

A Study of the Clinical Utilization of Cryoprecipitate at King Abdulaziz University Hospital

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Abstract. Many guidelines for cryoprecipitate utilization have been published, yet there is little evidence that these guidelines are being followed. A retrospective study was conducted to assess the appropriateness of cryoprecipitate utilization, based on pre-implemented guidelines over a four years period at King Abdulaziz University Hospital. Eighty-five patients who received 705 units cryoprecipitate were included. Transfusion was assessed according to the predetermined appropriateness criteria. Cryoprecipitate was used inappropriately in 48.1% of cases. Transfusion was for the following appropriate indications: hypofibrinogenemia (n = 20), factor deficiency (n = 8), management of massive transfusion (n = 8), post-partum bleed and for correction of uremic bleeding. Most appropriate cryoprecipitate usage occurred when there was secondary hypofibrinogenemia with active bleeding (19.9%). Cryoprecipitate was misused in almost half of the patients in the study. The most common inappropriate medical indication was to correct uremic bleed, while the most common surgical indication was for correction of surgical bleeding in the absence of a specific factor deficiency (22.5%). Internal audit could help identify the pattern of misuse. Education among the medical community can help improve cryoprecipitate utilization.

Keywords: Cryoprecipitate, Transfusion, Guidelines and Coagulopathy.

Introduction

Cryoprecipitate is a concentrate of high molecular weight plasma proteins. It is prepared by slowly thawing fresh frozen plasma (FFP) at

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4°C to 6°C. These results in the formation of an insoluble precipitate that can be resuspended in about 10 to 15 mL of plasma to be stored at -18°C for up to a year. The concentrate contains factor VIII, von Willebrand factor (vWF), fibrinogen, factor XIII, fibronectin and platelet microparticles^[1]. Each concentrate prepared from a single donor unit of plasma contains 80 to 100 IU of factor VIII and vWF, 150 to 300 mg (4.4-8.8 µmol/L) of fibrinogen, and 40 to 60 IU of factor XIII^[1,6].

Methods

All patients who received cryoprecipitate transfusion over a four years' period at King Abdulaziz University Hospital (KAUH) in Jeddah, Saudi Arabia from January 2005 to December 2009 were included. Data were collected by reviewing of medical records, which included date of transfusion, product transfused, initial diagnosis, indications for blood product use and number of units transfused. Each transfusion episode was assessed to determine whether it satisfied the indications for transfusion based on the hospital guidelines. Corresponding laboratory tests were collected, including the prothrombin time (PT), activated partial thromboplastin time (APTT), platelet count, fibrinogen levels, and serum creatinine values. All data collected were de-identified and any paper records were securely kept in the primary investigator's office.

Statistical Methods

Results were presented as means or percentages. Confidence intervals for means were calculated as 1.96 times the standard error, and for percentages by the Blyth-Still-Casella method using StatXact.5 SPSS was used for tabular analyses.

Table 1. Indications for the use of cryoprecipitate at King Abdulaziz University Hospital.

1	Hypofibrinogenemia (fibrinogen).
2	von Willebrand's disease in the absence of intermediate purity Factor VIII, to control bleeding if DDAVP failed, or when its use is contraindicated and in preparation for surgery.
3	Post-partum hemorrhage.
4	Uremic bleeding to control life-threatening bleeding after failure of DDAVP and or anti-fibrinolytic agent.
5	Massive transfusion (> 10 RBC units in 24 h continued bleeding).

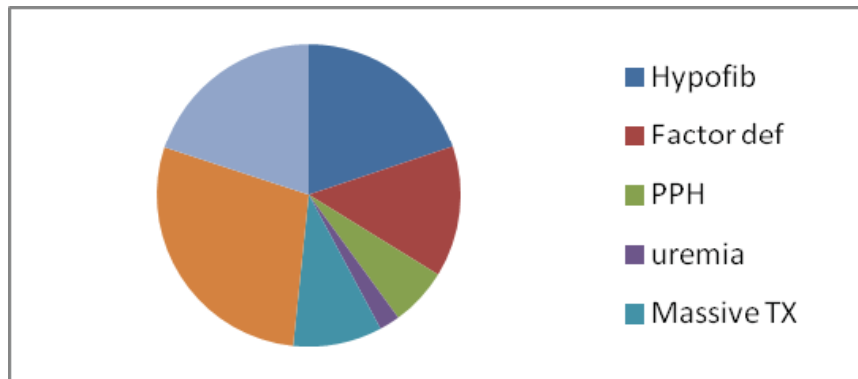


Fig. 1. Cryoprecipitate utilization at King Abdulaziz University.

Measures and Results

Patients mean age was 43.4 years (range 4-94 years). Male to female ratio was 1.3. In this audit, a high rate of inappropriate cryoprecipitate usage (48.1%) (Fig. 1) was identified. Cryoprecipitate was transfused for appropriate indications in forty-four (54.2%) patients. A total of three hundred sixty six units of cryoprecipitate concentrate were used for the following indications: acquired hypofibrinogenemia, specific factor deficiency (2 patients with Hemophilia A, 3 cases of von Willebrand's disease, vWD), one case of each; Factor XIII and Factor V deficiency, management of massive transfusion, post-partum bleeding and for correction of uremic bleeding. On the other hand, patients who received cryoprecipitate for inappropriate indications received in total three hundred thirty eight units. The average number of concentrate per transfusion episode was six bags. Most "inappropriate" cryoprecipitate usage was for the management of active surgical bleeding, with unmeasured coagulation tests (22% of total transfusions). While the most "appropriate" cryoprecipitate utilization was for the management of secondary hypofibrinogenemia with active bleeding (19.9% of total transfusions, which is equivalent to 140 units).

Hypofibrinogenemia

One hundred forty units of cryoprecipitate (19.9%) were transfused to twenty patients with acquired hypofibrinogenemia (Fig. 1). All patients exhibited evidence of coagulopathy (prolonged PT and PTT) with a mean fibrinogen level of 74.5 mg/dL (average 30-100 mg/dL). Causes of acquired hypofibrinogenemia are shown in Table 2. Six patients had hypofibrinogenemia secondary to hepatic coagulopathy received

cryoprecipitate (to control gastrointestinal tract hemorrhage, in preparation for ERCP and before attempting liver biopsy). Four female patients had postpartum hemorrhage, while the fifth had intra-operative bleeding during fibroid removal. Four cardiac surgery (CABAG) patients developed intra-operative bleeding, whereas four other patients with different medical conditions required cryoprecipitate transfusion. One patient had a large subdural hematoma and hypofibrinogenemia secondary to consumptive coagulopathy, and received cryoprecipitate pre-operatively. Cryoprecipitate transfusion corrected the fibrinogen level and controlled the bleeding episode in all patients.

Table 2. Causes of acquire hypofibrinogenemia at King Abdulaziz University Hospital.

Causes of Acquire Hypofibrinogenemia	Number of Patients
Hepatic coagulopathy	6
Cardiac procedures	4
Postpartum hemorrhage and intra-operative gynecological bleed	5
Others	4
Subdural hematoma	1

Causes of liver failure were liver cirrhosis hepatitis C and liver cirrhosis (two patients), sickle cell anemia with sickle hepatopathy (two patients 2), thalassemia major (one), unknown (one).

Cardiac procedures were coronary artery bypass

Other causes of acquired hypofibrinogenemia were DIC complicating malarial infection (one patient), SLE, rheumatoid arthritis (one), and unknown (one).

Congenital Factor Deficiency

Ninety-nine units of cryoprecipitate (14%) were transfused as a replacement for specific factor deficiency in six patients to control eight bleeding episodes (Table 3). Cryoprecipitate was given in the absence of specific factor concentrate. All patients had their bleeding stopped and required no further transfusion or surgical intervention.

Table 3. Cryoprecipitate used for specific factor deficiency at King Abdulaziz University.

Factor Deficiency	Number of Patients	Number of Episodes	Clinical Presentation
Hemophilia A	2	2	Acute hemarthrosis
von Willebrand's disease	3	5	Hematemesis, ruptured ovarian cyst, adenotonsillectomy
Factor XIII deficiency	1	1	Miscarriage
Factor V deficiency	1	1	Intra-peritoneal bleed

Post Partum Hemorrhage

Forty-four units of cryoprecipitate were transfused (6.2%) to six previously healthy pregnant women who developed post-partum hemorrhage. Two patients had abruption placenta, one had placenta previa, preeclampsia, retained product, and missed abortion. All patients showed evidence of a consumptive coagulopathy (prolonged PT, APTT and low platelets count); however, fibrinogen levels were not assessed. None of the patients fulfilled the criteria for DIC and none required massive transfusion. All six patients responded to cryoprecipitate with cessation of the bleeding except one patient who required recombinant Factor VII and ended up with hysterectomy.

Massive Transfusion

Sixty-seven (9.5%) units of cryoprecipitate were transfused to eight patients who received massive blood transfusion. All patients exhibited coagulopathy as evidenced by prolonged PT (mean, 31.3 seconds; range, 12-109 seconds) and PTT (mean, 77.3 seconds; range, 32-120 seconds). Thrombocytopenia was documented in four patients (mean platelets count 87.1; range, 32-200X10⁹/L). Fibrinogen level was not measured in all cases. Patient's characteristics were as follows: Two patients with aplastic anemia, one of which developed intracranial hemorrhage, while the other presented with an upper GIT bleeding. Two patients had postpartum hemorrhage, two patients with perforated duodenal ulcers, one patient developed intra-operative bleeding during laparoscopic cholecystectomy. One patient who was involved in a road traffic accident was presented with subdural hematoma. All patients had normalized their coagulation screen after receiving cryoprecipitate. Patients who had thrombocytopenia received platelets concentrate

Uremic Bleeding Syndrome

Two percents of cryoprecipitate were transfused to three patients with chronic renal failure (CRF) for acute bleeding episode after failure of tranexamic acid and synthetic vasopressin analog desmopressin (DDAVP) trial. One patient was a 64-year-old man with endstage renal failure (ESRF), post-renal transplantation who presented with uncontrolled rectal bleeding secondary to a peptic ulcer. He had a hemoglobin (Hb) value of 11 g/dl, a creatinine level of 690 µmol/L and a normal coagulation profile (PT, APTT and platelet count). A repeated Hb level showed a drop by 3 grams/dL in 24 hrs. Six units of cryoprecipitate

were transfused, in addition to six units of FFP and two units of packed red blood cells (PRBC). The second patient was a 50-years-old female patient on regular dialysis for CRF who developed an intra-operative hemorrhage during Permcath removal. Preoperative assessment revealed an Hb of 10 g/dL; creatinine level of 250 $\mu\text{mol/L}$ with a normal PT/APTT and platelets count. The patient received two units of PRBCs, six units of FFP and six units of cryoprecipitate to control her bleeding. The third patient received cryoprecipitate to control post-menopausal bleeding. She had a normal coagulation screen, and her creatinine 12 level was 450 $\mu\text{mol/L}$. The patient required three units of PRBCs and six units of cryoprecipitate. The bleeding in all three patients responded to transfusion of cryoprecipitate.

Inappropriate Indications in Medical Patients

Hundred seventy-four (24.7%) units of cryoprecipitate were used inappropriately for the following indications: Patients with chronic renal failure (n = 12), warfarin reversal (n = 2), acute lymphoblastic leukemia (ALL) prior to L asparaginase therapy (n = 3), hepatic coagulopathy (n = 4), factor V deficiency (n = 1) and unspecified diagnosis (n = 3) (Fig. 2). Eleven percent was transfused to patients with CRF (Table 4). All patients had a normal PT, APTT and platelets count, a mean Hb value of 9 g/dL (range 6-13 g/dL) and mean creatinine level of 459 $\mu\text{mol/L}$ (range 284-861 $\mu\text{mol/L}$). All patients were hemodynamically stable with none of the life-threatening bleeding and did not require urgent surgery. No DDAVP trial was used before transfusing cryoprecipitate.

Table 4. Clinical presentation of chronic renal failure patients with inappropriate usage of cryoprecipitate.

No.	Age	Sex	Clinical Presentation	Additional Actions and Outcome
1	33	M	Post dental extraction hematoma	No further actions
2	55	M	Epistaxis	No further actions
3	76	F	Post menopausal bleed	No further actions
4	73	F	Post menopausal bleed	No further actions
5	80	F	CRF + T. B. pleural effusion	Incomplete data
6	80		Bleeding peptic ulcer	FFP, PRBC and cryoprecipitate
7	64	M	CRF + chronic liver disease-hematemesis	Death
8	77	F	Post renal transplant sepsis	Death
9	38	M	Bleeding peptic ulcer helicobacter positive	Gastrectomy
10	69	F	CRF + acute endocarditis	Death
11	69	M	Post renal biopsy intra abdominal hematoma	Recombinant Factor VII

Cryoprecipitate was given to two patients for warfarin reversal. The first patient was a 60-years-old female who was on long-term anticoagulation for dilated cardiomyopathy. The patient's international normalization ratio (INR) on presentation was nine with no evidence of obvious bleeding. Since the incidence of life, threatening intracranial bleeding is particularly high in elderly individuals; hence, a need for urgent reversal. Warfarin was discontinued and cryoprecipitate transfusions were used to normalize the INR. Despite cryoprecipitate transfusions, the patient dropped her Hb due to retroperitoneal hematoma, which required FFP and recombinant Factor 7 to control the bleeding. The second patient presented with subdural hematoma and high INR. In preparation for evacuation, the patient received both FFP and cryoprecipitate, which normalized his INR.

Five patients with no active bleeding received cryoprecipitate in an attempt to correct their abnormal INR values secondary to liver disease (systemic lupus erythematosus, chronic active hepatitis, autoimmune hepatitis and two patients with unspecified diagnoses). Six (0.7%) units of cryoprecipitate were also transfused inappropriately for the management of intra-peritoneal bleeding in one female with congenital FV deficiency. This patient required further surgical-exploration and FFP to control her bleeding.

Inappropriate Indications in surgical Patients

Sixteen (22.5%) patients received 159 units of cryoprecipitate for correction of surgical bleeding (Fig. 2). All patients had no past medical history of bleeding tendency, normal preoperative coagulation screens including PT, APTT, and platelets count. None of the patients required massive transfusion. Fibrinogen level measured could not always be in a timely manner. The surgical procedures were CABG (n = 5), total hip or knee replacement (n = 3), modified radical mastectomy (n = 2), repair of a perforated gastric ulcer (n = 2), cholecystectomy (n = 2), and nephrectomy to treat Wilm's tumor (n = 2). Two patients who had GBAG required recombinant Factor VII while the third patient received platelets concentrate to control their bleeding.

Discussion

Cryoprecipitate contains factor VIII, von Willebrand factor (vWF), fibrinogen, factor XIII, fibronectin and platelet micro-particles^[1]. The

role of this complex product in the management of hemostasis has not been studied, except in patients with hemophilia A. Although, it has been used in different clinical scenarios. Table 1 lists the indications for cryoprecipitate utilization at KAUH. Clear consensuses are available on the appropriateness of cryoprecipitate to treat hypofibrinogenemia. If fibrinogen concentrate is not available^[2-4], however, the use of cryoprecipitate as a specific factor replacement when specific factor concentrate is not available, in uremic bleeding or surgical bleed debatable^[4-6].

Appropriate Indications

Fibrinogen is essential for normal platelet aggregation and for secondary hemostasis. Fibrinogen deficiency could be either congenital or acquired. The congenital abnormalities of fibrinogen classified as rare disorders. Acquired hypofibrinogenemia may be secondary to consumptive coagulopathies such as disseminated intravascular coagulation (DIC), or post-partum hemorrhage. Other causes include underlying disease states that limit fibrinogen synthesis (hepatic dysfunction, hematological malignancies), or dilutional in massive blood transfusion, or from increased fibrinolysis^[7]. Fibrinogen levels greater than 100 mg/dL generally are considered adequate for homeostasis^[6]. Treatment of fibrinogen deficiency underlying the cause of the coagulopathy, but when bleeding occurs or invasive procedures are planned, then replacement therapy using virally inactivated fibrinogen concentrate is the treatment of choice^[7]. This offers rapid restoration of fibrinogen levels with a small volume infusion, minimal preparation time and lower potential risk of transfusion transmitted viral infections^[2]. Cryoprecipitate and FFP are alternative treatments that should be used only when fibrinogen concentrate is not available^[10]. Cryoprecipitate has been used successfully for the supplementation of fibrinogen in patients with acquired^[8] hypofibrinogenemia. Although the fibrinogen content of cryoprecipitate may be variable^[9], current standards require that all tested individual units of cryoprecipitate contain a minimum of 150 mg (4.4 μ mol) of fibrinogen^[1]. Cryoprecipitate is the only available source of concentrated fibrinogen at KAUH.

Commercially available factor concentrate are the product of choice for treatment of congenital or acquired specific deficiency^[8]. They have far lower risks of blood-borne viral infection, particularly HIV, and are

preferred to blood component therapy^[10]. von Willebrand's disease (VWD) is the most common inherited bleeding disorder^[8]. The aim of therapy in VWD is to increase both, vWF and factor VIII levels. Synthetic vasopressin analog desmopressin (DDAVP) causes the release of endogenous factor VIII and vWF from its stores and is used for the treatment of Type 1 and 2N VWD^[11,12]. On the other hand, severe disease warrants other treatment option. An intermediate purity factor VIII concentrate preparation (Humate-P, Aventis; Behring, Kankakee, IL) is generally preferred over cryoprecipitate for the treatment of VWD as it carries less risk of transfusion transmitted infections^[10]. Cryoprecipitate has the full range of vWF multimers^[2,13] and provides a higher concentration of high-molecular-weight vWF than FFP^[1].

Congenital factor XIII (FXIII) deficiency is a very rare form of hemophilia (one in 5 million)^[14]. Acquired causes include disseminated intravascular coagulation, liver disease, L-asparaginase or fibrinolytic therapy. The bleeding manifestation is characterized by umbilical stump bleeding in up to 80%^[14], spontaneous abortion, mucosal bleeding and a high rate of spontaneous intracranial hemorrhage^[15,16]. One to ten percent FXIII activities in plasma is adequate for hemostasis^[17]. Plasma-derived (PD) pasteurized FXIII concentrates or recombinant FXIII-A2 are used for prophylaxis^[18].

It is generally inappropriate to transfuse cryoprecipitate in the treatment of hemophilia, VWD or factor XIII deficiency, according to the National Health and Medical Research Council, Australasian Society for Blood Transfusion (NHMRC/ASBT)^[19], and the United Kingdom hemophilia center doctors organization^[8]. However, the American Society of Anesthesiologists task force on blood component therapy^[20], consider it appropriate for non-bleeding patients with VWD in the perioperative or peripartum period, or in bleeding patient unresponsive to DDAVP. Furthermore, cryoprecipitate could be the only replacement therapy available due to shortage factor supply in some parts of the world^[13]. Traditional treatment for FXIII deficiency for acute or recurrent bleeding includes cryoprecipitate, and FFP when no specific factor concentrate is unavailable^[8].

Post partum hemorrhage (PPH) is a common complication of childbirth; it remains one of the major causes of maternal death in both developing and developed countries. The incidence of PPH is 5.8% and it

is defined as estimated blood loss ≥ 2500 ml.^[24] Abnormal coagulation screen in conjunction with ongoing bleeding or oozing from puncture sites, mucous surfaces, or wounds usually calls for a blood product of component therapy. Despite the introduction of several guidelines, transfusion criteria still vary widely between clinicians^[22]. A multidisciplinary team of obstetrician, anesthetists and hematologist is needed for the best management of PPH^[23,24]. Cryoprecipitate transfusion is more helpful than FFP in providing a higher concentration of fibrinogen in a smaller volume, and has a shorter rotate time compared to FFP. The Scottish Obstetric Guidelines and Audit Project (SOGAP)^[25], suggested that up to one liter of fresh frozen plasma (FFP) and ten units of cryoprecipitate might be given empirically in the face of relentless bleeding, while awaiting laboratory results to reduce the need for hysterectomy.

Massive transfusion is arbitrarily defined as the replacement of a patient's total blood volume in less than 24 hrs^[26]. Patients who receive massive transfusions may develop a dilution coagulopathy or DIC with thrombocytopenia and hypofibrinogenemia^[27]. Most often, bleeding in such patients is related to thrombocytopenia^[27,28], but there is evidence to suggest a possible advantage for using cryoprecipitate in these cases^[28,29]. It is generally considered appropriate to transfuse cryoprecipitate to correct prolongation of PT/APTT (> 1.5 x mean normal value) correlated with an increased microvascular bleeding, and to maintain Fibrinogen > 1.0 g/l If not corrected by FFP^[24,30]. However, The American Society of Anesthesiologists Task Force guidelines for perioperative transfusion^[20], recommend the use of cryoprecipitate to correct excessive microvascular bleeding in when fibrinogen level cannot be measured in a timely fashion.

Uremic bleeding syndrome is a well-recognized consequence of renal failure for more than 100 years^[31]. The bleeding disorder of CRF is primarily an acquired defect of primary hemostasis leading to mucocutaneous type bleeding^[32]. Platelet dysfunction and abnormal platelet-endothelial interaction are the main determinations of uremic bleeding^[33-35].

Various approaches to the hemorrhagic tendency in uremia have included treatment with cryoprecipitate^[36], vasopressin^[37], and dialysis with variable response to these treatments^[37-39]. Evidence-based

treatment recommendations for uremic bleeding identify cryoprecipitate as a reasonable therapeutic option for bleeding uremic patients who are hemodynamically stable, but in need of urgent surgery or those who are actively bleeding^[6]. It is also a reasonable approach for those who have failed a trial of DDAVP. Unfortunately, the response to cryoprecipitate in uremic patients can be short-term, unpredictable^[6] and multiple doses maybe necessary. Treatment failure is well recognized (up to 80% this audit), nevertheless, an appropriate option after dialysis, correction of anemia and DDAVP trail.

Inappropriate Indications in Medical Patients

Cryoprecipitate does not contain sufficient quantities of clotting factors: II, VII, IX and X. Therefore, it should not be used as a replacement therapy in patients with global coagulation factor deficiencies, like warfarin reversal or hepatic coagulopathy.

Warfarin is a widely used oral anticoagulant medication. It interferes with the gamma carboxylation of the Vitamin K - dependent clotting factors II, VII, IX, and X. The narrow therapeutic window of warfarin may result in bleeding complications. Life threatening intracranial bleeding is particularly high in elderly individuals. Immediate reversal requires clotting factor replacement therapy in the form of FFP, which contains all of the coagulation factors^[39].

Acquired coagulopathies observed in patients with liver disease are complex disorders, usually involving a combination of multiple coagulation factors deficiency, thrombocytopenia, platelet dysfunction, and abnormalities of the fibrinolytic system. The bleeding tendency can be corrected by transfusion of specific blood products. Fresh frozen plasma contains all the coagulation factors, therefore it is considered the blood product of choice for treating active bleeding^[40].

L-asparaginase is a chemotherapeutic agent commonly used in the treatment of both, adult and pediatric acute lymphoblastic leukemia (ALL)^[41]. Asparaginase therapy is associated with the depletion of both, antithrombin (AT) and fibrinogen^[42]. Potential toxicities include thrombosis and hemorrhage. National Cancer Institute predicted that neither FFP nor cryoprecipitate protected against central nervous system thrombosis (CNST) in patients with high-risk ALL, suggesting that prophylaxis is unwarranted for unselected patients^[43].

Congenital Factor V (FV) deficiency is another rare autosomal recessive bleeding disorder (1 per million)^[2,44]. Homozygous deficiency is associated with a moderately severe bleeding disorder in the form of easy bruising, epistaxis and oral cavity bleeding^[45]. Factor V is a labile factor that is lost during the preparation of cryoprecipitate, and there is no available virus-safe fractionated Factor V concentrate. Therefore, the only blood product available for replacement is FFP.

Inappropriate Indications in Surgical Patients

The value of cryoprecipitate to correct surgical bleeding in the absence of a specific factor deficiency is unclear^[46]. Sixteen patients (18.8%) received 159 units of cryoprecipitate (22.5%) perioperatively for correction of surgical bleeding task force. On blood component, therapy recommends the perioperative administration of cryoprecipitate in only three circumstances: for prophylactic use in patients with VWD, congenital fibrinogen deficiencies in the perioperative or peripartum period with, or VWD who are unresponsive to DDAVP. Cryoprecipitate was also recommended for bleeding patients with VWD, for the correction of microvascular bleeding in massively transfused patients with fibrinogen concentrations less than 80 to 100 mg/dL (0.80 - 1.00 g/L), or when fibrinogen concentrations cannot be measured in a timely manner^[20].

Fibrinogen level is the most important trigger for cryoprecipitate transfusion is an acute phase protein, which may rise rapidly within a few hours during infections, postoperatively or physiologically by pregnancy. In addition, intra- and inter-individual variability in the plasma fibrinogen measurements using the modification of Clauss method, has been noted in healthy volunteers with a coefficient of variation 5-10% undermine the usefulness of a single fibrinogen measurement^[47].

Data are sparse in the literature on the indications of cryoprecipitate use with a wide range of inappropriateness^[48-51]. The present study showed rate of inappropriateness of 48%, which is comparable to international reports^[51]. The weakness of this study is that it is a retrospective study with a questionable validity, where it relies on observations or events that was not recorded accurately, and that the results are based on one hospital. However, the duration of the study and conducted in a teaching hospital with pre-implemented transfusion

guidelines, may shed some lights on the transfusion practice in Saudi Arabia.

Conclusions

Blood components transfusion is an integral part of management of blood loss; however, this transfusion is not risk free. The risk of a transfusion-transmitted disease associated with cryoprecipitate transfusion is higher than that of red blood cells (RBCs), as cryoprecipitate is prepared from a pool of multiple products. This review showed that cryoprecipitate was inappropriately used in almost one-half of the patients. Our findings suggest that clinical practice for cryoprecipitate transfusion is out of pace with the local and international guidelines. Blood product use at KAUH may be substantially reduced if the local guidelines are adopted. Guidelines aid, but do not replace sound clinical judgment which plays an integral part in the transfusion decision. However, clinical audit can identify correctable errors, help change physician transfusion practices and reduce the inappropriate use of blood components.

Therefore, it is recommended that FFP be transfused instead of cryoprecipitate if the underlying cause of bleeding is a global coagulopathy related to liver disease or warfarin therapy. Furthermore, in view of some case reports of thrombotic complications of L-asparaginase treatment, the author strongly recommend against such routine practice until further evidence becomes available. Prospective randomized studies are needed to establish the appropriate indications for cryoprecipitate utilization in our patient population.

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كريوبرسيبيات والاستخدامات الإكلينيكية في مستشفى جامعة الملك عبدالعزيز - "تدقيق لفترة أربعة سنوات"

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المستخلص. دراسة استخدام كريوبرسيبيات طبقاً للمواصفات الموضوعية مسبقاً في مستشفى الملك عبدالعزيز. تم علاج خمسة وثمانين مريضاً باستخدام كريوبرسيبيات، وطبقاً للدراسة فإن نصف المرضى تلقوا العلاج خارج المواصفات الموضوعية. تم استخدام كريوبرسيبيات بطريقة ملائمة في حالات نقص عامل التجلط الأول (هايبيوفيرينو جينيميا)، وحالات نقص عوامل تجلط أخرى وفي علاج حالات النزف الشديد. ويعتبر أكثر سبب في استخدام كريوبرسيبيات في هذه الدراسة هو نقص عامل التجلط الأول المصاحب بالنزف. أظهرت الدراسة أن كريوبرسيبيات تم استخدامها بدون سبب واضح في نصف الحالات سواء في أقسام الباطنية أو الجراحة وأن المراجعة والتدقيق في استخدام مشتقات الدم تساعد على التعرف على هذه الحالات ومن ثم فإن نشر هذه المعلومات يساعد في ترشيد استخدام هذه المشتقات المهمة.