HEMATOLOGICAL SCORING SYSTEM IN EARLY DIAGNOSIS OF NEONATAL SEPSIS

BS NGUYỄN LÂM HOÀI PHƯƠNG
KHOA SƠ SINH

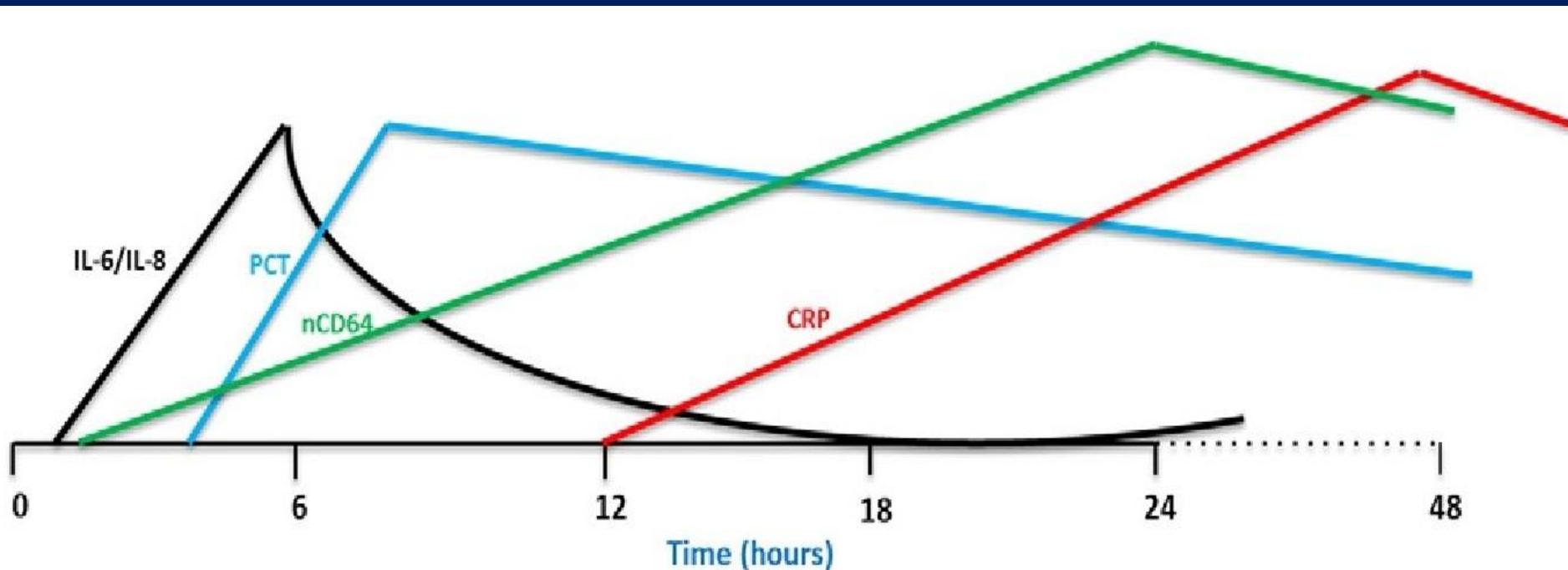# Biomarkers for the diagnosis of neonatal sepsis

Fig. 2. Timeline of the release of selective biomarkers. Interleukins-6 and -8 (IL-6/IL-8) are released within 2 h of the infection, peaking at approximately 6 h, and then declining over the following 24 h. Neutrophil CD64 (nCD64) can be detected within 1–6 h, while procalcitonin (PCT) is usually detected within 3–4 h of the inflammatory response, remaining at high levels for at least 24–48 h. C-reactive protein (CRP) is released at 12–24 h into the inflammatory response, and peaks at 48 h.

Margaret Gilfillan, Vineet Bhandari
Biomarkers for the diagnosis of neonatal sepsis and necrotizing entercolitis: Clinical practice guidelines

Khởi đầu từ 1 nghiên cứu:

Early diagnosis of neonatal sepsis using a hematologic scoring system

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1) Abnormal total leukocyte count,

2) Anormal total polymorphonuclear neutrophils (PMN) count,

3) Elevated immature PMN count,

4) Elevated immature: Total (I:T) PMN ratio,

5) Immature: Mature (I:M) PMN ratio ≥0.3,

6) Platelet count ≤150,000/mm^3,

7) And pronounced degenerative or toxic changes in PMNs.

Kết quả nghiên cứu:

❑ **The likelihood of sepsis with score ≥3 was 31%**

❑ **The higher the score the greater was the likelihood of sepsis.**

❑ **With score ≤2 the likelihood that sepsis was absent was 99%.**

The hematologic scoring system should improve the diagnostic accuracy of the complete blood cell count as a screening test for sepsis and could simplify and standardize the interpretation of this global test.

Tiếp theo, nhiều nghiên cứu khác cũng áp dụng phết máu ngoại vi dựa vào hệ thống điểm của RodWell (Hematologic Scoring System – HSS) nhằm chẩn đoán sớm nhiễm trùng huyết sơ sinh

<u>Bởi vì</u>:

The HSS is simple, quick, cost effective and readily available tool in the early-diagnosis of neonatal sepsis and could provide a guideline to decisions regarding antibiotic therapy.

Keywords: Neonatal Sepsis, Rodwell's Hematological Scoring System, HSS, Blood Culture, Peripheral Smear, hematological scoring system, polymorph, preterm

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                            Performance evaluation of **hematologic scoring system** in **early diagnosis** of **neonatal sepsis**.
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Early diagnosis of neonatal sepsis using a hematological scoring system.

OBJECTIVE:
To assess the utility of the hematologic scoring system (HSS) of Rodwell et al for the early detection of neonatal sepsis.

DESIGN:
Analysis of the peripheral smear findings according to the HSS by a pathologist blinded to the infection status of the neonate.

SUBJECTS:

One hundred and three high risk neonates having predisposing perinatal factors or clinical suspicion of sepsis.

RESULTS:

- **An abnormal I:T ratio followed by an abnormal I:M ratio were the most sensitive indicators in identifying infants with sepsis.**

- **These two criteria along with thrombocytopenia (< 150,000/cm3) had a high negative predictive value over 94%.**

- **The higher the score the greater the certainty of sepsis being present.**

CONCLUSION:

The HSS is simple, quick, cost effective and readily available tool in the early-diagnosis of neonatal sepsis and could provide a guideline to decisions regarding antibiotic therapy.
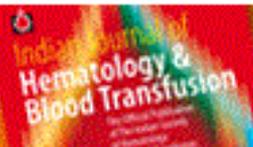
Significance of Hematological Scoring System (HSS) in Early Diagnosis of Neonatal Sepsis

Aparna Narasimha[1,2] and M. L. Harendra Kumar[1]

<u>The study included three groups:</u>
Group 1—infants with sepsis with positive blood cultures.
Group 2—infants with probable infection with strong clinical history but negative blood cultures.
Group 3—normal infants without any evidence of sepsis.

The present study is a prospective analysis of the hematologic profiles of 50 neonates admitted in the neonatal care unit.
The peripheral blood smears of all newborns from birth up to 1 week <u>were analysed for early diagnosis of neonatal sepsis using the hematological scoring system of Rodwell et al.</u>

Interpretation of hematological scoring system:

Score	Interpretation
≤2	Sepsis is unlikely
3 or 4	Sepsis is possible
≥5	Sepsis or infection is very likely

Significance of HSS in early diagnosis of neonatal sepsis

Scores of each of the groups

Groups	Score 0–2 (%)	Score 3–4 (%)	Score ≥ 5 (%)
Sepsis (12 cases)	–	–	12 (100)
Probable infection (26 cases)	7 (27)	8 (30.76)	11 (42.30)
Normal (12 cases)	5 (41.66)	5 (41.66)	2 (16.66)

Performance of individual hematologic findings

	Sensitivity (%)	Specificity (%)	Positive predictive value (PPV) (%)	Negative predictive value (NPV) (%)
Total WBC count	10.52	91.66	80	24.44
Total PMN count	89.47	8.33	75.55	20
I PMN count	78.94	8.3	73.17	11.11
I:T PMN ratio	63.15	75	88.88	39.13
I:M PMN ratio	73.68	50	82.35	37.5
Degenerative changes	68.42	66.66	66.66	40
Platelet count	47.36	75	85.71	31

Conclusion

1. **HSS is a simple, quick, cost effective tool which can be used as a screening test for early diagnosis of neonatal sepsis.**

2. **It may aid the clinicians in identifying sepsis and to institute proper anti-biotic therapy.**

3. **Unnecessary exposure of infants to antibiotic therapy can thus be avoided.**

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Performance Evaluation of Hematologic Scoring System in Early Diagnosis of Neonatal Sepsis

Manisha Makkar, Chinki Gupta,[1] Rambha Pathak,[2] Sunal Garg,[1] and N. C. Mahajan

Objectives:
The present study was undertaken to evaluate and highlight the importance of hematological scoring system (HSS) in the early detection of neonatal sepsis.

Materials and Methods:
The cross-sectional study enrolled 110 neonates who were clinically suspected of infection (study group) and normal neonates for comparison (controls), during the 1st week of life.

All peripheral blood smears were analyzed using HSS of Rodwell et al., by pathologists blinded to the infection status of the newborns.

Hematological scoring system

Criteria	Abnormality	Score
Total WBC count	≤5000/μl	1
	≥25000 at birth	1
	≥30000-12-24 h	
	≥21000-day 2 onwards	
Total PMN count	1800-5400	0
	No mature PMN seen	2
	Increased/decreased	1
Immature PMN count	600	0
	Increased	1
I:T PMN ratio	0.120	0
	Increased	1
I:M PMN ratio	≤0.3	0
	≥0.3	1
Degenerative changes in PMN	Toxic granules/cytoplasmic vacuoles	1
Platelet count	≤1.5 lakhs/μl	1

WBC – White blood cells; PMN – Polymorphonuclear neutrophils; I:T PMN ratio – Immature: Total ratio; I:M PMN ratio – Immature: Mature ratio

Performance evaluation of HSS in early diagnosis of neonatal sepsis

Score of each of the categories

Category	Scores 0-2 (%)	Score 3-4 (%)	Score ≥5 (%)
Sepsis; $n=42$	–	07 (16.67)	35 (83.33)
Probable infection; $n=22$	04 (18.18)	12 (54.55)	06 (27.27)
Normal; $n=46$	23 (50)	13 (28.26)	10 (21.74)

Performance evaluation of HSS in early diagnosis of neonatal sepsis

The performance of individual hematological parameter in diagnosing neonatal septicemia

	Sensitivity (%)			Specificity (%)			PPV (%)			NPV (%)		
	S	PS	S+PS	S	PS	S+PS	S	PS	S+PS	S	PS	S+PS
Total WBC count	56.2	83.33	43.18	91.66	91.66	86.36	85.71	25	86.36	70.21	75	56.89
Total PMN count	90.62	75	86.36	72.22	72.22	79.16	74.35	47.36	79.16	89.65	89.65	81.25
Immature: PMN count	96.87	75	90.90	91.66	91.66	93.02	91.17	75	93.02	97.05	91.66	89.18
Immature: Total PMN ratio	93.75	83.33	90.90	94.44	94.44	95.23	93.75	83.33	95.23	94.44	94.44	89.47
Immature: Mature PMN ratio	53.12	41.66	50	97.22	97.22	95.65	94.44	83.33	95.65	70	83.33	61.4
Degenerative changes	78.12	58.33	72.72	94.44	94.44	94.11	92.59	77.77	94.11	82.92	87.17	73.91
Platelet count	81.25	41.66	70.45	94.44	94.44	93.93	92.85	71.42	93.93	85	82.92	72.34

PPV – Positive Predictive Value; NPV – Negative Predictive Value; S – Sepsis; PS – Probable Sepsis; S+PS – Sepsis+probable sepsis; WBC – White blood cell; PMN – Polymorphonuclear neutrophils

HSS assigns a score of 1 for each of seven findings significantly associated with sepsis:

- **Score of ≤2** was interpreted as sepsis unlikely;

- **score 3-4**: Sepsis is possible

- **and ≥5** sepsis or infection is very likely.

- Minimum score that can be obtained is 0 and maximum score, 8.

Conclusion:

➤ **The sensitivities of the various screening parameters were found to be satisfactory in identifying early onset neonatal sepsis.**

➤ **It is a simple and feasible diagnostic tool to guide towards the decision-making for a rationale treatment.**

Evaluation of hematological scoring system in early diagnosis of neonatal sepsis

Abstract

- **The definite diagnosis of septicemia was made by a positive blood culture which required a minimum period of 48-72 hours and yielded a positive result in 30-70% of cases.**

- **Hence there was a critical need for laboratory tests that aid in the rapid diagnosis of neonatal sepsis.**

- **Smears were analyzed using Rodwell et al Hematological scoring system (HSS) in the peripheral smears**

The advantage of study was that these

- can be **done rapidly** even in small hospitals,

- allowing prompt treatment to neonates with sepsis and minimizing therapy.

- It **can be good predictors of short term neonatal outcome and carries diagnostic and prognostic value.**

Hematological Scoring system

Criteria	Abnormality	Score
Total WBC Count	<5000/cmm	1
	>25000 at birth	1
	>30000 12-24 hours	1
	>21000 Day 2 onwards	1
Total PMN Count	No mature PMN	2
	Increased/Decreased	1
Immature PMN Count	Increased	1
I:T PMN Ratio	Increased	1
I:T PMN Ratio	>0.3	1
Degenerative changes	Toxic-granules/ Cytoplasmic vacuoles	1
Platelet count	<150000/cmm	1

Hematological score interpretation was categorized into three categories:

Score 0-2: Sepsis unlikely

Score 3-4: Sepsis is possible

Score >5: Sepsis or infection very likely

The higher the score of HSS, the greater was the likelihood of sepsis.

Evaluation of HSS in early diagnosis of neonatal sepsis

Culture results	Score 0-2	Score 3-4	Score >5
Positive (n= 28)		8(28,75%)	20 (74,42%)
Negative (n= 132)	79(59,84%)	48(36,36%)	

Conclusion

➢ **Hematological scoring system is sensitive, simple, quick, cost effective and readily available tool for early diagnosis of neonatal sepsis.(1,6,12)**

➢ **It may aid the clinicians in early diagnosis of neonatal sepsis and unnecessary exposure of infants to antibiotics can be avoided.**

ĐỀ XUẤT

Nên áp dụng phết máu ngoại vi thường quy để giúp ích cho chẩn đoán sớm nhiễm trùng ở trẻ sơ sinh

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