References

1. National Blood Authority (2023). *Patient blood management guideline for adults with critical bleeding*. National Blood Authority, Canberra, Australia.
   https://www.blood.gov.au/pbm-guidelines
2. Schünemann H, Brozek J, Guyatt G, Oxman A. (2013). *Handbook for grading the quality of evidence and the strength of recommendations using the GRADE approach*.
   https://gdt.gradepro.org/app/handbook/handbook.html
3. Hultcrantz M, Rind D, Akl EA, Treweek S, Mustafa RA, Iorio A., Alper BS, Meerpohl JJ, Murad MH, Ansari MT, Katikireddi SV, Ostlund P, Tranaeus S, Christensen R, Gartlehner G, Brozek J, Izcovich A, Schunemann H, Guyatt G. (2017). The GRADE Working Group clarifies the construct of certainty of evidence. *J Clin Epidemiol* 87:4-13.
   https://pubmed.ncbi.nlm.nih.gov/28529184/

For more information

The Patient blood management guideline for adults with critical bleeding has been published on MAGICapp (an online guideline publishing platform).

It is also available for download at https://www.blood.gov.au/pbm-guidelines along with supporting materials and instructions on how to access the guideline in MAGICapp.

To provide feedback and inform future reviews of the modules, please send any comments on content or implementation to the project manager at:

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Patient blood management guideline for adults with critical bleeding

Quick Reference Guide

Table of Contents

Version control

Major Version No.	Release date	Section Updated	Details	Last date of evidence search
v2.0	4 September 2025	GPS5 and MHP	Cryoprecipitate dosage amended and warfarin reversal reference updated	29 September 2021
v1.0	8 August 2023	Guideline Release		29 September 2021

Disclaimer

This document is a general guide to appropriate practice, to be followed subject to the circumstances, health professional's judgement and patient's preference in each individual case. It is designed to provide information to assist decision making. Recommendations and good practice statements contained in this document are based on the best available evidence published up to 29 September 2021, with the exception of recombinant activated factor VII which included studies published up to 12 August 2019. The relevance and appropriateness of the information and recommendations in this document depend on individual circumstances. The recommendations and good practice statements are subject to change over time.

Each of the parties involved in developing this guideline expressly disclaims and accepts no responsibility for any undesirable consequences arising from relying on the information, recommendations or good practice statements contained in this guideline.

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Other considerations

^Haemorrhage control

- Early identification of cause of bleeding
- Control bleeding, using:
  - compression
  - packing
  - tourniquet
  - pelvic binder
- Surgical assessment:
  - early surgery or angiography to control bleeding

Suggested criteria for MHP activation

Clinical suspicion of critical bleeding **and** one or more of:

- Systolic blood pressure < 100 mmHg
- Heart rate > 100 bpm
- Positive focused assessment with sonography for trauma (FAST)
- Estimated blood loss > 1L
- Pallor

Resuscitation

- Institute active warming, avoid hypothermia
- Warm RBC through an approved blood warming device if available
- Prioritise blood components over crystalloids
- Consider permissive hypotension (systolic BP: 70 to 100 mmHg)

Special clinical situations

Direct oral anticoagulants
- Refer to haematologist

Warfarin reversal:
- Refer to Updated recommendations for warfarin reversal in the setting of four-factor prothrombin complex concentrate

Obstetric haemorrhage:
- Consider additional fibrinogen replacement

Severe traumatic brain injury:
- Permissive hypotension relatively contraindicated

Older adults:
- Hypotension and tachycardia may be late observations
- Caution with permissive hypotension

Suggested key contacts (*modify locally*)

- Blood bank/transfusion laboratory
- Anaesthetist
- Surgeon
- Haematologist
- Interventional radiology

Acronyms

APTT: activated partial thromboplastin time, **BP**: blood pressure, **bpm**: beats per minute, **iCa^{2+}**: ionised calcium, **FFP**: fresh frozen plasma, **INR**: international normalised ratio, **IU**: international unit, **IV**: intravenous, **MHP**: major haemorrhage protocol, **mmHg**: millimetres of mercury, **mmol/L**: millimoles per litre, **PLT**: platelets, **PT**: prothrombin time, **RBC**: red blood cells, **VHA**: viscoelastic haemostatic assays

Notes:

- This template was developed using the recommendations and good practice statements in the *Patient blood management guideline for adults with critical bleeding*. Recommendations in the guideline were based on the results of multiple systematic reviews. Good practice statements were developed based on indirect evidence and expert consensus. For further details see the full guideline.
- The content in this MHP is a guide only and must be adapted to local institutional requirements and resources. Health professionals should use clinical judgement and consider the clinical circumstances and patient preferences, to determine the appropriateness of this template for an individual patient.

This document was updated on 4 September 2025.

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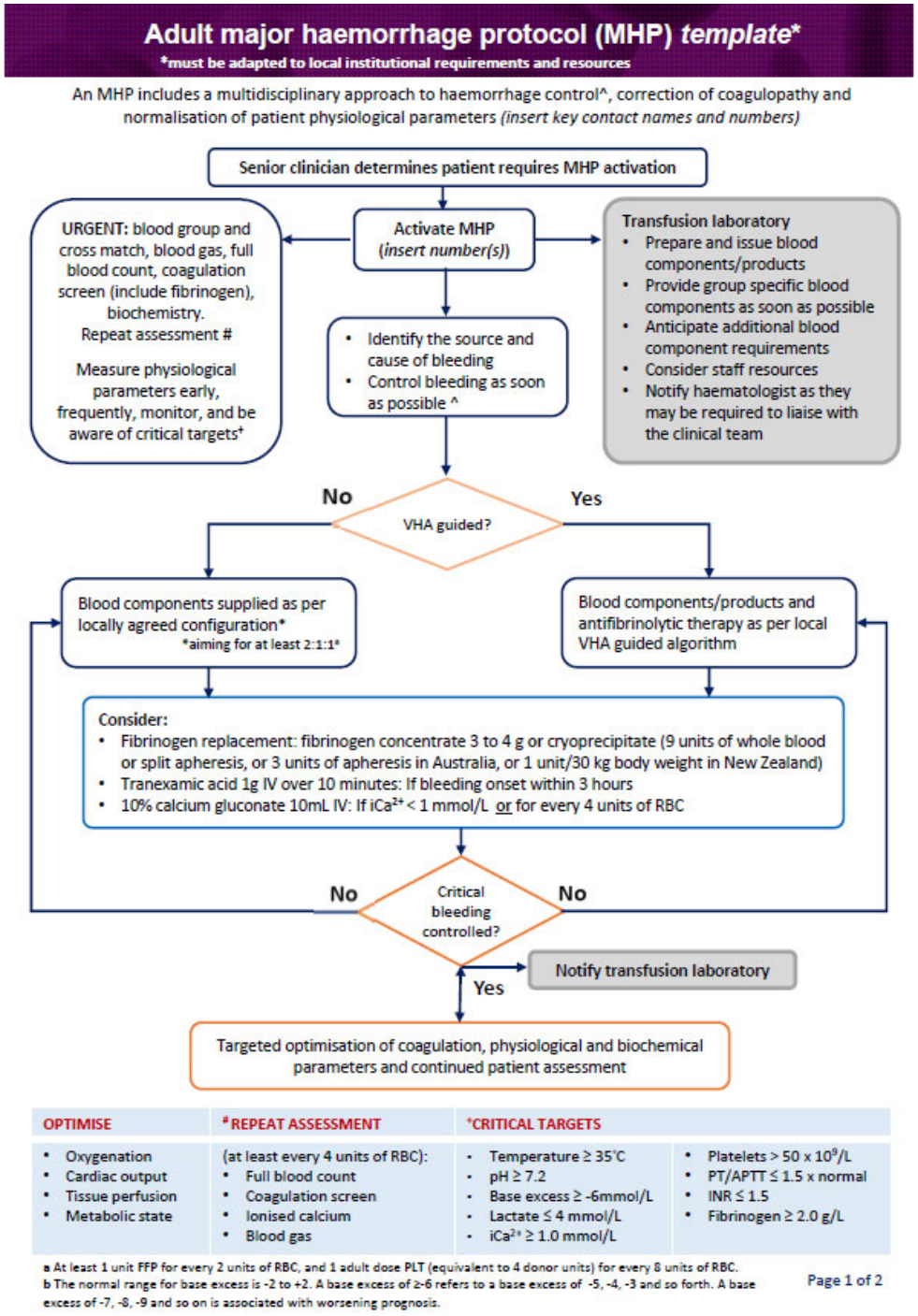

Introduction

This document summarises the Patient blood management guideline for adults with critical bleeding.[1] It comprises:

- the evidence-based recommendations
- consensus-based good practice statements
- a massive haemorrhage protocol (MHP) template, which is intended to be adapted to meet local needs.

Recommendations were developed according to the processes outlined by the GRADE working group[2, 3] by a Clinical/Consumer Reference Group (reference group) representing specialist colleges, societies and organisations. The recommendations are graded as strong or weak and for or against an intervention. The good practice statements are based on indirect evidence and expert opinion from the reference group. Definitions of the recommendations and good practice statements are as follows:

Strong recommendation for

The reference group is confident that the benefits outweigh the harms for almost everyone. All or nearly all informed people would likely choose this option.

Strong recommendation against

The reference group is confident that the harms outweigh the benefits for almost everyone. All or nearly all people would decline the intervention.

Weak recommendation for

The benefits probably outweigh the harms, but uncertainty exists. Most informed people would likely choose this option.

Weak recommendation against

The harms probably outweigh the benefits, but uncertainty exists. Most informed people would not choose this intervention; however, different choices may be appropriate in individual circumstances.

Good practice statement

Indicates that the reference group had high confidence in the indirect evidence. A systematic review was not completed, or there was insufficient evidence, and it was agreed it would be a poor use of the reference group's time to conduct a formal review.

Recommendations and good practice statements

ANZSBT: Australian & New Zealand Society of Blood Transfusion, APTT: activated partial thromboplastin time, FFP: fresh frozen plasma, GPS: good practice statement, INR: international normalised ratio, IU: international units, PT: prothrombin time, R: recommendation, RBC:FFP:PLT: red blood cells: fresh frozen plasma: platelets

R1

In patients with critical bleeding, it is recommended that institutions use a major haemorrhage protocol that includes a multidisciplinary approach to haemorrhage control, correction of coagulopathy and normalisation of physiological derangement.

(Strong recommendation, very low certainty about the evidence)

GPS1

The reference group agreed that it is essential to identify the cause of bleeding and control it as soon as possible.

*Refer to MHP template

R2

In patients with critical bleeding requiring activation of a major haemorrhage protocol, it is recommended that the following parameters be measured early and frequently*:

- temperature
- acid–base status
- ionised calcium
- haemoglobin
- platelet count
- PT/INR
- APTT
- fibrinogen level

*in addition to standard continuous physiological monitoring.

(Strong recommendation, low or very low certainty about the evidence)

GPS2

Values indicative of critical physiological derangement include:

- temperature < 35°C
- pH < 7.2, base excess < –6 mmol/L, lactate > 4 mmol/L
- ionised calcium < 1 mmol/L
- PT > 1.5 × upper limit of normal
- INR > 1.5
- APTT > 1.5 × upper limit of normal
- fibrinogen level < 2.0 g/L

The reference group agreed that it is good practice to monitor the above parameters and include a full blood count on, or prior to, activation of a major haemorrhage protocol. Consider repeating after administration of every 4 units of red blood cells.

R3

In patients with critical bleeding managed with a ratio-based major haemorrhage protocol, a high ratio of RBC:FFP:PLT* may be beneficial, although there is insufficient evidence to support a 1:1:1 ratio over a 2:1:1 ratio^.

*1 adult unit of apheresis or pooled platelets in Australia is equivalent to platelets derived from 4 single whole blood donor units. A transfusion ratio of 1:1:1 would equate to 4 units of red blood cells, 4 units of FFP and 1 adult unit of platelets.

^A transfusion ratio of 2:1:1 of RBC:FFP:PLT is lower than a transfusion ratio of 1:1:1, as the number of units of red blood cells increases without a proportionate increase in FFP or platelets. A transfusion ratio of 2:1:1 would equate to 8 units of red blood cells, 4 units of FFP and 1 adult unit of platelets.

(Weak recommendation, low or very low certainty about the evidence)

GPS3

The reference group agreed that in a ratio-based major haemorrhage protocol, it is good practice for the transfusion ratio of RBC:FFP:PLT to be no lower than 2:1:1.

*Refer to R3

GPS4

The reference group agreed that in a ratio-based major haemorrhage protocol, it is good practice that the ratio of RBC:FFP:PLT of at least 2:1:1 be achieved as soon as possible and be maintained until critical bleeding is controlled. In addition, assess fibrinogen and replace as required.

*Refer to R2 and R3

R4

In patients with critical bleeding, the following initial doses of FFP and platelets are suggested:

- FFP: a minimum of 1 unit with every 2 units of red blood cells
- Platelets*: a minimum of 1 adult unit with every 8 units of red blood cells

*1 adult unit of apheresis or pooled platelets in Australia is equivalent to platelets derived from 4 single whole blood donor units.

(Weak recommendation, low or very low certainty about the evidence)

Recommendations and good practice statements

GPS5

For other blood components and products, the reference group agreed that the following doses are a guide:

- Fibrinogen replacement: 3-4 g of fibrinogen concentrate which may be achieved using fibrinogen concentrate* or cryoprecipitate (9 units of whole blood cryoprecipitate or split apheresis cryoprecipitate^, or 3 units of apheresis cryoprecipitate in Australia^^, or 1 unit of cryoprecipitate/30 kg body weight in New Zealand).
- Prothrombin complex concentrate for warfarin reversal^: 25 to 50 IU/kg

There is insufficient evidence to provide recommendations for the optimal timing and/or dose of these blood components or products.

*Fibrinogen concentrate is approved in Australia and New Zealand for the treatment of acute bleeding episodes in patients with congenital fibrinogen deficiency. Use of fibrinogen concentrate outside these indications (including critical bleeding) is considered 'off-label.'

^A combination of these as both unit types are equivalent and interchangeable.

^^Based on current (2025) Australian Red Cross Lifeblood component data reporting 3 units of apheresis cryoprecipitate to be sufficient to deliver an adult dose in the range of 3 to 4g. This correlates with 9 units of split apheresis cryoprecipitate or 9 units of whole blood derived cryoprecipitate.

#Refer to Updated recommendations for warfarin reversal in the setting of four-factor prothrombin complex concentrate.

GPS6

The reference group agreed that it is good practice to administer red blood cells through a blood warming device whenever possible and aim to maintain the patient's core temperature ≥ 35°C.

GPS7

The reference group agreed that it is good practice to administer group specific blood components as soon as possible.*

*Refer to ANZSBT Guidelines for transfusion and immunohaematology laboratory practice

GPS8

When critical bleeding is controlled, the reference group agreed that it is good practice to cease the major haemorrhage protocol and proceed to targeted optimisation of coagulation, physiological and biochemical parameters and continued patient assessment.

R5

In patients with critical bleeding, the reference group suggests against the routine use of recombinant activated factor VII*.

* Recombinant activated factor VII is approved in Australia and New Zealand for the control of bleeding and surgical prophylaxis in patients with:

- inhibitors to coagulation Factors VIII or IX
- congenital FVII deficiency
- Glanzmann's Thrombasthenia who have antibodies to GPIIb-IIIa and/or HLA who present with refractoriness to platelet transfusions.

Use of recombinant activated factor VII outside these indications (including critical bleeding after trauma) is considered 'off-label' and is associated with harm.

Use of recombinant activated factor VII should only be considered in exceptional circumstance where all other available measures to control bleeding have been exhausted.

(Weak recommendation against, low or very low certainty about the evidence)

R6

In trauma patients with critical bleeding, the reference group suggests the early use (within 3 hours of injury) of tranexamic acid as part of a major haemorrhage protocol.

(Weak recommendation, low certainty of evidence about the evidence)

GPS9

The reference group agreed that there is insufficient evidence to provide a recommendation on the use of tranexamic acid in patients with critical gastrointestinal bleeding.

R7

In obstetric patients with critical bleeding, the early use (within 3 hours of the onset of haemorrhage) of tranexamic acid may be considered as part of a major haemorrhage protocol.

(Weak recommendation, low certainty of evidence about the evidence)

GPS10

The reference group agreed that the use of viscoelastic haemostatic assays* may be beneficial in patients with critical bleeding. There is insufficient evidence to provide a recommendation.

If viscoelastic haemostatic assays are used in the assessment of patients with critical bleeding, they must be used in conjunction with a major haemorrhage protocol.

*Interpretation of results requires specific expertise and training.

GPS11

The reference group agreed that the use of cell salvage* in patients with critical bleeding may be considered as part of a major haemorrhage protocol. There is insufficient evidence to provide a recommendation.

*The use of cell salvage requires specific expertise and training.