

# Evaluation of the delta neutrophil index (DNI) in equine neonatal sepsis

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## Background & Aim

Delta neutrophil index (DNI) represents the fraction of circulating immature granulocytes in peripheral blood automatically calculated by ADVIA-series hematology analysers and has been associated with sepsis in human neonates.

This retrospective study aimed to describe the diagnostic and prognostic potential of DNI in equine neonatal sepsis.

[neutrophil and eosinophil sub-fractions assayed in the myeloperoxidase channel by cytochemical reaction]

DNI (%) =

[polymorphonucleated sub-fraction counted in the nuclear lobularity channel by the reflected light beam]

## Methods

Reports of 116 foals less than 5d old at hospital admission, which underwent a complete physical evaluation, blood culture sampling, CBC (ADVIA 2120i, Siemens Healthineers), inflammatory markers and blood smear evaluation, were examined and classified into:



**H group (n=17)**

Healthy foals



**S group (n=23)**

Septic foals [positive blood culture + SIRS]



**NS group (n=76)**

Sick-nonseptic foals

## Results

Leukocyte and neutrophil counts were lower ( $p < 0.001$ ), while SAA concentration was higher ( $p < 0.001$ ) in S group than in NS group.

Overall in sick foals, DNI was able to discriminate between survivors ( $n=69$ ) and non-survivors ( $n=30$ ;  $p=0.01$ ), was higher in foals with the presence of neutrophils toxic changes and/or hyposegmented neutrophils (left shift) on blood smear evaluation than in foals without morphological changes ( $p=0.03$ ) and was weakly correlated with SAA concentration ( $r=0.3$ ;  $P=0.003$ ).

No differences were found in the DNI between the three groups.

Group	DNI	HCT	RBC	PLT	WBC	NEUTR	LYMPH	MONO	EOS	BASO
	%	%	$\times 10^6/\mu\text{L}$	$\times 10^3/\mu\text{L}$	$\times 10^3/\mu\text{L}$	$\times 10^3/\mu\text{L}$	$\times 10^3/\mu\text{L}$	cells/ $\mu\text{L}$	cells/ $\mu\text{L}$	cells/ $\mu\text{L}$
H	46.5 $\pm$ 14.7 (17.3-66.7)	45 $\pm$ 4 (39-53)	11.0 $\pm$ 1.7 (9.4-16.4)	173 $\pm$ 54 (40-254)	7.8 $\pm$ 1.5 (5.3-10.2)	5.5 $\pm$ 1.6 (2.8-8.0)	1.9 $\pm$ 8.6 (1.0-4.9)	195 $\pm$ 105 (50-440)	27 $\pm$ 22 (0-80)	74 $\pm$ 67 (20-220)
S	49.0 $\pm$ 18.3 (3.4-74.7)	43 $\pm$ 6 (30-55)	9.6 $\pm$ 2.3 (1.3-12.6)	154 $\pm$ 75 (30-287)	4.8 $\pm$ 4.5* (0.7-20.4)	3.8 $\pm$ 4.2* (0.2-18.3)	0.8 $\pm$ 0.3 (0.2-1.7)	239 $\pm$ 291 (10-1140)	8 $\pm$ 7 (0-30)	41 $\pm$ 29 (10-100)
NS	47.3 $\pm$ 24.3 (8.2-85.7)	40 $\pm$ 8 (12-56)	9.6 $\pm$ 1.8 (3.2-12.4)	178 $\pm$ 67 (23-337)	8.4 $\pm$ 4.6 (0.6-26.4)	7.0 $\pm$ 4.3 (0.4-20.1)	1.1 $\pm$ 0.6 (0.1-3.2)	213 $\pm$ 355 (10-2950)	12 $\pm$ 13 (0-70)	59 $\pm$ 94 (0-750)

Group	FG	SAA
	g/L	$\mu\text{g/dL}$
H	1.9 $\pm$ 0.5 (0.7-2.6)	4 $\pm$ 3 (1-10)
S	2.9 $\pm$ 1.5 (0.4-6.0)	250 $\pm$ 158* (5-507)
NS	2.3 $\pm$ 1.0 (1.0-6.3)	110 $\pm$ 145 (0-521)

Data are expressed as mean $\pm$ SD (min-max)

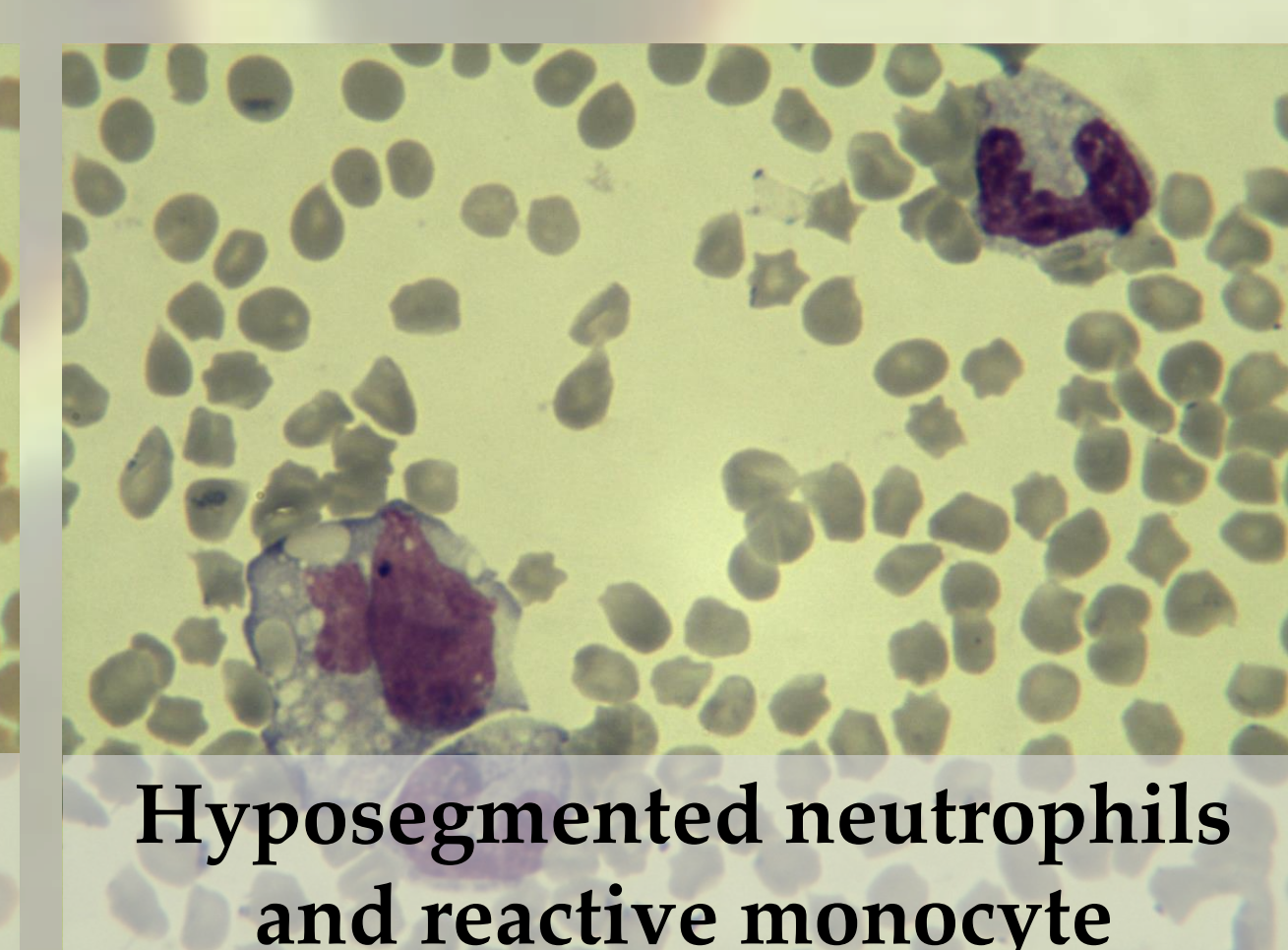
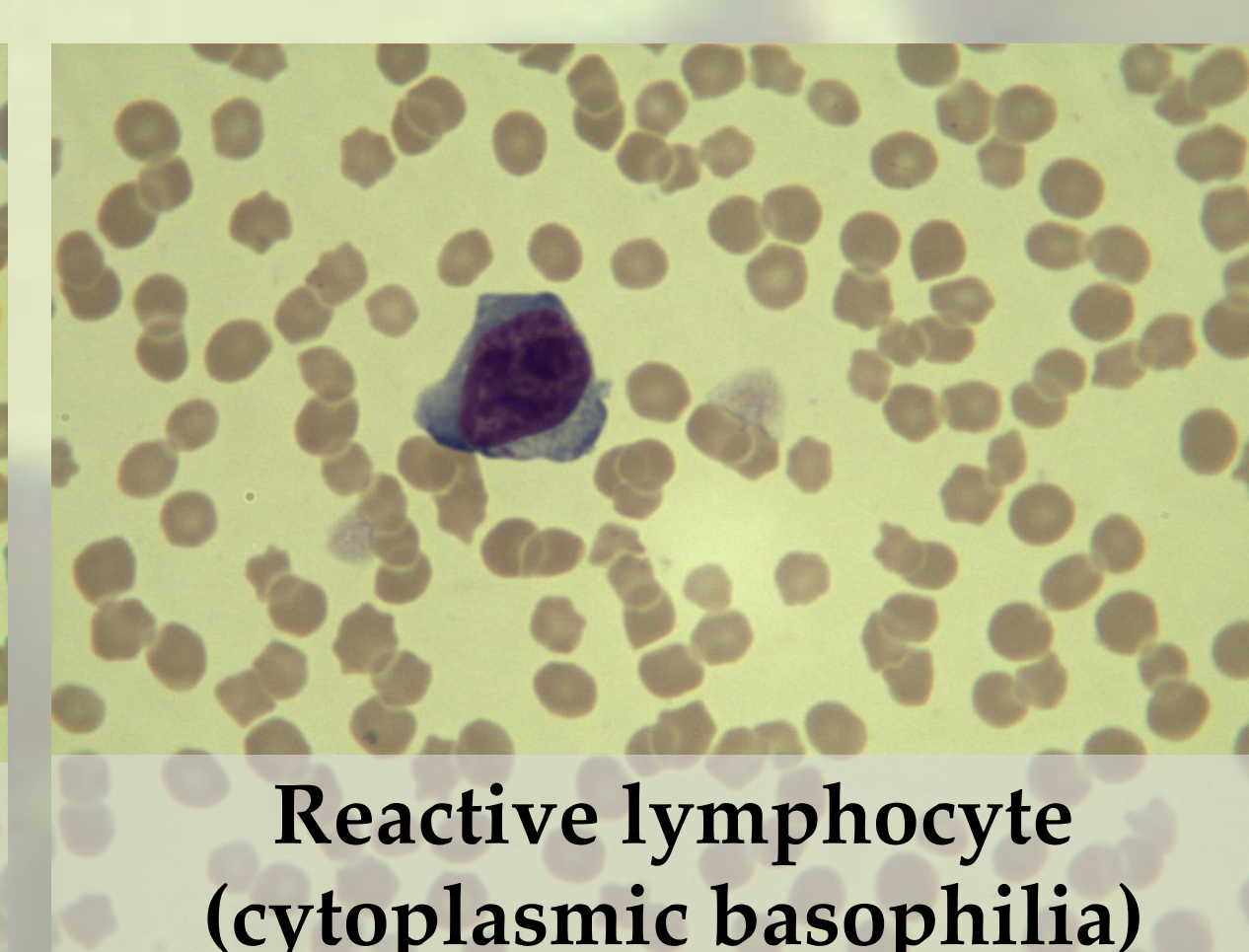
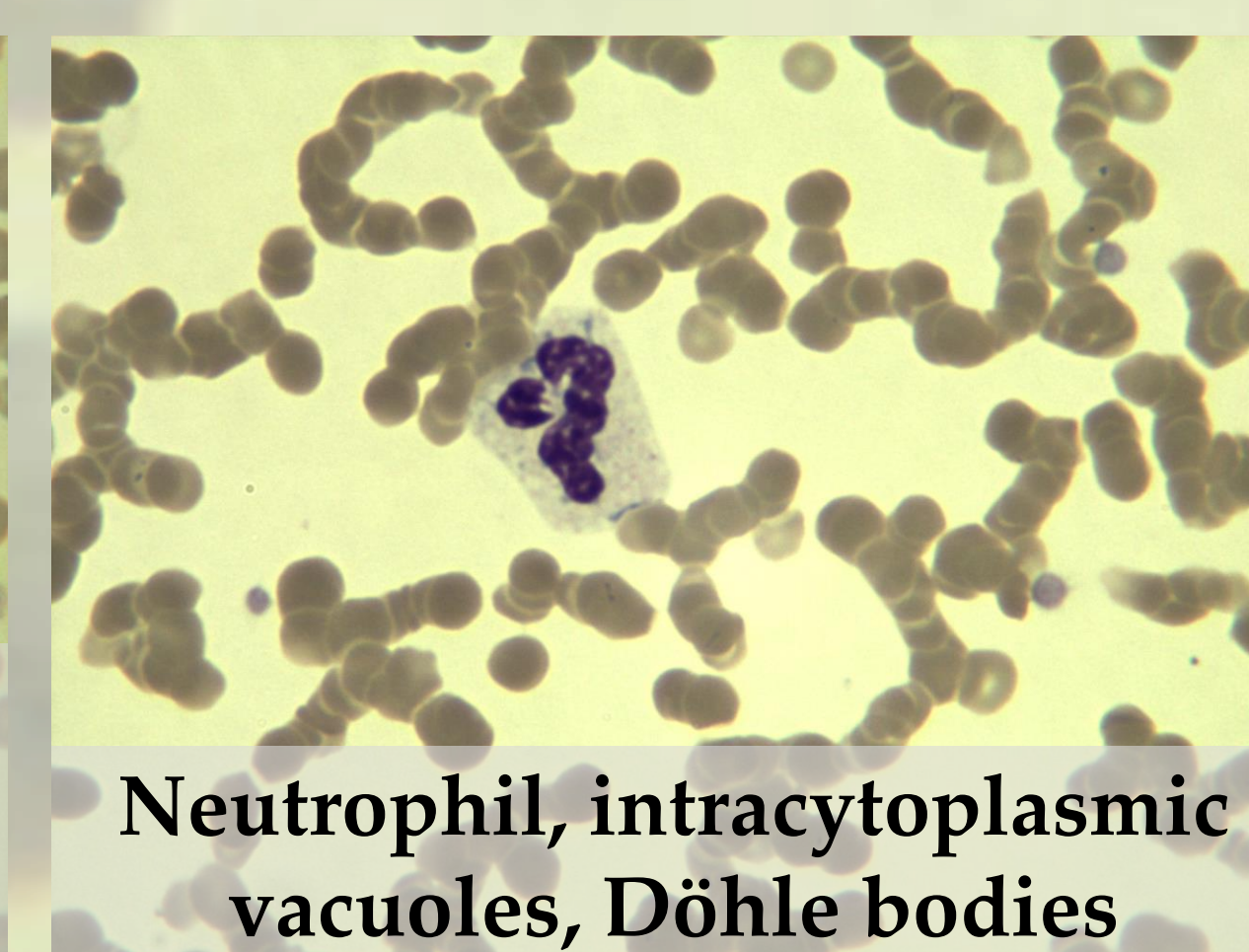
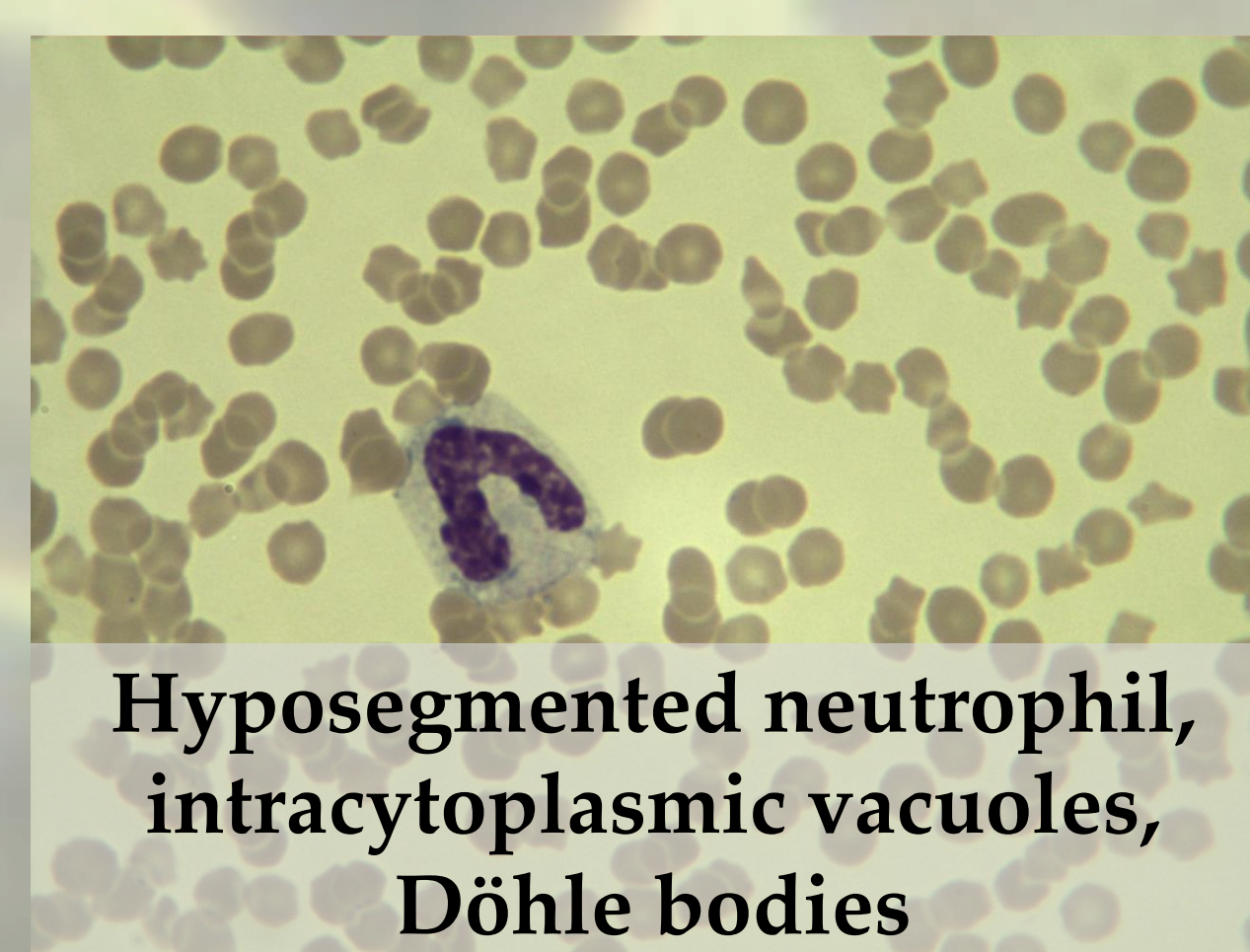
\* Significant differences among groups

Overall, 6/23 foals (26%) in S group and 8/76 foals (11%) in NS group showed neutrophils toxic changes and/or hyposegmented neutrophils on blood smear evaluation:

12/99 (12%) - Intracytoplasmic vacuoles  
7/99 (7%) - Hyposegmented neutrophils  
4/99 (4%) - Cytoplasmic basophilia  
2/99 (2%) - Döhle bodies  
1/99 (1%) - Ring neutrophils

Other morphological changes in WBC included:

4/99 (4%) - Reactive monocytes  
1/99 (1%) - Reactive lymphocytes



## Discussion

Automatically-derived DNI could anticipate the morphological evaluation of blood smears to detect the left shift, which, together with SAA concentration, is an indicator of inflammation.

## Clinical relevance

DNI deserves further insights for its prognostic potential and for leukogram interpretation in sick foals, which, if done manually, may be operator-dependent and time-consuming.