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RESEARCH ARTICLE

THE VALUE OF PROCALCITONIN IN THE ELDERLY: SIX-MONTH PROSPECTIVE STUDY

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ABSTRACT

Introduction: Bacterial infectious diseases in the elderly range of patients have a diagnostic problem that contribute to inadequate prescription of antibiotics (over-prescription or under-prescription) which can increase the mortality rate in this population. The C-reactive protein (CRP) and procalcitonin (PCT) have been developed to differentiate bacterial infections from other causes of inflammation and remain the most used parameters in this population. The aim of our work is to determine in this age range the added value of PCT and CRP for the diagnosis of infection requiring antibiotic therapy. **Patients and methods:** All patients admitted consecutively to the emergency department in the Avicenne Military Hospital in Marrakech and aged over 75 years over a period of 6 months were included (patients receiving antibiotics for more than 24 hours were excluded). On admission, demographic characteristics, comorbidities, and general signs (respiratory rate, temperature, pulse rate, confusion, falls, chills) were recorded and a biological assessment was carried out containing (PCT, CRP, leukocytes, albumin, urea and creatinine) and recorded for each patient. The PCT (measured using an immunoluminometric method) and CRP were found to be positive when they were ≥ 0.5 ng / mL and ≥3 mg / L respectively. Patients with SIRS (inflammatory systemic response syndrome) have been reported. Septic status, severe sepsis and septic shock present on admission have also been reported. The patients were classified as infected or not infected. **Results:** 153 patients were included in the study, of which 98 were women and 55 were men. The average age was 83.1 years (± 4.2). On interrogation 29% had end-stage chronic renal failure, 30% had diabetes, 49% had hypertension 31% had dementia, 20% were followed for tumor pathology, and 10% were followed for chronic obstructive pulmonary disease (COPD). The average of the results of the assessment was as follows: CRP = 32.9 ± 61.1 mg / L, albumin = 30.9 ± 5.2g / L, the calculated creatinine clearance was 41.1 ± 21 , 1 ml / min. PCT was positive in 15% of cases and CRP in 69.0% of patients. SIRS was present in 50 patients (32%), sepsis in 22 cases (14.4%) and severe sepsis in 14 cases (9%); but no septic shock was found on admission. Fifty nine per cent of patients were hospitalized, 61% of whom were in intensive care. The most frequently used diagnoses are: pneumonia (19.3%), heart failure (9.0%), falls with head trauma (5.5%), fractures (16.6%) and infection of the upper urinary tract (5.5%). A total of 53 cases of infections were diagnosed and distributed as follows: 24 pneumonias (45%), 9 cases of upper urinary tract infections (17%), 5 cases of miliary tuberculosis (10%), 7 cases of cellulitis (13%), 2 cases of endocarditis (4%) and 6 cases of deep abscess (11%). PCT had good specificity (96%) but low sensitivity (26%), with a negative predictive value and positive non-discriminatory predictive value (83% and 57%, respectively). Univariate use of logistic regression has shown that the presence of sepsis on admission was the best predictor of infection. However, PCT (> 0.5 ng / ml), the presence of SIRS, of temperature above 38 ° C or below 36 ° C and CRP (3 mg / L) have also been associated with the infection, but in the multivariate analysis, only sepsis and CRP positive were always associated with the infection **Conclusion:** The PCT can be useful for identifying seriously ill elderly patients but not for distinguishing between infected and non-infected patients.

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INTRODUCTION

Bacterial infectious diseases in the elderly range of patientshave a diagnostic problem due to the atypical clinical pictures, poorly informative history, poor or confusing clinical examination, additional examinations that are difficult to interpret.

The difference between a real infection or simple colonization. These factors contribute to inadequate prescription of antibiotics (over-prescription or under-prescription) which can increase the mortality rate in this population. Biological biomarkers of inflammation such as C-reactive protein (CRP) and procalcitonin (PCT) have been developed to differentiate bacterial infections from other causes of inflammation and

remain the most used parameters in this population. The CRP is a very sensitive but non-specific biomarker of infection, is considered insufficient alone to differentiate a bacterial infection from an inflammatory state, hence the need for coupling with PCT especially in this population. The aim of our work is to determine in this age range the added value of PCT and CRP for the diagnosis of infection requiring antibiotic therapy.

PATIENTS AND METHODS

All patients admitted consecutively to the emergency department in the Avicenne Military Hospital in Marrakech and aged over 75 years over a period of 6 months were includedfrom February 2018 to August 2018 (patients receiving antibiotics for more than 24 hours were excluded). On admission, demographic characteristics, comorbidities, and general signs (respiratory rate, temperature, pulse rate, confusion, falls, chills) were recorded and a biological assessment was carried out containing (PCT, CRP, leukocytes, albumin, urea and creatinine) and recorded for each patient. PCT (measured using an immunoluminometric method) and CRP were found to be positive when they were ≥0.5 ng / mL and ≥3 mg / L respectively. Patients with SIRS (inflammatory systemic response syndrome) have been reported and retained before:

- Number of white blood cells less than 4,000 elements / mm3 or more than 12,000 elements / mm3
- Temperature below 36 ° C or above 38 ° C,
- Respiratory rate greater than 20 cycles / min and pulse 90 beats / min

Septic status, severe sepsis and septic shock present on admission have also been reported. The patients were classified as infected or not infected.

RESULTS

153 patients were included in the study, of which 98 were women and 55 were men. The average age was 83.1 years (± 4.2). On interrogation 29% had end-stage chronic renal failure, 30% had diabetes, 49% had hypertension 31% had dementia, 20% were followed for tumor pathology, and 10% were followed for chronic obstructive pulmonary disease (COPD). The average of the results of the assessment was as follows: CRP = 32.9 ± 61.1 mg / L, albumin = 30.9 ± 5.2g / L, the calculated creatinine clearance was 41.1 ± 21 , 1 ml / min. PCT was positive in 15% of cases and CRP in 69.0% of patients. SIRS was present in 50 patients (32%), sepsis in 22 cases (14.4%) and severe sepsis in 14 cases (9%); but no septic shock was found on admission. Fifty nine per cent of patients were hospitalized, 61% of whom were in intensive care. The most frequently used diagnoses are: pneumonia (19.3%), heart failure (9.0%), falls with head trauma (5.5%), fractures (16.6%) and infection of the upper urinary tract (5.5%). A total of 53 cases of infections were diagnosed and distributed as follows: 24 pneumonias (45%), 9 cases of upper urinary tract infections (17%), 5 cases of miliary tuberculosis (10%), 7 cases of cellulitis (13%), 2 cases of endocarditis (4%) and 6 cases of deep abscess (11%). There was no significant association between PCT value and age, gender, creatinine clearance, fracture, neoplastic terrain, acute heart failure, and myocardial infarction. Sensitivity, specificity, negative predictive value, and positive predictive value for procalcitonin, sepsis, CRP, and SIRS are presented in Table 1. PCT had good specificity (96%) but low sensitivity (26%), with a negative predictive value and positive non-discriminatory predictive value (83% and 57%, respectively). Univariate use of logistic regression has shown that the presence of sepsis on admission was the best predictor of infection. However, PCT (> 0.5 ng / ml), the presence of SIRS, of temperature above 38 ° C or below 36 ° C and CRP (3 mg / L) have also been associated with the infection, but in the multivariate analysis, only sepsis and CRP positive were always associated with the infection (Table 2). In patients with active infection, 30 cases had negative PCT (<0.5 ng / mL), but the other parameters were less disturbed, suggesting a lower severity of infection in these patients. Finally, in the infected group, no patient with a negative CRP had a positive PCT, while six infected patients had a PCT and a CRP which returned negative (2 cases had an infection of the urinary tract, one case of pneumonia and 3 cases abscess).

DISCUSSION

PCT is a protein in the acute phase of inflammation that has been widely studied in the pediatric and adult populations (Torbicki *et al*., 2008; Mueller *et al*., 2004). The majority of studies carried out in the emergency room have shown that PCT is more sensitive and specific than the CRP for the diagnosis of bacterial infections requiring antibiotic therapy (Riedel, 2011). This is particularly true for bacterial meningitis, infection of ascites fluid, lower respiratory infection (acute community-acquired pneumonia) (Christ-Crain, 2004; Viallon, 1999; Muller, 2010), with a sensitivity of 88% and a specificity of 81% (Simon, 2004). However, PCT has low sensitivity in patients with acute heart failure, active neoplasia, myocardial infarction, recent surgery (Kallio, 2000; Remskar, 2002) pyelonephritis, appendicitis and potentially all localized infections (erysipelas). These diseases are particularly frequent in geriatrics and can therefore decrease the specificity of PCT to detect an infection (Claessens, 2010; Stucker, 2005). This study has failed to demonstrate good efficacy of PCT in detecting infection in the elderly admitted to the emergency room. With a threshold of 0.5 ng / ml, PCT is associated with the presence of the infection but not independently of other variables (such as CRP and SIRS). There was not a lack of specificity (94%), but rather a lack of sensitivity (24%), compared to previous studies (Simon, 2004; Hausfater, 2002 ; Chan, 2004; Chirouze, 2002). In studies of mixed populations or with infections or a less serious disease, PCT had a lower sensitivity. 9,16,18 Consequently, the characteristics of the populations studied are different; inclusion criteria vary from fever to presence of SIRS, severe sepsis or septic shock to bacteremia, and most studies have been conducted with a small number of patients (Simon, 2004; Hausfater, 2002; Chan, 2004; Chirouze, 2002; Reinhart, 2000). Studies carried out on a small group of patients in emergency departments; (Hausfater, 2002 ; Chan, 2004; Caterino, 2004; Guven, 2002) showed a higher sensitivity for PCT (sensitivity 78%) as well as leukocytosis and CRP predicted the infection (Guven, 2002) although the infected group probably had serious diseases because more than 65% had bacteremia, with a hospital mortality rate of around 30%. At the other end of the spectrum, two other studies found lower PCT sensitivity (70% and 35% with Thresholds of 0.6 ng / ml and 0.5 ng / ml, respectively).

Variables	Sensitivity	Specificity	PPV	NPV
		%		
PCT	26	96	57	83
SIRS	51	84	48	81
CRP > 3mg/ml	89	34	31	90
WBC	35	89	48	81
Temperature	21	99	69	79
Pulse	38	90	47	82
Respiratory rate	31	78	36	81
Sepsis*	42	99	96	85

WC = white Blood cells<4000 elements/mm3 ou >12000 elements/mm3, temperature < 36°C ou >38°C, Respiratory rate >20 cycles/ min et Pulse>90 battements / min. *SIRS associated with a documented or suspected infection.

Variable	Odds Ratio	P- value	Adjusted Odds Ratio	P- value
Sepsis	118.0 (17.1–928.0)	<.001	73.1 (7.6–768.1)	<.001
SIRS	7.0 (2.2–11.3)	<.001	0.6 (0.19–2.6)	.67
CRP≥ 3mg/ml	7.4 (2.8–17.1)	.001	3.7 (1.3–13.6)	.05
Procalcitonin≥ 5 ng/ml	5.2 (2.9–13.1)	.001	1.86 (0.4–7.1)	.42
Fever	10.9 (3.4–36.2)	<.001	-	-
WBC	3.8 (1.9–8.1)	.001	-	-
Pulse	3.2 (1.9–8.1)	<.001	-	-
Respiratory rate	1.9 (0.8–4.1)	.015	-	-
Measuring functional independence	0.97 (0.95–0.99)	.003	-	-

(Hausfater, 2002; Chan, 2004). Due to the low sensitivity of PCT, one study explored the relationship between the level of procalcitonin and hyper leukocytosis (Hausfater, 2002) This suggests a higher severity of infection in the group with a positive procalcitonin (Guven, 2002). The data from our study support this hypothesis, as procalcitonin was higher in patients with hyperleukocytosis, elevated CRP and renal failure. Therefore, all of these arguments suggest that PCT is a marker for the severity of infection rather than a marker for infection in an elderly population. Another explanation may be related to the results of PCT, it could have been measured too early or too late in this study but this seems unlikely because more than 90% of the patients in the study had symptoms that progressed for more than 48 hours. before admission to the emergency room. However, iterative measurements of procalcitonin are more predictive than a single measurement (Meisner, 2002). Senile senescence can also be an explanation for the lack of sensitivity of PCT, this hypothesis is difficult to test. Senescence is linked to multiple functional modifications of the immune system, since the level of pro-inflammatory cytokine production is reduced in the elderly when exposed to an acute state of stress (Krabbe, 2004). These cytokines have also been shown to stimulate the secretion of PCT, which may explain the poor secretion of PCT in this population (Meisner, 2002; Krabbe, 2004; Carrol, 2002).

Conclusion

The diagnosis of a septic condition in the elderly range of patients must use a range of clinical, radiological and biological arguments. The dosage of PCT in the emergency room in this population does not allow the detection of infection due to lack of sensitivity, but neither age nor comorbidity decreases the specificity of PCT. These results suggest the use of PCT in seriously ill elderly patients (Aalto, 2004).

REFERENCES

Aalto H., Takala A., Kautiainen H. *et al*., 2004. Laboratory markers of systemic inflammation as predictors of bloodstream infection in acutely ill patients admitted to hospital in medical emergency. *Eur J Clin Microbiol Infect Dis.,* 16:114–119.

Carrol ED., Thomson AP., Hart CA. 2002. Procalcitonin as a marker of sepsis. *Int J Antimicrob Agents*., 20:1–9.

Caterino JM., Scheatzle MD., Forbes ML. *et al*., 2004. Bacteremic elder emergency department patients: Procalcitonin and white count. *Acad Emerg Med.,* 11:393–396.

Chan YL., Tseng CP., Tsay PK. *et al*., 2004. Procalcitonin as a marker of bacterial infection in the emergency department: An observational study. *Crit Care.,* 8:R12–R20.

Chirouze C., Schuhmacher H., Rabaud C. *et al*., 2002. Low serum procalcitonin level accurately predicts the absence of bacteremia in adult patients with acute fever. *Clin Infect Dis.,*35:156–161.

Christ-Crain M., Jaccard-Stolz D., Bingisser R., Gencay MM., Huber PR., Tamm M. *et al*., 2004. Effect of procalcitonin-guided treatment on antibiotic use and outcome in lower respiratory tract infections: cluster-randomised, single-blinded intervention trial. Lancet, 363:600—7.

Claessens YE., Mathevon T., Kierzek G., Grabar S., Jegou D., Batard E. *et al*., 2010. Accuracy of C-reactive protein, procalcitonin, and mid-regional pro-atrial natriuretic peptide to guide site of care of community-acquired pneumonia. *Intensive Care Med*., 36:799—809.

Guven H., Altintop L., Baydin A. *et al*., 2002. Diagnostic value of procalcitonin levels as an early indicator of sepsis. *Am J Emerg Med.,* 20:202–206.

Hausfater P., Garric S., Ayed SB. *et al*., 2002. Usefulness of procalcitonin as a marker of systemic infection in emergency department patients: A prospective study. *Clin Infect Dis.,* 34:895–901.

Kallio R., Surcel HM., Bloigu A. *et al*., 2000. C-reactive protein, procalcitonin and interleukin-8 in the primary diagnosis of infections in cancer patients. *Eur J Cancer.,* 36:889–894.

Krabbe KS., Pedersen M., Bruunsgaard H. 2004. Inflammatory mediators in the elderly. *Exp Gerontol.,* 39:687–699.

Meisner M. 2002. Pathobiochemistry and clinical use of procalcitonin. *Clin Chim Acta.,* 323:17–29.

Mueller C., Scholer A., Laule-Kilian K., Martina B., Schindler C., Buser P. *et al*., 2004. Use of B-type natriuretic peptide in the evaluation and management of acute dyspnea. *N Engl J Med.,* 350:647—54.

Muller F., Christ-Crain M., Bregenzer T., Krause M., Zimmerli W., Mueller B. *et al*., 2010. Procalcitonin levels predict bacteremia in patients with community-acquired pneumonia: a prospective cohort trial. *Chest*., 138:121—9.

Reinhart K., Karzai W., Meisner M. 2000. Procalcitonin as a marker of the systemic inflammatory response to infection. *Intens Care Med.,* 26:1193–1200.

Remskar M., Horvat M., Hojker S. *et al*., 2002. Procalcitonin in patients with acute myocardial infarction. Wien Klin Wochenschr., 114:205–210.

Riedel S, Melendez JH, An AT, Rosenbaum JE, Zenilman JM. Procalcitonin as a marker for the detection of bacteremia and sepsis in the emergency department. Am J Clin Pathol 2011;135:182—9.

Simon L., Gauvin F., Amre DK. *et al*., 2004. Serum procalcitonin and C-reactive protein levels as markers of bacterial infection: A systematic review and meta-analysis. *Clin Infect Dis*.,39:206–217.

Stucker F., Herrmann F., Graf JD., Michel JP., Krause KH., Gavazzi G. 2005. Procalcitonin and infection in elderly patients. *J Am Geriatr Soc*., 53:1392—5.

Torbicki A., Perrier A., Konstantinides S., Agnelli G., Galie N., Pruszczyk P. *et al*., 2008. Guidelines on the diagnosis and management of acute pulmonary embolism: the Task Force for the Diagnosis and Management of Acute Pulmonary Embolism of the European Society of Cardiology (ESC). *Eur Heart J.,* 29:2276—315.

Viallon A., Zeni F., Lambert C., Pozzetto B., Tardy B., Venet C. *et al*., 1999. High sensitivity and specificity of serum procalcitonin levels in adults with bacterial meningitis. *Clin Infect Dis.,* 28:1313—6.

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