

A Comparative Biochemical Evaluation of Serum C- Reactive Protein (CRP) and Erythrocyte Sedimentation Rate (ESR) in Healthy Individuals and Patients Having Odontogenic Infections



Medical Science

KEYWORDS : C – reactive protein, Erythrocyte sedimentation rate, Odontogenic facial infection

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ABSTRACT

Aims & Objectives –To assess the efficacy of serum C – reactive protein and Erythrocyte sedimentation rate levels as monitoring tool for patients with facial space infections of odontogenic origin for determining severity of infection, to assess therapeutic efficacy of different treatment regime and to assess the recovery process during disease period. **Materials and Methods:** Thirty patients with facial space infections of odontogenic origin were enrolled in the study to evaluate level of serum CRP and ESR at the time of diagnosis and 1 week post operatively. The level of serum CRP and ESR were also assessed in 25 healthy individuals in control group. Serum CRP was measured by qualitative and semi quantitative, latex agglutination method. ESR was measured by Westergren method. Then results were compared.

Results: There was a rapid rise and fall of CRP compared to ESR which indicates CRP is much more sensitive indicator for infection and inflammation compared to ESR.

Conclusion - Incorporating CRP test in management of odontogenic facial infections help in stopping antibiotics safely, sparing patients from drug toxicity, probably decreasing the emergence of resistance and decreasing costs.

Introduction

C- reactive protein is one of the most dynamic acute phase proteins among the pentraxin protein family.¹ Its serum concentration can increase 1000 fold or more in various stimuli associated with infections and other types of tissue injuries.² Similar to the application of erythrocyte sedimentation rate (ESR) and white blood cell (WBC) counts, testing for CRP is most commonly performed to indicate the presence of acute inflammation and to monitor the development of postoperative infections.³ CRP elevates significantly within 4 to 6 hours, peaks in 24 to 48 hours after the acute infection of tissue injury occurs, and falls rapidly after the inflammation resolves. Rapid rise and fall of CRP with inflammatory process makes it much more sensitive indicator for infection and inflammation compared to ESR and WBC count.⁴⁻⁷

CRP acts as a pattern recognition molecule that can bind to specific molecular configurations typically exposed during cell death or found on the surfaces of pathogens. Thus, CRP contributes to host defence and plays a crucial role in the first line of innate host defence.

Serum CRP is nearly absent in healthy individuals and increases significantly when tissue damage occurs during infection, tissue injuries, or inflammation. Cytokines produced and released during tissue damage and inflammation, specifically interleukin-6 and TNF – α (tumor necrosis factor α) induce the production of CRP in hepatocytes. CRP production is proportional to the severity of tissue damage. C-reactive protein has long been recognized as an innate opsonin, that is, a protein that recognizes microbes and promotes their uptake by phagocytic cells. CRP also recognizes apoptotic and necrotic host cells and plays an important role in their clearance. This would contribute to the restitution of normal function and structure of injured tissues.⁸

Determination of CRP is used to monitor the therapeutic efficacy of different treatment regimens on infection. Its application in monitoring post operative infections is also one of the subjects of interest. CRP testing may be also useful tool in monitoring the recovery process after third molar surgery and identifying patients who need antibiotic therapy.

Methodology - A comparative biochemical study of serum CRP and ESR is conducted in patients with odontogenic infection and healthy individuals (control group). Patient's blood samples were collected and each group of 25 individuals was assessed. Serum CRP and ESR were measured in patients with odontogenic infections, post operatively (1 week) after antibiotic therapy. Serum CRP was measured by qualitative and semi quantitative, latex agglutination method. Accutex CRP test kit was used to determine level of serum CRP. ESR was measured

by westergren method. Then results were compared. Patients with any systemic infection other than odontogenic infection were excluded from the study.

Evaluation Criteria: Evaluation was done by Comparing pre-operative and 1 week post operative CRP and ESR value with Healthy individuals.

Normal values

CRP: Less than 0.6mg/dL

ESR: males: 3 to 7 mm in one hour Females: 5 to 9 mm in one hour

Plate -1 CRP Kit



Results - A total of 30 dental emergency patients with odontogenic space infection were participated in the present study and their level of serum CRP and ESR were assessed and compared with 25 healthy individuals (Control group).

In control group 25 healthy individuals were evaluated for the level of serum CRP and ESR. The level of serum CRP was less than 0.6 mg/dL (Negative) in 100 % of healthy individuals. The Mean \pm SD of ESR in 25 healthy individuals was 11.80 \pm 7.10 which is considered as normal.

The level of Serum CRP was positive (more than 0.6 mg/dL) in 76.7 % of patients. (Table- 1,2) The mean positive CRP level was 3.54. The preoperative ESR was elevated in 63.33 % of patients (Table-3) Mean \pm SD of pre operative ESR was 32.10 \pm 25.11 (Table 5) which was significantly higher compared to ESR of healthy individuals. (P = 0.001 **)

1 week post operatively 26 patients reported back for follow up evaluation. All the patients underwent Extraction of tooth, Incision and Drainage followed by post operative antibiotic therapy. In 73 % patients CRP was found to be within normal range while in 38.5 % of cases ESR was within normal range and remained

elevated in 61.53 % cases. (Table -4) In all 19 of patients who had positive CRP at the time of diagnosis, CRP returned within normal range while in case of ESR out of 16 only in 1 patient it was found within normal range 1 week post operatively. In 1 patient CRP and ESR were within normal range at the time of diagnosis and increased 1 week post operatively. The Mean \pm SD of post operative ESR was 28.00 \pm 17.28 which was significantly high. The significant change in CRP was observed in 76.92 % of cases while in case of ESR it was just 7.69 %. There was not a significant difference in ESR before and after treatment.

Significant reduction in serum CRP compared to ESR was observed in patients with odontogenic infections 1 week post operatively. (p <0.001 **)

Table -1. Distribution of Pre operative CRP in cases studied

Pre operative CRP	Number of patient	%
Negative	7	23.3
Positive	23	76.7
Total	30	100.0

Table -2. Distribution of Pre & post operative CRP in cases group

CRP	Pre (n=30)	Post (n=26)
Negative	7(23.3%)	25(96.2%)
Positive	23(76.7%)	1(3.8%)
• 1.2	2(6.7%)	-
• 2.4	13(43.3%)	1(3.8%)
• 4.8	6(20.0%)	-
• 9.6	2(6.7%)	-
Not recalled	-	4

Table -3. Distribution of Pre op ESR of patients studied (No of patients 30)

Pre operative Normal ESR (<20 mm in 1 hr)	Post operative higher ESR (> 20 mm in 1 hr)
11 (36.67 %)	19 (63.33 %)

Table -4. Distribution of Post operative ESR in cases group Total no of recalled patients 26

Post operative Normal ESR (<20 mm in 1 hr)	Post operative higher ESR (> 20 mm in 1 hr)
10 (38.5 %)	16 (61.5 %)

Table -5. Distribution of Pre & post operative ESR in cases group

	Pre-op (n=30)	Post-op (n=26)	P value
ESR	32.10 \pm 25.11	28.00 \pm 17.28	0.768

Discussion

Determination of serum CRP is an economical, consistent and reproducible test and is available in almost every hospital set-

tings. The half-life of CRP in the circulation is not significantly influenced by age and gender, and its serum concentration is largely determined by the rate at which CRP is produced and released into the blood.³ The single determinant of CRP level is its rate of synthesis, which in turn depends on the inflammatory intensity.⁹

Peltola et al¹⁰, Ellitsgaard et al¹¹ concluded in their respective studies that there is rapid rise of CRP during preoperative period and rapid fall post operatively compared to ESR. Similarly In the present study comparison between serum CRP and ESR was carried out in patients having odontogenic space infection and same results were obtained. Like CRP, increase in ESR was significantly evident preoperatively but it remained high, 1 week post operatively also. Post operatively decrease in ESR is comparatively slower than serum CRP.¹¹ There was no significant change observed in level of ESR before and after treatment. The concentration of serum CRP level is directly proportional to amount of tissue injury occurs and increases in case of trauma, infection, inflammation and malignancy.² Similarly in present study level of serum CRP was comparatively higher in more severe infections.

In the present study one patient had Negative CRP at the time of diagnosis and it was elevated 1 week post operatively. The reason for post operative rise in CRP could be microorganisms which lead to infection were not sensitive to the antibiotics which were administered.

Assessment of serum CRP level is not completely accurate test to detect infection.¹¹In present study 23.3 % patients did not respond to infection and there was no rise in CRP at the time of diagnosis. The reason for it could be CRP elevates significantly 24 to 48 hrs after acute infection and tissue injury occurs.³

As there is significant increase in CRP value in case of bacterial infection helps to differentiate it from viral infection.⁷CRP does not differentiate between post operative inflammation and infection.

Conclusion

Both CRP and ESR help in diagnosis and monitoring of the disease and helps in prognosis but assessment of level of serum CRP is much more sensitive than ESR in cases of facial space infections of odontogenic origin. As CRP test is economical, reproducible and available in most of the hospital setting, Incorporating it in management of odontogenic facial infections help in stopping antibiotics safely, sparing patients from drug toxicity, probably decreasing the emergence of resistance and decreasing costs.¹²Though CRP is not 100 % accurate test, it should always been monitored along with thorough clinical examination.

REFERENCE

1. Du Clos TW, Mold C. The role of C-reactive protein in the resolution of bacterial infection. *Curr Opin Infect Dis* 2001; 14(3):289-93. | 2. Gabay C, Kushner I. Acute-phase proteins and other systemic responses to inflammation. *N Engl J Med* 1999; 340(6):448-54. | 3. Yan-Fang Ren, Hans S. Malmstrom. Rapid quantitative determination of C-reactive protein at chair side in dental emergency patients. *Oral Surg Oral Med Oral Radiol Endod* 2007;104:49-55. | 4. Khan MH, Smith PN, Rao N, Donaldson WF. Serum C-reactive protein levels correlate with clinical response in patients treated with antibiotics for wound infections after spinal surgery. *Spine J* 2006;6(3):311-5. | 5. Of Bilgeni, T. Aticl, K.Durak,O.Karaeminog Ullari, MS Bilgen .C reactive protein and erythrocyte sedimentation rates after total hip and total knee arthroplasty. [The journal of medical research 2001;29 : 7 - 12]. | 6. Fabrizio Margheritini , Gianluca Camillieri , Luca Mancini , Pier Paolo Mariani C-reactive protein and Erythrocyte sedimentation rate changes following Arthroscopically assisted anterior cruciate ligament.[*Knee Surg, Sports Traumatol, Arthrosc*, (2001)9 :343-345. | 7. M Korppi,T. Heiskanen – kosma, M. Leinonen . White blood cell, C reactive protein, and erythrocyte sedimentation rate in pneumococcal pneumonia in children. *European respiratory journal*.1997;10:1125-1129. | 8. Terry W Du Clos.Functions of C reactive protein.*Trends in molecular medicine*.2000 ; 32 :274-278. | 9. Pedro Pova C-reactive protein: a valuable marker of sepsis. *Intensive Care Med* (2002) 28:235-243. | 10. Peltola H, Vahvanen V, Aalto K. Fever C-reactive protein, and erythrocyte sedimentation rate in monitoring recovery from septic arthritis: a preliminary study. *J Pediatr Orthop Surg* 1984;4:170-174. | 11. Ellitsgaard N, Andersson AP, Jensen KV, et al. Changes in C-reactive protein and erythrocyte sedimentation rate after hip fractures. *Int Orthopedics*.1991;15: 311- 314. | 12. Lars Bjerrum, Bente Gahrn-Hansen, Anders P Munck. C-reactive protein measurement in general practice may lead to lower antibiotic prescribing for sinusitis. *Br J Gen Pract*. 2004 September 1; 54(506): 659-662.