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Implementation of blood sparing protocol in pediatric scoliosis surgery : Effect on peri operative red blood cell requirements

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Position du problème et objectif(s) de l'étude:

Patient Blood Management program consist in multimodal strategies developed to reduce transfusion and improve global patient outcome.

The aim was to assess the implementation of blood sparing protocol -associating intravenous iron and erythropoietin Stimulating Agent- on transfusion requirements in pediatric scoliosis surgery. The secondary objectives include safety, adherence to protocol, postoperative hemoglobin, postoperative iron use, complication rate, length of stay and global costs.

Matériel et méthodes:

This retrospective, monocentric, comparative study included pediatric patients undergoing posterior spinal fusion planned between January 2017 and July 2022.

Three weeks before the date of surgery, patients were evaluating by an anesthetist. Blood sparing protocol was applied when hemoglobin was inferior to 13 g/dL. Speciality of intravenous iron admistred depending of the age of patient. In association two erythropoietin injections were systematically planned at home 21 and 14 days before the surgery, a third one could be necessary according to hemoglobin performed 10 days before the surgery.

Primary outcome was the rate of transfusion compared between the two periods (before and after the implemented protocol).

Descriptive statistics of the population were performed, Mann-Whitney or Student tests were used to compare quantitative data. Qualitative data were compared by Chi-2 test. Multivariate analysis were performed to determine risk factors associated with transfusion.

Résultats & Discussion:

611 patients were included, 293 in the period before the protocol and 318 in the period after. The rate of transfusion was lower in the group after protocol 21,9% (64) before compared to 9,15% (29) after $p<0,0001$ (OR=2,78 (CI 1,748; 4,459). Idiopathic and neuromuscular scoliosis were less likely to be transfused after the protocol compared to before.

Seven adverse events were noticed related to protocol, the majority was cutaneous, one was severe.

Adherence rate to the protocol was 96,3%. The rate of complications was similar between the two groups. Length of stay and hospitalization costs were reduced after the implementation of the protocol. Pre and postoperative hemoglobin were statistically higher in the group after the protocol implemented. Postoperative iron use were more frequent before the protocol.

Multivariable logistic regression analysis identified 4 risk factors of transfusion : ASA III-IV score, Non-idiopathic etiology, preoperative anemia and number of fusion levels.

Conclusion:

Pediatric scoliosis surgery constitute a major orthopedic surgery and is associated with transfusion risk. Even the increased safety of transfusion, transfusion remains linked to morbidity and mortality, postoperative infections and lengthening of stay. Development of PBM program is aimed at reducing transfusion through various strategies.

Our comparative retrospective study confirms that implementation of blood sparing protocol is effective to decrease perioperative transfusion requirements. The protocol associating intravenous iron and erythropoietin has shown safety and feasibility in clinic, with reduced length of stay and hospitalization

costs.

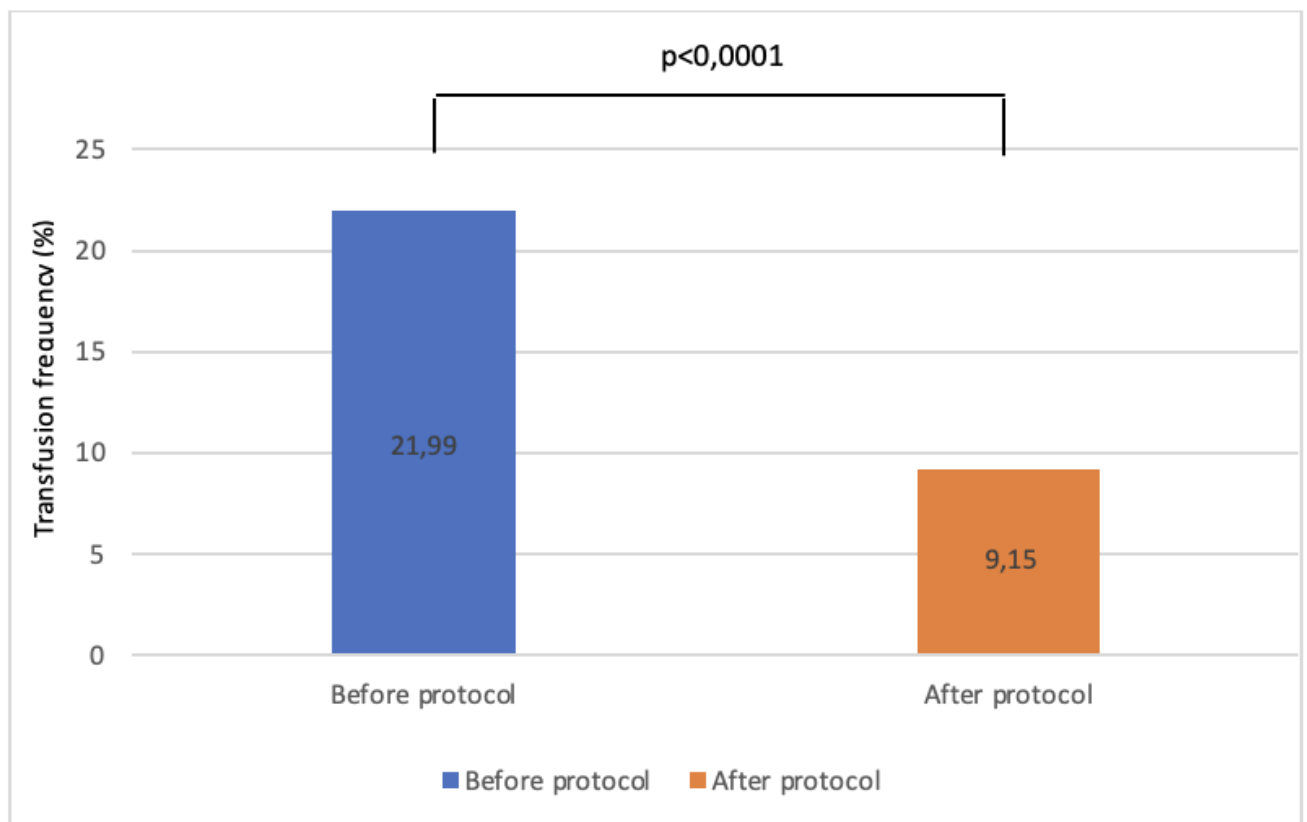
The evaluation of protocol daily applied seems to be necessary in aim of improving patient outcomes and healthcare.

To go further, the development of preoperative risk score predicting transfusion since anaesthetic consultation could be interesting to adapt and personalize patient blood management protocol according risk factors identified.

Tableau 1: Comparison before and after protocol : general and surgical data

Patients	Before protocol N= 293	After protocol N= 318	P value
N= 611			
Sex- n (%)			
Female	210 (71,67)	239 (75,16)	0,33
Male	83 (28,33)	79 (24,84)	
Age, y.o- mean (+/-SD)	15,25 (3,552)	15,23 (2,671)	0,815
BMI, Kg/m2- mean (+/-SD)	19,75 (3,992)	20,27 (3,91)	0,226
ASA Score, n (%)			
ASA I-II	248 (84,6)	270 (84,9)	>0,999
ASA III-IV	45 (15,4)	48 (15,1)	
Scoliosis etiology, n (%)			0,983
Idiopathic	192 (65,5)	212 (66,7)	
Neuromuscular	60 (20,5)	61 (19,2)	
Congenital	9 (3,1)	10 (3,1)	
Associated with syndrom	32 (10,9)	35 (11)	
Levels fusionned, mean (+/-SD)	12,23 (3,22)	12,1 (3,17)	0,766
Cobb angle, degrees – mean (+/-SD)	59,63 (17,7)	55,79 (14,86)	0,004
Surgery, minutes – mean (+/-SD)	194,3 (47,5)	192 (43,4)	0,916
Anemia (Hb<13 g/dL) - n, (%)	87(29,69)	148(46,54)	<0,001
Iron Deficiency (Ferritin<30) - n, (%)	62 (23,4)	94 (29,56)	0,047
Données per opératoires			
Tranexamic acid: Loading dose mg/Kg – mean(+/-SD)	11,2 (3,8)	15,7 (6,5)	<0,001
Tranexamic acid: Maintenance dose, mg/Kg/h mean(+/-SD)	0,58 (0,68)	1,25 (0,93)	<0,001
Rachi-analgesia morphin, Gamma/Kg – mean (+/-SD)	6,06 (2,35)	5,02 (1,33)	< 0,001
Blood losses, mL/Kg – mean (+/-SD)	7,4 (5,8)	8,3 (6,5)	0,064
Cell-saver use, n (%)	112 (38,6)	219 (68,9)	<0,0001
Vascular filling: Cristalloïds mL/Kg/min – mean(+/-SD)	14,89 (5,82)	14,85 (5,86)	0,94
Total vascular filling mL/Kg/min-mean (+/-SD)	15,2 (5,94)	15,04 (5,81)	0,75
Colloid use, n (%)	26 (8,9)	8 (2,5)	0,0006
Vasopressor use, n (%)	27 (9,4)	43 (13,96)	0,114

Figure: Primary endpoint Red blood cell transfusion frequency before and after the implementation of blood sparing protocol.



Les auteurs déclarent ne pas avoir toute relation financière impliquant l'auteur ou ses proches (salaires, honoraires, soutien financier éducationnel) et susceptible d'affecter l'impartialité de la présentation.