

ORIGINAL ARTICLE

Detection of Bacterial Infection Based on Age-Specific Percentile-Based Reference Curve for Serum Procalcitonin Level in Preterm Infants

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SUMMARY

Background: Considering the physiological changes in serum procalcitonin (PCT) levels in newborns due to age, we recently established an age-specific percentile-based reference curve for serum PCT level. The present study aimed to determine the best cutoff percentile line using this reference curve for the differentiation between infected and colonized preterm infants.

Methods: A total of 52 preterm infants with positive bacterial culture (9 with bacterial infection, 43 with colonization) were enrolled within the study period. The 97.5th, 95.0th, 92.5th, 90.0th, 80.0th, 70.0th, 60.0th, and 50.0th percentile lines were drawn in the reference curve. PCT levels in infected or colonized infants were used, and sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated. The best cutoff percentile line was determined in the receiver operating characteristic curve analysis.

Results: Of the 52 preterm infants, 9 were infected (5 and 4 infants with an onset of < 7 days and ≥ 7 days after birth, respectively), whereas 43 were colonized (6 and 37 infants with an onset of < 7 days and ≥ 7 days after birth, respectively). The best cutoff percentile lines were the 90.0th percentile (sensitivity, 0.800; specificity, 0.833; PPV, 0.800; NPV, 0.833) and 97.5th percentile (sensitivity, 1.00; specificity, 0.973; PPV, 0.800; NPV, 1.00) in infants with an onset of < 7 days and ≥ 7 days after birth, respectively.

Conclusions: The age-specific percentile-based reference curve for serum PCT level is clinically applicable as a new tool for diagnosing infections in preterm infants with positive culture results, particularly at ≥ 7 days after birth.

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Supplementary Data

Table 1. Overall infants.

a) 50.0th percentile.

	Infectious cases	Colonized cases	Total
>	9	27	36
≤	0	16	16
Total	9	43	52

Sensitivity: 1.00
 Specificity: 0.372
 PPV: 0.25
 NPV: 1.00

b) 60.0th percentile.

	Infectious cases	Colonized cases	Total
>	9	22	31
≤	0	21	21
Total	9	43	52

Sensitivity: 1.00
 Specificity: 0.488
 PPV: 0.29
 NPV: 1.00

c) 70.0th percentile.

	Infectious cases	Colonized cases	Total
>	9	16	25
≤	0	27	27
Total	9	43	52

Sensitivity: 1.00
 Specificity: 0.628
 PPV: 0.36
 NPV: 1.00

d) 80.0th percentile.

	Infectious cases	Colonized cases	Total
>	8	12	20
≤	1	31	32
Total	9	43	52

Sensitivity: 0.899
 Specificity: 0.721
 PPV: 0.400
 NPV: 0.969

e) 90.0th percentile.

	Infectious cases	Colonized cases	Total
>	8	6	14
≤	1	37	38
Total	9	43	52

Sensitivity: 0.889
 Specificity: 0.860
 PPV: 0.571
 NPV: 0.974

f) 92.5th percentile.

	Infectious cases	Colonized cases	Total
>	6	3	9
≤	3	40	43
Total	9	43	52

Sensitivity: 0.667
 Specificity: 0.930
 PPV: 0.667
 NPV: 0.930

g) 95.0th percentile.

	Infectious cases	Colonized cases	Total
>	6	3	9
≤	3	40	43
Total	9	43	52

Sensitivity: 0.667
 Specificity: 0.930
 PPV: 0.667
 NPV: 0.930

h) 97.5th percentile

	Infectious cases	Colonized cases	Total
>	6	2	8
≤	3	41	44
Total	9	43	52

Sensitivity: 0.667
 Specificity: 0.953
 PPV: 0.750
 NPV: 0.932

Table 2. Infants with an onset of < 7 days.

a) 50.0th percentile.

	Infectious cases	Colonized cases	Total
>	5	5	10
≤	0	1	1
Total	5	6	11

Sensitivity: 1.000
 Specificity: 0.167
 PPV: 0.500
 NPV: 1.000

b) 60.0th percentile.

	Infectious cases	Colonized cases	Total
>	5	4	9
≤	0	2	2
Total	5	6	11

Sensitivity: 1.000
 Specificity: 0.333
 PPV: 0.556
 NPV: 1.000

c) 70.0th percentile.

	Infectious cases	Colonized cases	Total
>	5	3	8
≤	0	3	3
Total	5	6	11

Sensitivity: 1.000
 Specificity: 0.500
 PPV: 0.625
 NPV: 1.000

d) 80.0th percentile.

	Infectious cases	Colonized cases	Total
>	4	2	6
≤	1	4	5
Total	5	6	11

Sensitivity: 0.800
 Specificity: 0.667
 PPV: 0.667
 NPV: 0.800

e) 90.0th percentile.

	Infectious cases	Colonized cases	Total
>	4	1	5
≤	1	5	6
Total	5	6	11

Sensitivity: 0.800
 Specificity: 0.833
 PPV: 0.800
 NPV: 0.833

f) 92.5th percentile.

	Infectious cases	Colonized cases	Total
>	2	1	3
≤	3	5	8
Total	5	6	11

Sensitivity: 0.400
 Specificity: 0.833
 PPV: 0.667
 NPV: 0.625

g) 95.0th percentile.

	Infectious cases	Colonized cases	Total
>	2	1	3
≤	3	5	8
Total	5	6	11

Sensitivity: 0.400
 Specificity: 0.833
 PPV: 0.667
 NPV: 0.625

h) 97.5th percentile

	Infectious cases	Colonized cases	Total
>	2	1	3
≤	3	5	8
Total	5	6	11

Sensitivity: 0.400
 Specificity: 0.833
 PPV: 0.667
 NPV: 0.625

Table 3. Infants with an onset ≥ 7 days.**a) 50.0th percentile.**

	Infectious cases	Colonized cases	Total
>	4	22	26
\leq	0	15	15
Total	4	37	41

Sensitivity: 1.000
 Specificity: 0.405
 PPV: 0.154
 NPV: 1.000

b) 60.0th percentile.

	Infectious cases	Colonized cases	Total
>	4	18	22
\leq	0	19	19
Total	4	37	41

Sensitivity: 1.00
 Specificity: 0.514
 PPV: 0.182
 NPV: 1.000

c) 70.0th percentile.

	Infectious cases	Colonized cases	Total
>	4	13	17
\leq	0	24	24
Total	4	37	41

Sensitivity: 1.00
 Specificity: 0.649
 PPV: 0.235
 NPV: 1.000

d) 80.0th percentile.

	Infectious cases	Colonized cases	Total
>	4	10	14
\leq	0	27	27
Total	4	37	41

Sensitivity: 1.000
 Specificity: 0.730
 PPV: 0.286
 NPV: 1.000

e) 90.0th percentile.

	Infectious cases	Colonized cases	Total
>	4	5	9
\leq	0	32	32
Total	4	37	41

Sensitivity: 1.000
 Specificity: 0.865
 PPV: 0.444
 NPV: 1.000

f) 92.5th percentile.

	Infectious cases	Colonized cases	Total
>	4	2	6
\leq	0	35	35
Total	4	37	41

Sensitivity: 1.000
 Specificity: 0.946
 PPV: 0.667
 NPV: 1.000

g) 95.0th percentile.

	Infectious cases	Colonized cases	Total
>	4	2	6
\leq	0	35	35
Total	4	37	41

Sensitivity: 1.000
 Specificity: 0.946
 PPV: 0.667
 NPV: 1.000

h) 97.5th percentile

	Infectious cases	Colonized cases	Total
>	4	1	5
\leq	0	36	36
Total	4	37	41

Sensitivity: 1.000
 Specificity: 0.973
 PPV: 0.800
 NPV: 1.000