Özgün Araştırma / Original Article

Jinekoloji - Obstetrik ve Neonatoloji Tıp Dergisi
The Journal of Gynecology - Obstetrics and Neonatology

Is Platelet Mass Index Useful to Reduce Prophylactic Platelet Transfusions in Neonates?

Platelet Kitle İndeksi Yenidoğanlarda Profilaktik Transfüzyon Sıklığını Azaltmada Yararlı mıdır?

Fatma İYİGÜN[1] https://orcid.org/0000-0003-4770-4112
İstemi HAN ÇELİK[1] https://orcid.org/0000-0002-2952-8154
Ahmet YAĞMUR BAŞ[2] https://orcid.org/0000-0002-1329-2167
Nihal DEMİREL[2] https://orcid.org/0000-0003-2044-2212

[1] Etlik Zübeyde Hanım Kadın Hastalıkları EAH, Ankara, Türkiye
[2] Ankara Yıldırım Beyazıt Üniversitesi, Pediatri Anabilim Dalı, Yenidoğan Yoğun Bakım Ünitesi, Ankara, Türkiye

ÖZ

Amaç: Trombositopeni yenidoğan yoğun bakım ünitelerinde (YYBÜ) sık görülen bir problemdir. Trombositopeniye sekonder kanama tahmin edilenden azdır ve platelet transfüzyonlarının (PT) %95'i profilaktik olarak yapılmaktadır. Ortalama platelet hacminin (OPH) yüksek olması genç, aktif ve daha etkili platelet plağı oluşumu ile ilişkilendirilmiş ve kanamanın OPH düşük olanlara göre daha az olduğu bildirilmiştir. Bu çalışmada geçmiş PT'larımızı platelet kitle indeksine (PKİ) göre değerlendirmek; platelet sayısı ve PKİ'e dayanan kılavuzların transfüzyon kararı üzerine etkilerini değerlendirmek ve PKİ'e dayanan kılavuz kullanılmış olsaydı transfüzyon sayısında azalma olup olmayacağını bulmayı amaçladık.

Gereç ve Yöntemler: 1 Ocak 2013 ve 31 Aralık 2015 arasında yapılan profilaktik PT'ları değerlendirildi. Veriler hastane kayıtlarından elde edildi. Platelet kitle indeksi OPH x platelet sayısı / 1000 formülü ile hesaplandı. Profilaktik PT'lar platelet sayısı ve PKİ'e dayanan kılavuzlara göre karşılaştırıldı.

Bulgular: Profilaktik PT 48 hastada 66 kez yapılmıştı ve tüm PT'larının %28'iydi. Ortanca gestasyonel yaş ve doğum ağırlığı 32 (23-41) hafta ve 1670 (450-4095) gramdı. Hastalardan 22'sinin doğum ağırlığı 1500 gramın altındaydı. Profilaktik PT yapılan hastaların hiçbirisinde kanama gözlenmedi. Platelet sayısına dayalı kılavuza uyum 96%'ydı. Eğer PKİ'e dayalı kılavuz kullanılsa idi 3 profilaktik PT daha az yapılacaktı ve transfüzyon sayısında %4.5 azalma olacaktı.

Sonuç: Hangi transfüzyon kılavuzu kullanılırsa kullanılsın sıkı bir şekilde kılavuza uyulması gereksiz PT sayısını ve transfüzyon ilişkili riskleri azaltmak için gerekli olan en önemli yöntemdir. Platelet sayısına dayalı kılavuza sıkı bir şekilde uyuluyor ise transfüzyon kararı verirken platelet kitle indeksi destekleyici olarak kullanılabilir.

Anahtar Kelimeler: Profilaktik platelet transfüzyonu, yenidoğan

ABSTRACT

Aim: Thrombocytopenia is a common clinical problem in neonatal intensive care units (NICU). Hemorrhage due to thrombocytopenia is a rare situation than expected and 95% of platelet transfusions (PTs) in NICU are prophylactic transfusions. Platelets with higher MPV are generally younger, more active and have better quality to form an effective platelet plug. Less hemorrhage was reported in patients with higher MPV than lower MPV. We aimed to evaluate our previous PTs according to platelet mass index (PMI), to compare the effect of platelet count based guideline (PCBG) and PMI based guidelines in transfusion decision and to find out whether any reduction of PTs could be seen or not if PMI based guideline was considered.

Material and Methods: Prophylactic PTs performed between January 1, 2013 and December 31, 2015 were evaluated. Data was obtained from medical records. PMI was calculated by MPV x platelet count / 1000. Prophylactic PTs were compared according to PCMG and PMI based guideline.

Results: Prophylactic PT number was 66 in 48 patients and accounted for 28% of platelet transfusions. Median gestational age and birthweight were 32 (23-41) weeks and 1670 (450-4095) g, respectively. 22 of the patients' birthweight were <1500 g. There was no bleeding episode in these patients. Compliance with PCBG was 96% (64/66). If PMI based guideline was used, 3 of the PTs should not have been performed and 4.5% reduction could be achieved.

Conclusion: Compliance with guideline strictly even which of PCBG or PMI based guideline used seems to be primary factor to eliminate unnecessary PTs and to reduce transfusion associated risks. Platelet mass index may be used as supportive if compliance of PCBG is highly adhered.

Keywords: Prophylactic platelet transfusion, newborn

INTRODUCTION

Thrombocytopenia is a common clinical problem in neonatal intensive care units (NICU). The incidence is variable depending on the patient population and definition of thrombocytopenia. Thrombocytopenia is determined in 22-35% of infants admitted to NICU, 50% of sick infants and approximately 75% of extremely low birth weight infants (1-3). The definition of thrombocytopenia is a platelet count <150 000/μL in all age groups and described as mild between 100 000-150 000/μL, moderetely severe between 50 000-100 000/μL and severe <50 000/μL (4).

Sorumlu Yazar/ Correspondin Author:
Fatma İYİGÜN,
Etlik Zübeyde Hanım Kadın Hastalıkları EAH, Ankara, Türkiye.
E-mail: drfatmaguzel@gmail.com

Başvuru tarihi: 03.01.2019
Kabul tarihi: 25.11.2019

Premature infants may have slightly lower values than term infants. Hemorrhage due to thrombocytopenia is rare than expected and 95% of platelet transfusions (PTs) in NICU are prophylactic transfusions to reduce the risk of spontaneous bleeding (5-7).

Transmission of bacterial and viral infections, fever, pulmonary hypertension, hemolytic and allergic reactions are associated with PTs. (8) Unnecessary PTs should be eleminated because of these risks and costs. Platelet count based transfusion guidelines (PCBG) have been used to decide prophylactic PTs. Platelet functions are ignored according to these guidelines. Patients with higher mean platelet volume (MPV) were reported to have less hemorrhage than lower MPV in thrombocytopenic conditions (9). Platelets with higher MPV are generally younger, more active and have better quality to form an effective platelet plug. (10) Platelet mass index (PMI) shows platelet function and calculated by MPV x platelet count / 1000. Limited studies in newborns showed that lower PT rate may be accompanied by using PMI in decision for transfusion without hemorrhage.

We aimed to evaluate our previous PTs according to PMI and compare the effect of PCBG and PMI based guidelines in transfusion decision and whether the frequency of PTs should be reduced if PMI based guideline was considered.

MATERIAL AND METHODS

This retrospective study took place in NICU of Etlik Zubeyde Hanim Women's Health Teaching and Research Hospital, Ankara, Turkey. Local ethical committe permision was taken. Data was collected from patient records. Study period was between January 1, 2013 and December 31, 2015. Number of inborn infants, neonatal intensive care unit admission and premature infants with low birth weight are approximately 16 000, 2500 and 330 per year, respectively. All transfusions were random donor PTs and administred as 10 mL/kg. Only prophylactic PTs were included. Patients who had more than one prophylactic PTs were also included. Exclusion criteria was transfusion due to active bleeding. All PTs were evaluated for compliance to our guideline, and the indications were compared in relation to PMI criteria to determine the unnecessary PTs.

Platelet count based PT guideline in our NICU during 3 years period was to keep platelet count as: (a) >100 000/μL in pre/postoperative patients, (b) >50 000/μL in unstable patients (on invasive mechanical ventilation, circulatory support, with sepsis, < 1000 g), (c) >20 000/μL in stable patients. (8)

If PMI based guideline was used, PT should be performed in conditions as (a) <800 in pre/postoperative patients, (b) <400 in unstable patients (on invasive mechanical ventilation, circulatory support, with sepsis, < 1000 g), (c) <160 in stable patients. (10)

Data analyses were performed using Statistical Package for Social Sciences (SPSS), version 20.0 for MAC (SPSS, Inc.,Chicago, IL). Descriptive statistics for variables with a normal distribution, mean (±standard deviation), for non-normally distributed variables median (minumum-maximum) were used. Nominal variables were showed with the number of cases and percentage (%).

RESULTS

A total of 235 PTs were performed in 117 patients during the study period. Prophylactic PT number was 66 in 48 patients, and account for 28% of PTs. There was no bleeding episode in these patients. Table 1 shows the demographic and clinical characteristics of patients with prophylactic PTs. Median gestational age and birthweight were 32 (23-41) weeks and 1670 (450-4095) g, respectively. 22 of the infants' birthweight were <1500 g. Compliance of PTs to PCBG and PMI based guideline was shown in Table 2. Compliance with PCBG was 96% (64/66). If PMI based guideline was used, 3 of the PTs should not have been performed and 4.5% reduction of PTs could be achieved.

Table 1. The demographic and clinical characteristics of patients

Gestational age (weeks, median)	32 (23-41)
Birth weight (g, median)	1670 (450-4095)
Gender (male/female)	29/19
Number of transfusions per patient (median)	1.3 (1-4)
Day of first transfusion (median)	10 (0-105)
Days of hospital stay (median)	30(1-121)
Number of transfusion according to indications	
>100 000/μL in pre/postoperative patients	2
>50 000/μL in unstable patients	53
>20 000/μL in stable patients	11

Table 2. Transfusions in accordance with platelet count and PMI based guidelines

Number of transfusions		PMI based guideline	
		Noncompliant	Compliant
Platelet count based guideline	Noncompliant	2	0
	Compliant	3	61

DISCUSSION

In the literature, most of the PTs up to 95% have been reported as prophylactic. Our prophylactic PT rate was 28% and lower than the previous studies (4, 6, 11). The benefits of these transfusions remain controversial. However, transfusion associated risks are well known and multiple transfusions increase the risks. Spontaneous bleeding is not only associated with platelet count but also associated with gestational age, platelet function, coagulation disorders, medications, stability of blood pressure, patent ductus arteriosus, infection, necrotizing enterocolitis and inflammation (1, 12). Therefore, PMI based guideline taking platelet functions into account instead of only platelet count can be used to reduce prophylactic PTs without increasing spontaneous hemorrhages (10).

Previous studies showed that adherence to transfusion guidelines was lower than expected. Baer et al. reported that compliance was 52% among 1600 thrombocytopenic newborns with 494 transfusions in 2007 and 65% among 70 newbors in 2008, respectively (13, 14). After these studies' low adherence rate, they implemented a program to increase compliance upto 90% and they performed 174 less PTs in 2009. (15) Petäjä et al. found a 40% compliance in 543 newborns (16). Kahvecioglu et al. reported a 46.8% compliance accor-

ding to their NICU's guidelines and explained this condition as clinicians' interpretation of patients' as more severe than it actually was (17). Our NICU's compliance to PCBG was 96% in 3 years period and higher than previous studies. Also, we had lower prophylactic PT rate. We have strictly used to perform transfusions for platelet, erythrocyte and fresh frosen plasma according to our NICU's guidelines.

The use of PMI based guideline in NICU was found to be associated with fewer PTs with no hemorrhage risk increase by Gerday et al. (10). Their study was a before versus after design prospective. Platelet transfusion decision was performed PCBG and PMI based guideline in period 1 and 2, respectively. Although they decreased PTs rate from 3.6% to 1.9%, PTs percentages in these periods were 91.3% and 75%, respectively. Compliance with guidelines increased from 54% to 72%. Kahvecioglu et al. performed a retrospective study to find out the influence of PMI based guideline if performed in their NICU during last 2 years (17). They found that 53.2% of PTs should not be given if PT decision was strictly performed according to current PCBG, and additional 11.5% reduction could be achieved with taking PMI into consideration. In a pilot study, Zisk et al. randomized PTs' decision according to platelet count and mass including 15 neonates in each group (18). There was no statistically difference in transfusion number, bleeding episodes and mortality despite more infants transfuse in PMI group (47% vs 38%). Ozturk et al. performed a prospective study similar to Zisk's et al. (19). They enrolled 50 neonates in each group. Approximately 50% of neonates received PTs and ~85-90 of these transfusions were prophylactic PTs. The number of transfusions, bleeding episodes and mortality did not differ. These prospective studies did not report what would be changed if they had been used other guideline in each group such as our and Kahvecioglu et al.'s studies. Our results showed that only 4.5% reduction (3 in 66 PTs) could be achieved if we had been used PMI based guideline. Previous studies showed PMI can be used to decrease prophylactic PTs. It should be considered that in these studies compliance of PCBG were lower than it should have been. In our study it seems that PMI based guideline had a limited effect on number of prophylactic PTs because of highly adherence of our NICU to PCBG. PMI based guideline can be helpful in NICU's where adherence to PCBG is lower than expected.

Retrospective design of our study is one of the limitations. Platelet transfusions were performed according to PCBG. There could be adherence problems to PMI based guideline if it was used, too. Future studies determining both guidelines simultaneously may be needed to evaluate the value of PMI based guideline.

In conclusion, platelet mass index may be used to decrease prophylactic PTs. Compliance with guideline strictly even which of PCBG or PMI based guideline used seems to be primary factor to eleminate unnecessary PTs and to reduce tranfusion associated risks.

There is no conflict of interest or any financial relationship.

REFERENCES

1. Wiedmeier SE, Henry E, Sola-Visner MC, Christensen RD. Platelet reference ranges for neonates, defined using data from over 47,000 patients in a multihospital healthcare system. J Perinatol 2009;29(2):130-136.

2. Christensen RD, Henry E, Wiedmeier SE, et al. Thrombocytopenia among extremely low birth weight neonates: data from a multihospital healthcare system. J Perinatol 2006;26(6):348-353.

3. Christensen RD, Henry E, Del Vecchio A. Thrombocytosis and thrombocytopenia in the NICU: incidence, mechanisms and treatments. J Matern Fetal Neonatal Med 2012;25 Suppl 4:15-17.

4. Christensen RD. Platelet transfusion in the neonatal intensive care unit: benefits, risks, alternatives. Neonatology 2011;100(3):311-318.

5. Christensen RD. Advances and controversies in neonatal ICU platelet transfusion practice. Adv Pediatr 2008;55:255-269.

6. Sola-Visner M. Platelets in the neonatal period: developmental differences in platelet production, function, and hemostasis and the potential impact of therapies. Hematology Am Soc Hematol Educ Program 2012;2012:506-511.

7. Estcourt LJ, Stanworth SJ, Murphy MF. Prophylactic platelet transfusions. Curr Opin Hematol 2010;17(5):411-417.

8. Christensen RD, Paul DA, Sola-Visner MC, Baer VL. Improving platelet transfusion practices in the neonatal intensive care unit. Transfusion 2008;48(11):2281-2284.

9. Eldor A, Avitzour M, Or R, Hanna R, Penchas S. Prediction of haemorrhagic diathesis in thrombocytopenia by mean platelet volume. Br Med J (Clin Res Ed) 1982;285(6339):397-400.

10. Gerday E, Baer VL, Lambert DK, et al. Testing platelet mass versus platelet count to guide platelet transfusions in the neonatal intensive care unit. Transfusion 2009;49(10):2034-2039.

11. Von Lindern JS, van den Bruele T, Lopriore E, Walther FJ. Thrombocytopenia in neonates and the risk of intraventricular hemorrhage: a retrospective cohort study. BMC Pediatr 2011;11:16.

12. Del Vecchio A, Motta M, Radicioni M, Christensen RD. A consistent approach to platelet transfusion in the NICU. J Matern Fetal Neonatal Med 2012;25(Suppl 5):93-96.

13. Baer VL, Lambert DK, Henry E, Snow GL, Sola-Visner MC, Christensen RD. Do platelet transfusions in the NICU adversely affect survival? Analysis of 1600 thrombocytopenic neonates in a multihospital healthcare system. J Perinatol 2007;27(12):790-796.

14. Baer VL, Lambert DK, Schmutz N, et al. Adherence to NICU transfusion guidelines: data from a multihospital healthcare system. J Perinatol 2008;28(7):492-497.

15. Baer VL, Henry E, Lambert DK, et al. Implementing a program to improve compliance with neonatal intensive care unit transfusion guidelines was accompanied by a reduction in transfusion rate: a pre-post analysis within a multihospital health care system. Transfusion 2011;51(2):264-269.

16. Petaja J, Andersson S, Syrjala M. A simple automatized audit system for following and managing practices of platelet and plasma transfusions in a neonatal intensive care unit. Transfus Med 2004;14(4):281-288.

17. Kahvecioglu D, Erdeve O, Alan S, et al. The impact of evaluating platelet transfusion need by platelet mass index on reducing the unnecessary transfusions in newborns. J Matern Fetal Neonatal Med 2014;27(17):1787-1789.

18. Zisk JL, Mackley A, Clearly G, Chang E, Christensen RD, Paul DA. Transfusing neonates based on platelet count vs. platelet mass: a randomized feasibility-pilot study. Platelets 2014;25(7):513-516.

19. Yavuzcan Ozturk D, Ercin S, Gursoy T, Karatekin G, Ovali F. Platelet mass index: is it a hope for reduction of platelet transfusion in NICU? J Matern Fetal Neonatal Med 2016;29(12):1926-1929.

Table 1. The demographic and clinical characteristics of patients

Gestational age (weeks, median)	32 (23-41)
Birth weight (g, median)	1670 (450-4095)
Gender (male/female)	29/19
Number of transfusions per patient (median)	1.3 (1-4)
Day of first transfusion (median)	10 (0-105)
Days of hospital stay (median)	30 (1-121)
Number of transfusion according to indications	
>100 000/μL in pre/postoperative patients	2
>50 000/μL in unstable patients	53
>20 000/μL in stable patients	11

Table 2. Transfusions in accordance with platelet count and PMI based guidelines

Number of transfusions		PMI based guideline	
		Noncompliant	Compliant
Platelet count based guideline	Noncompliant	2	0
	Compliant	3	61