# PCT与抗感染治疗节点

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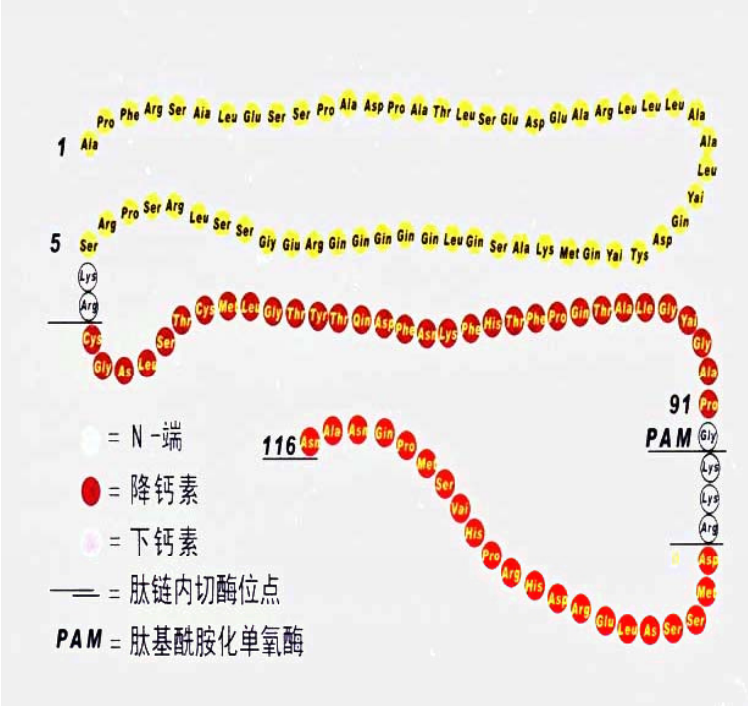
# 什么是PCT?

# 降钙素原(PCT)

- PCT是无激素活性的降钙素前肽物质
- 来自第11号染色体上的单拷贝基因
- 甲状腺滤泡旁细胞内粗面内质网翻译
- 成降钙素前体
- 内源多肽酶剪掉nPro-CT端单一序列
- 生成116个氨基酸的PCT。

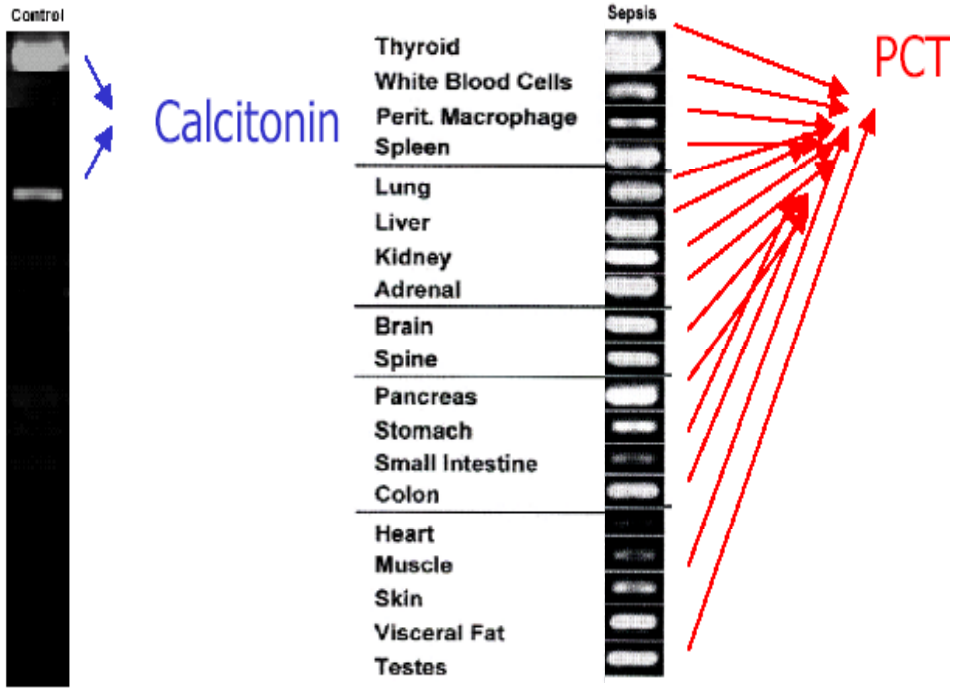


# 降钙素原(PCT)

细菌感染时诱导产生。

病毒感染或自身免疫

病时水平很低。



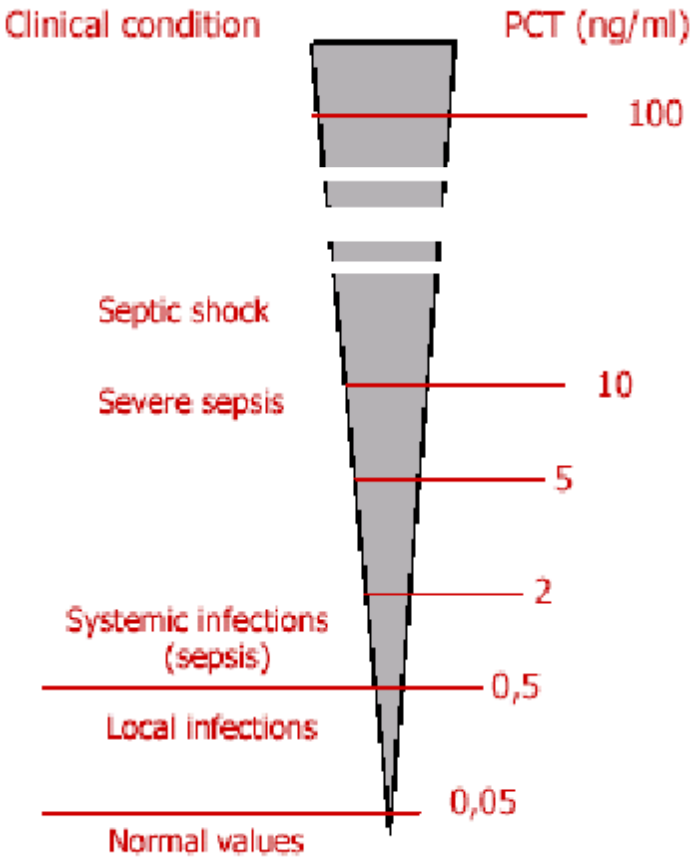

PCT在正常人体的产生部位

细菌感染时PCT在人体的产生部位

# 降钙素原(PCT)

- Oberhoffer等测定242例脓毒症
- 患者的血浆PCT，逻辑回归分析
- 发现血浆PCT与脓毒症相关。

- 随病情发展，PCT浓度在严重
- 的疾病中（如脓毒症、脓毒性
- 休克）逐渐升高。

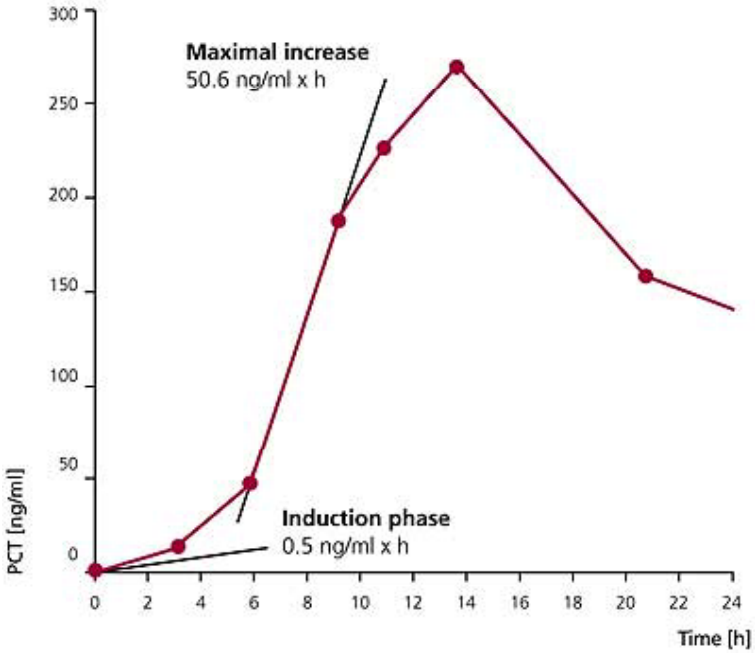


# 降钙素原(PCT)

一个76岁女性病人，在偶然输注一被细菌污染的液体后，
观察其血浆PCT浓度：

在第一阶段（＜6h）PCT大约每小时增加0.5ng/ml。

在后一阶段，连续测量，大约每一小时增加50ng/ml。

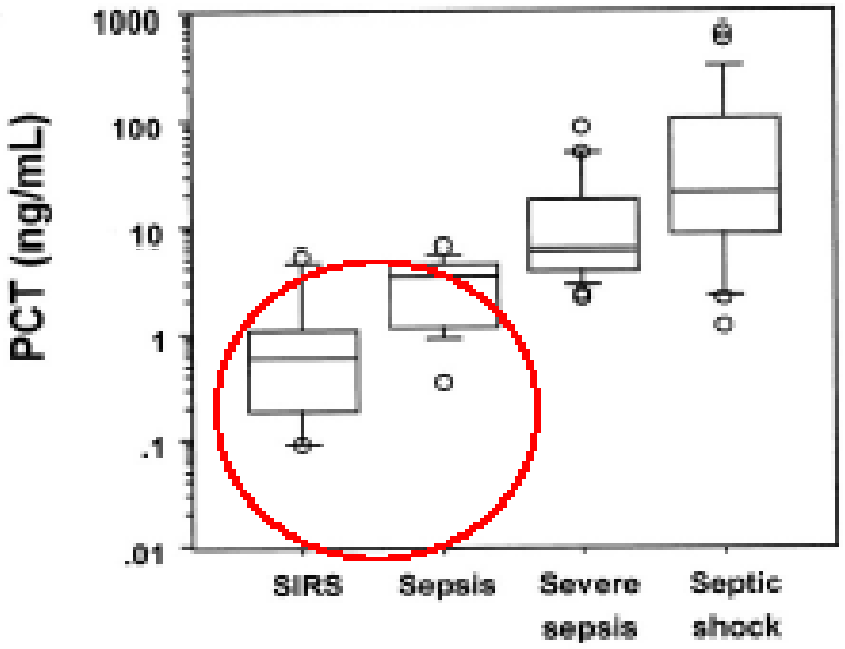



Brunkhorst F.M et al,Intens Care Med 1998,24:888-892

# 降钙素原(PCT)

- PCT对脓毒性休克的预测
- 诊断价值为：敏感性100%、
- 特异性72%、阳性预测值
- 86%、阴性预测值92%。

- PCT是诊断严重感染和脓毒
- 症最好辅助诊断指标之一



# 病理情况下PCT如何变化?

Table 2. Principal causes of hyperprocalcitonemia

| | |
|---|---|
| A. | Neuroendocrine tumors |
| | Medullary thyroid cancer |
| | Small cell lung cancer |
| | Carcinoid syndrome |
| B. | Noninfectious systemic inflammation |
| | Inhalational injury |
| | Pulmonary aspiration |
| | Pancreatitis |
| | Heat stroke |
| | Mesenteric infarction |
| C. | Severe infection |
| | Bacterial |
| | Viral |
| | Parasitic |
| D. | Sepsis |
| E. | Trauma |
| | Mechanical injury |
| | Burns |
| | Surgery |

The Journal of TRAUMA® Injury, Infection, and Critical Care

# Serum Procalcitonin Levels in Patients With Multiple Injuries Including Visceral Trauma (J Trauma. 2009;66:243–249.)

*Marcus Maier, MD, Sebastian Wutzler, MD, Mark Lehnert, MD, Maika Szermutzky, MD, Hendrik Wyen, MD, Tobias Bingold, MD, Dirk Henrich, MD, Felix Walcher, MD, and Ingo Marzi, MD*

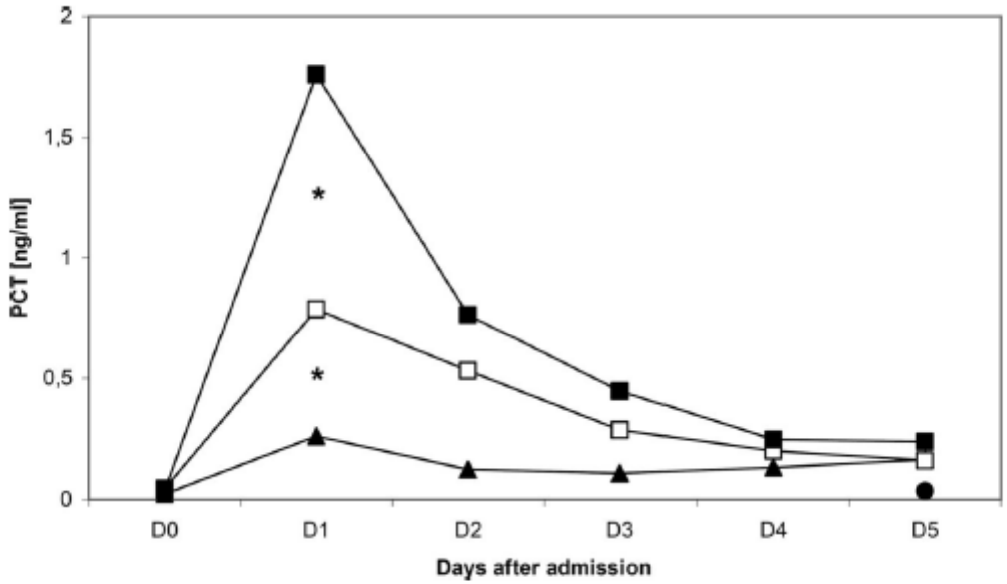



**Fig. 1.** PCT *concentrations in serum of multiply traumatized patients in dependency of the trauma severity. A time course during 5 consecutive days is shown.* Black squares*: ISS 42 to 75 points (n = 11);* open squares*: ISS 25 to 41 points (n = 17);* black triangles*: ISS 16 to 24 points (n = 10);* black circle*: healthy volunteers (n = 9). D0 marks the first blood sample obtained in the emergency room.* *p < 0.05, *ISS 42 to 75 versus ISS 25 to 41 and ISS 25 to 41 versus ISS 16 to 24, respectively.*

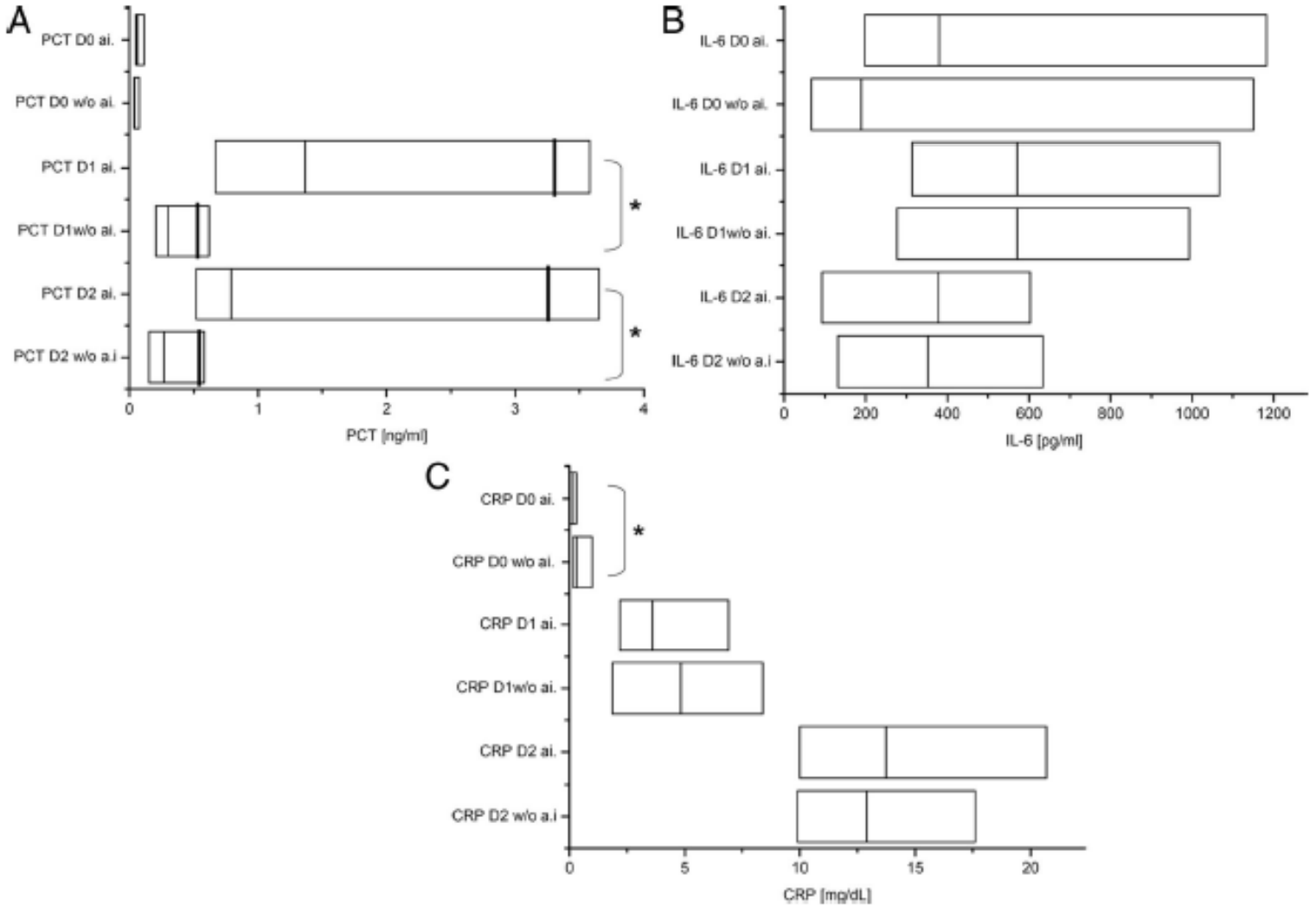



**Fig. 3.** PCT *(A)*, IL-6 *(B)*, and CRP *(C)* plasma concentrations in serum of multiple traumatized patients (ISS ≥25) with abdominal injury (AI, $n = 24$) and without abdominal injury (w/o AI, $n = 20$) on the day of admission (D0) and the following two days (D1, D2). 95% confidence intervals of the median are shown. Only PCT plasma concentrations on D1 and D2 allow to differentiate regarding the occurrence of severe abdominal injury. Black bars in panel indicate the mean values. *$p < 0.05$ AI versus w/o AI.

（J Trauma. 2009;66:243–249.）

# 为何严重创伤等引起PCT增高

- 多发伤、热休克、重症胰腺炎和大手术后

✓ 肠道内毒素易位可能是其原因（Pancreas 2003; 27:239-243；Burn Care Rehabil 2005; 26:383-391）

- PCT2—4hr开始升高，1—2d高峰，3—5d降到较低水平（Crit Care 2006;10:R1）
- 如血浆PCT水平据高不下或下降后又升高，可能是感染性并发症的出现（Shock 2003; 20:420-426）

# Infection

- Localized Bacterial Infection with negative blood and without symptomatology of sepsis (Infection 2005; 33:257–263; Int J Tuberc Lung Dis 2006; 10:510–51)
- PCT is higher in bacteremia than that in negative blood culture (J Infect 2006; 52:169–177)
- Increased serum ProCT levels often occur in urinary tract infections (Pediatr Infect Dis 2001; 20:507–516)

# Sepsis

文献报道

Table 3. Range of serum procalcitonin levels in several studies of patients with severe systemic infection/sepsis

| Range, ng/mL | Reference |
|---|---|
| 6–53 | 41 |
| 1.48–15.26 | 55 |
| Indeterminate[a] to 353 | 74 |
| 1–722 | 75 |
| 2.1–607.7 | 76 |
| Indeterminate to 767 | 77 |

[a]Indeterminate indicates below the functional sensitivity of the assay.

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- 55. Crit Care 2004; R234–R242
- 74. Clin Infect Dis 2002; 35:156–161
- 75. Pediatr Crit Care Med 2003; 4:190–195
- 76. Arch Dis Child 2006; 91:117–120
- 77. Crit Care Med 2004; 32:1166–1169


Crit Care Med 2008 Vol. 36(3): 941

Intensive Care Med (2006) 32:1577–1583
DOI 10.1007/s00134-006-0306-3

ORIGINAL

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Nils-Olivier Olsson
Bernard Blettery

# Serum procalcitonin measurement contribution to the early diagnosis of candidemia in critically ill patients

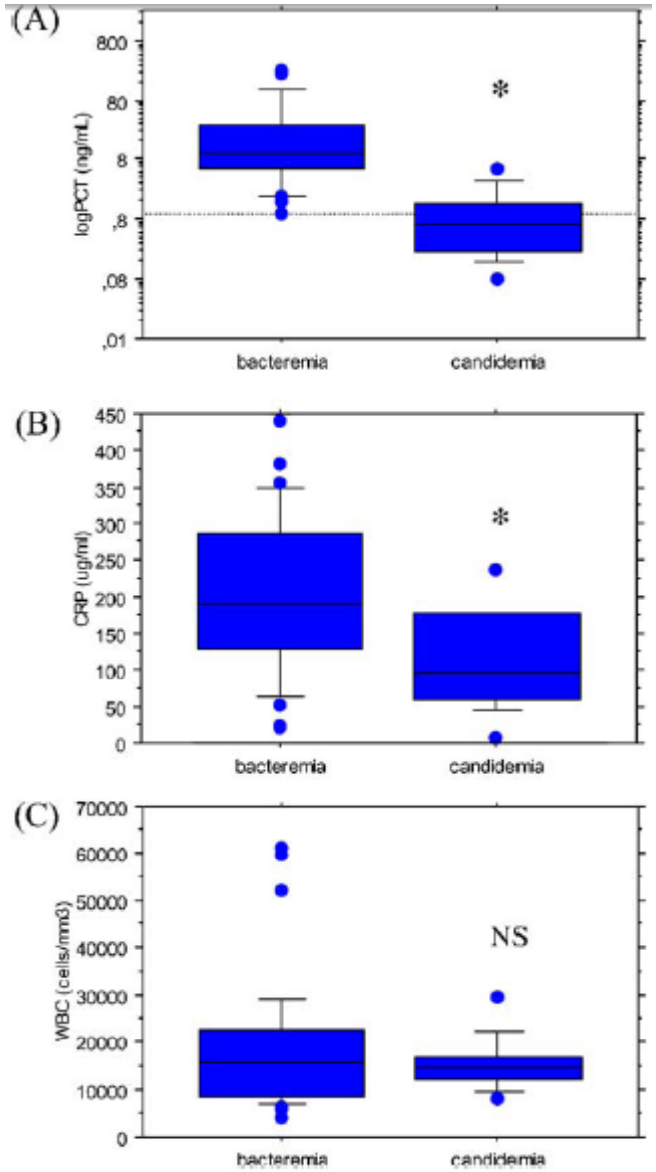


**Fig. 1** **a** Serum PCT level, **b** CRP level, and **c** WBC count at the onset of either bacteremia ($n = 35$) or candidemia ($n = 15$) in critically ill patients and clinical sepsis. Data are presented as box plots with median lines, 25th and 75th percentile boxes, and 10th and 90th-percentile error bars. The *circles* represent the outliers. A log scale is used for the y-axis in **a**. *$p < 0.05$ between bacteremia and candidemia

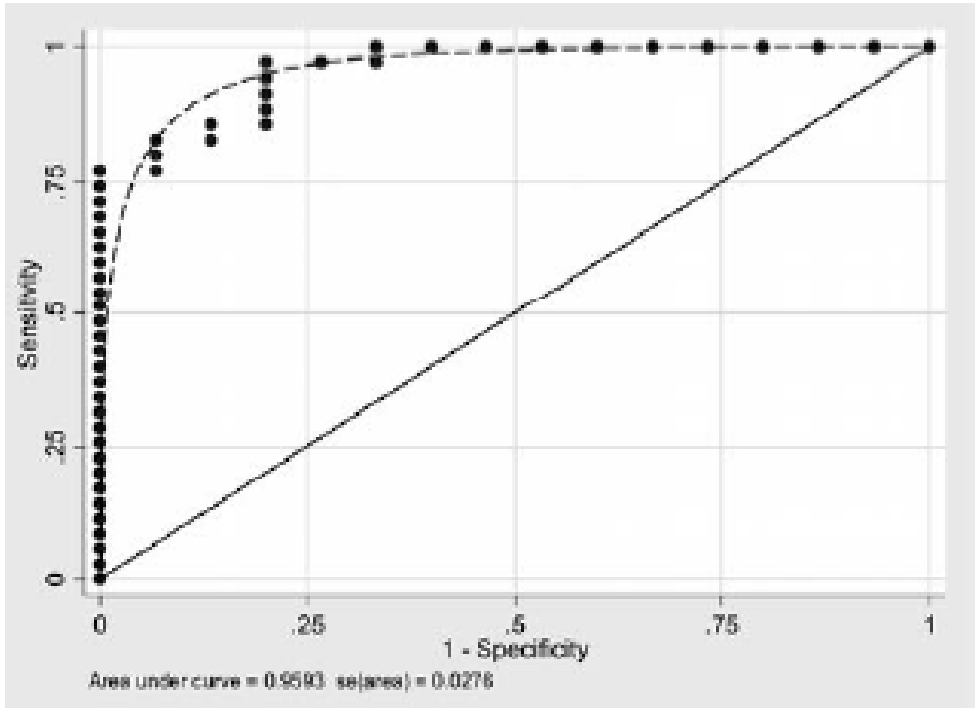


**Fig. 2** ROCC of serum PCT for the diagnosis of candidemia in critically ill patients with clinical sepsis and positive blood cultures. *Circles* indicate PCT values and the *dashed line* represents the corresponding ROCC assuming a normal distribution of the variable

Intensive Care Med (2006) 32:1577–1583

# Accuracy of procalcitonin for sepsis diagnosis in critically ill patients: systematic review and meta-analysis

*Benjamin M P Tang, Guy D Eslick, Jonathan C Craig, Anthony S McLean*

*Lancet Infect Dis* 2007; 7: 210–17

Department of Intensive Care Medicine, Nepean Hospital, Penrith, New South Wales, Australia (B M P Tang MD, A S McLean MD); School of Public Health, University of Sydney, Sydney, New South Wales (B M P Tang, G D Eslick PhD, J C Craig MD); and Department of Medicine, University of Sydney, Nepean Hospital, Penrith (G D Eslick)

Procalcitonin is widely reported as a useful biochemical marker to differentiate sepsis from other non-infectious causes of systemic inflammatory response syndrome. In this systematic review, we estimated the diagnostic accuracy of procalcitonin in sepsis diagnosis in critically ill patients. 18 studies were included in the review. Overall, the diagnostic performance of procalcitonin was low, with mean values of both sensitivity and specificity being 71% (95% CI 67–76) and an area under the summary receiver operator characteristic curve of 0·78 (95% CI 0·73–0·83). Studies were grouped into phase 2 studies (n=14) and phase 3 studies (n=4) by use of Sackett and Haynes' classification. Phase 2 studies had a low pooled diagnostic odds ratio of 7·79 (95% CI 5·86–10·35). Phase 3 studies showed significant heterogeneity because of variability in sample size (meta-regression coefficient –0·592, p=0·017), with diagnostic performance upwardly biased in smaller studies, but moving towards a null effect in larger studies. Procalcitonin cannot reliably differentiate sepsis from other non-infectious causes of systemic inflammatory response syndrome in critically ill adult patients. The findings from this study do not lend support to the widespread use of the procalcitonin test in critical care settings.

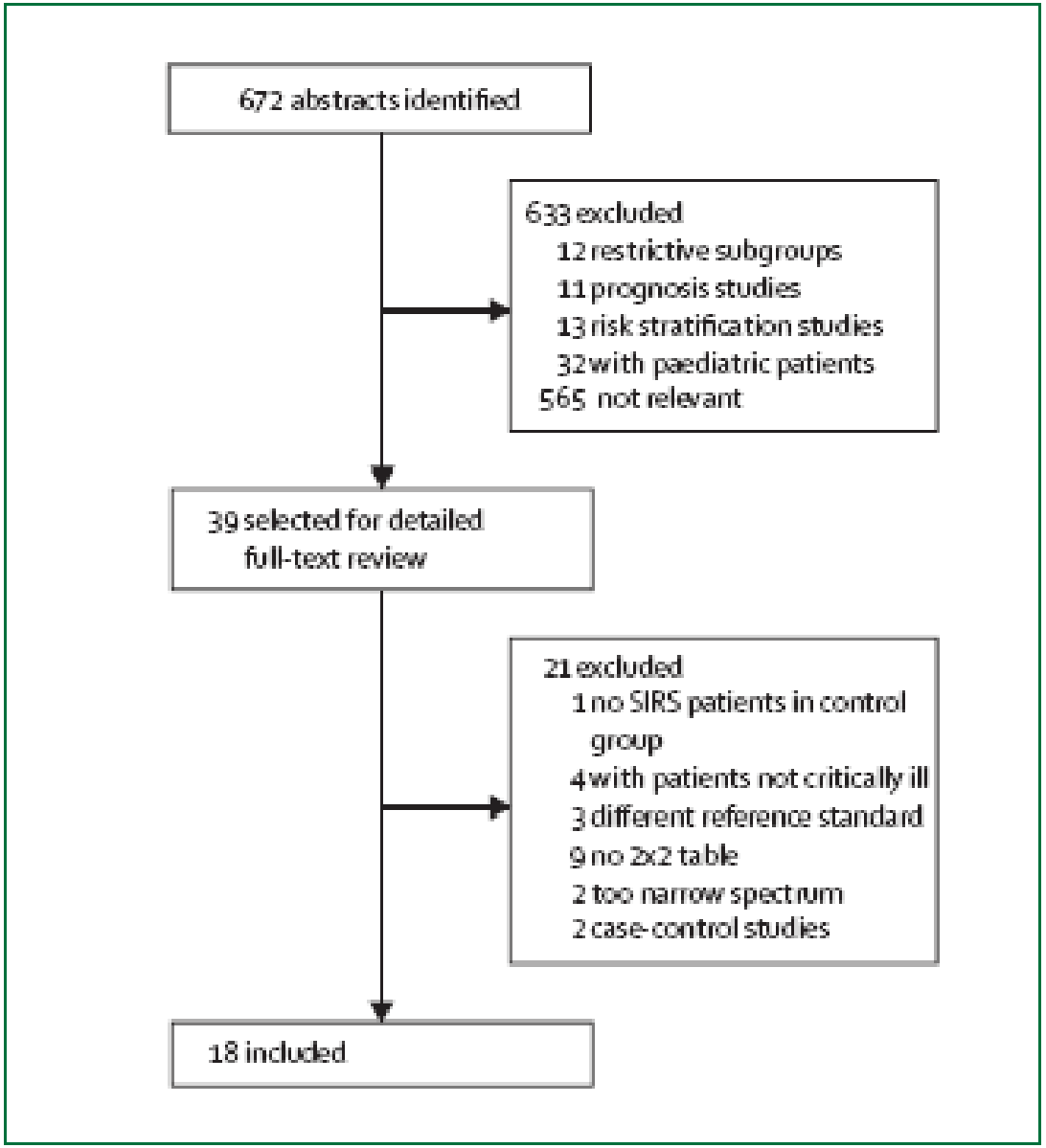


***Figure 1:*** Study identification, inclusion, and exclusion

Some studies were excluded by more than one category. SIRS=systemic inflammatory response syndrome.

# Accuracy, sensitivity and specifi city of procalcitonin

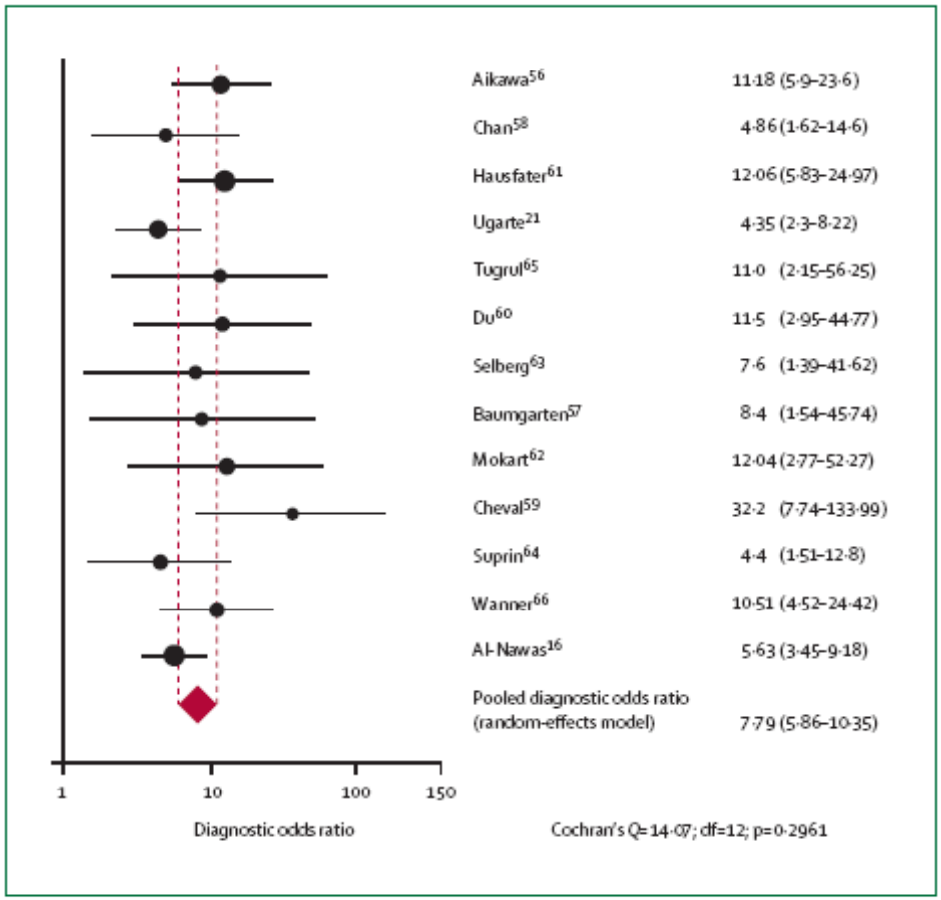


***Figure 2***: Diagnostic odds ratios of group 1 studies
Circles represent individual studies. Error bars represent 95% CIs. Diamond represents pooled diagnostic odds ratio, with dashed lines representing its 95% CI. Size of circles is proportional to weighting by inverse variance. SE=standard error.

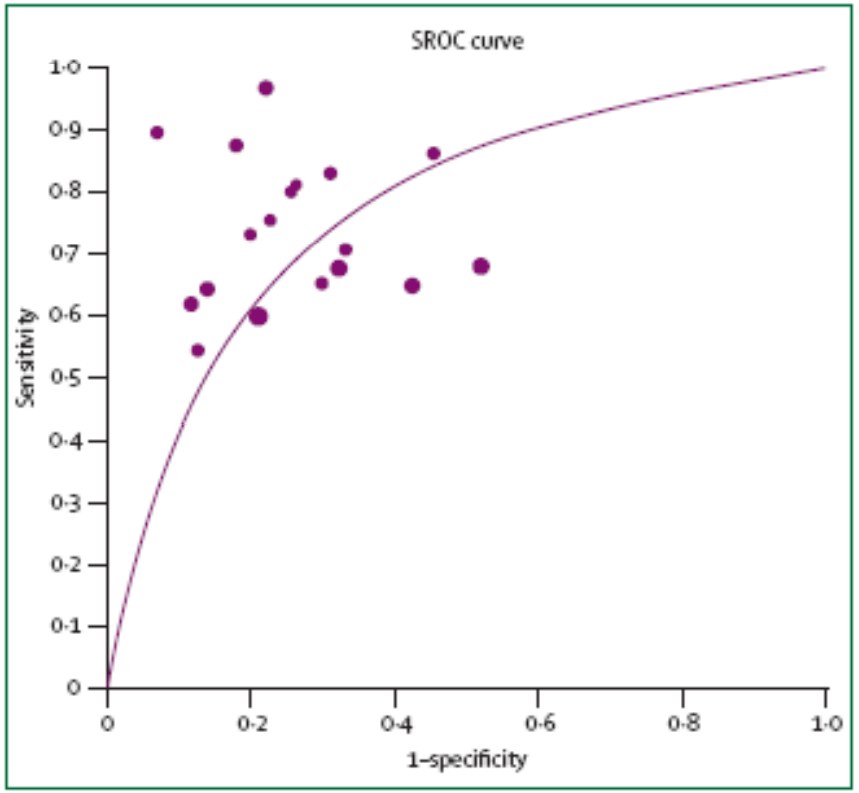


***Figure 3***: Summary receiver operator characteristic (SROC) curve of all studies
Circles indicate individual study estimates of sensitivity and 1–specificity. Size of circles is proportional to inverse variance of each study.

Lancet Infect Dis 2007; 7:210–17

# 影响PCT的非细菌感染因素

# Influence of renal dysfunction on the accuracy of procalcitonin for the diagnosis of postoperative infection after vascular surgery

Julien Amour, MD, PhD; Aurélie Birenbaum, MD; Olivier Langeron, MD, PhD; Yannick Le Manach, MD; Michèle Bertrand, MD; Pierre Coriat, MD; Bruno Riou, MD, PhD; Maguy Bernard, MD, PhD; Pierre Hausfater, MD, PhD

Crit Care Med 2008; 36:1147–1154

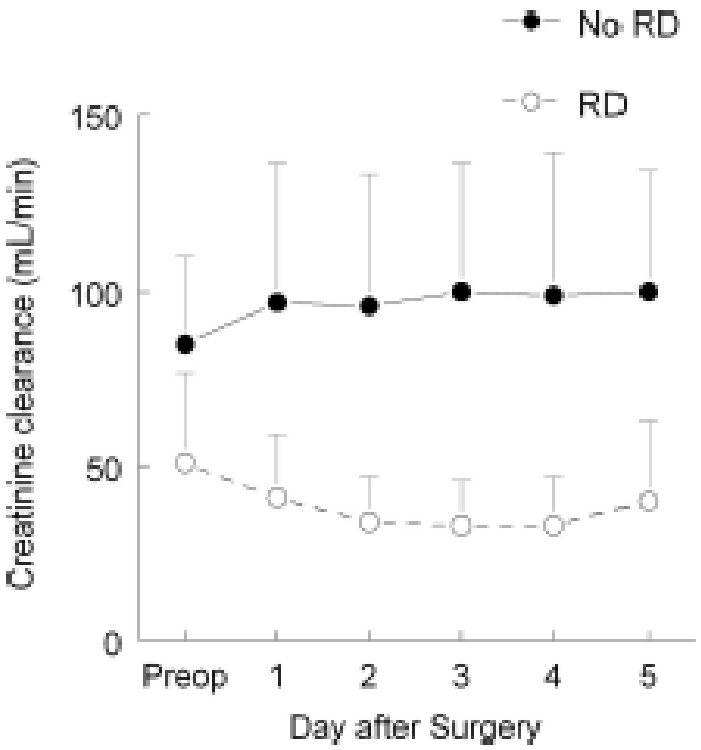


Figure 1. Evolution of estimated creatinine clearance during the perioperative period in patients without (n = 201) and with postoperative renal dysfunction (*RD*, n = 75). (See Methods for definition). Data are means ± SD. No statistical comparison was performed.

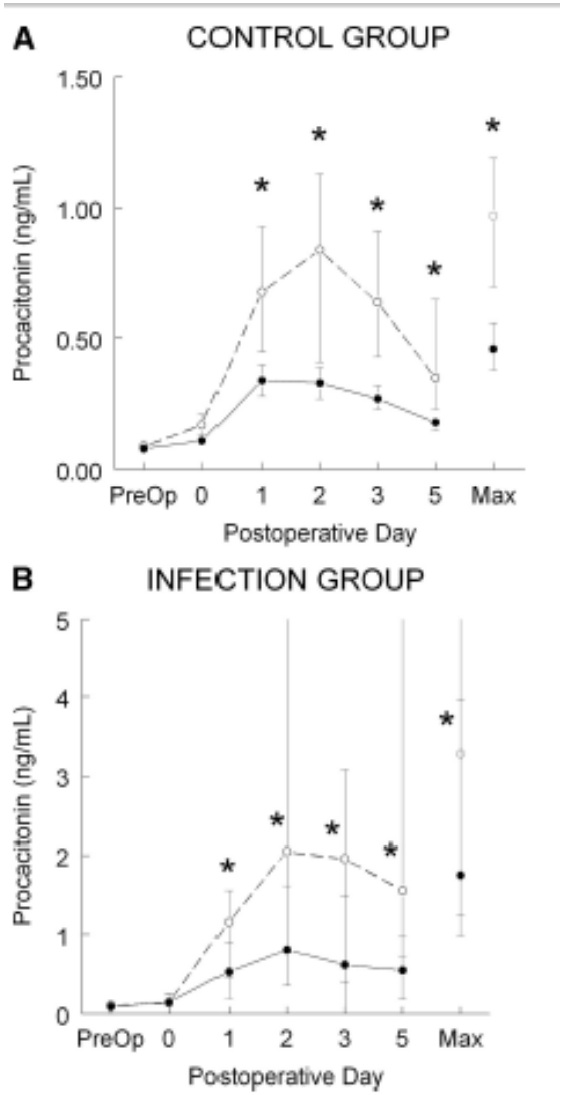


Figure 2. Comparison of procalcitonin in patients without (*full circles* and *full line*, n = 201) and with postoperative renal dysfunction (*open circle* and *dotted line*, n = 75) in the control group (*Panel A*) and the infection group (*Panel B*). Data are medians [95% confidence interval]. *$P < 0.05$ (between group comparisons).

Crit Care Med 2008; 36:1147–1154

**Available online** http://ccforum.com/content/13/2/R37

Research

Open Access

# Marked increase of procalcitonin after the administration of anti-thymocyte globulin in patients before hematopoietic stem cell transplantation does not indicate sepsis: a prospective study

Helena Brodska[1,2], Tomas Drabek[2,3], Karin Malickova[1,2], Antonin Kazda[1,2], Antonin Vitek[2,4], Tomas Zima[1,2] and Marketa Markova[2,4]

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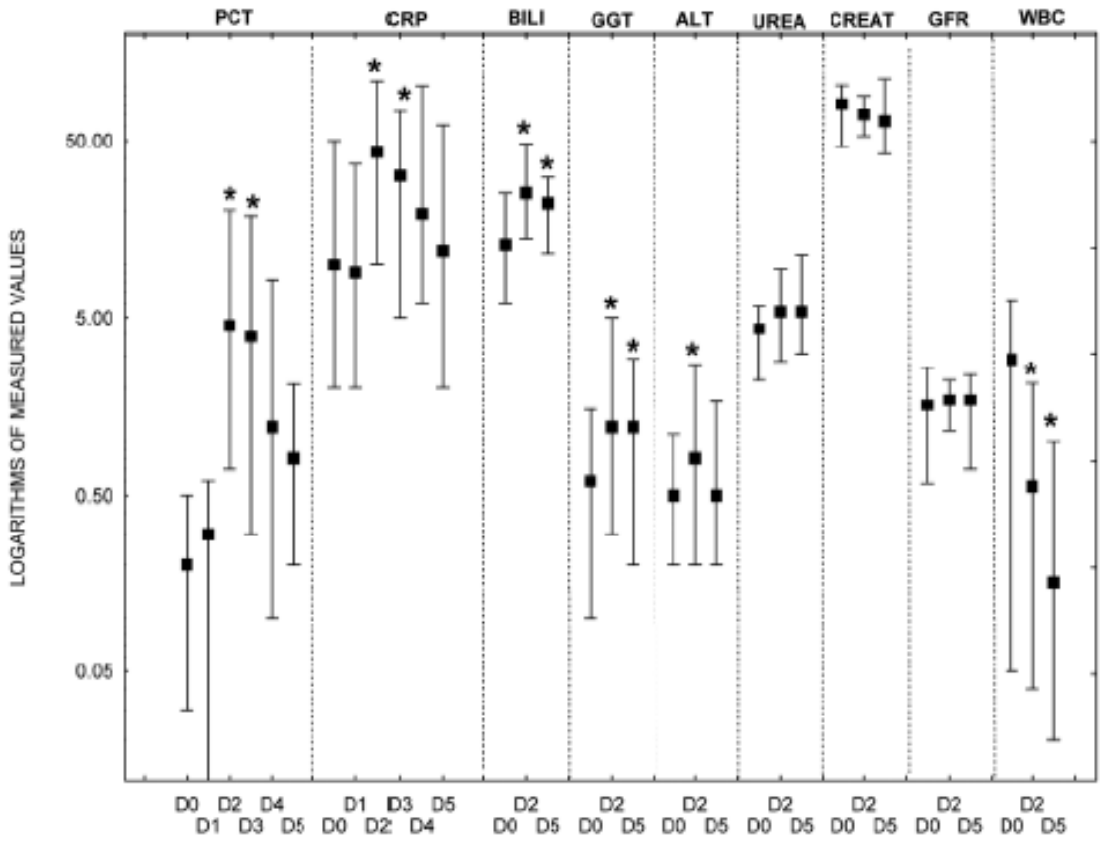
*Critical Care* 2009, **13**:R37 (doi:10.1186/cc7749)
This article is online at: http://ccforum.com/content/13/2/R37

**Figure 1**




Dynamics of measured parameters during conditioning with anti-thymocyte globulin. Values are presented as mean ± standard deviation. *$P < 0.05$ versus baseline. ALT, alanin aminotransferase (normal: 0.1 to 0.78 μkat/L); BILI, bilirubin (normal: 2 to 17 μmol/L); CREAT, creatinine (normal: 44 to 104 μmol/L for females and 44 to 110 μmol/L for males); CRP, C-reactive protein (normal: <7 mg/L); Dx, day of conditioning regimen (see Results section for details); GFR, glomerular filtration rate (normal: 1.5 to 2.0 mL/s); GGT, gamma-glutamyl transferase (normal: 0.1 to 0.68 μkat/L); PCT, procalcitonin (normal: < 0.5 μg/L); urea (normal: 2.0 to 6.7 mmol/L for females and 2.8 to 8.0 mmol/L for males); WBC, white blood cell (count) (4.3 to 10.8 × $10^9$/L).

Critical Care 2009, 13:R37 (doi:10.1186/cc7749)

BMC Infectious Diseases

BioMed Central

Research article

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# Impact of previous sepsis on the accuracy of procalcitonin for the early diagnosis of blood stream infection in critically ill patients

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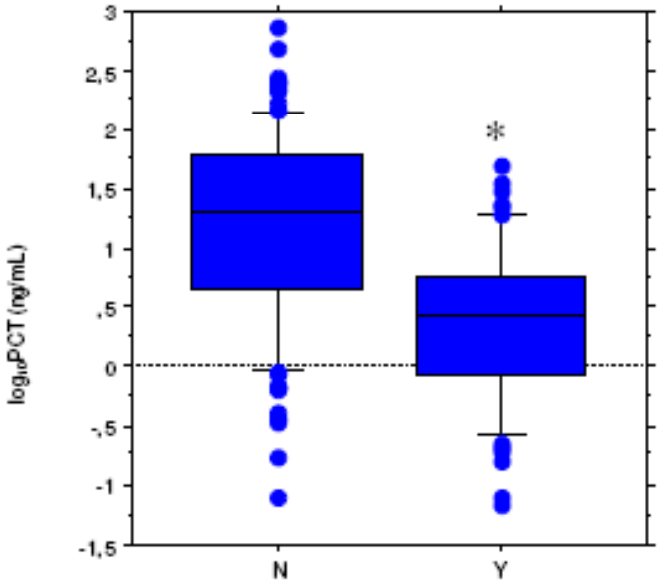
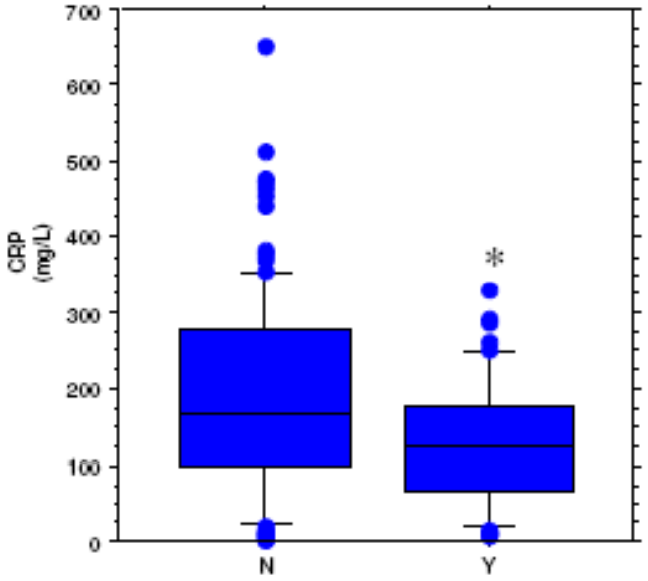
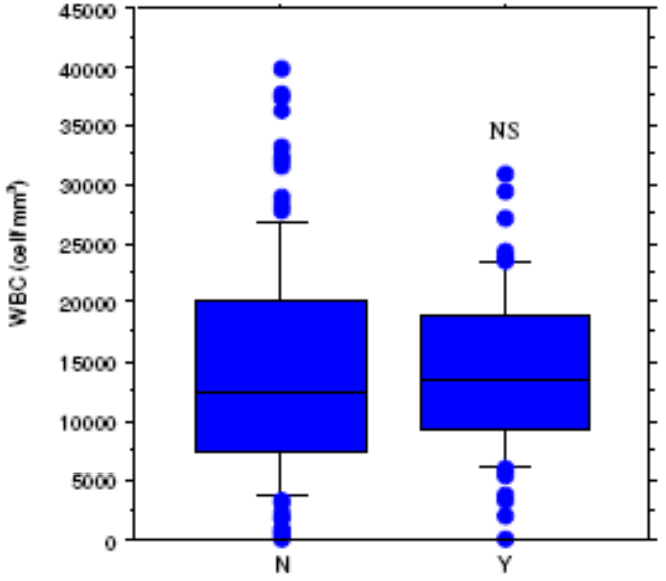



Fig1. Serum procalcitonin (PCT) level (Fig. A), C-reactive protein (CRP) level(Fig. B) and white blood cells count (WBC) (Fig. C), at the onset of blood stream infection according to its primary (left boxes, n = 127) or secondary status (right boxes, n = 62) in critically ill patients with clinical sepsis.

(B)




(C)




BMC Infectious Diseases 2008, 8:163

# PCT对抗感染治疗的指导意义

- 指导病原微生物的判断
- 抗感染治疗节点
- 抗感染疗效评判
- 抗感染治疗的疗程

# PCT对抗感染治疗的指导意义

- 指导病原微生物的判断
-
-
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JOURNAL OF CLINICAL MICROBIOLOGY, July 2010, p. 2325–2329 Vol. 48, No. 7
0095-1137/10/$12.00 doi:10.1128/JCM.00655-10


# MINIREVIEW

# Use of Plasma Procalcitonin Levels as an Adjunct to Clinical Microbiology[▽]

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*Department of Medical Education, Providence Portland Medical Center, and Department of Medicine, Oregon Health and Science University, Portland, Oregon*



TABLE 1. Role of PCT levels in the interpretation of clinical microbiology data in patients with lower respiratory tract infections

| Bacterial pathogen detected | Viral pathogen detected | Procalcitonin level (ng/ml) | Interpretation |
|---|---|---|---|
| No | No | ≤0.05 | No evidence of bacterial or viral infection |
| No | No | 0.5–1,000 | Innate immunity activated; suspect noncultured bacteria, e.g., oral anaerobic organisms |
| No | Yes | ≤0.05 | Viral infection |
| No | Yes | 0.25–1,000 | Dual viral and bacterial infection; failure to identify etiologic bacteria |
| Yes | Yes | 0.25–1,000 | Dual infection with virus and bacteria |
| Yes | No | ≤0.05 | Bacterial colonization |
| Yes | Yes | ≤0.05 | Bacterial colonization and viral infection |

Infection
DOI 10.1007/s15010-011-0126-4

CLINICAL AND EPIDEMIOLOGICAL STUDY

# Evaluation of potential biomarkers for the discrimination of bacterial and viral infections

**P. Chalupa · O. Beran · H. Herwald · N. Kaspříková · M. Holub**

**Table 4** Comparison of laboratory parameters in patients with bacterial and viral infections

| Parameter | Bacterial infection ($n = 54$) | | | Viral infection ($n = 27$) | | | *P*-value | AUC |
|---|---|---|---|---|---|---|---|---|
| | Median | Lower quartile (25%) | Upper quartile (75%) | Median | Lower quartile (25%) | Upper quartile (75%) | | |
| Serum parameter | | | | | | | | |
| PCT (ng/ml) | 1.84 | 0.64 | 13.63 | 0.05 | 0.05 | 0.06 | <0.001 | 0.952 |
| HBP (ng/ml) | 51 | 30 | 72 | 20 | 17 | 26 | <0.001 | 0.837 |
| IL-6 (pg/ml) | 50 | 20 | 198 | 20 | 20 | 20 | <0.001 | 0.830 |
| Cortisol (nmol/l) | 609 | 505 | 765 | 394 | 349 | 483 | <0.001 | 0.817 |
| sCD14 (ng/ml) | 3,645 | 3,021 | 7,303 | 2,059 | 1,432 | 6,868 | <0.001 | 0.733 |
| IL-8 (pg/ml) | 28 | 20 | 74 | 20 | 20 | 20 | 0.001 | 0.708 |
| IFN-γ (pg/ml) | 185 | 81 | 1,240 | 169 | 13 | 553 | 0.244 | 0.580 |
| IL-10 (pg/ml) | 20 | 20 | 20 | 20 | 20 | 20 | 0.479 | 0.549 |
| TNF-α (pg/ml) | 20 | 20 | 20 | 20 | 20 | 20 | 0.492 | 0.547 |
| Peripheral blood cells | | | | | | | | |
| Leukocytes (cells/µl) | 13,100 | 9,100 | 16,300 | 7,750 | 5,600 | 9,700 | <0.001 | 0.799 |
| Neutrophils (cells/µl) | 10,000 | 6,775 | 14,300 | 1,450 | 3,300 | 6,600 | <0.001 | 0.852 |
| Lymphocytes (cells/µl) | 800 | 600 | 1,200 | 1,450 | 1,250 | 1,950 | <0.001 | 0.841 |
| Monocyte expression marker | | | | | | | | |
| CD14 (MFI) | 133 | 80 | 760 | 394 | 165 | 841 | <0.001 | 0.750 |
| HLA-DR (MFI) | 935 | 398 | 1,613 | 1,155 | 927 | 1,747 | 0.064 | 0.645 |
| TLR2 (MFI) | 192 | 144 | 259 | 209 | 131 | 310 | 0.593 | 0.538 |
| TLR4 (MFI) | 52 | 29 | 92 | 52 | 33 | 80 | 0.954 | 0.504 |

Data are presented as median (lower quartile–upper quartile)

*AUC* area under the curve, *MFI* mean fluorescence intensity

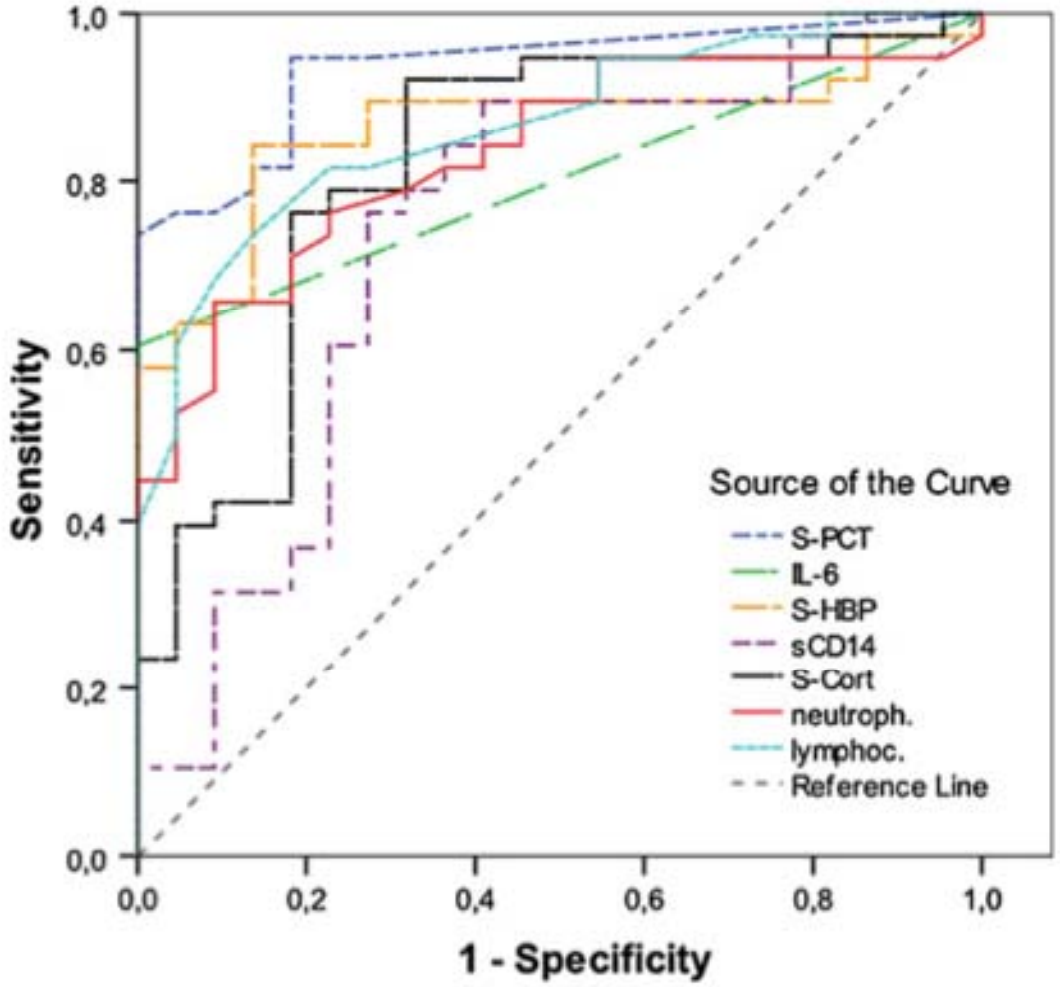



**Fig. 1** Receiver operating characteristic (ROC) curves of selected biomarkers with high diagnostic value for discrimination between bacterial and viral infection

# PCT对临床指导意义

- 抗感染治疗的节点

BMC Infectious Diseases

Research article

Open Access

# Diagnostic and prognostic value of procalcitonin among febrile critically ill patients with prolonged ICU stay

Iraklis Tsangaris*[1], Diamantis Plachouras†[2], Dimitra Kavatha†[2], George Michael Gourgoulis†[2], Argirios Tsantes[3], Petros Kopterides[1], George Tsaknis[1], Ioanna Dimopoulou[1], Stylianos Orfanos[1], Evangelos Giamarellos-Bourboulis[2], Helen Giamarellou[2] and Apostolos Armaganidis[1]

BMC Infectious Diseases 2009, 9:213 doi:10.1186/1471-2334-9-213

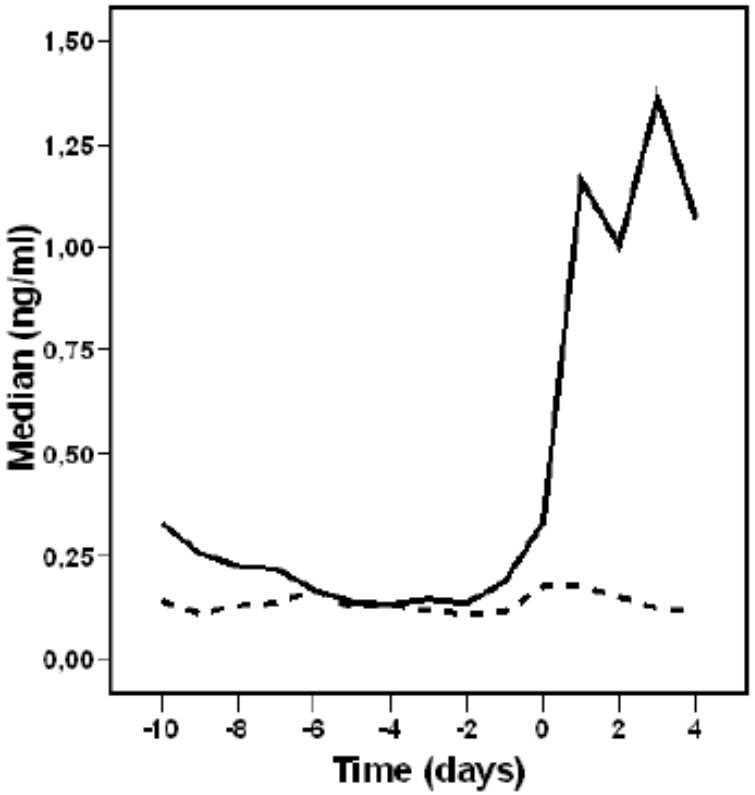



**Figure 3**
**PCT values for patients with (constant line) and without (dotted line) proven infection before and after the onset of fever (D1).** PCT: Procalcitonin, D1: Day1 (day of fever onset).

**Table 4: Validity of a four-fold increase of PCT value between day 1 (PCT1: day of fever onset) and the six previews days (PCT0 to PCT-5) for differentiating patients with and without proven infection**

| | Sensitivity | Specificity | PPV |
|---|---|---|---|
| PCT1-PCT0 | 59.26 | 86.95 | 84.20 |
| PCT1-PCT(-1) | 64 | 82.60 | 80 |
| PCT1-PCT(-2) | 68 | 77.27 | 77.27 |
| PCT1-PCT (-3) | 69.56 | 76.17 | 69.65 |
| PCT1-PCT(-4) | 66.67 | 80 | 77.77 |
| PCT1-PCT(-5) | 66.67 | 73.68 | 73.68 |

PPV: Positive Predictive Value, PCT: Procalcitonin

BMC Infectious Diseases 2009, 9:213 doi:10.1186/1471-2334-9-213

Virulence 1:2, 88-92; March/April 2010; © 2010 Landes Bioscience

# Guidance of antibiotic therapy with procalcitonin in lower respiratory tract infections

## Insights into the ProHOSP study

Philipp Schuetz,[1,*] Mirjam Christ-Crain,[1] Werner Albrich,[2] Werner Zimmerli[3] and Beat Mueller,[2] for the ProHOSP Study Group[†]

[1]Department of Internal Medicine; Division of Endocrinology; Diabetes and Clinical Nutrition; University Hospital Basel; Switzerland; [2]Department of Internal Medicine; Kantonsspital Aarau; Aarau, Switzerland; [3]Department of Internal Medicine; Kantonsspital Liestal; Liestal, Switzerland

[†]Members of the ProHOSP Study Group are listed in the appendix

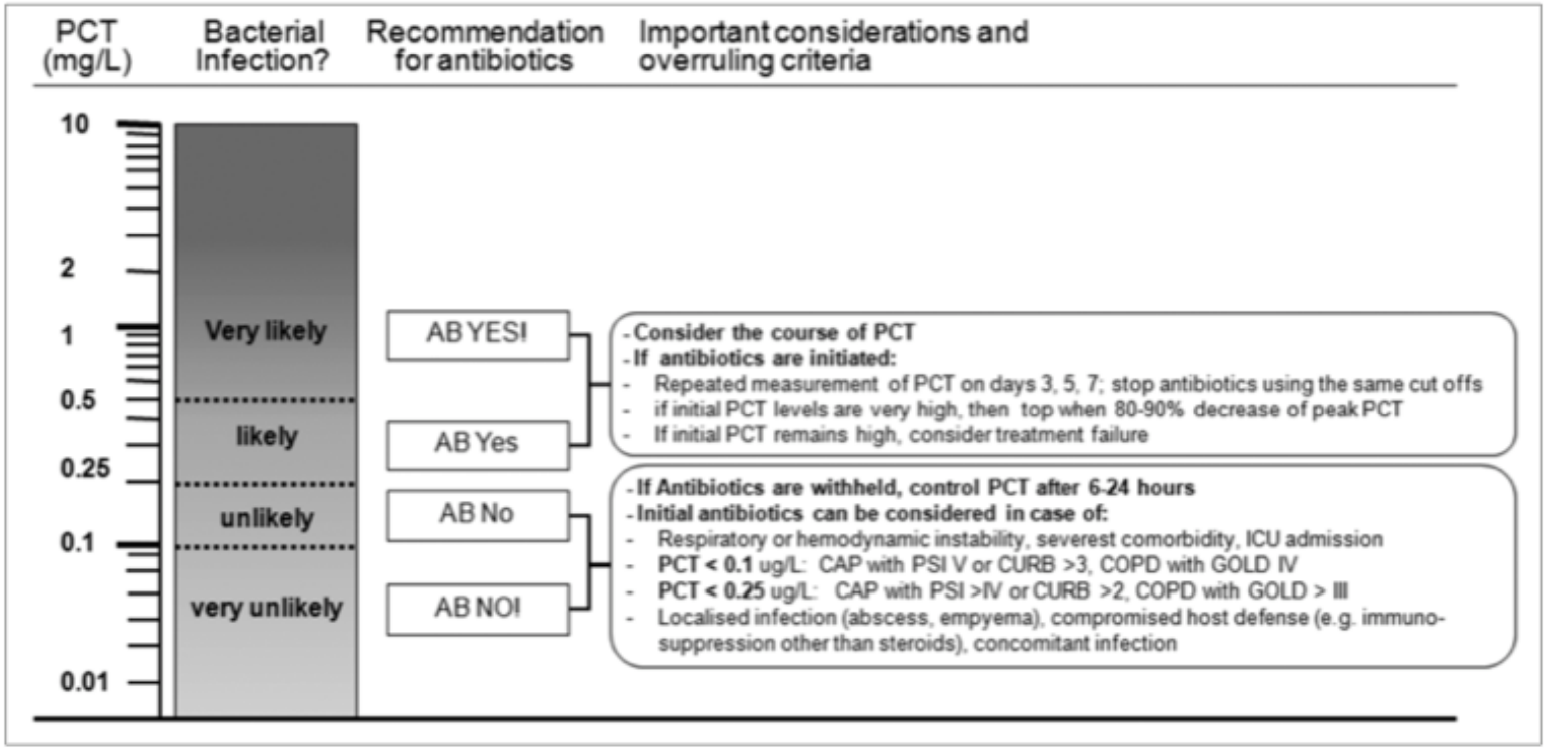



**Figure 1.** Algorithm for Antibiotic Guidance. AB, Antibiotic; PSI, Pneumonia severity index; CURB65, confusion, urea, respiratory rate, blood pressure, age >65 years.

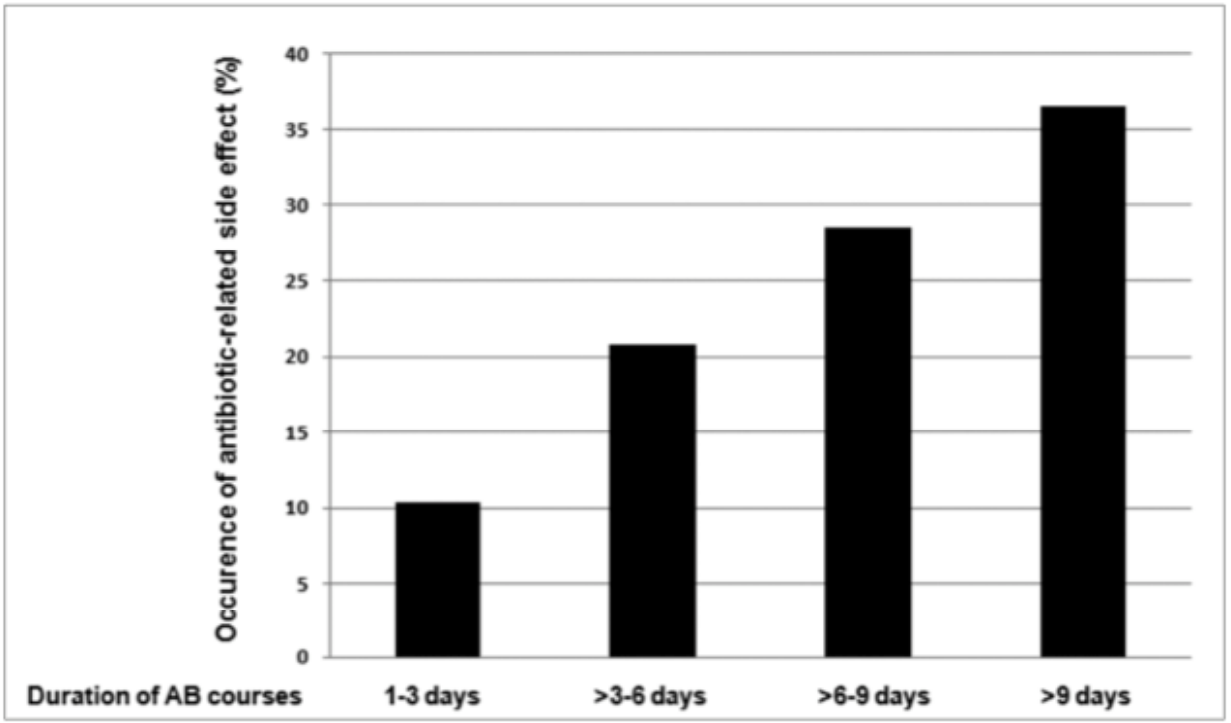



**Figure 3.** Antibiotic-related side effects in different treatment durations of LRTI. AB, Antibiotic.

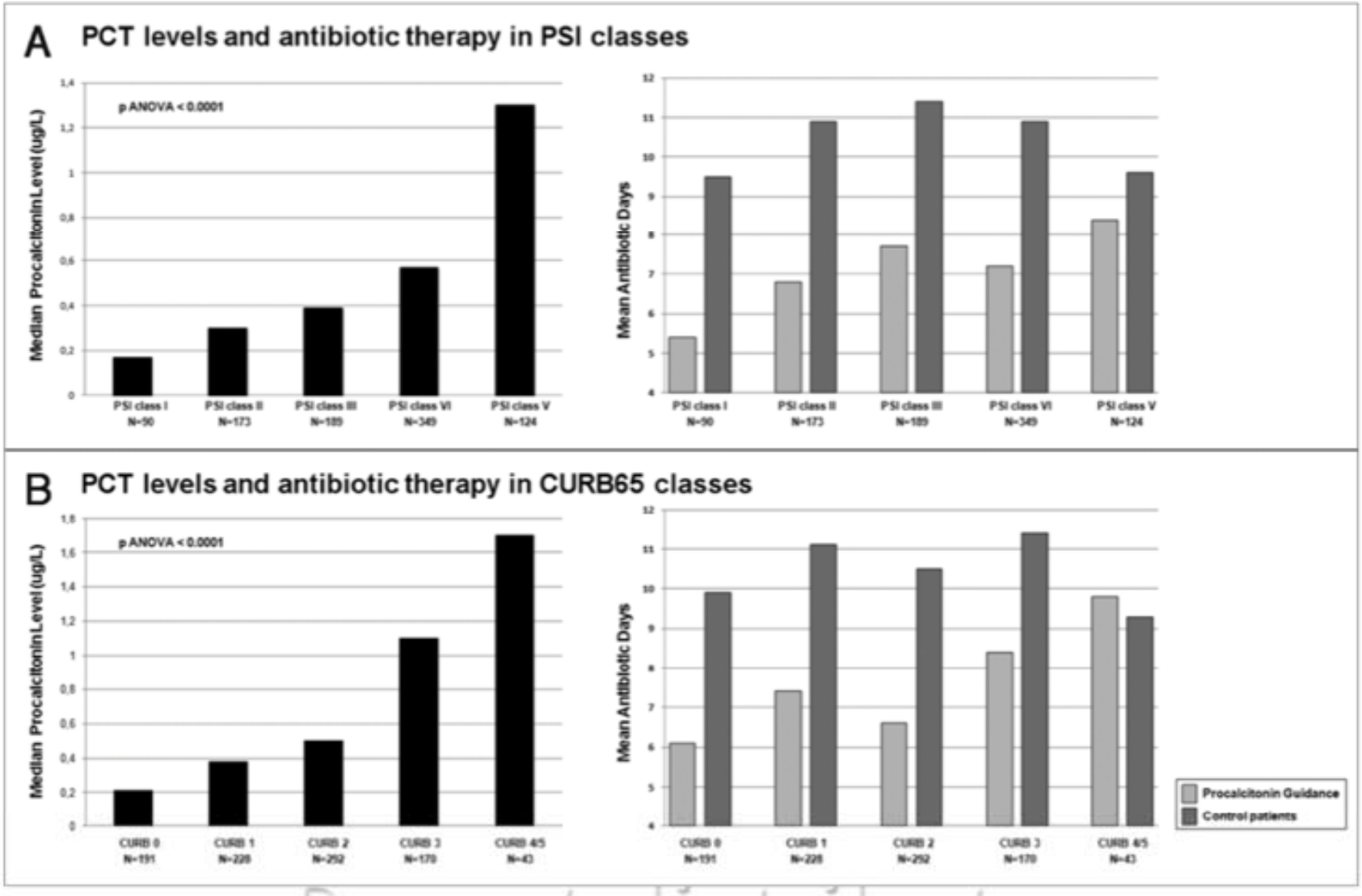



**Figure 2.** Procalcitonin concentrations and Antibiotic Therapy in different severities of CAP. PSI, Pneumonia severity index; CURB65, confusion, urea, respiratory rate, blood pressure, age >65 years.

ORIGINAL CONTRIBUTION

# Effect of Procalcitonin-Based Guidelines vs Standard Guidelines on Antibiotic Use in Lower Respiratory Tract Infections

## The ProHOSP Randomized Controlled Trial

JAMA. 2009;302(10):1059-1066

**Figure 1.** Flow Diagram of Patients in Trial

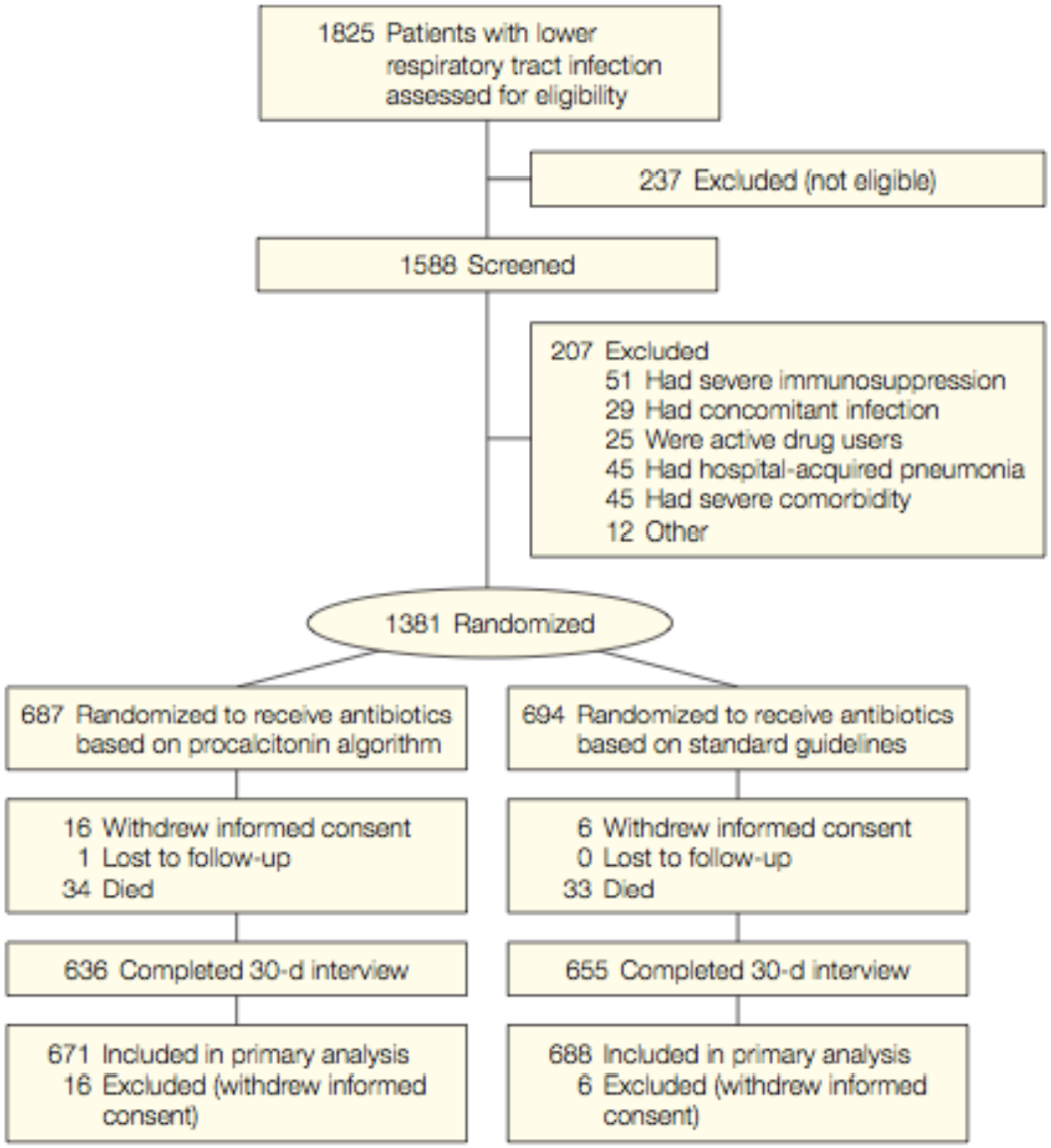


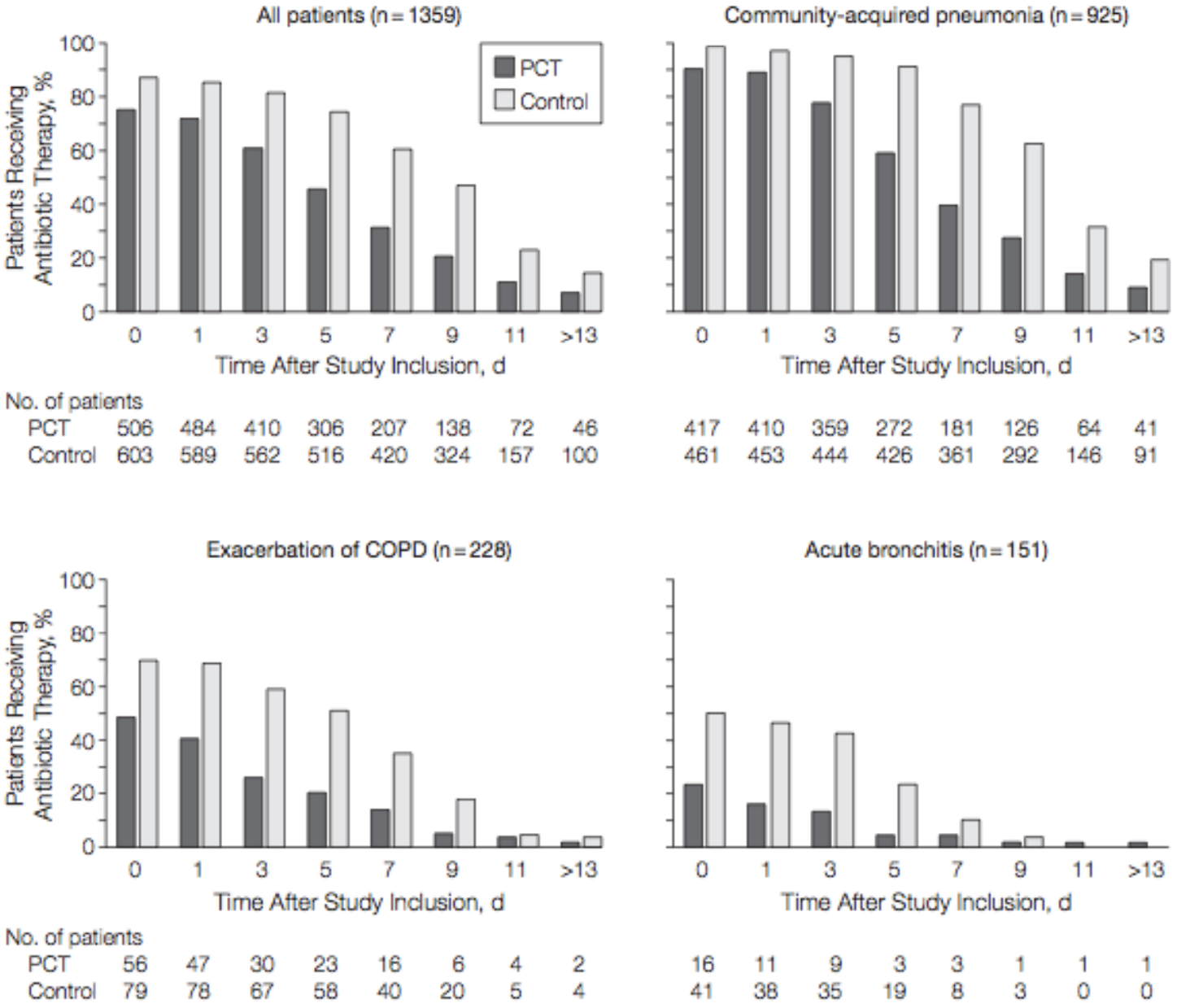
**Table 2.** Rates of Combined Adverse Outcomes and Mortality by Randomization Group

| | No. (%) of Patients | | |
|---|---|---|---|
| | PCT Group | Control Group | Risk Difference, % (95% CI) |
| All patients (intention-to-treat)[a] | (n = 671) | (n = 688) | |
| Overall adverse outcome | 103 (15.4) | 130 (18.9) | –3.5 (–7.6 to 0.4) |
| Death | 34 (5.1) | 33 (4.8) | 0.3 (–2.1 to 2.5) |
| ICU admission | 43 (6.4) | 60 (8.7) | –2.3 (–5.2 to 0.4) |
| Recurrence/rehospitalization | 25 (3.7) | 45 (6.5) | –2.8 (–5.1 to –0.4) |
| Disease-specific complication | 17 (2.5) | 14 (2.0) | 0.5 (–1.1 to 2.0) |
| Per-protocol population | (n = 633) | (n = 650) | |
| Overall adverse outcome | 95 (15.0) | 123 (18.9) | –3.9 (–8.2 to 0.03) |
| Death | 29 (4.6) | 31 (4.8) | –0.2 (–2.6 to 2.0) |
| Community-acquired pneumonia | (n = 460) | (n = 465) | |
| Overall adverse outcome | 74 (16.1) | 94 (20.2) | –4.1 (–9.1 to 0.9) |
| Death | 24 (5.2) | 26 (5.6) | –0.4 (–3.3 to 2.6) |
| Exacerbation of COPD[a] | (n = 115) | (n = 113) | |
| Overall adverse outcome | 15 (13.0) | 21 (18.6) | –5.3 (–14.8 to 4.4) |
| Death | 4 (3.5) | 5 (4.4) | –0.9 (–6.4 to 4.5) |
| Acute bronchitis | (n = 69) | (n = 82) | |
| Overall adverse outcome | 6 (8.7) | 8 (9.8) | –1.1 (–10.4 to 8.7) |
| Death | 1 (1.4) | 0 | 1.4 (–2.9 to 6.1) |
| Other diagnoses | (n = 27) | (n = 28) | |
| Overall adverse outcome | 8 (29.6) | 7 (25.0) | 4.6 (–18.7 to 27.5) |
| Death | 5 (18.5) | 2 (7.1) | 11.4 (–7.5 to 28.9) |

Abbreviations: CI, confidence interval; COPD, chronic obstructive pulmonary disease; ICU, intensive care unit; PCT, procalcitonin.

[a] Outcome was missing for 1 patient with exacerbation of COPD. For the calculation of the risk (n and %) in each group, this patient was treated as being without adverse outcome, but estimates for the risk difference are based on multiple imputation of the missing outcome.

**Figure 2.** Antibiotic Exposure in Patients Receiving Antibiotic Therapy




PCT indicates procalcitonin; COPD, chronic obstructive pulmonary disease.

# Conclusion

Inpatients with lower respiratory tract infections, PCT guidance compared with standard guidelines resulted in similar rates of adverse outcomes, as well as lower rates of antibiotic exposure and antibiotic-associated adverse effects

Infection Clinical and Epidemiological Study

# Effect of Procalcitonin-Guided Treatment in Patients with Infections: a Systematic Review and Meta-Analysis

H. Tang, T. Huang, J. Jing, H. Shen, W. Cui

Infection 2009; 37: 497–507 DOI 10.1007/s15010-009-9034-2

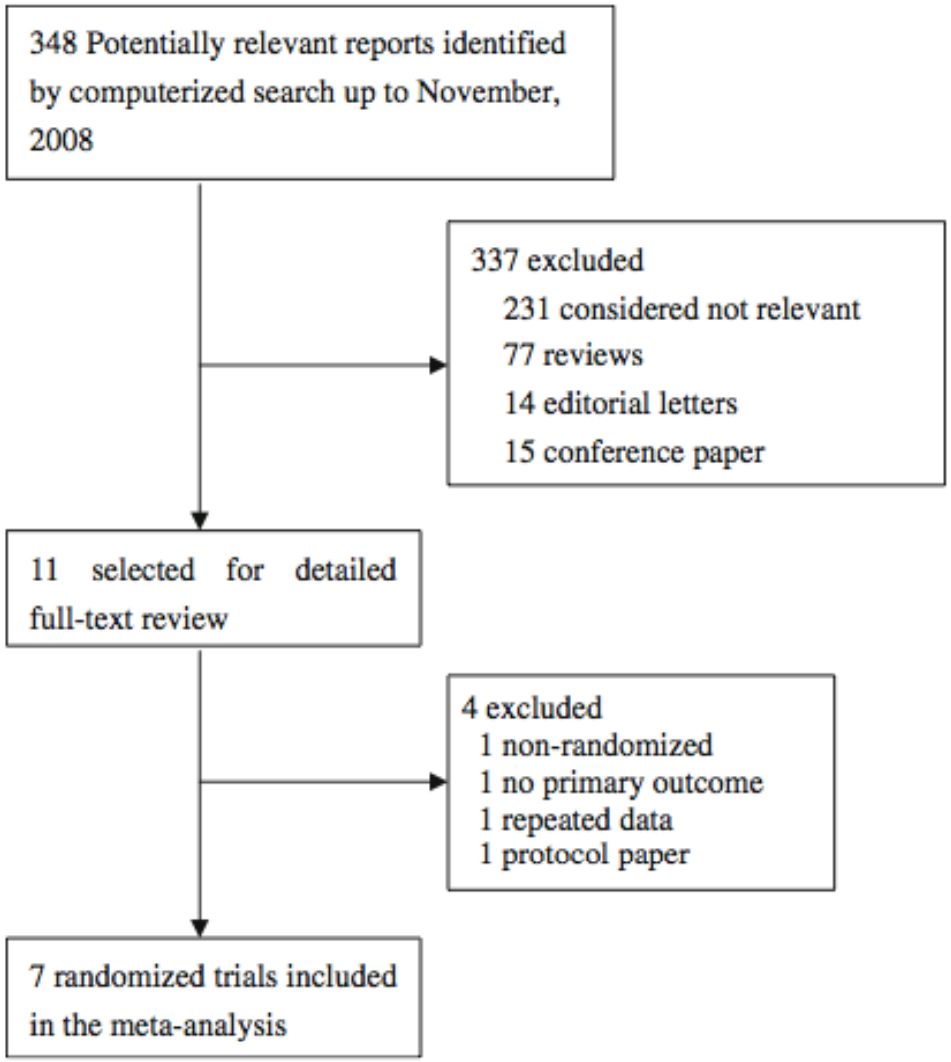
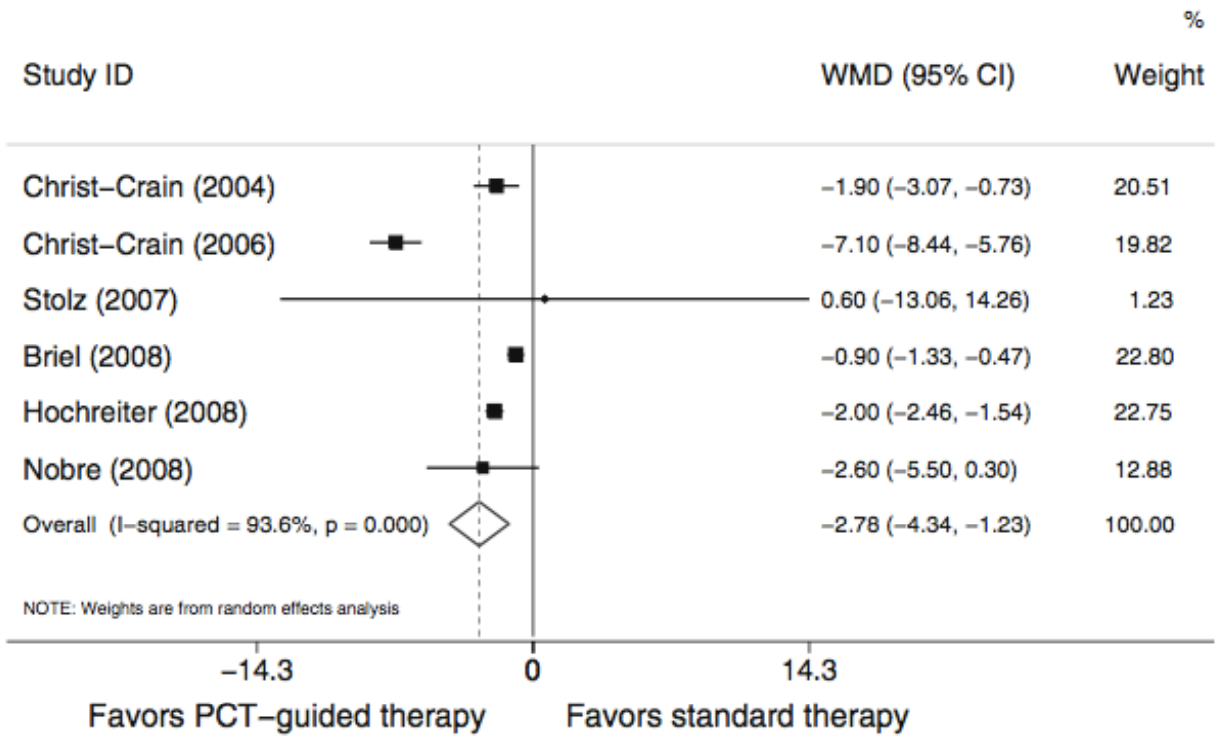



**Figure 1.** Study identification, inclusion, and exclusion for meta-analysis.

**Figure 3.** Forrest plot of pooled weighted mean difference for duration of antibiotic therapy from six randomized trials. WMD: Weighted mean difference. CI: confidence interval.




Duration of Antibiotic Therapy

**Figure 5.** Forrest plot of pooled relative risks (RR) for antibiotic exposure from four randomized trials.

Antibiotic Exposure

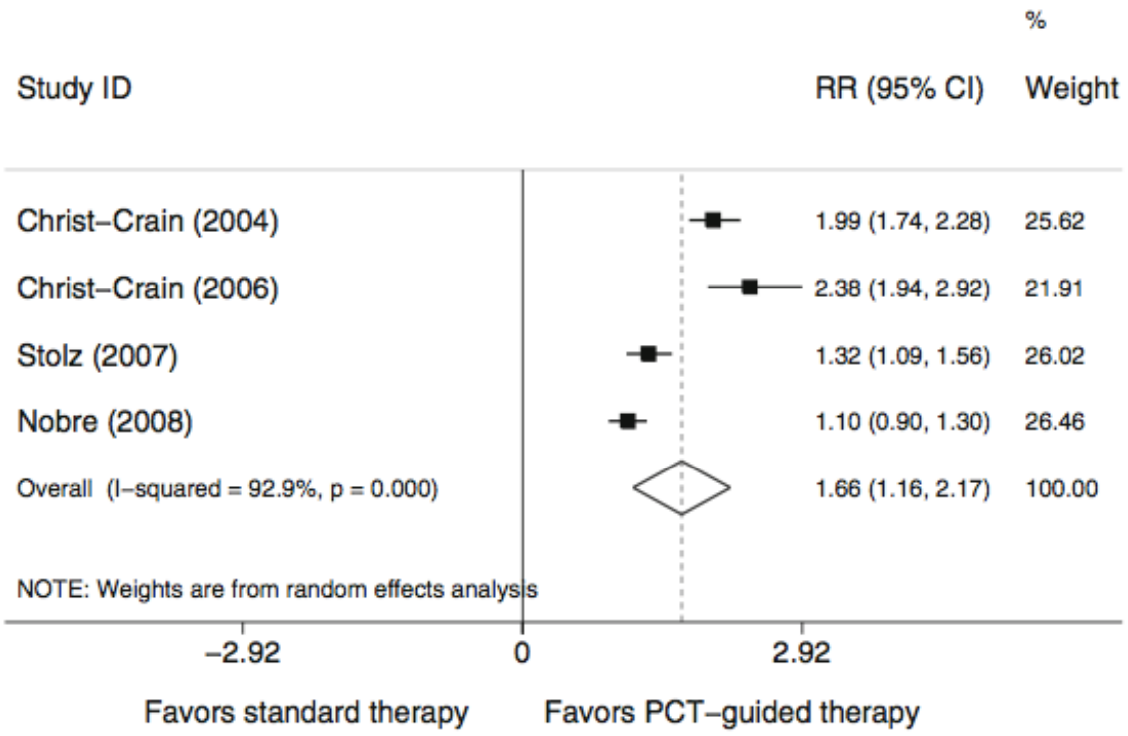


**Figure 6.** Forrest plot of pooled weighted mean difference for length of stay in intensive care unit from four randomized trials.

ICU Stay

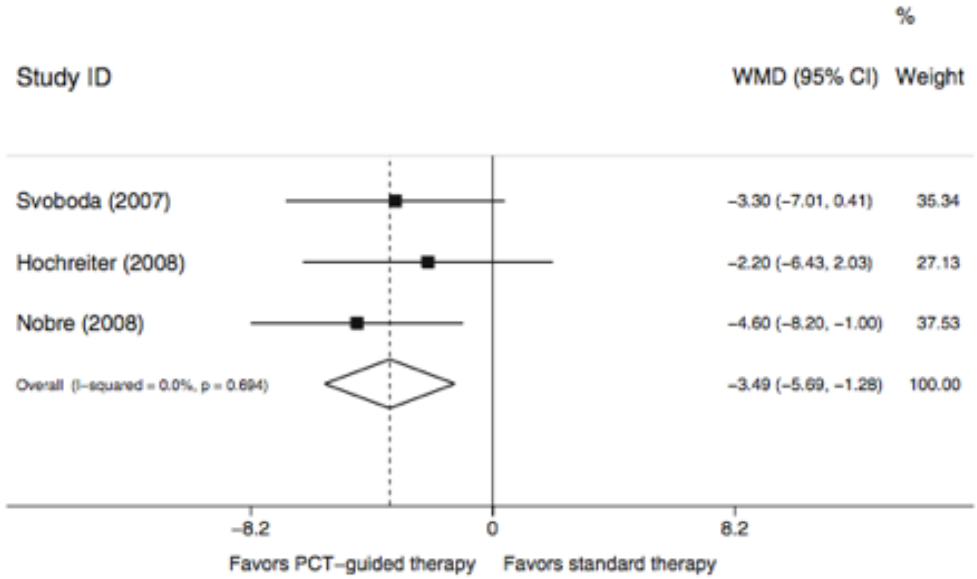
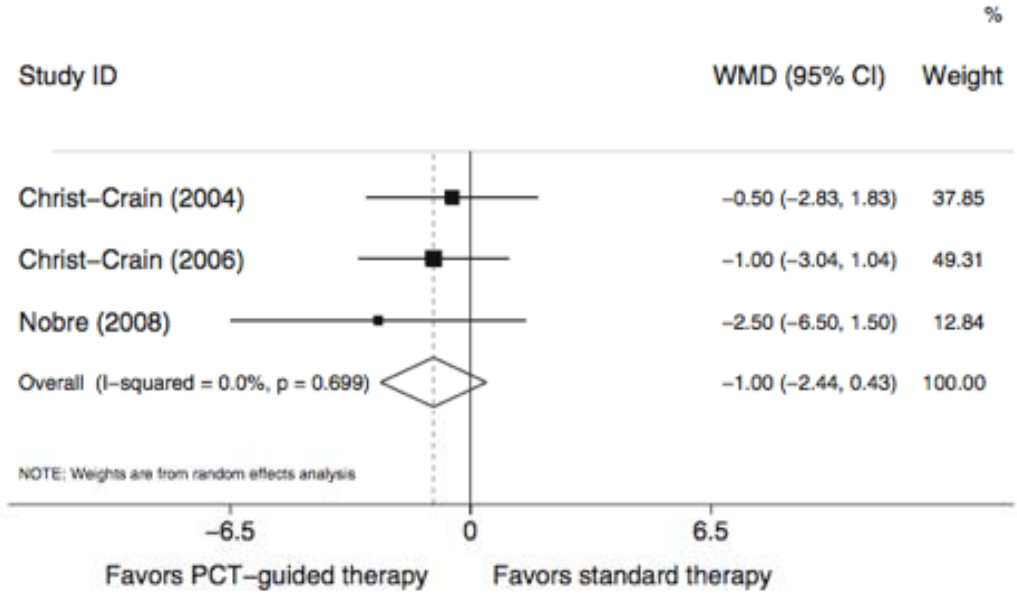



**Figure 7.** Forrest plot of pooled weighted mean difference for hospital length of stay from three randomized trials.

Hospital Stay



# PCT对抗感染治疗的指导意义

- 
- 抗感染疗效评判
- 

Research

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# Procalcitonin kinetics within the first days of sepsis: relationship with the appropriateness of antibiotic therapy and the outcome

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This article is online at: http://ccforum.com/content/13/2/R38

**Table 2**

**Procalcitonin changes at various time points in patients with bacterial sepsis according to antibiotic therapy**

| | First-line empirical antibiotic therapy | | *P* value |
|---|---|---|---|
| | Appropriate | Inappropriate | |
| PCT at D1 (n = 180; 129 S, 51 NS)[a] | 27.2 (62.7) | 29.6 (96.7) | 0.92 |
| PCT at D2 (n = 163; 117 S, 46 NS)[a] | 27.4 (45.1) | 40.9 (74.3) | 0.09 |
| ΔPCT D1–D2 | +1.7 (35.0) | +5.2 (47.4) | 0.20 |
| PCT at D3 (n = 164; 117 S, 47 NS)[a] | 24.4 (58.4) | 34.4 (55.7) | 0.12 |
| ΔPCT D2–D3 | -3.9 (35.9) | +5.0 (29.7) | <0.01 |
| PCT at D4 (n = 121; 80 S, 41 NS)[a] | 17.3 (45.8) | 32.4 (46.2) | 0.03 |
| ΔPCT D1–D4 | -9.1 (46.7) | -0.8 (102.5) | 0.01 |
| ΔPCT D3–D4 | -8.3 (21.5) | -8.4 (16.6) | 0.97 |

Changes in procalcitonin (PCT) values at various time points in patients with bacterial sepsis according to the appropriateness of the first-line empirical antibiotic therapy. S, survivors; NS, nonsurvivors. ΔPCT D1–D2, procalcitonin decrease between day 2 and day 1 after the onset of sepsis, and so forth. [a]Missing data are due to insufficient serum sample or death of patients within the 1-day, 2-day or 3-day-period following the onset of sepsis. D1, day sepsis is diagnosed.

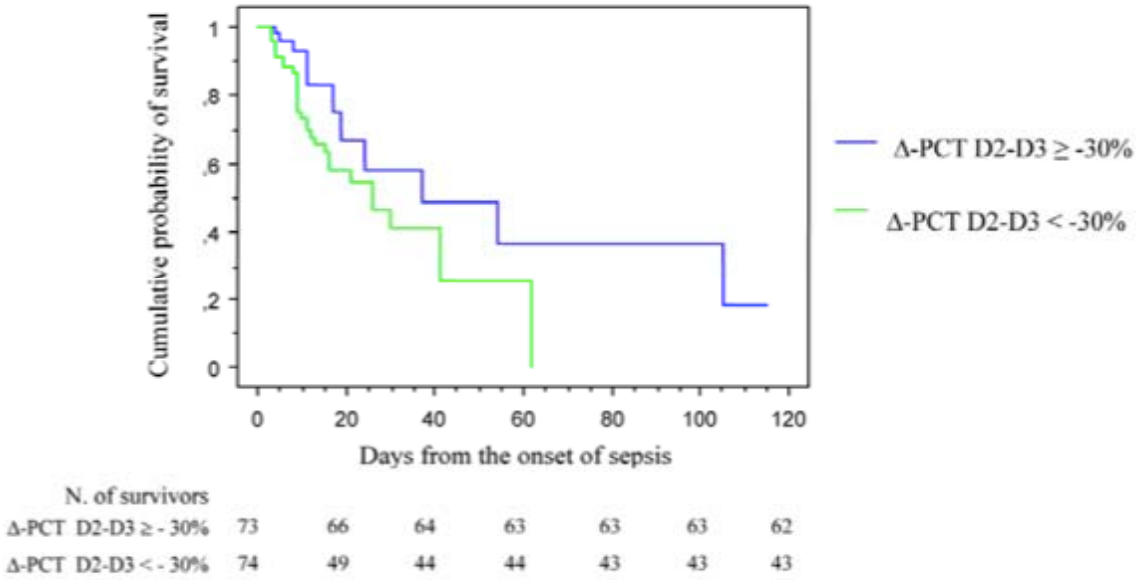
**Table 3**

**Factors predictive of the appropriateness of first-line empirical antibiotic therapy in patients with bacterial sepsis**

| | Odds ratio | Variable type | 95% confidence interval | *P* value |
|---|---|---|---|---|
| Gram staining (positive) | 2.61 | Dichotomous | 1.13 to 6.03 | 0.02 |
| ΔPCT D2–D3 | 10.29 | Continuous | 1.66 to 63.9 | 0.01 |

Multivariate analysis of factors predictive of the appropriateness of the first-line empirical antibiotic therapy in 147 patients with bacterial sepsis. PCT, procalcitonin; D1, day sepsis is diagnosed; ΔPCT D2–D3, procalcitonin decrease between day 3 and day 2 after the onset of sepsis.

**Figure 1**




Kaplan–Meier estimated survival after the onset of bacterial sepsis. Kaplan–Meier estimated survival in the intensive care unit after the onset of bacterial sepsis in 147 patients with bacterial sepsis according to the procalcitonin variation between day 3 and day 2 (log-rank test, $P = 0.04$). D1, day sepsis is diagnosed; ΔPCT D2-D3, procalcitonin decrease between day 3 and day 2 after the onset of sepsis.

**Table 5**

**Procalcitonin changes at various time points in patients with bacterial sepsis according to the outcome**

| | Survivors | Nonsurvivors | *P* value |
|---|---|---|---|
| PCT at D1 (n = 180; 129 S, 51 NS)[a] | 21.7 (52.0) | 43.0 (107.4) | 0.30 |
| PCT at D2 (n = 163; 117 S, 46 NS)[a] | 25.7 (41.5) | 43.9 (76.3) | 0.13 |
| ΔPCT D1–D2 | +1.8 (35.9) | +4.8 (44.6) | 0.44 |
| PCT at D3 (n = 164; 117 S, 47 NS)[a] | 21.3 (41.0) | 40.8 (85.7) | 0.04 |
| ΔPCT D2–D3 | -4.5 (24.0) | +5.4 (52.3) | <0.01 |
| PCT at D4 (n = 121; 80 S, 41 NS)[a] | 14.0 (29.1) | 34.9 (66.6) | <0.01 |
| ΔPCT D1–D4 | -3.2 (38.8) | -14.1 (97.8) | 0.05 |
| ΔPCT D3–D4 | -5.9 (14.8) | -13.1 (28.2) | 0.06 |

S, survivors; NS, nonsurvivors; PCT, procalcitonin; D1, day sepsis is diagnosed; ΔPCT D1–D2, procalcitonin decrease between day 2 and day 1 after the onset of sepsis, and so forth. [a]Missing data are due to insufficient serum samples or death of patients within the 1-day, 2-day or 3-day period following the onset of sepsis.

**Key messages**

- The PCT time course within the first days of management of sepsis could be a critical issue in the critically ill patients.
- A marked decreased of PCT between the second and third days might be expected in the patients with appropriate empirical antibiotic therapy and good outcome.

# PCT对抗感染治疗的指导意义

- 
- 
- 抗感染治疗的疗程

Research

Open Access

# Procalcitonin to guide duration of antibiotic therapy in intensive care patients: a randomized prospective controlled trial

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This article is online at: http://ccforum.com/content/13/3/R83

**Table 2**

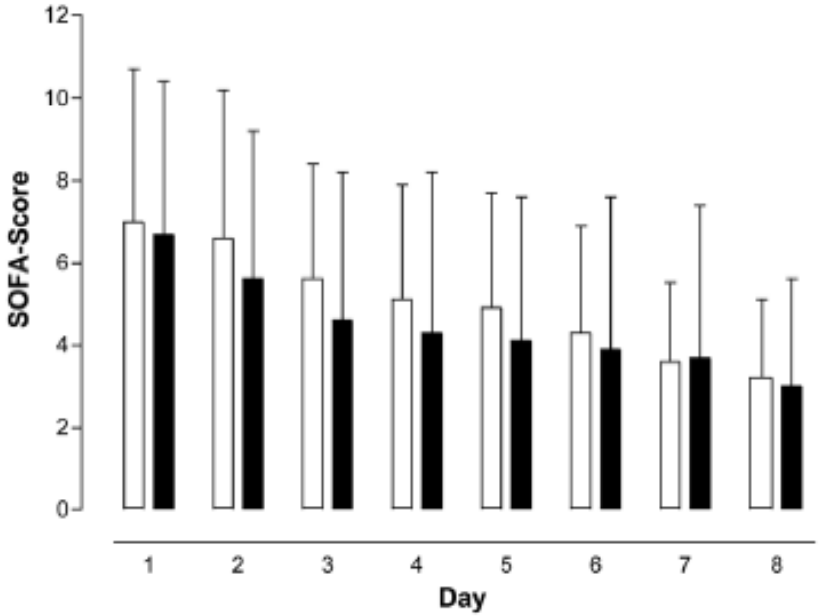
**Frequency of used antibiotics and length of therapy**

| | Controls | PCT-guided antibiotic therapy | *P* |
|---|---|---|---|
| **Antibiotic classes (%)** | | | >0.05 |
| Acylaminopenicillin + BLI | 51.8 | 55.2 | |
| Acylaminopenicillin + nitroimidazole | 19.6 | 15.5 | |
| Carbapenem | 8.8 | 10.4 | |
| Aminobenzylpenicillin + BLI | 5.4 | 6.9 | |
| Fluorochinolone | 5.4 | 5.2 | |
| Cephalosporins of Group 3b | 5.4 | 3.4 | |
| Others | 3.6 | 3.4 | |
| **Length of antibiotic therapy (days)** | 7.9 ± 0.5 | 5.9 ± 1.7 | <0.001 |

BLI = β-lactamase inhibitor; PCT = procalcitonin. Mean ± standard deviation.

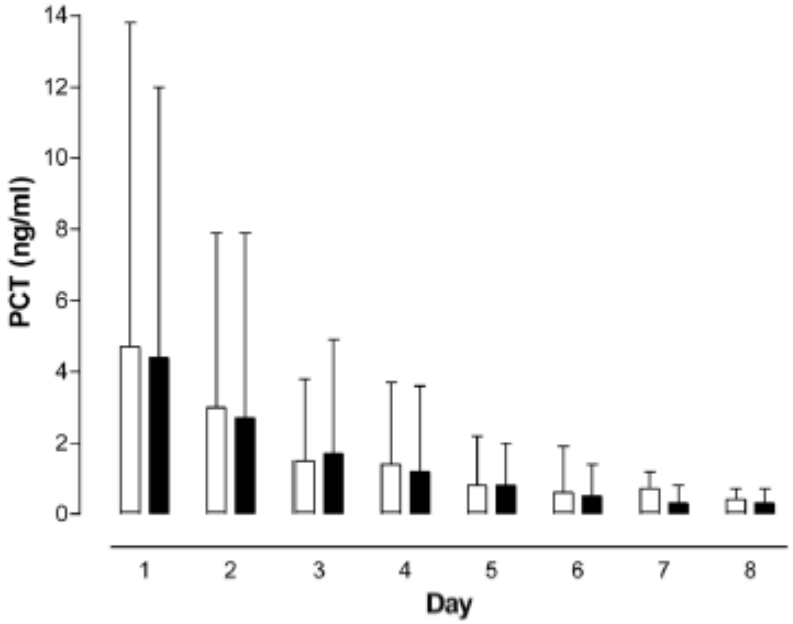
Critical Care 2009, 13:R83 (doi:10.1186/cc7903)

**Figure 1**



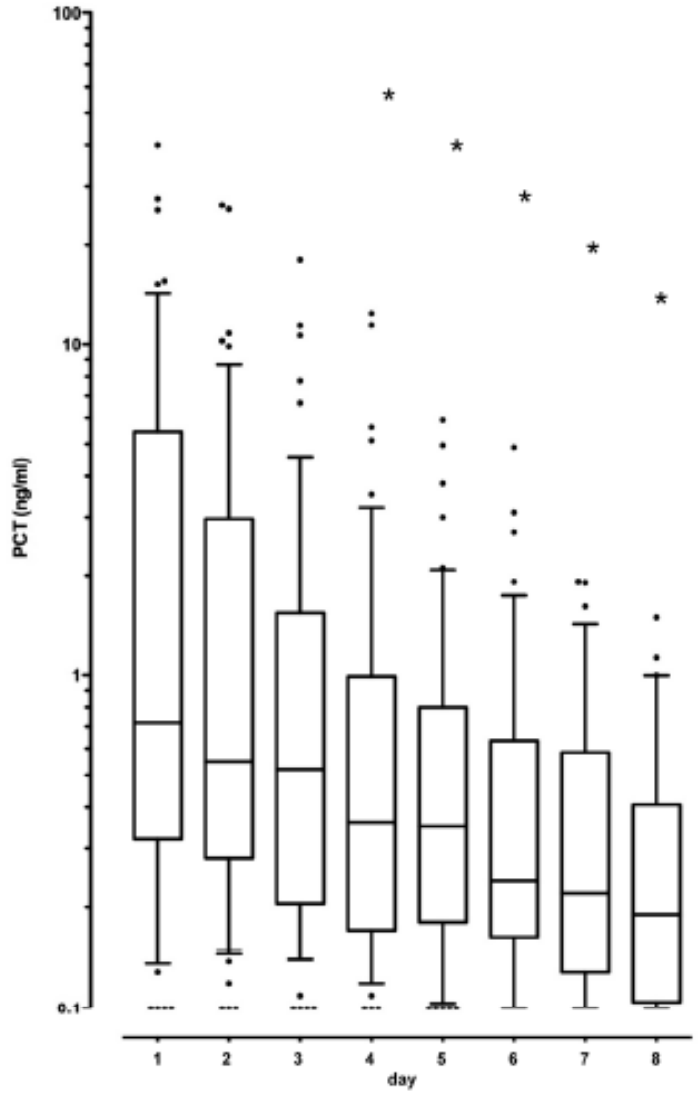

Sequential Organ Failure Assessment scores. No difference in score was seen between patients with procalcitonin-guided antibiotic treatment (filled columns) and the control group (empty columns). Mean ± standard deviation. SOFA = Sequential Organ Failure Assessment.

**Figure 5**




Procalcitonin concentrations. No difference in concentration was seen between patients with procalcitonin (PCT)-guided antibiotic treatment (filled columns) and the control group (empty columns). Mean ± standard deviation.

Critical Care 2009, 13:R83 (doi:10.1186/cc7903)




Procalcitonin levels solely shown for the intervention arm. In the group with procalcitonin (PCT)-guided antibiotic therapy duration, the PCT values starting on the fourth day are significantly lower in comparison to the initial value (box-plots with lower quartile, median and upper quartile, 0.1- and 0.9-quantile for the whisker length and outliers as item representation). • — Outliers, *$P < 0.05$.

Critical Care 2009, 13:R83 (doi:10.1186/cc7903)

# Use of Procalcitonin to Shorten Antibiotic Treatment Duration in Septic Patients

## A Randomized Trial

Vandack Nobre[1], Stephan Harbarth[2], Jean-Daniel Graf[3], Peter Rohner[4], and Jérôme Pugin[1]

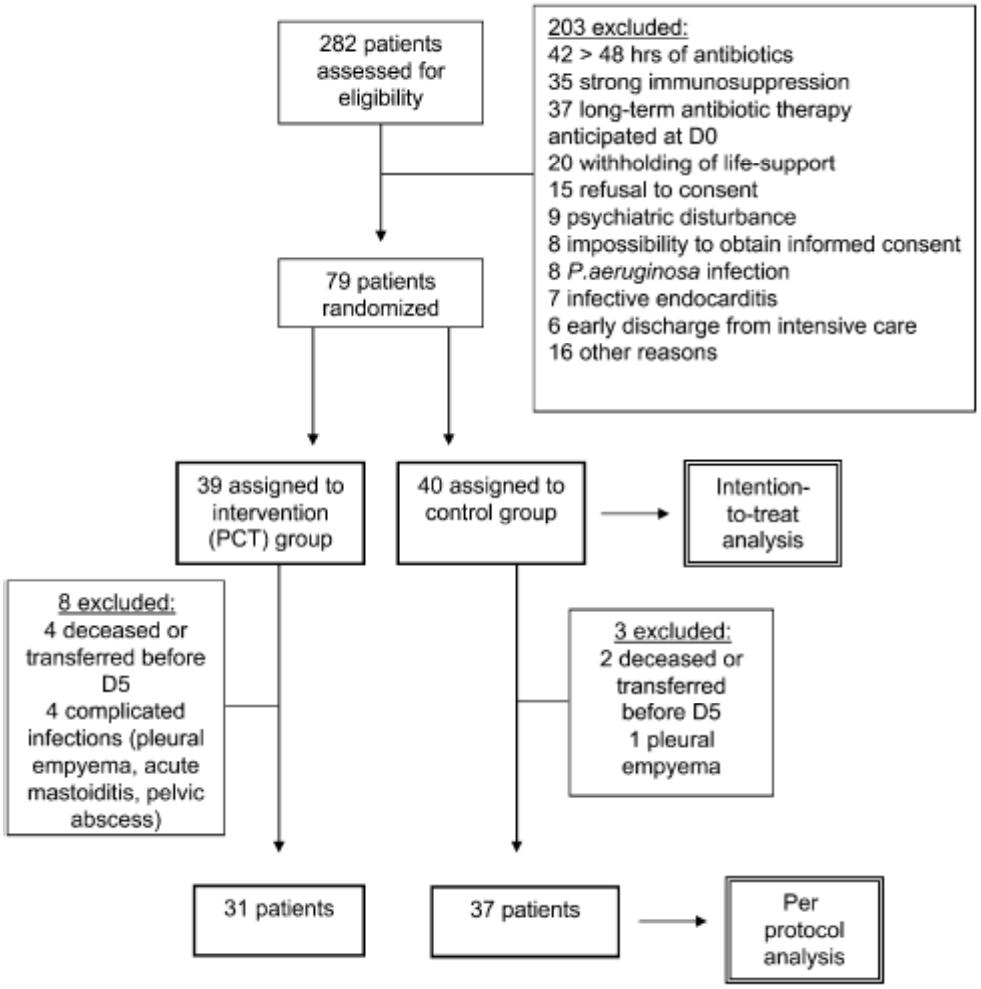



*Figure 1.* Trial profile. D0 = Day 0; D5 = Day 5; PCT = procalcitonin.

Am J Respir Crit Care Med , 2008;177:498

## TABLE 3. OUTCOMES USING PER-PROTOCOL ANALYSIS

| Per-Protocol Analysis | Control Group (*n* = 37) | PCT Group (*n* = 31) | RR (95% CI) | *P* Value |
|---|---|---|---|---|
| Primary outcomes | | | | |
| Duration of antibiotic therapy, first episode of infection, median d (range) | 10 (3–33) | 6 (4–16) | Mean difference: 3.2 (1.1 to 5.4) | 0.003 |
| Total antibiotic exposure days/1,000 d | 655 | 504 | 1.3 (1.1 to 1.5)* | 0.0002 |
| Days alive without antibiotics, mean ± SD | 13.6 ± 7.6 | 17.4 ± 7.6 | Mean difference: 3.8 (0.1 to 7.5) | 0.04 |
| Secondary outcomes | | | | |
| Clinical cure, n (%) | 31 (83.8) | 28 (90.3) | 0.8 (0.5 to 1.3) | 0.48 |
| 28-d mortality, n (%) | 6 (16.2) | 5 (16.1) | 1.0 (0.5 to 1.8) | 0.74 |
| In-hospital mortality, n (%) | 7 (18.9) | 6 (19.4) | 0.9 (0.6 to 1.7) | 0.79 |
| Sepsis-related death, n (%) | 1/6 (16.6) | 3/5 (60) | 0.3 (0.1 to 2.0) | 0.44 |
| Primary infection relapse rate, n (%) | 1 (2.7) | 1 (3.2) | 0.9 (0.9 to 3.7) | 0.70 |
| ICU length of stay, median d (range) | 5 (1–30) | 3 (1–18) | Mean difference: 4.3 (0.4 to 8.3) | 0.03 |
| Hospital length of stay, median d (range) | 21 (5–89) | 14 (5–64) | Mean difference: 2.2 (−1.9 to 6.3) | 0.16 |

For definition of abbreviations, see Table 2.

* In these cases, the result expresses the index of relative risk.

Am J Respir Crit Care Med , 2008;177:498

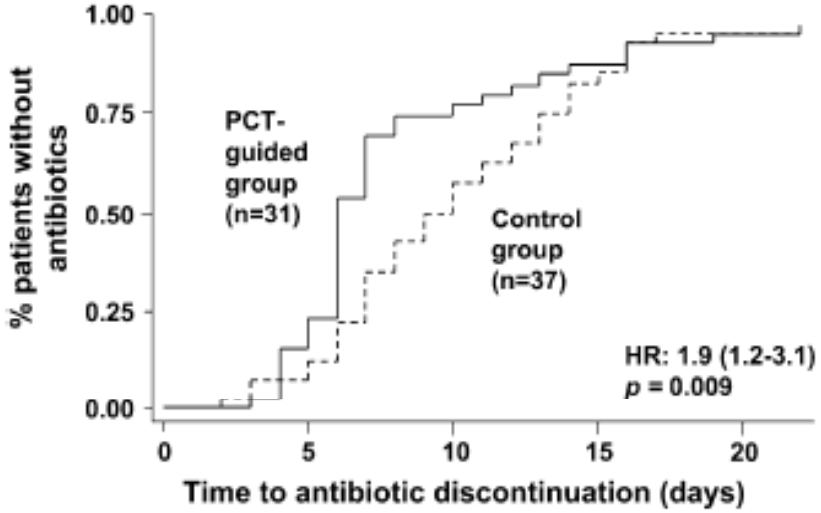



*Figure 3.* Kaplan-Meier plots showing the evolution with time of the percentage of patients who remained on antibiotics in the procalcitonin (PCT) and control group. HR = hazard ratio.

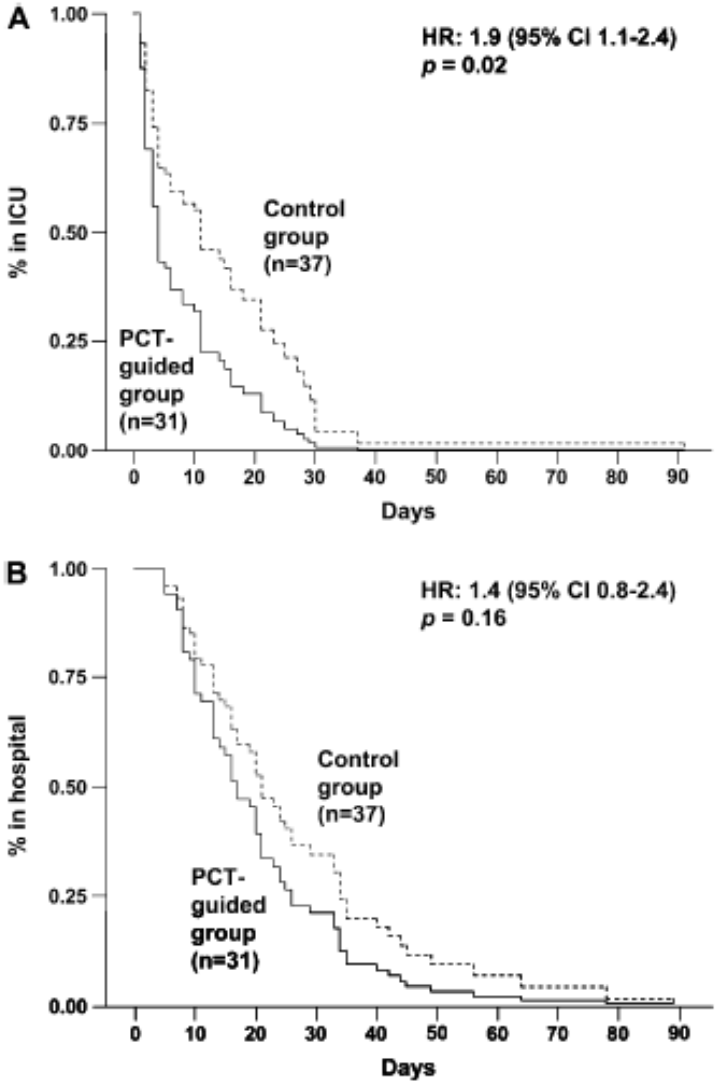



*Figure 4.* Kaplan-Meier plots showing the evolution with time of the percentage of patients remaining in the intensive care unit (ICU) (*A*) and in the hospital (*B*), in the procalcitonin (PCT) and the control group. HR = hazard ratio.

Am J Respir Crit Care Med , 2008;177:498

# 总　　结

- 影响血浆PCT水平因素较少，对细菌感染判断有较大指导意义
- PCT可帮助临床医生判断病原微生物、抗感染治疗节点、抗生素疗效和疗程等

# Thank You For Your Attention!