

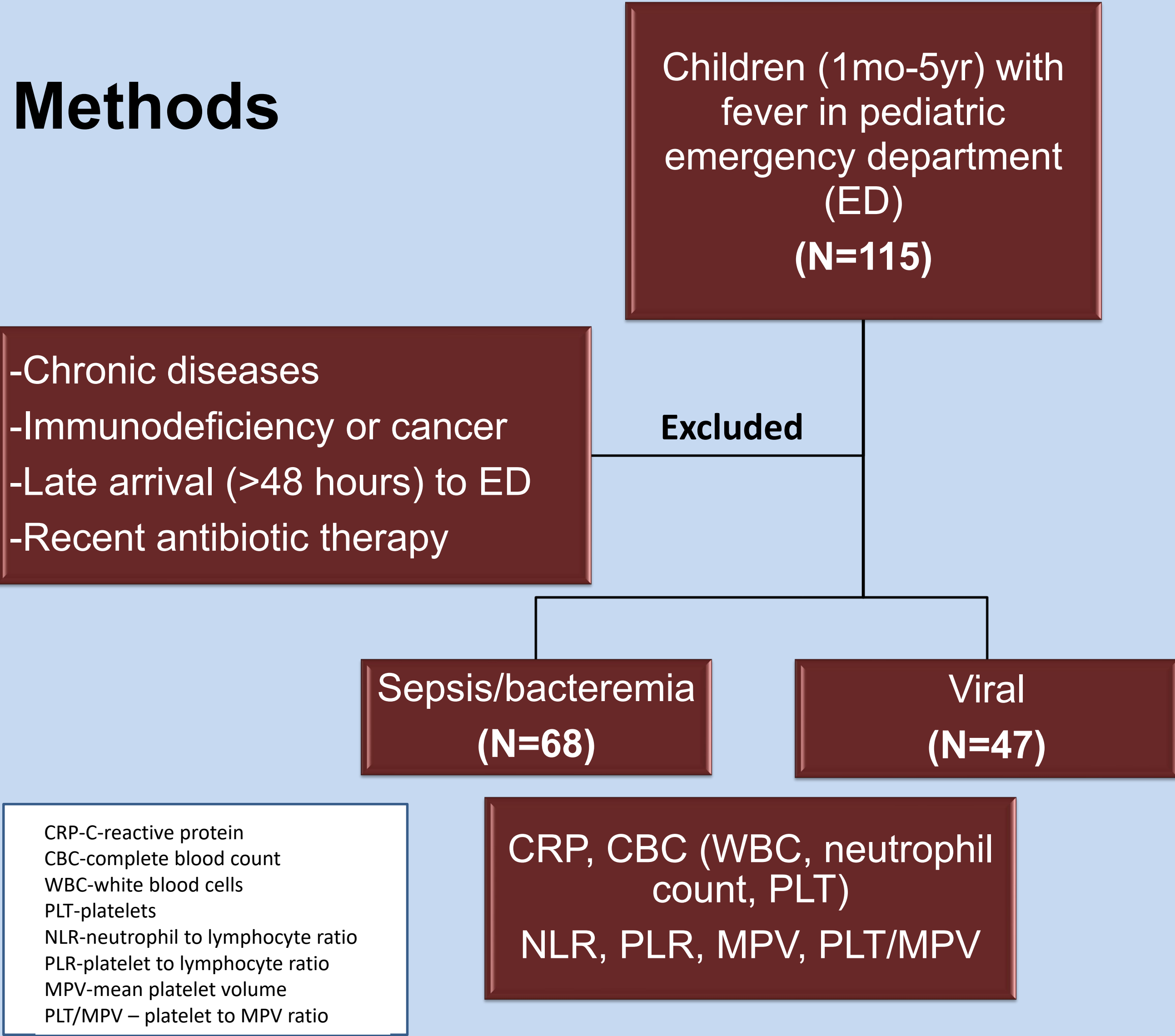
Background

Bacteremia and sepsis are the leading cause of death in children worldwide. In fact, innate and adaptive immune response in children differ immensely. Thus, the susceptibility to severe bacterial infection leading to bacteremia and sepsis is markedly increased, especially in children less than 5 years of age. Early recognition and timely treatment are essential for preventing progression to more severe forms and lethal outcomes (1)

Aims

- 1) To investigate the diagnostic value of NLR, PLR, MPV, PLT and PLT/MPV as early markers (<12h after onset of symptoms) in viral infection vs bacterial (bacteremia/sepsis)
- 2) To apply cut-off levels of inflammatory markers
- 3) Develop a prediction model to distinguish between severe bacterial and viral infection in pediatric patients

Methods



Data analysis was performed using Microsoft Excel and IBM SPSS Statistics version 21.0 software. P value <0.05 was considered significant

Results

Table 1. Baseline characteristics for all the children, at any time of arrival

Parameter	Bacterial (n = 68)	Viral (n = 47)	P value
Demographic data			
Age (months)	9 [3–24]	12 [6–27]	0.274
Male gender, n (%)	31 (45.6)	23 (48.9)	0.857
Laboratory markers			
WBC (×10 ⁹ /L)	17.94 ± 10.04	10.42 ± 4.21	<0.001
Neutrophils (×10 ⁹ /L)	10.93 ± 8.03	5.08 ± 3.42	<0.001
PLT (×10 ⁹ /L)	370.15 ± 134.65	288.91 ± 107.14	0.001
CRP (mg/L)	88.92 ± 83.05	13.95 ± 16.06	<0.001
NLR	2.69 ± 2.03	1.83 ± 1.70	0.006
PLR	99.04 ± 62.89	97.07 ± 55.87	0.905
MPV	9.03 ± 1.21	9.16 ± 1.33	0.717
PLT/MPV	41.42 ± 15.86	33.45 ± 17.97	0.001

Table 2. Comparison of all children laboratory markers between bacterial and viral infection patients (early arrival)

Laboratory marker	Bacterial (n = 16)	Viral (n = 9)	P value
WBC (×10 ⁹ /L)	16.11 ± 9.11	9.89 ± 4.65	0.007
Neutrophils (×10 ⁹ /L)	9.43 ± 8.59	5.06 ± 4.07	0.077
PLT (×10 ⁹ /L)	390.43 ± 88.11	282.29 ± 79.35	0.001
CRP (mg/L)	38.26 ± 44.21	7.20 ± 8.19	0.008
NLR	2.58 ± 2.19	2.07 ± 2.00	0.547
PLR	117.99 ± 82.06	113.42 ± 65.41	0.874
MPV	9.02 ± 1.09	9.58 ± 0.82	0.202
PLT/MPV	43.86 ± 11.58	29.80 ± 8.69	<0.001

Laboratory marker	Bacterial (n = 16)	Viral (n = 9)	P value
WBC (×10 ⁹ /L)	12.80 ± 5.45	8.59 ± 3.62	0.037
Neutrophils (×10 ⁹ /L)	5.83 ± 4.09	3.49 ± 2.28	0.121
PLT (×10 ⁹ /L)	403.19 ± 84.03	304.50 ± 80.29	0.010
CRP (mg/L)	30.31 ± 43.67	6.64 ± 8.87	0.120
NLR	1.64 ± 1.43	1.33 ± 1.20	0.598
PLR	121.21 ± 89.82	115.19 ± 72.51	0.718
MPV	9.44 ± 0.62	9.78 ± 0.44	0.152
PLT/MPV	42.70 ± 8.57	31.01 ± 8.21	0.008

Results are expressed as mean ± standard deviation, median [range] or n (percentage). WBC = white blood cells; PLT = platelets; CRP = C-reactive protein; NLR = neutrophil-lymphocyte ratio; PLR = platelet-lymphocyte ratio; MPV = mean platelet volume

Table 4. Area under the curve (AUC), confidence intervals and sensitivity, specificity for cut-off values for all children

Laboratory marker (cut-off)	AUC	95% CI	P value
WBC (>11.5 ×10 ⁹ /L)	0.730	0.634–0.826	0.049
Neutrophils (>5.35 ×10 ⁹ /L)	0.676	0.573–0.778	0.002
PLT (>315 ×10 ⁹ /L)	0.631	0.527–0.736	0.018
CRP (>20 mg/L)	0.748	0.654–0.842	<0.001
NLR (1.58)	0.651	0.542–0.759	0.001
Laboratory marker (cut-off)			
	Sensitivity (%)	Specificity (%)	
WBC (>11.5 ×10 ⁹ /L)	80.3	64.8	
Neutrophils (>5.35 ×10 ⁹ /L)	74.2	61.2	
PLT (>315 ×10 ⁹ /L)	71.7	54.5	
CRP (>20 mg/L)	80.3	68.8	
NLR (1.58)	73.0	57.7	

Table 5. Sensitivity and specificity, area under the curve (AUC) and confidence intervals for cut-off values for all children who arrived early to ED (<12 hours)

Laboratory marker (cut-off)	AUC	95% CI	P value
PLT/MPV (30.0)	0.844	0.720–0.969	<0.001
PLT/MPV (30.0)			
	Sensitivity (%)	Specificity (%)	
	95.2	53.3	

Conclusion and perspectives

- **WBC** and **CRP** showed to be **the most reliable** biomarkers to determine bacterial infection and differentiate from viral infections, at **any time** of arrival
- **PLT** and **PLT/MPV** could be considered as a **bacterial infection marker** in patients who arrived to ED **early**. They could allow prediction of further bacteremia development
- **PLT/MPV** is one of the most sensitive **early** bacteremia/sepsis markers in **infants**
- Combination of these biomarkers should inflict a more precise diferenciation between bacterial and viral infection, which would make **a low-cost, easily applicable, approachable biomarker** in any medical settings

Acknowledgement: special thanks to Lina Jankauskaite, who is the best mentor and motivator ever!

Contact information: emilijatam@gmail.com, gineta.va@gmail.com, lina.jankauskaite@ismuni.lt

Figure 1. ROC curve of all biomarkers

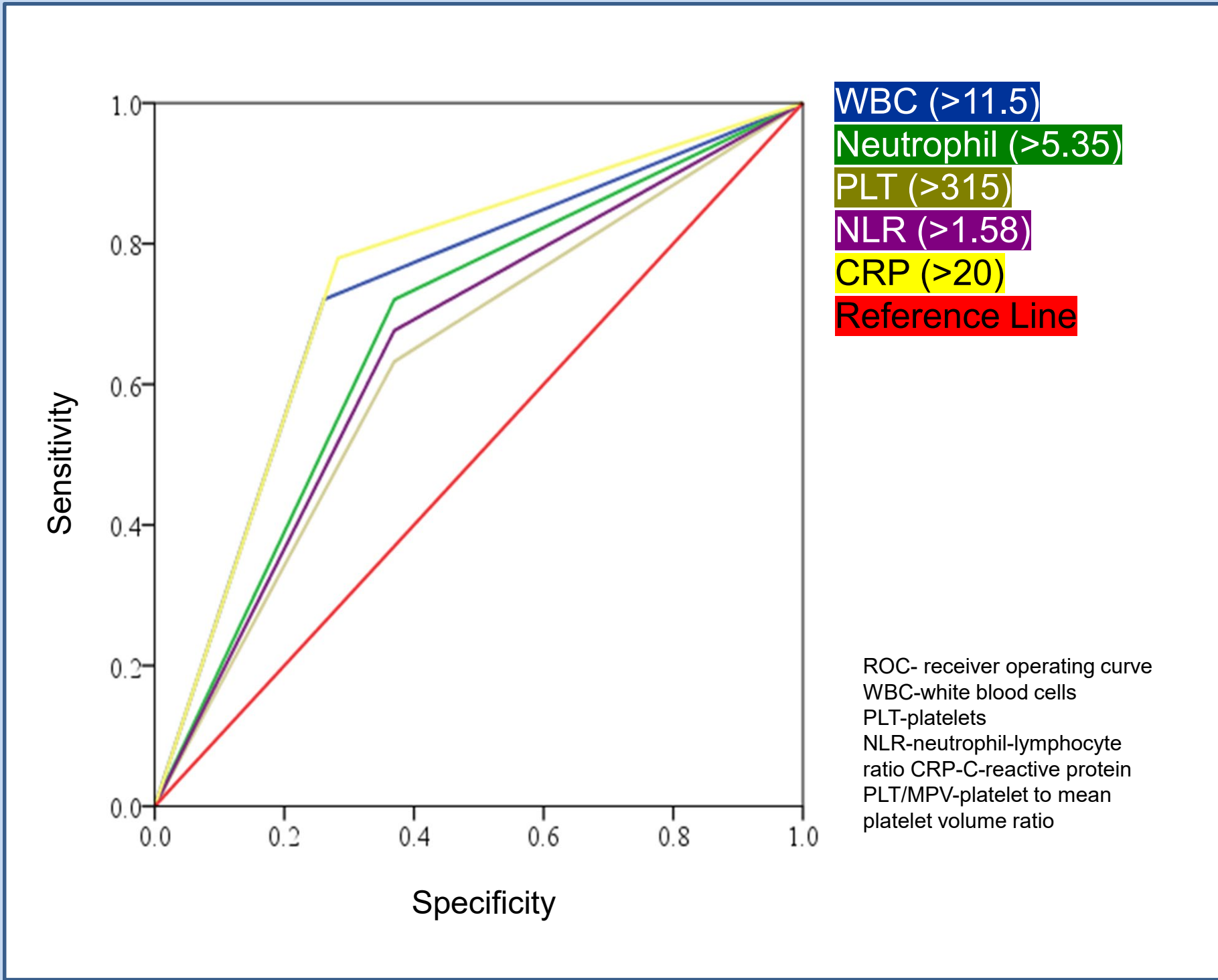


Figure 2. ROC curve of PLT/MPV

