

The Effect of Neonatal Sepsis on Platelet Count and their Indices

Abdalla Alshorman,^{*1} Mohammed Maghayreh,¹ Wadah Khriesat,²
Sulaiman Swedan²

Abstract

Objective: To study the effect of neonatal sepsis on the platelets' counts and sizes. Also, our study aims to verify if there are significant differences in the platelet's indices between gram-positive or gram-negative sepsis or being full term or premature.

Patient and Methods: This study was conducted prospectively over a one year period starting from January 2006 at Princess Rahmah Teaching Hospital. The study included all neonates who were admitted to neonatal intensive care units with a clinical diagnosis of sepsis. Only neonates who had positive blood culture results were included in the study, else were excluded from the study. All neonates included in the study had full septic work up including the platelet's number and size. Other serological and radiological investigations were selectively done when needed.

Result: Neonatal sepsis was diagnosed in 105 cases. Sepsis caused by gram-positive microorganisms was seen in 50(47.6%) with Staphylococcus coagulase negative microorganism being the commonest accounting for 44 (41.9%). Gram-negative microorganism was seen in 55 (52.4%), with klebsiella pneumonia accounting for 42(40 %). Full term babies' account for 59(56.1%) while premature babies account for 46 (43.9%). Thrombocytopenia was present in 45(42.8%) of the all cases of neonatal sepsis, of which 27 (60%) were found among gram negative sepsis. The remaining 18(40%) cases were due to gram-positive microorganisms. 19 (42.2%) of the cases of thrombocytopenia are premature babies and 26(57.8%) are full term babies.

The mean platelet volume was found to be high in 29 (27.6%) of all cases. Nineteen (65.5%) were found to be attributed to gram negative sepsis and the remaining 10 (34.4) of cases were gram positive microorganism.

Conclusion: Low platelets count and high mean platelets volume was present in nearly quarter of children with neonatal sepsis. There is no statistical significance difference in these indices and gram negative or positive sepsis, neither being premature or full term baby.

Abbreviations: (MPV) Mean Platelet Volume, (PWD) Platelet Distribution Width, (PRTH) Princess Rahmah Teaching Hospital, (SCBU) Special Care Baby Unit.

Keywords: Neonatal sepsis, platelet count, platelets indices.

(J Med J 2008; Vol. 42 (2): 82-86)

Received

April 23, 2007

Accepted

March 13, 2008

1- Consultant Pediatrician, Princess Rahmah Teaching Hospital, Irbid, Jordan.

2- Consultant Pediatrician, Jordan University of Science and Technology, Irbid, Jordan.

* Correspondence should be addressed to:

Abdalla Alshorman

E-mail: shorman_abd2004@yahoo.com

© 2008 DAR Publishers/ University of Jordan. All Rights Reserved.

Introduction

Neonatal sepsis is a life threatening condition which needs urgent diagnosis and proper management. It is one of the most common causes of NICU admission and one of the major causes of morbidity and mortality throughout the world.¹ Sepsis had been reported to be more common in premature babies than in full term.²⁻⁴ Coagulase-negative staphylococci are the most common causes of late-onset septicemia in neonates in intensive care nurseries.²⁻⁴ Clinical and laboratory diagnosis of infection with coagulase-negative staphylococci can be difficult.⁴⁻⁶ Gram-negative organisms had been reported to have a higher incidence of thrombocytopenia and high MPV when compared to patients with Gram-positive microorganism causing sepsis.⁵⁻⁷

Thrombocytopenia has been used as an early indicator but a non-specific laboratory marker for sepsis.^{8,9}

Increased platelet volume (MPV) indicates an increased proportion of young platelets in the circulation. Platelet decreases in size as they become older in age suggesting the presence of high platelet volume of increased platelet production and/ or destruction.¹⁰

In neonatal period, MPV range from 10 -12fl, and can be some time helpful in determining whether the decrease in platelet volume is primarily caused by the decrease in production (small MPV) or increased destruction (normal to large MPV).^{9,10}

Guida et al.,¹¹ in a previous study, reported that neonatal sepsis is frequently associated with thrombocytopenia and elevation in MPV. Neonatal sepsis due to gram negative microorganism is associated with lower platelet count and prolonged duration of thrombocytopenia in comparison with that due to gram positive sepsis. However, O'Connor et al.¹² reported that MPV was often elevated in patients with staphylococcus coagulase negative despite finding normal platelet count.

This prospective study was conducted to study the value of platelet count and size in neonates with culture proven sepsis. Also, to determine any significant differences in platelets count and size present between those due to gram- negative and gram-positive infectious agent or being premature of full term.

Patient and Methods

Princess Rahmah Teaching Hospital (PRTH) is one of the main hospitals in the city of Irbid. Irbid is the main city in the north of Jordan with an estimated population of around one million populations. Princess Rahmah is a pediatric hospital with 100 pediatric beds and another 40 incubator and cots at the Special Care Baby Unit (SCBU). This study was conducted in this hospital at 2006 starting from January. The ethical committee of PRTH approved the study.

The inclusion criteria of the study is to include all neonates who were admitted to the neonatal intensive care unit with a documented diagnosis of sepsis delivered in the same hospital; those born somewhere else but referred to the hospital because of sepsis; or neonates who developed sepsis during the period of hospitalization for another reason and proved to have sepsis by positive blood culture. Both premature and full terms were included in this study. The demographic characteristics were collected on a data collection sheet developed for the sake of the study. All the neonates included in this study must have blood culture positive. Neonates who had clinical picture of sepsis without positive blood culture were not included in the study. We were unable to do any of the viral or fungal studies because of financial limitations. The following investigations were conducted from all neonates included in the study: blood culture, total white cell count, platelets count and size, CSF analysis and culture, and urine analysis and culture, in addition to other serological and radiological investigations which were done selectively when indicated. All cases were managed with intravenous antibiotics and other supported measures.

Initial antibiotics combination used in this hospital are: ampicillin and third generation cephalosporin or aminoglycosides, which were changed, with therapy, according to culture and sensitivity result. Blood samples for complete blood picture were analyzed by using automated cell counter (micros 60 Rosh) machine for TWBC, platelet and their indices were done at the time of culture- proven sepsis. Mean platelet volume was also measured. Thrombocytopenia was defined as platelet count less than 150,000/mm, MPV range between (6.5 -11um³) and PDW range between (10 -18 %).

Results

Neonatal sepsis was detected in (105) cases during the study period. Table (1) details the correlation between platelet count, the type of microorganisms and the type of maturity of the neonates included in the study.

Neonatal sepsis caused by gram +ve microorganism was seen in 50 (47.6%). Of this Staphylococcus coagulase negative microorganism accounts for 44 (41.9%), of the neonates studied. Gram-negative microorganism, was observed in 55(52.3%) with Klebsiella pneumonia being the commonest accounting for 42 (40. %). Full term account was 59 (56.1%) of neonatal sepsis, while premature account for 46 (43.9%); male gender constitute (47.6%) and female (52.4%).

Thrombocytopenia was present in (27) children of those due to gram negative sepsis versus 18 of those due to gram positive sepsis, P=0.17, odd ratio (95%CI)=1.71(0.73, 4.05).

The mean platelet volume (MPV) was high in 29(27.6%) of all cases of neonatal sepsis. Out of which 19 (65.5%) cases were found to have gram negative organism and the remaining 10(34.4) of cases were seen in gram positive microorganism, P=0.74, odd ratio (95%CI) =2.23(0.84, 5.96). Both thrombocytopenia and high MPV are nearly equal in both premature and full term babies.

Table (1): Distribution of neonates in relation to platelet count, MPV, type of microorganism and maturity status.

Culture types	Low platelet		Normal platelet		Normal MPV	High MPV	Total
	Full term	premature	Full term	premature			
Gram negative							
<i>klebsiella</i>	11	8	13	10	26	15	42(40%)
<i>E-.coli</i>	2	2	0	0	3	1	4(3.9%)
<i>enterobacter</i>	0	0	1	0	1	1	1(0.9%)
<i>Enterococci</i>	0	1	0	2	2	0	3(2.8%)
<i>meningococcus</i>	1	0	0	0	0	1	1(0.9%)
<i>acentobacter</i>	1	0	0	0	0	1	1(0.9%)
<i>aurococcus</i>	0	0	1	0	1	0	1(0.9%)
<i>pseudomonas</i>	0	0	1	0	1	0	1(0.9%)
<i>Haemophilus Influenzatype b</i>	1	0	0	0	1	0	1(0.9%)
Gram positive							
<i>Staph coagulase negative</i>	9	8	13	14	37	8	44(41.9%)
<i>Staph Aureus</i>	1	0	3	0	2	2	4(3.9%)
<i>Alpha hemolytic streptococcus</i>	0	0	1	1	2	0	2(1.9%)
Total	26(24.7%)	19(18%)	33(31.4%)	27(25.7%)	76(72.3%)	29(27.6%)	105(100%)

Discussion

Platelets are believed to be active participants in the host defense, and the thrombocytopenia seen during sepsis episodes may be caused, in part, by the consumption of platelets directly in these processes.⁴ They are capable of phagocytosis and can generate cytotoxic-free radicals and oxidative molecules when activated.⁴

Staphylococcus coagulase negative followed by klebsiella species microorganism are the most common two pathogens causing sepsis in our study. Low platelet count associated sepsis were seen in both types of sepsis caused by gram negative microorganism and gram positive microorganism, and account for 42% of all of cases of neonatal sepsis.

Increase in the Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW) have been reported to be seen more commonly in preterm neonates with sepsis that are full term.¹⁰ In the present study, we have shown that there is no statistical significance difference in the platelets response to infection whether being full term or premature as P was more than 0.05. Also, neonatal sepsis due to Gram-negative organisms had no significant difference in the number of neonate with thrombocytopenia, when compared with patients with Gram-positive sepsis (P=0.17). A finding has been reported to be significantly different by other investigator.^{2,3} The increase in mean platelet volume developed in 25% of cases of neonatal sepsis in our study had been reported previously.¹⁰⁻¹² There is no significant differences found in relation to platelets MPV and to the microorganism being due to negative sepsis as P=0.074. Previous studies reported a significant difference in relation to certain types of pathogens.^{11,12}

Analysis of platelet counts is a simple and readily available laboratory test. Further work is needed for a better understanding of the basis of the observed effects of different infectious organisms on platelet counts and platelet indices, in particular; the interactions among platelets,

infectious organisms, and thrombopoietin in septic neonates need to be examined.

We concluded that low platelet count and high MPV associated sepsis were seen in both type of sepsis caused by gram negative microorganism and gram positive microorganism. There is no statistical difference between these platelets response and the type of microorganism; its being full term or premature.

References

- 1- Karen M.Puopolo. In: Manual of Neonatal Care, 5th ed. Cloherty JP, Stark AR (Eds.), Lippincott-Wilkins, Philadelphia, 2004; 287-313.
- 2- Moro ML, De Toni A, Stolfi I, Carrieri MP, Braga M, Zunin C. Risk factors for nosocomial sepsis in newborn intensive and intermediate care units. Eur J Pediatr. 1996; 155:315-332.
- 3- Khadilkar V, Tudehope D, Fraser S. A prospective study of nosocomial infection in a neonatal intensive care unit. J Paediatr Child Health 1995; 31:387-391.
- 4- Escobar GJ. The neonatal "sepsis work-up" personal reflections on the development of an evidence-based approach toward newborn infections in a managed care organization Pediatrics 1999; 103: 360-373.
- 5- Modanlou HD, Ortiz OB. Thrombocytopenia in neonatal infection. Clin Pediatr (Phila) 1981; 20:402-407.
- 6- Storm W. Use of thrombocytopenia for the early identification of sepsis in critically ill newborns. Acta Paediatr Acad Sci Hung 1982; 23:349-355.
- 7- Benjamin DK Jr, Ross K, McKinney RE Jr, Benjamin DK, Auten R, Fisher RG. When to suspect fungal infection in neonates: clinical comparison of Candida albicans and Candida parapsilosis fungemia with coagulase-negative staphylococcal bacteremia. Pediatrics 2000; 106:712 -718.
- 8- Ververidis M, Kiely EM, Spitz L, Drake DP, Eaton S, Pierro A. The clinical significance of thrombocytopenia in neonates with necrotizing enterocolitis. J Pediatr Surg.2001; 36:799 -803
- 9- Scheifele DW, Olsen EM, Pendray MR. Endotoxemia and thrombocytopenia during neonatal necrotizing enterocolitis. Am J Clin Pathol.1985; 83:227-229.

10-Patrick RH, Lazarchick J. Effects of bacteremia on an automated platelet measurement in neonate. Am J Clin Pathol 1990, 93: 391.
11-Jack D. Guida, Anette M. Kunig, Kathleen H. Leef RN, Steven E. McKenzie, David A. Paul. Platelet count and sepsis in very low birth weight neonates: is there an organism-specific response. Pediatrics 2003; 111 (6) 1411-1415.

12-O'Connor TA, Ringer KM, Gaddis ML. Mean platelet volume during coagulase-negative staphylococcal sepsis in neonates. Am J Clin Pathol.1993; 99:69 -71.

تأثير التسمم الوليدي على عدد صفيحات الدم ومؤشرات صفيحات الدم

عبد الله الشorman¹، محمد مغايره¹، وضاح خريسات²، سليمان سويدان²

1- قسم طب الأطفال، مستشفى الأميرة رحمة التعليمي، اربد، الأردن ؛ 2- قسم طب الأطفال، جامعة العلوم والتكنولوجيا الأردنية، اربد، الأردن

الملخص

الهدف: دراسة تأثير التسمم الوليدي على عدد وحجم صفيحات الدم، للتحقق مما إذا كان هنالك اختلافات هامة في مؤشرات صفيحات الدم، نتيجة تسمم الوليد بجراثيم موجبة الغرام أو سالبة الغرام أو كون المريض مكتمل النمو أو خديجاً.

طريقة الدراسة: أجريت هذه الدراسة خلال سنة واحدة بدءاً من كانون الثاني عام 2006 في مستشفى الاميرة رحمة التعليمي. تتضمن الدراسة كل الأطفال حديثي الولادة الذين أدخلوا الى وحدة العناية المركزية الوليدية ويعانون من اشتباه اصابتهم بالتسمم سريرياً. تضمنت الدراسة من ظهرت عندهم فحوصات ايجابية لزراعة الدم، وما عدا ذلك فقد استثنى من الدراسة كل الأطفال حديثي الولادة الذين دخلوا الدراسة عمل لهم كل الفحوصات لتسمم الدم تتضمن عدد وحجم صفيحات الدم. وهناك بعض الإستقصاءات المصلية والشعاعية عملت بشكل انتقائي عند الحاجة.

النتيجة: شخّص التسمم الوليدي في (105) حالات منها (50) (47.6%) حالة كانت موجبة الغرام واغلبها المكورات العنقودية سالبة التخثر في (44) (41.9%). (55) (52.4%) حالة كانت سالبة الغرام واغلبها الكلبسيلا الرئوية في (42) (40%) حالة. كان عدد الأطفال حديثي الولادة مكتملي النمو (59) (56.1%) بينما الأطفال الخدج (46) (43.9%).

نقص الصفيحات كان موجوداً في (45) (42.8%) من كل حالات التسمم الوليدي، التي منها (27) (60%) وجد بين تسمم بجراثيم سالبة الغرام و(18) (40%) حالة كانت بسبب تسمم بجراثيم موجبة الغرام. (19) (42.2%) من حالات نقص الصفيحات كانت عند اطفال خدج و(26) (57.8%) مكتملي النمو.

حجم صفيحة الدم المتوسط وجد عالياً في (29) (27.6%) من كل الحالات. (19) (65.5%) منها كان قد نتج عن تسمم بجراثيم سالبة الغرام و(10) (34.4%) من الحالات كانت ناتجة عن تسمم بجراثيم موجبة الغرام.

النتائج: ظهر نقص الصفيحات الدموية وزيادة متوسط حجم الصفيحات الدموية في ربع الحالات المصابة بتسمم الوليدي. ليس هناك اختلافات احصائية مهمة في مؤشرات الصفيحات الدموية عند حديثي الولادة المصابين بتسمم الوليد سواءً أكان ناتجاً عن جراثيم سالبة أو موجبة الغرام، أو الأطفال مكتملي النمو أو الأطفال الخدج.

الكلمات الدالة: التسمم الوليدي، عدد صفيحات الدم، مؤشرات صفيحات الدم.