Abstract

We evaluated platelet indices changes in septic neonates with thrombocytopenia in order to identify an organism-specific relation of thrombocytopenia. Such identification could contribute in gaining precious time upon initiation of adequate treatment as long as to clarify pathophysiology underlined to sepsis thrombocytopenia. We analyzed in a combined prospective and retrospective study, blood analysis parameters of neonates who suffered septicemia and were admitted to a single level III neonatal intensive care unit (NICU), during a 6-year period. SPSS analysis through hierarchical linear regression helped us to verify that the relation and diagnostic utility of platelet indices for the type of sepsis was independent of the effects of other variables which we controlled for possible interactions. The evaluation of all platelet indices showed that all of them and each one separately were statistically significant as predictors of organism-specific type of sepsis. In gram negative sepsis thrombocytopenia, platelet indices tend to reflect a hypo proliferation profile thus indicating that gram negative thrombocytopenia seems to be mediated through a hypo proliferation in marrow. On the other hand, platelet indices in gram positive sepsis reflect mostly a peripheral destruction profile, thus supporting that gram positive sepsis thrombocytopenia is mainly related to peripheral destruction of platelets. As a conclusion, platelet indices help to differentiate central versus peripheral cause of thrombocytopenia. Their statistically significant diagnostic utility in identification of organism-specific type of sepsis upon nadir of thrombocytopenia, indicates that thrombocytopenia in gram negative sepsis is associated with a central suppression of platelet production which is effectuated in a gradual but rapid way, whereas gram positive sepsis through destruction of platelets in periphery. That further explains why neonates manage more efficiently gram positive than gram negative sepsis from which they also risk to suffer significant hemorrhagic manifestations.

Introduction

Blood analysis is the most common analysis performed for diagnosis and follow-up of sepsis in all patients [1]. Thrombocytopenia [Platelets (PLT) <150k/μl] and severe thrombocytopenia (PLT 0-30k/μl) are common findings in septic neonates with the severity depending on the type of sepsis. Platelet indices [platelet distribution width (PDW), mean platelet volume (MPV), plateletcrit (PCT)] may contribute to early diagnosis and follow-up of organism-specific type of sepsis while cultures are pending. They could help to early initiation of appropriate therapy as long as to increase of knowledge upon pathophysiological mechanisms and causality of sepsis-related thrombocytopenia [2].

Aims

To evaluate platelet indices changes in septic neonates with thrombocytopenia as related to the causative microorganism [gram-positive (gram+), gram-negative (gram-)] and their gestational age (GA). To define characteristics of thrombocytopenia that could be useful as early diagnostic and follow-up markers of organism-specific type of sepsis. To identify organism-specific types of thrombocytopenia that could help us to clarify pathophysiology of sepsis-induced thrombocytopenia.

Patients and Methods

We analyzed, in a combined prospective and retrospective study, blood analysis parameters of neonates admitted to a single level III neonatal intensive care unit (NICU) who suffered septicemia, during a 6-year period. Sepsis was defined as compatible clinical signs with a minimum of one positive blood culture and increased C-reactive protein (CRP). Only the first episode of sepsis was included, so that any confounding effects from previous episodes of sepsis to be avoided. Complete cell blood counts (CBC) were effectuated on a Coulter MAXX Counter. Thrombocytopenia was only taken into account if repeated measures were provided and no clots had been identified on microscope analysis. All CBC that did not report platelet indices were excluded from the study. Thrombocytopenia was defined as PLT < 150 k/μl, severe thrombocytopenia as PLT 0-30 k/μl and thrombocytosis as PLT > 450 k/μl.

CBC and CRP were recorded upon the day of first positive blood culture (Time 1), on day when platelets reached their minimum platelet count [nadir of thrombocytopenia (Time NAD)] and on day when blood culture turned out to be negative (Time 2), along with duration of thrombocytopenia. Nucleated Red Blood Cells (NRC) were identified on Time 1 and Time 2.

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Platelet Indices in Septic Neonates Aid in Diagnosis of Organism-Specific Type of Sepsis

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Patients who received platelet and blood transfusion(s) before reported time points were excluded. In case that on Time 1, severe thrombocytopenia was already established and a platelet transfusion was required, CBC on Time 1 was recorded as Time NAD and no other CBC was taken into account. Thrombocytopenia was defined as any significant PLT decrease as related to neonate’s platelet count prior to infection. In order to determine platelet indices on Time 1 and Time NAD, only CBC with PLT < 100 k/μl was evaluated. As CBC of healthy controls, we used those who had presented no complication of prematurity or primary disease (such as thrombocytopenia, intra-ventricular hemorrhage more than first degree, retinopathy of prematurity or other), that could be confused as hematological parameters of sepsis. No CBC (in both healthy controls and patients) was effectuated only for the needs of the study.

Neonates were classified according to gestational age (GA) in three groups: GA: 25-31 weeks (w), GA: 32-37 w, and GA >37 w. NRC, White Blood Cells (WBC), PLT were compared in 3 groups: GA: 25-31 weeks (w), GA 32-36w, GA 37-40 w.

Results

Study population and demographic characteristics: 154 neonates with sepsis were studied. 92/154 suffered gram+ and 62/154 gram- sepsis. 97/154 was boys and 57/154 was girls. Mean birth weight (BW) was 2214, 29 grams (gr) [Standard Deviation (SD) +/- 935.12] and mean GA was 34, 1 w (SD +/- 4.32).

GA correlation revealed that gram- sepsis mostly affected neonates of GA 25-31w [Pearson chi-square (χ2) 0.000], gram+ mainly GA>37w (χ2 0.000) while fungus predominantly complicated GA <27w neonates (χ2 0.000).

On Time 1, leukopenia (χ2 0.000), PLT2 <30 (χ2 0.02) and maximum CRP (CRPMAX) values 200-300mg/dl (χ2 0.009) were
accurate signs of gram- sepsis, as also for Extremely Low Birth Weight (ELBW) neonates (BW< 1000 gr).

Leukopenia persisted till Time 2 (p<0.01). Low absolute neutrophil count (ANC) was also a sign of gram- sepsis ($\chi^2$ 0.000), though it rarely occurred in gram+ sepsis. On Time 1 and Time 2, normal White Blood Cells (WBC) values were related to gram+ sepsis ($\chi^2$ 0.000), whereas CRP MAX values >100 to gram- sepsis ($\chi^2$ 0.000).

On Time 1, NRC increased (100-10000) in fungus (85.7%) and in gram- sepsis (52,9%) (p 0.02). NRC increase in fungus, remained when statistical analysis included sepsis patients and no healthy controls, though in smaller significance (p 0.08); probably, due to small number of patients with fungus sepsis. On Time 2, NRC remained increased (71,4% in gram- (44,4%) and gram+ (26,6%) sepsis (p 0.028). In healthy controls, NRC were not elevated (0-99 ($\chi^2$ 0.000)).

During sepsis, 99/154 neonates (46/92 gram+, 53/62 gram-) developed thrombocytopenia, whereas 71/154 neonates (26/92 gram+, 45/62 gram-) reached PLT<100k/μl, and 39/71 (31/39 gram-) PLT<30k/μl.

14 neonates deceased (1 gram+/13 gram-). In infants who survived, blood culture turned out to be negative in 4 days (SD 3,46) while PLT returned to normal in 10,5 days (SD 11,3). Thrombocytosis was once recorded after restoration of thrombocytopenia, in gram+ sepsis.

Severe thrombocytopenia predominated in gram-, and in ELBW neonates. It correlated to dismal outcome in both gram+ and gram- (p 0.02) and persisted despite the return of blood cultures to negative; thus it did not constitute an independent indicator of correspondence to antibiotic regimen.

Severe thrombocytopenia was recorded on 8/30 (26,6%) ELBW neonates and 6/70 (8,5%) neonates with BW > 1000 gr (p 0.02). ELBW presented severe thrombocytopenia on day 1; more precociously as compared to neonates with BW > 1000 gr.

The type of microorganism (gram+/ gram-) tended to be more important factor for nadir of thrombocytopenia than birth weight. PLT on Time NAD (PLTNAD) values declined to <30 k/μl in gram- and fungus sepsis, while in gram+ only reached 61-150 k/μl ($\chi^2$ 0.000). PLTNAD was recorded on 2, 88 days (SD 2.38) since Time 1 for gram+ and on 3, 32 days (SD 2.73) for gram- sepsis. For neonates suffering gram- sepsis, PLTNAD was recorded in a slightly longer interval, though blood cultures turned out to be negative earlier than in those suffering gram+ sepsis (possible influence from patients with dismal outcome who were excluded from the study).

On Time 1, 14 neonates (13/14 gram-) had already severe thrombocytopenia due to gram- sepsis ($\chi^2$ 0.01). On Time 2, severe thrombocytopenia persisted in 17 neonates (16/17 gram-) (p 0.05). For neonates suffering fungus sepsis, PLT on Time 2 (PLT2) remained among 30-60 k/μl ($\chi^2$ 0.000) while for those suffering gram+ sepsis, PLT2 remained between 150-450 k/μl ($\chi^2$ 0.000).

Platelet indices were evaluated on Time 1 and on Time NAD for PLT<100 k/μl. On Time NAD, 71 neonates (45 gram- / 26 gram+) and on Time 1, 43/71(26 gram- /17 gram+) presented PLT<100k/ μl (Figure 1 and Table 1).

On Time 1, MPV on Time 1 (MPV1) remained lower in neonates suffering gram- sepsis (9, 75 fl), as compared to those suffering gram+ sepsis (10, 25 fl). MPV1 in group GA 32-36 was higher for neonates suffering gram+ (10, 92 fl) as compared to those suffering gram- sepsis (9, 93 fl) and the same has been recorded in group GA 24-31w (gram+ 10,45fl; gram- 9, 77 fl). PDW on Time 1 (PDW1) in group GA 24-31 w remained lower in gram- (13,86%) than in gram+ sepsis (18,43%), and the same has been recorded in group GA 32-36 w (gram- 17,76%; gram+ 18,97%). In term infants PDW1 increased in gram- (18, 76%) versus to gram+ sepsis (16, 38%). PCT on Time 1 (PCT1), in group GA 24-31 w, remained lower in gram- (0,013 %) than in gram+ sepsis (0,058 %). This decrease was even more evident in group GA 32-36 w (gram- 0,009 %; gram+ 0,066 %).

On Time NAD, MPV remained lower in gram- (9,13 fl) as compared to gram+ sepsis (10, 76 fl) in all GA groups. The relative increase that MPV presented on Time NAD (MPVNAD), in gram+ sepsis, was more evident in groups GA 24-31 w (gram+ 10,53 fl; gram- 8,76 fl) and GA 32-36 w (gram+ 11,94 fl; gram- 9,44 fl) (p 0.02).

PDW on Time NAD (PDWNAD) was higher in gram+ (18, 37%) than in gram- sepsis (17, 37%), in all GA groups apart from term neonates (p 0.05). The increase of PDWNAD in gram+ sepsis was significant in groups GA 24-31 w (gram+ 18,03%; gram- 17,01%) and GA 32-36 w (gram+ 19,76%; gram- 17,11%) (p 0.02). PCT on Time NAD (PCTNAD) decreased significantly in gram- (0,009%) versus to gram+ sepsis (0,04%). This decrease was predominant in groups GA 24-31 w (gram- 0,005%; gram+ 0,044) and GA 32-36 w (gram- 0,01%; gram+ 0,045) (p 0.02). PCTNAD decrease was equivalent in gram- (0,064%) and gram+ sepsis (0,06%) in term neonates.

SPSS analysis through hierarchical linear regression, reveals that all platelet indices upon nadir of thrombocytopenia have a statistically significant importance in predicting organism-specific type of sepsis that overweight all other parameters examined even that of CRP (SPSS, Multiple Hierarchical Linear Regression). In our statistical model, we have gradually added sex, weight, GA, WBCNAD, PLTNAD, PDWNAD, PCTNAD, and MPVNAD and examined if the statistical significance remained even when all parameters had been examined for any shared variability. This ensured that all these parameters would get « credit »for any shared variability that they could have with the predictor that we are really interested in, which in our study were platelet indices, each one interested in, which in our study were platelet indices, each one
The change in R squares helped us to evaluate how much predictive power was added to the model by the addition of each supplementary variable. When examined in a hierarchical way, R square increased gradually. Thus, we had for 1: sex (R square 0.142), 2: weight (R square 0.144), 3: GA (R square 0.257), 4: WBCNAD (R square 0.322), 5: CRPNAD (R square 0.324) 6: PLTNAD (R square 0.611) 7: PDWNAD (R square 0.618) 8: PCTNAD (R square 0.664) 9: MPVNAD (R square 0.700). Thus, we saw that CRPNAD did not add more predictive power than WBCNAD. PLTNAD and platelet indices added predictive power in a significant way, whereas MPVNAD was the most predictive in between all parameters (R square 0.700).

**Discussion**

Thrombocytopenia is commonly encountered in neonatal period. It’s frequency has been estimated to range from 20-40% newborns admitted to Neonatal Intensive Care Units (NICU) [3]. Furthermore, it has also been a common manifestation in bacterial...
### Model Summary

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### ANOVA

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sepsis, though its absence is not a useful tool to exclude sepsis [4]. In neonates, thrombocytopenia is reported in 10-70% of neonates with sepsis. Neonates are particularly vulnerable to infections due to their immature immune system.

Thrombocytopenia has been reported to present in early course of septicemia, while blood cultures are pending [5]. It has been found to characterize 83% of sick neonates admitted to NICU, whereas blood cultures turn out to be positive in 33.8% of cases [6]. Therefore, platelet count may be considered as an early predictor for the diagnosis of septicemia [7]. As rapid, accurate diagnosis of sepsis and early initiation of appropriate antibacterial treatment are essential for achieving a better prognosis, potential use of thrombocytopenia for early identification of organism-specific type of sepsis would be of paramount importance for vulnerable neonates [5].

The question if the presence of thrombocytopenia could help predict the organism causing sepsis has been imposed and explored the last decade, though an organism-specific relationship with thrombocytopenia could not be determined. In neonates, this question is always of clinical interest as early distinction of bacterial-type specific infection is essential for early initiation of appropriate antibiotic therapy and thus elimination of infection.

The overall performance of the immune system in the neonatal period is diminished in several important aspects. The fetal immune system develops in a sterile and protected environment and therefore lacks antigenic experience as it is modulated in order to co-exist with the mother’s immune system. Soon after birth, the neonate mainly depends upon components of the innate or antigen-independent immune system, including phagocytes, natural killer (NK) cells, antigen-presenting cells (APCs), humoral mediators of inflammation and complement [8]. As a result, very young infants are more susceptible to serious bacterial infection, as well as to viral and fungal infections [9]. More specifically, organisms that can cause significant morbidity in neonates include group B streptococci, Escherichia coli, and Candida species [8]. These specific organisms cause neonatal infections more frequently than other organisms because the newborn has an increased risk of exposure to these pathogens.

In premature infants, immunity is even more defective [10]. This is related to lack of passive immunity due to deficient placental transmission, as long as inability to produce own antibodies due to even more significant immaturity of immune system. Furthermore, skin of premature infants is particularly thin and offers tiny protection. Additionally, white blood cell count is decreased, thus leading to decreased ability to phagocyte bacteria.

Due to the defective immune system of premature infants, risk of infection appears as an emergency. On the other hand, wide-spectrum antibiotics use urges the development of resistant bacteria. Empirical antibiotic therapy should be as « narrow » as possible; otherwise development of resistant germs arises prominently. Speedy narrowing of antibiotics spectrum used in neonatal sepsis is essential for preserving the wise use of antibiotics and avoiding epidemics of multi-resistant strains that could be fatal for neonates.

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a Predictors: (Constant), SEX  
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j Dependent Variable: GRAM

Multiple Hierarchical Regression: SPSS, Hierarchical Multiple Linear Regression including Sex, Weight, Gestational Age (GA), as long as White Blood Cells (WBC) upon nadir of thrombocytopenia (WBCNAD), C-Reactive Protein (CRP) on nadir of thrombocytopenia (CRPNAD), Platelets (PLT) on nadir (NAD) of thrombocytopenia (PLTNAD), Platelet Distribution Width (PDW) on nadir (NAD) of thrombocytopenia (PDWNAD), Plateletcrit (PCT) on nadir (NAD) of thrombocytopenia (PCTNAD), Mean Platelet Volume (MPV) on nadir (NAD) of thrombocytopenia (MPVNAD), all measured in neonates suffering of gram-positive (gram+) either gram-negative (gram-) sepsis.
Differential diagnosis between infections and other diseases of prematurity (perinatal asphyxia, immune disorders) is especially difficult. Identification of type of sepsis through blood cultures is hard in premature neonates, as blood samples have to be restricted to very essential ones and quantity of blood obtained usually cannot be sufficient for sepsis identification. Neonatologists usually cannot wait to obtain a second blood culture to have reliable results as a gram negative sepsis could be too aggressive to let them time to act. Any help obtained from simple blood exams could be extremely precious. As the result from a blood analysis could be obtained faster than the result of a CRP, exploring further advantages of blood analysis as compared to CRP could be of special practical benefit. Nowadays that we are at the time of minimal handling of neonates, working out ways to minimize medical exams, either getting the most out of routine tests is always worthwhile as it respects guidelines and the need for personalized medicine.

On the other hand, dealing with a neonate with thrombocytopenia, who risks entering into Disseminated Intravascular Coagulation (DIC) and suffering bleeding complications, certainly raises the concern of treating physicians and urges them to request repeatedly medical examinations. Working out upon a more accurate interpretation of blood analysis and the potential to foresight deterioration and bleeding tendencies, could provide us a valuable weapon for the most effective treatment of thrombocytopenia-associated sepsis in neonates.

As a conclusion, early recognition of cause-specific sepsis facilitates early initiation of adequate antibiotic therapy and elimination of the infection. Otherwise, the initiation of therapy could be delayed and the risk of disseminated sepsis and multi-failure organ with associated complications (encephalitis, pneumonia) may not be avoided. As organism-specific sepsis identification through blood culture is not always feasible and it is time-consuming, studies upon organism-specific identification of sepsis through alternative ways could be precious for daily medical practice.

Aggregated clinical experience in neonatology departments reveals that neonates suffering gram-negative infections tend to suffer more significant hemorrhagic manifestations and risk to enter to severe disseminated intravascular coagulation more rapidly than neonates suffering gram positive sepsis. Clinical observations that neonates may tolerate better thrombocytopenia due to gram positive sepsis, as compared to gram negative sepsis thrombocytopenia which may be fatal, arise questions upon endotoxins effects on platelets in different types of sepsis. They also emphasize the importance of exploring upon thrombocytopenia as an early diagnostic tool of organism-specific sepsis identification.

Platelet count as an isolated feature did not help us to identify an organism specific response, as thrombocytopenia could characterize all types of sepsis [11]. Till now studies did not succeed to correlate platelet count with an organism-specific response neither to explain the different clinical characteristics that define thrombocytopenia induced by different types of sepsis [12]. Studies in infants indicated that common sepsis-causing pathogens could have different effects upon platelet kinetics [1].

Neonates often present thrombocytopenia due to immaturity and inability of medulla to correspond to innate increased needs. Premature neonates are supposed to present an innate medulla suppression that is often related to additional diseases related to prematurity (perinatal asphyxia, immune disorders). Exclusion of neonates who presented such diseases helped to obtain more reliable results. Further comparison in groups adjusted to GA helped to exclude variations due to prematurity. Recent studies indicate that prematurity affect platelet indices [13], thus reference ranges should be justified upon gestational age and not applied in a uniform way indifferent from age of gestation [14]. In our study, comparisons with normal controls according to gestational age and in-between different gestational age groups suffering different types of sepsis, helped to verify if the variation of platelet indices in thrombocytopenia was specifically related to an organism-specific response than to prematurity and to point out a pathophysiological mechanism of organism-specific sepsis-induced thrombocytopenia.

Necessity for transfusions and increased danger of DIC in case of gram-negative sepsis arise the question whether different organism-specific type of sepsis could provoke a different organism-specific response from medulla. Platelet indices are determined through medulla production, thus they could help us to explore pathophysiology of sepsis induced thrombocytopenia as long as to identify a possible relation the causative germ of sepsis.

As blood cells indices help to identify the causality and pathophysiology of anemia, in a similar way, platelet indices may indicate if the mechanism of thrombocytopenia may be mainly based upon destruction in the periphery, whether there may be implicated a central mechanism (medullar suppression) mediated through endotoxins and immune complexes. This could lead to a suppressed medulla response through a smaller and defective platelet production. Recent studies report that platelet indices have a significant role in the discrimination between hyper destructive and hypo productive thrombocytopenia and thus could be very helpful in the differential diagnosis of thrombocytopenia in an inexpensive way as they are routinely generated by automated cell counters [15].

In our study, comparison of platelet indices’ variation in between different types of sepsis strengthened the mediation of a medulla suppression to specific-organism sepsis. In gram negative sepsis, platelet indices tend to reflect a hypo proliferation profile through a hypo proliferation in marrow. On the other hand, platelet indices in gram positive sepsis reflect more a peripheral destruction profile, related to peripheral destruction of platelets.

Abnormalities in PLT indices have been reported to reflect increased illness severity and higher risk to death as compared with normal PLT indices [2]. In these studies, comparisons have been effectuated between healthy and severe ill but not in between different types of sepsis. In our study, comparison between gram negative and gram positive sepsis pointed out that decreased MPV was associated with even increased illness severity as compared to gram negative sepsis. Increased MPV was associated with gram
positive sepsis which tends to be less aggressive than gram negative sepsis.

Low MPV has previously been associated with bleeding in thrombocytopenia [16]. In our study, low MPV was identified in neonates suffering gram negative sepsis. Circulating platelets were smaller, and their lower MPV was compatible to infants increased tendency for hemorrhagic manifestations. On the other hand, gram positive sepsis was related to platelets with larger volume, thus more effective and in accordance with less hemorrhagic manifestations. These are coherent to neonatologist’s relevant clinical experience.

SPSS analysis through hierarchical linear regression helped us to verify that the relation and diagnostic utility of platelet indices for the type of sepsis was independent of the effects of other variables. We verified that variables examined first in our model (demographics, CRP, WBC, PLT) did not explain away the entire association between platelet indices and type of sepsis (Output 1). The hierarchical evaluation helped us to verify that the predictors controlled first (weight, sex, GA, WBC, CRP, PLT) did not have an effect above the effects of the predictors controlled in the last. On the contrary, the predictors controlled in the end helped us to evaluate that PDW, PCT; MPV measured on nadir of thrombocytopenia had an effect above all other variables.

The evaluation of all platelet indices showed that they could predict an organism-specific type of sepsis. It is interesting that their prediction value over weighted those of WBC, CRP and PLT. That means that evaluation of WBC, CRP and PLT as isolated parameters is less accurate than their incorporation in a model including platelet indices for sepsis diagnosis.

The addition of all parameters in a hierarchical way (weight, sex, GA, WBC, CRP, PLT) did not lose but added significant diagnostic value to our prediction model. The gradual evaluation of each one of platelet indices in our model indicated that every added parameter achieved to increase our model’s diagnostic value, as its statistical significance remained even after examination of all confounding parameters.

The fact that platelet indices show a statistical significance in diagnosis of thrombocytopenia upon nadir of thrombocytopenia and not upon Time of first blood culture either Time of negative culture, points out upon implications of platelet indices in unraveling pathophysiology of sepsis-associated thrombocytopenia. As platelet indices have been identified to help upon differentiating of central versus peripheral cause of thrombocytopenia, their statistically significant diagnostic utility in identification of organism-specific type of sepsis upon nadir of thrombocytopenia, indicates that thrombocytopenia in gram negative sepsis is associated with a gradual (though evolving in a rapid way) central suppression of platelet production; whereas gram positive sepsis through destruction of platelets in periphery. That further explains why neonates manage more efficiently gram positive than gram negative sepsis from which they also risk to suffer significant hemorrhagic manifestations.

Conclusions

Thrombocytopenia and especially severe thrombocytopenia could be a diagnostic marker for gram- and fungus sepsis. Increased MPV and PDW levels may be an early indicator of gram+ sepsis, while blood cultures are pending. In gram- sepsis, platelets are maintained small with normal to low levels of MPV and PDW, whereas in gram+ they tend to be large as PDW and MPV levels increase. Neonates suffering gram+ sepsis are possibly able to manage thrombocytopenia better than neonates with gram- sepsis who are at high risk of developing severe hemorrhagic manifestations, implicating a sepsis-induced impairment of platelets production.

Medulla is forced to adjust to increased needs for platelets production as determined through increased platelets destruction though, the influence of each organism-specific type of sepsis will finally determine in a different way the platelets production.

Legends for Figure 1, Table 1 and SPSS, Multiple Hierarchical Linear regression.

Legend for Figure 1: Variations of Mean Platelet Volume (MPV) (fl), Platelet Distribution Width (PDW) (%), Plateletcrit (PCT) (%) as measured and compared in between 1: neonates without thrombocytopenia, 2: positive blood culture, and 3: nadir (NAD) of thrombocytopenia. MPV, PDW and PCT measurements upon positive blood culture (2) and nadir (NAD) of thrombocytopenia (3) concerned neonates suffering thrombocytopenia with Platelets (PLT) < 100 k/μl due to gram-negative (gram-) and gram-positive (gram+) sepsis; neonates were also divided in groups according to their Gestational Age (GA) 24-31 weeks (w), GA 32-36w, GA 37-40 w.

Legend for Table 1: Mean Platelet Volume (MPV) (fl), Platelet Distribution Width (PDW) (%), Plateletcrit (PCT) (%) [(mean value and standard deviation (SD)] were measured on Time 1 (Positive Blood Culture) and on Time Nadir of Thrombocytopenia (NAD) for neonates suffering thrombocytopenia with Platelets (PLT) < 100 k/μl, due to gram-negative (gram-) and gram-positive (gram+) sepsis. Mean Platelet Volume (MPV) (fl), Platelet Distribution Width (PDW) (%), Plateletcrit (PCT) (%) [(mean value and standard deviation (SD)] were also measured for neonates without thrombocytopenia; neonates were also divided in groups according to their Gestational Age (GA) 24-31 weeks (w), GA 32-36w, GA 37-40 w.

Legend for SPSS, Multiple Hierarchical Regression: SPSS, Hierarchical Multiple Linear Regression including Sex, Weight, Gestational Age (GA), as long as White Blood Cells (WBC) upon nadir of thrombocytopenia (WBCNAD), C-Reactive Protein (CRP) on nadir of thrombocytopenia (CRPNAD), Platelets (PLT) on nadir (NAD) of thrombocytopenia (PLTNAD), Platelet Distribution Width (PDW) on nadir (NAD) of thrombocytopenia (PDWNAD), Plateletcrit (PCT) on nadir (NAD) of thrombocytopenia (PCTNAD), Mean Platelet Volume (MPV) on nadir (NAD) of thrombocytopenia (MPVNAD), all measured in neonates suffering of gram-positive (gram+) either gram-negative (gram-) sepsis.
References


