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The role of Th2 Cytokines Interleukin-4 and Interleukin-5 in assessing severity and prognosis of acute pancreatitis

Улога Тх2 цитокина интерлеукин-4 и интерлеукин-5 у процени тежине и прогнозе акутног панкреатитиса

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SUMMARY

Introduction/Objective Acute pancreatitis (AP) is relatively common disease which in most patients has favorable course. However, in approximately 20% patients, the course of the disease is more severe with high mortality (40–50%). The evaluation of disease severity is now primarily based on protocols that includes clinical, laboratory, and radiographic diagnostic procedures, APACHE II score, Ranson score, CT index, and CT necrosis score. Key cells in the immunopathogenesis of AP are T-lymphocytes, and recent studies indicate the role of Th2 and their effector cytokines: interleukin (IL) -4 and: interleukin (IL) -5.

The purpose of our study was to determine the potential clinical value of IL-4 and IL-5 as biochemical markers for predicting development of severe, necrotizing form of acute pancreatitis with systemic complication such as systemic inflammatory response syndrome (SIRS).

Methods This prospective study included 240 patients hospitalized at The Clinic for Emergency Surgery of Clinical Center of Serbia as AP. Levels of IL-4 and IL-5 in serum were detected using commercial Bender Med Systems (BMS716FF) kits.

Results IL-4 and IL-5 were statistically significant increased on the second day of hospitalization with maximum values on the third day. In patients with severe AP complicated with necrosis and/or sepsis values were rising all through the seventh day.

Conclusion Levels of IL-4 and IL-5 in peripheral blood correlate with SIRS, Ranson score and clinical outcome in AP patients, therefore these cytokines are potential early biomarkers of disease progression and related complications.

Keywords. acute pancreatitis; interleukin-4; interleukin-5: biomarker

САЖЕТАК

Увод/циљ Акутни панкреатитис (АП) је релативно често обољење које у већини случајева има бениган ток. Међутим, код око 20% пацијената, ток болести је много тежи, а смртност и даље врло висока (40–50%). Процена тежине болести сада се превасходно заснива на протоколима који укључују клиничке, лабораторијске и радиографске дијагностичке поступке, *APACHE* II скор, Рансон скор, ЦТ индекс и скор ЦТ некрозе. У имунопатогенези АП кључне ћелије су Т-лимфоцити, а новија истраживања указују на улогу Тх2 и њихових ефекторских цитокина: интерлеукина (ИЛ)-4 и ИЛ-5.

Циљ ове студије био је да се испита клинички значај серумских нивоа ИЛ-4 и ИЛ-5 као потенцијалних биомаркера тешке форме АП са системским компликацијама као што је синдром системског инфламаторног одговора (СИРС)

Методе Ова проспективна студија укључила је 240 пацијената са АП хоспитализованих на клиници за ургентну хирургију универзитетског клиничког центра Србије. Серумски нивои ИЛ-4 и ИЛ-5 детектовани су свакодневно употребом комерцијално доступних *Bender Med Systems* (*BMS716FF*).

Резултати Нивои ИЛ-4 и ИЛ-5 у серуму били су статистички значајно повишени другог дана, док су максималне вредности достигли трећег дана хоспитализације. Код оболелих од тешке форме АП са СИРС нивои поменутих цитокина били су повишени до седмог дана.

Закључак Вредности концентрација ИЛ-4 и ИЛ-5 показују високо значајну корелацију са СИРС и Рансон скором и исходом, те наша студија показује да ови цитокини могу бити рани биомаркер тежине АП, појаве системских компликација и исхода болести.

Кључне речи: акутни панкреатитис, интерлеукин-4, интерлеукин-5, биомаркер.

INTRODUCTION

Acute pancreatitis (AP) is a common inflammatory condition with a highly variable clinical course that can cause severe local and extra-pancreatic organ dysfunction and failure. The most common causes are gallstones and alcohol, accounting for up to 80% of cases [1]. The diagnosis of AP requires the patient to present with abdominal pain consistent with AP

and the elevation of serum amylase or lipase (> 3 times upper limit of normal). Although advancement in diagnosis and treatment of AP has been made, this disease is still serious and potentially lethal [2]. The clinical course of AP can show minimal organ dysfunction with recovery in several days, but patients may experience a severe attack involving organ failure and severe complications as well as a high mortality rate. Severe acute pancreatitis (SAP) is defined as an episode of pancreatitis with persistent organ failure [3]. SAP is associated with high morbidity and mortality due to the development of pancreatic and extra-pancreatic necrosis, their subsequent infection and multisystem organ failure (MOF). In the case of SAP with sterile necrosis mortality rate can be as low as 12%, but in those with multiple organ failure mortality rate could be as high as 85% [4]. Thus, early assessment of the severity and initial aggressive fluid resuscitation decreases morbidity and mortality [5]. Patients with SAP benefit considerably from early management in an intensive care unit [5, 6]. Therefore, esearches focus on possibilities of an early assessment of the severity of an attack. Development of an Early severe acute pancreatitis (ESAP), in first week, accounts for 37.5–44% mortality among patients with AP [7]. During the second week AP progresses to Infected pancreatic necrosis (IPN), which results in Systemic inflammatory response syndrome(SIRS), Multiple organ dysfunction syndrome MODS, sepsis and a second wave of mortality [8]. Nevertheless, not all patients with acute necrotizing pancreatitis (ANP) develop IPN, suggesting that certain susceptibility factors make the patients with ANP prone to IPN. In AP innate immunity recognize damage-associated molecular patterns released from necrotizing pancreatic cells and stimulate adaptive immune response [9]. Cytokines play an important role in etiopathogenesis of AP by causing an inflammatory response that leads to tissue damage and organ dysfunction or failure in patients with SAP. The inflammatory response trigger both recruitment and activation of inflammatory cells that can progress to pancreatic necrosis [10]. Local recruitment and activation of inflammatory cells in acute

pancreatitis induce the production of pro-inflammatory (IL-1β, IL-6 and IL-8as well as tumor necrosis factor-alpha[11]) and anti-inflammatory cytokines (IL-4, IL-10, IL-13 and TGFβ)[9]. Previous studies have shown increased production of IFN-γ, typical Th1 cytokine in patients with AP[12]. On the other hand, role of Th2 cells and their cytokines (IL-4 and IL-5) in development of acute and chronic pancreatitis is still controversial. In Th2-mediated response IL-4 stimulates B-cells to produce IgE and induce alternative activation of macrophages resulting in M2 phenotype, while IL-5 is important in eosinophil recruitment and activation[13].

Therefore, the purpose of our study was to determine the potential clinical value of IL-4 and IL-5 as biochemical marker for predicting development of severe, necrotizing form of acute pancreatitis with systemic complications (SIRS, ARDS, MODS, POF).

METHODS

Patients

A total of 240 patients at the Clinic for emergency surgery, Emergency center, Clinical center of Serbia, aged 18–75 years, with no history of malignancy and/or systemic diseases, were included in our study. Study was conducted multidisciplinary. Informed consent was obtained from all cases before enrollment into the study. The protocol of this study was approved by the Ethics Committee of the Clinical Center of Serbia. The diagnosis of AP was established based on the following 3 criteria: 1) abdominal pain or signs of AP; 2) serum amylase and/or lipase 5 times the upper limit of normal, and 3) characteristic findings for AP on computed tomography scan. We monitored 75 parameters divided in 7 groups: demographic, clinical, radiographic, operations, laboratory, systemic complications and scores (SIRS, APACHE II, Ranson, CT index, necrosis score)[14,15].

Radiographic method: native RTG, abdominal US, CT and/or MR.

Three group of laboratory analysis were followed:

1. standard and specific biochemical analysis: D-dimer, CRP, INR and plasminogen.
2. microbiological findings for diagnosis of infection in necrotic pancreatitis.
3. serum levels of IL-4 and IL-5.

Monitoring levels of cytokines and laboratory findings

Daily samples of blood were routinely tested for standard, specific biochemical analysis and for determining the levels of serum cytokines from 1-7 day. Blood samples were centrifuged with the speed of 3000 rpm for 10 minutes and prior to the analysis the serum was kept at - 20^0 C. The cutoff of 6 pg/ml was taken as a minimal concentration of IL-4 and IL-5.

Cytokines were quantified according to the manufacturer's instructions using Bender Med Systems GmbH (BMS716FF). The samples were run on Beckman Coulter system. CRP was quantified according to the manufacturer's instructions with commercial Olympus test using Olympus analyzer AU400. Standard laboratory methods were used for hemostatic, blood and enzyme activity.

Statistical analysis

Continuous variables are reported as mean ± standard deviation (SD), and categorical variables are expressed as N (%) of study participants. The student t-test was used to compare continuous variables between the two groups, and ANOVA for comparing continuous variables between three or more groups. The Pearson's correlation analysis was used for determining the correlation between the biochemical parameters and scores. ROC (receiver operative characteristics) curves were used to assess the predictive power of v methods were used. The most predictive parameters were approximately under 1 of the ROC curve. On the

other hand, 0.5 parameters proved to be with no significance. All P values were 2-sided, and $P \leq 0.05$ was considered to be statistically significant. All statistical analyses were conducted using SPSS statistical package for Windows ver.11.1.

The study was done in compliance with the institutional standards on ethics.

RESULTS

There was a total of 240 patients with AP that fulfilled inclusion criteria, 144 subjects (53.3%) were male and 96 (41.7%) were female. Forty-five percent had SIRS score 3 and 4 at the time of admission and 95% had SIRS score two or more. Ranson score was 3-6 in 65% of patients and 16% of patients had maximal values (6 and 7) of Ranson score.
Overall, 78 (32.5%) patients died during hospitalization.

We quantified the circulating cytokines IL-4 and IL-5 on the first day (day of admission into hospital) and after 24h, 48h, 72h and 168h. We evaluated these cytokines in patients with SAP and early mortality. There was statistically significant increase in the concentration of circulating IL-4 and IL-5 on the 2nd day of hospitalization with maximum values on the 3rd day (Table 1). In patients with SAP complicated with necrosis and/or sepsis values were rising all through the 7th day (Table 1, 2 and 3).

There was highly statistically significant correlation between concentrations of IL-4, IL-5 and SIRS (Table 4 and 5). Concentrations of these cytokines in serum of our patients did not corelate with CRP values and Apache II score (Table 4 and 5). Levels of IL-5 were significantly higher in group of patients with negative outcome (Table 5 and 6). Interleukin-4 was also higher in these patients, but correlation with outcome have not reached statistical significance (Table 4 and 6). Correlation between Ranson score and measured levels of IL-5 was satistically highly significant (Table 5) in contrast to IL-4 (Table 4). Amylase levels, important for diagnosis of AP, were lower in patients with negtive outcome, and there is

negative correlation with concetrations of both cytokines that we analyzed in this study (Table 4,5 and 6).

DISSCUSION

The aim of this study was to analyze serum levels of Th2 cytokines in AP patients and potential correlation with the severity of disease. Initial clinical response to pancreatitis is SIRS which can develop in sepsis with MODS. SIRS usually happen in the first week and its progression is a critical step in the prognosis of AP[16]. Most of our patients had SIRS score two or more (95%) and 45% had SIRS score 3 and 4 at the time of admission. This indicates that on admission most of our patient had complicated AP with highly developed inflammatory process, and almost 50% had developed septic syndrome. After initial injury of acinar cells progression of AP could be divided in 3 stages: local inflammation, generalized inflammatory response and final stage of sepsis with MODS. In our study group most of our patients were in stage of generalized inflammatory response. Ranson score was in 65% of patients 3-6 and 16 % of patients had maximal values (6 and 7) of Ranson score. These values can explain, and certainly highly correlate with, the high SIRS scores on admission. Overall, in this study 78 (32.5%) patients died during hospitalization, while in literature mortality rates as high as 30%[17]. The main cause of early death in AP patients is ARDS, 60% of our patients died in first 6 days of hospitalization mostly because of pulmonary complication [18].

Wide spectrum of inflammatory mediators are included in inflammatory process which consequently modulates migration of leukocytes, increases vascular permeability, damages local tissue and can cause generalized inflammation with damages to the kidneys, lungs and other organs [19]. T-helper cells are grouped with varieties of cytokines they produce. Th1 cells are involved in defense mechanisms against intracellular pathogens and

produce TNF-α and interferon-γ[9]. Various factors can influence the polarization of Th cells, including the cytokine profile of the environment in which Th cells undergo the process of transdifferentiation. Th1 and Th2 cytokine products reciprocally reduce each other's activity[9].

In our study, according to the similarities between these two interleukins, their behavior in severe forms of acute pancreatitis is practically identical. The values of their concentrations increase significantly on the second day of the disease, reaching the highest values on the third day, and in severe forms of infected necrosis and sepsis, these values increase until the seventh day, when the last measurements were made (Table 1, 2 and 3). Table 6 shows the values of IL-4 and IL-5 in correlation to the outcome. In our study the survivors, both IL-4 and IL-5, had lower values than non-survivors but only IL-5 was statistically significant (Table 7). Rodriguez et al. reported lower levels of IL-4 but significantly higher IL-5 in serum of patients with severe AP and non-survivors[20]. Similarly, our results showed that IL-5 highly significantly correlates with the outcome of acute pancreatitis (Table5). Intracellular labeling of IL-4 and IL-10 showed that Th2 and regulatory T cells were induced in a mouse model of severe acute pancreatitis. These findings suggest that anti- inflammatory response develops not only after but also during tissue damage in AP. Sendler et al also found higher IL-4 analyzing human samples, but levels of this cytokine were not in correlation with disease severity[21]. Alternative macrophage activation induced by IL-4 and IL-13 is responsible not only for anti-inflammatory response in AP but also for fibrosis in chronic pancreatitis which can be reduced by blocking these cytokines[22].

IL-4 and IL-5 correlate with SIRS (Table 4 and 5), as reported in the literature[23], although more attention is paid to the values of these interleukins in some other conditions (asthma) [24, 25].

CONCLUSION

Values of IL-4 and IL-5 can potentially be used as an early marker of severity of AP, early marker of sepsis and outcome because of a significant statistical correlation with outcome, SIRS and Ranson score.

Conflict of interest: None declared.

REFERENCES

1. Brunicardi FC, editor. Schwartz's principles of surgery. Eleventh edition. New York: McGraw-Hill; 2018.
2. Boxhoorn L, Voermans RP, Bouwense SA, Bruno MJ, Verdonk RC, Boermeester MA, et al. Acute pancreatitis. The Lancet. 2020 Sep;396(10252):726–34. https://doi.org/10.1016/S0140-6736(20)31310-6. PMID: 32891214
3. Garg PK, Singh VP. Organ Failure Due to Systemic Injury in Acute Pancreatitis. Gastroenterology. 2019 May;156(7):2008–23. https://doi.org/10.1053/j.gastro.2018.12.041. PMID: 30768987 PMCID: PMC6486861
4. Zerem E. Treatment of severe acute pancreatitis and its complications. World J Gastroenterol. 2014;20(38):13879. https://doi.org/10.3748/wjg.v20.i38.13879. PMID: 25320523 PMCID: PMC4194569
5. Lee PJ, Papachristou GI. Management of Severe Acute Pancreatitis. Curr Treat Options Gastroenterol. 2020 Dec;18(4):670–81. https://doi.org/10.1007/s11938-020-00322-x. PMID: 33230385 PMCID: PMC7673973
6. Tenner S, Baillie J, DeWitt J, Vege SS. American College of Gastroenterology Guideline: Management of Acute Pancreatitis: Am J Gastroenterol. 2013 Sep;108(9):1400–15. https://doi.org/10.1038/ajg.2013.218. PMID: 23896955
7. Sharma D, Jakkampudi A, Reddy R, Reddy PB, Patil A, Murthy HVV, et al. Association of Systemic Inflammatory and Anti-inflammatory Responses with Adverse Outcomes in Acute Pancreatitis: Preliminary Results of an Ongoing Study. Dig Dis Sci. 2017 Dec;62(12):3468–78. https://doi.org/10.1007/s10620-017-4813-6. PMID: 29080144
8. Banks PA, Bollen TL, Dervenis C, Gooszen HG, Johnson CD, Sarr MG, et al. Classification of acute pancreatitis—2012: revision of the Atlanta classification and definitions by international consensus. Gut. 2013 Jan;62(1):102–11. https://doi.org/10.1136/gutjnl-2012-302779. PMID: 23100216
9. Watanabe T, Kudo M, Strober W. Immunopathogenesis of pancreatitis. Mucosal Immunol. 2017 Mar;10(2):283–98. https://doi.org/10.1038/mi.2016.101. PMID: 27848953
10. Sah RP, Garg P, Saluja AK. Pathogenic mechanisms of acute pancreatitis: Curr Opin Gastroenterol. 2012 Sep;28(5):507–15. https://doi.org/10.1097/MOG.0b013e3283567f52. PMID: 22885948 PMCID: PMC3682674
11. Fisic E, Poropat G, Bilic-Zulle L, Licul V, Milic S, Stimac D. The Role of IL-6, 8, and 10, sTNFr, CRP, and Pancreatic Elastase in the Prediction of Systemic Complications in Patients with Acute Pancreatitis. Gastroenterol Res Pract. 2013;2013:1–6. https://doi.org/10.1155/2013/282645.
12. Yang L, Chen S, Zhao Q, Sun Y, Nie H. The Critical Role of Bach2 in Shaping the Balance between CD4 + T Cell Subsets in Immune-Mediated Diseases. Mediators Inflamm. 2019 Dec 30;2019:1–9. https://doi.org/10.1155/2019/2609737. PMID: 32082072 PMCID: PMC7012215
13. Paul WE, Zhu J. How are T(H)2-type immune responses initiated and amplified?. Nat Rev Immunol. 2010;10(4):225-235. doi:10.1038/nri2735. doi:10.1038/nri2735 PMID: 20336151
14. Marik PE, Taeb AM. SIRS, qSOFA and new sepsis definition. J Thorac Dis. 2017 Apr;9(4):943–5. https://doi.org/10.21037/jtd.2017.03.125. PMID: 28523143 PMCID: PMC5418298
15. Basit H, Ruan GJ, Mukherjee S. Ranson Criteria. [Updated 2020 Aug 15]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK482345/.
16. Singh M. Pancreatic Necrosis: A Challenging Complication of Acute Pancreatitis. Int Clin Pathol J [Internet]. 2018 Jan 18 [cited 2021 Aug 24];6(1). Available from: https://medcraveonline.com/ICPJL/pancreatic-necrosis-a-challenging-complication-of-acute-pancreatitis. html https://doi.org/10.15406/icpjl.2018.06.00146.
17. Baron TH, DiMaio CJ, Wang AY, Morgan KA. American Gastroenterological Association Clinical Practice Update: Management of Pancreatic Necrosis. Gastroenterology. 2020 Jan;158(1):67-75.e1. https://doi.org/10.1053/j.gastro.2019.07.064. PMID: 31479658
18. Zhang W, Zhang M, Kuang Z, Huang Z, Gao L, Zhu J. The risk factors for acute respiratory distress syndrome in patients with severe acute pancreatitis: A retrospective analysis. Medicine (Baltimore). 2021 Jan 15;100(2):e23982. https://doi.org/10.1097/MD.0000000000023982. PMID: 33466140 PMCID: PMC780854
19. Abul KA, editor. Basic Immunology. Sixth edition. Philadelphia.:Elsevier; 2019.
20. Rodriguez-Nicolas A, Martínez-Chamorro A, Jiménez P, Matas-Cobos AM, Redondo-Cerezo E, Ruiz-Cabello F. TH1 and TH2 Cytokine Profiles as Predictors of Severity in Acute Pancreatitis: Pancreas. 2018 Apr;47(4):400–5. https://doi.org/10.1097/MPA.0000000000001006. PMID: 29517628
21. Sendler M, van den Brandt C, Glaubitz J, Wilden A, Golchert J, Weiss FU, et al. NLRP3 Inflammasome Regulates Development of Systemic Inflammatory Response and Compensatory Anti-Inflammatory Response Syndromes in Mice With Acute Pancreatitis. Gastroenterology. 2020 Jan;158(1):253-269.e14. https://doi.org/10.1053/j.gastro.2019.09.040. PMID: 31593700

22. Xue J, Sharma V, Hsieh MH, Chawla A, Murali R, Pandol SJ, et al. Alternatively activated macrophages promote pancreatic fibrosis in chronic pancreatitis. Nat Commun. 2015 Nov;6(1):7158. https://doi.org/10.1038/ncomms8158. PMID: 25981357 PMCID: PMC4632846
23. Jekarl DW, Kim KS, Lee S, Kim M, Kim Y. Cytokine and molecular networks in sepsis cases: a network biology approach. Eur Cytokine Netw. 2018 Sep;29(3):103–11. https://doi.org/10.1684/ecn.2018.0414. PMID: 30547887
24. Bagnasco D, Ferrando M, Varricchi G, Passalacqua G, Canonica GW. A Critical Evaluation of Anti-IL-13 and Anti-IL-4 Strategies in Severe Asthma. Int Arch Allergy Immunol. 2016;170(2):122–31. https://doi.org/10.1159/000447692. Bagnasco D, Ferrando M, Varricchi G, Passalacqua G, Canonica GW. A Critical Evaluation of Anti-IL-13 and Anti-IL-4 Strategies in Severe Asthma. Int Arch Allergy Immunol. 2016;170(2):122–31. https://doi.org/10.1159/000447692.
25. Busse W, Chupp G, Nagase H, et al. Anti-IL-5 treatments in patients with severe asthma by blood eosinophil thresholds: Indirect treatment comparison [published correction appears in J Allergy Clin Immunol. 2019 Jun;143(6):2336]. J Allergy Clin Immunol. 2019;143(1):190-200.e20. doi:10.1016/j.jaci.2018.08.031. PMID: 30205189

Table 1. Measurement time IL-4 and IL-5

Measurement time (h)	Mean (pg/ml)	Standard deviation	95% Confidence interval	
			Lower limit	Upper limit
IL - 4				
0	1920,67	3323,52	1423,37	2417,97
24	2305,84	6261,21	1441,49	3170,19
48	7184,94	15536,24	5007,54	9362,33
72	3040,39	5627,20	2239,36	3841,43
168	2175,86	4640,94	1504,51	2847,21
IL – 5				
0	325,50	631,18	231,05	419,94
24	262,11	538,30	187,80	336,42
48	584,32	1509,28	369,47	799,17
72	319,77	443,65	256,61	382,92
168	236,52	405,06	176,94	296,09

Table 2. Intragroup and intergroup dependence (concentration of IL-4 and IL-5)

Source of variation	Variance	F	P
IL-4			
Between Groups	941061024,49	13,240	0,000
Within Groups	71077579,37		
IL-5			
Between Groups	3675826.141	5.469	.000
Within Groups	672141.520		

Table 3. Tukey HSD (parameter interdependence-dependent variable: IL-4 and IL-5)

(I) Measurement time (h)	(J) Measurement time (h)	Mean difference (I-J) (h)	Standard error	P	95% Confidence interval	
					Lower limit	Upper limit
IL-4						
0	24	-385,17	870,00	0,992	-2762,92	1992,58
	48	-5264,26 (*)	876,05	0,000	-7658,54	-2869,98
	72	-1119,72	882,43	0,710	-3531,43	1291,99
	168	-255,18	889,17	0,999	-2685,32	2174,94
24	0	385,17	870,00	0,992	-1992,58	2762,92
	48	-4879,09 (*)	841,06	0,000	-7177,76	-2580,42
	72	-734,54	847,71	0,909	-3051,37	1582,27
	168	129,98	854,72	1,000	-2206,00	2465,97
48	0	5264,26(*)	876,05	0,000	2869,98	7658,54
	24	4879,09(*)	841,06	0,000	2580,42	7177,76
	72	4144,54(*)	853,91	0,000	1810,76	6478,32
	168	5009,07(*)	860,88	0,000	2656,26	7361,88
72	0	1119,72	882,43	0,710	-1291,99	3531,43
	24	734,54	847,71	0,909	-1582,27	3051,37
	48	-4144,54(*)	853,91	0,000	-6478,32	-1810,76
	168	864,53	867,37	0,857	-1506,01	3235,08
168	0	255,18	889,17	0,999	-2174,94	2685,32
	24	-129,98	854,72	1,000	-2465,97	2206,00
	48	-5009,07(*)	860,88	0,000	-7361,88	-2656,26
	72	-864,53	867,37	0,857	-3235,08	1506,01
IL-5						
0	24	63,38	84,60	0,945	-167,84	294,61
	48	-258,82 (*)	85,81	0,022	-493,35	-24,29
	72	5,72	85,81	1,000	-228,80	240,25
	168	88,98	87,16	0,846	-149,23	327,19
24	0	-63,38	84,60	0,945	-294,61	167,84
	48	-322,20 (*)	82,43	0,001	-547,51	-96,90
	72	-57,65	82,43	0,957	-282,95	167,64
	168	25,59	83,83	0,998	-203,54	254,73
48	0	258,82 (*)	85,81	0,022	24,29	493,35
	24	322,20 (*)	82,43	0,001	96,90	547,51
	72	264,55 (*)	83,67	0,014	35,86	493,24
	168	347,80 (*)	85,05	0,000	115,33	580,27
72	0	-5,72	85,81	1,000	-240,25	228,80
	24	57,65	82,43	0,957	-167,64	282,95
	48	-264,55 (*)	83,67	0,014	-493,24	-35,86
	168	83,25	85,05	0,865	-149,21	315,72
168	0	-88,98	87,16	0,846	-327,19	149,23
	24	-25,59	83,83	0,998	-254,73	203,54
	48	-347,80 (*)	85,05	0,000	-580,27	-115,33
	72	-83,25	85,05	0,865	-315,72	149,21

*the mean difference is statistically significant, P< .05.

Table 4. Correlations of IL-4 concentration and protocol parameters

Parameters		Gender	SIRS	Outcome	Years	CRP	Amylase	Apache II	Ranson	IL-4
Gender	r	1	-0,139*	-0,194**	0,185**	-0,306**	-0,130	-0,062	-0,104	-0,083
	P		0,043	0,004	0,006	0,000	0,059	0,367	0,140	0,295
SIRS	r	-0,139*	1	0,677**	0,232**	0,274**	0,028	0,268**	0,331**	0,201**
	P	0,043		0,000	0,000	0,000	0,683	0,000	0,000	0,009
Outcome	r	-0,194**	0,677**	1	0,569**	0,502**	-0,110	0,481**	0,520**	0,099
	P	0,004	0,000		0,000	0,000	0,102	0,000	0,000	0,186
Years	r	0,185**	0,232**	0,569**	1	0,414**	0,146*	0,373**	0,334**	0,168*
	P	0,006	0,000	0,000		0,000	0,032	0,000	0,000	0,027
CRP	r	-0,306**	0,274**	0,502**	0,414**	1	-0,181**	0,274**	0,277**	-0,023
	P	0,000	0,000	0,000	0,000		0,000	0,000	0,000	0,469
Amylase	r	-0,130	0,028	-0,110	0,146*	-0,181**	1	0,066*	-0,202**	-0,079*
	P	0,059	0,683	0,102	0,032	0,000		0,041	0,003	0,025
Apache II	r	-0,062	0,268**	0,481**	0,373**	0,274**	0,066*	1	0,327**	0,013
	P	0,367	0,000	0,000	0,000	0,000	0,041		0,000	0,686
Ranson	r	-0,104	0,331**	0,520**	0,334**	0,277**	-0,202**	0,327**	1	0,069
	P	0,140	0,000	0,000	0,000	0,000	0,003	0,000		0,390
IL-4	r	-0,083	0,201**	0,099	0,168*	-0,023	-0,079*	0,013	0,069	1
	P	0,295	0,009	0,186	0,027	0,469	0,025	0,686	0,390	

r-Pearson correlation coefficient
**The correlation is statistically significant, P<0.01; * The correlation is statistically significant, P< 0.05.

Table 5. Correlations of IL-5 concentration and protocol parameters

Parameters		Gender	SIRS	Outcome	Years	CRP	Amylase	Apache II	Ranson	IL-5
Gender	r	1	-0,139*	-0,194**	0,185**	-0,306**	-0,130	-0,062	-0,104	-0,087
	P		0,043	0,004	0,006	0,000	0,059	0,367	0,140	0,269
SIRS	r	-0,139*	1	0,677**	0,232**	0,274**	0,028	0,268**	0,331**	0,332**
	P	0,043		0,000	0,000	0,000	0,683	0,000	0,000	0,000
Outcome	r	-0,194**	0,677**	1	0,569**	0,502**	-0,110	0,481**	0,520**	0,254**
	P	0,004	0,000		0,000	0,000	0,102	0,000	0,000	0,001
Years	r	0,185**	0,232**	0,569**	1	0,414**	0,146*	0,373**	0,334**	0,082
	P	0,006	0,000	0,000		0,000	0,032	0,000	0,000	0,284
CRP	r	-0,306**	0,274**	0,502**	0,414**	1	-0,181**	0,274**	0,277**	0,001
	P	0,000	0,000	0,000	0,000		0,000	0,000	0,000	0,966
Amylase	r	-0,130	0,028	-0,110	0,146*	-0,181**	1	0,066*	-0,202**	-0,059
	P	0,059	0,683	0,102	0,032	0,000		0,041	0,003	0,094
Apache II	r	-0,062	0,268**	0,481**	0,373**	0,274**	0,066*	1	0,327**	-0,007
	P	0,367	0,000	0,000	0,000	0,000	0,041		0,000	0,828
Ranson	r	-0,104	0,331**	0,520**	0,334**	0,277**	-0,202**	0,327**	1	0,280**
	P	0,140	0,000	0,000	0,000	0,000	0,003	0,000		0,000
IL-5	r	-0,087	0,332**	0,254**	0,082	0,001	-0,059	-0,007	0,280**	1
	P	0,269	0,000	0,001	0,284	0,966	0,094	0,828	0,000	

r-Pearson correlation coefficient

**The correlation is statistically significant, P<0.01; * The correlation is statistically significant, P< 0.05.

Table 6. Values of IL-4, IL-5 and other parameters relating to outcome

Parameters	**Outcome***	**Mean**	**Standard deviation**
Years	1	46,38	12,08
	2	62,30	8,02
CRP	1	104,60	113,98
	2	251,28	128,51
Amylase	1	1383,62	1257,38
	2	1094,20	867,69
Apache II	1	12,44	3,75
	2	17,84	6,04
IL-5	1	214,27	452,21
	2	557,57	860,65
IL-4	1	1653,14	3550,45
	2	2360,03	2504,26

* 1-alive, 2-dead

Table 7. Results of comparison of two patient groups in respect of outcome (Students t-test)

Parameters	t	P
Years	-10,529	0,000
CRP	-8,953	0,000
Apache II	-8,475	0,000
IL-4	-1,327	0,186
IL-5	-3,498	0,001

Grouping variable: OUTCOME

