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Case Report
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ROTEM™ -Guided Blood Product Management for a Liver Transplant Recipient Presenting for Tracheostomy with Severe Thrombocytopenia (10/nl)

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Abstract

Bleeding can be life-threatening during tracheostomy. This possibility is a major concern in liver transplant recipients with severe thrombocytopenia and hepatic coagulopathy. Point-of Care (POC) devices such as ROTEM™ provide more detailed hemostasis information than Standard Laboratory Tests (SLT). However, many liver transplant centers do not use POC coagulation assessment and elect to prophylactically transfuse platelets in the setting of severe thrombocytopenia. We present a case of ROTEM™ guided, blood product free, percutaneous tracheostomy in a liver transplant patient with severe thrombocytopenia (10/nl).

Introduction

In nearly 60 years, Liver Transplantation (LT) has evolved from high-risk surgery to a routine procedure [1]. The first 100 LT recipients died from uncontrolled intraoperative bleeding or shortly postoperatively. Initial survivors often died a couple of weeks later from severe rejection. Bleeding complications were not only related to less surgical experience, but also to limited experience and understanding of End-Stage-Liver-Disease (ESLD) coagulation physiology and pathophysiology. Frequently abnormal Standard Laboratory Tests (SLT) for coagulation assessment in patients with ESLD, such as Prothrombin Time (PT), activated Partial Thromboplastin Time (aPTT), or platelet count may suggest an elevated bleeding risk, triggering Fresh Frozen Plasma (FFP) or platelet transfusions to prevent anticipated hemorrhage. However, rather than coagulopathy, portal hypertension is a more important contributor to bleeding complications [2]. Fluid restriction is a common strategy to avoid bleeding, but FFP administration increases portal pressure and facilitates bleeding. Although almost 40-years ago Kang et al. [3] reported that the use of Thromboelastography (TEG) can reduce the transfusion rate, many centers remain reluctant to use whole blood coagulation testing such as TEG™ or ROTEM™. ROTEM™ guided coagulation factor administration can be a safe alternative to SLT and FFP transfusion in LT patient's also avoiding fluid overload [4].

This case report followed the Declaration of Helsinki and the ethics committee waived informed consent.

We report the postoperative course of an LT recipient including tracheostomy while being severely thrombocytopenic (10/nl) relying on ROTEM™ results to avoid any blood product administration.

Case Presentation

A 66-year-old patient with a lab-MELD score of 14 and an exceptional score of 22 (hepatocellular carcinoma) within Milan criteria underwent an uneventful LT. Intraoperatively he received 2 units of RBC and ROTEM™ guided 4 gm Fibrinogen. Early after ICU admission the noradrenaline dose requirement increased up to 0.9 µg/kg/min. ROTEM™ analysis excluded coagulopathic bleeding with the following normal values: Maximum Clot Firmness (MCF) in EXTEM was 53 mm, Clotting Time (CT) 78 sec, MCF in FIBTEM was 14 mm (Figure 1) [5]. At the same time INR and aPTT was 2.3 and 123 sec respectively. The patient underwent re-laparotomy with a diagnosis of surgical bleeding from segment 6 that was surgically controlled. Two RBCs and ROTEM™ guided 4 g Fibrinogen and 1500 I.E. Prothrombin Complex Concentrate (PCC) were administered. Postoperative routine

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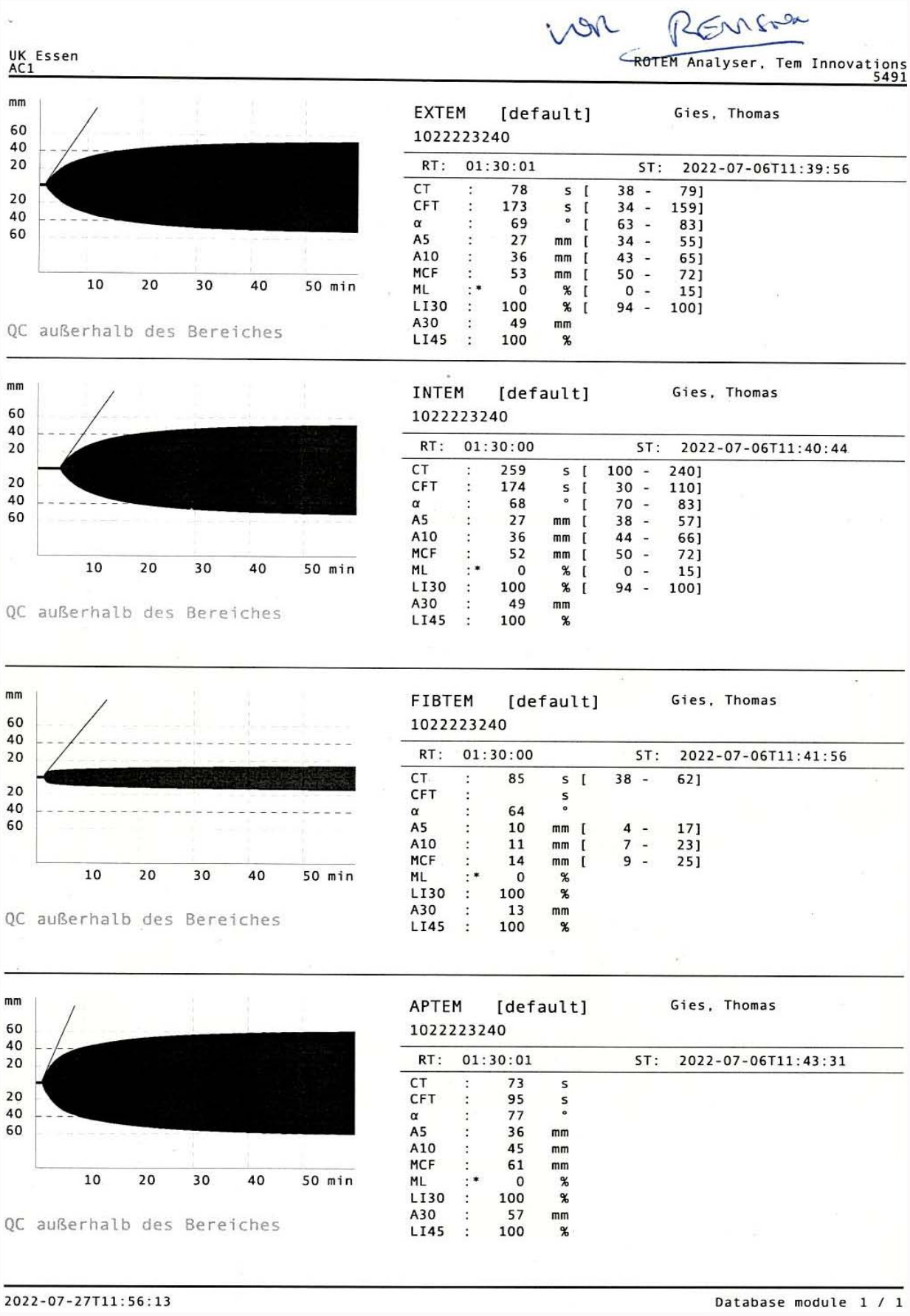

Figure 1: Rotem Analysis upon arriving at the ICU. Coagulopathic bleeding could be excluded.

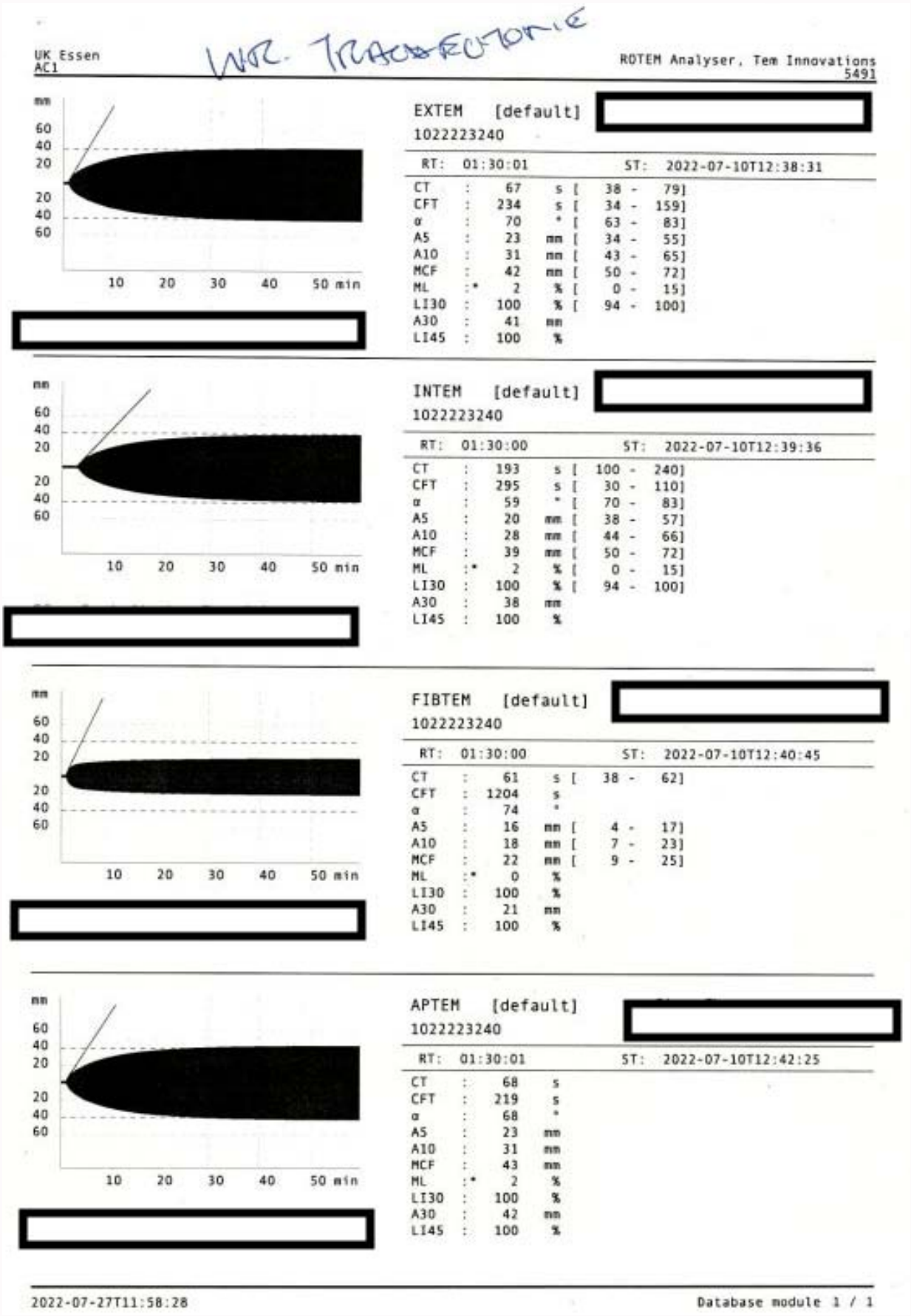

Figure 2: ROTEM before tracheotomy: CT and MCF in EXTEM is normal. MCF in FIBTEM is in regular range. No need for platelet transfusion.

contrast-enhanced Doppler-Ultrasound suggested hepatic artery thrombosis, subsequently confirmed by Angio CT. The patient underwent a second laparotomy with discovery of a non-thrombotic spastic hepatic artery. Topical papaverine restored arterial flow. The complicated clinical course eventually required a tracheostomy for long-term ventilation. At this time the platelet count was 10/nl. Rather than preemptive platelet transfusion for the surgery, the procedure was safely done without bleeding complication or need for blood product transfusion just following ROTEM™ results (Figure 2).

Discussion

Patients with ESLD are considered to have a bleeding risk, although many of them have a propensity for thrombosis [6]. SLTs poorly predict bleeding or thrombosis. ESLD is often accompanied by a balanced reduction of pro- and anticoagulant factors, with the exception of F VIII and von-Willebrand (vWF), which are mainly produced in the endothelium [7]. SLTs-INR, aPTT or fibrinogen level- do not reflect the decreased levels of protein C/S or AT III. Primary hemostasis is achieved by interaction of platelets with vWF. Thrombocytopenia, often present in ESLD is balanced by up to a 3-fold higher serum concentration of vWF and lower levels of its inhibitor ADAMTS 13. Overall Thrombin Generation (TG) is preserved in primary and secondary hemostasis [1]. Studies of TG in patients with Acute-on-Chronic Liver Failure (ACLF) are more complex than in those with ESLD [8]. While TG in patients with ESLD is similar to healthy controls, the balance of hemostasis in ACLF is more fragile due to simultaneous changes in fibrinolysis. Hypofibrinolysis occurs more often in ACLF and seems to be associated with a higher rate of sepsis and multiorgan failure [8].

Bleeding in ESLD is related to portal hypertension and spontaneous bleeding or procedure related bleeding is uncommon. There is no indication for prophylactic blood products. Bleeding complications are more likely related to the nature of the procedure and/or operator experience [9]. In 1985 Kang et al. [3] showed a 30% blood product transfusion rate reduction with TEG use during liver transplantation. TEG and ROTEM™ assess whole blood coagulation and are sensitive to decreased levels of pro- and anticoagulants as well as interaction with platelets [10]. Both methods are superior to SLTs in clinical practice [11]. The effectiveness of TEG guided coagulation management was shown in 2 RCTs. Both studies demonstrated significantly less blood product use with TEG guidance, without increasing procedure related bleeding [12,13]. FFP transfusion increases portal venous pressure and the risk of bleeding without significant TG improvement and therefore should be avoided [1,14].

Coagulation factor concentrates may be good FFP alternatives. Examples are fibrinogen concentrate and activated 4- factor PCC that contains F II; VII; IX, X; and Protein C and S. All factors are dissolved in heparin [6]. ROTEM™ or TEG guided factor concentrate administration appears to be safe without increasing thrombo-embolic events [4]. PCCs should only be used with coagulation monitoring and in the presence of sufficient fibrinogen levels [9].

Platelet transfusion in LT patients are associated with increased mortality [15], and should be guided by whole blood coagulation monitoring [6].

Conclusion

ROTEM™ guided coagulation management in our case was safe and superior to SLTs and helped to avoid unnecessary blood product transfusion without increasing bleeding complications.

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