship. Given the rising emphasis on Patient Blood Management (PBM)-particularly in Taiwan-transfusion practices warrant critical reassessment. While platelets remain essential in select cases, routine liberal use should be reconsidered. Clinical guidelines should incorporate evidence-based thresholds and individualized decision-making. Our results support broader evaluation and adoption of restrictive strategies within institutional and national PBM frameworks.

In managing uncontrolled UGI bleeding, there is a historical tendency to intensify platelet transfusions in hopes of achieving haemostatic control. However, our data demonstrate that a restrictive platelet transfusion approach-implemented as a single-unit policy-did not worsen patient outcomes in either mortality or length of stay (Figure 1). Laboratory indicators such as haemoglobin trends, oxygen saturation, and blood pressure remained stable across both periods (Figures 5,6), suggesting that hemodynamic compromise did not increase under the more conservative transfusion regimen. These findings align with PBM principles, which caution against empirical platelet transfusion based solely on guideline thresholds. Transfusion should be reserved for cases with severe thrombocytopenia or active bleeding due to platelet dysfunction, rather than used reflexively to control haemorrhage. Unwarranted transfusions may offer no benefit and risk volume overload, immunologic reactions, or paradoxical coagulopathy [13,14]. By avoiding routine "boosting" of platelet transfusions in uncontrollable UGI bleedings, especially in the absence of severe thrombocytopenia, clinicians may reduce harm while conserving resources. This study reinforces that restrictive strategies are not only safe but may better reflect a pathophysiology-driven transfusion model that modern PBM frameworks promote.

Although UGI bleeding can be life-threatening, our study provides objective evidence that a restrictive, single-unit platelet transfusion approach is safe even in the context of severe haemorrhage. After policy implementation, platelet use decreased significantly in both survivors and non-survivors (Figure 2), yet there were no corresponding adverse signals in key outcome metrics, including mortality, length of stay (Figure 1), hemodynamic, or oxygenation (Figure 5). Laboratory data further reinforce these findings. Haemoglobin levels remained stable, with no rise in the proportion of critically low values (<7 or <8 g/dL), despite a marked reduction in Hb testing (Figure 6), suggesting that clinical equipoise was maintained. Importantly, recent international evidence supports this approach. A randomized trial in hematologic malignancy patients (TOPPS) demonstrated that withholding prophylactic platelet transfusion (unless bleeding) was non-inferior and safe-highlighting that platelet deficiency alone is not always the primary driver of bleeding risk [15]. Guidelines advocate restrictive red cell transfusion to reduce mortality and rebleeding, underscoring the importance of conserving blood products in acute care. Consistent with this principle, our findings suggest that non-indicated platelet escalation provides no additional benefit and may introduce avoidable risks. A physiology-guided, threshold-based approach supports safe transfusion restraint, even in uncontrolled UGI bleeding.

5.1. Limitations

However, this study has limitations. Patients were not stratified by bleeding aetiology, detailed chart reviews were not performed, and adjunctive therapies were not analysed. These factors may influence transfusion needs and clinical outcomes and should be considered when interpreting our results.

6. Conclusion

According to Virchow's triad, thrombosis is driven by endothelial injury, altered blood flow, and hypercoagulability. While platelet transfusion aids haemostasis, our findings suggest it may be nonessential for effective bleeding control in severe UGI cases, especially when vasoconstriction fails. The restrictive policy did not worsen outcomes, highlighting that haemostasis often occurs via mechanisms beyond platelet support and reinforcing the need for evidence-based, individualized transfusion strategies.

7. Funding

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9. Ethics Statement

This study was performed in accordance with the Taiwan Blood Services Foundation and the Taiwan Society of Blood Transfusion guidelines. The Institutional Review Board of the CGMH approved this study (IRB No. 202200407B0) and waived the requirement for informed consent.

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