Summary of guideline recommendations from the European guideline on management of major bleeding and coagulopathy following trauma.

Rossaint et al. Critical Care (2016) 20:100 DOI 10.1186/s13054-016-1265-x

General Measures

- Measure serum lactate and/or base deficit to monitor the extent of bleeding and shock
- Low initial Hb is an indicator of severe bleeding associated with coagulopathy.
- Target systolic blood pressure of 80–90 mmHg until major bleeding has been stopped or mean arterial pressure ≥80 mmHg in case of severe TBI (GCS ≤8)
- restricted volume replacement to achieve target blood pressure until bleeding can be controlled
- No hypotonic fluids such as Ringers Lactate with severe head trauma
- excessive use of 0.9 % NaCl solution should be avoided
- Restricted use of colloids due to the adverse effects on haemostasis
- For life-threatening hypotension use vasopressors in addition to fluids to maintain arterial pressure
- Implement a local evidence-based guideline for management of the bleeding trauma patient and a local clinical quality and safety management system that includes parameters to assess key measures of bleeding control and outcome

Coagulation Support

- monitoring and measures to support coagulation be initiated **immediately** upon hospital admission repeated monitoring of coagulation with traditional laboratory methods and/or a viscoelastic method.
- **initial management** with either Plasma and RBC in a ratio of at least 1:2 or with Fibrinogen concentrate and RBC according to Hb level.
- After initial management **goal-directed strategy** guided by standard laboratory coagulation values and/or viscoelastic tests
- **TXA:** tranexamix acid should be given as early as possible (loading dose of 1 g over 10 min, and another 1g over 8 h) and not more than 3 hrs after the injury
- **Plasma**: plasma should be administered to maintain PT and APTT <1.5 times the normal control. Plasma should be avoided in patients without substantial bleeding.
- **Fibrinogen**: fibrinogen concentrate or cryoprecipitate if significant bleeding is accompanied by viscoelastic signs of a functional fibrinogen deficit or a plasma fibrinogen level of less than 1.5–2.0 g/l. initially 15–20 single donor units of cryoprecipitate or 3–4 g fibrinogen concentrate. Repeat doses guided by viscoelastic monitoring and laboratory assessment of fibrinogen levels.
- **Platelets**: keep platelet count above 50 × 109/l and in in patients with ongoing bleeding and/or TBI above 100 × 109/l. initial dose of four to eight single platelet units or one aphaeresis pack.
- **Calcium:** calcium is maintained within the normal range during massive transfusion
- **PCC:** use early for the emergency reversal of vitamin K-dependent oral anticoagulants. PCC or plasma can be used for delayed coagulation initiation using viscoelastic monitoring providing fibrinogen levels are normal
- **Novo Seven:** off-label use of rFVIIa only if major bleeding and traumatic coagulopathy persist despite all other attempts to control bleeding and best-practice use of conventional haemostatic measures

Management of anticoagulants

- Use platelets for; substantial bleeding or intracranial haemorrhage who are on antiplatelet agents, platelet dysfunction in a patient with microvascular bleeding
- measure platelet function in patients treated with antiplatelet agents.
- **Desmopressin:** (0.3 µg/kg) can be used for platelet-inhibiting drugs or von Willebrand disease. Not indicated for routine use in the bleeding trauma patient.
- **NOAC**: measure anti-factor Xa level sin patients treated with rivaroxaban, apixaban or edoxaban. For life-threatening bleeding:, TXA 15 mg/kg (or 1 g) and highdose (25-50 U/kg) PCC/aPCC until specific antidotes are available
- **NOAC**: measure dabigatran levels or if unavailable, thrombin time and APTT to allow a qualitative estimation of the presence of dabigatran. For life-threatening bleeding: idarucizumab (5 g intravenously) or, if unavailable, we suggest treatment with high-dose (25–50 U/kg) PCC/aPCC, in both cases combined with TXA 15 mg/kg (or 1 g)