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Research article

Rotational thormboelastolmetry guided transfusion practice in living donor liver transplantation, A retrospective comparative study

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ABSTRACT

Introduction: Living donor liver transplantation (LDLT) is a complex surgery with high risk for massive bleeding and blood component transfusion. This retrospective study investigated the effect of adopting ROTEM based transfusion algorithm on blood products transfusion practice among LDLT recipients and the effect of this change on patient outcome.

Material and methods: Data of 216 patients with predicted intraoperative massive bleeding (blood loss ≥70 ml blood/kg, or blood loss > 150 ml/min with hemodynamic affection with continuing need for transfusion) were collected from our database. Patients were divided into two groups according to transfusion protocol applied; Pre-ROTEM group (n = 95), ROTEM group (n = 121). Basal characteristics, blood component transfusion, graft outcome and patient outcome (28-day mortality and one-year mortality) were compared between the two groups.

Results: Transfused packed red blood cells (PRBCs) units, fresh frozen plasma (FFP) units, and application of massive transfusion protocol (MTP) were significantly lower in the ROTEM group compared to pre-ROTEM group [8(7) vs 4.5(5), $p < 0.01$, 12.5(4) vs 5.6(3), $p < 0.001$, 29% vs 20%, $p < 0.005$ respectively]. The survival distributions for the two studied groups showed no statistically significant difference, $p < 0.46$.

Conclusions: ROTEM based transfusion algorithms applied in LDLT decreased blood component transfusion and enhanced early graft function.

1. Introduction

Living donor liver transplantation (LDLT) is complex surgery with high risk for massive bleeding. Blood component transfusion has been associated with complications like infection, immunomodulation, volume overload and lung injury [1,2].

Standard laboratory tests like INR and platelet count have failed to predict or guide blood transfusion during orthotopic liver transplantation OLT [3]. Rotational thormboelastolmetry (ROTEM) has enhanced the understanding of coagulopathy changes during OLT thus improved transfusion practices, avoiding unnecessary transfusions and decreasing over all blood component transfusion [4].

In our center, ASA transfusion guidelines [5] were used for management of bleeding and blood component transfusion in the peri-transplant period. After 2012, ROTEM based algorithm was applied in patients with predictors of massive bleeding and in case of intraoperative massive transfusion.

This retrospective study investigated the effect of adopting ROTEM based transfusion algorithm on blood products transfusion practice during LDLT recipients and the effect of this change on patient outcome (early graft function - 28-day mortality).

2. Material and methods

After approval of institutional review board, Database of patients undergoing LDLT in our center, from 2008 to 2016 was screened for cases with pre-operative predictors of massive intraoperative bleeding (defined as bleeding ≥70 ml blood/kg) including the following parameters; (INR ≥ 2, platelet count $\leq 50 \cdot 10^9$/L, Hemoglobin level ≤8 gm/dl, Model for end stage liver disease (MELD) ≥30, Serum albumin ≤2.5 gm/dl) [1,6]. A patient was included in the analysis if one or more of the above mentioned predictors existed in the day before the operation. Included patients were divided into two groups; Pre-ROTEM group (n = 95), ROTEM group (n = 121), illustrated in Fig. 1.

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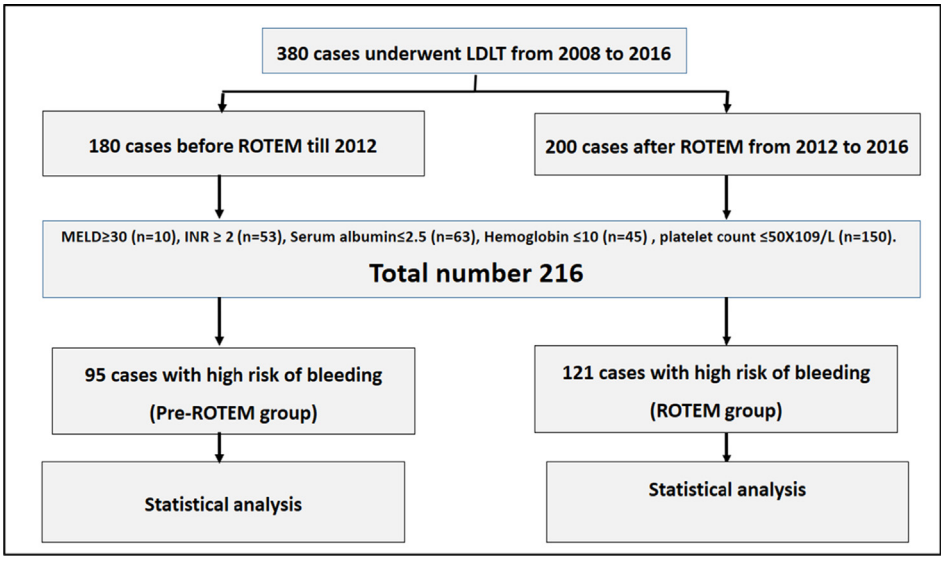

Fig. 1. Study flow chart. LDLDT: living donor liver transplantation, MELD: model for end-stage liver disease, INR: international normalized ratio.

In both groups, pH, electrolytes and body temperature are optimized based on the approved institutional protocol, target HB level was 8 gm/dl unless patient is known ischemic heart or developed new onset ischemic changes detected by transesophageal echocardiography or electrocardiographic trace, in this case target HB level was 10 gm/dl. In **Pre-ROTEM group,** ASA guidelines [5] was used to guide transfusion where FFP (15 ml/kg) was transfused if INR ≥ 2, Packed RBCs were transfused if hemoglobin became less than 8 gm/dl. In case of intraoperative massive bleeding; (blood loss ≥70 ml blood/kg or > 4 RBC units in 1 h, or blood loss > 150 ml/min with hemodynamic affection with continuing need for transfusion), FFP to RBCS to platelet 1:1:1 ratio protocol was applied. **In ROTEM group**, coagulation defects were screened by EXTEM and INTEM done before induction of anesthesia, according to the results of the two tests, further tests (FIBTEM, HEPTEM, APTEM) were done if indicated. Blood component transfusion was tailored according to the findings based on Essener-Runde algorithm [7]. A10 amplitude was used for earlier intervention. Low A10 amplitude in EXTEM while normal in FIBTEM indicates either platelet deficiency or dysfunction. A low A10 amplitude is low in both EXTEM and FIBTEM signifies fibrinogen deficiency. A prolonged CT in INTEM, that is corrected in HEPTEM demonstrates heparin or heparin-like effect. Fibrinolysis is diagnosed at a CLI < 85% within 60 min. APTEM test is used to assess antifibrinolytic drug effectiveness to stop lysis [8,9], Fig. 2.

3. Statistical analysis

Patients' data were extracted from our program database. Data were collected, tabulated, and statistically analyzed using IBM SPSS version 20. Continuous data were presented as mean ± SD or median [interquartile range] according to normality of distribution tested by Kolmogorov– Smirnov test. Nominal and categorical data were presented as number (percentage). Differences between the two groups were analyzed using two way independent samples T test, Mann-Whitney test or chi-square test as appropriate. A log rank test was run to determine if there were differences in the one-year survival between both groups.

4. Results

380 cases underwent LDLT surgery from January 2008 till December 2016, 216 patients showed at least one of the pre-operative predictors for intraoperative massive bleeding and was included in the study. Cases were divided into two groups according to availability of ROTEM device; Pre-ROTEM group (n = 95), ROTEM group (n = 121), Fig. 1. During assessment of graft function four cases (2 from each group) were excluded due to vascular occlusion with markedly elevated liver enzymes. As shown in Table 1, no statistical difference was found between the two groups regarding age, BMI, basal serum albumin, basal

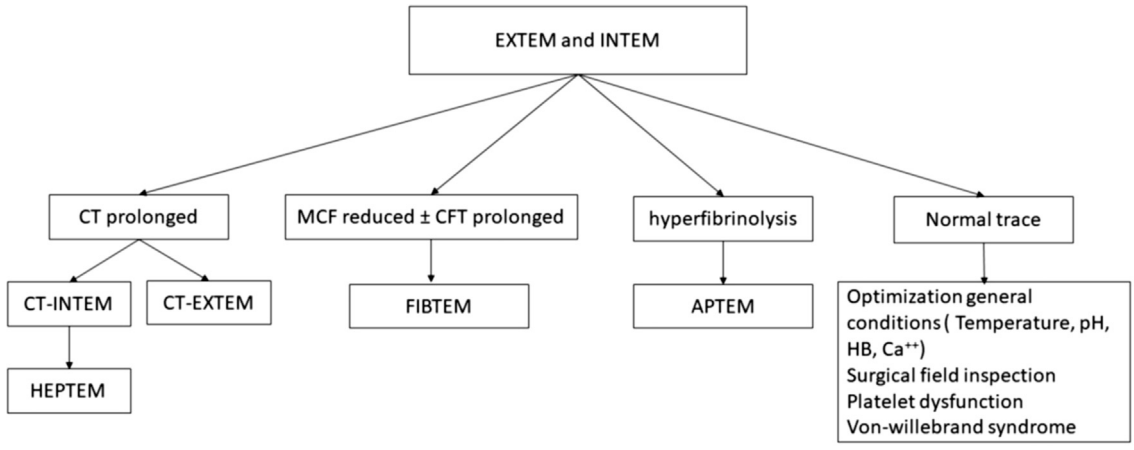

Fig. 2. ROTEM based transfusion algorithm. Hb: Hemoglobin level, CT: Clotting time, MCF: maximum clot firmness, CFT: clot formation time.