

Improving Awareness about Patient Blood Management in Portugal: A Call for Action Arising from a Delphi Panel



ARTIGO ORIGINAL

Melhorar a Consciencialização sobre Patient Blood Management: Um Repto de Ação a Partir de um Painel de Delphi

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ABSTRACT

Introduction: Anaemia and iron deficiency are associated with increased mortality and poor surgical outcomes. Consensus in their definitions is expected to optimize their management, which is encompassed by patient blood management, providing patient-centred care while improving patient safety and clinical outcomes. Patient blood management implementation is even more relevant in contingency times and faces barriers due to lack of standardization, among others. The aim is to establish a consensus on these diagnoses and implement patient blood management principles in clinical practice in Portugal.

Material and Methods: Eight experts in Transfusion Medicine, Haematology, Anaesthesiology, Internal Medicine, and Obstetrics/Gynaecology were assembled; a focus group was conducted, defining 33 statements. A Delphi panel was conducted, with experts from the clinical specialities named above as well as from General Surgery, Urology, and Orthopaedics.

Results: The Delphi panel's rounds had 70 (Round 1) and 46 (Round 2) respondents. Specialists were consensual in only two statements, on the existence of a preoperative patient blood management consultation for candidates to elective surgeries in which the use of blood derivatives is anticipated and, on the importance of the correction of postoperative anaemia and iron deficiency. Of the remaining 31 statements, 27 reached high agreement or disagreement by the respondents.

Conclusion: Consensus was reached in only two (6%) of the 33 statements. There was a consensual agreement on the relevance of establishing patient blood management as the standard of care and of valuing preoperative and postoperative patient blood management interventions. Nevertheless, our results point to the lack of awareness regarding patient blood management principles – which could result in better postoperative outcomes, shorter hospitalizations, reduced costs and increased availability of beds. Training and literacy initiatives could help further implement patient blood management standards in Portuguese hospitals.

Keywords: Anemia; Anemia, Iron-Deficiency; Biomarkers/blood; Blood Transfusion; Consensus; Iron Deficiencies; Perioperative Care

RESUMO

Introdução: A anemia e ferropenia estão associadas a um aumento da mortalidade e a piores resultados no período pós-operatório. Consensualizar as suas definições permitirá otimizar a sua gestão. O *patient blood management* engloba essa gestão, com relevo acrescido em situações de contingência, focado nos cuidados centrados no doente e na melhoria da segurança e dos *outcomes*. As barreiras à implementação de princípios *patient blood management* prendem-se, entre outras, com falta de padronização. Pretende-se estabelecer um consenso sobre estes diagnósticos e implementação de *patient blood management* na prática clínica em Portugal.

Material e Métodos: Foram reunidos oito especialistas em Imuno-hemoterapia, Hematologia Clínica, Anestesiologia, Medicina Interna e Obstetrícia/ Ginecologia. Foi realizado um *focus group*, onde foram definidas 33 afirmações. Além disso, foi realizado um painel Delphi, com especialistas das áreas mencionadas acima, assim como de Cirurgia Geral, Urologia e Ortopedia.

Resultados: As duas rondas do painel Delphi tiveram, respetivamente, 70 e 46 respondedores. Estes foram consensuais em apenas duas afirmações, na existência de consulta pré-operatória de *patient blood management* para os candidatos a cirurgias eletivas em que se antecipa o uso de hemoderivados e, na importância da correção da anemia e ferropenia pós-operatórias. Das 31 afirmações restantes, 27 atingiram alta concordância ou discordância pelos respondentes.

Conclusão: Foi alcançado consenso em apenas duas (6%) das 33 afirmações. Houve consenso sobre a relevância de estabelecer o *patient blood management* como *standard of care* e a valorização das intervenções de *patient blood management* pré e pós-operatórias. No entanto, os resultados indiciam falta de consciencialização sobre os princípios de *patient blood management* – que poderiam levar a melhores resultados pós-operatórios, com redução do tempo de hospitalização e dos custos e maior disponibilidade de camas. Iniciativas de formação e literacia poderiam ajudar a uma melhor implementação dos princípios de *patient blood management* nos hospitais portugueses.

Palavras-chave: Anemia; Anemia por Deficiência de Ferro; Biomarcadores/sangue; Consenso; Cuidados Perioperatórios; Deficiências de Ferro; Transusão de Sangue

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INTRODUCTION

Anaemia is defined as haemoglobin levels below the accepted lower level of the normal range,¹ set at 12 g/dL in women and 13 g/dL in men by the World Health Organization (WHO).² Nonetheless, these reference values have been challenged³ and there is an urge to establish suitable thresholds and to define anaemia while ensuring its adequate diagnosis and management.⁴ Furthermore, anaemia has been independently associated with increased morbidity, mortality, and poorer outcomes in a variety of disorders.^{5,6}

Regarding iron deficiency, which is very common in the general population, no absolute consensus exists in terms of which biomarkers should be used for assessing the human iron status.⁷ This is of particular relevance due to its frequent coexistence with anaemia, as well as its independent association with increased mortality.⁸ Additionally, both anaemia and iron deficiency are more frequent in older age. Given that the Portuguese population is ageing, that probably results in more surgeries for patients with anaemia or iron deficiency.

Patient blood management (PBM) consists, according to the Society for the Advancement of Blood Management, in the proper and timely application of evidence-based concepts designed to maintain haemoglobin concentration, optimize haemostasis, and minimize blood loss – in order to improve patient outcomes.⁹ This innovative multidisciplinary approach encompasses, in its broadness, the management of perioperative anaemia and iron deficiency.¹⁰

The incorporation of PBM principles into clinical practice and hospital-based processes is linked with improvements in patient safety and clinical outcomes,^{11,12} in order to provide patient-centred care. These principles are even more relevant in contingency times, in which the third pillar of PBM (harness and optimize physiological reserve of anaemia) and its restrictive transfusion strategies¹³ are relevant. Moreover, a meta-analysis indicated that PBM may be associated with a potential decrease in post-operative complications, when compared with control management, therefore highlighting the potential cost-effectiveness of its implementation in daily practice.¹⁴ Nevertheless, implementation of PBM has not been widespread due to specific barriers such as the lack of awareness of the new standard operating procedures, and that many hospitals still need guidance to implement PBM – which ought to be the standard of care – in clinical routine.^{10,15}

The aim of this study was to establish a consensus through a Delphi panel on the diagnosis of anaemia and iron deficiency, and on the implementation of PBM principles in clinical practice, by Portuguese medical experts in Transfusion Medicine, Haematology, Anaesthesiology, Internal Medicine, Obstetrics and Gynaecology, General Surgery, Urology, and Orthopaedics.

MATERIAL AND METHODS

The main purpose of the study was to assess the agreement level amongst medical specialists, regarding topic A

– Anaemia and iron deficiency definitions; topic B – Patient blood management (PBM); and topic C – Follow-up of post-operative patients.

A group of eight medical experts in Transfusion Medicine, Haematology, Anaesthesiology, Internal Medicine, and Obstetrics and Gynaecology was assembled, and a focus group was conducted. The participants of the focus group were selected by invitation, and the meeting was conducted by a physician who did not intervene in the discussion. In this focus group, 33 statements concerning the above-mentioned topics were agreed upon (Table 1).

The conduct of a two-round Delphi Panel followed the statement setting phase. The Delphi panel method aims at reaching consensus on a given subject according to the opinion of experts through a multistage process of interactive rounds.¹⁶ Its application is deemed as particularly useful in approaching complex, large, and multidisciplinary issues,¹⁷ such as the topics covered by this study.

Round 1

The focus group participants were asked to reply to an anonymized online questionnaire sent by e-mail. They were equally invited to send the questionnaire's web-link to approximately twenty other medical experts working in their field (Transfusion Medicine, Haematology, Anaesthesiology, Internal Medicine, and Obstetrics and Gynaecology), as well as in General Surgery, Urology, and Orthopaedics. All participants were asked to categorize the 33 statements, presented in a randomized order, using a 4-point Likert scale: fully disagree; disagree; agree; fully agree.

The target response rate for round 1 was set at 50 respondents, and the consensus agreement level was set at 70%: all statements with at least 70% of responses “fully agree” or “fully disagree” were considered as consensual. The statements not reaching this consensus agreement level were subsequently selected to be include in an additional stage – Round 2.

Round 2

The experts who had participated in the first round were then asked to reply to another anonymized online questionnaire sent by e-mail, and the aim was to categorize the statements which failed to reach a consensus in round 1, using the same 4-point Likert scale.

The target response rate for round 2 was set at 30 respondents, and the consensus agreement level was set at 70%: all statements with at least 70% of responses “fully agree” or “fully disagree” were considered as consensual. All statements reaching above 70% in terms of combined agreement (i.e., “agree” and “fully agree”) or disagreement (i.e., “disagree” and “fully disagree”), were classified as “highly agreed” upon.

RESULTS

Round 1

Consistent answers from 70 participants were obtained

Table 1 – Statements for the consensus process – round 1

A. Anaemia and iron deficiency	
A1	The World Health Organization (WHO) definition of anaemia is the most suitable. [Hb < 12.0 g/dL, women; Hb < 13.0 g/dL, men]
A2	In clinical practice the World Health Organization (WHO) definition of anaemia is not generally adopted.
A3	I define iron deficiency as ferritin below 30 ng/mL.
A4	I define iron deficiency as transferrin saturation ratio below 20%.
A5	To define iron deficiency, it is necessary to use ferritin levels together with the transferrin saturation ratio.
A6	The clinical and physiological contexts are of central importance to define iron deficiency.
A7	The definition of anaemia is different in the postoperative context.
A8	In the postoperative period a haemoglobin level of 10 g/dL does not imply any intervention.
A9	It is expectable for ferritin values to be altered after surgery.
A10	Ferritin is a good iron deficiency marker after surgery.
B. Patient blood management – PBM	
B1	A preoperative PBM medical appointment must exist only when addressing major surgeries.
B2	A preoperative PBM medical appointment must exist for all patients who are candidates to elective surgeries in which blood products are expected to be used.
B3	A preoperative PBM medical appointment must exist to all patients with anaemia candidates to elective surgeries.
B4	A preoperative PBM medical appointment must exist for all patients who are major surgery candidates.
B5	A preoperative PBM medical appointment must exist only when intraoperative blood losses above 500 mL are anticipated.
B6	A preoperative PBM medical appointment must exist only when addressing major surgeries.
B7	The preoperative hematologic assessment cannot be performed by the General Practitioner.
B8	The preoperative evaluation should include the reticulocytes' evaluation.
B9	In a patient with anaemia or iron deficiency which was documented the day before surgery there is no need to start preoperative treatment.
B10	Transfusion of red cell concentrates is the best strategy to treat anaemia in the immediate postoperative period (48 hours).
B11	It is mandatory to postpone elective surgeries of anaemic patients who have started anaemia correction in the preoperative period.
B12	In the postoperative period the evaluation of Complete Blood Count (CBC), ferritin, and transferrin saturation should be performed as soon as possible after surgery.
B13	In patients with stable volaemia the evaluation of CBC, ferritin, and transferrin saturation should be performed 12 to 24 hours after surgery.
B14	In the postoperative period the evaluation of CBC, ferritin, and transferrin saturation should be performed in all patients with anaemia (preoperative or postoperative) before hospital discharge.
B15	Postoperative clinical instability of patients in PBM programs do not change the timings to evaluate CBC, ferritin, and transferrin saturation.
B16	After surgery, the CBC should not include reticulocytes.
B17	After surgery it is equally important to correct anaemia and iron deficiency.
B18	The preferred treatment for anaemia in the postoperative period is transfusion of red cell concentrates.
B19	In the postoperative period iron deficiency without anaemia should not be treated.
B20	Erythropoiesis stimulant agents have no place in anaemia's postoperative correction.
C. Postoperative follow-up	
C1	A stable patient with controlled anaemia at the date of hospital discharge does not require subsequent follow-up.
C2	After hospital discharge the postoperative hematologic assessment should be conducted by the General Practitioner.
C3	At the postoperative 30 days reevaluation, the surgeon should re-evaluate the CBC, ferritin, and transferrin saturation.

in the first round, which was above the target response rate previously established (50 respondents). The response rate was 100% for all statements.

None of the 33 sentences obtained consensus level in the first round. For this reason, all the sentences were transposed to the second stage of consultation - round 2.

Round 2

Consistent answers from 46 participants were obtained in the second round, which was equally above the target response established (30 respondents). Again, the response rate was 100% for all statements.

A consensus level was obtained for two sentences. Considering combined levels of agreement (i.e., "agree"

and “fully agree”) or disagreement (i.e., “disagree” and “fully disagree”), 27 statements were classified as highly agreed upon. The remaining four sentences were disregarded.

The obtained results are summarized in Table 2.

The specialists were consensual (i.e., more than 70% concordance) regarding [B2] “a preoperative PBM (Patient

Blood Management) medical appointment must exist for all patients who are candidates to elective surgeries in which blood products are expected to be used” (71.7%) and that [B17] “after surgery it is equally important to correct anaemia and iron deficiency” (76.1%).

More than 90% of the participants agreed or fully agreed

Table 2 – Answers to the second stage of the consensus process - round 2

Reference number	Sentence
A1	The World Health Organization (WHO) definition of anaemia is the most suitable. [Hb < 12.0 g/dL, women; Hb < 13.0 g/dL, men]
A2	In clinical practice the World Health Organization (WHO) definition of anaemia is not generally adopted. [Hb < 12.0 g/dL, women; Hb < 13.0 g/dL, men]
A3	I define iron deficiency as ferritin below 30 ng/mL.
A4	I define iron deficiency as transferrin saturation ratio below 20%.
A5	To define iron deficiency, it is necessary to use ferritin levels together with the transferrin saturation ratio.
A6	The clinical and physiological contexts are of central importance to define iron deficiency.
A7	The definition of anaemia is different in the postoperative context.
A8	In the postoperative period a haemoglobin level of 10 g/dL does not imply any intervention.
A9	It is expectable for ferritin values to be altered after surgery.
A10	Ferritin is a good iron deficiency marker after surgery.
B1	A preoperative PBM medical appointment must exist only when addressing major surgeries.
B2	A preoperative PBM medical appointment must exist for all patients who are candidates to elective surgeries in which blood products are expected to be used.
B3	A preoperative PBM medical appointment must exist to all patients with anaemia candidates to elective surgeries.
B4	A preoperative PBM medical appointment must exist for all patients who are major surgery candidates.
B5	A preoperative PBM medical appointment must exist only when intraoperative blood losses above 500 mL are anticipated.
B6	A preoperative PBM medical appointment must exist only when addressing major surgeries.
B7	The preoperative hematologic assessment cannot be performed by the General Practitioner.
B8	The preoperative evaluation should include the reticulocytes' evaluation.
B9	In a patient with anaemia or iron deficiency which was documented the day before surgery there is no need to start preoperative treatment.
B10	Transfusion of red cell concentrates is the best strategy to treat anaemia in the immediate postoperative period (48 hours).
B11	It is mandatory to postpone elective surgeries of anaemic patients who have started anaemia correction in the preoperative period.
B12	In the postoperative period the evaluation of CBC, ferritin, and transferrin saturation should be performed as soon as possible after surgery.
B13	In patients with stable volaemia the evaluation of CBC, ferritin, and transferrin saturation should be performed 12 to 24 hours after surgery.
B14	In the postoperative period the evaluation of CBC, ferritin, and transferrin saturation should be performed in all patients with anaemia (preoperative or postoperative) before hospital discharge.
B15	Postoperative clinical instability of patients in PBM programs do not change the timings to evaluate CBC, ferritin, and transferrin saturation.
B16	After surgery, the CBC should not include reticulocytes.
B17	After surgery it is equally important to correct anaemia and iron deficiency.
B18	The preferred treatment for anaemia in the postoperative period is transfusion of red cell concentrates.
B19	In the postoperative period iron deficiency without anaemia should not be treated.
B20	Erythropoiesis stimulant agents have no place in anaemia's postoperative correction.
C1	A stable patient with controlled anaemia at the date of hospital discharge does not require subsequent follow-up.
C2	After hospital discharge the postoperative hematologic assessment should be conducted by the General Practitioner.
C3	At the postoperative 30 days reevaluation, the surgeon should re-evaluate the CBC, ferritin, and transferrin saturation.

■: consensus “Fully agree”; ■: consensus combined levels “Agree” and “Fully agree”; ■: consensus combined levels “Disagree” and “Fully disagree”; ■: lack of consensus
PBM: patient blood management; CBC: complete blood count; FD: fully disagree; D: disagree; A: agree; FA: fully agree

about: [A6] “the clinical and physiological contexts are of central importance to define iron deficiency” (95.7%); [A9] “it is expectable for ferritin values to be altered after surgery” (91.3%); [B3] “a preoperative PBM medical appointment must be offered to all patients with anaemia, candidates for elective surgeries” (91.3%). Concomitantly, more than 90% of the participants disagreed or fully disagreed

that: [B9] “in a patient with anaemia or iron deficiency which was documented the day before surgery there is no need to start preoperative treatment” (93.5%); [B18] “the preferred treatment for anaemia in the postoperative period is transfusion of red cell concentrates” (93.5%); [B19] “in the postoperative period iron deficiency without anaemia should not be treated” (95.7%).

	D + FD (%)	FD (%)	D (%)	A (%)	FA (%)	A + FA (%)	Consensus	Agreement
	19.6	2.2	17.4	60.9	19.6	80.4	-	x
	43.5	6.5	37.0	39.1	17.4	56.5	-	-
	13.0	2.2	10.9	43.5	43.5	87.0	-	x
	21.7	4.4	17.4	45.7	32.6	78.3	-	x
	15.2	2.2	13.0	34.8	50.0	84.8	-	x
	4.3	2.2	2.2	41.3	54.4	95.7	-	x
	76.1	32.6	43.5	19.6	4.4	23.9	-	x
	73.9	23.9	50.0	21.7	4.4	26.1	-	x
	8.7	0.0	8.7	41.3	50.0	91.3	-	x
	76.1	32.6	43.5	21.7	2.2	23.9	-	x
	34.8	13.0	21.7	37.0	28.3	65.2	-	-
	2.2	0.0	2.2	26.1	71.7	97.8	x	-
	8.7	0.0	8.7	23.9	67.4	91.3	-	x
	17.4	2.2	15.2	30.4	52.2	82.6	-	x
	78.3	30.4	47.8	17.4	4.4	21.7	-	x
	78.3	32.6	45.7	19.6	2.2	21.7	-	x
	71.7	23.9	47.8	17.4	10.9	28.3	-	x
	15.2	0.0	15.2	50.0	34.8	84.8	-	x
	93.5	69.6	23.9	6.5	0.0	6.5	-	x
	84.8	32.6	52.2	13.0	2.2	15.2	-	x
	71.7	19.6	52.2	17.4	10.9	28.3	-	x
	50.0	2.2	47.8	39.1	10.9	50.0	-	-
	28.3	2.2	26.1	56.5	15.2	71.7	-	x
	10.9	0.0	10.9	52.2	37.0	89.1	-	x
	82.6	28.3	54.4	17.4	0.0	17.4	-	x
	87.0	39.1	47.8	13.0	0.0	13.0	-	x
	2.2	0.0	2.2	21.7	76.1	97.8	x	-
	93.5	56.5	37.0	6.5	0.0	6.5	-	x
	95.7	60.9	34.8	4.4	0.0	4.4	-	x
	80.4	23.9	56.5	15.2	4.4	19.6	-	x
	87.0	30.4	56.5	10.9	2.2	13.0	-	x
	41.3	2.2	39.1	52.2	6.5	58.7	-	-
	15.2	2.2	13.0	41.3	43.5	84.8	-	x

At least 80% of the experts agreed or fully agreed in [A1] “the World Health Organization (WHO) definition of anaemia is the most suitable” (80.4%); [A3] “[they] define iron deficiency as ferritin below 30 ng/mL” (87%); [A5] “to define iron deficiency, it is necessary to use ferritin levels along with the transferrin saturation ratio” (84.8%); [B4] “a preoperative PBM medical appointment must be offered to all patients who are major surgery candidates” (82.6%); [B8] “the preoperative evaluation should include a reticulocyte count” (84.8%); [B14] “in the postoperative period the evaluation of Complete Blood Count (CBC), ferritin, and transferrin saturation should be performed in all patients with anaemia (preoperative or postoperative), before hospital discharge” (89.1%); [C3] “at the postoperative 30 days follow-up, the surgeon should re-evaluate the CBC, ferritin, and transferrin saturation” (84.8%). Likewise, at least 80% of the experts disagreed or fully disagreed that: [B10] “transfusion of red cell concentrates is the best strategy to treat anaemia in the immediate postoperative period (48 hours)” (84.8%); [B15] “postoperative clinical instability of patients in PBM programs do not change the timings to evaluate CBC, ferritin, and transferrin saturation” (82.6%); [B16] “after surgery, the CBC should not include a reticulocyte count” (87%); [B20] “erythropoiesis stimulant agents have no place in the postoperative correction of anaemia” (80.4%); [C1] “a stable patient with controlled anaemia at the date of hospital discharge does not require subsequent follow-up” (87%).

Finally, 70% or more of the respondents agreed or highly agreed in: [A4] “[they] define iron deficiency as transferrin saturation ratio below 20%” (78.3%); [B13] “in patients with stable volaemia the evaluation of CBC, ferritin, and transferrin saturation should be performed 12 to 24 hours after surgery” (71.7%). Similarly, 70% or more of the respondents disagreed or highly disagreed that: [A7] “the definition of anaemia is different in the postoperative context” (76.1%); [A8] “in the postoperative period a haemoglobin level of 10 g/dL does not imply any intervention” (73.9%); [A10] “ferritin is a good iron deficiency marker after surgery” (76.1%); [B5] “a preoperative PBM medical appointment must exist only when intraoperative blood losses above 500 mL are anticipated” (78.3%); [B6] “a preoperative PBM medical appointment must exist only when addressing major surgeries” (78.3%); [B7] “the preoperative haematological assessment cannot be performed by the General Practitioner / Family Physician” (71.7%); [B11] “it is mandatory to postpone elective surgeries of anaemic patients who have started anaemia correction in the preoperative period” (71.7%).

No consensus or agreement level was reached regarding the WHO definition of anaemia not being generally adopted in clinical practice, that a preoperative PBM medical appointment must exist only when addressing major surgeries, that the evaluation of CBC, ferritin, and transferrin saturation index should be performed as soon as possible after surgery, and that after hospital discharge the postoperative hematologic assessment should be conducted by the General Practitioner / Family Physician.

DISCUSSION

The aim of this study was to establish a consensus through a Delphi Panel on the diagnosis of anaemia and iron deficiency and on the implementation of PBM principles in clinical practice, which was only partially achieved. Consensus level was achieved for only two of the 33 statements included in the panel (6%) - the lack of consensus on this topic reinforces the need for awareness-raising training programs in this area and the implementation of PBM programmes.^{18,19} Moreover, a high agreement level was reached for 27 statements (82%). Even though these results signal convergent perspectives from a broad range of medical specialties, they equally highlight the lack of awareness regarding PBM principles – which would allow better postoperative outcomes and minimization of other interventions.

The EMPIRE study, a population-based, cross-sectional study, estimated the prevalence of anaemia in Portugal as 19.9%, with 84% of cases previously undiagnosed.²⁰ This data also reinforces the need to conduct additional studies at the national level, given the epidemiology and prevalence of anaemia, and the implications it may have for the population. Apart from the established need for additional research and international consensus,²¹ training and literacy initiatives could help further implement PBM standards in Portuguese hospitals.

The experts established as consensual that: PBM medical appointments must be offered to all patients who are candidates for elective surgeries in which blood products are expected to be used, and after surgery, it is equally important to correct anaemia and iron deficiency. These recommendations are in line with other studies, which have recognized the need for evidence-based approaches, with PBM activities being included in the preoperative, perioperative and postoperative routines, in all surgical units.⁵ Furthermore, the postoperative treatment of anaemia and iron deficiency has been acknowledged as relevant in the literature, and linked with better postoperative outcomes, as well as improvements in patient performance and quality of life.²²

In terms of anaemia and iron deficiency (Topic A), the respondents agreed on the WHO’s definition of anaemia as being the most suitable, not considering it to be different in the postoperative context. Additionally, they disagreed that haemoglobin levels of 10 g/dL after surgery will not imply an intervention. As for the definition of anaemia (although bearing in mind that it may not translate into specific clinical approaches to given patients or haemoglobin levels), these findings are mirrored by other studies in which the WHO reference standards have indeed been commonly used.^{11,23,24}

About iron deficiency, the experts agreed about the need of using ferritin levels (below 30 ng/mL) as well as the transferrin saturation ratio (below 20%). Additionally, the clinical and physiological contexts were agreed as being of central importance to the definition of iron deficiency. There is no full international consensus on biomarkers for the assessment of the iron status, since the diagnostic accuracy

of iron deficiency depends on its selection.⁷ However, the panel's agreement is aligned with other studies on this matter, namely, in terms of the aforementioned reference levels and the multifactorial definition of iron deficiency.^{3,8,25,26} Finally, the experts agreed that it is expected that for ferritin levels change after surgery, due to the elevation of ferritin levels as part of the postoperative acute phase inflammatory response.²⁷ It was agreed that ferritin is not a good iron deficiency marker in the period after surgery.

Regarding patient blood management (Topic B), the clinicians agreed that all patients with anaemia who are candidates for elective surgery should have a preoperative PBM medical appointment, as well as all patients who are major surgery candidates. Conversely, combined levels of disagreement above the established threshold were reached for statements arguing that: preoperative PBM medical appointments should only be available when intraoperative blood losses above 500 mL are anticipated; preoperative PBM medical appointments should be available only when the patient is undergoing major surgery; the General Practitioner / Family Physician cannot perform the preoperative haematological assessment. Indeed, shifting to a wide-ranging PBM focus and its application to all surgical candidates has been widely linked with: improvements in costs; mitigation of patient risk; reduction of complications; and increased patient safety.^{9,15,28-30} However, PBM has been commonly presented as both a patient-centred and a hospital-centred model,²⁸ and so it is worth reinforcing agreement on the potential inclusion of the General Practitioner / Family Physician in the preoperative haematological assessment.

Concerning the parameters and timings of preoperative and postoperative evaluations, the experts agreed that: both the preoperative and the postoperative evaluation should include the evaluation of reticulocytes; in patients with stable volaemia, the evaluation of CBC, ferritin, and transferrin saturation should be performed 12 to 24 hours after surgery; in the postoperative period the evaluation of CBC, ferritin, and transferrin saturation should be performed in all patients with anaemia (preoperative or postoperative), before hospital discharge. Conversely, they disagreed that postoperative clinical instability of patients in PBM programs does not change the timings to evaluate CBC, ferritin, and transferrin saturation. These findings are equally reflected by other studies, which: recognize the relevance of measuring the reticulocyte count before and after surgery³¹⁻³³; refer to the re-evaluation of CBC, ferritin, and transferrin saturation in the first 24 hours following surgery (although the lowest haemoglobin levels may be seen three to four days after surgery)³⁴; and highlight the patient-focused approach, depending on its physiological and clinical statuses – arguing that patients should be followed after surgery to ensure continued management of their anaemia during their hospital admission and after discharge.⁹ The panel's agreement is reinforced by the final topics, in which it is stated that ferritin levels can be modified after surgery, as well as that ferritin can be a valid marker for iron deficiency.

As for anaemia or iron deficiency treatment in the preoperative period, the specialists disagreed that in a patient with anaemia or iron deficiency which has only been documented the day before surgery there is no need to start preoperative treatment. They equally disagreed that it is mandatory to postpone elective surgeries of anaemic patients who have started anaemia correction in the preoperative period. Indeed, the published evidence supports the fact that preoperative anaemia is associated with a worse prognosis, and thus emphasizes the need for its correction before surgery.^{35,36} Nonetheless, it has equally been argued that treatment of anaemia and iron deficiency should start as early as possible in the preoperative period³⁷ and that in particular circumstances it may be beneficial to postpone surgical procedures until anaemia improvement or resolution.³⁸ Regarding anaemia or iron deficiency treatment in the postoperative period, the specialists disagreed that: transfusion of red cell concentrates is the best strategy to treat anaemia in the immediate postoperative period (48 hours); the preferred treatment for anaemia in the postoperative period is transfusion of red cell concentrates. In fact, despite anaemia being known as an independent risk factor for morbidity and mortality in elective surgeries, blood transfusions have equally been independently associated with morbidity and mortality.^{11,28} Finally, combined disagreement levels were above the established threshold when mentioned that iron deficiency without anaemia during the postoperative period should not be treated and that erythropoiesis stimulant agents have no place in the postoperative correction of anaemia. Iron deficiency is acknowledged as an independent entity beyond anaemia, worth treating on its own, regardless of anaemia being its leading symptom.^{8,39} Furthermore, erythropoiesis stimulant agents are known to be potentially beneficial in the perioperative period, by improving survival rates, decreasing blood transfusions and shortening hospitalization.^{26,40} As such, these agents are often recommended within preoperative decision algorithms, but their suitability in postoperative similar algorithms has also been mentioned.¹⁰

About the postoperative follow-up (Topic C), the respondents agreed that, at the postoperative 30-day reevaluation, the surgeon should re-evaluate the CBC, ferritin, and transferrin saturation. This finding reinforces the relevance of including several medical specialities and their expertise within a patient-centred PBM approach. Also, on this topic, the experts disagreed that a stable patient with controlled anaemia at the date of hospital discharge will not require subsequent follow-up. Once again, this is in line with the current recommendations in terms of follow-up of anaemic patients, which may imply monitoring and interventions beyond the hospital stay.^{32,34}

Limitations

Due to the nature of this study's methodology, as well as the need to comply with privacy and personal data regulations, it is not possible to differentiate the inputs from experts working in different medical domains, which may

introduce bias in the obtained results in terms of medical specialty representativity.

CONCLUSION

Prior studies have highlighted the consensual relevance of establishing an individualized plan, within the context of PBM as the standard of care, and of valuing preoperative and postoperative PBM interventions, thus highlighting the relevance of correcting anaemia and ID in the perioperative context.

In this Delphi panel, experts established as consensual that PBM medical appointments should exist for all patients who are candidates for elective surgeries in which blood products are expected to be used and that after surgery it is equally important to correct anaemia and iron deficiency. However, our results point out that convergent perspectives from a broad range of medical specialties exist, as do knowledge gaps in PBM principles and thus future training and literacy initiatives could be useful. These, focusing on harmonised practices in minimising or avoiding blood transfusion, would allow to further help the development and implementation of PBM standards in Portuguese hospitals, reducing morbimortality in post-surgery patients, costs and increasing availability of hospital beds.

AUTHORS CONTRIBUTION

ARN, DB: Planning and design of the work; data analysis; writing and critical review of the manuscript.

AM: Concept of the work; panel management; data analysis; writing and critical review of the manuscript.

VB, DG, JGA, FL, JM, TML: Member of the focus group; critical review of the manuscript.

PROTECTION OF HUMANS AND ANIMALS

The material submitted conforms with regulations currently in force regarding research ethics. The work was performed in accordance with the principles of the Declaration of Helsinki updated in 2013.

DATA CONFIDENTIALITY

The authors declare having followed the protocols in use at their working center regarding patients' data publication.

COMPETING INTERESTS

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