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Review Article

Massive Transfusion Protocol: Role of maximum Surgical Blood Ordering Schedule

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Abstract

Preoperative placement of blood requests frequently overshoots the actual need resulting in unnecessary cross matching, which can be reduced by formulating maximum surgical blood ordering schedule (MSBOS). It is a table of elective surgical procedures, which lists the number of units of blood routinely cross-matched pre-operatively.

MSBOS based on the past blood utilization records for different surgeries and keeping patients variables in consideration wherever required would provide an efficient way of blood utilization and appropriate management of blood bank resources.

The objective of this review throw eight on is to the blood utilization in various surgeries that can result in unnecessary cross-matching, wastage of blood bank resources, and financial losses to the patients could be reduced.

Key words: Blood requests, crossmatch, polytrauma, Blood transfusion.

Introduction

Institutional Maximum Surgical Blood Ordering Schedule (MSBOS) algorithm developed with data analysis and consensus of surgeons, anaesthesiologists and blood banks can be a useful tool to promote judicious utilization of blood and blood components of blood and reduce the unnecessary wastage. [1]

In 1970s, Friedman and his colleagues proposed (MSBOS) as a way to limit outdating risk of blood stocks. MSBOS is a table of elective surgical procedures which lists the units of red cells routinely cross-matched for them pre-operatively.[1] MSBOS is basically designed to order enough blood for 85-90% of patients for each surgical procedure.

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The following transfusion Indices are used to determine the blood utilization for each surgical procedures while designing MSOBS.[2]

1. The formula for cross-matched to transfusion: C:T ratio = No. of units cross-matched

No. of units transfused

A ratio of > 2 is considered indicative of significant blood wastage.

2. The formula for transfusion probability: Transfusion probability % = No. of patients trans fused x100

No. of patients cross-matched

A value of < 30 was considered indicative of significant blood wastage.

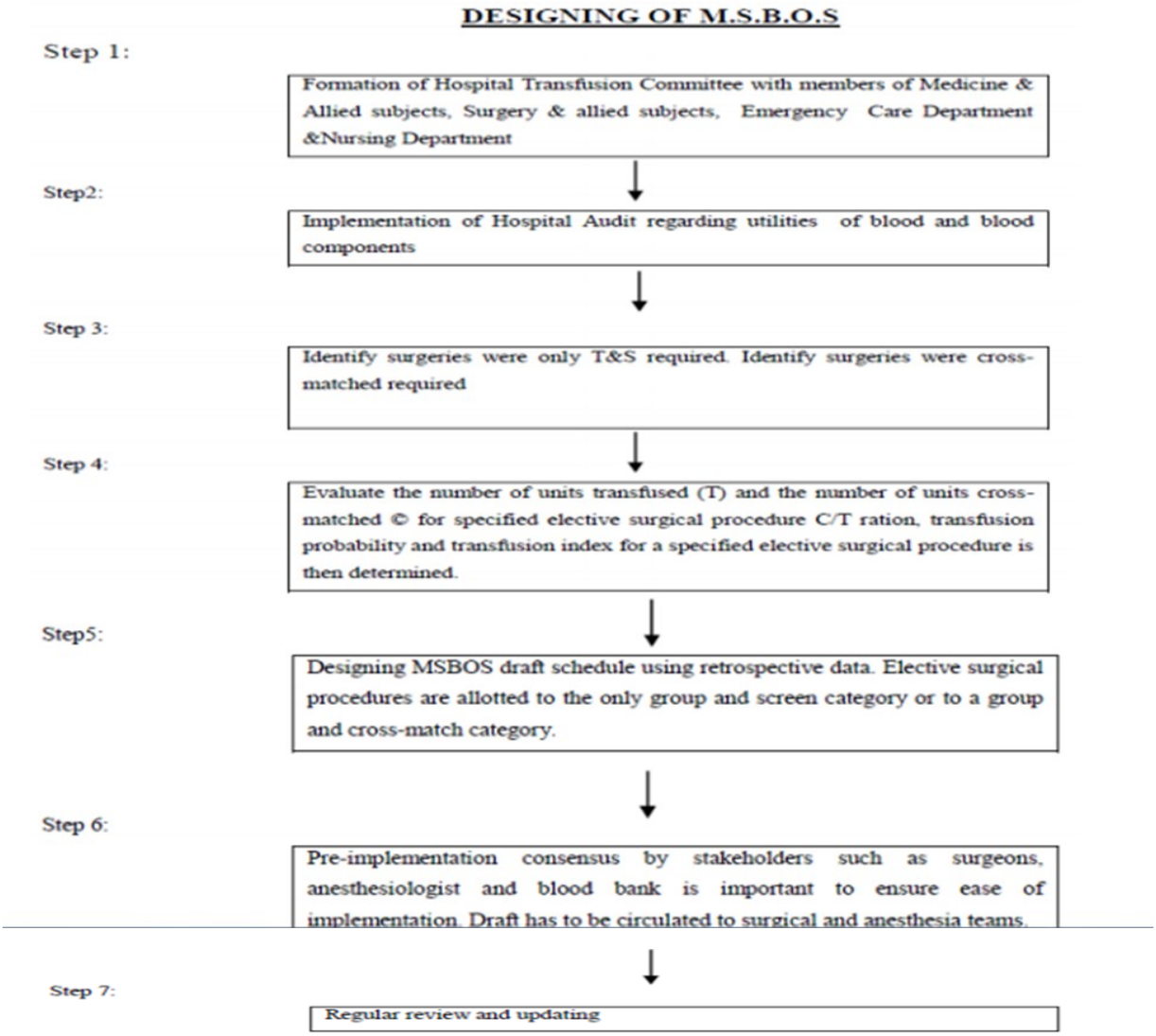
3. The formula for Transfusion index: Transfusion index = No. of units transfused
No. of patients cross-matched.

A value of <0.5 signifies no need for cross-match. Ideally a C/T ration of 1:1 would be most desirable and most efficient, but it is never achievable. Therefore a C/T ration of 2:1 for all procedure has been accepted as a reasonable goal. MSBOS is a viable option to avoid unnecessary, excessive cross matching of blood for elective surgical procedures.[2]

Massive Transfusion (MT) occurs in a variety of clinical settings, such as trauma, obstetrics and major surgery. Severe trauma contributes to about 1 in

10 moralities and potentially preventable death among injured patients. is uncontrolled post-traumatic bleeding and one third of all bleeding trauma patients show signs of coagulopathy at admission. Multiple organ failure and death are more frequently seen in such patients as compared to patients with Similar injury patterns in the absence of coagulopathy.[3]

The Protocol for designing of M S B O S is in the bellow.



Definition of Massive Transfusion (MT)

MT refers to the transfusion of large volumes of blood products over a short period of time to a patient who has severe or uncontrolled hemorrhage.

MT has been defined in different ways depending on the number of units and the timeframe in which they are given.[3]

In adults, there most common definitions of MT are:

1. Transfusion of ≥ 10 red blood cell (RBC) units, which approximates the total blood Volume (TBV) of an average adult patient, within 24 hr.
2. Transfusion of 4 RBC units in 1 h with anticipation of continued need for blood products support and
3. Replacement of 50% of the TBV by blood products within 3 h

Because of the age and weight variability in determining TBV in children, pediatrics patients require separate MT definitions as follows:

I. Transfusion of 100% TBV within 24 h
II. Transfusion support to replace ongoing hemorrhage of 10% TBV per min and
III. Replacement of 50% TBV by blood products within 3 h

Indications for Massive Transfusion Protocol

Thomasson et al in their study on assessment of MTP contents and indications for activation found that although trauma was the single most common indication, the majority of adult (58%) and pediatric (65%) activation were on non- trauma. Majority hospitals used a single MTP with GI bleeding and Obstetric bleeding as frequent non-trauma indication for MTP activation in the adults & ECMO-related bleeding in pediatric cases. [4]

Pathophysiology

The haemostatic defects in patients undergoing massive hemorrhage are dynamic and have multifactorial pathogenesis that relate to early trauma-induced coagulopathy (ETIC), transfusion of blood products, and infusion of crystalloids. The presence of ETIC correlates with poor clinical outcomes anticoagulation and hyper fibrinolysis. In brief, tissue injury from trauma or surgery release tissue factor, locally and subsequently systematically, which activates coagulation pathways.[4]

Predicting MT

Though, early recognition & prompt treatment improves outcomes but which patient will require MT is difficult to predict & should ideally occur during the initial trauma assessment. Various Prediction Tools/ Scoring systems using both Clinical & laboratory parameters are in place but none of them is perfect. Various scores are mentioned before.

1. Trauma associated sever hemorrhage (TASH)
2. Assessment of blood consumption (ABC)
3. Emergency transfusion score
4. McLaughlin mass transfusion score
5. Shock index (SI)
6. Prince of wales hospitals/Rainer score
7. Vandromme score
8. Trauma bleeding severity score

TASH has got 7 clinical and laboratory variables: Hemoglobin, Base excess, Systolic arterial pressure, Heart rate, Free intra-abdominal fluid, Complex fractures, Gender. Possible scores ⟶ 0-28& Higher ⟶ TASH ⟶ Inc. Probability of MT.[5]

Advantages ⟶ Results re available within 15 minutes

ABC Scoring tool does not require laboratory data, tabulation of injury severity scores, or any significant mathematical computations. It includes penetrating Trauma, Systolic Blood Pressure 90 Mm Hg. Heart Rate 120 Beats /Min. FAST Positive Focused Abdominal Sonography for Trauma.

2 out of 4 parameters are positive ⟶ MT

Advantages ⟶ Simplicity & can be determine during initial assessment.

AIM Of treatment /clinical Management

MTP includes empirical treatment that optimizes the management of resuscitation and correction of coagulopathy at the same time. Critical is the maintenance of adequate blood flow and arterial pressure to maintain tissue oxygenation to vital organs. In the past, patients who bled profusely were initially given colloid or crystalloids and blood products were given almost after 2 liter of fluid resuscitation, usually guided by targets to keep hemoglobin 10 gm/dl, platelet count > 50000/ul & INR $\leq$ 1.5.[6]

Challenge

Delays in laboratory TAT and dilutional coagulopathy which leads to continued blood loss. Early use of RBCS, plasma, Platelet & reduced crystalloid use in resuscitation was started after many studies highlighted increase morbidity and mortality with aggressive crystalloid use % better understanding of pathophysiology of ETIC. Mathematical consideration of resuscitation also favored early blood components support. Administration of RBC-plasma : Platelet at 1:1:1 ratio more closely resembles WB.A retrospective review of patients receiving MT at a US combat hospital demonstrated reduced mortality from 65% to 19% when the RBC: Plasma ratio decreased from 8:1 to 1:4 : 1.[7]

Massive Transfusion Protocols

MTPS can include preparation and administration of blood products based on either laboratory tests or predetermined transfusion package or integration of both. Although the numbers & timing of blood components delivery, laboratory testing algorithms & other aspects of the MTPS varies between institutions but all MTPS use predetermined transfusion packages which include platelet and plasma with RBC units.[8]

Developing an institutional MTP

This facilities communication between different services (Trauma, Nursing Transfusion Medicine & other Laboratories). Standard protocols defining specific assures good patient care, improve patients survival & reduces rates r organ failure & post-trauma complications.[8]

MTP should define.

1. When and who should initiate MTP
2. Notification of the transfusion service and laboratory regarding start and stop of MTP
3. Laboratory testing algorithm

4. Blood product preparation and delivery (i.e. Predetermined transfusion package)
5. Other patient care needs (such as blood warmers, nursing care).[9]

Consideration for MTP development

A. Policies for emergency release & delivery of blood products; The protocols for administration of D-Positive RBCS to a D-negative or unknown patient, issuing ABO-incompatible plasma & administration of antigen positive to a patient with the corresponding red cell alloantibody should be in place.
B. To follow patient identification protocolsto avoid transfusion errors. Groups O RBCS & AB plasma if Blood group unknown, even Group A plasma can be used a t times.[9]
C. If type –specific products are being issued, adequate patient identification steps should be in place to ensure prevention of ABO mistransfusion & two sample policy should be preferred.
D. Policy for Rh D positive or Negative Blood products should be in place. In some situation s, after a fixed certain number of D-negative RBCS & depending on the inventory and the likelihood of survival we can switch from D-positive RBCS to D-negative.
E. Stocking Thawed Plasma for immediate issue as it takes about 20 mins to thaw plasma. Expedited plasma transfusion MTP reduces over all transfusion requirement & mortality.
F. Inventory of liquid AB plasma. Liquid AB plasma is preserved in citrate & has 26 days expiry with risk of Ta GVHD and D sensitization.

Laboratory Monitoring During MTP Challenging

Monitoring of hemostasis in MTP is challenges as no validated coagulation assay can detect coagulopathies accurately in a timely manner in bleeding patients.[10]

1. Conventional coagulation assay (PT, aPTT and fibrinogen levels) There is no real time monitoring & it cannot detect Hemostatic abnormalities like Plateletdyfunction, hyper fibrinolysis, factor XII deficiency. They do not quantify the relative contribution of pro-coagulant and anti-coagulant factors.
2. POC Hemostasis assay

Thromboelastography (TEG) and Rotational Thromboelastometry (ROTEM) offer clinicians a graphic representation of the coagulation process & provide information to guide blood components therapies.

Advantages

- TAT shorter
- Can detect Hyperfibrinolysis
- Assess all phases of coagulation
- Can be performed at the patient's true temperature.

TEG/ROTEM has been shown to reduce the transfusion requirement and need of MT. There is no universal agreement on the use of TEG/ROTEM to monitor and direst component therapy in patient with MT.[1]

Selection of available blood products ⟶ Red blood cells OLD vs NEW

Studies suggest that clinical effect of storage lesions & transfusing older RBCS significantly associated with an increased mortality risk. Prospective RCTS (ARIP, ABLE and RECESS trials) have highlighted fresher RBCS do not significantly improve clinical outcomes or mortality in various clinical settings.[2]

There are no prospective clinical trialson RBC storage age on outcomes for MT patients.[3]

Platelets While refrigeration (1C-6C) decreases platelet viability and post-infusion increments but cold platelets readily aggregate in vitro and have a better metabolic profile. During emergency resuscitation, the clinical emphasis is in favor of achieving rapid hemostasis rather than a durable increase in platelet count-therefore, it has been suggested that refrigerated platelets dedicated for emergency transfusion may have clinical benefits.[4] Plasma There are multiple plasma products available & their selection depends on the timeliness of product availability and the coagulation factor content.[4]

Damage control resuscitation: concentrates on restoring a patients' physiology rather than completing surgical repair. Concept of hemostatic resuscitation (HR) where effective whole blood is transfused into the patient in its component parts. Ration of 1 FFP : 1 LD-PRBC with targeted use of platelets and cryoprecipitate is advocated. [5]

Goal directed therapy

Administration of blood products increase morbidity & the exact ration of protocol-driven resuscitation is till unclear. Imperatives to ensure correct delivery of appropriate blood products on an individualized basis. The timing of switch from protocol to targeted therapy depends on clinical circumstances, numbers of experienced personnel & information available to the clinician.[6]

Recent literature aims to provide guidance on the management of major bleeding and coaguilopathy following traumatic injury and encourages adaptation of the guiding principles described to individual institutional circumstances and resources. Major recommendations:[7]

1) Initial resuscitation and prevention of further bleeding Minimal time elapse between Injury and reaching of victim in trauma center.
2) Local bleeding management - local compression to limit life-threatening bleeding of imminent cerebral herniation where hyperventilation is suggested
3) Ventilation: Avoid hypoxemis. Normoventilation of trauma patients except in cases of imminent cerebral herniation where hyperventilation is suggested.
4) Diagnosis and monitoring of bleeding Scoring-shock index
5) Hemoglobin- low initial Hb is considered as an indicator for severe bleeding associated with coagulopathy. Repeat Hb as an initial Hb value in the normal range confounding influence of resuscitation measures (IV fluids & blood)
6) Serum lactate and base deficit: These measurements act as a sensitive test to estimate and monitor the extent of bleeding and shock.[8]
7) Coagulation monitoring early and repeated monitoring of hemostatic, using either a combined conventional coagulation assay and / or (POC) PT/ INR and / or a viscoelastic method (VEM). (VEM provides a rapid assessment of hemostatis to support clinical decision making.[9]
8) Platelet function monitoring The role of POC platelet function devices in guiding hemostatic therapy is not established.
9) Restricted volume replacement- Initial treatment of trauma-induced hypotension uses the concept of DCR, with restricted volume replacement and permissive hypotension.
10) Tissue oxygenation Trauma without brain injury Permissive hypotension with a target SBP of 80-90 mmhg (MAP-mean arterial pressure 50-60mmhg)In patients with severe TB (GCS≤8) MAP ≥80 mm Hg be maintained.
11) Type of fluid-In Hypotensive Bleeding Trauma Patient Isotonic crystalloid & Balanced electrolyte solutions preferred.
12) Erythrocytes Recommended target Hb of 7 to 9 g/dl. RCTS support restrictive transfusion strategies (Hb thresholds 7 and 9 g/dl) are as safe as, or safer than, liberal strategies(threshold ≥ 9g /dl). Exception Acute coronary syndrome.
13) Temperature management : Measures to reduce heat loss and warm the hypothermic patient to achieve & maintain normo- thermais as Hypothermic patient require more blood products.
14) Initial management of bleeding and coagulaopathy -antifibrinolytic agents: TXA is to be administered as soon as possible & within 3 h after injury is there is bleeding or patient is at risk of significant hemorrhage.
    DOSE
    Loading dose of 1g infused over 10 min, followed by an I.v. infusion of 1 g over 8 h Administration of TXA should not await results from a viscoelastic assessment.
15) Initial coagulation resuscitation: For every initial coagulation support while waiting for the results of viscoelastic or laboratory tests, administer 2g of fibrinogen to mimic the expected 1:1 ration along with first four units of RBC which potentially corrects hypo-fibrinogenaemia if already present.[10]

Conclusion

MSBOS provides guidelines for frequently performed elective surgical procedures by recommending the maximum number of units of blood to be cross matched preoperatively. [1]

Blood Transfusion is recognized as one of the eight essential component of comprehensive emergency obstetric care which has been shown to reduce the maternal mortality. In developing country like India, efforts must be made to make blood transfusion services well maintained and readily available to reduce maternal morbidities and mortalities.[2]

- Effect vive communication
- Well defined MTP
- Restrictive resuscitation
- Targeted therapy to avoid lethal triad
- Blood products & products rations
- Use of tranexamic acid
- Point of care testing

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